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# *A Decade of Semiconductor Start-Ups*

*Third Edition*



**352**

*A Strategic Analysis Report*

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**Dataquest**

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*A Decade of Semiconductor Start-Ups*  
*Third Edition*

*Technology Products Group*

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# *A Decade of Semiconductor Start-Ups*

## **Introduction**

During the last ten years, there has been an explosion of new activity in the semiconductor industry. Dataquest has identified 170 start-ups formed between 1979 and 1989. These start-ups are developing new niche markets and technologies that did not exist only a few years ago. Several new companies already have become \$100 million operations. In the 1990s, some may well become \$1 billion companies. Although several start-ups have failed, the ranks were quickly replenished by a host of newcomers. As new technologies and applications emerge, Dataquest expects to see many more start-ups in Europe, Asia, and the United States by the year 2000.

Dataquest believes that it is crucial to watch these swiftly moving start-ups—the industry's barometers of change—because they represent emerging new technologies, markets, and applications.

For our client's convenience, Dataquest has prepared *A Decade of Semiconductor Start-Ups—Third Edition*, a compendium of information about these start-ups. The information contained in this directory was gathered through surveys, telephone interviews, and publicly available material. Some of the text was integrated directly from background information provided by the companies. This report, updated regularly, provides the following information:

- Historical trends in start-up activity
- Key factors of successful start-ups
- Venture capital financing information
- Strategic alliances
- Technology trends (memory, microprocessors, digital signal processing (DSP), application-specific ICs (ASICs), GaAs, linear/analog, and others as they emerge)
- Company profiles

## **Definition of a Start-Up**

Dataquest defines a start-up as a semiconductor manufacturer that designs and ships finished products in the merchant or captive sectors; they need not have in-house wafer fabrication facilities. Because of the high cost of state-of-the-art plants and equipment, we observe that most start-ups use silicon foundries to reduce up-front costs. The start-up completes the circuit designs, sends the masks to foundries for fabrication, and may or may not complete packaging in-house. Most start-ups conduct in-house testing.

Because a company must first ship a product to be considered a start-up, Dataquest does not include design houses in its definition of a start-up. However, Dataquest does include captive manufacturers under the start-up title, provided they have begun operations during the past 10 years. We also consider semiconductor operations of large corporations to be start-up activities if the corporation was not previously involved in semiconductor activity.

For purposes of this directory, a start-up's age will not exceed 10 years. After a company is 10 years old, Dataquest no longer considers it a start-up, and the company is dropped from the book. Also, many of the companies profiled in previous editions have become highly successful operations. For this reason, we have created the concept of the graduate—a company that has become too large to be considered a start-up. To become a graduate, a company must exceed \$100 million in revenue *twice* in its lifetime. A list of graduates is shown in Table 2c.

## **Historical Trends**

The semiconductor industry is a vibrant industry that has gone through numerous business cycles and technology developments during its 30-year history. Dataquest observes that the industry has

had the following six distinct phases since the early 1950s:

- Establishment of the industry under Bell Labs and Shockley Transistor (1947 to 1957)
- Domination by Fairchild, National Semiconductor, Raytheon, Signetics, and other early start-ups (1957 to 1967)
- A boom in start-up companies such as AMD, Intel, and MMI that offered NMOS standard products (1968 to 1974)
- Consolidation of the industry through mergers and acquisitions (1975 to 1979)
- A boom in ASIC start-ups in 1982 and 1983; high-performance CMOS and GaAs start-ups in 1984; and HCMOS, DSP, ASICs, PC chip sets, and telecommunications IC start-ups (1985 to 1988)
- A second consolidation of the industry through mergers, acquisitions, and fab agreements

As shown in Figure 1, there have been three waves of semiconductor start-ups, each triggered by new process technologies. During the mid-1950s, companies such as Fairchild, Shockley Transistors, and Texas Instruments, all specializing in tran-

sistors and PMOS technology, rose to prominence. In the late 1960s, AMD, Intel, National, and others introduced NMOS technology. Since the late 1970s, a third wave of start-ups has developed next-generation technologies such as high-performance CMOS and GaAs processes; gate arrays, standard cells and silicon compilers for IC design; DSP, power transistors, and graphics and telecommunications ICs.

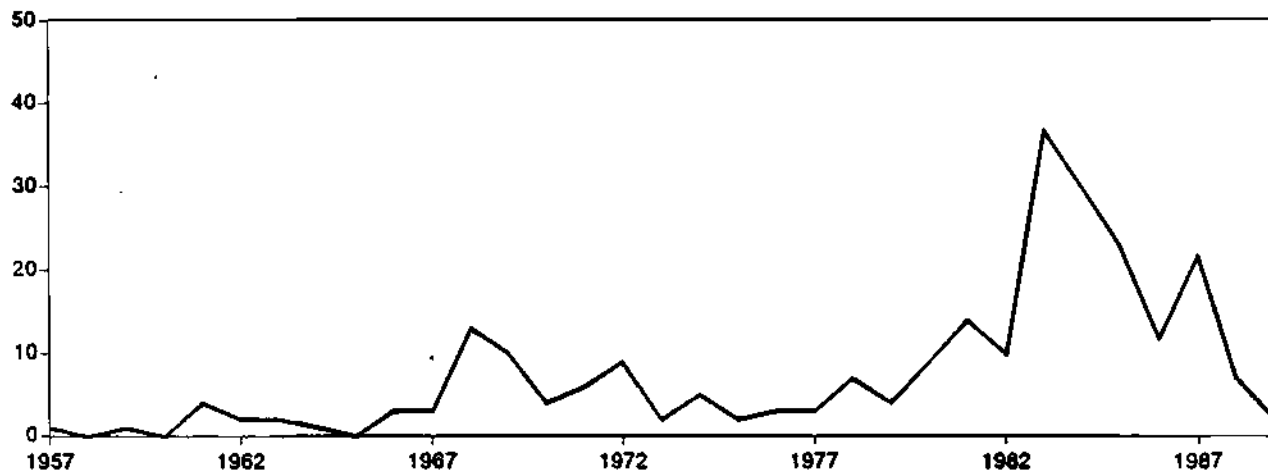
Historically, Dataquest has observed the following major trends in semiconductor start-up activity:

- A 12- to 15-year period between waves of start-ups, suggesting a technology life cycle that takes this amount of time to progress from initial research to commercialization and then to a gradual decline
- Technological and market leadership by key start-ups within a decade of existence
- Consolidation, acquisition, and a shakeout of start-ups following each peak of start-up activity
- A rapid loss of market share among older companies that are unable to compete with start-ups in emerging technologies
- Successively larger waves of start-up companies and increasing competition

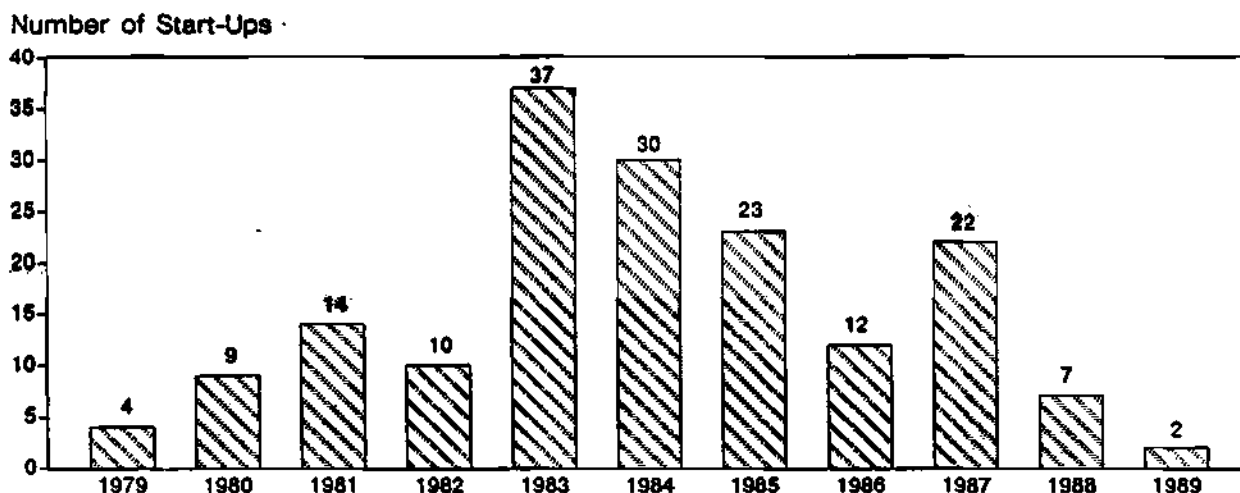
Figure 1

Start-Up Activity by Year  
(1957-1989)

Number of Companies



**Figure 2**  
Semiconductor Start-Ups by Year  
1979-1989



0005344-2

Source: Dataquest  
January 1990

- An emphasis on niche market strategies involving proprietary designs, CAD software, and excellent service
- Dispersion of start-up activity outside Silicon Valley due to the growing role of noncomputer applications, venture capital newcomers, and foreign government sponsorship

The latest wave of start-ups, which peaked in 1983, gradually is slowing down as existing start-ups commercialize their products and seek new rounds of financing. Figure 2 shows start-up activity for the 1979 through 1989 period. After a slow year in 1986, 1987 was strong, with the introduction of 22 new companies. Although the figures for 1988 have not been finalized, it appears at this time that 1988 will be a slower year than 1987 in terms of the number of start-ups. Dataquest believes that the industry has entered another phase of consolidations, mergers, and failures. This market shakeout occurs as niche markets become crowded and companies search for new directions in technology, products, and applications. In the mid-to-late 1990s, however, we anticipate a fourth wave of start-ups that will be involved with GaAs, optoelectronics, artificial intelligence (AI), parallel processors, three-dimensional ICs, voice recognition and synthesis, bioelectronics, and other emerging fields. These start-ups will become the

major technology drivers as we enter the 21st century.

### Start-Up Activity, 1988 and 1989

In 1988 and 1989, start-up activity in the semiconductor industry fell off quite substantially. In 1988, Cypress Semiconductor developed another satellite, Multichip Technology, which specializes in multichip memory modules. In 1989, Video Seven and G-2, two affiliates of LSI Logic, merged to form Headland Technology. Also in 1989, two executives from Chips and Technologies left to form S3, Inc., which will specialize in silicon subsystems. Overall, Dataquest identified only seven start-ups in 1988 and two so far in 1989. Because Dataquest does not identify a company as a viable entity until significant financing is secured or until a product is introduced, it is likely that the number of start-ups for 1988 and 1989 will increase as more companies meet Dataquest's definition of a start-up.

One of the main reasons for the decline in start-up activity is the lack of venture funding available for semiconductor start-ups. Beginning in 1987, the venture capital community has become increasingly disenchanted with the semiconductor industry. It is becoming extremely difficult for a new company to secure the venture financing necessary to bring a product to market. Without venture funding, many start-ups never get off the ground.

In addition, many of the niches that start-ups have recently pursued are becoming quite crowded. The markets for ASICs and fast SRAMs are especially so; start-up fatality rates are rising and entry rates are falling as a consequence. Start-ups, therefore,

currently are searching for new niches to inhabit, and Dataquest expects start-up activity to be limited until a market with significant growth potential is uncovered.

Tables 1a through 1k list start-up activity by year.

**Table 1a**

**Start-Up Activity by Year—1989 (2)**

Company	Location	Product
Headland Technologies, Inc.	Fremont, CA	Micros
S3, Inc.	Santa Clara, CA	Micros

Source: Dataquest  
January 1990

**Table 1b**

**Start-Up Activity by Year—1988 (7)**

Company	Location	Product
Advanced Hardware Architectures	Moscow, ID	Micros
ISSI	Sunnyvale, CA	Memory
Multichip Technology	San Jose, CA	Memory
Plus Logic	San Jose, CA	ASICs
Power Integrations	Mt. View, CA	Analog
The DSP Group	Emeryville, CA	DSP
TranSwitch	Shelton, CT	Telecom

Source: Dataquest  
January 1990

**Table 1c**

**Start-Up Activity by Year—1987 (22)**

Company	Location	Product
ACC Microelectronics	Santa Clara, CA	Micros
Aspen Semiconductor	San Jose, CA	Memory, ASICs
Chartered Semiconductor	Singapore	ASICs, foundry
Cree Research	Durham, NC	Discretes
Genesis Microchip	Canada	ASICs
G-2 Incorporated (Merged into Headland)	Milpitas, CA	Micros
Hualon Micro-Electronics Corp.	Taiwan	Analog, ASICs, micros, telecom
Integrated Information Technology	Santa Clara, CA	Micros

(Continued)

Table 1c (Continued)  
Start-Up Activity by Year—1987 (22)

Company	Location	Product
Intergraph Adv. Processor Div.	Palo Alto, CA	Micros
Linear Integrated Systems	Fremont, CA	Analog
MOSPEC Semiconductor	Taiwan	Discretes, foundry
nCHIP	San Jose, CA	Multichip modules
Oak Technology	Sunnyvale, CA	Micros
Oxford Computer	Oxford, CT	Memory
Paradigm Technology (formerly GL Micro Devices)	San Jose, CA	Memory
Photonic Integration Research	Columbus, OH	Opto
RAMAX	Australia	Memory
SIMTEK Corp.	Colorado Springs	Memory
Synergy Semiconductor	Santa Clara, CA	Memory
Togai InfraLogic	Irvine, CA	Fuzzy logic
US2	San Jose, CA	ASICs
VIA Technologies, Inc. (Formerly LOGICSTAR)	Fremont, CA	Micros

Source: Dataquest  
January 1990

Table 1d  
Start-Up Activity by Year—1986 (12)

Company	Location	Product
Advanced Microelectronic Products	San Jose, CA	Discretes
BKC International Electronics	Lawrence, MA	Discretes
Gazelle Microcircuits	Santa Clara, CA	GaAs
HNC, Inc.	San Diego, CA	Neural networks
Innovative Silicon Technology	Carrollton, TX	ASICs
MemTech Technology Corp.	Santa Clara, CA	Bubble memory
PLX Technology Corp.	Mt. View, CA	ASICs
Powerex, Inc.	Youngwood, PA	Discretes
Synaptics, Inc.	San Jose, CA	Neural networks
TSMC	Taiwan	Foundry
Telcom Devices Corp.	Newbury Park, CA	GaAs
Triad Semiconductors	Colorado Springs, CO	Memory

Source: Dataquest  
January 1990

**Table 1e**  
**Start-Up Activity by Year—1985 (23)**

Company	Location	Product
ABM Semiconductor <sup>1</sup>	San Jose, CA	GaAs opto
Actel Corp.	Sunnyvale, CA	ASICs
Acumos	San Jose, CA	ASICs
Advanced Linear	Sunnyvale, CA	Linear
Alliance Semiconductor	San Jose, CA	Memory
ANADIGICS	Warren, NJ	GaAs analog and digital
Catalyst Semiconductor	Santa Clara, CA	Memory
Chips & Technologies <sup>2</sup>	San Jose, CA	Micros
Dolphin Integration	France	ASICs
ES2	West Germany	ASICs
GAIN Electronics <sup>1</sup>	Somerville, NJ	GaAs ASICs
Hittite Microwave	Woburn, MA	GaAs MMICs
Intercept <sup>1</sup>	Sunnyvale, CA	ASICs
Krysalis <sup>3</sup>	Sunnyvale, CA	Ferroelectric memory
Level One Communications	Folsom, CA	Telecom
NovaSensor	Fremont, CA	IC sensors
Orbit Semiconductor	Sunnyvale, CA	Foundry
Sahni <sup>4</sup>	Sunnyvale, CA	ASICs
Saratoga Semiconductor <sup>5</sup>	Cupertino, CA	BiCMOS memory
Tachonics <sup>1</sup>	Plainsboro, NJ	GaAs
Three-Five Systems	Phoenix, AZ	GaAs opto
Topaz Semiconductor	San Jose, CA	Discrete, linear
Wolfson Microelectronics	Scotland	ASICs, DSP

<sup>1</sup>Inactive<sup>2</sup>Graduate<sup>3</sup>Acquired<sup>4</sup>Closed<sup>5</sup>Chapter 11Source: Dataquest  
January 1990

**Table 1f**  
**Start-Up Activity by Year—1984 (30)**

Company	Location	Product
Advanced Power Technology	Bend, OR	Power MOSFETs
ATMEL	San Jose, CA	ASICs, memory, linear
Austek Microsystems	Australia	Micros
Celeritek	San Jose, CA	GaAs FETs, MMICs
Cirrus Logic	Milpitas, CA	Micros
Crystal Semiconductor	Austin, TX	Linear
Custom Arrays	Sunnyvale, CA	ASICs
Dallas Semiconductor	Dallas, TX	Memory, linear, micros
Edsun Laboratories	Waltham, MA	Micros
Epitaxx Inc.	Princeton, NJ	GaAs opto
Integrated CMOS Systems	Sunnyvale, CA	ASICs

(Continued)



Table 1f (Continued)  
Start-Up Activity by Year—1984 (30)

Company	Location	Product
Integrated Power Semi <sup>1</sup>	Scotland	Linear
Lytel	Somerville, NJ	GaAs opto
Molecular Electronics	Torrance, CA	Bioelectronics
NMB Semiconductor	Chatsworth, CA	Memory, foundry
NSI Logic	Marlboro, MA	Micros
Novix	Cupertino, CA	Micros
Pacific Monolithics	Sunnyvale, CA	GaAs MMICs
Performance	Sunnyvale, CA	Memory, micros, logic
PromTech	San Jose, CA	Memory
Quasel Taiwan <sup>2</sup>	Taiwan	Memory
Ramtron	Colorado Springs, CO	Ferroelectric memory
SID Microelectronics	Brazil	Discretes, linear
Silicon Microsystems <sup>1</sup>	San Jose, CA	Memory
TMMIC <sup>3</sup>	Mt. View, CA	GaAs MMIC
TriQuint Semiconductor	Beaverton, OR	GaAs analog/digital
Vitesse Semiconductor	Camarillo, CA	GaAs digital, foundry
VTC	Bloomington, MN	Linear, ASICs, foundry
Wafer Technology <sup>4</sup>	Rancho Palos Verdes, CA	Logic
Xilinx	San Jose, CA	ASICs

<sup>1</sup>Acquired<sup>2</sup>Hybrid<sup>3</sup>Removed<sup>4</sup>ClosedSource: Dataquest  
January 1990

Table 1g  
Start-Up Activity by Year—1983 (37)

Company	Location	Product
Altera	Santa Clara, CA	ASICs
Asahi Kasei Microsystems	Japan	ASICs, linear, micros, memory
BIT	Beaverton, OR	DSP
Brooktree	San Diego, CA	Linear
Calmos Systems	Canada	ASICs, DSP, linear, memory
Calogic	Fremont, CA	Linear, ASICs
Custom Silicon	Lowell, MA	ASICs
Cypress Semiconductor <sup>1</sup>	San Jose, CA	Memory, ASICs, DSP
Elantec	Milpitas, CA	Linear
Electronic Technology	Ames, IA	ASICs
Exel Microelectronics	San Jose, CA	Memory, micros, ASICs
Hyundai America <sup>2</sup>	Santa Clara, CA	Memory
iLSi	Colorado Springs, CO	ASICs
ICT	San Jose, CA	Memory, ASICs
Inova	Santa Clara, CA	Memory

(Continued)

Table 1g (Continued)  
Start-Up Activity by Year—1983 (37)

Company	Location	Product
Iridian <sup>2</sup>	Chatsworth, CA	GaAs FETs
IXYS	San Jose, CA	Power FETs, ICs
Laserpath <sup>2</sup>	Sunnyvale, CA	ASICs
Lattice Semiconductor	Hillsboro, OR	ASICs
Logic Devices	Sunnyvale, CA	Memory, DSP, micros
Maxim Integrated Products	Sunnyvale, CA	Linear
Micro Linear	San Jose, CA	ASICs, linear
Mietec N.V.	Belgium	ASICs
Modular Semiconductor	Santa Clara, CA	Memory, micros
MOS Electronics	Sunnyvale, CA	Memory
Opto Tech	Taiwan	GaAs opto
Samsung Semiconductor	San Jose, CA	Linear, discretcs, logic, memory
Seattle Silicon	Bellevue, WA	ASICs
Sierra Semiconductor	San Jose, CA	ASICs, memory, micros, linear
S-MOS Systems <sup>1</sup>	San Jose, CA	Memory, micros, ASICs, linear
Texet <sup>2</sup>	Allen, TX	Discretcs
Vadem	San Jose, CA	Micros
Vatic <sup>3</sup>	Mesa, AZ	ASICs
Visic <sup>4</sup>	San Jose, CA	Memory
Vitellic	San Jose, CA	Memory
WaferScale Integration	Fremont, CA	Memory, ASICs, micros
Zoran	Santa Clara, CA	DSP

<sup>1</sup>Graduate<sup>2</sup>Closed<sup>3</sup>Merged<sup>4</sup>AcquiredSource: Dataquest  
January 1990

Table 1h  
Start-Up Activity by Year—1982 (10)

Company	Location	Product
Array Devices <sup>1</sup>	San Diego, CA	ASICs
Custom MOS Arrays <sup>2</sup>	Milpitas, CA	ASICs
IC Sensors	Milpitas, CA	Pressure sensors
ICI Array Technology	San Jose, CA	ASICs
Isocom	England	Opto
Microwave Monolithics	Simi Valley, CA	GaAs MMICs
Microwave Technology	Fremont, CA	GaAs FETs, MMICs
Sensym	Sunnyvale, CA	IC sensors
Solid State Optonics	San Jose, CA	Opto
XTAR	San Diego, CA	Micros

<sup>1</sup>Closed<sup>2</sup>MergedSource: Dataquest  
January 1990

Table 1i  
Start-Up Activity by Year—1981 (14)

Company	Location	Product
Adaptec	Milpitas, CA	Micros
Barvon Research <sup>1</sup>	Milpitas, CA	ASICs
GigaBit Logic	Newbury Park, CA	GaAs ASICs, logic, memory
IMP	San Jose, CA	ASICs
LTC	Milpitas, CA	Linear
LSI Logic <sup>2</sup>	Milpitas, CA	ASICs, DSP, micros
Opto Diode	Newbury Park, CA	GaAs LEDs
Panatech Semi <sup>1</sup>	Santa Clara, CA	ASICs
SEEQ Technology	San Jose, CA	Memory, micros
Signal Processor <sup>1</sup>	Salt Lake City, UT	DSP
Silicon Systems <sup>1</sup>	Tustin, CA	Linear, micros
Telmos <sup>3</sup>	Sunnyvale, CA	ASICs, linear, opto
Weitek	Sunnyvale, CA	DSP
Zytrex <sup>3</sup>	Sunnyvale, CA	Memory, logic

<sup>1</sup>Acquired<sup>2</sup>Graduate<sup>3</sup>ClosedSource: Dataquest  
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Table 1j  
Start-Up Activity by Year—1980 (9)

Company	Location	Product
California Micro Devices	Milpitas, CA	ASICs, linear
Comlinear	Ft. Collins, CO	Analog
Harris Microwave Semiconductor	Milpitas, CA	GaAs FETs, MMICs
IDT <sup>1</sup>	Santa Clara, CA	Memory, logic, DSP, micros
Kyoto Semiconductor	Japan	Optoelectronics
Si-Fab	Scotts Valley, CA	Foundry
Spectrum Microdevices	Frederick, MD	ASICs
Trilogy <sup>2</sup>	Cupertino, CA	Waferscale integration
VLSI Design Assoc. <sup>3</sup>	Campbell, CA	Micros

<sup>1</sup>Graduate<sup>2</sup>Sold semiconductor operations<sup>3</sup>Now AvaseemSource: Dataquest  
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Table 1k  
Start-Up Activity by Year—1979 (4)

Company	Location	Product
AMCC	San Diego, CA	ASICs
Matra-Harris	France	ASICs, memory, micros
United Microelectronics	Taiwan	Linear, micros, memory, foundry
VLSI Technology <sup>1</sup>	San Jose, CA	ASICs, memory, micros

<sup>1</sup>Graduate

Source: Dataquest  
January 1990

## The Driving Factors

Why was there such a strong surge in semiconductor start-up activity in the late 1970s and early 1980s? Semiconductor start-ups faced increasingly expensive plant and equipment costs, growing competition from Asia, and a depressed market in 1981 and 1982. Yet a record number of semiconductor companies were started in 1983. Dataquest believes that the following factors drove this explosion of activity:

- The infusion of venture capital
- The strong start-up activity in computers, telecommunications, design workstations, and consumer electronics, all of which required state-of-the-art ICs
- The proliferation of specialized market niches that required fast turnaround times
- A growing number of experienced engineers and managers frustrated by the sluggishness of innovation within larger companies
- More user-friendly CAD systems and support software
- Worldwide fabrication facility overcapacity and silicon foundries that allowed start-up companies to defer fabrication investments
- The entry of U.S., Japanese, South Korean, and Taiwanese companies with sizeable financing
- The growing demand for higher-performance ICs with reduced power consumption (i.e., CMOS)

During the early 1980s, Dataquest observed a mismatch between U.S. and foreign vendors that specialized in NMOS processes and the growing demand for CMOS ASICs, memory, logic devices, and other new products. Start-ups were quickly able to fill these market gaps by emphasizing advanced process technologies, design, and focused marketing.

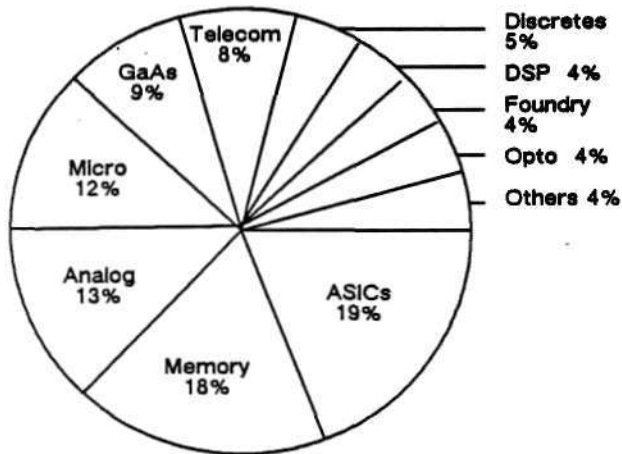
## The Third Wave

The third wave of start-ups differs from previous start-up generations because of the sheer variety and number of companies, which makes generalizations difficult. However, Dataquest notes that the following several trends may have a major impact on the industry:

- More start-ups are being located outside Silicon Valley, especially in the Southwest and East Coast of the United States, and in Europe.
- Increasingly, start-ups are using silicon foundries as an alternative to building their own fabs, which shortens time to market and allows these companies the opportunity to focus on IC design, product development, and marketing.
- Increasingly, Asian silicon foundries are being used because of their high-quality wafers and an apparent lack of interest among U.S. vendors to compete.
- Numerous strategic alliances are occurring between start-ups and Asian companies to develop, manufacture, market, and distribute products jointly.

Figure 3

## Semiconductor Start-Up Product Lines



0005344-3

Source: Dataquest  
January 1990

- More corporate investors and government backers throughout the world are participating in start-ups.
- Most start-ups have chosen to be niche players, where profit margins tend to be higher; and most are concentrated in fast-growing markets, such as ASiCs, microcomponents (especially microperipherals), and telecommunications.

The third wave of start-up companies offers a wide variety of products, as shown in Figure 3. Application-specific ICs (ASiCs) and high-performance CMOS memory and logic are attracting most of the attention. The microcomponent segment has grown substantially during the past two years; it currently represents 12 percent of semiconductor start-up product lines.

One of the fastest-growing product areas is the PC peripheral chip set market. The market for logic chip sets has attracted a host of new entrants in 1988 and 1989 and is approaching the saturation point. Dataquest expects a similar growth pattern in

the other peripheral chip set markets (e.g., graphics, communication, mass storage, modem, and fax). Dataquest also expects significant growth in the market for telecommunications ICs.

Dataquest has recognized very little growth in the GaAs market segment. Two companies, GAIN Electronics and Tachonics, have failed, and we have not identified any new GaAs start-ups. The technology still is in its developmental stages, and it may be quite some time before it gains wide acceptance.

## Keys to Success

The third wave of start-ups share many common characteristics. In general, the more successful companies tend to be as follows:

- Highly focused, flexible, and able to move quickly out of stagnant markets and into high-growth markets
- Willing to develop new markets and educate users about their products and design services
- Positioned at the leading edge because of their advanced process technologies and proprietary CAD software
- Resourceful in attracting venture capital from U.S. and foreign venture capitalists, corporate investors, and OEMs
- Aggressive in building strategic alliances to develop new applications jointly and secure wafer fab capacity, especially in Asia

Of course, not all recent start-ups fit this profile. Some companies are failing and are being acquired because of faulty management, weak finances, or poor product planning and marketing. Table 2a lists the companies that are no longer operating or have filed for Chapter 11 protection. Table 2b lists those companies that have been acquired by or merged with another company. Table 2c is a list of companies that have graduated from start-up status by achieving \$100 million in annual sales twice in their lifetimes.

Table 2a

## Companies That Are No Longer Operating

Company	Year Formed	Location	Product
ABM	1985	San Jose, CA	GaAs opto
Array Devices	1982	San Diego, CA	ASICs
GAIN Electronics	1985	Somerville, NJ	GaAs ASICs
Hyundai America	1983	Santa Clara, CA	Memory
Intercept Microelectronics	1985	Sunnyvale, CA	ASICs
Iridian	1983	Chatsworth, CA	GaAs FETs
Laserpath	1983	Sunnyvale, CA	ASICs
Sahni	1985	Sunnyvale, CA	ASICs
Saratoga Semiconductor	1985	Cupertino, CA	BiCMOS memory
Tachonics	1985	Plainsboro, NJ	GaAs
Telmos	1981	Sunnyvale, CA	ASICs, linear
Texet	1983	Allen, TX	Discretes
Trilogy	1980	Cupertino, CA	Waferscale
Wafer Tech	1984	Rancho Palos Verdes, CA	Logic
Zytrex	1981	Sunnyvale, CA	CMOS logic

Source: Dataquest  
January 1990

Table 2b

## Companies That Have Been Acquired or Merged

Company/Year Formed	Product	Acquired by	Year Acquired
Barvon Research (1981)	ASICs	Sipex	1988
Custom MOS Arrays (1982)	ASICs	CMD	1986
Exel Microelectronic (1983)	Memory, micros, ASICs	Exar	1986
G-2 Incorporated (1987)	Micros	Headland	1989
Integrated Power Semiconductor (1984)	Linear	Seagate	1987
Krysalis (1985)	NV memory	National	1989
Panatech (1981)	ASICs	Ricoh	1987
Signal Processor (1981)	DSP	Analog Devices	1983
Silicon Macrosystems (1984)	Memory	Austek	1986
Silicon Systems (1981)	Micros	TDK	1989
Vatic (1983)	ASICs	Thomson-Mostek	1986
Visic (1983)	Memory	VLSI Technology	1986
VTC (1984)	Linear, ASICs, foundry	Control Data	1987

Source: Dataquest  
January 1990

**Table 2c**  
**Companies That Have "Graduated" from Start-Up Status**

Company	Year Formed	Location	Product
Chips & Technologies	1985	San Jose, CA	Micros
Cypress Semiconductor	1983	San Jose, CA	Memory, ASICs, DSP
IDT	1980	Santa Clara, CA	Memory, logic, DSP, micros
LSI Logic	1981	Milpitas, CA	ASICs, DSP, micros
S-MOS Systems, Inc.	1983	San Jose, CA	Memory, micros, ASICs, linear
VLSI Technology	1979	San Jose, CA	ASICs, memory, micros

Source: Dataquest  
January 1990

**Table 3**

**Geographic Dispersion of Start-Up Companies**

Silicon Valley	75
Southwest United States	21
Northwest United States	7
Midwest United States	3
Northeast United States	11
Southeast United States	2
ROW	18
<b>Total</b>	<b>137</b>

Source: Dataquest  
January 1990

**Geographic Dispersion of Start-Up Companies**

Silicon Valley still leads with the number of semiconductor start-ups, but other areas are beginning to attract more start-ups. As shown in Table 3, 75 of the 137 companies identified in this book are located in Silicon Valley. This figure translates to 55 percent of these start-ups. In recent years, Dataquest has noticed a trend toward location outside Silicon Valley due to the increased availability of local financing and government

support. Figure 4 shows the geographic concentration of start-ups in the United States.

Dataquest anticipates more worldwide start-up activity due to growing public and private interest in promoting venture capitalism and entrepreneurialism. In the future, we expect the following regions to become increasingly active:

- The East Coast of the United States, especially New Jersey ("Gallium Gulch"), Maryland ("Bioelectronics Center"), and North Carolina ("Research Triangle")
- The Southwest United States, especially Austin and Dallas, Texas
- Europe, especially Scotland, West Germany, and France
- Israel
- Asia, especially Taiwan, China, Singapore, Malaysia, and India

By the year 2000, we expect to see a semiconductor industry that is not so concentrated in existing areas, but is much more global in scope. The trend toward closer vendor/user ties will accelerate this global shift. Because of the grass roots nature of start-ups, they will have a significant impact on the direction of regional industries and economies.

Tables 4a through 4g list start-up companies by location and region.

Figure 4  
Geographic Concentration of Start-Up Activity



0005344-4

Source: Dataquest  
January 1990



Table 4a  
Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
ACC Microelectronics	Santa Clara	1987
Actel Corp.	Sunnyvale	1985
Acumos	San Carlos	1985
Adaptec	Milpitas	1981
Advanced Linear Devices	Sunnyvale	1985
Advanced Microelectronic Products	San Jose	1986
Alliance Semiconductor	San Jose	1985
Altera Corporation	Santa Clara	1983
Aspen Semiconductors	San Jose	1987
ATMEL Corporation	San Jose	1984
Avasem Corporation	San Jose	1980
California Micro Devices	Milpitas	1980
Calogic Corp.	Fremont	1983
Catalyst Semiconductor	Santa Clara	1985
Celeritek	San Jose	1984
Cirrus Logic	Milpitas	1981
Custom Arrays Corp.	Sunnyvale	1984
The DSP Group	Emeryville	1988
Elantec	Milpitas	1983
Exel Microelectronics	San Jose	1983
Gazelle Microcircuits	Santa Clara	1986
Harris Microwave Semiconductor	Milpitas	1980
Headland Technologies, Inc.	Fremont	1989
IC Sensors	Milpitas	1982
ICI Array Technology	San Jose	1982
Inova Microelectronics Corp.	Santa Clara	1983
Integrated CMOS Systems	Sunnyvale	1984
Integrated Information Technology	Santa Clara	1987
Intergraph—Adv. Processor Div.	Palo Alto	1987
International CMOS Technology	San Jose	1983
IMP	San Jose	1981
Isocom Ltd.	Campbell	1982
ISSI	Sunnyvale	1988
IXYS Corp.	San Jose	1983
Krysalis Corp.	Sunnyvale	1985
Linear Integrated Systems	Fremont	1987
Linear Technology Corp.	Milpitas	1981
Logic Devices Inc.	Sunnyvale	1983
Maxim Integrated Products	Sunnyvale	1983
MemTech Technology Corp.	Santa Clara	1986
Micro Linear Corp.	San Jose	1983
Microwave Technology, Inc.	Fremont	1982
Modular Semiconductor	Sunnyvale	1983
MOS Electronics Corp.	Sunnyvale	1983
Multichip Technology	San Jose	1988
nCHIP, Inc.	San Jose	1987
NovaSensor	Fremont	1985
Novix	Cupertino	1984
Oak Technology, Inc.	Sunnyvale	1987

(Continued)

**Table 4a (Continued)**  
**Start-Ups in Silicon Valley (75)**

Company	Location	Date Formed
Orbit Semiconductor	Sunnyvale	1985
Pacific Monolithics	Sunnyvale	1984
Paradigm Technology	San Jose	1987
Performance Semiconductor	Sunnyvale	1984
Plus Logic	San Jose	1988
PLX Technology Corp.	Mountain View	1986
Power Integrations	Mountain View	1988
PromTech	San Jose	1984
Samsung Semiconductor, Inc.	San Jose	1983
SEEQ Technology, Inc.	San Jose	1981
Sierra Semiconductor	San Jose	1984
Si-Fab Corp.	Scotts Valley	1981
Sensym, Inc.	Sunnyvale	1982
Solid State Optonics	San Jose	1982
S3	Santa Clara	1989
Synaptics, Inc.	San Jose	1986
Synergy Semiconductor Corp.	Santa Clara	1987
Topaz Semiconductor	San Jose	1985
US2	San Jose	1987
Vadem	San Jose	1983
VIA Technologies	Fremont	1987
Vitellic Corp.	San Jose	1983
WaferScale Integration	Fremont	1983
Weitek Corp.	Sunnyvale	1980
Xilinx Inc.	San Jose	1984
Zoran Corp.	Santa Clara	1983

Source: Dataquest  
 January 1990

**Table 4b**  
**Start-Ups in the Southwest (21)**

Company	Location	Date Formed
AMCC	San Diego, CA	1979
Brooktree Corp.	San Diego, CA	1983
Comlinear Corp	Ft. Collins, CO	1980
Crystal Semiconductor	Austin, TX	1984
Dallas Semiconductor	Dallas, TX	1984
GigaBit Logic	Newbury Park, CA	1981
HNC	San Diego, CA	1986
Innovative Silicon Technology	Carrollton, TX	1986
Integrated Logic Systems	Colorado Springs, CO	1983
Microwave Monolithics	Simi Valley, CA	1982
Molecular Electronics Corp.	Torrance, CA	1984
NMB Technologies	Chatsworth, CA	1984

(Continued)

**Table 4b (Continued)**  
**Start-Ups in the Southwest (21)**

Company	Location	Date Formed
Opto Diode Corp.	Newbury Park, CA	1981
Ramtron Corp.	Colorado Springs, CO	1984
SIMTEK Corp.	Colorado Springs, CO	1987
Telcom Devices Corp.	Newbury Park, CA	1986
Three-Five Systems, Inc.	Phoenix, AZ	1985
Togai InfraLogic	Irvine, CA	1987
Triad Semiconductors	Colorado Springs, CO	1986
Vitesse Semiconductor	Camarillo, CA	1984
XTAR Corp.	San Diego, CA	1982

Source: Dataquest  
 January 1990

**Table 4c**  
**Start-Ups in the Northwest (7)**

Company	Location	Date Formed
Advanced Hardware Architectures	Moscow, ID	1988
Advanced Power Technology, Inc.	Bend, OR	1984
Bipolar Integrated Technology	Beaverton, OR	1983
Lattice Semiconductor	Hillsboro, OR	1983
Level One Communications	Folsom, CA	1985
Seattle Silicon Corp.	Bellevue, WA	1983
TriQuint Semiconductor	Beaverton, OR	1984

Source: Dataquest  
 January 1990

**Table 4d**  
**Start-Ups in the Midwest (3)**

Company	Location	Date Formed
Electronic Technology Corp.	Ames, IA	1983
Photonic Integration Research	Columbus, OH	1987
VTC Inc.	Bloomington, MN	1984

Source: Dataquest  
 January 1990

**Table 4e**  
**Start-Ups in the Northeast (11)**

Company	Location	Date Formed
ANADIGICS	Warren, NJ	1985
BKC International	Lawrence, MA	1986
Custom Silicon	Lowell, MA	1983
Edsun Laboratories	Waltham, MA	1984
Epitaxx Inc.	Princeton, NJ	1984
Hittite Microwave Corp.	Woburn, MA	1985
Lytel	Somerville, NJ	1984
NSI Logic	Marlboro, MA	1984
Oxford Computer	Oxford, CT	1987
Powerex	Youngwood, PA	1986
TranSwitch	Shelton, CT	1988

Source: Dataquest  
 January 1990

**Table 4f**  
**Start-Ups in the Southeast (2)**

Company	Location	Date Formed
Cree Research	Durham, NC	1987
Spectrum Microdevices	Frederick, MD	1980

Source: Dataquest  
 January 1990

**Table 4g**  
**Start-Ups in the ROW Region (18)**

Company	Location	Date Formed
Asahi Kasei Microsystems	Japan	1983
Austek Microsystems	Australia	1984
Calmos Systems	Canada	1983
Chartered Semiconductor	Singapore	1987
Dolphin Integration	France	1985
European Silicon Structures	West Germany	1985
Genesis Microchip	Canada	1987
Hualon Micro-Electronics Corp.	Taiwan	1987
Kyoto Semiconductor Corp.	Japan	1980
Matra-Harris Semiconducteur	France	1979
Mietec N.V.	Belgium	1983
MOSPEC Semiconductor Corp.	Taiwan	1987
Opto Tech Corp.	Taiwan	1983
RAMAX Ltd.	Australia	1987
SID Microelectronics	Brazil	1984
TSMC	Taiwan	1986
UMC	Japan	1979
Wolfson Microelectronics Ltd.	Scotland	1985

Source: Dataquest  
 January 1990

## Success Factors

As competition intensifies in the semiconductor industry, building a successful start-up company will become increasingly difficult. What are the key factors that will distinguish the winners from the losers? Based on the track records of existing companies and our discussions with venture capitalists, Dataquest believes that the following factors are critical:

- **Management**
  - A strong management team, top-notch engineers, and excellent marketing managers
  - A unique business strategy with achievable goals including a clear definition of a customer's problem to be solved, rather than technology looking for an application
  - A stable source of financing that will allow sustained operation for five to eight years—maybe longer in a new market
- **Product Development**
  - Access to leading-edge processing expertise
  - Access to quality CAD software and support tools
  - Close relations with customer base
- **Manufacturing**
  - An experienced operations manager and strong in-house manufacturing knowledge
  - A silicon foundry agreement during initial years
  - A plan to ensure access to a state-of-the-art wafer fabrication facility
- **Marketing**
  - Global marketing perspective
  - Highly focused marketing plan
  - Asia monitoring capability (especially Japan)
  - A plan for overseas sales, marketing, and distribution agreements in the second or third year of production

Absolutely critical for success is the building of a strong management team. Successful new companies are those that attract talented and experi-

enced personnel to fill positions in key areas including development, manufacturing, and international operations. Companies with only one or two of these positions filled with first-rate managers usually have trouble during the product commercialization phase. In general, the start-ups most likely to fail are those that are strong in technology but weak in marketing, manufacturing, and general management. Many companies are built around engineers who do not have the breadth of management and marketing experience required to run a company successfully.

The lack of marketing intelligence is another common pitfall. Most start-ups concentrate on the U.S. market and ignore overseas markets until they attain a certain sales volume. Unfortunately, these companies overlook significant sales opportunities and emerging foreign competitors. Dataquest believes that a global posture is critical for start-up companies, especially with the growing competition from European and Asian companies.

In evaluating start-up companies, we believe the following questions should be asked:

- What are the prior achievements of key officers and managers?
- Is the product line unique or a significant improvement over its competitors? Is it diversified enough to withstand fierce price competition?
- How much does the start-up invest in R&D?
- Does the start-up have plans to conduct joint research with universities and strategic partners?
- What is the start-up's marketing strategy? Is it domestic only or a global strategy?
- Is the start-up planning foundry agreements and/or plant construction? What is the timing?
- If the start-up has an agreement with an Asian company, is it giving away the store?
- Is the company prepared to respond to rapid technological innovation?

## Financing

The start-ups in this directory have raised more than \$2 billion in venture funding so far. In addition, public offerings have made up an additional \$1.2 billion to start-up capital stock. The 1989

public offering totals are skewed by a \$460 million public offering for NMB Semiconductor. Tables 5a and 5b contain information regarding public offerings by start-ups. Table 5a lists initial public offerings including company, date, and amount raised. Table 5b lists all public offerings by

start-ups. Figure 5 shows start-up financing by year, highlighting monies raised by public offerings and those raised by other means. Table 6 contains to-date totals for funding by start-up and provides information regarding the source of funds for each company.

**Table 5a**  
**Initial Public Offerings by Start-Ups**

Company	Date	Amount
VLSI Technology	February 1983	\$ 53.0M
LSI Logic	May 1983	\$160.0M
ZyMOS Corp.	July 1983	\$ 46.9M
SEEQ	September 1983	\$ 20.0M
Integrated Devices Technology	February 1984	\$ 16.1M
United Microelectronics	July 1985	\$ 7.5M
Linear Technology Corp.	May 1986	\$ 24.0M
Cypress Semiconductor	June 1986	\$ 72.0M
California Micro Devices	October 1986	\$ 5.2M
Chips & Technologies	October 1986	\$ 11.3M
IMP	June 1987	\$ 22.3M
Dallas Semiconductor	September 1987	\$ 35.1M
Maxim Integrated Products	February 1988	\$ 7.0M
Altera Corp.	March 1988	\$ 15.0M
Weitek Corp.	September 1988	\$ 8.35M
Logic Devices	November 1988	\$ 5.4M
NMB Semiconductor	September 1989	\$460.0M
Cirrus Logic	June 1989	\$ 24.0M
International CMOS Technology	June 1989	\$ 3.6M
Lattice	November 1989	\$ 14.0M

Source: Dataquest  
January 1990

**Table 5b**  
**Public Offerings by Start-Ups**

Company	Date	Amount
VLSI Technology	February 1983	\$ 53.0M
LSI Logic	May 1983	\$160.0M
ZyMOS Corp.	July 1983	\$ 46.9M
SEEQ	September 1983	\$ 20.0M
Integrated Logic Systems	January 1984	\$ 5.0M
Integrated Device Technology	February 1984	\$ 16.1M
Micron Technology	June 1984	\$ 25.0M
Micron Technology	May 1985	\$ 25.0M
United Microelectronics	July 1985	\$ 7.5M
VLSI Technology	April 1986	\$ 33.0M
Linear Technology Corp.	May 1986	\$ 24.0M
Cypress Semiconductor	June 1986	\$ 72.0M
Adaptec, Inc.	June 1986	\$ 10.0M
Micron Technology	August 1986	\$ 13.4M

(Continued)

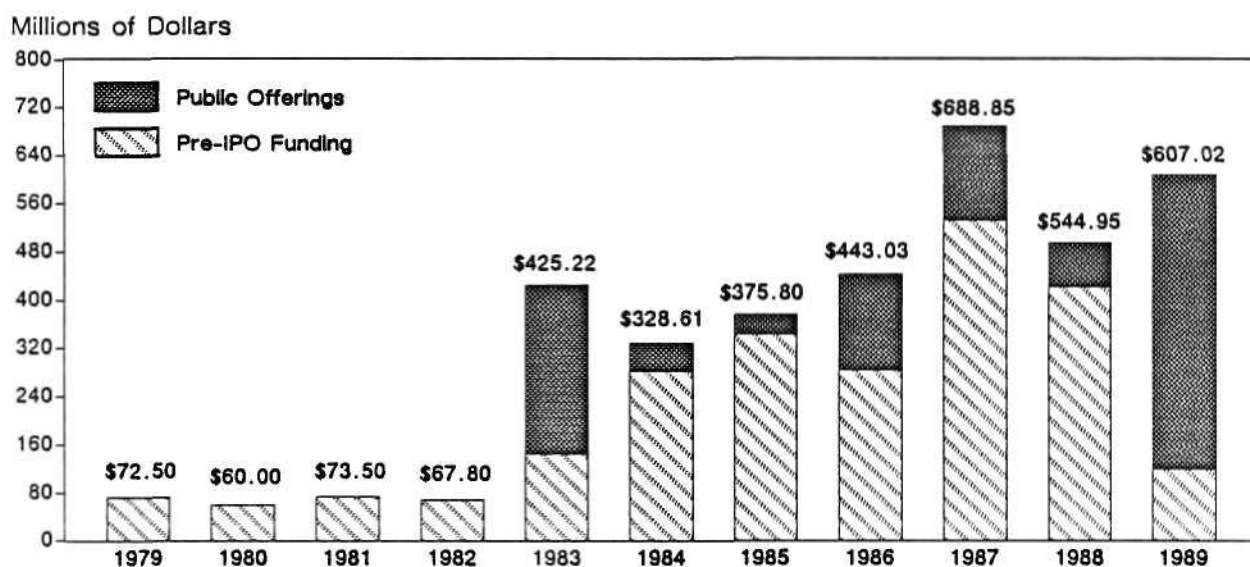
**Table 5b (Continued)**  
**Public Offerings by Start-Ups**

Company	Date	Amount
California Micro Devices	October 1986	\$ 5.2M
Chips & Technologies	October 1986	\$ 11.3M
LSI Logic	April 1987	\$ 21.0M
Xicor	April 1987	\$ 22.8M
Cypress Semiconductor	June 1987	\$ 39.8M
IMP	June 1987	\$ 22.3M
Chips & Technologies	July 1987	\$ 15.5M
Dallas Semiconductor	September 1987	\$ 35.1M
Maxim Integrated Products	February 1988	\$ 7.0M
Xicor	March 1988	\$ 17.0M
Altera Corp.	March 1988	\$ 15.0M
SEEQ	April 1988	\$ 19.5M
Weitek Corp.	September 1988	\$ 8.35M
Logic Devices	November 1988	\$ 5.4M
NMB Semiconductor	1989	\$460.0M
International CMOS Technology	June 1989	\$ 3.6M
Cirrus Logic	June 1989	\$ 24.0M
Lattice	Filed September 1989	N/A

N/A = Not Available

Source: Dataquest  
January 1990

**Figure 5**  
**Start-Up Financing by Year**  
**1979-1989**



0005344-5

Source: Dataquest  
January 1990

Table 6

**Capitalization by Company to Date  
(Millions of Dollars)**

<b>Company</b>	<b>Amount</b>	<b>Sources</b>
Actel Corp.	\$ 19.70	Venture capital, private corporate
Advanced Power Technology	\$ 13.80	Venture capital
Altera Corp.	\$ 42.90	Lease, venture capital, public offering
ANADIGICS	\$ 29.00	Venture capital, corporate
AMCC	\$ 22.00	Venture capital, corporate
Aspen Semiconductor	\$ 7.40	Corporate
ATMEL	\$ 3.30	Venture capital
Austek Microsystems	\$ 6.70	Venture capital
Bipolar Integrated Technology	\$ 56.10	Lease, government, venture capital, corporate
BKC International	\$ 2.52	Private, loan
Brooktree	\$ 30.90	Venture capital, corporate
California Micro Devices	\$ 5.20	Public offering
Calmos Systems	\$ 5.50	Private
Calogic Corp.	\$ 0.02	Private
Catalyst Semiconductor	\$ 4.50	Private
Celeritek	\$ 8.40	Venture capital
Chartered Semiconductor	\$ 40.00	Corporate
Cirrus Logic	\$ 51.60	Public offering, venture capital, corporate
Cree Research	\$ 3.00	N/A
Crystal Semiconductor	\$ 31.20	Venture capital, corporate
Custom Arrays	\$ 2.35	Corporate, private
Dallas Semiconductor	\$ 74.40	Public offering, bond, venture capital
Dolphin Integration	\$ 0.60	Corporate, private
Elantec, Inc.	\$ 23.40	Venture capital, corporate
Electronic Technology Corp.	\$ 2.00	Venture capital, government
Epitaxx Inc.	\$ 1.50	Venture capital
ES2	\$ 44.00	Corporate, venture capital
Exel Microelectronics	\$ 36.00	Private, corporate, venture capital
Gazelle Microcircuits	\$ 17.20	Venture capital
GigaBit Logic	\$ 46.30	Venture capital, corporate
HNC	\$ 6.63	Private, venture capital
Hualon Micro-Electronics	\$ 30.00	Corporate
IMP	\$ 81.90	Public offering, venture capital, corporate, lease
Inmos	\$100.00	Government, venture capital
Inova	\$ 14.80	Venture capital, corporate
Integrated CMOS Systems	\$ 12.20	Venture capital, private
Integrated Logic Systems	\$ 5.00	Public offering
International CMOS Technology	\$ 13.50	Venture capital, public offering, corporate
ISSI	\$ 2.80	Corporate, private, venture capital
IXYS	\$ 16.70	Venture capital, private
Krysalis	\$ 4.20	Venture capital
Lattice	\$ 15.20	Public offering, credit, private, venture capital
Level One Communications	\$ 14.05	Venture capital, private
Logic Devices	\$ 5.40	Public offering

(Continued)



Table 6 (Continued)

Capitalization by Company to Date  
(Millions of Dollars)

Company	Amount	Sources
Linear Technology Corp.	\$ 59.00	Lease, corporate, venture capital, public offering
Lytel	\$ 20.00	Corporate
Matra-Harris Semiconducteur	\$ 40.00	Corporate
Maxim Integrated Products	\$ 30.30	Public offering, venture capital, lease, corporate
Micro Linear Corp.	\$ 53.30	Lease, venture capital corporate
Micron Technology	\$151.90	Private, public offerings
Microwave Technology	\$ 10.10	Venture capital, corporate
MOSel	\$ 6.00	Corporate, private
MOSPEC	\$ 11.75	Private
nCHIP	\$ 4.80	Venture capital, private
NMB	\$471.11	Public offering, private
Novix Inc.	\$ 1.00	Venture capital
Oak Technology	\$ 6.00	Venture capital, private
Pacific Monolithics	\$ 8.50	Venture capital
Paradigm Technology	\$ 12.60	Venture capital
Performance Semiconductor	\$ 32.90	Venture capital, private, lease
Photonic Integration Research	\$ 10.00	Corporate, private
Plus Logic	\$ 5.00	Venture capital
PLX Technology	\$ 1.90	Venture capital
Power Integrations	\$ 10.60	Venture capital, corporate
PromTech	\$ 0.20	Private
RAMAX	\$ 0.85	Government
Ramtron	\$ 34.50	Corporate
S3	\$ 6.00	Venture capital
Samsung Semiconductor	\$ 13.00	Venture capital, corporate
Seattle Silicon	\$ 28.80	Venture capital, corporate
SEEQ	\$ 82.50	Public offerings, venture capital, corporate, private
Sensym	\$ 14.20	Venture capital, corporate
SID Microelectronics	\$ 14.20	Private
Sierra Semiconductor	\$ 51.10	Venture capital, corporate
Synaptics	\$ 2.10	Venture capital
Synergy Semiconductor	\$ 12.90	Venture capital, private
TSMC	\$282.00	Venture capital, corporate, government
Three-Five Systems	\$ 5.50	Venture capital, corporate
Togai InfraLogic	\$ 4.20	Venture capital
United Microelectronics	\$ 20.00	Public offering, corporate, government
US2	\$ 4.52	Venture capital
Vitellic	\$ 55.20	Venture capital, corporate
Vitesse Semiconductor	\$ 25.40	Venture capital, government
WaferScale Integration	\$ 45.60	Venture capital, corporate
Weitek Corp.	\$ 15.85	Public offering, venture capital
Xilinx	\$ 21.00	Venture capital, corporate
Zoran	\$ 33.80	Venture capital, corporate

N/A = Not Available

Source: Dataquest  
January 1990

## Venture Capital

Beginning in 1983, venture capital funding of semiconductor start-ups grew at a substantial rate. In 1986, funding slowed in the face of an industry recession. The industry recovered in 1987 and attracted new venture financing. Since that time, however, the venture capital community has shown declining interest in the semiconductor industry. The prevailing feeling among venture capital investors is that U.S. start-ups cannot compete with Japanese companies. In addition, the 1987 stock market crash has caused lower stock valuations industrywide, which is causing investors to think twice about floating their start-up companies on the stock market. Despite the fact that the stock market has recovered from the crash to post all-time highs, high-tech stocks remain in disfavor. Without a strong stock market as a means of recovering investment costs, many venture capitalists are choosing to stay out of this uncertain market.

Dataquest has identified a similar pattern among European investors as well. European investors are choosing to fund medium-size companies rather than start-ups. The venture capital industry is looking to back companies that want to acquire or buy stakes in small electronics companies. This method avoids the cost and risk of flotation and often provides a higher return on investment.

Japanese venture capitalists typically are more conservative than investors in the United States.

Japanese companies rarely invest in start-ups; investors in Japan are more likely to invest in established companies. Japanese venture capitalists also tend not to fund high-tech companies and now are finding significant return in service industries, which support Japan's growing affection for leisure activities.

During the past few years, Dataquest has identified a general increase in total venture capital funding worldwide. Despite this fact, we are witnessing a growing disenchantment with the semiconductor industry among venture capitalists. This disenchantment is causing start-ups to seek new funding alternatives such as private placements or large loans. For this reason, Dataquest predicts a decline in start-up activity for the near future.

## Venture Capital Companies

Of the 115 companies that released funding information to Dataquest, 61 companies reported the use of venture capital funding. This number may actually be much higher because, in many cases, profiled companies provided limited financial information. Dataquest identified 331 venture capital companies that provided funding to start-ups between 1979 and 1989. Thirty-four companies have been involved in five or more rounds of financing. Table 7 provides information about the 66 venture capitalists that were involved in three or more rounds of financing during this period.

Table 7

### Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Hambrecht & Quist (17)	VLSI Technology	December 1980
	LTC	September 1981
	Xilinx	March 1984
	Austek Microsystems	July 1984
	Exel Microelectronics	September 1984
	Crystal Semiconductor	October 1984
	Integrated CMOS Systems	1985
	Seattle Silicon	February 1985
	Exel Microelectronics	August 1985
	Gazelle Microcircuits	August 1986
	Sierra Semiconductor	October 1986
	Gazelle Microcircuits	April 1987
	Seattle Silicon	August 1987

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

<b>Venture Capital Firm</b>	<b>Company</b>	<b>Date</b>
<b>Hambrecht &amp; Quist (Continued)</b>	Seattle Silicon	August 1988
	Gazelle Microcircuits	September 1988
	Integrated CMOS Systems	October 1988
	Vitellic	January 1989
<b>Kleiner, Perkins, Caufield &amp; Byers (17)</b>	VLSI Technology	December 1980
	LSI Logic	January 1981
	SEEQ	March 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Xilinx	March 1984
	Zoran Corp.	October 1985
	Crystal Semiconductor	February 1986
	Gazelle Microcircuits	August 1986
	SEEQ	October 1986
	Gazelle Microcircuits	April 1987
	Synaptics	June 1987
	Power Integrations	May 1988
	Gazelle Microcircuits	September 1988
S3, Inc.	April 1989	
nCHIP	August 1989	
Power Integrations	August 1989	
<b>Merrill, Pickard, Anderson &amp; Eyre (13)</b>	LSI Logic	February 1982
	Maxim Integrated Products	1983
	Weitek Corporation	March 1983
	Cypress Semiconductor	April 1983
	Dallas Semiconductor	June 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Saratoga Semiconductor	May 1986
	Synergy Semiconductor	February 1988
	Gazelle Microcircuits	September 1988
	Plus Logic	January 1989
	S3	April 1989
Power Integrations	August 1989	
<b>Sequoia Capital (12)</b>	LTC	September 1981
	LSI Logic	February 1982
	Cypress Semiconductor	April 1983
	Microwave Technology	August 1983
	Sierra Semiconductor	January 1984
	Elantec, Inc.	December 1986
	Vitesse Semiconductor	February 1987
	Synergy Semiconductor	July 1987
	Elantec, Inc.	September 1988
	Integrated CMOS Systems	October 1988
	Plus Logic	January 1989
S3	April 1989	

(Continued)

Table 7 (Continued)  
Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Adler & Company (11)	AMCC	April 1979
	IXYS Corp.	1983
	AMCC	March 1983
	Zoran Corp.	August 1983
	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Maxim Integrated Products	February 1985
	IXYS Corp.	October 1985
	IXYS Corp.	August 1987
	AMCC	September 1987
	IXYS Corp.	August 1988
Oak Investment Partners (11)	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Vitellic	March 1984
	Dallas Semiconductor	June 1984
	IXYS Corp.	October 1985
	Pacific Monolithics	September 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	Vitesse Semiconductor	January 1988
	Synergy Semiconductor	February 1988
IXYS Corp.	August 1988	
Robertson, Colman & Stephens (10)	IMP	August 1981
	Sensym	October 1982
	AMCC	March 1983
	WaferScale Integration	February 1984
	Cirrus Logic	March 1984
	Cypress Semiconductor	April 1984
	Sensym	May 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	AMCC	September 1987
U.S. Venture Partners (10)	AMCC	March 1983
	Microwave Technology	August 1983
	Performance Semiconductor	October 1984
	IXYS Corp.	October 1985
	Micro Linear Corp.	February 1986
	Elantec, Inc.	December 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	IXYS Corp.	August 1988
	Elantec, Inc.	September 1988
Brentwood Associates (9)	Maxim Integrated Products	1983
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Cirrus Logic	May 1985

(Continued)

Table 7 (Continued)  
Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Brentwood Associates (Continued)	California Devices	August 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	June 1986
	Performance Semiconductor Plus Logic	August 1988 January 1989
Mayfield Fund (8)	LSI Logic	January 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Cypress Semiconductor	August 1985
	Celeritek, Inc.	August 1986
	Synergy Semiconductor	July 1987
	S3 nCHIP	April 1989 August 1989
Mohr, Davidow Ventures (8)	Sierra Semiconductor	January 1984
	Actel Corp.	June 1986
	Vitesse Semiconductor	January 1988
	Power Integrations	May 1988
	US2	March 1989
	S3	April 1989
	nCHIP Power Integrations	August 1989 August 1989
Burr, Egan, Deleage & Co. (7)	Elantec, Inc.	August 1984
	Sierra Semiconductor	April 1985
	IXYS Corp.	October 1985
	Celeritek, Inc.	August 1986
	IXYS Corp.	August 1987
	IXYS Corp. Elantec, Inc.	August 1988 September 1988
DSV Partners (7)	Maxim Integrated Products	1983
	Epitaxx Inc.	March 1984
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Integrated CMOS Systems Integrated CMOS Systems	May 1987 October 1988
New Enterprise Associates (7)	Microwave Technology, Inc.	August 1983
	Dallas Semiconductor	February 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	Dallas Semiconductor	April 1987
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Technology Venture Investors (7)	LTC	September 1981
	Sierra Semiconductor	January 1984
	Altera Corp.	April 1984
	Cirrus Logic	May 1985

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Technology Venture Investors (Continued)	Inova	February 1986
	Synaptics	May 1986
	Synaptics	June 1987
Venrock Associates (7)	VLSI Technology	December 1980
	Sierra Semiconductor	January 1984
	Celeritek, Inc.	March 1985
	Gazelle Microcircuits	April 1987
	Integrated CMOS Systems	May 1987
	Gazelle Microcircuits	September 1988
Advanced Technology Ventures (6)	Integrated CMOS Systems	October 1988
	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	Performance Semiconductor	October 1984
	Actel Corp.	October 1985
	Actel Corp.	June 1986
Alex Brown & Sons (6)	Togai InfraLogic	December 1988
	IMP	June 1983
	ANADIGICS	April 1985
	Weitek	January 1986
	Dallas Semiconductor	March 1986
	Dallas Semiconductor	April 1987
Concord Partners (6)	ANADIGICS	January 1989
	Microwave Technology	August 1983
	Zoran Corp.	October 1985
	Power Integrations	May 1988
	Micro Linear	August 1989
	US2	March 1989
Crosspoint Venture Partners (6)	Power Integrations	August 1989
	Sensym	October 1982
	Laserpath	June 1983
	Sensym	May 1984
	Laserpath	July 1985
	Krysalis	May 1986
Harvard Management (6)	Krysalis	December 1986
	Cypress	March 1985
	BIT	May 1986
	Performance Semiconductor	November 1986
	Elantec	December 1986
	Elantec	September 1988
J.H. Whitney (6)	Gazelle Microcircuits	September 1988
	Cypress	April 1983
	WaferScale	February 1984
	Vitellic	March 1984
	Xilinx	March 1984
	Vitesse	February 1987
Synergy	February 1988	

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Rothschild Ventures (6)	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	ANADIGICS	April 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	August 1988
	Togai InfraLogic	December 1988
Bessemer Venture Partners (5)	Maxim Integrated Products	1983
	WaferScale Integration	February 1984
	Vitelc	March 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
Grace Ventures (5)	IXYS	October 1985
	Zoran Corp.	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
	IXYS	August 1988
Harvest Ventures (5)	IMP	August 1981
	IXYS	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
	IXYS	August 1988
Hillman Ventures (5)	SEEQ	March 1981
	IMP	June 1983
	SEEQ	October 1986
	Actel Corp.	August 1988
	Power Integrations	August 1989
J.F. Shea & Company (5)	Advanced Power Technology	N/A
	Altera	April 1984
	Dallas Semiconductor	June 1984
	Exel Microelectronics	September 1984
	IXYS	August 1988
Matrix Partners (5)	AMCC	March 1983
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
	AMCC	September 1987
	Synergy Semiconductor	February 1988
Sutter Hill Ventures (5)	LSI Logic	January 1981
	LTC	September 1981
	Weitek Corp.	February 1982
	Sierra Semiconductor	January 1984
	Celeritek	March 1985
Accel Partners (4)	AMCC	March 1983
	WaferScale Integration	February 1984
	Micro Linear	November 1985
	AMCC	September 1987

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Associated Venture Investors (4)	Sierra Semiconductor	January 1984
	Elantec	August 1984
	Elantec	September 1988
	PLX Technology	August 1989
Bay Partners (4)	Sierra Semiconductor	January 1984
	Exel Microelectronics	September 1984
	California Devices	August 1985
	IXYS	August 1988
Continental Illinois Venture Corp. (4)	IMP	August 1981
	WaferScale Integration	November 1984
	Three-Five Systems	September 1987
	HNC	June 1988
John Hancock Venture Capital (4)	Dallas Semiconductor	June 1984
	California Devices	September 1986
	SEEQ	October 1986
	Saratoga Semiconductor	March 1987
Julian, Cole & Stein (4)	Advanced Power Technology	N/A
	Level One	December 1985
	Level One	December 1986
	Level One	September 1987
Norwest Venture Capital Management (4)	Seattle Silicon	February 1985
	Actel Corp.	June 1986
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
Republic Ventures (4)	IMP	August 1982
	Dallas Semiconductor	June 1984
	BIT	May 1986
	GigaBit Logic	September 1988
Riordan Venture Group (4)	GigaBit Logic	March 1982
	Exel Microelectronics	September 1984
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Union Venture Corp. (4)	IDT	June 1983
	GigaBit Logic	February 1985
	BIT	May 1986
	GigaBit Logic	September 1988
Venture Growth Associates (4)	AMCC	March 1983
	Altera Corp.	April 1984
	Dallas Semiconductor	June 1984
	AMCC	September 1987
Alan Patricof Associates (3)	ANADIGICS	April 1985
	California Devices	August 1985
	ANADIGICS	January 1989

(Continued)



**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Alpha Partners (3)	Altera Corp.	June 1983
	Inova	1984
	Inova	February 1986
Arthur D. Little (3)	IXYS	October 1985
	ANADIGICS	November 1986
	IXYS	August 1988
Berkeley International (3)	Crystal Semiconductor	June 1987
	Sierra Semiconductor	September 1987
	Performance Semiconductor	August 1988
Berry Cash Southwest Partnership (3)	Crystal Semiconductor	October 1984
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
Bryan & Edwards (3)	Sierra Semiconductor	April 1985
	Inova	February 1986
	Vitesse	February 1987
Cowen & Company (3)	LTC	April 1983
	BIT	July 1987
	Performance Semiconductor	August 1988
Fairfield Venture Partners (3)	Micro Linear	October 1983
	ANADIGICS	April 1985
	BIT	July 1986
GE Venture Capital Corp. (3)	ANADIGICS	April 1985
	Laserpath	July 1985
	SEEQ	October 1986
Hambro International Venture Fund (3)	Integrated CMOS Systems	May 1987
	Edsun Labs	July 1988
	Integrated CMOS Systems	October 1988
Hill, Kirby & Washing (3)	Seattle Silicon	February 1985
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
HLM Partners (3)	Dallas Semiconductor	March 1986
	Saratoga Semiconductor	March 1987
	Dallas Semiconductor	April 1987
Hook Partners (3)	California Devices	October 1986
	Vitesse Semiconductor	January 1988
	Plus Logic	January 1989
InnoVen (3)	Weitek Corp.	January 1981
	Weitek Corp.	February 1982
	California Devices	August 1985
Merrill Lynch Venture Capital (3)	California Devices	August 1985
	Micro Linear	August 1988
	Elantec	September 1988

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
New Venture Partners (3)	Dallas Semiconductor	June 1984
	Cirrus Logic	June 1987
	Vitesse Semiconductor	April 1989
Rainier Venture Partners (3)	Seattle Silicon	February 1985
	Xilinx	December 1985
	Seattle Silicon	August 1987
Robert Fleming Investment Management (3)	AMCC	March 1983
	IMP	June 1983
	Cypress	April 1984
Shaw Venture Partners (3)	Pacific Monolithics	August 1985
	Actel Corp.	October 1985
	Actel Corp.	June 1986
Sprout Group (3)	Synaptics	May 1986
	Synaptics	June 1987
	Actel Corp.	August 1988
TA Associates (3)	Exel Microelectronics	September 1984
	Exel Microelectronics	August 1985
	Paradigm Technology	May 1989
Warburg, Pincus Ventures (3)	WaferScale Integration	February 1984
	Epitaxx Inc.	March 1984
	Level One	September 1987
Weeden Capital Partners (3)	Krysalis	May 1986
	Krysalis	December 1986
	BIT	April 1988
Welsh, Carson, Anderson & Stowe (3)	IMP	August 1981
	Altera Corp.	April 1984
	Zoran Corp.	October 1985

N/A = Not Available

Source: Dataquest  
January 1990

## Strategic Alliances

An important development in the start-up area is the proliferation of licensing and joint-development agreements with established companies. At a time when venture capital has become increasingly scarce, small companies often are under pressure for near-term funding. In addition to seeking funds, start-ups are entering strategic alliances for a variety of other reasons, such as the following:

- To avoid the prohibitive costs of a fab
- To increase production capacity

- To defray increasing product development costs
- To strengthen product portfolios
- To increase a worldwide presence
- To protect the start-up from the danger of obsolescence of a process technology by entering fab agreements

Strategic alliances can be valuable to both start-up companies and larger companies. Large companies often enter into alliances with technology-rich start-ups as a way of entering emerging markets. Through agreements with large companies,

start-ups are able to take advantage of the manufacturing, marketing, and financial power of large companies. Table 8 lists the advantages of strategic alliances to start-ups.

Until recently, companies that sought access to new technologies or markets often would resort to acquisition. Acquisition arrangements, however, can be ill-conceived, inefficient, and unsuccessful. Acquisitions frequently trigger a flight of top engineers and lower employee morale in the acquired company.

Corporate partners are seeking something more than mere dollar gains. Agreements include access to technology, designs, and guaranteed production.

To accomplish strategic objectives, companies are considering a broader range of limited and focused cooperative agreements, such as the following:

- Minority equity investments
- Technology licensing
- Joint marketing
- Joint ventures
- All or part of manufacturing

Figure 6 shows the number of start-up alliances per year for the period 1979 through 1989. Tables 9a through 9k list start-up alliances by year.

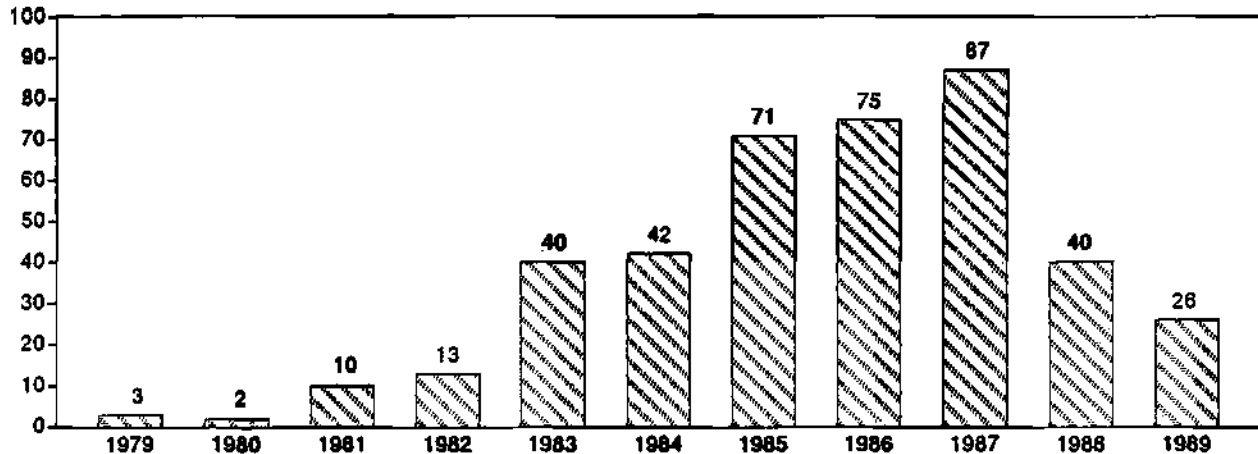
Table 8

Advantages of Start-Up Strategic Alliances

Offense	Defense
Secure technologies	Work with potential rivals
Gain access to markets	Keep out competitors
Rapid market entry	Monitor technology and market trends
Fill in product portfolios	Cut production costs
Foundry capacity	Financial viability
Cash infusions	
Greater product acceptance	
Ease trade frictions	
<b>Pitfalls and Problems of Alliances</b>	
<b>Management</b>	
Language and cultural differences	
Management styles	
Conflicting business goals	
Unequal levels of commitment	
Differing negotiating styles	
<b>Technology</b>	
Giving away the store	
Receiving little in return	
Stuck with a nonindustry standard	
<b>Market</b>	
Quarrels over territory	
Loss of overseas expansion potential	
Encroachment into U.S. market	

**Figure 6**  
**Alliances by Year**  
**1979-1989**

Number of Alliances



0005344-6

Source: Dataquest  
 January 1990

**Table 9a**  
**1989 Alliances (26)**

Companies	Description
ACC Microelectronics Motorola	April 1989—Motorola to second-source the ACC82020 and ACC82300 chip sets and cache controller and tag RAM to be introduced in late 1989
Crystal Semiconductor Analogic	June 1989—Analogic to become VAR of the Crystal ADC product line
HNC Fusion Group	September 1989—Partnership to market software utilities designed to integrate neural computing into financial applications
ICT AMD	July 1989—ICT and AMD to codevelop 1Mb EPROM with an access time of 55ns
IIT Ascii	1989—Ascii to distribute IIT products in Japan
IIT Mitsui	1989—Mitsui to distribute IIT products in Japan
IIT Yamaha	1989—Yamaha to provide wafer fab services to IIT
IMP Mitel	March 1989—Mitel to exchange four communications chip designs for IMP's 1.2-micron MxCMOS process, ACL1.2-DCL1.2 cell libraries, and mixed A/D design methodology

(Continued)

Table 9a (Continued)

## 1989 Alliances (26)

Companies	Description
ISSI UMC	January 1989—Licensing and manufacturing agreement with UMC, which will provide foundry services to ISSI
ISSI TSMC	August 1989—TSMC to provide foundry services to ISSI
ISSI LSI Logic	September 1989—Licensing and manufacturing agreement, LSI to provide foundry services to ISSI
Lattice AMD	May 1989—Cross-licensing agreement: Lattice gained rights to AMD's 22V10 PLD and the use of 22V10 architecture in manufacturing Generic Array Logic devices. AMD to manufacture GAL devices using Lattice's architecture
Oxford Computer Scan Graphics	September 1989—Joint development of image scanning devices using Oxford's "Intelligent Memory Chip" technology
RAMAX Epi Materials	October 1989—RAMAX to market EML's epi-treated wafers into Asia
Ramtron Seiko-Epson	April 1989—S-E to help finance FRAM basic development. Joint development of submicron CMOS FRAM production process
Ramtron Alcan Aluminum	June 1989—Ramtron and Alcan to codevelop advanced ferroelectric materials. Alcan made 6.5 percent equity investment in Ramtron
SEEQ National	June 1989—SEEQ and National scale back 1987 agreement to cover only current flash technology. SEEQ to continue to develop 0.8-micron flash chips alone
Samsung NCR	January 1989—Technology exchange and license agreement gives Samsung ASIC capability and NCR SRAM capability
Samsung Zilog	June 1989—Two licensing and marketing agreements permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 MCUs and the Z85C30 Serial Communications Controller
Samsung Quadtree Software	February 1989—Quadtree to develop full-function software models of Samsung's high-performance DRAM controllers
Seattle Silicon GigaBit Logic	June 1989—Seattle Silicon and GBL to develop comprehensive set of design software tools for GaAs ASICs
Togai InfraLogic Mitsubishi	September 1989—Togai and Mitsubishi Heavy Industries to codevelop air conditioning system based on fuzzy logic controller
VIA Technologies Fujitsu	March 1989—Partnership to codevelop peripheral chip sets for Sun-compatible workstations

**Table 9b**  
**1988 Alliances (40)**

Companies	Description
Actel Corp. Texas Instruments	November 1988—TI to alternate source Actel's ACT 1 family of gate arrays and resell the Action Logic System, Actel's CAE system. Actel gains access to TI's EPIC 1 CMOS wafer processing technology and manufacturing capabilities
AMCC Plessey	January 1988—Jointly develop high-performance ECL gate arrays with up to 14,000 gates
Adaptec Chips & Technologies	October 1988—Joint introduction of a series of products for IBM PS/2 Models 50-, 60-, and 80-compatibles
Adaptec Chips & Technologies	January 1988—Adaptec and Chips to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80
BIT Arizona Microtek	July 1988—BIT and AZM to codevelop custom ICs using BIT's high-performance BIT-1 technology. AZM will serve as independent design house to develop LSI designs for BIT customers
Brooktree Analog Devices	January 1988—Analog Devices to second-source Brooktree's video DACs
Calmos Siltronics	February 1988—Calmos' acquisition of Siltronics' bipolar component business for \$500,000
Catalyst Semiconductor Oki	November 1988—Oki to second-source the CAT35C102 and CAT35C202 serial EEPROMs
Cirrus Logic Award Software	July 1988—Award to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets
Cirrus Logic Phoenix Technologies	September 1988—Phoenix will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus
Cree General Instrument	August 1988—Cree and GI agreed to codevelop and manufacture silicon-based rectifiers
Custom Arrays Teledyne	February 1988—Custom and Teledyne to codevelop a new family of BiCMOS semicustom and cell-based libraries
ES2 Philips	February 1988—Philips to provide foundry services on its 1.5-micron CMOS line
ES2 US2	January 1988—ES2 establishes US2, a U.S.-based affiliate
GAIN Interface Tech	March 1988—GAIN to supply personalized versions of its GFL gate array product family
GBL Cray Research	January 1988—Cray placed \$6.5 million foundry offer
Gazelle TriQuint	September 1988—TriQuint to manufacture GaAs devices for Gazelle; \$16.9 million contract

(Continued)

**Table 9b (Continued)**  
**1988 Alliances (40)**

<b>Companies</b>	<b>Description</b>
GigaBit Logic NKT (Denmark)	September 1988—GBL and NKT form GIGA to serve European and Israel markets for ICs
GigaBit Logic SC Hightech	December 1988—GBL to market SC Hightech's GaAs ICs worldwide, excluding Japan. Provides opportunity for codevelopment of GaAs ICs in the future. SC Hightech may provide foundry services to GBL
ICI Array National	March 1988—ICI Array Technology to use National Semiconductor's design systems and process specifications to develop proprietary ASICs
IXYS ABB	May 1988—IXYS and ASEA Brown Boveri form joint venture to strengthen industrial power control marketplace using ABB's patented copper substrate bonding technology and IXYS' smart power, IGBTs, and MegaMOS expertise
LSI Logic Sun	March 1988—LSI Logic to manufacture, market, modify, and enhance MPU-related components, software, and systems using Sun's SPARC
LSI Logic ITI	March 1988—Imaging Technology Inc. (ITI) to design a new generation of imaging products using LSI Logic's L64200 series of real-time image processing chips
Level One Mitel	May 1988—Joint development agreement
Matra-Harris Aspen Cypress	April 1988—R&D agreement. MHS to provide \$4.57M in funding, and technical and design expertise for development of ultrahigh-speed ECL circuits to be developed by Aspen
Maxim Supertex	April 1988—Agreed to jointly develop 690 family of MPU supervisory circuits
Micron Intel	March 1988—Intel to market Micron DRAMs under Intel's label, beginning with 256K products
Micron SMC	April 1988—Micron's purchases 1.6 million shares of Standard Microsystems Corp. (SMC) common stock at \$6.03 per share
Ramtron ITT Semiconductor	June 1988—Codevelopment program to develop submicron ferroelectric manufacturing process
Ramtron NMB Semiconductor	October 1988—Codevelopment and licensing program to develop 4Mb DRAM process technology and products utilizing Ramtron's ferroelectric materials
Ramtron TRW	November 1988—Codevelopment program to develop rad-hard NV memory for aerospace and defense applications
Seattle Silicon Oki	August 1988—Seattle Silicon and Oki to codevelop a compiler for a process-independent, five-port, high-speed SRAM module
TriQuint MSC	March 1988—Microwave Semiconductor Corporation (MSC) and TriQuint to provide interchangeable GDS-II tape with equivalent performance for GaAs analog and digital ICs and MMICs

(Continued)

Table 9b (Continued)

## 1988 Alliances (40)

Companies	Description
VLSI Technology Harris	April 1988—Codevelop a rad-hard gate array and future commercial and nonrad-hard military gate arrays
VLSI Technology Sanyo	April 1988—Sanyo to manufacture and market VLSI Technology's 32-bit ACORN RISC Machine IC family worldwide
Vadem Intel	March 1988—Intel invests in IBM Model 30 and PC XT-compatible chip set that Vadem is developing
Vadem Intel	September 1988—Intel to refer customers to Vadem for Vadem's PC chip set
Zoran Toshiba	January 1988—Technology and manufacturing alliance
Zoran SGS-Thomson	March 1988—Technology and manufacturing alliance
iLSi Oki	April 1988—Oki to manufacture and sell gate arrays based on iLSi technology and provide foundry service

Source: Dataquest  
January 1990

Table 9c

## 1987 Alliances (87)

Companies	Description
ANADIGICS Bendix	June 1987—Contract from Bendix Aerospace to develop CAD tools for the DOD's MMIC program
ATMEL Sanyo Electric	1987—ATMEL and Sanyo signed a foundry contract to produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs
Adaptec SCO	October 1987—Adaptec and the Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system
Adaptec Conner Peripherals	October 1987—Adaptec to supply disk controller ICs to Conner Peripherals
Alcatel Mietec SGS-Thomson	1987—Alcatel, Mietec, SGS-Thomson—transfer of a 1.2-micron CMOS process
Alliance NMB	December 1987—Five-year agreement covering 256K and 1Mb DRAMs; NMB to manufacture and sell the devices worldwide
Altera WSI Sharp	January 1987—Codevelop a family of standalone microsequencer products with wafers manufactured by Sharp of Japan

(Continued)



Table 9c (Continued)

## 1987 Alliances (87)

Companies	Description
Altera Cypress	June 1987—Codevelop a family of CMOS EPLDs
Asahi Kasei Crystal Semi	January 1987—Asahi Chemical's acquisition of an 8 percent share in Crystal for approximately \$4 million; Asahi Kasei to manufacture and market Crystal's devices for the far eastern market
Asahi Kasei ICT	January 1987—Asahi Kasei's receipt of a license to ICT's technology; Asahi Kasei to market ICT's EEPROMs
Aspen Cypress	December 1987—Cypress' guaranteed \$7.4 million to Aspen, a wholly owned subsidiary of Cypress, which will fabricate and sell ECL devices
Austek ZyMOS	October 1987—ZyMOS licensed to make and sell the Austek Microcache as part of the POACH chip set
BIT Sun	July 1987—Sun's license of a bipolar 32-bit RISC MPU to BIT
Batelle Institute Photonic MEC NTT	July 1987—The Batelle Institute, Mitsubishi Electric Corporation (MEC), and NTT—formation of Photonic Integration
CDI IST	April 1987—Joint product development and second-source agreement covering two families of ASICs using channelless architectures
CMD Tachonics	March 1987—Tachonics to manufacture commercial and military GaAs ICs using CMD cell design and tools in the 1.0- to 0.5-micron range
CMD Telefonica	November 1987—Joint venture agreement to form a company named California Micro Devices SA in Spain
Calmos Samsung	January 1987—Calmos' license of its 8200 series of devices to Samsung in exchange for a foundry commitment
Catalyst Oki Electric	March 1987—Previous agreement extended to include a wide range of CMOS EEPROMs
Chartered National Sierra STC	October 1987—National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation established joint-venture company, Chartered Semiconductor Corporation
Cirrus Logic WDC	January 1987—Cirrus Logic's license of a custom Winchester disk drive controller IC to Western Digital Corporation
Cirrus Logic DIA-Semicon	October 1987—DIA-Semicon Systems to distribute new and existing products in Japan
Cirrus Logic Award Software	November 1987—Award Software to develop a VGA graphics BIOS and demonstration board for Cirrus Logic's GD510/520 VGA chip set

(Continued)

**Table 9c (Continued)**  
**1987 Alliances (87)**

<b>Companies</b>	<b>Description</b>
Cypress Sun	July 1987—Joint development of a CMOS RISC MPU product line based on Sun's SPARC
Cypress Matra-Harris	December 1987—Prior agreement extended to include manufacture and marketing of five Cypress 64K SRAMs
Dallas Xecom	May 1987—Three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families
Dallas AMP	August 1987—Dallas and AMP R&D partnership to develop interconnect techniques
ES2 Lattice Logic	1987—ES2's acquisition of Lattice Logic
ES2 Philips	February 1987—ES2, Philips, and TI joint agreement for the manufacture of the SystemCell; TI and Philips to supply volume parts, ES2 to provide prototypes and low-volume quantities
ES2 Mitsui & Co.	October 1987—ES2 and Mitsui & Co. joint purchase of a Japanese software and design company called Best, which will market ES2's products in Japan
Elantec Micro Power	November 1987—Micro Power to market Elantec's FET power buffers
G-2 LSI Logic	July 1987—LSI Logic's establishment of G-2 as a wholly owned subsidiary; LSI Logic to provide macrocells, megacells, and gate arrays
Genesis National	October 1987—Design center and manufacturing agreement
GigaBit Logic Tachonics	October 1987— Mutual second-sourcing of GaAs standard and ASIC products developed by each other
GigaBit Logic Cray Research	January 1987—Cray Research's \$3.3 million foundry order
GigaBit Logic Cray Research	May 1987—Cray Research's January order increased from \$3.2 million to \$5.5 million
GigaBit Logic Seattle Silicon WTC	April 1987—GBL, Seattle Silicon, and the Washington Technology Center (WTC) to form a joint design project and fabricate a functional, compiler-based GaAs IC design
IDT VTC	January 1987—IDT to second-source VTC's FCT product line
IDT MIPS Computer	November 1987—IDT to manufacture MIPS Computer's complete line of 32-bit RISC MPUs
IMP Electrolux	November 1987—Five-year agreement with Electrolux to develop ASIC devices for home appliances

(Continued)

Table 9c (Continued)  
1987 Alliances (87)

Companies	Description
IST SDA Systems	May 1987—SDA Systems to develop CAD systems for use by Innovative Silicon Technology's (IST's) customers
Inova Westinghouse	June 1987—Westinghouse Advanced Technology Division to work with Inova in long-term strategic planning areas
Intergraph Fujitsu	Early 1987—Fujitsu to provide wafer fabrication services to Intergraph's Advanced Processor Division
Krysalis National	December 1987—Seven-year agreement with National Semiconductor to pursue UniRAM technology jointly
LSI Logic Stellar Computer	January 1987—LSI Logic to supply custom ASICs to Stellar Computer for use in a graphics supercomputer
LSI Logic Aida Corp.	January 1987—Aida Corp. to incorporate LSI Logic's gate array libraries into its design automation tools
LSI Logic ZyCAD Corp.	February 1987—LSI Logic's acquisition of the marketing rights to a customized version of ZyCAD's Logic Evaluator circuit design accelerators
LSI Logic Case Technology	March 1987—Joint development to allow LSI Logic's schematic libraries to be designed on Case Technology's workstations
LSI Logic Sun	April 1987—LSI Logic and Sun's joint establishment of an ASIC laboratory project at San Jose State University
LSI Logic Logic Automation	May 1987—Joint development to incorporate LSI Logic's channeled gate arrays on Logic Automation's Mentor Graphics workstations
LSI Logic Asix Systems	June 1987—LSI Logic's licensing of its ASIC design verification software to Asix Systems Corp.
LSI Logic Video Seven	July 1987—LSI Logic's acquisition of 20 percent of Video Seven for \$7 million in cash
LSI Logic ACT	August 1987—Joint venture company named Inter-Act Corporation, which will develop and market software/hardware development system for the MIL-STD-1750 embedded system market
LSI Logic MIPS Computer	November 1987—LSI Logic to manufacture and market MIPS Computer Systems' entire family of circuits, including its 32-bit RISC MPU and floating point coprocessor
LTC TI	March 1987—Five-year agreement allowing TI to select six LTC circuits every six months; TI to pay royalties
Lattice SGS	February 1987—LSC's licensing of its GAL products to SGS Semiconductor; both companies to cooperate on future PLD products
Lattice National	April 1987—National Semiconductor's minority investment in LSC and licensing of its GAL technology
Lattice MMI	November 1987—LSC's licensing of MMI's patent; exchange of rights to worldwide patents in PLDs

(Continued)

Table 9c (Continued)

## 1987 Alliances (87)

Companies	Description
Matra-Harris Intel	June 1987—CIMATEL dissolved by Intel
NMB TI	November 1987—NMB to manufacture and supply TI with TI-designed 1Mb field RAMs
Pacific Monolithics TriQuint Ford	November 1987—PM and TriQuint are team members with Ford for smart weapons, radar, electronic warfare contracts
Pacific Monolithics TriQuint Allied-Bendix	November 1987—PM and TriQuint are team members with Allied-Bendix for two communications and radar contracts
Performance MIPS Computer	November 1987—Performance to manufacture and market MIPS Computer Systems' 32-bit RISC MPU, floating-point coprocessor, and other peripherals
PromTech Yamaha	1987—PromTech's licensing of its EPROM technology to Yamaha Corp., which will combine it with voice- and image-processing capabilities
RAMAX Ramtron	June 1987—RAMAX's licensing of ferroelectric process technology from Ramtron
SEEQ National	October 1987—Four-year agreement to develop and market a new family of CMOS flash EEPROMs
SEEQ Hamilton-Standard	October 1987—SEEQ to supply 256K EEPROMs to Hamilton-Standard
Samsung Intel	June 1987—Samsung to supply Intel with 64K and 256K DRAMs, which Intel will sell under its own label
Seattle Semiconductor National	October 1987—National's 1.25-micron and 1.20-micron VHSIC CMOS processes qualified for design with Concorde, Seattle Silicon' ASIC compiler
Seattle Silicon UTMC	June 1987—Seattle Silicon and UTMC to jointly design and fabricate ASICs used in tactical and strategic radiation environments
Sierra Mentor Graphics	September 1987—Sierra's MIXsim behavioral modeling tools available on Mentor Graphics' Idea workstation
TriQuint TRW	June 1987—Jointly develop and supply Class-S level GaAs devices for space applications
VLSI Technology Visic	1987—VLSI's acquisition of Visic for approximately \$525,000
VLSI Technology TCMC	March 1987—Agreement covering second-sourcing and product development for memory designs including FIFOs, dual-port RAMs, cache-tag RAMs, and SRAMs

(Continued)

**Table 9c (Continued)**  
**1987 Alliances (87)**

<b>Companies</b>	<b>Description</b>
VLSI Technology Zilog	May 1987—VLSI to second-source Zilog's Super8 MCU and FIFOs
VLSI Technology GE Solid State	July 1987—GE to produce and market VLSI's VGT10 and VGT100 families of CMOS gate arrays
VLSI Technology Daisy Systems	November 1987—Gate array design kit offered for Daisy's CAE workstation
VLSI Technology Oak Technology	November 1987—Codevelop IBM PS/2 logic chips, using VLSI Technology's software tools
VTC Control Data	1987—VTC became a wholly owned subsidiary of Control Data (CDC); VTC's award of a \$7.5 million contract from CDC's Government Systems Division to supply ASIC chips
VTC TRW	March 1987—TRW Components International and VTC to cross sample space-quality, Class-S devices including rad-hard CMOS SRAMs, comparators, amps, and transceivers
VTC VME Technology	September 1987—VTC's contract to design, develop, and manufacture a VMEbus interface IC (VMIC) for the VME Technology Consortium
Vitesse E-Systems	August 1987—E-systems to use Vitesse's GaAs technology in its current and future programs
Vitesse Ford	October 1987—Vitesse and Ford Microelectronics to mutually second-source each other's IC foundry services
Vitesse VLSI Technology	September 1987—Vitesse to develop a GaAs cell library for VLSI's design tools
WSI GE/RCA	July 1987—Prior agreement expanded to include EPROM manufacturing
Weitek HP	May 1987—Hewlett-Packard to manufacture and incorporate the Weitek model 2264/65 chip set in current and future HP Precision Architecture computers
Xicor Intel	June 1987—R&D agreement terminated; cross-licensing and royalty obligations remain in force
ZyMOS Intel	November 1987—Intel to market ZyMOS' POACH AT system logic set bundled with its 80286 MPU, which will be sold as 82X3X multifunctional peripherals
iLSi Yamaha	December 1987—Yamaha's purchase of a license for iLSi's gate arrays in exchange for royalties and foundry service

Source: Dataquest  
 January 1990

**Table 9d**  
**1986 Alliances (75)**

Companies	Description
Actel Corp. Data General	June 1986—Joint development agreement covering gate arrays and a fab arrangement
Altera Data I/O FutureNet	May 1985—OEM marketing agreement with Data I/O's FutureNet for the DASH schematic capture packages
BIT Raytheon	July 1986—Joint development of ASICs
Brooktree Fairchild	April 1986—Broad-ranging partnership combining Brooktree's D/A conversion technology with Fairchild's manufacturing capability
CMD CMA	September 1986—Merger of CMD and Custom MOS Arrays (CMA)
CMD Fuji	November 1986—CMD's licensing of HCMOS gate array and cell-based design technology to Fuji Photo Film for \$1 million
CSi Motorola	August 1986—CSi to act as the northwestern independent design center for Motorola
CSi NCR	September 1986—NCR's licensing of CSi's cell-based library
Catalyst Thomson-CSF	1986—Catalyst and Thomson to conduct R&D in France
Catalyst Oki Electric	July 1986—Long-term R&D of NVRAMs for ASICs, using CMOS EPROMs and EEPROMs
Chips National	November 1986—National Semiconductor to manufacture CMOS ICs for Chips & Technologies under fabrication agreement
Cirrus Logic Silicon Systems	October 1986—Cirrus Logic's and Silicon Systems' exchange of controller and buffer manager functions
Custom Array Teledyne	1986—Joint development agreement for a new family of BiCMOS semi-custom and cell-based libraries
Dallas Thomson-Mostek	January 1986—Thomson-Mostek's receipt of Dallas' multiport memory in exchange for laser production equipment and TCMC's MK4501 FIFO
ES2 British Aerospace	January 1986—British Aerospace investment of \$5 million
ES2 SDA Systems	January 1986—ES2 to market SDA Systems' design systems throughout Europe and to use them in design centers
ES2 Philips TI	May 1986—ES2, Philips-Elcoma, and Texas Instruments—cooperation on the SystemCell cell-based library
Exel Microelectronics Exar	February 1986—Exar's completion of the \$5.5 million acquisition of Exel
GAIN NTT	September 1986—Technology transfer giving GAIN access to NTT's self-aligned implantation for N+layer translator (SAINT) technology

(Continued)

Table 9d (Continued)  
1986 Alliances (75)

Companies	Description
ICI Array ICI	January 1986—Imperial Chemical Industries Plc—acquisition of Array Technology
ICT Gould Semiconductor	April 1986—ICT's transfer of its CMOS EEPROM technology and products in exchange for foundry service and second-sourcing of PEEL and EEPROM devices
IMP Lattice Logic	May 1986—Lattice Logic's CHIPSMITH Silicon compiler software available with IMP's design rules
IMP Silicon Compilers	June 1986—SCI and IMP to develop analog compilation capability for SCI's Genesis Silicon Development
IMP Micro Linear MBB	August 1986—IMP and Micro Linear—agreement to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period
IMP Lasarray	August 1986—IMP and Lasarray to cooperate on a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module
IXYS Samsung	January 1986—Samsung's receipt of IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high current power MOS devices in Samsung facility
LSI Logic Raytheon	January 1986—Raytheon to second-source LSI Logic's LL700 Series of logic arrays; LSI Logic will provide its LDS software system to design and produce the logic arrays
LSI Logic Master Images	March 1986—LSI Logic's acquisition of a 20 percent equity interest in Master Images, a photomask supplier
LSI Logic Sun	April 1986—LSI Logic to sell and use internally Sun Microsystems' workstation and advanced schematic capture system
LSI Logic STC	May 1986—LSI Logic's acquisition of a majority stake in STC's semiconductor division
LTC National	July 1986—Patent licensing agreement Linear Technology Corp. (LTC) rights to products under two national BiFET patents; National was granted rights to LTC's BiFET-related patents
Lattice Seiko-Epson	January 1986—Seiko-Epson licensed to Lattice's high-speed 64K SRAM
MOSel Hyundai	February 1986—MOSel—8Kx8 and 1Mb SRAMs and 1.2- and 1.5-micron CMOS processes provided to Hyundai in exchange for a foundry commitment
MOSel Sharp	June 1986—MOSel—a 256K SRAM design based on a 1.2-micron CMOS process provided to Sharp, which provided 256K SRAMs
Matra-Harris Silicon Compilers	June 1986—MHS to integrate its 2-micron, double-metal CMOS process with Silicon Compilers' Genesis silicon design systems

(Continued)

Table 9d (Continued)  
1986 Alliances (75)

Companies	Description
Matra-Harris Weitek	March 1986—Matra-Harris Semiconducteur's (MHS) receipt of Weitek's 16-bit integer multiplier product family; Weitek has preferred access to the MHS CMOS process in exchange for foundry services
Maxim Intersil	April 1986—Second-source agreement
Micro Linear Analog Design	July 1986—Micro Linear to integrate its micro and macrocell libraries into Analog Design tools' workbench CAE system
Micro Linear Daisy Systems	November 1986—Daisy Systems to port Micro Linear's cell libraries to its workstations
Micron Samsung	July 1986—Samsung's purchase of a 2.7 percent interest in Micron for \$5 million as part of an out-of-court settlement; Micron received Samsung SRAM and EEPROM technologies for a 1.0 percent royalty
NMB National	September 1986—NMB to manufacture fast SRAMs; this agreement is no longer in effect
Novix Harris	July 1986—The Novix FORTH language MPU included in Harris' ASIC library
Performance Westinghouse	August 1986—Performance to fabricate a VHSIC Phase-I, 11,000-gate gate array designed by the Westinghouse Defense and Electronics Center
Powerex Westinghouse Mitsubishi	1986—Powerex formed by Westinghouse, GE, and Mitsubishi Electric; Powerex received licenses and technology from the companies
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems, using Seiko-Epson's CMOS process
SEEQ AMD/MMI	November 1986—Monolithic Memories acquisition of 16 percent of SEEQ for \$4 million; jointly develop CMOS EEPROM-based PLDs
SEEQ Motorola	December 1986—Engineering development agreement to develop an EEPROM microcomputer
Samsung Mostek	1986—Agreement covering Mostek's 256K DRAM technology
Samsung Goldstar Hyundai	1986—Samsung, Goldstar, and Hyundai to cooperate on a 1Mb DRAM
Seattle Silicon Gould AMI	September 1986—Gould AMI provides Seattle Silicon with proprietary geometric design rules and performance characteristics of selected fab processes
Seattle Silicon Burroughs	August 1986—Seattle Silicon and Burroughs to jointly develop a new-generation design system for ICs
Sierra Mentor Graphics	December 1986—Sierra's cell library supported on Mentor Graphics' workstations

(Continued)



Table 9d (Continued)  
1986 Alliances (75)

Companies	Description
Silicon Systems Ferranti	February 1986—SSi to second-source Ferranti's data conversion ICs in the United States
Silicon Systems Telmos Universal	August 1986—Universal's second-source agreement between Telmos and Silicon Systems acquired for the fabrication of analog/digital arrays
Silicon Systems RCA	February 1986—RCA to second-source SSI's monolithic modem ICs; RCA gained rights to SSI's analog CMOS process; SSI gained rights to RCA's digital 2-micron CMOS process; RCA also agreed to supply SSI with CMOS wafers over three years
Silicon Systems Oki Electric	September 1986—Oki to second-source SSI's K-series modems; Oki will pay royalties, furnish DSP chips, and provide foundry services
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems using Seiko-Epson's CMOS process
TSMC Philips	1986—N.V. Philips' 27.5 percent interest in Taiwan Semiconductor Manufacturing Corp. and option to purchase controlling interest in the company
TriQuint EEsof	May 1986—EEsof to incorporate TriQuint's custom GaAs MMIC foundry models into Touchstone, a minicomputer and workstation-based MMIC CAD program
UMC TRW	April 1986—Joint development of 1.25-micron VLSI products
UMC SMC	June 1986—Contract to cooperate on computer ICs
VLSI Technology Mosaic Systems	1986—Joint agreement to build die and plug them together on the Mosaic process
VLSI Technology Intel	1986—Codeveloped a single-chip interface for the Intel-based Multibus II system bus architecture
VLSI Technology Acorn Computer	May 1986—Codeveloped a single chip, 32-bit RISC MPU, and associated controller chips
VTC Silicon Compilers	May 1986—VTC to provide its 1.6- and 1.0-micron two-layer metal CMOS processes to users of Genesis; VTC to develop a rad-hard cell for Genesis
Vitellic Philips	March 1986—Vitellic's access to Philips' process technology; Vitellic to design a family of high-performance CMOS SRAMs
Vitellic Sanyo	October 1986—Jointly develop a high-speed 64K SRAM family; Sanyo will manufacture the SRAMs

(Continued)

**Table 9d (Continued)**  
**1986 Alliances (75)**

<b>Companies</b>	<b>Description</b>
Vitesse TRW	December 1986—Vitesse to supply TRW with high-performance wafers, die, and packaged devices, which TRW will assemble, test, qualify, and sell to the space quality, Class-S level market
WSI GE/RCA Sharp	March 1986—GE/RCA and Sharp have a five-year agreement with WSI to jointly develop an advanced cell library
Weitek Step Engineering	March 1986—Step Engineering to produce development tools for debugging and microcoding of Weitek's floating-point integer processor designs
Weitek Quadtree	April 1986—Quadtree Software to develop behavioral simulators for the WTL2264/2265 chip set
Weitek Matra-Harris	May 1986—Technology exchange and foundry agreement. MHS granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to MHS' CMOS process in exchange to manufacturing a variety of Weitek products
XTAR Fairchild	September 1986—Fairchild to alternate-source XTAR's X1000/X2000 graphics MPU chip set, which Fairchild will redesign and manufacture using its FACT fabrication process
Xilinx MMI/AMD	June 1986—MMI/AMD to manufacture and market Xilinx's Logic Cell Arrays and development system
ZyMOS Daewoo Corp.	April 1986—Controlling interest in ZyMOS acquired by Daewoo Corp.
iLSi Motorola	June 1986—iLSi's licensing of its line of gate arrays to Motorola
iLSi Sumitomo	December 1986—Sumitomo's licensing of ASIC design technology from iLSi exchange for royalty payments and foundry services

Source: Dataquest  
January 1990

**Table 9e**  
**1985 Alliances (71)**

<b>Companies</b>	<b>Description</b>
AMCC Sanders	February 1985—Sanders to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only
AMCC Seiko-Epson	May 1985—AMCC and Seiko-Epson entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process was merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process

(Continued)

**Table 9e (Continued)**  
**1985 Alliances (71)**

Companies	Description
Altera Intel	June 1985—Extension of 1984 agreement with Intel for two years; includes additional products using Intel's CHMOS process and its evolutions
Altera P-CAD Systems	February 1985—Marketing agreement with P-CAD Systems
ATMEL General Instrument	March 1985—ATMEL technology provided to GI for fab capacity; this agreement is no longer in effect
Barvon Research Micron Technology	November 1985—Micron's acquisition of a 16 percent equity interest in Barvon to design ASICs for Micron
Brooktree Toshiba	1985—Brooktree's Technology licensed by Toshiba for consumer digital audio applications
CMD TRW	July 1985—TRW to manufacture HCMOS gate arrays in its JAN-qualified fab, using CMD/CMA's 1.2-micron design rules
CSi Viewlogic	October 1985—Custom Silicon's (CSi's) cell-based library offered on Viewlogic's Workview workstation
Catalyst Zilog	December 1985—Joint development and second-sourcing agreement; initial product will be a version of Zilog's Z8 MCU
Chips Toshiba Yamaha Fujitsu	November 1985—Foundry services from these companies subcontracted by Chips & Technologies
Cirrus Logic AMD	September 1985—Cirrus Logic's development of an MCU for AMD in exchange for foundry services
Cypress Matra-Harris	October 1985—Cypress masks for its SRAMs and 1.2-micron CMOS process transferred to MHS, which received 2 percent of Cypress' stock for \$25 million
Cypress Weitek	October 1985—Joint development of a series of VLSI logic circuits designed by Weitek and manufactured by Cypress
ES2 Lattice Logic	1985—ES2 to market Lattice's logic compiler in Europe
ETC NCR	October 1985—Electronic Technology Corp. (ETC) to establish design centers and design cell-based ICs for NCR
Exel Microelectronics Samsung	May 1985—Prior agreement extended to include second-source Exel's 2Kx8 NMOS EEPROM
GAIN Mitsui	1985—Mitsui's acquisition of 30 percent interest in GAIN

(Continued)

Table 9e (Continued)

## 1985 Alliances (71)

Companies	Description
ICS VLSI Technology Toshiba	1985—VLSI Technology and Toshiba to provide foundry services for Integrated CMOS Systems (ICS)
ICS Universal	1985—Cooperative gate array agreement to personalize wafers and designs supplied by ICS
IDT Internix	April 1985—Sales contract for Internix to sell IDT's products in Japan
IMP Iskra	April 1985—IMP's and Iskra's codevelopment of a CMOS analog cell library for which IMP provides foundry services
IMP National	April 1985—IMP to second-source National's 2-micron gate arrays
Inmos NMB/Minebea	March 1985—NMB/Minebea to ship 50 percent of its 256K DRAM output to Inmos
Inova UMP	November 1985—UMP to provide wafers to Inova
LSI Logic Toshiba	June 1985—Four-year joint venture to develop a 50,000-gate sea-of-gates array
LSI Logic C. Itoh	April 1985—C. Itoh to sell LSI Logic's products in Japan
LSI Logic Kawasaki Steel	August 1985—Formed joint-venture gate array company in Japan, Nihon Semiconductor
LTC Motorola	January 1985—Agreement granting each company rights to a number of patents
MOSel UMC	October 1985—MOSel's EEPROM, a 2Kx8 SRAM, and a 2-micron process transferred to UMC in exchange for fab capacity
MOSel Fuji Electric	September 1985—Fuji Electric supplied 4- and 6-inch wafers, using MOSel 1.5- and 2.0-micron processes; companies to jointly develop CMOS 16K and 64K SRAMs for MOSel
Maxim Brown Boveri	February 1985—Maxim to design and manufacture devices for Brown Boveri
Micro Linear Rockwell	1985—Rockwell's \$1.2 million investment in Micro Linear and receipt of ASIC linear product technology; Rockwell provides wafers
Micro Linear Toko	October 1985—Toko to make bipolar devices for Micro Linear at its Saitama, Japan, plant
NMB Vitellic	November 1985—A 1Mb CMOS DRAM license granted to NMB's plant capacity

(Continued)

Table 9e (Continued)

## 1985 Alliances (71)

Companies	Description
Quasel Taiwan ERSO	May 1985—Technology license
Ramtron General Motors	1985—Contract with General Motors to demonstrate ferroelectric feasibility in special applications such as space and automotive
S-MOS Siliconix	November 1985—Agreement allowing Siliconix to produce 1.5- and 2.0-micron gate arrays designed by Seiko-Epson and S-MOS
SEEQ Silicon Compilers	July 1985—All EEPROM designs provided by SEEQ for integration into SCI's Genesil System
Samsung Intel	January 1985—Samsung licensed to second-source certain Intel micros
Samsung Exel Microelectronics	May 1985—Prior agreement extended to include 64K EEPROMs
Samsung Zytrex	June 1985—LSI Logic devices and proprietary ICE-MOS process provided to Zytrex; Zytrex is no longer in business
Sierra VLSI Technology	January 1985—Sierra Semiconductor licensed by VLSI for IC software design tools in exchange for Sierra's cell-based designs
Silicon Systems Rogers	November 1985—Joint venture to design, manufacture, and market value-added intelligent flexible subsystems, called SMARTFLEX Systems
Tachonics Grumman	July 1985—Tachonics became a subsidiary of the Grumman Corporation
Topaz Hytek	July 1985—Topaz acquired by Hytek Microsystems; Hytek and Topaz cooperated on developing precision standard hybrid circuits
UMC Unicorn	January 1985—Unicorn, a design center based in Silicon Valley, funded by UMC for \$2.5 million; joint development of a cell library
UMC Honeywell Synertek	July 1985—Nonexclusive product licenses gained by UMC for 18 ICs formerly produced by Synertek
Universal Edsun Laboratories	September 1985—Joint development with Edsun Laboratories for computer-related CMOS products
VLSI Technology Rockwell	1985—Jointly develop erasable programmable logic arrays
VLSI Technology Honeywell Synertek	April 1985—Rights to a CRT controller, interface circuits, 40 SRAMs, and a 16K ROM acquired by VLSI
VLSI Technology National	April 1985—National Semiconductor CMOS EPROM technology supplied to VLSI; VLSI manufactured the part and supplied wafers

(Continued)

**Table 9e (Continued)**  
**1985 Alliances (71)**

Companies	Description
VLSI Technology Nihon Teksei	June 1985—Sales contract to sell mainly standard product LSIs into the Japanese market
VLSI Technology Daisy Systems	June 1985—VLSI's design tools and silicon compilers available on CHIPMASTER and SILICONMASTER workstations
VLSI Technology Zilog	June 1985—Zilog licensed to use VLSI's design software; cooperate to develop megacell versions of Zilog products
VLSI Technology Hewlett-Packard	October 185—Hewlett-Packard to use selected VLSI design tools on HP workstations
VLSI Technology MEM	1985—VLSI's process technology, which will be used by VLSI installed by Microelectronics-Marin (MEM)
VLSI Technology Olivetti	1985—Joint design center in Italy
VLSI Technology Bull Group	1985—VLSI's design technology licensed by Bull to develop computer products
VLSI Technology University of Louvain	1985—Agreement to install VLSI's IC design methodology to teach advanced IC design to students
Vitellic Sony	June 1985—Sony's access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity
Vitellic Hyundai	July 1985—Hyundai obtains license to Vitelic memory products in exchange for manufacturing capacity
Vitesse AMD	November 1985—Jointly develop and manufacture AMD's AM2900 family of MPUs in GaAs
WSI Sharp	October 1985—Prior agreement extended to include WSI's 1.6-micron CMOS technology
Weitek Intel	October 1985—Weitek to develop an interface IC that Intel will second-source; Intel to provide foundry services
Weitek National	October 1985—National to design, manufacture, and market an interface chip
Xicor Intel	August 1985—R&D technology exchange agreement to develop EEPROMs; both companies cross-licensed their EEPROM technology
Xilinx Seiko-Epson	December 1985—Codevelop logic cell arrays and development systems; Seiko-Epson to manufacture; jointly develop Seiko-Epson's CMOS process
ZyMOS General Instrument	April 1985—Extended agreement for an additional three years; covers cell library and foundry services
ZyMOS Source III	September 1985—ZyMOS to provide foundry services for Source III

**Table 9f**  
**1984 Alliances (42)**

Companies	Description
AMCC Honeywell	August 1984—Honeywell to second-source AMCC's Q700 gate arrays and to alternative-source bipolar gate arrays
Altera Intel	August 1984—CHMOS EPROM fabrication technology and foundry services provided by Intel; Altera provided its EPLD design, test, and development support
Calogic Koki Company	December 1984—Koki to sell Calogic's CMOS data bus driver ICs in Japan
Custom Arrays ATAC-Diffusion	1984—ATAC to operate a design center and conduct marketing for Custom Arrays in Europe
Custom Arrays Ferranti-Interdesign	1984—The MM family is the result of a joint venture with Ferranti, which also acts as a second source
Custom Arrays Interdesign	1984—Jointly developed the MM family of linear arrays
Custom Silicon FutureNet	March 1984—CSI's cell-based design available on the FutureNet DASH design system
ETC Gould-AMI	1984—Agreement for 3- and 5-micron single-layer metal CMOS gate arrays; AMI provides foundry services
ICT IMP	July 1984—Codevelopment of a CMOS EEPROM process
IMP National	1984—Five-year technology exchanges and second-sourcing agreement covering IMP's cell-based designs and National's CMOS process
IMP Micro Linear	June 1984—Codevelopment of a 10V CMOS process; IMP provides foundry services
IXYS Ricoh	1984—Wafers provided by Ricoh; IXYS provided its power MOSFET HDMOS process
Inmos NMB	June 1984—NMB to produce the Inmos 256K CMOS DRAM for an initial sum and royalties; NMB will also cooperate on the Inmos 64K and 1Mb DRAMs
Inmos Thorn-EMI	1984—Thorn-EMI's acquisition of 76 percent of Inmos
Inmos Hyundai	December 1984—Hyundai—\$6 million payment for the Inmos 256K DRAM technology
LSI Logic AMD	August 1984—Jointly develop CMOS standard cell definitions and a library for design of large-scale ICs
LSI Logic Intersil	February 1984—Agreement covering LSI Logic's HCMOS process logic arrays and Intersil's CMOS gate array family

(Continued)

Table 9f (Continued)

## 1984 Alliances (42)

Companies	Description
LTC Signetics	June 1984—Signetics to purchase die in wafer form and receive manufacturing rights for three precision op amps and other products; Signetics provided LTC with certain small outline packaging services
LTC Interdesign	July 1984—The right to design IC arrays, using up to three of LTC's processes, and dedicated foundry capacity to manufacture the Interdesign designs granted by LTC
Lattice Synertek	July 1984—Cross-licensing and second-sourcing agreement covering Lattice's UltraMOS process in exchange for Synertek's production capacity
Lattice VLSI Technology	September 1984—Lattice CMOS EEPROM and SRAM technology provided to VLSI in exchange for foundry services
Maxim Intersil	1984—Agreement to exchange products as part of a legal settlement
Micron National	November 1984—A license to manufacture and sell Micron's 64K DRAM purchased by National for about \$5 million
Modular Ricoh	November 1984—Modular Semiconductor CMOS designs and processes for a 16K SRAM and 256K DRAM provided to Ricoh
NMB Minebea	1984—NMB is the subsidiary of and is financed by Minebea
NMB Inmos	June 1984—NMB to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the output
Novix Sysorex	March 1984—Sysorex International participant in first-round financing
PromTech Japanese Company	1984—PromTech licensed technology
S-MOS IMI	April 1984—Two-year agreement with International Microcircuits Inc. (IMI) to second-source 2-micron CMOS gate arrays and share cell-based libraries
Sierra National	July 1984—Technology exchange covering selected CMOS products and processes; Sierra leased a facility from National
TriQuint Tektronix	January 1984—TriQuint is a subsidiary of Tektronix
VLSI Technology Visic	February 1984—VLSI Technology and Visic to design and market CMOS 64Kx1 and 16Kx4 CMOS DRAMs
VLSI Technology Fairchild	May 1984—Joint development and second-source of Fairchild's 2-micron CMOS gate arrays

(Continued)



**Table 9f (Continued)**  
**1984 Alliances (42)**

<b>Companies</b>	<b>Description</b>
VLSI Technology Silicon Compilers	October 1984—VLSI licensing of Silicon Compilers' RasterOp graphics processor chip in exchange for foundry services for customers who design circuits using SCI's design systems
VLSI Technology Western Digital	1984—Joint agreement to develop CMOS versions of propriety WD products and second-source several of WD's products; VLSI provides foundry support for three years
VTC CDC	October 1984—Control Data Corp. (CDC) invests \$56 million in VTC; the arrangement includes a fabrication technology license
Vitellic Kyocera	March 1984—Kyocera participated in first-round financing
Vitellic ERSO	May 1984—ERSO and Vitelic to codevelop EPROMs and 64K and 256K CMOS DRAMs
Vitesse Norton Company	July 1984—The initial investment of \$30 million provided by the Norton Company
WSI Sharp	December 1984—Sharp to produce a 64K CMOS EPROM for manufacturing capacity and royalties licensed by WSI
ZyMOS Intel	July 1984—ZyMOS ZyP design automation system provided for Intel's CHMOS II process; ZyMOS to manufacture Intel's 80C49 8-bit MCU

Source: Dataquest  
January 1990

**Table 9g**  
**1983 Alliances (40)**

<b>Companies</b>	<b>Description</b>
AMCC Signetics	September 1983—AMCC and Signetics to exchange future families of gate arrays and processes
AMCC Daisy Systems	February 1983—The Q-700 gate array family on Gatemaster supported by Daisy
Acrian Bharat	1983—Acrian technology transferred to Bharat Electronics Limited
Asahi Kasei Hitachi Limited	1983—Hitachi Limited's advanced CMOS process technology licensed by Asahi Kasei
BIT Analog Devices	1983—Equity investment
CDI Olympus Optical	January 1983—CDI gate array technology transferred to Olympus Optical Co.

(Continued)

**Table 9g (Continued)**  
**1983 Alliances (40)**

Companies	Description
CDI Western Microtechnology	1983—CDI's gate arrays sold through Western Microtechnology's design center
CMD/CMA Ricoh	1983—Joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and cell-based ICs
CMD/CMA Micro Innovators	January 1983—Merge of CMD/CMA with Micro Innovators, a team of custom MOS/LSI designers
Custom Silicon NCR	November 1983—CSi to design and recall NCR's cell-based and gate array products in New England
Cypress MMI/AMD	June 1983—Cypress 1.2-micron CMOS process and warrants received by MMI/AMD in exchange for loan guarantees
ETC Exar	December 1983—Foundry services provided by Exar
Exel Microelectronics Samsung	1983—Samsung Semiconductor license to second-source its 16K EEPROMs granted by Exel
GBL Kidder, Peabody	December 1983—R&D partnership to develop four ultrahigh-speed GaAs SRAMs
ICT Hyundai	October 1983—International CMOS Technology (ICT) and Hyundai to jointly develop devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs; Hyundai allocated 30 percent of its wafer fab capacity for an equity interest in ICT
IMP Zoran	June 1983—Codevelopment of a CMOS PROM technology
IMP IXYS	November 1983—Codevelopment of a high-voltage CMOS process
Inmos General Instrument	October 1983—Inmos' 8Kx8 EEPROM licensed by General Instrument
Inmos Intel	December 1983—Intel and Inmos to develop consistent specifications on 64K and 256K CHMOS DRAMs
LSI Logic RCA	April 1983—RCA to second-source LSI Logic's 5000 Series
LSI Logic SGS	April 1983—SGS licensed by LSI as an LSI 500 Series and CAD software alternative source
LSI Logic Toshiba	June 1983—Jointly developed a channelless compacted array
LTC Teijin Japan Macnics Technology Trading	June 1983—Agreements for distribution in Japan

(Continued)

Table 9g (Continued)

## 1983 Alliances (40)

Companies	Description
Lattice Floating Point Systems	1983—Lattice UltraMOS technology provided in exchange for FSP's DSP and array processor technologies; FSP also made an equity investment
Micron ITT/STC	January 1983—ITT/STC granted a worldwide license by Micron to manufacture and sell 64K DRAMs
Micron Samsung	June 1983—Samsung granted a license by Micron to manufacture and market Micron's 64K and 256K DRAMs in exchange for cash
Micron Commodore	August 1983—Commodore licensed by Micron to produce a 64K DRAM; this agreement is no longer in effect
Mietec Sprague	1983—Cross-licensing agreement with Sprague for a BiMOS process
Samsung SST	1983—Samsung Semiconductor is the U.S. subsidiary of Samsung Semiconductor and Telecommunications (SST)
S-MOS Seiko-Epson	1983—S-MOS affiliated with Seiko-Epson, which holds 30 percent of S-MOS
SEEQ Silicon Compilers	1983—SEEQ to manufacture SCI's Ethernet data link controller
UMC AMI	April 1983—Dialer ICs produced in cooperation with AMI
Universal Siliconix	June 1983—Siliconix to set up a design center for Universal's gate arrays in Swansea, Wales
Universal Western Digital	August 1983—Western Digital to second-source Universal's CMOS gate arrays
VLSI Technology Ricoh	1983—Technology exchange for NMOS and CMOS mask ROMs
VLSI Technology KIET	1983—VLSI's 32K ROM technology licensed by KIET in exchange for foundry services
VLSI Technology Texas Instruments	July 1983—VLSI to second-source TI's TME4500A DRAM controller and developer of its 256K DRAM controller
VLSI Technology Wang Labs	November 1983—Wang purchased 15 percent of VLSI's stock for \$34 million
ZyMOS Intel	January 1983—ZyMOS ZyP CAD system provided for Intel's CHMOS I process; codevelop a cell library
ZyMOS General Instrument	August 1983—GI to use ZyP software and Zy40000 to design the Zy4000 cell library

**Table 9h**  
**1982 Alliances (13)**

<b>Companies</b>	<b>Description</b>
AMCC Sorep	January 1982—AMCC and Sorep to design, assemble, test, and market gate arrays in France
AMCC Thomson-CSF	July 1982—Thomson-CSF to alternate-source and develop AMCC's bipolar Q-700 series of gate arrays
Acrian Communications Transistor	1982—Acrian acquisition of Communications Transistors Corp.
CDI Telmos	1982—CDI's linear CMOS products licensed by Telmos
CDI Corintech	October 1982—Corintech, a thick-film manufacturer, to make and sell CDI gate arrays in Britain
CMD/CMA Ricoh	Ricoh wafers provided to CMD/CMA
CMD/CMA Racal	1982—CMD/CMA to manufacture and sell Racal's CMOS gate arrays in the United States
LSI Logic AMD	January 1982—A five-year license to manufacture the LCA 1200 Series of ECL macrocell arrays received by AMD
LSI Logic Fujitsu	1982—Agreement covering HCMOS gate arrays
LTC Silicon General	July 1982—Technology exchange and second-sourcing agreement; Silicon General provided PWMs and two additional circuits and second-sources several high-current series pass regulators developed by LTC
SEEQ Rockwell	July 1982—SEEQ 16K EEPROM and 16K UV EPROM technology provided to Rockwell for cash, a lease, and a royalty
SEEQ TI	August 1982—SEEQ EEPROM licensed to TI in exchange for TI's TMS7000 8-bit MCU
Universal Siliconix	December 1982—Second source for Universal's 5-micron ISO-5 and 3-micron ISO CMOS gate arrays
VLSI Technology Ricoh	1982—All wafers provided by Ricoh

Source: Dataquest  
 January 1990

**Table 9i**  
**1981 Alliances (10)**

<b>Companies</b>	<b>Description</b>
Barvon Research Ricoh	1981—Foundry services provided by Ricoh
Barvon Research Goldstar	1981—Foundry services provided by Goldstar; joint development of an analog/digital CAD
CDI LSI Logic	July 1981—CDI's HC Series of gate arrays exchanged for LSI Logic's LDS1 CAD system

(Continued)

Table 9i (Continued)

## 1981 Alliances (10)

Companies	Description
CDI Giltspur	November 1981—A U.K. design center for CDI gate arrays established by Giltspur, a supplier of MPUs
Inmos TI	October 1981—Agreement for 64K DRAMs
LSI Logic Toshiba	August 1981—Joint development of a family of 1,000- to 10,000-gate CMOS arrays
Matra-Harris Intel	March 1981—Agreement covering NMOS circuits and a joint design facility, named Cimatel, in Nantes, France
SEEQ Amkor	1981—IC products assembled by Amkor
VLSI Technology Bendex	August 1981—Warrant guarantee for 14 percent of VLSI Technology preferred stock; \$2 million R&D funding, \$15 million equipment lease line
ZyMOS Intermedics	November 1981—Additional financing from Intermedics for \$4 million

Source: Dataquest  
January 1990

Table 9j

## 1980 Alliances (2)

Companies	Description
CDI AMI	1980—CDI HC series licensed to AMI
VLSI Technology Amkor	1980—Assembly for VLSI Technology's IC products provided by Amkor

Source: Dataquest  
January 1990

Table 9k

## 1979 Alliances (3)

Companies	Description
AMCC Signetics	April 1979—Signetics to alternate-source the Q700 Quick-Chip series
UMC ERSO	1979—ERSO granted UMC a license for design and process technology for 4-inch silicon wafers
ZyMOS Intermedics	1979—Financing from Intermedics, Inc., for \$10 million and lease guarantee for \$5 million; ZyMOS supplied custom ICs

Source: Dataquest  
January 1990

## Start-Up Affiliations

In addition to strategic alliances, many start-ups have agreed to affiliations or acquisitions and have even acquired the assets of former companies. A number of companies in this directory are the result of joint ventures of other larger companies. Start-ups are a part of acquisitions and affiliations for the following reasons:

- To gain financial backing

- To exploit technologies developed at parent companies
- To gain mobility to enter new product markets
- To enlarge product lines
- To penetrate markets in other areas

Table 10 shows a list of start-up companies that either have been acquired, are affiliated with other companies, or have acquired other companies.

**Table 10**  
**Start-Up Company Affiliates or Subsidiaries of Larger Companies**

Company	Affiliation
Aspen Semiconductor	Subsidiary of Cypress Semiconductor
Austek	Acquired Silicon Microsystems (1986)
Chartered Semiconductor	Joint Venture among National Semiconductor, Singapore Technology Corp., and Sierra Semiconductor
Crystal Semiconductor	Acquired Texas Micro-Circuit (1984)
Custom Arrays	Subsidiary of ATAC
Electronic Technology Corp.	Subsidiary of J-TEC
Exel Microelectronics	Acquired by Rohm (1988)
Harris Microwave	Subsidiary of Harris Corp.
Headland Technology	Affiliate of LSI Logic
ICI Array Technology	Acquired by ICI Plc (1986)
Intergraph Advanced Processor Division	Division of Intergraph Corp., acquired via acquisition of Fairchild Advanced Processor Division (1987)
IXYS	Acquired ASEA Brown Boveri Power Semiconductor Group (1989)
Krysalis Corporation	Acquired by National Semiconductor (1989)
Matra-Harris Semiconducteur	Joint venture between Matra and Harris Corp.
MemTech Technology Corp.	Acquired Crystal Division of Materials Progress Corp. (1987)
Microwave Technology, Inc.	Acquired Monolithic Microsystems (1987)
MOSPEC Semiconductor	Subsidiary of President Enterprises Corp.
Multichip Technology	Subsidiary of Cypress Semiconductor
NMB Semiconductor	Division of NMB Technologies, which is a subsidiary of Minebea Co. Ltd. of Tokyo
NMB Semiconductor	Acquired Composite Recording Head Division of Seagate Technology
Orbit Semiconductor	Comdial was acquired by Orbit Instruments in 1985 and was renamed Orbit Semiconductor
Powerex, Inc.	Joint Venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corp.
Ramtron Corp.	Subsidiary of Newtech Development Corp.
Samsung Semiconductor	Subsidiary of Samsung Electronics Co., of the Samsung Group, a South Korean conglomerate
Sensym, Inc.	Acquired by Fasco Sensors & Controls (1989)
Spectrum Microdevices	Part of Fairchild Communications & Electronics

(Continued)

**Table 10 (Continued)**  
**Start-Up Company Affiliates or Subsidiaries of Larger Companies**

Company	Affiliation
Telecom Devices Three-Five Systems	Subsidiary of Opto Diode Corp. Formed via leveraged buyout of National Semiconductor's Optoelectronics business unit (1985)
Topaz Semiconductor	Subsidiary of Hytek Microsystems
TriQuint Semiconductor	Subsidiary of Tektronix
United Silicon Structures	Affiliate of ES2
VTC Incorporated	Subsidiary of Control Data Corp.

Source: Dataquest  
January 1990

## Technology Trends

### General Trends

Start-up companies in the United States historically have been at the leading edge of new product and process technology trends. The newest wave of start-up companies offer leading-edge process technologies, but many start-ups are subcontracting to external fabs. Many start-ups currently are planning products with submicron geometries, using advanced CMOS and BiCMOS technologies.

CMOS requires less power and generates less heat than bipolar and NMOS. Designers therefore can pack more circuits and functions onto a single chip, providing better price performance. Other advantages of CMOS that make it applicable for very large scale integration (VLSI) are broad operating temperature ranges, superior noise immunity, and improved electrostatic discharge protection. It also is a very versatile process technology that can be applied to both analog and digital circuits and can be combined with bipolar technologies to result in hybrid technologies such as BiCMOS. Most start-ups currently use a CMOS process technology.

Some other innovative technologies include bipolar ECL, BiCMOS, GaAs, and the Josephson Junction that IBM abandoned. Dataquest has identified many companies that are developing GaAs processes, and a few start-ups are beginning to explore BiCMOS. In fact, Aspen Semiconductor currently is offering BiCMOS ECL RAMs and PLDs.

Many of the companies also are taking a systems approach to designing ICs, an activity that mainline

companies have not traditionally pursued. In recent years, Dataquest has identified a trend toward the "system on a chip." The ultimate expression of this idea would be a monolithic system chip that integrates logic and memory into the microprocessor. As companies pursue higher system performance through the use of ASICs and specialized peripheral chip sets, we have noticed that these companies find value in design engineers who possess both IC logic and systems expertise.

Current changes in the marketplace present the following challenges:

- Technology barriers as the industry approaches 0.5-micron design rules
- A demand for specialized chips with smaller overall markets
- Development costs of memory products that will reach as much as \$100 million
- Rising costs for manufacturing equipment

To meet these challenges, companies are doing the following:

- Developing increasingly sophisticated computer and software tools
- Developing other technologies such as GaAs
- Focusing on end-use markets
- Emphasizing service

Table 11 lists the start-up companies alphabetically along with the product markets in which they participate.

Table 11

## Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
ACC						x	
Actel Corp.		x					
ANADIGICS				x			
ATMEL	x				x		Telecom
Acumos		x					
Adaptec						x	
AHA						x	
Advanced Linear	x						
AMP							Discrete
Advanced Power							Discrete
Alliance					x		
Altera		x					
AMCC		x					
Asahi Kasei	x	x			x	x	Telecom
Aspen		x			x		
Austek					x		
Avasem		x					
BKC							Discrete
BIT			x				
Brooktree	x						
CMD		x					
Calmos	x	x	x		x	x	Telecom
Calogic	x	x					
Catalyst					x	x	
Celeritek	x			x			Discrete
Chartered		x					Foundry
Cirrus Logic						x	
Comlinear	x						
Cree							Discrete
Crystal	x						Telecom
Custom Arrays	x						
Custom Silicon		x					
Dallas	x		x		x	x	Telecom
Dolphin		x					
DSP Group			x				
Exel Microelectronics		x			x		Telecom
Edsun						x	
Elantec	x						
ETC		x					
Epitaxx Inc.				x			Opto
ES2		x					
Gazelle				x			
Genesis		x					
GigaBit		x		x	x		Foundry
Harris				x			
Headland						x	

(Continued)



Table 11 (Continued)

## Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Hecht-Nielson							Neural network
Hittite				✗			
Hualon	x				x	x	Telecom
IC Sensors	x						
ICI Array		x					
ISSI					x		
IXYS							Discrete
IST		✗					
Inova					x		
Integrated CMOS		✗					
IIT						x	
Integrated Logic		✗					
Intergraph APD						✗	
ICT		✗			✗		
IMP		✗					
Isocom							Opto
Krysalis					✗		
Kyoto				✗			Opto
Lattice		x					
Level One							Telecom
LIS	x						
LTC	x						
Logic Devices			x		x	x	
Lytel				✗			Opto
Matra-Harris		x	x		x	x	Telecom
Maxim	x						
MemTech							Opto
Micro Linear	x	x					
M/W Monolithics			✗				
M/W Technology	x			✗			
Mietec		x					
Modular					x	x	Telecom
MOSel					x		
MOSPEC							Discrete, foundry
Multichip					✗		
nCHIP							Multichip modules
NMB					✗		Foundry
NovaSensor	x						
Novix						x	
NSI						x	
Oak Technology					x		
Opto Diode				✗			Opto

(Continued)

Table 11 (Continued)

## Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Opto Tech				x			Opto, discrete Foundry
Orbit							
Oxford					x		
PLX Technology	x						
Pacific Mono.				x			
Paradigm					x		
Performance					x	x	
Photonic Integration							Telecom
Plus Logic		x					
Power Integ.	x						
Powerex							Discrete
PromTech					x		
RAMAX					x		
Ramtron					x		
S3						x	
SEEQ					x		
SID	x						Discrete
SIMTEK					x		
Samsung	x				x		Discrete, telecom
Seattle Silicon		x					
Sensym	x						
Si-Fab							Foundry
Sierra	x	x			x		Telecom
Solid State							Discrete
Spectrum		x					
Synaptics							Neural network
Synergy					x		
TSMC							Foundry
Telcom Devices				x			Opto
Three-Five				x			
Togai							Fuzzy logic
Topaz							Discrete
TranSwitch							Telecom
TriQuint				x			
Triad					x		
UMC	x	x			x	x	Foundry, telecom
US2		x					
VIA Technologies						x	
VTC	x	x					
Vadem						x	
Vitelc					x		

(Continued)

**Table 11 (Continued)**  
**Alphabetical List of Start-Up Companies and Product Lines**

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Vitesse		x		x	x	x	
WaferScale		x			x		
Weitek			x				
Wolfson		x					
XTAR						x	
Xilinx		x					
Zoran			x				

Source: Dataquest  
January 1990

## Product Analysis

### Emerging Technology Companies

Start-up companies in the United States historically have been at the leading edge of new trends in product and process technology. Many of the start-ups in this directory follow this same pattern. Table 12 lists some of the emerging technology companies and the areas in which they are developing.

### ASICs

ASICs are transforming the electronics industry. System manufacturers are shifting their procurement content from standard ICs to ASICs. The

functions of the standard ICs are being put into cell libraries used by system designers to incorporate a number of specific functions on one chip, thus providing a "single-chip system solution." This design methodology provides system manufacturers with a technique to accomplish the following:

- Reduce system size
- Reduce system cost
- Improve system security
- Reduce system development time
- Improve system performance
- Improve system reliability

**Table 12**  
**Emerging Technology Companies**

Company	Technology/Product
Cree Research	Silicon carbide discretes
HNC	Neural network ICs
Krysalis	Ferroelectric memory
Molecular Electronics	Biomembranes (bioelectronics)
Photonic Integration	Optoelectronic ICs
RAMAX	Ferroelectric memory
Ramtron	Ferroelectric memory
Synaptics	Neural network ICs
Togai InfraLogic	Fuzzy logic processors

Source: Dataquest  
January 1990

ASICs were a \$7.4 billion market in 1988 and are projected to be a \$17.8 billion market by 1994. More than 59 percent of all logic ICs consumed during 1988 were ASICs; the ASIC market consists of the following four product categories:

- Programmable logic devices (PLDs)
- Gate arrays
- Cell-based ICs (CBICs)
- Full-custom ICs

With the development of industry standards in the gate array segment, gate arrays have become a

commodity product. As a result, companies with high-volume manufacturing capabilities, especially Japanese companies, now are dominating the market. More start-ups are entering the PLD market because there are no standards, it is a more fragmented market, and companies can protect their products with patented architectures. To survive, start-ups must avoid products that require large manufacturing muscle and develop strong ties with the customer. The key to success in this market is to provide a unique ASIC solution. This solution may take the form of a unique architecture or the development of cells for specific applications, such as telecommunications. Table 13 lists the companies that participate in the ASIC market.

Table 13  
Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Actel Corp.	x				
Acumos	x				
Altera				x	
AMCC	x				
Asahi Kasei	x		x		
Aspen				x	
Avasem			x		
Calmos	x		x		
Calogic	x				
CMD	x		x		
Custom Arrays		x			
Custom Silicon	x				
Dolphin			x		
ETC		x			
ES2					x
Exel Microelectronics				x	
Genesis	x		x		
GigaBit			x		
ICI Array	x	x			
IST	x		x		
ICS	x				
iLSi	x				
ICT				x	
IMP	x		x		
Lattice				x	
Matra-Harris		x			
Micro Linear		x			
Mietec			x		
PLX				x	
Plus Logic				x	

(Continued)

Table 13 (Continued)

## Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Seattle Silicon			x		x
Sierra			x		
Spectrum Micro	x				
UMC	x		x	x	x
US2					x
VTC	x		x		x
WaferScale			x		
Xilinx				x	

Source: Dataquest  
January 1990

### Analog ICs

The term "analog" defines electrical signals that have the property (or potential) of being continuously variable and that do not represent encoded numerical values. From 1988 through 1993, Dataquest predicts a compound annual growth rate (CAGR) of 12.4 percent for the analog IC market. Historically, analog ICs have grown well, between 16 and 20 percent in revenue during the last 10 years. The need to interface between the digital world and the real world has driven this growth. The need for accuracy, an easier means of design, and higher speed and precision also have been large factors. We expect these factors to continue to drive growth. Of great interest to the future growth of analog ICs, however, will be the development of analog ASIC circuitry, as employed in arrays and cell libraries.

Companies that offer analog products are concentrating on high-growth products, particularly analog ASICs, data converters, and telecom-specific products. A very specialized niche is the IC sensor segment. Three companies that offer sensor products are IC Sensors, NovaSensor, and Sensym.

Application-specific analog ICs, another analog approach, are expected to be a key area. Companies that can design cost-effective and reliable analog and digital circuits on a single chip will be able to provide a valuable service to the market. Companies that currently offer analog array design services are listed in the subsection entitled "ASICs."

Product segments in the analog marketplace include the following:

- Operational amplifiers
- Comparator products
- Consumer circuits
- Data conversion products
- Interface products
- Voltage regulators/voltage references
- Sensor products

Telecommunications ICs, which constitute an additional analog market segment, are listed separately in the subsection entitled "Telecommunications."

Dataquest believes that analog ASICs and telecom IC products will be the only areas that will show growth in 1989. In the long range (i.e., 1988 through 1993), Dataquest anticipates strong growth in the areas of analog ASICs, data converters, and telecom ICs. The CAGRs for each of these segments are 21.4 percent, 17.3 percent, and 16.2 percent, respectively. Major markets for analog ICs include data processing, communications, industrial, military, consumer, and transportation/automotive.

Table 14 lists the participants in the market for analog ICs.

**Table 14**  
**Companies That Offer Analog ICs**

	Op Amps	Comparators	Consumer	Data Conv.	Interface	Regulators/ References	Sensors
ALD	x	x					
Asahi Kasei				x			
ATMEL				x	x		
Avasem				x			
Brooktree	x		x	x			
Calmos	x			x			
Calogic	x					x	
Celeritek	x						
Comlinear	x			x			
Crystal	x			x			
Dallas					x		
Elantec	x	x			x		
Hualon			x				
IC Sensors							x
LIS				x			
LTC	x	x		x	x	x	
Maxim	x			x	x	x	
Micro Linear				x	x		
Microwave Technology	x						
NovaSensor							x
Power Integrations				x			
Samsung	x	x		x	x	x	
Sensym							x
Sierra				x			
Topaz				x	x		
UMC			x	x			
VTC	x	x		x	x		

Source: Dataquest  
 January 1990

## Digital Signal Processing

The digital signal processing (DSP) market is a fast-growing area with many niche market opportunities for innovative start-up companies. DSP applications have emerged as consumers of substantial numbers of ICs, particularly in the communications and military market segments, which currently represent approximately 75 percent of all DSP applications. However, technology and products are migrating quickly into mainstream commercial and consumer areas.

DSP products, as defined by Dataquest, comprise four categories: single-chip DSP microprocessors, microprogrammable devices, special-function cir-

cuits, and ASIC DSP products. DSP microprocessors are analogous to the MPUs used in the PC environment; the main difference is that their architectures are optimized to solve digital signal processing problems. Microprogrammable products are used to build customized architectures to solve high-performance problems and include multipliers, multipliers/accumulators, sequencers, and other traditional bit-slice products. Special-function devices include modems, codecs, filters, and speech- and image-processing devices. ASIC DSP products use a cell-based approach and are designed specifically for DSP applications.

Table 15 shows the companies that participate in the DSP market.

Table 15  
Companies That Offer DSP Products

	DSP MPU	Microprogrammable	Special Function
BIT		x	
Calmos			x
Dallas	x		
The DSP Group			x
Logic Devices		x	
Matra-Harris		x	
Weitek		x	
Wolfson		x	
Zoran	x		x

Source: Dataquest  
January 1990

### Discrete Semiconductors

The term "discrete" refers to a packaged semiconductor device that has a single function, meaning that one or several functioning circuits are in the package. Technically, optoelectronic devices belong in this category, but for the purpose of this directory, we are treating them separately.

Dataquest divides the discrete market into seven separate categories: small signal and power transistors; small signal, power, and zener diodes; thyristors; and other discretes. Power field-effect transistors (FETs) are included as a separate category because many of the newer companies are

concentrating in this area. FETs differ from most bipolar transistors in that they are voltage-controlled rather than current-controlled devices. FETs are available in two types: junction types (JFETs) and metal oxide types (MOSFETs).

The value of the discrete market was \$7.5 billion in 1988. The discrete market grew at a CAGR of 13.4 percent from 1982 through 1987. We believe that the CAGR will be considerably less from 1988 through 1993, at 7 percent. The strongest product growth is expected to be in the power device and other discrete categories. Table 16 shows the companies that participate in the discrete semiconductor market.

Table 16  
Companies That Offer Discrete Products

	Diodes	Transistors	Power FETs	Thyristors	Others
AMPi			x		
APT			x		
BKC International	x				
Celeritek		x			
Cree Research	x				
IXYS			x		x
MOSPEC		x	x		
Powerex	x			x	
SID		x			
Samsung		x	x		
Topaz			x		

Source: Dataquest  
January 1990

**Table 17**  
**Companies That Offer Foundry Services**

Company	Location
Chartered Semiconductor	Singapore
GigaBit Logic	United States
MOSPEC Semiconductor	Taiwan
NMB Semiconductor	Japan
Orbit Semiconductor	United States
Si-Fab Corporation	United States
Taiwan Semiconductor Manufacturing	Taiwan
UMC	Taiwan

Source: Dataquest  
January 1990

### Foundry

The companies listed in Table 17 offer semiconductor foundry services. GigaBit Logic, MOSPEC, and NMB also offer other products and services. The most recently formed company is Chartered Semiconductor Corporation, which was formed as a joint venture among National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation to establish a technology base in Singapore.

### Gallium Arsenide

Gallium arsenide (GaAs) and other III-V compound semiconductors have made a slow transition from the laboratory to commercial applications. Users of supercomputers, telecommunications hardware, instrumentation, and consumer products are discovering major benefits in performance and improved functionality by taking advantage of this space-age technology. The worldwide market for GaAs semiconductors surpassed the \$2.5 billion mark in 1988, up from 1987 shipments of an estimated \$2.2 billion to more than \$2.7 billion. The predominant devices were discrete optoelectronics; ICs make up less than 10 percent of these figures. GaAs is projected to exceed \$4 billion by 1992; however, less than 30 percent of this value will be in ICs.

#### Advantages of GaAs over Silicon

The following are advantages that GaAs semiconductors have over silicon:

- Circuit switching 3 to 10 times faster

- Speed/power product 5 to 6 times more efficient
- Relative insensitivity to temperature and power supply variations
- Upper temperature limit of 350°C versus 175°C
- Superior levels of radiation tolerance
- Integrated optoelectronics on a single chip
- Wider range of resistivity due to semi-insulating substrates

#### Disadvantages of GaAs versus Silicon

The disadvantages of GaAs semiconductors compared with silicon are as follows:

- Higher wafer cost (typically 20 times or more)
- Lower level of digital circuit integration at a given point in time
- Lack of volume-production parametric test capability
- Design tasks more difficult; fewer expert engineers

GaAs has potentially wide-range applications in military, communications, and data processing market segments. Although GaAs is not likely to replace silicon in the foreseeable future as the workhorse semiconductor material, we do expect substantial growth in the GaAs market.



The following are potential GaAs IC applications:

- Telecommunications: opto and microwave electronics
- Computers and peripherals
- Instrumentation
- Consumer electronics
- Robotics
- Automotive
- Military/government

GaAs products are segmented into the following classifications:

- Analog ICs—MIC amps, MIC converters, frequency multipliers, ASICs
- Digital ICs—Logic, memory, ASIC, dividers, cost models
- Optoelectronics—LEDs, lasers, detectors, photovoltaic cells, isolators, couplers, integrated opto devices

- Discretes—Small-signal transistors, power FETs

Table 18 shows the participants in the gallium arsenide market.

### Memory

Because it is very difficult for a start-up to compete in a commodity market such as DRAMs or slow SRAMs, most memory start-ups are entering niche markets. It is important for a start-up to enter a market that matches its abilities. For this reason, many new memory companies have chosen to enter the market for fast SRAMs. This market is well suited to start-up participants for the following reasons:

- It offers good margins.
- It requires a strong process technology.
- It requires strong technical support.
- It requires close customer contact, which is necessary to design products to fit client needs.
- It does not require a large fab.

Table 18

Companies That Offer GaAs Products

	Analog MMICs	Digital Linear	RAMs	ASICs	Std. Logic	Discretes	Opto
ANADIGICS	x	x					
Celeritek	x	x				x	
Epitaxx Inc.							x
Gazelle				x			
GigaBit		x	x	x	x		
HMS	x	x			x	x	
Hittite	x						
Isocom							x
Kyoto							x
Lytel							x
M/W Monolithics	x						
M/W Technology	x	x					
Opto Diode							x
Opto Tech						x	x
Pacific	x	x		x			
Telecom Devices							x
Three-Five							x
TriQuint	x	x		x	x		
Vitesse		x	x	x	x		

Source: Dataquest  
January 1990

Most start-ups are well positioned to meet the success requirements in the fast SRAM market. U.S. companies have a particular advantage over Japanese companies in one crucial area: U.S. companies are able to establish much closer contact with their U.S. clients because of their domestic production capability. The goal of most start-ups is to become niche players. To sustain success with a niche strategy, however, the company must dominate the niche.

Other niches that start-ups are pursuing include the high-speed EPROM and EEPROM markets and other nonvolatile memory markets such as ferroelectric memory. In addition, a number of start-ups are positioning themselves in markets for specialty memories such as FIFO and dual-port devices.

Table 19 lists the participants in the memory product market.

Table 19  
Companies That Offer Memory Products

	DRAM	SRAM	ROM	EPROM	EEPROM	FIFO	Others
Alliance	x	x					
Asahi Kasei		x	x				
Aspen		x					
ATMEL				x	x		x
Austek							x
Calmos		x					
Catalyst		x		x	x		
Dallas		x				x	x
Exel							x
GigaBit		x					
Hualon		x	x				
ISSI		x					
Inova		x					
ICT				x	x		
Krysalis							x
Logic Devices		x				x	x
Matra-Harris		x					x
Modular		x					
MOSel		x				x	x
Multichip		x					
NMB	x						
Oxford							x
Paradigm		x					
Performance			x				
PromTech				x			
RAMAX							x
Ramtron							x
Samsung	x	x			x		
SEEQ				x	x		
Sierra					x		
SIMTEK							x
Synergy		x					
Triad		x					x
UMC		x				x	
Vitellic	x	x				x	x
Vitesse		x					
WaferScale				x			

Source: Dataquest  
January 1990

## Microcomponents

Microcomponent products generally command higher ASPs than other ICs, frequently are sole-sourced, and have fostered the development of high-end niche markets. Start-up companies are offering graphics controllers, hard and floppy disk controllers, CRT controllers, and peripheral chip sets. A small number of start-ups are producing microprocessors, but the microprocessor market is dominated by larger companies such as Intel and Motorola.

During the past two years, the logic chip set market has been the fastest-growing segment of the microcomponent market. Worldwide, there were only 6 PC logic chip set vendors in 1987. In 1988, the number of vendors climbed to 13, a figure that continues to grow. Many of these new entrants are start-ups. Dataquest believes that the rapid increase in new entrants and capacity has carried this market to the point of saturation. We expect this saturation to lead to aggressive price competition,

causing vendors to look for penetration of these products into new applications and markets. At this point, the growth rate of chip set shipments will be tied directly to the growth rate of PC shipments. The CAGR for chip set shipments from 1989 to 1993 is estimated to be only 12.2 percent. This growth level should attract fewer new entrants and cause some participants to exit the industry.

Dataquest believes that this rapid market saturation is bound to be repeated in each of the PC peripheral chip set markets—logic, graphics, communications, mass storage, modem, and fax—as established chip set and semiconductor companies follow one another into these most obvious product-line extensions. The graphics chip set market already is showing signs of saturation, marked by severe pricing pressure. At the same time, apparently low barriers to entry invite many new market participants.

Table 20 lists the companies that offer microcomponent products.

**Table 20**  
Companies That Offer Microcomponent Products

	MPU	MCU	MPR Commun.	Mass Storage	Sys. Support	Key/Display
ACC Micro					x	
Adaptec				x		
Asahi Kasei		x				
Avasem					x	
Calmos	x			x	x	
Catalyst		x				
Cirrus Logic			x	x		x
Dallas		x			x	x
Edsun			x		x	x
Headland						x
Hualon			x		x	x
IIT	x					x
Intergraph APD	x					
Logic Devices			x		x	
Matra-Harris	x	x			x	x
Modular					x	
Novix	x					
NSI Logic						x
Oak Technology					x	x
Performance	x				x	
SEEQ	x				x	
S3					x	
UMC	x	x		x	x	x
XTAR						x

Source: Dataquest  
January 1990

## Optoelectronics

Optoelectronics is a field that combines the technologies of optics and electronics. Visible devices, including light-emitting device (LED) lamps and LED displays, are the market segments concerned with the interactions between light-emitting and filtering devices and electronics. LEDs are commodity products. Optocouplers and other opto areas are more customized products. Both of these products are growing at a faster pace than LEDs. Other opto areas include products such as photodiodes and phototransistors, solar cells, infrared lamps, lasers, and CCD sensors.

Dataquest divides the optoelectronics market into four separate categories: LED lamps, LED displays, optoelectronic couplers, and other optoelectronic devices. The total market for optoelectronics grew at a rate of 15.8 percent compounded annually from 1982 through 1987. Dataquest expects this growth rate to continue at the lesser rate of 11.4 percent compounded annually from 1988 through 1993. Price pressure in the industry is eroding dollar growth, although new technologies and applications continue. The optoelectronics

segment is being fueled by the communications and computer industries, which use light as a medium for communication. Optoelectronics also are heavily used in the consumer market.

Table 21 lists the companies that offer optoelectronic products.

## Telecommunications ICs

The telecommunication IC market is growing faster than the analog IC market, of which it is a segment. In fact, Dataquest predicts a CAGR of 16.2 percent for the telecom IC segment in the 1988 through 1993 period. One factor driving the growth of telecommunication ICs is the need to automate the office by linking personal computers. Another factor is the need to communicate faster, farther, and in a variety of ways, including satellites and facsimile machines. The demand for better and faster communication also is spurring the development of new devices such as line interfaces and switch arrays.

Table 22 lists the companies that offer telecommunications ICs.

Table 21  
Companies That Offer Optoelectronic Products

	Light Emitting	Light Sensing	Others
Cree Research	x		
Epitaxx Inc.	x	x	
Isocom			Optocouplers
Kyoto	x	x	
Lytel	x		Lasers
Opto Diode	x		
Opto Tech	x		Photodiodes Phototransistors
Solid State Telcom Devices	x	x	Photodiodes

Source: Dataquest  
January 1990

Table 22  
Companies That Offer Telecommunications ICs

	Dialer	Modem	UART/ DUART	Line Interface	Codec/ Filter	Switch Array	Others
Asahi Kasei					x		
ATMEL					x		
CMD	x				x		
Calmos					x		*
Crystal	*	*		x			*
Dallas			x				
Exel			x				
Hualon	*						x
Level One				x			
Matra-Harris		*		x	x		
Modular			x				
Photonic							x
Samsung	*				x		*
Sierra	*	*			x		
Topaz						x	
TranSwitch							x
UMC	*		x				

Source: Dataquest  
January 1990

## Company Profiles

Dataquest has profiled 137 semiconductor start-ups in the following subsection. The data for these profiles were collected through personal and telephone interviews, surveys, and publicly available material. Some of the text was integrated verbatim

from background information provided by the companies.

The 1990 edition contains some information not included in earlier editions of this directory. The asterisks (\*) in the board of directors and company executives sections denote company founders. At the end of each profile, the name of the company's PR firm is listed if one exists.

# ACC Microelectronics Corporation

3295 Scott Blvd., Suite #400

Santa Clara, CA 95054

408/980-0622

Fax: 408/980-0626

ESTABLISHED: February 1987

NO. OF EMPLOYEES: 50

## BACKGROUND

ACC Microelectronics Corporation was established in February 1987 to design, produce, and market VLSI devices for advanced computer and communication products. The Company was founded by W.T. Chiang, a designer of the Intel 80386. ACC is concentrating on developing VLSI circuit device chip sets to be used as "gap bridging" solutions in several major application areas such as communications, computer systems controllers, and computer system board integration.

The Company has developed a full line of high-performance products, including nine chip sets and 15 individual chips. These products include a single-chip turbo-IBM PC XT-compatible peripheral controller, a single-chip floppy disk controller for XT, AT, PS/2 Model 30, and PS/2 Models 50, 60, 70, and 80-compatible computers, a 386 chip set, and a 386SX chip set. ACC's target markets include OEMs, distributors, and value-added integrators of computer and communication systems.

In April 1989, ACC announced a strategic alliance with Motorola's Semiconductor Products Sector. The agreement allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers. Previously, ACC and Motorola announced an alternate-source licensing agreement for the ACC3200 series of disk controllers.

In the future, ACC Microelectronics will offer a complete line of system-level VLSI chip set solutions for advanced computers and communications.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*W.T. Chiang

Intel, Senior Manager

### VP Eng

Mark Shieu

Amiga, Director

### Dir Prod Mktg

Jack Yuan

Genoa, Prod Mktg Mgr

\*Founder

## FINANCING

ACC Microelectronics is privately financed.

## RECENT HIGHLIGHTS

### November 1989

ACC introduced a four-device chip set for IBM PC AT-compatible computer systems. The new ACC-82021 chip set operates at up to 20 MHz and supports Intel 80286 and 80386SX microprocessors.

### November 1989

ACC announced its three-device ACC-82300 chip set for IBM PC AT-compatible computer systems. The new chip set operates at 20 or 25 MHz and supports the Intel 80386 microprocessor.

### November 1989

ACC introduced the ACC-82030 single-chip AT controller. The new highly integrated controller chip is packaged in a unique 256-pin surface mount device developed by Motorola as part of ACC's earlier agreement with Motorola.

# ACC Microelectronics Corporation

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## ALLIANCES

### Motorola

April 1989

ACC and Motorola announced a strategic alliance that allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers.

Motorola also gained second-source rights to a cache controller and a tag RAM developed by ACC.

## MANUFACTURING

### Technology

1.5- and 1.0-micron CMOS

### Facilities

Santa Clara, CA  
Design, test

## PRODUCTS

Single Chip XT—ACC1000

Single Floppy Disk Controller—ACC3201

386SX AT Chip Set—ACC82020

386 AT Chip Set—ACC82300

## OTHER INFORMATION

ACC's PR firm is Shotwell Public Relations.

# Actel Corporation

955 E. Arquez Avenue

Sunnyvale, CA 94086

408/739-1010

Fax: 408/739-1540

ESTABLISHED: October 1985

NO. OF EMPLOYEES: 60

## BACKGROUND

Actel Corporation designs, manufactures, and markets user-configurable integrated solutions for the design and implementation of ICs in electronic systems.

The Company was founded by Amr Mohsen, a former Intel program manager of advanced technology development.

Actel has developed a CMOS gate array based on proprietary architecture and customer-configurable interconnect technologies. Customers can map applications instantly with Actel's design automation systems, which includes development software and system hardware.

In 1987, Actel received \$750,000 in follow-on funding, bringing first-round financing to \$9.1 million. In March 1988, William Davidow, an Intel veteran and well-known venture capitalist, was elected chairman of Actel.

## BOARD

(Name and Affiliation)

William H. Davidow, Chairman  
Mohr, Davidow Ventures

\*Amr Mohsen  
Actel Corporation

Carver Mead  
California Institute of Technology

Jos Henkens  
Advanced Technology Ventures

Vahe Sarkissian  
Data General Corporation

Ed Zshau  
Censtor Corporation

John East  
Actel, President/CEO

Robert G. Spencer  
Hillman Ventures

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
John East  
AMD, VP Logic Products

VP Operations  
Paul Franklin  
MMI, GM-Memory, Digital & Logic Divisions

Sr VP Sales/Mktg  
M. Douglas Rankin  
Signetics, VP WW Sales

VP Finance  
Richard S. Mora  
HHB, VP Finance

VP Engineering  
Jeff M. Schlageter  
AMD, Managing Dir Peripheral Products

\*Founder

## FINANCING

October 1985  
Initial  
\$0.5M  
Private, Advanced Technology Capital, Shaw  
Venture Partners

June 1986  
Round 1  
\$9.1M  
Advanced Technology Ventures; Brentwood  
Associates; Mohr, Davidow Ventures; Norwest  
Venture Capital; Oak Associates; Shaw Venture  
Partners; Data General



# Actel Corporation

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August 1988

Round 2

\$9.3M

Hillman Ventures, Sprout, DLJ Ventures,  
Rothschild Ventures, Equity Venture Capital,  
Hughes Aircraft

agreement with Data General that allowed Data General to design and develop semiconductor products based on Actel's technology. In return, Data General supplied Actel with use of test equipment, wafer fabrication, and engineering facilities (expired).

## RECENT HIGHLIGHTS

February 1988

Actel introduced the ACT 1 family of FPGAs, which can be designed, programmed, and tested from a 386-based PC in a matter of hours.

July 1988

Actel disclosed technical details of its Programmable Low Impedance Circuit Element (PLICE) antifuse nonvolatile interconnect, a strategic technology important to the company's thrust into desktop-configurable products.

Texas Instruments

November 1988

Actel and TI signed a seven-year technology and licensing agreement. Under the pact, TI will alternate-source the ACT 1 family of gate arrays and resell the Action Logic System (ALS)—Actel's fully-automatic CAE system. Actel will gain access to TI's advanced EPIC 1 CMOS wafer-processing technology and manufacturing capabilities.

## ALLIANCES

Data General

1986

Actel signed a three-year joint development

## MANUFACTURING

Technology

CMOS

Facilities

Sunnyvale, CA

30,000 sq. ft.

R&D, development, marketing, administration

## PRODUCTS

A family of field-programmable Gate Arrays supported by a design automation system

Gate Arrays

Device	Description
Act 1010	1,200-gate FPA
Act 1020	2,000-gate FPA
Action Logic TM System	Development hardware and software

## OTHER INFORMATION

Actel's PR firm is Tsantes and Associates.

**Acumos, Inc.**  
 1531 Industrial Road  
 San Carlos, CA 94070  
 415/591-1488  
 Fax: 415/591-1483

**ESTABLISHED: 1985**

**NO. OF EMPLOYEES: 15**

**BACKGROUND**

Acumos, Inc., specializes in analog-to-digital arrays, small-to-medium high-drive and high-voltage arrays, and analog switching arrays that incorporate both CMOS and DMOS switches. The Company offers both full-custom and standard cell devices.

In 1987, Acumos offered the A300 gate array that incorporates analog and digital functions. The device, which is a PLD replacement part, is designed for voice filtering, robotics, magnetic disk drive applications, and communications markets. The Company plans later introductions of specialty high-voltage products.

In 1985, the Company acquired Semi Processes Inc.'s gate array assets, including inventory, wafers, and test equipment. The Company is servicing SPI's customer base for low-density CMOS gate arrays in the 50- to 700-gate range.

Acumos subcontracts manufacturing and assembly with U.S. and offshore companies. The Company plans to sell into the Japanese and U.S. markets.

**BOARD**

Not available

**PRODUCTS**

Gate Arrays

Device	Linewidth	Gates	Description
7001/7004/7005	4-micron	100 to 700	High 15V Output Drive Digital Gate Arrays, Typical 3ns Delay
D315-D3120 Series	3-micron	150 to 1,200	Typical 2ns Delay
A300	4-micron	300	Analog/Digital Array with Op Amps, Resistors, Capacitors, Comparators, 5ns-Internal Gate Delay
CD01/CD02		30-100	CMOS/DMOS Monolithic Gate Array

**OTHER INFORMATION**

Acumos does not employ a PR firm.

**COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President**

\*Man Shek Lee  
 GTE, Mgr IC Design

**VP**

\*Chieh Chang  
 GTE, Sr Design Engr

\*Founder

**FINANCING**

Not available

**ALLIANCES**

None

**MANUFACTURING**

**Technology**

3.0-, 4.0-, 5.0-micron silicon-gate CMOS

**Facilities**

San Carlos, CA  
 4,000 sq. ft.  
 Design and test

## Adaptec, Inc.

691 S. Milpitas Boulevard  
Milpitas, CA 95035  
408/945-8600  
Fax: 408/262-1845

ESTABLISHED: May 1981

NO. OF EMPLOYEES: 567

### BACKGROUND

Adaptec, Inc., is one of the leading suppliers of high-performance input/output (I/O) solutions. Product offerings include proprietary VLSI circuits, a broad line of small computer systems interface (SCSI) host adapters and enhanced small device interface (ESDI) disk controller boards for personal computers, local area network (LAN) interface units, a family of SCSI test and development systems, and imaging systems controller products. Adaptec stock is traded over the counter under the NASDAQ symbol ADPT.

Adaptec designs full-custom, semicustom, and gate array circuits in NMOS, CMOS, and bipolar technologies in geometries ranging from 4.0- to 1.0-micron. Products are targeted to customers in three segments of the microcomputer market: the personal computer market; the multiuser systems, network file server, and engineering workstation market; and the supercomputer market for scientific and business applications. Adaptec also designs and manufactures host adapters and controller boards for the AT, Micro Channel and, soon, extended industry standard architecture (EISA) bus architecture microcomputers.

Adaptec is one of the leaders in the SCSI industry with chips, boards, test and development systems, software support, and communication products. The Company eventually will apply the interface to its laser printer controller boards. Adaptec's SCSI protocol chip has been incorporated into a host adapter made by IBM, and its controller chips have been selected by peripheral customers such as Conner, Hitachi, Quantum, Seagate, Seiko-Epson, and Sony. Adaptec has won contracts for its board products from microcomputer makers such as Nokia, Tandy, Unisys, and Zenith. Additionally, the Company's network interface unit, the Nodem, was "blessed" by Apple Computer and featured in the introduction of Apple's Macintosh Portable.

The Company subcontracts all IC production; however, it also performs final test on all products to maintain the quality and reliability of its devices. High-volume board products are assembled in Singapore by Adaptec's wholly owned manufacturing entity, Adaptec Manufacturing Singapore (AMS).

Adaptec markets and distributes controller boards and circuits to a broad spectrum of computer and disk drive manufacturers, a number of reseller channels, and domestic and international industrial distributors. The Company has 15 manufacturers' representative organizations, 5 industrial distributors, and 19 international distributors.

### BOARD

(Name and Affiliation)

John G. Adler

Adaptec, Inc., President/CEO

Lawrence B. Boucher

Adaptec, Inc., Chairman

Robert J. Loarie

Lawrence, WPG Partners, General Partner

David F. Marquardt

Technology Venture Investors, General Partner

B. J. Moore

Outlook Technology Inc., President

W. Ferrell Sanders

Asset Management Co., Senior Associate

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO

John G. Adler

Amdahl, VP Product Dev

## **Adaptec, Inc.**

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### **VP Engineering**

Larry Sasscer  
Amdahl, Mgr Channel Dev

### **VP/GM**

Jeffrey A. Miller  
Intel, Mktg Mgr/MPU Ops

### **VP Finance/CFO**

Paul Hansen  
Raychem, Asst Controller

### **VP Systems**

Bernard G. Nieman  
Shugart, Project Manager

### **VP Sales**

Roger McLean  
Imagen Corp., VP OEM Sales/Mktg

### **VP Mfg**

Gary J. Weitz  
Finnigan, General Manager

### **VP Peripheral Products**

G. Venkatesh  
Commodore Int'l, Director of Mktg

turing Singapore, manufactures surface-mount controllers.

### **October 1987**

Adaptec signed a \$5 million contract to supply Conner Peripherals with disk controller ICs during 1988.

### **1988**

Adaptec introduced the industry's first PS/2 Micro Channel disk controllers.

### **June 1988**

Adaptec announced a major corporate restructuring. Under the new plan, the Company is organized into four major groups: Test and Development Systems, Chips, Boards, and Communications Products. Each group is nearly autonomous, with separate marketing, management, and profit-and-loss responsibility.

### **July 1989**

Adaptec established a regional sales and support office in Singapore, headed by K.S. Yeo, regional sales manager.

## **FINANCING**

### **June 1986**

IPO  
\$10.0M  
Initial public offering

## **RECENT HIGHLIGHTS**

### **1979**

Adaptec founders created SCSI.

### **1983**

Adaptec introduced the industry's first programmable disk controller chips.

### **1984**

Adaptec introduced the industry's first multitasking disk controllers/host adapters.

### **January 1987**

Adaptec established a subsidiary in Singapore. The new company, called Adaptec Manufac-

## **ALLIANCES**

### **SCO**

#### **October 1987**

Adaptec signed an agreement with The Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system.

### **Chips & Technologies**

#### **January 1988**

Adaptec and Chips & Technologies aligned to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80.

## **MANUFACTURING**

### **Technology**

4.0- to 1.0-micron NMOS, CMOS, bipolar

**Facilities**

Milpitas, CA  
 100,000 sq. ft.  
 Administration, development

Singapore  
 45,000 sq. ft.  
 Manufacturing

**PRODUCTS**

**Integrated Circuit Products**

Device	Description
AIC-010F	10-Mbps Programmable Storage Controller
AIC-011F	15- and 24-Mbps Programmable Storage Controller
AIC-250F	MFM Encoder/Decoder
AIC-270F	2,7 RLL Encoder/Decoder
AIC-300F	Dual-Port Buffer Controller
AIC-301	Enhanced Dual-Port Buffer Controller
AIC-500	SCSI Interface Circuit
AIC-560	PC AT Interface Chip
AIC-610F	10-Mbps Integrated Programmable Storage Controller
AIC-6110	Single-Chip Synchronous SCSI Controller
AIC-6160	Single-Chip PC AT Mass Storage Controller
AIC-6190	Single-Chip Micro Channel Mass Storage Controller
AIC-6225	33-Mbps (1,7 RLL) Data Separator
AIC-6250	20MB Host Transfer with SCSI Protocol Circuit

**Board Products**

**SCSI Host Adaptors**

AHA-1540	PC AT-to-SCSI Host Adaptor
AHA-1542	PC AT-to-SCSI Host Adaptor
AHA-1640	Micro Channel-to-SCSI Host Adaptor

**Hard Disk Controllers**

ACB-231X	AT-to-ST412/506 MFM Hard Disk Controller, 5 Mbps
ACB-237X	AT-to-ST412/506 RLL Hard Disk Controller, 7.5 Mbps
ACB-232X	AT-to-ESDI NRZ Hard Disk Controller, 10 Mbps
ACB-232XB-8	AT-to-ESDI NRZ Hard Disk Controller, 15 Mbps
ACB-2610	Micro Channel-to-ST412/506 MFM Hard Disk Controller
ACB-2670	Micro Channel-to-ST412/506 RLL Hard Disk Controller
ACB-2620	Micro Channel-to-ESDI Hard Disk Controller

**SCSI Test and Development Systems**

SDS-1	SCSI Development System with Initiator Emulation
SDS-2	SCSI Development System with Target and Initiator Emulation
SDS-3	Synchronous SCSI Development System with Target and Initiator Emulation

**SCSI-to-LAN Interface Unit**

Nodem	Connects SCSI-based PCs to Ethernet
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**OTHER INFORMATION**

Adaptec does not employ a PR firm.

# Advanced Hardware Architectures, Inc.

P.O. Box 9669  
Moscow, ID 83843  
208/883-8000  
Fax: 208/882-0105

ESTABLISHED: February 1988

NO. OF EMPLOYEES: 25

## BACKGROUND

Advanced Hardware Architectures (AHA) was formed in 1988 to develop VLSI products based on a proprietary sorting and error-correction technologies developed by the Idaho Research Foundation. The Company's first products are a family of high-speed, single-chip Reed-Solomon encoder/decoder chips and a family of sorter coprocessor boards. AHA implements its patented sorting and error-correction technologies with very high speed hardware architectures.

AHA is the first commercial venture of the Idaho Research Foundation, the high-technology development arm of the University of Idaho. The Company is headed by John Overby, who joined AHA after holding the position of CEO with Advanced Input Devices.

The Company uses both CMOS and GaAs process technologies for its current product offerings and will use other technologies as the need arises. All of the Company's wafer fabrication operations are contracted to outside firms. AHA plans to set up a small fab of its own eventually. The Company currently operates two facilities in Moscow, Idaho, that total 10,000 square feet. AHA's future product focus will continue to be proprietary sorting and coding products. The Company plans to expand its capacity to allow for rapid product growth.

## BOARD

(Name and Affiliation)

John Overby  
Advanced Hardware Architectures, President

Dr. Richard Callahan  
Idaho Research Foundation, Inc.

Dr. Gary Maki  
UI/Microelectronics Research Center

Steve Shinn  
Investor

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
John Overby  
A.I.D., President and CEO

**VP Finance**  
Gordon Scott  
A.I.D., COO and CFO

**VP Sorting Products**  
Dr. J. Shovic  
University of Idaho/MRC, Research

**VP Coding Products**  
Dr. Pat Owsley  
University of Idaho/MRC, Research

## FINANCING

Advanced Hardware Architectures has had three rounds of financing, which totaled more than \$1 million.

## ALLIANCES

None

## MANUFACTURING

### Technology

CMOS, GaAs, and others as needed

### Facilities

Moscow, ID  
Two locations that total 10,000 sq. ft.  
R&D, marketing, test

# **Advanced Hardware Architectures, Inc.**

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## **PRODUCTS**

**PerFEC Series—Very High Speed, Single-Chip Reed-Solomon Encoder/Decoder Chips**  
**Aha!Sort Series—Sorter Coprocessor Boards**

## **OTHER INFORMATION**

Advanced Hardware Architectures' PR firm is Hanna-Wheeler.

PerFEC and Aha!Sort are trademarks of Advanced Hardware Architectures, Inc.

# Advanced Linear Devices, Inc.

1180 F. Mariloma Way

Sunnyvale, CA 94086

408/720-8737

Fax: 408/720-8297

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 10

## BACKGROUND

Advanced Linear Devices, Inc., (ALD) designs, develops, manufactures, and markets linear ICs for low-power, low-voltage precision applications. Products are manufactured using a proprietary silicon-gate CMOS technology optimized for 5V operation. They are used for industrial control and electronic instrumentation, computer and peripheral equipment, medical instrumentation, telecommunications, aerospace, and military systems.

The Company offers two product lines. A series of about 25 standard products that include timers/oscillators, op amps, comparators, and n-channel and p-channel MOSFETs.

The second product line, which was offered in March 1988, is a Function-Specific Standard Cell Linear Program for the design of custom and semicustom ICs. The library includes timers/oscillators, op amps, comparators, and MOSFETs, as well as diodes, resistors, and capacitors. The program consists of a kit of 86 standard ICs of 20 different types and a design manual. Customers use the parts to bread board the desired circuit, then return the working design to ALD, which then designs the circuit.

ALD subcontracts wafer fabrication to two foundries in the United States and assembly to contractors in the Far East. ALD conducts all wafer probe, sort, and final test at its facility in Sunnyvale, California. In 1987, ALD put in place its U.S. and Canadian network of sales representatives and established a U.S. distributor network.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Robert Chao  
Supertex, VP Product

### VP Product Opns

\*Larry Iverson  
Supertex, Mgr Process Engr

### VP Mktg/Sales

\*Michael O'Neal  
Micropower, VP Mktg/Sales

\*Founder

## FINANCING

Not available

## RECENT HIGHLIGHTS

### April 1986

ALD offered its first product, the ALD55 monolithic CMOS timer. It features 500ns monostable mode and 2-MHz astable mode operation.

### August 1986

ALD offered the ALD2301 silicon-gate CMOS dual comparator with typical response time of 650ns.

### November 1986

ALD offered the ALD1502/2502/4501 family of quad CMOS timers that operate on 2V to 12V supplies. The series is available in commercial and military grades.

### March 1987

ALD offered the ALD2701 CMOS dual rail-to-rail op amp. The device operates from single or dual supplies and input and output signal levels both extended to the supply voltage rails.



# Advanced Linear Devices, Inc.

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March 1988

ALD offered the function-specific standard cell ASIC approach for linear ICs.

## ALLIANCES

Not available

## Facilities

Sunnyvale, CA  
10,000 sq. ft.  
Manufacturing  
Design, test  
Administration

## MANUFACTURING

### Technology

3.0-, 5.0-micron silicon-gate CMOS

## PRODUCTS

Device	Description
ALD1701	CMOS, Rail-to-Rail, Micropower Amplifier
ALD1702	CMOS, Rail-to-Rail, Oscillation Resistant Amplifier
ALD1703	CMOS, Low-Cost Amplifier
ALD1704	CMOS, Low-Cost, JFET-Replacement Amplifier
ALD1706	CMOS, Rail-to-Rail, Very Low Power Amplifier
ALD2701	Dual, CMOS, Rail-to-Rail, Micropower Amplifier
ALD4701	Quad, CMOS, Rail-to-Rail, Micropower Amplifier
ALD2301	Dual, CMOS, Open Collector Output Comparator w/Drivers
ALD4302	Quad, CMOS, Push-Pull Outputs Comparator w/Drivers
ALD555/1502/1504	Single-Precision Timer/Oscillator
ALD2502/2504	Dual-Precision Timer/Oscillator
ALD4501/4503	Quad-Precision Timer/Oscillator
ALD1101	Dual N MOSFET Transistors
ALD1102	Dual P MOSFET Transistors
AID555-1	One-volt Single Timer/Oscillator

## OTHER INFORMATION

ALD does not employ a PR firm.

# Advanced Microelectronic Products, Inc.

1/F #17 Industriale E. 2nd Road  
Hsinchu, Taiwan

North American Headquarters  
1887 O'Toole Avenue, Ste. C-111  
San Jose, CA 95131  
408/727-8880  
Fax: 408/727-6320

ESTABLISHED: June 1986

NO. OF EMPLOYEES: N/A

## BACKGROUND

Advanced Microelectronic Products, Inc. (AMPi), was formed to design, manufacture, and market power MOSFETs. The Company is implementing a three-pronged strategy. Initially, the Company entered the market with standard, functional equivalents to International Rectifier's line of leading power MOSFETs. Concurrently, it designed value-added products from its standard product line. Future plans involve using proprietary technology to offer smart power devices.

In August 1986, the Company produced its first prototype product, the IRF450 power amplifier. By April 1987, the Company readied its line of International Rectifier-compatible products and opened its North American headquarters in Santa Clara.

AMPi has established relationships with ERSO (Taiwan), which will conduct manufacturing, and Lingsen (Taiwan) and New Era (Hong Kong), which will perform assembly for AMPi.

Sales representatives have been signed in the United States, Canada, and the Far East.

## BOARD

(Name and Affiliation)

Bob Jih, Chairman of the Board  
Advanced Microelectronic Products, CEO

## COMPANY EXECUTIVES

(Position and Name)

President  
James Yen

CEO  
Bob Jih

CFO  
H.K. Hu

## FINANCING

Not available

## ALLIANCES

Not available

## MANUFACTURING

### Technology

3-micron MOS

### Facilities

Santa Clara, CA  
Design, marketing

Hsinchu, Taiwan  
Headquarters, engineering, manufacturing,  
assembly, test

# Advanced Microelectronic Products, Inc.

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## PRODUCTS

Device	Voltage	Drain Source (Amps)	Current Package
AM0610LL/AM2222LM	60	15.0, 19.0	TO-92
AM10KLM/AM2222LM	60	0.25, 0.3	TO-237
AM4000 Family	100 to 500	18.0 to 56.0	AMPAK-04
IRF100-400	60 to 500	12.0 to 33.0	TO-3
IRF500-800/BUZ	50 to 500	1.3 to 30.0	TO-220AB

## OTHER INFORMATION

AMPi does not employ a PR firm.

# Advanced Power Technology, Inc.

405 S.W. Columbia Street  
Bend, OR 97702  
503/382-8028  
Fax: 503/388-0364

ESTABLISHED: June 1984

NO. OF EMPLOYEES: 70

## BACKGROUND

Advanced Power Technology (APT) designs, manufactures, and markets low-cost, high-power MOSFETs for advanced electric power switching applications, such as data processing and telecommunications equipment, defense systems, and variable-speed electric motors.

APT has developed a family of large-die MOSFETs that match the power and price advantages of low-speed thyristors and bipolar transistors with equivalent switching speeds. The MOSFETs feature lower on resistance and lower input capacitance, achieved with a metal-gate and 6-micron feature sizes. APT has also reduced manufacturing costs by developing a simpler MOSFET design that reduces the number of masks required.

The Company's future plans include developing a line of hybrids and insulated gate bipolar transistors (IGBTs).

## BOARD

(Name and Affiliation)

Charles Cole, Chairman

Julian, Cole & Stein, General Partner

Leib Orlanski

Freshman, Marantz, Orlanski, Cooper and Klein, Attorney, Partner

Patrick Sireta

Advanced Power Technology, Inc.,  
President/CEO

Ed Snape

The Vista Group, General Partner

Dave Stein

Julian, Cole & Stein, General Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO

Patrick Sireta  
TI, VP CMOS Div

VP Marketing

Barry Chenes  
PowerTek, VP Sales

VP Operations

John Hess  
SEEQ, Dir Operations

CFO

Robert M. Holburn  
TI, Ctr WW MOS Mem

VP Engr

Dah Wen Tsang  
Theta-J, Dir Research

Sales Manager

Terry Bowman  
Micron, VP Sales/Mktg

## FINANCING

1985

Seed  
\$0.4M

1985

Round 1  
\$2.5M

1986/1987

Round 2  
\$8.1M

# Advanced Power Technology, Inc.

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1988

Round 3

\$2.8M

Major investors include Julian, Cole & Stein; The Vista Group; Orient Ventures; 1st Chicago Investment Advisors; Sunwestern Ventures Company; J.F. Shea Company; and Mitsui & Company (U.S.A.), Inc.

## RECENT HIGHLIGHTS

October 1986

First prototype MOSFETs produced.

March 1987

Internal wafer fabrication facility became fully operational.

June 1987

APT shipped its first sample MOSFETs for evaluation.

December 1987

First production MOSFETs were shipped to customers.

February 1989

APT introduced the world's most powerful MOSFET, Monster MOS. It can supply 10KW through a single full-bridge configuration.

## ALLIANCES

Not available

## MANUFACTURING

### Technology

5-micron metal-gate MOS

4-inch wafers

### Facilities

The Company conducts all manufacturing in its Bend, Oregon, facility. Assembly for military products is done in the United States; other assembly is conducted by companies overseas.

Bend, OR

31,750 sq. ft.

Total area

18,250 sq. ft.

Administration, assembly, test

13,500 sq. ft.

R&D, engineering, wafer fabrication (including 4,000 sq. ft. Class 10 clean room)

## PRODUCTS

Device	Vds Volts	Id cont. Amps	Idm Amps	Available
AP35XX	350	7.5 to 183.0	30.0 to 732.0	Now
APT40XX	400	7.5 to 183.0	30.0 to 732.0	Now
APT45XX	450	6.5 to 152.0	26.0 to 608.0	Now
APT50XX	500	6.5 to 152.0	26.0 to 608.0	Now
APT55XX	550	5.3 to 122.0	10.6 to 488.0	Now
APT60XX	600	5.3 to 122.0	10.6 to 488.0	Now
APT75XX	750	4.0 to 91.0	16.0 to 364.0	Now
APT80XX	800	4.0 to 91.0	16.0 to 364.0	Now
APT90XX	900	3.0 to 76.0	12.0 to 304.0	Now
APT100XX	1,000	3.0 to 76.0	12.0 to 304.0	Now

## OTHER INFORMATION

APT does not employ a PR firm.

# Alliance Semiconductor

1930 Zanker Road  
San Jose, CA 95112  
408/436-1860

ESTABLISHED: 1985

NO. OF EMPLOYEES: 1,000

## BACKGROUND

Alliance Semiconductor was formed to design, manufacture, and market SRAMs and DRAMs. The Company is using a 1.2-micron CMOS planar process which, when combined with architectural innovations, produces value-added high-speed devices.

In December 1987, Alliance offered the AS4C188 16Kx4 SRAM that features access times of 25ns, 30ns, and 35ns. In 1988, the Company introduced a pair of 1Mb DRAMs in 1Mbx1 and 256Kx4 configurations. Products are designed for superminis, workstations, and other computing applications using 32-bit MPUs running at 20-MHz or better.

The Company's future plans are to offer FIFOs and other specialty memories, and to encourage designers to consider the high-speed DRAMs as complete replacements for cache memories.

Alliance has signed agreements to have some of its DRAMs manufactured by NMB Semiconductor in Japan, while the SRAMs are being manufactured by Goldstar in South Korea.

Alliance is now manufacturing 1Mb DRAMs in its new Lee's Summit, Missouri, facility.

## BOARD

(Name and Affiliation)

N.D. Reddy, Chairman  
Alliance Semiconductor  
C.N. Reddy  
Alliance Semiconductor

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
\*N.D. Reddy  
Modular Semiconductor, President

## VP Sales/Mktg

Robert Reid  
Oki Semiconductor, SR VP

## VP Engineering

\*C.N. Reddy  
Cypress Texas Instruments, SRAM Dsn Mgr  
\*Founder

## FINANCING

The Company has financed its developmental activity with private investment and seed funding from its offshore corporate partners.

### March 1989

\$1.2M  
UtiliCorp United

\$1.2M  
Hallmark

\$0.2M  
Kansas City Valve & Fitting Co.

\$0.2M  
Black and Veatch

\$0.1M  
Dunn Industries

Tax credits, loan guarantees, grants  
\$2.27M  
State of Missouri

Letter of credit  
\$3.0M  
Private investor

## RECENT HIGHLIGHTS

### March 1989

Alliance agreed to lease manufacturing facilities outside Kansas City, Missouri, from AT&T.

# Alliance Semiconductor

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## ALLIANCES

### NMB

December 1987

Alliance Semiconductor signed a five-year agreement with NMB Semiconductor covering 256K and 1Mb DRAMs. NMB will manufacture the devices and sell them worldwide.

## MANUFACTURING

### Technology

1.2- and 1.0-micron CMOS

## Facilities

Kansas City, MO

120,000 total sq. ft.

Manufacturing

45,000 sq. ft.

Used for Class 10 clean room

## PRODUCTS

Device	Description	Speed
AS4C188	16Kx4 SRAM	25, 30, 35ns
AS4C1000	1Mbx1 DRAM	60, 70, 80ns
AS44C256	256Kx4 DRAM	60, 70, 80ns

## OTHER INFORMATION

Alliance does not employ a PR firm.

**Altera Corporation**  
2610 Orchard Parkway  
San Jose, CA 95134-2020  
408/984-2800  
Fax: 408/296-3140

**ESTABLISHED: June 1983**

**NO. OF EMPLOYEES: 225**

## **BACKGROUND**

Altera Corporation designs, manufactures, and markets user-configurable EPROM-based ICs and associated CAE development systems and is focused entirely on developing this market. Altera invented and was the first company to ship electrically programmable logic devices (EPLDs).

The Company's products are specified for operation over commercial, industrial, and military operating ranges. The predominant users are manufacturers that supply equipment for the industrial, office automation, and telecommunications markets as well as military and aerospace contractors. Altera is qualified to supply devices to the requirements of MIL-STD-883 Revision C.

Altera's CAE tools and user-configurable devices allow design engineers to create custom logic functions on the IBM PC. Wafers using 1.0- and 0.8-micron CMOS technology are obtained through technology agreements. This strategy allows Altera to concentrate on architecture, circuit design, software, and service, which has earned the Company a reputation for providing excellent service and easy-to-use CAD software. The Company's goals are to achieve \$100 million in annual sales in 1990 and to be recognized as the technology leader in the user-configurable IC market.

In March 1988, Altera amended its registration statement for an initial public offering of 4 million shares of common stock at \$5.50 per share. Of the shares being offered, 1 million were sold by certain selling shareholders. The statement was originally filed in October 1987. Net proceeds will be used principally for working capital and for repayment of long-term debts.

In 1987, Altera began offering function-specific EPLDs. The StandAlone Microsequencer (SAM)

family integrates 448 words of EPROM memory with a microcoded sequencer and pipelined register for microcoded state machines and sequencer applications. The Buster family of configurable bus interface peripheral devices combines a programmable bus interface, PLD, and storage elements in a single device.

In January 1988, Altera introduced three new products for the IBM PS/2 add-in board market. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface, the EPB2002 direct memory access (DMA) arbitration chip integrates the additional logic needed for DMA capability, and the MCMAP provides software design support. The interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems. Add-in boards are licensed and encouraged by IBM and serve to add functions not included in the basic computers such as expanded memory, communications interfaces, peripheral equipment, and other functions as fax and voice mail.

The Company markets its products in North America, Europe, Australia, the Far East, and the Pacific Rim through direct sales offices and a network of distributors and sales representatives. Altera's distributors include Hall-Mark, Lionex, Pioneer, Quality Components, Schweber Electronics, and Wyle in the United States, and Future Electronics and Semad in Canada.

## **BOARD**

Rodney Smith  
Michael Ellison  
Paul Newhagen  
T. Peter Thomas



# Altera Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Rodney Smith  
Fairchild, GM/Linear Div

### VP Marketing

David A. Laws  
AMD, VP Bus Dev

### VP Sales

John Duffy  
Fairchild, VP Sales/Mktg

### VP/IC Engr

\*Robert F. Hartmann  
Source III, President

### VP Technology

\*Dr. James Sansbury  
Hewlett-Packard, Production Mgr

### VP Finance

\*Paul Newhagen  
Source III, Controller/CFO

### VP Operations

Bipin Shah  
Fairchild, Operations Mgr

### VP Software Engr

Clive McCarthy  
Fairchild, Marketing Mgr

### Mgr Human Res

John Waller  
Zoran, Mgr Human Res

\*Founder

## FINANCING

### June 1983

Round 1  
\$1.3M  
Alpha Partners

### April 1984

Round 2  
\$6.0M  
Allstate Investments; Cable, Howse & Cozadd;

F. Eberstadt & Company Inc.; John F. Shea;  
Technology Venture Investors; Welsh, Carson,  
Anderson & Stowe; Venture Growth Associates

Lease  
\$2.0M  
Bank of America

### March 1985

Round 3  
\$9.9M  
Original investors; Analog Devices Ent.;  
Citibank N.A.; DeMuth, Folger, & Terhune  
Venture Capital; Institutional Venture Partners;  
Parker Drilling Company

Lease  
\$2.0M  
Bank of America

### May 1986

Round 4  
\$5.0M  
European investors

Lease  
\$1.7M  
Bank of America

### March 1988

\$15.0M  
Initial public offering

## RECENT HIGHLIGHTS

### November 1986

Altera achieved full compliance to the Class B requirements of MIL-STD-883, Revision C for the EP310 and EP1210 devices. All other Altera devices in most package styles are available screened and environmentally tested to the MIL-STD specifications while compliancy requirements are being satisfied.

### February 1987

Altera and Monolithic Memories, Inc., (MMI) settled the patent infringement suit brought against Altera by MMI. Altera agreed to the entry of a consent of judgment and the parties agreed to license each other under certain patents in the programmable logic field.

## March 1987

Altera offered the StandAlone Microsequencer (SAM) family of EPLDs. The devices are user-configurable ICs designed for complex state machines and high-performance controller applications operating up to 30 MHz. These are the first products resulting from the Company's agreement with WaferScale Integration.

## March 1987

Altera's LogiCaps now supports IBM's EGA and the Hercules graphics controllers. Altera also reduced the price of LogiCaps from \$950 to \$695.

## October 1987

Altera introduced two families of function-specific EPLDs. SAM for complex state machines and high-performance controllers, and Buster for user-configurable MPU peripherals.

## January 1988

Altera announced three new products for IBM PS/2 add-in boards. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface. The EPB2002 is a direct memory access (DMA) arbitration chip that integrates the additional logic needed for DMA capability. The MCMMap provides software design support. The EPB2001 interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems.

## March 1988

Altera amended its registration statement for an IPO of 4 million shares of common stock at \$5.50 per share, originally filed in October 1987. Of the shares being offered, 1 million were being sold by certain shareholders. The net proceeds will be used principally for working capital and for repayment of long-term debt.

## ALLIANCES

### Intel

#### August 1984

Altera signed a five-year technology exchange

agreement with Intel. Intel provided CHMOS EPROM fabrication technology and foundry services; Altera provided its EPLD design and test technology and software and hardware development support. Intel will be an alternate source for the CHMOS EPLDs. Both companies cooperate on developing support tools for EPLD development systems.

### June 1985

The agreement with Intel was extended for two additional years and includes additional products using Intel's CHMOS process and its evolutions.

### P-CAD Systems

#### February 1985

Altera entered a marketing agreement with Personal CAD Systems, Inc., which called for combining P-CAD's PC-CAPS, used for schematic capture, and PC-LOGs, a logic simulator, with Altera's A+PLUS and LogicMap software (expired).

### Data I/O FutureNet

#### May 1985

Altera entered an OEM marketing agreement with Data I/O's FutureNet for the DASH series of schematic capture packages (expired).

### Cypress

#### June 1987

Cypress Semiconductor and Altera signed a five-year agreement to develop a family of CMOS EPLDs. The 5,000-gate family is named MAX for Multiple Array Matrix. Altera is providing architecture, circuit design, and software support. Cypress is providing 0.8-micron CMOS EPROM process, manufacturing, and marketing support.

### WSI

#### January 1987

Altera Corporation and WaferScale Integration, Inc., (WSI) announced a five-year technology agreement focused on the development of new, high-performance, user-configurable logic products. Altera will provide architecture, circuit design, and software support for the new family of products. WSI will contribute its strengths in high-speed CMOS process and EPROM memory device development. Wafers will be provided by Sharp of Japan.

# Altera Corporation

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## Texas Instruments

July 1988

Altera Corporation and Texas Instruments (TI) announced the signing of a long-term agreement that encompasses a seven-year technology exchange and supply agreement for high-performance, high-density, user-configurable integrated circuits. Altera will provide architecture, circuit design, and software technology. TI will make available worldwide manufacturing capabilities and its high-voltage EPIC advanced CMOS process.

## MANUFACTURING

Untested wafers are provided through technology exchange agreements with Intel, WaferScale/Sharp, Cypress Semiconductor, and other foundry

relationships. Assembly operations are subcontracted to two vendors. Volume production assembly is conducted in the Far East; quick-turn and prototype assembly is performed locally. Assembled components are final tested, burned-in, marked, packed, and shipped at Altera.

## Technology

1.2-micron CHMOS  
0.8- and 1.0-micron CMOS EPROM

## Facilities

Santa Clara, CA  
52,000 sq. ft.  
Administration, engineering, manufacturing, marketing

## PRODUCTS

### User-Configurable ICs

Part No.	Description	Speed
EP3XX	300-gate EPLD	35, 40 MHz
EP6XX	600-gate EPLD	26, 45 MHz
EP9XX	900-gate EPLD	26, 45 MHz
EP12XX	1,200-gate EPLD	28 MHz
EP18XX	2,100-gate EPLD	20 MHz
EPS448	StandAlone Microsequencer (SAM)	30 MHz
EPB1400	Configurable Peripheral (Buster)	25 MHz
EPB2001	Microchannel Interface Chip	
EPB2002	DMA Arbitration Chip	
EPM5032	32 Macrocell 88 MHz EPLD	88 MHz
EPM5128	128 Macrocell 50 MHz EPLD	50 MHz

Most of the above are available in commercial, military, and industrial temperature ranges in a variety of speed grades. The components are offered in both ceramic and plastic dip packages and J-lead surface-mount packages. Pin-grid array packages are also available.

## Design Tools

Part No.	Description
PLDS2	Development System for EP Series Devices
A+Plus	Software Logic Compilers for Programmable Logic
LogiCaps	Schematic Capture
PLSME	State Machine Software
PLFSIM	Simulation Software
PLSLIB	TTL Macrofunction Library
MMap	IBM PS/2 Micro Channel Interface Software Support
PLDS-SAM	Development System for SAM Devices
SAM+PLUS	SAM Design Processor
Hardware	Hardware Programming Units and Package Adaptors
PLCAD-SUPREME	Development system for EP Series Devices
PLCAD-ENCORE	Development system for EP Series Devices and EPM Devices
PLDS-MAX	Development system for EPM Series Devices

Altera's development systems run on Daisy Systems Corporation's Personal LOGICIAN workstation, and on more than 18 personal computers including AT&T, COMPAQ Plus, COMPAQ Deskpro, Columbia, Columbia Portable, Corona, IBM PC/XT/AT, IBM Portable, ITT XTRA, Leading Edge, MAD 86186, Panasonic SR. Partner, Televideo, Sperry, ISI Model 5160, Zenith 100 and 151 PC, and Intersil System PC.

## OTHER INFORMATION

Altera's PR firm is Paul Franson Associates.

## ANADIGICS, Inc.

35 Technology Drive  
Box 4915

Warren, NJ 07060

201/668-5000

Telex: 510-600-5741

Fax: 201/668-5068

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 70

### BACKGROUND

ANADIGICS, Inc., designs, manufactures, and markets gallium arsenide (GaAs) analog and digital ICs for the telecommunications, military, and instrumentation markets. The Company is currently offering RF microwave and signal conditioning amplifiers, A/D converters, dividers, and multiplexers/demultiplexers. In addition, ANADIGICS offers GaAs services and designs both catalog and custom GaAs ICs, as well as custom hybrid assemblies, including fiber-optic data links.

The founders are Ronald Rosenzweig and George Gilbert, who cofounded Microwave Semiconductor Corporation, and Dr. Charles Huang, who was director of GaAs R&D and wafer fabrication services at Avantek.

The Company's strategy is to establish its own niche in producing GaAs ICs for high-frequency analog and digital applications in the defense and communications markets.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

\*Ronald Rosenzweig  
Microwave Semiconductor Corporation,  
President

#### Exec VP/COO

\*George Gilbert  
Microwave Semiconductor Corporation, Exec  
VP Opns

#### VP Engr

\*Dr. Charles Huang  
Avantek, Dir GaAs R&D

#### Dir Sales/Mktg

Michael P. Gagnon  
TRW LSI Products, Mgr Strat Plan

#### Dir Finance

John Lyons  
General Electric, Dir Finance

\*Founder

### FINANCING

#### April 1985

##### Round 1

\$10.0M

Alan Patricof Associates, NY; Alex Brown & Sons; Fairfield Ventures; General Electric Venture Capital; Orange Nassau; Rothschild Inc.; Smith Barney Venture Capital

#### Lease

\$10.0M

GE Credit Corp., EQUITEC, and others

#### November 1986

##### Round 2

\$10.0M

First-round investors; Arthur D. Little Co.; Century IV Fund; Englehard Corp.; Memorial Drive Fund; Metropolitan Life Insurance Co.

# ANADIGICS, Inc.

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## January 1989

Round 3

\$9.0M

Thomson-C.S.F. Ventures; Canaan Venture Partners (formerly GE Venture); Philadelphia Ventures (formerly Century IV); Smith, Barney, Harris, Upham; Atlas Associates, Inc.; Alan Patricof Associates; Alex Brown and Sons; Metropolitan Life Insurance; Memorial Drive Trust

## RECENT HIGHLIGHTS

### January 1987

ANADIGICS offered the AOP3510 350-MHz unity gain stable GaAs op amp in commercial and military grades. The device has a bandwidth of 70 MHz and a settling time of 20ns.

### March 1987

ANADIGICS offered the AWA20601 and ADA25001 wideband MMIC gain amplifiers. The Company also offered the ADV3040 4-to-1 divider.

### June 1987

ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

### July 1987

ANADIGICS offered the ACP10010 comparator for ATE and high-speed fiber-optic receivers.

### September 1987

ANADIGICS offered the ATA30010, a 3-GHz transimpedance amplifier.

### January 1988

ANADIGICS introduced the ALD30010, a 3-GHz laser driver.

### February 1988

ANADIGICS was awarded a \$500,000 contract from the navy to develop a chip set for X-band radars.

## March 1988

ANADIGICS completed the first stage of a \$4 million equity financing. Investors were ABS Ventures, Alan Patricof Associates Inc., Alex Brown Emerging Growth, Canaan Venture Limited Partnership, Century IV Partners, Fairfield Ventures, First Century Partnership III, Investments Orange Nassau, Memorial Drive Trust, Metropolitan Life, and Rothschild Inc.

## April 1989

ANADIGICS introduced two new transimpedance amplifiers, the ATA03010 and the ATA30011.

## ALLIANCES

### Bendix

June 1987

ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

## SERVICES

GaAs IC design  
GaAs foundry  
Assembly  
Test

## MANUFACTURING

### Technology

1.0m and 0.5m-GaAs MESFET

Low-power D-MESFET process technologies will be available in the future.

### Facilities

Warren, NJ

55,000 sq. ft.

Design, test, manufacturing, administration

10,000 sq. ft.

Clean room

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**PRODUCTS**

<b>Device</b>	<b>Description</b>
AOP1510	Op Amp, 150 MHz
AOP3510	Monolithic Op Amp, 350 MHz
AWA20601	10dB Gain Amplifier, 2 to 6 GHz
ACP10010	Comparator, 1.0ns Typical Delay
ADA25001/25002	25dB Gain Amplifier, 3 GHz
ADV3040	4-to-1 Divider
ALD30010	Laser Driver, 3 GHz
ATA30011	Transimpedance Amplifier, 3 GHz
APS30010	Phase Splitter, 3 GHz
ATA0310	Transimpedance 300-MHz Amplifier
ASW40010	DC—4-GHz Spdt switch
ASW80010	DC—8-GHz Spdt switch fiber optic receiver products
AAR10010	1-GHz, 1,330nm Analog Receiver
AAR10015	1-GHz, 800nm Analog Receiver
AAR10020	1-GHz, High-Output, 1,300nm Analog Receiver
AAR10025	1 GHz, High-Output, 800nm Analog Receiver
ADR16010	1.6-Gbps, 1,300nm Digital Receiver
ADR16015	1.6-Gbps, 800nm Digital Receiver
ADR16020	1.6-Gbps, ECL Output, 1,300nm Digital Receiver
ADR16025	1.6-Gbps, ECL Output, 800nm Digital Receiver
ADR16030	1.6-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR16035	1.6-Gbps, 800nm Digital Rcvr/Clock Recovery
ADR12030	1.2-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR12035	1.2-Gbps, 800nm Digital Rcvr/Clock Recovery

**OTHER INFORMATION**

ANADIGICS' PR firm is Norm Fenichel.

# Applied Micro Circuits Corporation

6195 Lusk Boulevard

San Diego, CA 92121

619/450-9333

Fax: 619/450-9885

ESTABLISHED: April 1979

NO. OF EMPLOYEES: 225

## BACKGROUND

Applied Micro Circuits Corporation (AMCC) specializes in the design and manufacture of high-speed ECL gate arrays. In 1987, the Company began offering BiCMOS gate arrays. AMCC targets its products at OEMs that make industrial instruments, high-performance computers, electronic warfare systems, test equipment, graphics hardware, and telecommunications equipment.

AMCC is a privately held company that was formed by Howard Bobb and Joe Mingione, who had previously been American Microsystems Inc.'s chairman of the board and marketing manager, respectively. AMCC was founded in Cupertino, California, but later acquired Solitron Devices' 32,000-square-foot facility in San Diego. After converting it to run 4-inch wafers, AMCC's fab facility became operational late in 1981. Under the leadership of Roger Smullen, AMCC refocused its efforts in 1983 to the high-performance array marketplace. Mr. Smullen replaced the founders as president and CEO.

There are 29 sales representative organizations with more than 90 sales people that handle AMCC's gate arrays in North America, Europe, Israel, and the Far East.

## BOARD

(Name and Affiliation)

Roger A. Smullen, Chairman  
Plus Logic

William K. Bowes, Jr.  
U.S. Venture Partners

F.K. Fluegel  
Matrix Partners, L.P.

Franklin P. Johnson  
Asset Management Corporation

Albert Martinez  
Applied Micro Circuits Corp.

Gregorio Reyes  
ASET

Arthur Stabenow  
Micro Linear

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
Albert Martinez  
TRW, VP/GM LSI Products Div

VP Finance/Admin  
Joel O. Holliday  
Spin Physics, VP Finance

VP Mktg/Sales  
A. C. D'Augustine  
Inmos, Dir. Worldwide Sales

VP Operations  
Don Schrock  
Burr-Brown, VP/GM Data Products Div

VP Engineering  
Ray Yuen  
National Semiconductor, Design Manager

## FINANCING

April 1979  
Round 1  
\$5.0M  
Fred Adler & Co., Ampersand Associates,  
International Industrial Investments Inc.,  
Kimball Organ, Timex



# Applied Micro Circuits Corporation

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**March 1983**

**Round 2**

**\$5.0M**

Accel Capital; Adler & Co.; Asset Mgmt. Co.; Harrison Capital; International Industrial Investments (France); Kemper; Matrix Partners; Oak Investment Partners II; Prime Capital; Robert Fleming Ltd.; Robertson, Colman & Stephens; US Ventures; Venture Growth Associates

**September 1987**

**Round 3**

**\$12.0M**

Accel Capital; Adler & Co.; Asset Mgmt. Co.; Eberstadt Fleming Venture Capital; Harrison Capital; International Industrial Investments (France); Jamieson & Co.; Kemper; Kimball Manufacturing; Matrix Partners; Oak Investment Partners; Olivetti; PaineWeber Ventures; PM Investment; Prime Capital; Robertson, Colman & Stephens; Time, Inc.; US Venture Partners; Venture Growth Associates

## RECENT HIGHLIGHTS

**May 1987**

AMCC offered the Q5000 Series of bipolar products and entered the BiCMOS logic array market with its Q14000 series. The Q14000 is the result of a two-year joint development agreement with Seiko-Epson.

**July 1987**

AMCC named Albert Martinez president and chief executive officer, filling a vacancy that had existed since March 1987 when former president Jonathon K. Yu left the Company. Mr. Martinez was most recently vice president and general manager of TRW's LSI Product Division in La Jolla, California.

**September 1987**

AMCC completed a private sale of \$12 million in convertible preferred stock. The funds are being used to reduce short-term borrowing and provide working capital for anticipated growth, including expansion into its recently completed facility in San Diego, California.

**September 1987**

AMCC moved into its new corporate facility in San Diego. The 100,000-square-foot building, on a 6.5-acre site, houses engineering, marketing, and administrative staff. The additional facility brings AMCC's total space to 121,000-square-feet, which includes a Class 10 fab and production facility.

**January 1988**

AMCC and Plessey signed an agreement to jointly develop a family of high-performance ECL gate arrays. The arrays, which range up to 18,000-gates, will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

**June 1988**

AMCC announced a major contract with Datatape, Inc., for seven logic array circuits. This contract is expected to be worth \$3 million to \$4 million over the next two years.

## ALLIANCES

**Signetics**

**April 1979**

Signetics and AMCC agreed to allow Signetics to provide alternate sourcing of the Q700 Quick-Chip series. AMCC was licensed to market designs for Signetics' 8A-1200 gate array family.

**September 1983**

AMCC and Signetics signed an extension of the prior agreement that covers a technology transfer of future gate array families and junction-isolated and oxide-isolation processes.

**Thomson-CSF**

**July 1982**

AMCC signed an agreement with Thomson-CSF under which Thomson-CSF provided alternate sourcing and will develop AMCC's high-performance, bipolar Q-700 series of gate arrays. AMCC received \$1 million over five years.

**Daisy**

**February 1983**

Daisy offered support for AMCC's Q-700 gate array family on its Gatemaster gate array development system; AMCC provided the design software.

# Applied Micro Circuits Corporation

## Honeywell

August 1984

Honeywell signed an agreement to second source AMCC's Q700 series gate arrays and to alternate source AMCC's bipolar gate arrays.

## Sanders

February 1985

Sanders agreed to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only.

## Seiko-Epson

May 1985

Seiko and AMCC entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process is merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process.

## Plessey

January 1988

AMCC and Plessey agreed to jointly develop a family of high-performance ECL gate arrays up

to 16,000 gates. It will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

## MANUFACTURING

### Technology

2.0-, 3.0-, and 5.0-micron double-level-metal bipolar

1.5-micron BiCMOS

Three-level fine pitch metal

4-inch wafers

### Facilities

San Diego, CA

116,000 sq. ft.

Administration, marketing, development, manufacturing

5,000 sq. ft.

Class 10 clean room

## PRODUCTS

### ECL Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
Q700	Bipolar	5.0	0.9	250 to 1,000
Q1500	Bipolar	5.0	0.9	1,500 to 1,700
Q3500	Bipolar	3.0	0.6	1,300 to 3,500
Q5000	Bipolar	2.0	0.3	1,300 to 5,000
Q20000	Bipolar	1.0	0.1	1,000 to 16,000

### BiCMOS Gate Arrays

Q14000	BiCMOS	1.5	0.7	2,160 to 13,440
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### Foundry

Process	Minimum Geometries	Number of Base Layers	Number of Metal Layers/Pitch	Wafer Size
Bipolar Junction				
Isolated	5.0-micron	7	2/10, 16	4"
Bipolar Oxide Isolated	3.0-micron	10	2/7, 10	4"
Bipolar Oxide Isolated	2.0-micron	10	3/5.5, 8.0, 15	4"
BiCMOS Oxide Isolated	1.5-micron	11	3/4.5, 6, 7	4"

## OTHER INFORMATION

AMCC does not employ a PR firm.

# Asahi Kasei Microsystems Co., Ltd.

Imperial Tower 1-1  
Uchisaiwai-cho 1-chome  
Chiyoda-ku, Tokyo, Japan  
03/507-2371  
Fax: 03/591-2567

ESTABLISHED: June 1983

NO. OF EMPLOYEES: N/A

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## BACKGROUND

Asahi Kasei Microsystems Co., Ltd., manufactures and markets memory, application-specific ICs, linear, and microcontroller products. The Company was originally founded as Asahi Microsystems, Inc., by Asahi Chemical of Japan and American Microsystems Inc. (AMI) in June 1983. The Company focused on the design and marketing of custom and ASICs based on AMI technology.

In 1986, the Company became a wholly owned subsidiary of Asahi Chemical and changed its name to Asahi Kasei Microsystems. Asahi Kasei Microsystems has established an Electronics Research Laboratory in Atsugi, Japan, to develop new bipolar and CMOS process technologies and new applications, and plans to set up a manufacturing facility in two years.

The Company has established technical ties with Hitachi Ltd. for the acquisition of its advanced CMOS process technology. Asahi Kasei will manufacture and market Crystal's devices for the Far Eastern market, and International CMOS Technology (ICT) will market its EEPROMs.

AMI manufactures all the custom and standard products it develops and Hitachi manufactures its digital ICs. The Company manufactures new products developed through its tie-up with ICT on a small scale at an Atsugi plant.

## BOARD

Not available

## COMPANY EXECUTIVES

Not available

## FINANCING

Not available

## ALLIANCES

### Hitachi

Asahi Kasei has licensed Hitachi Limited's advanced CMOS process technology.

### Crystal Semiconductor

Asahi Kasei will manufacture and market Crystal's devices for the Far East market.

### ICT

Asahi Kasei will market International CMOS Technology's (ICT) EEPROMs.

## MANUFACTURING

### Technology

2- and 3-micron CMOS

### Facilities

Not available

# Asahi Kasei Microsystems Co., Ltd.

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## PRODUCTS

### SRAMs

Device	Description	Speed (ns)
AKM6264	64K 8Kx8	100, 120, 150
AKM6287	64K 64Kx1	45, 55, 70
AKM6288	64K 16Kx4 (In Development)	25, 35, 45
AKM62256	256K 32Kx8	85, 100, 120, 150
AKM6207	256K 256Kx1 (In Development)	35, 45
AKM6208	256K 64Kx4 (In Development)	35, 45
AKM66203	1Mb Module 128Kx8	100, 120, 150

### ROMs

AKN623257/8	256K 32Kx8	150, 200
AKN62321	1Mb 128Kx8	150, 200
AKN62312	2Mb 256Kx8	200
AKN62412	2Mb 256Kx8/128Kx16	200
AKN62304	512Kx8	200
AKN62404	512Kx8/256Kx16	200

### Gate Arrays

Family	Gates	Typical Internal Delay (ns)
AK61H	448 to 2,560	2.0
AK62B	4,032 to 7,136	1.8
AK62H	4,309 to 24,020	0.7

### Cell-Based Library

Device	Description
Digital Cells	CPU/Peripheral Cells—Clock Generator, Bus Controller, DMA Controller, Programmable Counter/Timer, Multiplier Memory Cells—ROM, RAM
Analog Cells	Op Amps, A/D Converter, SCF Filters

### Microcontrollers

AKMC4608	4-Bit Telephone Chip with DTMF Generator, LCD Driver, Real-Time Clock, 8Kx10 ROM, 1Kx4 RAM
AKMC4678	4-Bit Answering Machine Chip with DTMF Receiver, 8Kx10 ROM, 512x4 RAM
AKMC4919	4-Bit General-Purpose MCU with 1 microsecond of Instruction Time, 16Kx10 ROM, 992x4 RAM

### Linear ICs

CS31412	A/D Converter
CS7008	Programmable Universal Filter

## OTHER INFORMATION

Asahi Kasei Microsystems does not employ a PR firm.

# Aspen Semiconductor Corporation

58 Daggett Drive  
San Jose, CA 95134  
408/432-7050  
Fax: 408/943-2741

ESTABLISHED: December 1987

NO. OF EMPLOYEES: 35

## BACKGROUND

Aspen Semiconductor Corporation was formed in December 1987 to design and develop ultrahigh-speed ECL-compatible memory and PLD products with subthree nanosecond access times. The Company was formed and financed by Cypress Semiconductor Corporation and operates as a wholly owned subsidiary of Cypress.

Aspen is the brainchild of Cypress chief T.J. Rodgers, who has also established Multichip Technology and Ross Technology as Cypress subsidiaries. Rodgers' plan is to establish a number of small satellite companies under Cypress' control as an alternative to the large corporation. Hopefully, this type of organization will help maintain an aggressive start-up mentality within the corporation. Cypress provided the initial \$7.4 million in financing and has an option to repurchase the Company at any time.

Aspen currently offers four ECL RAM products and four ECL PLDs. All of these devices are manufactured using a 0.8-micron BiCMOS process at Cypress' fabrication facilities. Aspen currently is shipping 1K and 4K SRAMs and plans to introduce a 64K device in Q1 1990. All Aspen-developed products are marketed by Cypress and sold under the Cypress logo. ECL RAMs and PLDs will be the basis of the Aspen product line in the future. New products currently are under development but no indication has been given as to the nature of these products.

## BOARD

(Name and Affiliation)

Dr. T.J. Rodgers, Chairman  
Cypress Semiconductor Corp., President/CEO

L.J. Sevin  
Sevin-Rosen Management Company, President

Larry Sonsini  
Wilson, Sonsini, Goodrich and Rosati, Partner

Robert C. Lutz  
Aspen Semiconductor Corporation, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
Robert C. Lutz  
AMD, Director

Dir Marketing  
David C. Ford  
Actel, Director of Mktg

## FINANCING

December 1987  
Round 1  
\$7.4M  
Cypress Semiconductor

## ALLIANCES

Cypress  
December 1987  
Cypress provided initial funding in the amount of \$7.4 million. Aspen operates as a wholly owned subsidiary of Cypress and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Aspen-developed devices will be fabricated by Cypress and sold through Cypress' sales organization.

## MANUFACTURING

### Technology

0.8-micron BiCMOS  
1.0, 0.8-micron bipolar

### Facilities

San Jose, CA  
12,000 sq. ft.  
Administrative, design, development, marketing

# Aspen Semiconductor Corporation

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## PRODUCTS

### ECL RAMs

10/100E422	256x4	3ns
10/100E422L	256x4	5 to 7ns low power
10/100E474	1Kx4	3ns
10/100E474L	1Kx4	5 to 7ns low power

### ECL PLDs

10/100E301	16P8	3, 4, 6ns
10/100E302	16P4	2.5, 4.0 6.0ns
10/100E301L	16P8	4, 6ns low power
10/100E302L	16P4	4, 6ns low power

## OTHER INFORMATION

Aspen does not employ a PR firm.

# ATMEL Corporation

2125 O'Nel Drive  
San Jose, CA 95131  
408/441-0311

ESTABLISHED: December 1984

NO. OF EMPLOYEES: 152

## BACKGROUND

ATMEL (Advanced Technology-Memory & Logic) specializes in the design, manufacture, and marketing of high-speed EPROM, Flash EPROM, EEPROM, EPLD, and analog products. The Company's products are manufactured using a CMOS technology with geometries as low as 1-micron combined with two-layer metal and silicide processes.

ATMEL was founded by George Perlegos, Gust Perlegos, and T.C. Wu with private funds. Its first products were a CMOS 64K EEPROM at 120 to 450ns and a CMOS 256K EPROM operating at 120 to 250ns. They were followed by a CMOS 512K EPROM operating at 120 to 250ns. Currently, ATMEL offers additional EPROM, EEPROM, EPLD, 5-volt only Flash EPROM, and analog devices in a variety of organizations and densities.

In 1987, ATMEL introduced a line of linear products, including the AT76C10 programmable amplifier/delay equalizer, which is designed for use in modem and data communication equipment.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*George Perlegos  
SEEQ, VP Engineering

### VP Technology

\*Dr. T.C. Wu  
SEEQ, Process Dev Mgr

### VP/General Manager

\*Dr. Gust Perlegos  
SEEQ, Engr Manager

### VP Finance

Raymond Ostby  
Intel, Ctr Europe Ops

### VP Sales

Jack Peckham  
Semi Processes, Dir Sales/Mktg

### VP Plan & Info Sys

Mikes Sisois  
Qronos, VP Prod Dev

### VP Marketing

B. Jeffrey Katz  
Intel, Dir of Mktg

\*Founder

## FINANCING

December 1987

Round 2

\$3.3M

Institutional Venture Partners

## RECENT HIGHLIGHTS

June 1989

ATMEL agreed to purchase Honeywell's Solid State Electronics Division in Colorado Springs, Colorado. The facilities contain three wafer-fabrication areas, including a 6-inch facility, and related assembly, testing, and engineering facilities.

## ALLIANCES

### General Instrument

March 1985

ATMEL provided technology for its OTP EPROM, UV EPROM, and EEPROM in exchange for fab capacity at GI's plant in Chandler, Arizona (expired).

### Sanyo Electric

1987

ATMEL and Sanyo signed a foundry contract under which Sanyo will produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs.

# ATMEL Corporation

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## MANUFACTURING

### Technology

1.25-micron two-level-metal CMOS  
1.00-micron two-level-metal CMOS

### Facilities

San Jose, CA  
100,000 sq. ft.

Administration, engineering, design, test, sales  
and marketing

Colorado Springs, CO

250,000 sq. ft.

Fabrication, assembly, test, and engineering

## PRODUCTS

### High-Speed EPROM

Device	Density	Organization	Speed (ns)
27H64	64K	8Kx8	45-90
27HC256	256K	32Kx8	55-120
27HC1024	1Mb	64Kx16	55-120

### EPROM

27C128	128K	16Kx8	120-250
27C256	256K	32Kx8	120-250
27C512	512K	64Kx8	120-250
27C513	512K	4x16Kx8	150-250
27C1024	1Mb	64Kx16	150-250
27C010	1Mb	128Kx8	150-250

### CMOS PROM

28HC191/291	16K	2Kx8	35-90
27HC641/642	64K	8Kx8	35-90

### EPROM (5-volt only Flash EPROM)

29C256	256K	32Kx8	150-250
29C010	1Mb	128Kx8	150-250

### High-Speed EEPROM

28HC16	16K	2Kx8	45-120
28HC64	64K	8Kx8	55-120
28HC256	256K	32Kx8	70-120

### EEPROM

28C04	4K	512x8	150-350
28C16/17	16K	2Kx8	150-350
28C64	64K	8Kx8	150-350
28PC64	64K	8Kx8 Paged	150-350
28C256	256K	32Kx8	150-350
28C010	1Mb	128Kx8	150-350
28C1024	1Mb	64Kx16	120-250



**EPLD**

<b>Device</b>	<b>Gates</b>	<b>Speed (ns)</b>
22V10	500	15-40
V750	750	30-40
V2500	2,500	35-45
V5000	5,000	30-40

**Linear**

<b>Device</b>	<b>Description</b>
76C10	Programmable Telephone Line Delay Equalizer/Amplifier
76C171, 176	Triple 6-Bit color palette DAC; 50-65 MHz

**OTHER INFORMATION**

ATMEL does not employ a PR firm.

## **Austek Microsystems Pty. Inc.**

2903 Bunker Hill Lane #201  
Santa Clara, CA 95054  
408/988-8556  
Fax: 408/988-0818

## **Austek Microsystems Pty. Ltd.**

Technology Park, Adelaide  
South Australia 5095, Australia  
8/260-0155  
Fax: 8/260-8261

**ESTABLISHED: July 1984**

**NO. OF EMPLOYEES: 85**

### **BACKGROUND**

Austek designs, manufactures, and markets VLSI components for the cache controller and digital signal processor markets. The Company was founded in 1984 as a design source and supplier of VLSI components. From 1984 to 1987, Austek developed custom products for Australian and U.S. customers. Through these programs, the Company gained considerable expertise in cache architectures, digital signal processing, and floating point processing. Austek has built on these experiences to establish itself as supplier of proprietary standard products to the high-performance cache memory and DSP markets.

The Company was the first to introduce integrated cache controllers for the 30386 (the A38152 in June 1987) and 80286 (the A28285 in November 1988). Its first DSP product, the A41102 frequency domain processor (FDP), was introduced in November 1988; the FDP implements the fast Fourier transform and is used in imaging and instrumentation applications.

Austek designs and fabricates system level design examples incorporating its products for customer evaluation purposes and to provide its customers with tools to reduce their product development cycle time.

Austek subcontracts wafer fabrication to Hewlett-Packard and VLSI Technology in the United States and Ricoh in Japan. High-volume assembly is subcontracted to Indy and Pantronix in the United States, Anam in Korea, and Seiko-Epson in Japan. Austek qualifies and tests each product in-house.

Austek is a privately held Delaware corporation and has two main facilities. One is in Santa Clara, California, where activities include corporate headquarters, marketing, sales, applications

engineering, the cache products business unit, and manufacturing. The other, located in Adelaide, Australia, focuses on product development, CAD, the DAP products business unit, and advanced development.

### **BOARD**

(Name and Affiliation)

A.C. Summers, Chairman  
Bennett and Fisher Ltd.

Denis L. Redfern  
Austek Microsystems, President and CEO

Dr. Ivan Sutherland  
Evans & Sutherland, Cofounder

Roger Buckeridge  
CP Ventures, Director

Jos Henkens  
Advanced Technology Ventures, General Partner

Barry Hilson  
Australia Industry Development Corporation

Dr. J. Craig Mudge  
Austek Microsystems, Director Advanced Development

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President and CEO**  
Denis Redfern  
Wormald Data Systems, Division Manager

**VP Sales**  
George Adler  
AMD, VP Sales—West

**VP Marketing**  
Roger Fisher  
TI, Strategic Marketing Manager

# Austek Microsystems Pty. Inc./Ltd.

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## VP Engineering

Geoff Smith  
CSIRO, Engineering Manager

## VP Manufacturing

John Gloekler  
NSC, Product Engineering Manager

## CFO and VP Finance

Steve Pekarthy  
Ultron Labs, VP F & A

## Dir Advanced Development

Dr. J. Craig Mudge  
DEC, Director VLSI

## FINANCING

### July 1984

Round 1

\$6.7M

Advanced Technology Ventures, Hambrecht and Quist, Rothschild Ventures, Caznove Ltd., Newmarket Ltd., Australian Industry Development Corp., Bennett and Fisher, and other individual investors

### November 1986

Round 2

\$6.4M

Original investors

### March 1988

Round 3

\$3.2M

Original investors

### September 1989

Round 4

\$1.3M

Original investors

## RECENT HIGHLIGHTS

### August 1989

Austek offered the A38202 Microcache cache controller for systems using Intel's 80386.

### September 1989

Austek offered the A38204 Burst Mode Memory Controller for systems using Intel's 80386 and Austek's A38202 Microcache. This device is a companion to the A38202.

### November 1989

Austek and Western Digital signed a letter of intent whereby Western Digital will use Austek cache controllers in its system logic products.

### December 1989

Austek offered the A38202SX Microcache, cache controller for systems using Intel's 80386SX.

## ALLIANCES

### ZyMOS

October 1987

Austek and ZyMOS cooperated in the marketing and sales of Austek's A38152 Microcache with the ZyMOS POACH chip set for Intel 80386-based systems.

## SERVICES

VLSI and system design

VLSI manufacturing management

VLSI test

## MANUFACTURING

### Technology

1.0-, 1.2- and 1.5-micron double-metal CMOS

### Facilities

Santa Clara, CA

10,000 sq. ft.

Adelaide, Australia

20,000 sq. ft.

**PRODUCTS**

<b>Device</b>	<b>Description</b>
A38152	Microcache cache controller for Intel 80386, 32Kb cache size, 16, 20, and 25 MHz
A29285	Microcache cache controller for Intel 80286, 32Kb and 64Kb cache sizes, 20 and 25 MHz
A38202	Microcache cache controller for Intel 80386, 32Kb, 64Kb, and 128Kb cache sizes, 25 and 33 MHz
A38204	Burst mode memory controller for Intel 80386 and Austek A30202 systems, implements burst fills and two-level write buffer, 25 and 33 MHz
A41102	Frequency domain processor, implementing the fast Fourier transform, 40 MHz

**OTHER INFORMATION**

Austek Microsystems employs Joyce Lekas Public Relations as its PR firm.

# Avasem Corporation

(Formerly: VLSI Design Associates)

1271 Parkmoor Avenue

San Jose, CA 95126

408/297-1201

Fax: 408/925-9460

ESTABLISHED: May 1980

NO. OF EMPLOYEES: 48

## BACKGROUND

Avasem Corporation was formed to provide application-specific IC design, prototyping, and production services for electronic systems OEMs. The Company specializes in mixed analog and digital devices. Products are developed using the Company's standard cells and automated design tools. Proprietary design rules allow for multi-source wafer fabrication. The Company has established strategic alliances with production foundries.

In 1984, the Company introduced its first standard IC product—the V3829 floppy disk separator. The offering was followed by the V8500, a SCSI bus interface device introduced in 1986, and the V8580, a SCSI bus host device introduced in 1987. In March 1988, the Company announced the VDA-176, the first product in a family of RAMDAC devices. The device features a 256x18 SRAM color look-up table with triple 6-bit D/A converters for use as a color palette in computer graphics systems. A pipeline design allows pixel rates of up to 80 MHz. A pixel word mask allows displayed colors to be changed in a single write cycle, rather than by modifying the look-up table.

## BOARD

\*Mark R. Guidry, Chairman, President, CFO  
Carolyn C. Guidry, Secretary  
Richard S. Miller, VP Analog Products  
K. Venkateswaran, VP Digital Products

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CFO

\*Mark Guidry  
Fairchild Semiconductor, Manager

### VP Analog Prod

Richard Miller  
Fairchild Semiconductor, Manager

### VP Digital Prod

K. Venkateswaran  
Fairchild Semiconductor, Manager

### CFO

Mike Cleland  
ICT Array Technology, Manager

\*Founder

## FINANCING

Initial capital was provided by founders, receivable financing by Saratoga National Bank.

## SERVICES

Design  
Prototypes  
High-Rel Processing  
Test

## MANUFACTURING

### Technology

1.2- to 5.0-micron CMOS

### Facilities

San Jose, CA  
27,000 sq. ft.  
Design and test

# Avasem Corporation

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## PRODUCTS

<b>Device</b>	<b>Description</b>
V3829	Floppy Disk Separator
V8500	SCSI Bus Interface Device
V8580	SCSI Bus Host Device
V3676	Color Palette RAMDAC
V2116	2Kx8 CMOS SRAM
V2102	256Kx8 CMOS SRAM
V8520	Winchester Disk Controller

## OTHER INFORMATION

Avasem does not employ a PR firm.

# Bipolar Integrated Technology

1050 Northwest Compton Drive  
Beaverton, OR 97006  
503/629-5490

ESTABLISHED: July 1983

NO. OF EMPLOYEES: 165

## BACKGROUND

Bipolar Integrated Technology, Inc. (BIT), designs, manufactures, and markets high-performance bipolar VLSI computational building blocks for the high-end digital signal processing (DSP) and data processing markets.

The Company's founders include George Wilson, Kenneth Schlotzhauer, James Pickett, Kenneth Giles, and Les Soltesz. Steve Cooper recently joined BIT as president and chief executive officer. Mr. Cooper was most recently president and COO at Silicon Systems.

BIT has developed a VLSI bipolar process named BIT1. The process is based on 2-micron lithography and polysilicon self-aligning techniques. BIT1 density is said to be comparable to 1.5-micron CMOS and is five times denser than existing bipolar ECL.

The Company's ECL and TTL products include 16x16 integer multipliers, 16x16 multiplier-accumulators, five-port register files, and a floating-point multiplier/ALU 2-chip set. BIT has also developed ECL gate arrays with Raytheon and will produce a bipolar 32-bit RISC MPU as a result of an agreement with Sun Microsystems.

BIT has established a nationwide network of sales representatives and has opened sales offices in Norcross, Georgia, and in Saratoga and Costa Mesa, California.

## BOARD

(Name and Affiliation)

\*George Wilson, Chairman  
Bipolar Integrated Technology, CTO

Stephen E. Cooper  
Bipolar Integrated Technology, President &  
CEO

Larry Sullivan  
Analog Devices Enterprises

Wayne Kingsley  
InterVen Partners

Jeff Watts  
Union Venture Corp.

Dr. William Lattin  
Logic Automation, Pres/CEO

Randall R. Lunn  
Fairfield Ventures, General Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CTO  
\*George Wilson  
Tektronix, Sr Engr/Bip Div

President/CEO  
Stephen E. Cooper  
Silicon Systems, President/COO

VP Tech Dev  
\*Dr. Kenneth Schlotzhauer  
Tektronix, Sr Engr

VP Mktg  
Chris DeMonico  
TI, Strat Mktg Mgr VLSI Products

VP Finance  
\*Kenneth Giles  
Columbian Co., VP Finance

VP Engr  
John Deignan  
Intel, Design Mgr

VP Operations  
Kevin Stewart  
VTC, Operations Mgr

\*Founder

# Bipolar Integrated Technology

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## FINANCING

**1983**

Seed

\$0.3M

Analog Devices, Inc.

**May 1984**

Start-up

\$3.7M

Analog Devices, Inc.; First Interstate Venture Capital; BancBoston Ventures

Lease

\$3.4M

Bank of Boston

\$4.1M

Oregon State Revenue Bond

**May 1986**

Round 1

\$7.7M

Original investors, Harvard Mgmt. Co., Raytheon Company, Republic Ventures, Union Venture Corp.

**July 1986**

Round 2

\$2.5M

Fairfield Venture Partners, InterVen

**July 1987**

Round 3

\$10.0M

Round 1 & 2 investors, Cowen & Co., DFC Ventures, Manufacturers Hanover, Pell Rudman & Co.

**April 1988**

Round 4

\$11.2M

Round 3 investors, Bancorp Hawaii, Sun Microsystems, Weeden Capital Mgmt.

**June 1988**

Round 5

\$13.5M

Oxford Partners, New England Capital Corp., Analog Devices, Raytheon Co., InterVen Partners

## RECENT HIGHLIGHTS

**November 1986**

BIT offered two 16x16 fixed-point multiplier/accumulators, the B3011 and B2011. The B3011 is an ECL version and the B2011 is a TTL version.

**November 1986**

BIT sampled the B3210 1K register file with a typical read-cycle time of 6ns.

**February 1987**

BIT offered a chip set that consists of a floating-point multiplier and a floating-point ALU and offers 60-mflop performance for nonpipelined 64-bit operations. The B3110 multiplier and B3210 ALU are ECL 10KH compatible. The B2110 multiplier and B2120 ALU are TTL versions.

**July 1987**

BIT signed an agreement with Sun Microsystems to produce a bipolar 32-bit RISC MPU.

**October 1987**

Stephen E. Cooper was elected chairman of the board and CEO of BIT.

**January 1988**

BIT was selected by *Electronic Business* magazine as one of the 38 "hot" electronics industry start-ups. The results were based on a poll of 125 leading venture capitalists.

## ALLIANCES

**Analog Devices**

1983

Analog Devices participated in all rounds of BIT financing.

**Raytheon**

July 1986

Raytheon and BIT agreed to jointly develop VLSI ECL gate arrays and standard cell devices using the BIT1 process. Raytheon will use its CAD/CAE facilities, and BIT will perform wafer fabrication with Raytheon marketing the resulting products.



# Bipolar Integrated Technology

## Sun Microsystems

July 1987

Sun Microsystems licensed BIT to produce a 32-bit bipolar RISC MPU using its BIT1 process. The part uses Sun's scalable processor architecture (SPARC) developed for workstation applications. BIT has full marketing rights including software support. BIT plans to offer a higher performance RISC SPARC chip in 1989 using its BIT2 process.

custom LSI designs for current and future BIT customers.

## MANUFACTURING

### Technology

1.2-micron bipolar

### Facilities

Beaverton, OR

46,000 sq. ft.

Design and manufacturing

6,000 sq. ft.

Class 10 clean room

## Arizona Microtek

July 1988

BIT and AZM agreed to develop custom ICs using BIT's high-performance BIT-1 technology. AZM will act as an independent design house providing complete capabilities to develop

## PRODUCTS

Device	Description	Clocked Multiply Time
B3018	ECL 16x16 Integer Multiplier	13ns
B2018	TTL 16x16 Integer Multiplier	19ns
B3011	ECL 16x16 Multiplier-Accumulator	15ns
B2011	TTL 16x16 Multiplier-Accumulator	16ns
B3210	ECL 64x18-bit Five-Port Register File	7ns
B2210	TTL 64x18-bit Five-Port Register File	16ns
B3110/2110	2-Chip Set Floating-Point Multiplier	50ns
B3120/2120	Floating-Point ALU	25ns

## OTHER INFORMATION

BIT's PR firm is KVO, Inc.

# BKC International Electronics, Inc.

6 Lake Street  
Lawrence, MA 01841  
508/681-0392  
Fax: (508) 681-9135

ESTABLISHED: January 1986

NO. OF EMPLOYEES: 100

## BACKGROUND

BKC International Electronics was founded in 1985 by three former ITT Semiconductor Employees, who purchased the germanium diode line and hi-rel test lab from ITT in 1985 and began operations in 1986. The Company produces a wide range of high-reliability discrete semiconductors, including small signal switching diodes, zener diodes, rectifiers, and germanium diodes.

By February 1, 1986, BKC had received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types approved and manufactured by ITT. In November 1986, BKC announced the purchase of the silicon wafer fab facility from ITT. The purchase included all the equipment, process, and quality specifications and procedures necessary to produce JAN, JANTX, and JANTXV switching diodes and zener diodes. Final approval from DESC was granted April 29, 1987.

To date, the Company has raised \$2.5 million in financing through bank loans and the private sale of common stock. BKC conducts operations in an 80,000 square foot plant in Lawrence, Massachusetts, which houses design, wafer fab, assembly and test operations. During the next three years, the Company plans to increase wafer fab capabilities to include mesa construction. In the future, BKC plans to add new discrete semiconductors such as 5W zeners, Schottky diodes and rectifiers, switching rectifiers, and transient suppressors to its product lines.

## BOARD

Not Available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
\*Gerald T. Billadeau  
ITT, CFO

**VP Marketing**  
\*John L. Campbell  
ITT, Sales

**VP Operations**  
\*William J. Kady  
ITT

\*Founder

## FINANCING

**1985-1989**  
Bank Loans  
\$2.0M Total  
Comfed Savings Bank

**1985, 1986, 1987**  
Multiple offerings  
Private sale of common stock  
\$525,000  
Private investors

## RECENT HIGHLIGHTS

**February 1986**  
BKC received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types previously approved and manufactured by ITT.

**November 1986**  
BKC announced the purchase of the silicon wafer fab facility from ITT.

# **BKC International Electronics, Inc.**

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## **MANUFACTURING**

### **Technology**

BKC uses Planar, mesa, and germanium gold bonding process technologies.

## **Facilities**

Lawrence, MA  
80,000 sq. ft.

Headquarters, wafer fab, assembly, test, design

## **PRODUCTS**

Small Signal Switching Diodes  
Zener Diodes  
Rectifiers  
Germanium Diodes

## **OTHER INFORMATION**

BKC does not employ a PR firm.

# Brooktree Corporation

9950 Barnes Canyon Road

San Diego, CA 92121

619/452-7580

Fax: 619/452-1249

Telex: 383596

ESTABLISHED: 1983

NO. OF EMPLOYEES: 290

## BACKGROUND

Brooktree Corporation designs, develops, and markets high-performance data conversion devices. The Company currently offers a complete line of VIDEODACs, which are D/A converters designed for use in video applications; RAMDACs, which are a combination of VIDEODACs and a color look-up table on one chip; and other related products. Brooktree's products are based on the Brooktree Matrix, a proprietary design technology that allows the combination of analog and digital processes on a single chip. The Company uses standard CMOS or bipolar manufacturing processes.

One of the founders of Brooktree was Dr. Henry Katzenstein, who developed the Brooktree Matrix. The Matrix is a fundamental advance in data conversion architecture and was the initial impetus for the formation of the Company. James Bixby, president of the Company, previously was director of engineering at Spin Physics, a division of Eastman Kodak. While at Spin Physics, Mr. Bixby developed a high-speed motion analysis system.

In November 1987, Brooktree acquired Manx Engineering Corp., a small company that has developed specialized hardware for document compression/decompression. The acquisition gives Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

Brooktree also intends to broaden its customer base with the addition of a product line aimed at ATE and instrumentation applications. The Company is currently offering a series of timing vernier ICs for ATE use.

## BOARD

(Name and Affiliation)

\*Myron Eichen, Chairman  
Brooktree Corporation

James Bixby  
Brooktree Corporation

\*Ellsworth Roston  
Roston and Schwartz

Sid Webb  
Titan Corporation

Jack Savidge  
Venture Strategies

F. Duwaine Townsend  
Ventana Corporation

Bill Mobratten  
Independent

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

James Bixby  
Spin Physics, Dir Engr

### VP/Chief Scientist

\*Henry Katzenstein  
Quantrad, VP/Ch Scientist

### VP/CFO

William Peavey  
Monitor Labs, VP Finance/CFO

### VP

Steve Ou  
Rockwell, Dir Dev Engr

### VP Distribution

Joseph Santen  
Burr-Brown, GM Data Conv

### VP/Sales

Richard Lee  
Mostek, VP Sales

# Brooktree Corporation

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## VP/GM Components

Charles Long  
GE, VP/GM

## VP Strat Plan

Stewart Kelly  
Intel, Strat Bus Chrmn

## VP Human Resources

Bob Zabaronick  
Cipher Data Prod, P Human Rescs

## VP/Dir Subsystems

Jeffrey Teza  
Integrated Circuit Engineering, Mgr Custom  
Design

\*Founder

## FINANCING

### January 1982

Start-up  
\$0.4M  
Founders

### Late 1982-Early 1983

Seed  
\$0.3M  
Management, private investors

### Summer 1983

Round 1  
\$0.7M  
Management, private investors

### Early 1985

Round 2  
\$5.0M  
Institutional investor

### Summer 1985

Round 3  
\$5.0M  
Institutional investor

### Early 1986

Round 4  
\$10.0M  
Institutional investor, individual and foreign  
investors, Fairchild Semiconductor

### Early 1987

Round 5  
\$5.0M  
Institutional investor

### Late 1987

Round 6  
\$5.0M  
Shintech (a division of Shin-Etsu), individual  
and foreign investors

## RECENT HIGHLIGHTS

### July 1987

Brooktree offered radio-frequency identification (RF ID) chips that are being used to automate tool changing. The chips are a mix of on-chip logic, PROMs, and communication components that identify the right tool so the host computer can direct its attachment.

### November 1987

Brooktree acquired Manx Engineering Corp., a small company that developed specialized hardware for document compression/ decompression. The acquisition gave Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

### January 1988

Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

## ALLIANCES

### Toshiba 1985

Toshiba signed a royalty-bearing licensing agreement to utilize Brooktree technology for consumer digital audio applications.

### Fairchild April 1986

Brooktree and Fairchild signed a broad-ranging partnership coupling Brooktree's D/A conversion technology with Fairchild's manufacturing capability. Fairchild made an equity investment and provides foundry services (expired April 1988).

## Analog Devices

January 1988

Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

## Facilities

San Diego, CA

73,000 sq. ft.

Headquarters, design, development, test

## MANUFACTURING

### Technology

3.0-, 2.0-, 1.2-micron Silicon-Gate

Double-Metal CMOS

2.0-, 1.5-micron ECL bipolar

## PRODUCTS

### Video DACs

Device	Description	Clock Rate (MHz)
Bt101	Triple 8-Bit, Pipelined Operation	50, 30
Bt102	Single 8-Bit, 0, 7.5, or 10 IRE Pedestal	75
Bt103	Triple 4-Bit, Pipelined Operation	75, 30
Bt106	Single 8-Bit, Pipelined Operation	50, 30
Bt107	Single 8-Bit, 2:1 Multiplexed Pixel Inputs	400
Bt108	Single 8-Bit, Pipelined Operation	400, 300, 200
Bt109	Triple 8-Bit, Pin Compatible to TDC1318	250

### Imaging

Device	Description	Conv. Rate (MHz)
Bt208	8-Bit Flash Video A/D Converter	15, 18
Bt251	Single-Channel 8-Bit Image Digitizer	15
Bt253	Triple-Channel 8-Bit Image Digitizer	15

### RAMDACs

Bt450	Triple 4-Bit, 16x12 Dual-Port Color Palette RAM	70, 50, 30
Bt451	Triple 4-Bit, 256-Word Dual-Port Color Palette RAM	25, 110, 80
Bt453	Triple 4-Bit, 256-Word Color Palette RAM	66, 40
Bt454	Triple 4-Bit 16x12 Color Palette RAM	170, 110
Bt457	Single 8-Bit, 256x8 Dual-Port Color Palette RAM	125, 100, 80
Bt461	Single 8-Bit, Multiplexed TTL Pixel Ports	170, 110, 80
Bt471	Triple 6-Bit, 256x18 Color Palette RAM	80, 50, 35
Bt473	Triple 8-Bit True Color, 256-Word Palette	35, 50, 66, 80
Bt476	Triple 6-Bit, 256-Word Color Palette	35, 50, 66
Bt478	Triple 6/8-Bit, 256-Word Color Palette	35, 50, 66, 80
Bt459	Triple 8-Bit, 256-Word Color Palette with Cursor	80, 110, 135
Bt492	Single 8-Bit, 256-Word Palette, 100K ECL	360

# Brooktree Corporation

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## Graphics Peripheral Devices

Device	Description	Conv. Rate (MHz)
Bt401-404	256x8 Pipelined SRAM, Optional 3x8 Overlay Registers, 10KH and 100K ECL Compatible	250
Bt424	40-Bit Multi-Tap Shift Register, 10KH ECL/TTL Compatible	250
Bt431	64x64 User Definable Cursor 35 MHz per 5 pixels	
Bt438	Clock Generator Chip for 125-MHz CMOS RAMDACs	250
Bt439	Clock Generator/Synchronizer Chip for Single Channel 125-MHz CMOS RAMDACs	150
Bt501/502	Octal ECL/TTL Bidirectional Transceiver/Translator, 10KH and 100K ECL Compatible	N/A

## D/A Converters

Device	Description	Settling Time
Bt104	Monolithic Single 12-bit, Unlatched Data Inputs	40ns
Bt105	Monolithic Single 12-bit, Latched Version of Bt104	40ns
Bt110	Monolithic Octal 8-bit, Standard MPU Bus Interface	100ns

## ATE Devices

Device	Description
Bt601	Dynamically Programmed Timing Edge Vernier, 10KH ECL Compatible
Bt602	Programmable Timing Edge Vernier, 20ps Resolution, 10KH ECL Compatible
Bt603	Programmable Timing Edge Delay, 20ns to 200ns span, 10KH ECL Compatible
Bt604	125-MHz 10KH ECL Compatible Dynamically Programmed Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt605	125-MHz 10KH ECL Compatible Programmable Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt606	Programmable Timing Edge Delay, 20ns to 200ns Span
Bt687	Ultrafast ECL Dual Comparator

## Military Devices

Bt101/883	MIL-STD-883C Version of Bt101 VIDEODAC, 30-MHz Clock Rate
Bt102/883	MIL-STD-883C Version of Bt102 VIDEODAC, 66-MHz Clock Rate
Bt453	MIL-STD-883C Version of Bt453 RAMDAC, 40-MHz Clock Rate, 40-Pin Ceramic Sidebraced DIP Package
Bt458/883	MIL-STD-883C Version of Bt458 RAMDAC, 100-MHz Clock Rate, 84-Pin Ceramic PGA Package

## OTHER INFORMATION

Brooktree's PR firm is Rigoli, Pamphilon, Demeter.

# California Micro Devices Corporation

215 Topaz Street  
Milpitas, CA 95035-2398  
408/263-3214  
Fax: 408/263-7846

ESTABLISHED: 1980

NO. OF EMPLOYEES: 300

## BACKGROUND

California Micro Devices Corporation (CMD) designs, manufactures, and markets a wide range of high-performance electronic components through its thin-film, ASIC, and microcircuits divisions. The components are marketed to military, aerospace, medical, computer, and communications customers.

CMD was formed originally in 1980 to acquire the assets of Capsco Sales, Inc., a thin-film company founded in 1976. In 1982, CMD established Custom MOS Arrays (CMA), which designed, manufactured, and marketed HCMOS cell-based ICs and gate arrays in the 200- to 2,000-gate range. In September 1986, CMD and CMA merged into one company. Dr. Handel H. Jones, formerly president of CMA, became president and COO of the new company.

CMA operates as the ASIC division of CMD and produces primarily gate array and cell-based ICs based on 2.5-, 2.0-, and 1.25-micron HCMOS technologies, with complexities of from 100 to 20,000 gates. The Company has adapted its cell-based designs to analog and digital products and has increased the level of integration by depositing precision thin film onto the ICs.

The thin-film division designs and manufactures precision resistive products including networks, capacitors, and metallized substrates for both hybrid and microwave applications. The division also produces nonimpact, high-density, color ink-jet printheads. In November 1985, the Company introduced its proprietary SX resistor chip materials for high-performance applications that require precision resistance and stability characteristics.

In August 1987, CMD acquired the assets of GTE Communication Systems' Microcircuits Division for \$14.5 million. The acquisition covered all of Microcircuits' assets including

inventory, receivables, trade payables, intellectual properties, five acres of land, silicon wafer foundry and test facilities, and personnel. In the transaction, GTE Communication Systems also granted a preferred vendor status to CMD and a license to proprietary technology in custom chips.

The division, which operates as the Microcircuits Division of CMD, offers custom telecommunication circuits, MPU and peripherals ICs, and gate arrays used in telecommunications systems. R&D efforts focus on products in the telecommunications arena. About 60 percent of sales is into the telecommunications market, 20 percent in the personal computer market, with the remainder from foundry business. The division provides about 50 percent of its production to support the internal requirements of GTE Communications Systems.

In January 1989, CMD formed the Vanguard Semiconductor Division, which will be run by former Aspen founder/president/CEO Narpat Bhandari.

## BOARD

(Name and Affiliation)

- \*Chan M. Desaigouard, Chairman  
California Micro Devices Corporation, CEO
- James P. Burgess  
Cambur Company, President
- Dr. C. Lester Hogan  
Fairchild Instruments, Former  
Vice Chairman, President & CEO
- Dr. Handel H. Jones  
International Business Strategies, Chairman
- Dr. Angel G. Jordan  
Carnegie-Mellon University, Provost
- Stuart Schube  
Acorn Ventures, Inc., President



# California Micro Devices Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO

Chan M. Desai  
ITT Semiconductor, Far East Sales Dir

### CFO/VP Finance, Asst Secretary

Steven J. Henke  
Monsanto, Div Controller

### VP/GM Microcircuits Div

Dr. Tarsaim L. Batra  
Gould/AMI, Director Process Technology

### VP Technology, Pres—Vanguard Semiconductor

Narpat Bhandari  
Aspen Semiconductor (Div of Cypress Semiconductor), Founder, Pres and CEO

### VP/GM Thin Film Division

Satish Kumar  
United Supertek, Dir of Mktg

### VP Sales and Tactical Mktg

Stephen R. Pass  
Linear Technology, VP Sales

### VP Foundry and Int'l Ops

Zia H. Malik  
LSI Logic, Mgr Technical Liaison

\*Founders

## FINANCING

### October 1986

\$5.2 M  
Initial public offering

## RECENT HIGHLIGHTS

### September 1986

CMD and Custom MOS Arrays merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

### October 1986

CMD made an initial public offering of 1 million shares of common stock at \$6 per share. The offering raised \$5.2 million.

### August 1987

CMD acquired the assets of GTE Microcircuits Division.

### November 1987

CMD offered the G8870, a CMOS DTMF receiver that is a combination decoder and filter. The device is said to detect all 16 DTMF tone pairs and convert them into code.

### August 1988

California Micro Devices announced that it entered into an agreement with Gould Inc. to acquire the assets and assume selected liabilities of American Microsystems Inc., a wholly owned subsidiary of Gould Inc., for approximately \$70 million in cash.

### January 1989

California Micro Devices announced the formation of Vanguard Semiconductor Division.

## ALLIANCES

### Ricoh

1982

Ricoh provided wafers to CMA.

1983

CMD signed a joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and standard cells.

### Racal

January 1982

Racal agreed to allow CMA to design, manufacture, and sell Racal's new 5-micron silicon-gate CMOS gate arrays in the United States.

### Micro Innovators

January 1983

CMA merged with Micro Innovators, Inc., to acquire a team of seasoned custom MOS/LSI designers and expand its product line to include standard cell and full-custom designs in silicon-gate CMOS at both 5- and 3-micron geometries.

### TRW

July 1985

TRW agreed to manufacture HCMOS gate arrays of from 500 to 25,000 gates in its JAN-qualified fab, using CMA's 1.2-micron design rules. TRW will use the rules internally for its DSP products.

# California Micro Devices Corporation

## CMA

September 1986

CMD and CMA merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

## Fuji Photo Film

November 1986

CMD signed an agreement with Fuji Photo Film Co., Ltd., under which CMD will license its HCMOS gate array and cell-based design technology for \$1 million. Fuji Photo Film will use the technology internally in image- and information-processing equipment.

## Tachonics

March 1987

CMD signed an agreement with Tachonics Corporation that calls for Tachonics to manufacture commercial and military GaAs ICs at its foundry in New Jersey. CMD will provide cell design and tools in the 1.0- to 0.5-micron range. Initial products will be GaAs gate arrays in the 500- to 2,500-gate range and with radiation-hardened capability.

## Telefonica

November 1987

CMD and Telefonica signed a joint venture agreement to form a company named California

Micro Devices SA in Spain. CMD plans to invest about \$2 million and will own approximately one-third of the company. CMD SA will offer thin-film passive components for hybrid assemblies, gate arrays, cell-based ICs, and nonimpact printhead substrates. CMD and Telefonica will also jointly develop ASICs. CMD will provide technology and training.

## MANUFACTURING

### Technology

1.25-, 1.5-, 2.0-, and 2.5-micron HCMO Silicon-gate, single- and dual-layer metal 4-inch and 6-inch wafers

### Facilities

Milpitas, CA  
40,000 sq. ft.  
Total space

15,000 sq. ft.  
Class 1,000 clean room

Tempe, AZ  
46,000 sq. ft.  
Manufacturing, test—Class 1,000

20,000 sq. ft.  
Clean room—Class 100 & 10

## PRODUCTS

### CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
C1000	Si-Gate	1.5	0.8	5,000 to 18,000
C2000	Si-Gate	2.0	2.0, 1.25	200 to 3,100
C3000	Si-Gate	2.5	2.5	1,500 to 10,500
C5000	Si-Gate	1.25	0.4	500 to 25,000

### CMOS Cell Library

Process	Linewidth (Microns)	Delay (ns)	Cells
Si-Gate	1.25	0.25	120 gates, 200 MSI, RAM, ROM, PLA, 2901 Family, DMA Controllers, UART, USART
Si-Gate	2.0	1.2	Same as above
Si-Gate	2.5	2.5	Same as above

# California Micro Devices Corporation

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## Linear

G8870  
G8912

CMOS DTMF Receiver that Combines Decoder and Filter  
PCM Filter

## OTHER INFORMATION

California Micro Devices does not employ a PR firm.

## Calmos Systems, Inc.

20 Edgewater Street  
Kanata, Ontario, Canada K2L 1V8  
613/836-1014  
Fax: 613/831-1742  
Telex: 053-4501

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 65

### BACKGROUND

Calmos Systems designs, develops, and markets a variety of devices, including VHSIC-level products that use CMOS and bipolar processes. The Company's CMOS products consist of the CA80C85B MPU and the 8000 series of peripherals, including SCSI and SCC devices. The bipolar product line is centered on a family of wireless components for cellular radio and pager applications. The Company also offers fast-turn prototyping and low-volume production runs that use e-beam technology.

In February 1988, Calmos acquired Siltronics' bipolar IC line. The acquisition adds about \$2.5 million to Calmos' sales, which were \$2 million in 1987. Calmos has purchased Siltronics' assets, especially the equipment for testing and assembly of the circuits.

Calmos hired about 24 of Siltronics' key employees, including founder and Vice President Gyles Panther, doubling the size of Calmos' work force.

The Siltronics product line consists of FM receiver chips for data and cellular radio applications, a delta codec chip based on an exponentially variable step-size algorithm, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

The Company participates in a EUREKA, a European consortium R&D project and is working with European Silicon Structures (ES2) to exploit the technology in ASIC design. Calmos, together with ES2, offers quick-turn prototyping using direct-write e-beam technology, which can implement several design projects on the same wafer.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

Dr. Adam Chowaniec  
Commodore, VP Technology

#### VP R&D

John Roberts  
Mosaid, Dir Mktg

#### VP Sales/Mktg

William Woodley  
Mosaid, VP/Bus Mgr

#### VP Finance/GM

D. Rosati  
Cognos, Controller

#### VP Engineering and Technology

Andrew Herrington  
Amiga, Dir Engineering

#### GM Manufacturing

S. Henthorn  
Siltronics, Dir Mfg

### FINANCING

Not available

Round 1

\$1.0M

Private

Not available

Round 2

\$0.4M

Private

# Calmos Systems, Inc.

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Not available

Round 3

\$3.6M

Private and grants

November 1987

Round 4

\$0.5M

Private

## RECENT HIGHLIGHTS

January 1987

Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

September 1987

Calmos announced that it has developed a prototype of a public-key data-encryption system implemented on a chip. The chip uses an algorithm developed at the University of Waterloo in Ontario that allows encryption by exponentiation at speeds of several hundred bits per second.

November 1987

Calmos received a federal contribution of more than \$3 million from the Canadian DRIE to join the EUREKA program. The project involves the expansion of the Company's headquarters located in Kanata, Ontario, to include packaging and test facilities for semiconductor products and the expansion of its CAE system.

February 1988

Calmos acquired Siltronic's bipolar component business for \$500,000. Siltronic's product line consists of FM receiver chips, a codec chip,

DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

## ALLIANCES

Samsung

January 1987

Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

European Silicon Structures

February 1987

Calmos formed an alliance with ES2 to offer quick-turn prototyping.

Siltronics

February 1988

Calmos acquired Siltronic's bipolar component business for \$500,000. The product line consists of FM receiver chips, a codec chip, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

## SERVICES

Prototyping

Low-Volume Production

## MANUFACTURING

### Technology

2.0- and 3.0-micron CMOS

0.9- to 1.5-micron CMOS VHSIC

3.0- and 5.0-micron bipolar

### Facilities

Kanata, Ontario, Canada

20,000 sq. ft.

Manufacture, test, design

## PRODUCTS

### ASICs

Device	Description
CMOS Gate Arrays	228 to 1,000 Gates, 2ns Typical Delay
Structured Cell Library	80 Cells Including 4-Bit Adders Shift Registers
Macro Cell Library	RAM, ROM, Dual-Port RAM, 29C01, 80C85, and 8200 Series of Peripherals

**Microcomponents**

Device	Description	Speed
CA80C85B	8-Bit MPU with Extended Instruction Set	3 to 5 MHz
CA80C85S	CA80C85B with Static Operation (2Q88)	6 to 10 MHz
<b>8000 Series Peripherals</b>		
CA82C12	8-Bit MPU	8 to 10 MHz
CA82C37A	Static DMA Controller	5 to 10 MHz
CA82C54	Static Interval Timer	8 to 10 MHz
CA82C55A	Static Peripheral Interface	5 to 10 MHz
CA82C59A	Static Interrupt Controller	5 to 10 MHz
CA82C84A	Static Clock Generator/Driver	8 to 10 MHz
CA82C88	Static Bus Controller	5 to 10 MHz
CA53C80	Static SCSI Interface Controller	1.5 to 3.0 Mbps
CA34C168	Real-Time Data Encryption Processor	300 Kbps

**DSP**

CA29C128	Digital FIR Filter Controller	25 MHz
DFS001-P	PC Board with Programmable FIR Filter and with Software Interface	
FIRCALC-PC	FIR Filter CAD Program	

**Memory**

CA16C08	2Kx8 SRAM	25ns
CA16C09	2Kx9 SRAM	25ns
CA64C08	8Kx8 SRAM	35ns
CA64C09	8Kx9 SRAM	35ns

**Bipolar IC Product Line**

**Communications Circuits**

S422	FM Receiver
S412	Cellular Radio Receiver
S404/406	FM Receiver Two-Chip Set
S408/410	FM Receiver for Data
S2842	Delta Codec

**Power Supply Circuits**

S420/424	Low-Voltage DC-DC Converters
S2862	Power Supply Monitor

**Specialty Circuits**

S416	Programmable Monolithic Diode Matrix
S2854	MPU Control Circuit
S144	Triple Op Amp

**OTHER INFORMATION**

Calmos does not employ a PR firm.

# Calogic Corporation

237 Whitney Place  
Fremont, CA 94539  
415/656-2900

ESTABLISHED: July 1983

NO. OF EMPLOYEES: 50

## BACKGROUND

Calogic Corporation designs, develops, and manufactures DMOS analog products, CMOS and bipolar linear products, and gate arrays. The Company also builds fabrication facilities and markets semiconductor equipment.

The Company was founded without venture capital. From 1985 to 1987, it initially concentrated on foundry contracts and building mini fabrication facilities using its own facility as a model. Calogic has set up fabrication facilities for Data Linear, Microwave Device Modules, and other foreign companies.

In the first quarter of 1988, Calogic began ramping up its proprietary line of linear products, which includes op amps, reference, and regulators.

Calogic achieved a positive cash flow within its first year of operation. The Company is profitable, with sales of about \$5 million and continues to grow at a rate of approximately 50 to 100 percent per year.

## BOARD

(Name and Affiliation)

\*Manny Del Arroz, Chairman

\*Dr. Charlie Allen, Consultant

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**

Manny Del Arroz

Intel, Process Manager

\*Founder

## FINANCING

1983

Initial

\$0.025M

Private

## ALLIANCES

Koki Company

December 1984

Calogic and Koki reached an agreement regarding the sale of Calogic's CMOS data bus driver ICs by Koki in Japan. (expired)

## MANUFACTURING

### Technology

3-micron DMOS

5.0- to 3.0-micron metal-gate CMOS

3.0-micron bipolar linear with thin film

High-Speed Complementary Bipolar on DI

### Facilities

Fremont, CA

30,000 sq. ft.

Design, manufacturing, and test

7,000 sq. ft.

Including a Class 100 clean room

# Calogic Corporation

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## PRODUCTS

- Op Amps
- Regulators
- References
- DMOS FET
- CMOS MPR
- DMOS Switching Arrays
- J Fet
- High-Speed Buffer Amplifiers
- Current Feedback Amplifiers
- Other Linear Analog Products

## OTHER INFORMATION

Calogic does not employ a PR firm.



# Catalyst Semiconductor, Inc.

2231 Calle De Luna  
Santa Clara, CA 95054  
408/748-7700  
Fax: 408/980-8209  
Telex: 5106017631

ESTABLISHED: October 1985

NO. OF EMPLOYEES: 52

## BACKGROUND

Catalyst Semiconductor, Inc., was formed to design, develop, and manufacture leading-edge, nonvolatile memories as well as to provide this technology to application-specific and peripherals ICs. This design base is directed toward consumer, industrial, and military applications.

The Company was founded by B.K. Marya, previously the founder and CEO of Exel Microelectronics, Inc. Its long-term strategy is to gain ASIC leadership through the use of nonvolatile memory technology.

## BOARD

(Name and-Affiliation)

\*B.K. Marya

Catalyst Semiconductor, president

George Pottorff

Pottorff, MacFarlane & Associates, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

B.K. Marya

Exel, President

### Exec VP

Stephen Michael

GE Solid State, VP Custom ICs

### VP Corp Dev

Hide Tanigami

Exel, Bus Dev/Japan

### Dir European Sales

Barry Stanley

Mostek, Sales/Manager

### Dir American Sales

Thomas Malgesini

Intel, Field Sales Engineer

### Dir Tactical Mktg

Reggie Huff

Exar, Sales Mgr

### Dir Strat Mktg

Nick Samaras

National, Mktg Mgr

\*Founder

## FINANCING

### October 1985

Round 1

\$4.5M

Private placement

## RECENT HIGHLIGHTS

### January 1987

Catalyst offered the CAT93C46 and CAT59C11, two CMOS 1K serial EEPROMs. The devices offer selectable serial memory organization and automatic write instruction.

### March 1987

Catalyst and Oki Electric extended a previous agreement to include a wide range of CMOS EEPROMs. The agreement includes 1K serial EEPROMs; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs.

### April 1987

Stephen Michael, formerly vice president of GE Semiconductor's Custom Integrated Circuit Department, joined Catalyst as executive vice president and COO. He has responsibility for all day-to-day operations.

### June 1987

Catalyst offered the CAT62C580, a CMOS 8-bit MCU with 16K of EEPROM on-chip.

## Catalyst Semiconductor, Inc.

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The device also includes 3 Kbytes of mask-programmable ROM and 128 bytes of data RAM.

### June 1987

Catalyst offered the KASK 52580 program development and evaluation system for the CAT62C580 single-chip, 8-bit MCU. The system runs on the IBM PC AT or compatible MS-DOS machines.

### July 1987

Catalyst offered its first CMOS SRAMs. The CAT71C256 and CAT71C256L are low-power 32Kx8 devices with an access/cycle time of 85ns. The CAT71C88 is a 16Kx4 SRAM with an access time of 45ns.

### Sept. 1987

Catalyst sampled a 1Mb EPROM with an access time of 120nsCAT27010.

### October 1987

Catalyst introduced the CAT28C16A and CAT28C17A, its first 16K EEPROMs. Both are organized as 2Kx8 and offer a 150ns access time.

### 1988 Developments

Catalyst introduced the CAT28C64A and CAT28C65A 64K EEPROMs.

Catalyst introduced the CAT35C102 and CAT35C202 2-Kbit serial EEPROMs.

Catalyst introduced the CAT35C104 and CAT35C204 4-Kbit serial EEPROMs.

Catalyst offered the CAT62C780, a CMOS 8-bit MCU with 8K of EEPROM on-chip. The device also includes 6Kbytes of mask-programmable ROM and 192 bytes of data RAM.

Catalyst introduced the CAT35C704 and CAT35C804 Secure Access Serial EEPROMs. These unique memories offer password-protected access to data and feature configuration.

Catalyst introduced its first military temperature device with the CAT27HC256. This is a 256-Kbit EPROM that provides 55ns access

times. It also is available in industrial and commercial temperature grades as well as a low-power version, the CAT27HC256L.

Catalyst introduced a CMOS 1-Mbit EPROM, the CAT27C210, configured as 64Kx16 for 16- and 32-bit processor applications.

## ALLIANCES

### Zilog

#### December 1985

Catalyst and Zilog entered into a joint development and second-source agreement for user-programmable standard products. The Companies' initial effort will be a version of Zilog's Z8 microcontroller with on-chip, electrically alterable capabilities that use Zilog's 1.25-micron, n-well CMOS process.

### Thomson CSF

#### 1986

Catalyst and Thomson will conduct research and development in France.

### Oki Electric

#### July 1986

Catalyst and Oki entered into an agreement that calls for long-term research and development of NVRAMs for ASICs using CMOS EPROMs and EEPROMs. Terms include a nonexclusive marketing agreement.

#### March 1987

Catalyst and Oki Electric extended the previous agreement to include a wide range of CMOS EEPROMs. The two companies planned a joint introduction of a 1K serial EEPROM; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs by the end of 1987.

#### November 1988

Catalyst and Oki signed an agreement that gives Oki a second-source license to sell the Catalyst 2K CMOS serial EEPROM, the CAT35C102, and the CAT35C202 on a worldwide basis.

### Seiko

#### February 1987

Catalyst and Seiko Instruments signed a technology exchange and foundry agreement.

**MANUFACTURING**

**Technology**

1.2-micron design rules  
 Double-metal, double-poly CMOS  
 Submicron technology in development

**Facilities**

Santa Clara, CA  
 20,000 sq. ft.  
 Offices, test

**PRODUCTS**

**CMOS SRAM**

**Device**

**Description**

CAT71C256  
 CAT71C256L

32Kx8  
 32Kx8 (low-power version)

**CMOS NVRAMs**

CAT22C10  
 CAT22C12  
 CAT24C44

64x4  
 256x4  
 16x16 Serial RAM

**CMOS EPROMs**

CAT27HC256  
 CAT27HC256L  
 CAT27C210

32Kx8  
 32Kx8 (low power)  
 1 Mbit (64Kx16)

**NMOS EPROMs**

CAT2764A  
 CAT27128A  
 CAT27256  
 CAT27512  
 CAT27010

8Kx8 (OTP)  
 16Kx8 (OTP)  
 32Kx8 (OTP)  
 64Kx8 (OTP)  
 1 Mbit (128Kx8) OTP and UV versions

**Parallel CMOS EEPROMs**

CAT28C16A/28C17A  
 CAT28C64A/28C65A  
 CAT28C256

2Kx8  
 8Kx8  
 64Kx8

**Serial CMOS EEPROMs**

CAT93C46/59C11  
 CAT35C102/CAT35C202  
 CAT35C104/CAT35C204  
 CAT35C704/CAT35C804

1K Serial  
 2K Serial  
 4K Serial  
 4K Secure Access Serial

**Microcontrollers (SmartCard Chips)**

CAT62C580  
 CAT62C780

8-Bit MCU, 16K of EEPROM on-chip, 3 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM  
 8-bit MCU, 8K of EEPROM on-chip, 6 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM

**Development Tools**

EASE 62580

A Program Development and Evaluation System for the CAT62C580 Single-Chip, 8-Bit MCU

**OTHER INFORMATION**

Catalyst's PR firm is John Ranavicks.

**Celeritek, Inc.**  
617 River Oaks Parkway  
San Jose, CA 95134  
408/433-0335  
Fax: 408/433-0991

ESTABLISHED: 1984

NO. OF EMPLOYEES: 110

## BACKGROUND

Celeritek, Inc., designs, manufactures, and markets GaAs FETs, MMICs, and custom subsystems such as up/down converters for military and commercial applications.

The Company has developed a thin-film microwave amplifier technology and manufactures many of its low-noise and medium-power GaAs FETs in-house. All microwave amplifier thin-film circuits use a high-energy sputtering process for reliable and repeatable metal adhesion. The Company can also manufacture silicon MOS capacitors. Celeritek uses a family of standard amplifier modules that can be combined and aligned to achieve customer-specific specifications.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Tamer Hussein  
Granger Assoc., VP Operations

### VP Amp Ops

\*Gary Policky  
Avantek, Mgr Adv Dev M/W

### VP SC Ops

\*Ross Anderson  
Avantek, Mgr GaAs Dev

### VP Finance

\*John Beman  
ROLM, Controller

### VP Marketing

\*Robert Jones  
Avantek, Dir Marketing

\*Founder

## FINANCING

### March 1985

Round 1  
\$3.2M  
Greylock Management, Sutter Hill, Venrock Associates

### August 1985

Follow-on  
\$1.0M  
Original investors

### August 1986

Round 2  
\$4.2M  
Original investors; Burr, Egan, Deleage; Glynn Ventures; Mayfield Fund; Morgan Stanley

## RECENT HIGHLIGHTS

### July 1987

Celeritek leased 23,860 square feet of R&D space in San Jose, California.

### December 1987

Avantek filed a suit against Celeritek and two of its founders, Tamer Hussein and Ross Anderson, charging theft of trade secrets.

## ALLIANCES

None

## MANUFACTURING

### Technology

GaAs

# Celeritek, Inc.

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## Facilities

San Jose, CA

23,860 sq. ft.

Research and development  
and manufacturing

1,000 sq. ft.

Class 100 clean room

## PRODUCTS

### Low-Noise Amplifiers

Family	Frequency	Power Output
CMA Series	0.5 to 18.0 GHz	+18 dBm
CMT Series	2 to 18 GHz	+18 dBm
CMT Series	18 to 40 GHz	+10 dBm

### Medium-Power Amplifiers

CPA Series	6 to 18 GHz	+27 dBm
CPT Series	6 to 18 GHz	+30 dBm

### Microsize Connectorless Amplifiers

240/400 Series	2 to 18 GHz
520 Series	0.5 to 4.0 GHz

### MMIC Chips

CMM-2 Amp	2 to 6 GHz
CMM-4 Amp	2 to 18 GHz
CMS-12 Switch	DC to 18 GHz

### GaAs FETs

CF004-02	2 to 40 GHz	+13 dBm
CF003-01	2 to 20 GHz	+22 dBm
CF010-01	2 to 18 GHz	+28 dBm

### Integrated Assemblies

Frequency Converters  
Switched Amplifiers  
Log Amplifiers

## OTHER INFORMATION

Celeritek does not employ a PR firm.

# Chartered Semiconductor Pte Ltd.

3-Lim Teck Kim Road  
STC Building 10-02  
Singapore 0208  
Phone: 65-320-7271

ESTABLISHED: October 1987

NO. OF EMPLOYEES: N/A

## BACKGROUND

Chartered Semiconductor Pte Ltd. is a result of a joint venture among National Semiconductor Corporation, Singapore Technology Corporation, and Sierra Semiconductor Corporation. Singapore Technology holds 74 percent of the Company, Sierra holds 17 percent, and National holds the remaining 9 percent. Total initial investment in the facility and equipment was about \$40 million.

The Company, which is located at a 170,000-square-foot site in the Singapore Science Park, will initially fabricate and test CMOS wafers and ASIC devices primarily for Sierra Semiconductor and National Semiconductor. Chartered Semiconductor began construction in October 1987 and began its first wafer starts in Q2 1989. The facility fabricates submicron devices in a Class 1 clean room with an initial capacity of 5,000 6-inch wafers per month. The facility will be capable of generating about \$50 million in revenue per year.

Sierra is contributing its proprietary Triple Technology CMOS process, technical management, and training. National is providing CMOS process technology, technical training, and technical support in the construction and start-up of the clean-room facility. Singapore engineers have been training at Sierra's San Jose, California, facility for more than two years. Tom Klein, vice president and founder of Sierra, will supervise the facility construction and start-up of the manufacturing process. Sierra's Triple Technology is capable of integrating analog, digital, and EE memory on one chip.

## BOARD

(Name and Affiliation)

Ming Seong Lim, chairman

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**Managing Director**  
B. John Hambridge  
Fairchild, VP Logic Division

## FINANCING

Oct. 1987  
Round 1  
\$40.0M  
National Semiconductor Corporation; Sierra Semiconductor Corporation; Singapore Technology Corporation

## ALLIANCES

National, Sierra, Singapore  
Oct. 1987  
National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation cooperated in a joint venture to form Chartered Semiconductor.

## SERVICES

Foundry  
Manufacturing

## MANUFACTURING

**Technology**  
Submicron CMOS  
6-inch wafers

## Facilities

Singapore  
170,000 sq. ft.  
Manufacturing

The Company started wafer production in Q2 1989. The facility includes a Class 1 clean room and has an initial capacity of 5,000 wafers per month.

## **Chartered Semiconductor Pte Ltd.**

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### **PRODUCTS (Planned)**

CMOS Wafers  
ASIC Devices

### **OTHER INFORMATION**

Chartered Semiconductor does not employ a PR firm.

**Cirrus Logic, Inc.**  
1463 Centre Pointe Drive  
Milpitas, CA 95035  
408/945-8300

ESTABLISHED: 1984

NO. OF EMPLOYEES: 175

### BACKGROUND

Cirrus Logic, Inc., designs, manufactures, and markets optimized mass storage controllers, communications controllers, and graphics controller chips for data communications, mass storage control, and display/graphics control applications. The Company's VLSI circuits use a proprietary silicon compilation technique and can be designed as standard products, as well as market- and customer-specific derivatives.

Cirrus Logic is the commercial follow-on to Patil Systems, a research laboratory founded in 1981. In 1984, financing was received from Nazem & Company of New York, and Cirrus Logic acquired Patil Systems.

Cirrus Logic developed a proprietary IC design method called Storage/Logic Array (S/LA) to design custom ICs in design times equivalent to those for standard cells with the density and performance of full-custom devices. Suhas Patil invented the S/LA concept, a type of silicon compilation technology with supporting CAD tools for logic design, simulation, and automatic layout.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

\*Michael Hackworth  
Signetics, Sr VP

#### Exec VP/Strat Ops

Kamran Elahian  
CAE Systems, Founder/President

#### VP R&D

\*Dr. Suhas Patil, Chairman  
Patil Systems, Founder

#### VP Engineering

Kenyon Mei  
Intel, GM OEM Comm

#### VP Manufacturing

Michael L. Canning  
Teledyne, President/GM

#### VP Marketing

George Alexy  
Intel, Mktg Mgr MPUs

#### VP Finance

Marilyn Guerrieri  
Zitel, Dir Finance

#### VP Sales

Bill Caparelli  
VLSI Technology, VP Sales/Mktg.

\*Founder

### FINANCING

#### March 1984

Seed

\$1.6M

Nazem & Company; Robertson, Colman & Stephens

#### May 1985

Round 1

\$7.5M

Brentwood Associates; Nazem & Company; New Enterprise Associates; Robertson, Colman & Stephens; Technology Venture Investors

#### May 1986

Round 2

\$3.0M

Previous investors; Institutional Venture Partners



# Cirrus Logic, Inc.

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## November 1986

### Round 3

\$4.5M

Previous investors; Kuwait & Middle East Financial; New York Life Insurance

## June 1987

### Round 4

\$11.0M

Previous investors; Berkeley Development Capital; Evergreen Management Partners; New Venture Partners; T.R. Technology Investment; UNC Ventures

## June 1989

### IPO

\$24.0M

Initial public offering

## RECENT HIGHLIGHTS

### June 1987

Cirrus Logic raised \$11.0 million in funding. The funds were used to expand manufacturing and test capabilities, with the intent of doubling test capacity. Cirrus Logic also purchased \$1.5 million worth of Sun Microsystems workstations for its design centers.

### October 1987

Cirrus Logic offered the CL-GD510/520, a video graphics array device for the IBM PS/2-compatible market. A custom version of the device was developed in part with Video Seven.

### November 1987

Cirrus Logic offered the CL-SH135 CMOS enhanced Winchester hard-disk formatter chip.

Cirrus Logic offered the CL-SH250, a CMOS single-chip SCSI disk controller that consists of a formatter, buffer manager, and SCSI bus interface.

### December 1987

Cirrus Logic announced that it had begun volume production of the CL-GD510/520 chip set.

### April 1988

Cirrus Logic offered the CL-SH260, a CMOS single-chip PC XT/AT-compatible disk controller that consists of a formatter, buffer manager, and PC XT/AT bus interface.

## July 1988

Cirrus Logic announced a family of single-chip controllers, the RPX family, for raster printer acceleration. The first two chips in the RPX family are designed as coprocessors specifically to enhance the speed and reduce the systems costs of laser printers.

## ALLIANCES

### AMD

#### September 1985

Cirrus Logic and AMD agreed to a technology exchange wherein Cirrus Logic will use silicon-compiled, 1.6-micron, double-metal CMOS-processed wafers to develop an MCU for AMD. AMD provides foundry services. (completed)

### Silicon Systems

#### October 1986

Cirrus Logic and Silicon Systems agreed to exchange controller and buffer manager functions and mutually second-source the devices. Both chips will be processed with a 2-micron CMOS technology. (completed)

### WDC

#### January 1987

Cirrus Logic licensed a custom Winchester disk drive controller IC to WDC, which gained indirect access to the product when it acquired Adaptive Data Systems, Inc., a board manufacturer.

### DIA-Semicon Systems

#### October 1987

Cirrus Logic signed an agreement with DIA-Semicon Systems in Japan to distribute new and existing products in Japan. Cirrus Logic began sales of its Winchester disk controller chip set in Japan. DIA-Semicon Systems was founded in 1986 and is 80 percent owned by Mitsubishi Electric Corporation.

### Award Software

#### November 1987

Award Software, Inc., of Los Gatos, California, agreed to develop a VGA graphics Basic I/O System (BIOS) and demonstration board for Cirrus Logic's GD510/520 VGA chip set. The agreement includes a complete hardware and software solution for PS/2-compatible graphics.

July 1988

Award announced an agreement to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets.

Phoenix Technologies Ltd.

September 1988

Phoenix Technologies will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus Logic.

### Facilities

Milpitas, CA

50,000 sq. ft.

Administration, engineering, design, and marketing

10,000 sq. ft.

Class 1,000 clean room (test facility)

## MANUFACTURING

### Technology

3.0-micron NMOS and CMOS

1.2-, 1.5-, and 2.0-micron, double-metal CMOS

## PRODUCTS

### Mass Storage Controllers

Device	Description
CL-SH120	CMOS Buffer Storage Manager
CL-SH130	CMOS Winchester Hard Disk Formatter
CL-SH135	CMOS Enhanced Winchester Hard-Disk Formatter
CL-SH250	SCSI Disk Controller with Formatter, Buffer Manager
CL-SH260	Disk Controller with Formatter, Buffer Manager, XT/AT Bus Interface

### Display Controller

CL-GD510A/520A	Video Graphics Array—IBM New Generation
CL-GD610/620	Controller chips for laptop computers
CL-GD315	Laser printer coprocessors
CL-GD340	Laser printer coprocessors
CL-CD180	Multichannel communications controller (8 channel)

## OTHER INFORMATION

Cirrus Logic does not employ a PR firm.

# Comlinear Corporation

4800 Wheaton Drive  
Fort Collins, CO 80525  
303/226-0500  
Fax: 303/226-0564

ESTABLISHED: 1980

NO. OF EMPLOYEES: 150

## BACKGROUND

Comlinear Corporation, located in Fort Collins, Colorado, was formed in 1980 by David Nelson, a former Hewlett-Packard employee. The original technical staff and management were drawn heavily from Hewlett-Packard. Comlinear is a manufacturer and supplier of high-performance analog signal processing components. Comlinear's amplifier products include high-speed hybrid and monolithic operational amplifiers, buffers, and clamping amplifiers. Converter products include track/hold amplifiers, A/D converters, and D/A converters. The corporate philosophy is to focus development on products that make a significant contribution toward solving customer problems.

Comlinear Corporation is housed in a custom-built facility, which is DESC certified to MIL-STD-1772. This facility houses the manufacturing, quality assurance, R&D, administration, and marketing operations for the Company.

Comlinear's proprietary signal processing components are sold worldwide to a diverse group of commercial, industrial, and military customers.

Application areas include communications (satellite systems, radar, fiber optics), avionics (electronic countermeasures, instrumentation), video (high-resolution displays, video processing, and distribution), and automatic test equipment.

## BOARD

(Name and Affiliation)

David Nelson, Chairman  
Comlinear Corp., CEO

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President, CFO

Barry Rowan  
Hewlett-Packard, Finance

### VP R&D

John Farnbach  
Hewlett-Packard, R&D Manager

### Executive VP Marketing

David Ford  
Hewlett-Packard, Product Manager

### VP QA

Bob Vinton  
National Semiconductor, Quality Manager—  
Mil. Aero.

### VP Manufacturing

Hal Chase  
Hewlett-Packard, Manager—Hybrid Products

### CEO, Director Advanced Products

\*David Nelson  
Hewlett-Packard

\*Founder

## FINANCING

Not available

## ALLIANCES

### TRW LSI

May 1988

Comlinear and TRW LSI agreed to a joint development of high-resolution, high-speed data conversion products.

# **Comlinear Corporation**

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## **MANUFACTURING**

### **Facilities**

**Ft. Collins, CO**

**50,000 sq. ft.**

**Design, manufacturing, test, administration**

## **PRODUCTS**

**Op Amps**

**Unity Gain Buffer Amplifiers**

**Linear (Video) Amplifiers**

**Track & Hold Amplifiers**

**Encased Amplifiers**

**A/D Converters**

**D/A Converters**

## **OTHER INFORMATION**

**Comlinear's PR firm is Tallant/Yates.**

## Cree Research Inc.

2810 Meridian Parkway

Durham, NC 27713

919/361-5709

Fax: 919/361-4630

ESTABLISHED: 1987

NO. OF EMPLOYEES: N/A

### BACKGROUND

Cree Research Inc. was formed to develop, design, manufacture, and market discrete devices using silicon carbide (SiC) technology developed at North Carolina State University (NCSU). Founders of the Company are Eric Hunter; Calvin H. Carter, Jr.; Neal Hunter; John A. Edmond; and John Palmour—all former research team members at the university. Cree Research has obtained exclusive worldwide rights on the university's 10 U.S. SiC patents and on any future filings.

Initially, the Company is focusing on simple devices—diodes and blue LEDs that have immediate benefit to customers in aircraft engine applications, deep well drilling, and digital color imaging. Prototypes were introduced in April 1988.

In November 1987, the Company raised \$500,000 in financing to fund itself through the prototype stage. In March 1988, \$2.5 million was raised in first-round financing. The funds are being used to establish an 8,200-square-foot manufacturing facility, which was completed in July 1988.

The Company has won contracts with the Department of Defense, has set up arrangements for assembly and test services, and is discussing arrangements with major semiconductor manufacturers.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

Eric Hunter

MKS Instruments, District Sales Mgr

### Dir Technology

Calvin H. Carter

NCSU, Assoc Professor

### FINANCING

#### November 1986

Seed

\$0.5M

Not available

#### March 1988

Round 1

\$2.5M

Not available

### ALLIANCES

#### GI

August 1988

Cree and GI entered into a joint-development program to develop and manufacture silicon-based rectifiers.

### SERVICES

Assembly

Test

### MANUFACTURING

#### Technology

MESFETs and MOSFETs on silicon carbide

#### Facilities

Durham, NC

10,000 sq. ft.

Development, design, manufacturing

## **Cree Research Inc.**

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### **PRODUCTS**

#### **Diodes**

High-Temperature pn, 350° Centigrade with Reverse-Bias Leakage Current of less than 1 nanoamp at +125V

#### **Blue LEDs**

### **OTHER INFORMATION**

Cree Research does not employ a PR firm.

# Crystal Semiconductor Corp.

4210 South Industrial Road

P.O. Box 17847

Austin, TX 78760

512/445-7222

TWX: 910-874-1352

Fax: 512/445-7581

ESTABLISHED: October 1984

NO. OF EMPLOYEES: 100

## BACKGROUND

Crystal Semiconductor Corp. develops, manufactures, and markets advanced smart analog ICs that combine analog and digital functions on a single CMOS device for the telecommunications/data communications, instrumentation, and industrial automation market segments.

Crystal is a privately held company founded by Michael J. Callahan and James H. Clardy. Crystal acquired the assets and technology of Texas Micro-Circuit Engineering, a company that Michael Callahan founded and served as president.

Crystal is developing three product lines for a variety of niche markets: telecommunications/data communications including PCM transceivers and data communications transceivers; digitally enhanced analog-to-digital and digital-to-analog data acquisition products; and signal-conditioning and application-specific filters.

In April 1986, Crystal Semiconductor announced its first product, the CSC8870B, a DTMF receiver. The circuit can be used in telephone-answering machines and credit card verification systems. In June 1986, the CSC7008 Universal Filter and Crystal-ICE Filter Development System was offered. The development system is a PC-based system that incorporates filter synthesis, coefficient-generation software, and an in-circuit emulator (ICE).

Crystal Semiconductor markets its products through the combined efforts of a direct sales force and a worldwide network of manufacturers' representatives and distributors.

## BOARD

(Name and Affiliation)

H. Berry Cash, Chairman

Berry Cash Southwest Partnership

L.J. Sevin

Sevin, Rosen Management Company

\*James H. Clardy

Crystal Semiconductor

\*Michael J. Callahan

Crystal Semiconductor

\*Dietrich R. Erdmann

Sevin, Rosen Management Company

Steven Sharp

Independent Venture Cap., Megatest  
Power Integrations Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO

James H. Clardy

Harris, VP WW Ops

VP Engineering

Michael J. Callahan

Texas Micro-Circuit, Founder/Pres

VP Marketing

Craig H. Ensley

Rockwell, Director Mktg

VP Technology

Eric J. Swanson

AT&T, Telecom Engr Mgr

VP Sales

Alan R. Schuele

Cypress Semiconductor, Regional Sales Mgr

\*Founder

# Crystal Semiconductor Corp.

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## FINANCING

**October 1984**

Round 1

\$4.5M

Berry Cash Southwest Partnership; Dietrich Erdmann; Hambrecht & Quist; The Hill Partnership; InterWest Partners; Republic Investment Co.; Sevin, Rosen Management Company

**February 1986**

Round 2

\$6.7M

Original investors; Coronado Venture Fund; Crown Associates; Kleiner, Perkins, Caufield & Byers; Rho Management Company; Rust Ventures

**January 1987**

Equity

\$15.0M

Asahi Chemical

**June 1987**

Round 3

\$5.0M

Berkeley International

## RECENT HIGHLIGHTS

**January 1987**

Asahi Chemical acquired an 8 percent share in Crystal for about \$4 million. Asahi Kasei Microsystems, a subsidiary of Asahi Chemical, will manufacture and market Crystal's devices for the Far Eastern market. The agreement gives Crystal an aggregate financial package of \$15 million.

**April 1987**

Crystal offered the CS61534 analog line interface, which combines the analog transmit and receive line interface functions for T1/CEPT applications. The device features a programmable line driver and on-chip data-and-timing recovery circuit.

**April 1987**

Crystal offered the CS5016 16-bit, self-calibrating D/A converter featuring conversion

time of 16 microseconds, MPU interface, three-state output buffers, and digitally selectable unipolar or bipolar output ranges.

**May 1987**

Crystal offered the CSZ511X Series of 12-, 14-, and 16-bit successive approximation A/D converters for DSP systems.

**September 1987**

Crystal offered the CS7820 8-bit A/D self-contained converter with a 1.36-microsecond conversion time.

**October 1987**

Crystal offered the CS3112 self-calibrating, 12-bit, 1-microsecond track-and-hold amplifier.

**December 1987**

Crystal offered the CS5012-7 self-calibrating, 12-bit, 100-KHz sampling A/D converter with on-chip sample-and-hold amplifier.

**January 1988**

Crystal offered the CSZ5412 monolithic 12-bit, 1-MHz, self-calibrating A/D converter with on-chip track-and-hold amplifier, MPU interface, three-state output, and overrange output.

**August 1989**

Crystal reported its first quarterly profit since the company was founded in 1984.

## ALLIANCES

**Asahi Chemical**

January 1987

Asahi Chemical acquired an 8 percent share in Crystal for about \$4 million.

**Analogic Corp.**

June 1989

Crystal Semiconductor and Analogic Corp. signed a strategic alliance which established Analogic as a value-added re-seller of the Crystal ADC line.



## MANUFACTURING

### Technology

- 2.0-, 3.0-micron CMOS silicon-gate
- 2-layer poly structure, single layer of metal

### Facilities

- Austin, TX
- 25,000 sq. ft.
- Design and test

Crystal is planning a production facility in 1990. Currently, Orbit Semiconductor and International Microelectronic Products in the United States, Mitel Semiconductor of Canada, and Asahi Chemical of Japan provide foundry services.

## PRODUCTS

### Jitter Attenuators

- T1 1.5-MHz and CCITT 2.0-MHz Jitter Attenuators, 4.5- to 8.5-MHz Token-Ring Jitter Attenuators

### DTMF Receivers

### Fiber-Optic Transmitters/Receivers

- Optimodems, Fiber-Optic T1 Transmitter/Receivers, LEDs

### Analog Data Converters

- Crystal offers a full line of 12-, 14-, 16-, and 20-Bit A/D converters, with varying speeds and operating frequencies.

### Amplifiers

- Quad, 1-microsecond Acquisition Time, Track and Hold
- Single, 1-microsecond Acquisition Time, Track and Hold

### Filters

- Universal Digitally Programmable Switched-Capacitor Filter, ICE Development System

### Evaluation Boards

- Available for all product lines

### ISDN Primary Rate Line Interfaces

- T1 (1.544 MHz and PCM-30 (2.048 MHz) Line Interfaces, T1 Analog Interface

### ISDN Primary Rate Transceiver

- T1 Transceiver

### Military Devices

- 12-, 14-, and 16-microsecond A/D Converters

## OTHER INFORMATION

Crystal Semiconductor does not employ a PR firm.

# Custom Arrays Corporation

525 Del Rey Avenue  
Sunnyvale, CA 94086  
408/749-1166  
Fax: 408/749-1718  
Telex: 510-600-5119

ESTABLISHED: October 1984

NO. OF EMPLOYEES: 10

## BACKGROUND

Custom Arrays Corporation was formed to design and manufacture analog bipolar linear arrays that are supported by a CAE design software environment and run on MS-DOS on a PC AT hardware platform. The Company also offers quick-turn prototyping services.

The Company's founder is Pierre R. Irissou, who also serves as the Company president and the vice president of research and development. Mr. Irissou remains a board member of ATAC, which has exclusive marketing rights for Custom Arrays' products in France. In October 1987, the Company merged with a blind-pool public corporation and is listed on the pink sheets and traded OTC. The Company is incorporated in Nevada; however, all operations are conducted in Sunnyvale, California.

The Company's short-term strategy is to offer quick turnaround on prototypes based on its MM and MV families of bipolar arrays. The MM family consists of nine arrays with 2 to 28 macrocells. The MV family consists of five arrays with 4 to 20 macrocells. Both families are a result of a joint development venture with Ferranti-Interdesign, located in Scotts Valley, California.

The Company's long-term strategy is to expand its bipolar array offerings to include thin-film technology options, including laser-trim capability. Custom Arrays is developing new arrays based on a high-voltage BiCMOS process compatible with thin-film technology.

Custom Arrays has expanded its facilities to support in-house reticle and mask manufacture, direct-step-on-wafer (DSW) photolithography,

wafer processing for metal patterning and top-glass passivation, dice-package assembly, and full-production testing at both the wafer and package level.

## BOARD

(Name and Affiliation)

B. Bornette, Chairman  
ELF Aquitaine, France  
\*Pierre R. Irissou  
Custom Arrays Corporation  
George Krautner  
Custom Arrays Corporation  
Emmanuel Celerier  
SOFIPA, France  
Herve Thiriez  
Independent

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
\*Pierre R. Irissou  
ATAC Diffusion S.A., Managing Director  
  
Exec VP  
George Krautner  
Ferranti-Interdesign, VP Mktg/Sales  
  
VP Finance  
William Hass  
Ferranti-Interdesign, VP Finance  
  
VP Corporate Development  
Arun Pande  
Not available  
\*Founder

# Custom Arrays Corporation

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## FINANCING

October 1984

Seed

\$300,000

ATAC Diffusion S.A. (division of ELF  
Aquitaine)

October 1986

Seed

\$500,000

SOFIPA (investment division of ELF  
Aquitaine)

July 1987

Seed

\$400,000

FINAXIA, private investors

October 1987

Seed

\$145,000

Merger with Venture Nexus, Inc.

May 1988

Seed

\$500,000

Societe Financiere Internationale de  
Participations

Gaz et Eaux

\$500,000

## PRODUCTS

### Linear Arrays

MM Family of 20V Bipolar Analog Arrays with 2 to 28 Macrocells

MV Family of 40V Bipolar Analog Arrays with 4 to 20 Macrocells

### Development Tools

B-SPICE

Circuit (SPICE) Simulator (PC 386)

LIBERTY

MM and MV Layout and Verification Software

PC-PG

Mask File Translator for Pattern Generation

LIKE

Cell-Based IC Design Software

## OTHER INFORMATION

Custom Arrays Corporation's PR firm is Joyce Lekas Associates.

## ALLIANCES

### ATAC-Diffusion

1984

ATAC operates a design center and conducts  
marketing for Custom Arrays in Europe.

### Ferranti-Interdesign

1984

The MM family is the result of a joint develop-  
ment venture with Ferranti-Interdesign, Inc.

Ferranti-Interdesign acts as a second source.

### Teledyne

February 1988

Custom Arrays entered into a joint develop-  
ment agreement with Teledyne Semiconductor  
for a new family of BiCMOS semicustom and  
cell-based libraries. The technology will feature  
operating voltage levels of 18V.

## SERVICES

Quick-turn prototyping

## MANUFACTURING

### Technology

Bipolar

BiCMOS

### Facilities

Sunnyvale, CA

12,000 sq. ft.

Manufacture, assembly, test

## Custom Silicon Inc.

600 Suffolk Street  
Lowell, MA 01854  
617/454-4600  
Fax: 617/458-4931

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 25

### BACKGROUND

Custom Silicon Inc. (CSI) was formed to serve the low-volume and high-complexity ASIC markets by acting as a "time-shared captive semiconductor division" to companies in regional markets. It acts as a value-added reseller of wafer fabrication capacity through its strategic relationships with major semiconductor manufacturers.

CSI's approach is one of extremely vertical marketing that focuses on applications. CSI offers 2- and 3-micron CMOS gate arrays and standard cells that are supported on Mentor, Daisy, FutureNet, and VIEWlogic workstations. CSI currently produces devices with up to 14,000 gates and planned to add a family of CMOS and bipolar linear arrays in the first quarter of 1987.

CSI is the ASIC distribution channel for NCR Corporation for both New England and the Pacific Northwest; it is also the northeastern independent design center for Motorola. In September 1986, WSI NCR licensed CSI's standard cell library that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863 gates. CSI's library was built from NCR's existing library.

CSI's sales strategy is to build a network of regional operations to act as distribution channels for major manufacturers that serve the engineering-intensive segments of the ASIC market.

### BOARD

(Name and Affiliation)

Albert P. Belle Isle  
Custom Silicon Inc.

Richard A. Charpie  
Paine Webber Ventures  
David W. Guinther  
Custom Silicon Inc.  
Sumner Kaufman  
Kaufman & Co.  
Kenneth J. Revis  
Turner Revis Associates  
Henry R. Shean  
Custom Silicon Inc.

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

Albert P. Belle Isle  
Wang, Vice President

#### VP R&D

Donald L. Gay  
Wang, Program Mgr

#### VP Marketing

David W. Guinther  
Wang, Program Dir

#### VP Finance

Henry R. Shean  
Wang, Controller R&D

#### VP Sales

Robert J. Brown, Jr.  
SGS, VP Sales

### FINANCING

April 1983

Seed

\$0.1M

Kaufman & Co.; private investors

# Custom Silicon Inc.

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## February 1984

Round 1

\$1.1M

Bank of New England; First Chicago; Turner  
Revis Associates

## June 1985

Round 2

\$2.8M

Original investors; Massachusetts Capital  
Resource Company; Paine Webber Ventures

## VIEWlogic

October 1985

CSi offered its standard cell library on  
VIEWlogic's Workview PC-based workstation.  
The library includes 165 digital primitives and  
7,400 TTL macrocells.

## Motorola

August 1986

CSi agreed to act as the northeastern  
independent design center for Motorola.

## ALLIANCES

### NCR

November 1983

CSi and NCR entered into an exclusive tech-  
nology licensing and sourcing agreement under  
which CSi will design and resell cell-based and  
gate array products in New England. The prod-  
ucts use NCR's 3.0-micron CMOS and NMOS  
technologies. NCR provides manufacturing.

September 1986

NCR licensed CSi's standard cell library that  
includes 342 TTL macrocells and microcom-  
puter building blocks of up to 5,863 gates.  
CSi's library was built from NCR's existing  
library.

### FutureNet

March 1984

CSi offered its standard cell library on the  
FutureNet DASH design system.

## SERVICES

Wafer fabrication agent

## MANUFACTURING

### Technology

3.0-, 2.0-, and 1.5-micron CMOS and bipolar

### Facilities

Lowell, MA

12,000 sq. ft.

Design

CSi has a long-term licensing and sourcing  
agreement with NCR, which provides preferred  
access to multiple manufacturing facilities.

## PRODUCTS

### CMOS Standard Cells

Device	Description
Micro Blocks Family	200 Cells Including Adders, ALUs, Multiplexers; Dual-Port RAMs; Multiplexers, Shift Registers; and Three-State Bus Drivers
TTL Macro Cells	Encoders, Decoders, Adders, Shift Registers, Multiplexers, Counters
Supercells	ROM, RAM, EEPROM, PLA, MPU, Timer, SCSI Controller
Analog Cells	General-Purpose Op Amp and Comparator, 8-Bit A/D and D/A Converter, Current-Bias Generator, Analog Switch, Oscillators

### CMOS Gate Arrays

Family	Linewidth (Microns)	Delay (ns)	Gates
HCA 6200	2.0	1.9	2,430 to 4,860
HCA 6300	3.0	2.5	648 to 2,295
HCA 62A00	2.0	1.1	600 to 8,558

**CMOS Standard Cells (Continued)**

**Bipolar Gate Arrays**

<b>Family</b>	<b>Technology</b>	<b>Delay (ns)</b>	<b>Gates</b>
MCA ECL	ECL	0.5	652 to 2,500
MCA ALS	TTL	1.1	500 to 2,800
MCA ETL	Mixed ECL/TTL	1.1	2,950

**OTHER INFORMATION**

Custom Silicon does not employ a PR firm.

# Dallas Semiconductor Corporation

4350 Beltwood Parkway

Dallas, TX 75244

214/450-0400

Fax: 214/450-0470

ESTABLISHED: February 1984

NO. OF EMPLOYEES: 500

## BACKGROUND

Dallas Semiconductor Corporation designs, manufactures, and markets low-power CMOS memory, linear, and microcontroller circuits and subsystem products. The Company is an applications-oriented supplier that uses proprietary late-definition techniques to customize wafers after test and characterization. This flexibility, called soft silicon, is achieved through the use of lithium power sources, direct laser writing, high-energy ion implantation, and subsystem integration.

The resulting products offer OEMs the advantage of adding functionality without the redesign of existing systems. Some of the more innovative products are the Company's intelligent sockets, which add features such as nonvolatility and timekeeping ability; timekeeping circuits, which replace up to 20 discrete components in the IBM PC AT and PS/2-compatible computers; silicon timed circuits, which replace crystal and discrete components and feature-precise, system-signal timing; security products, which protect software from unauthorized use; teleservicing products that provide the capability to perform remote software upgrades and service equipment anywhere in the world over the telephone line; chips that provide the structure for two-way data transmission through the air, resulting in wireless, automatic identification; and a family of modular chip-laden subassemblies that snap into locking connectors for rapid construction of electronic systems.

In August 1984, Dallas purchased Commodore's Texas plant for \$3.5 million. Until early 1987, the Company purchased all wafers and completed its late-definition technique at its plant in Texas. In 1987, Dallas completed construction of a \$10 million wafer fabrication facility adjacent to its headquarters. The facility was expanded in 1988 to increase capacity. It includes a

10,420-square-foot, Class 1 clean room and has the capacity to produce 6-inch CMOS wafers with geometries down to 0.6-micron. Currently, Dallas processes about 90 percent of its wafer needs.

Dallas Semiconductor ships its wafers to assembly contractors in the Philippines and Korea for separation and packaging. It conducts burn-in and final testing on its devices and conducts its own subsystem assembly.

Dallas markets to OEMs in the United States, Canada, Europe, and Asia. The Company uses a direct sales force, worldwide distributors, and authorized manufacturers' representatives.

## BOARD

(Name and Affiliation)

\*C. Vin Prothro, Chairman  
Dallas Semiconductor Corporation

\*John Smith, Jr.  
Dallas Semiconductor Corporation

Chao C. Mai  
Dallas Semiconductor Corporation

M.D. Sampels  
Worsham, Forsythe, Sampels, and Wooldridge

Richard L. King  
Ventech Partners, L.P.

C. Richard Kramlich  
New Enterprises Associates

Carmelo J. Santoro  
Silicon System, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*John Smith, Jr.  
Mostek, Facilities Dir

# Dallas Semiconductor Corporation

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## CEO

\*C. Vin Prothro  
Mostek, President, CEO, Chairman

## VP Mfg

\*Chao Mai  
Mostek, VP R&D

## VP Mktg & Prod

\*Michael Bolan  
Southwest Ent., Mgr Tech Planning  
Development

## VP Sales

Sandy Scherpenberg  
Mostek, Applications Engineer

## Controller

Michael Pate  
Arthur Young & Co., Senior Auditor

\*Founder

## FINANCING

### February 1984

Seed

\$2.0M

Abingworth Ltd., New Enterprises Associates,  
Southwest Enterprises Associates; Ventech  
Partners

### June 1984

Round 1

\$10.8M

Initial investors; Arscott, Norton & Assoc.;  
Crossroads Capital; First Source Capital Corp.;  
John Hancock Venture Capital Fund LP;  
Merrill, Pickard, Anderson & Eyre; New  
Venture Partners; Oak Investment Partners;  
Republic Venture Group; J.F. Shea &  
Company; Venture Growth Associates

### Industrial Bond

\$6.5M

Republic Bank, Dallas

### March 1986

Round 2

\$15.0M

Previous investors, British Petroleum Ventures,  
Alex Brown & Sons, Emerging Growth Stocks,  
HLM Partners, Merifin N.V.

### April 1987

Round 3

\$5.0M

Abingworth Ltd., Alex Brown & Sons, British  
Petroleum Ventures, Emerging Growth Stocks,  
HLM Partners, Merifin N.V., New Enterprise  
Associates, Southwest Enterprises Associates, T.  
Rowe Price, Threshold Fund, Ventech Partners

### September 1987

\$35.1M

Initial public offering

## RECENT HIGHLIGHTS

### Q1 1987

Dallas began producing wafers in a newly  
constructed, \$10 million wafer fabrication  
facility adjacent to its headquarters.

### February 1987

Dallas offered the DS2167 digital signal  
processor (DSP) said to double the link of  
full-duplex telephone transmission lines. The  
DS2167 combines a DSP with the adaptive  
differential pulse code modulation (ADPCM)  
standard.

### March 1987

Dallas offered the DS5000 8-bit CMOS soft  
MCU, which features nonvolatile technology  
designed to preserve all information in the  
absence of power.

### October 1987

Dallas offered 3.75 million shares of common  
stock at \$9 per share in an initial offering and  
raised \$36 million. The proceeds will be used  
for capital equipment and general corporate  
purposes.

### October 1987

Dallas offered the DS1207 CMOS Timekey  
circuit designed to control access to PC soft-  
ware packages for specified periods of time.

### May 1987

Dallas and Xecom signed a second-source  
agreement covering Xecom's modem products  
and development kits and Dallas' SmartSocket  
and SmartWatch families. The companies will  
also cooperate on developing and manufac-  
turing future modem-related products, the  
area of Xecom's expertise.



# Dallas Semiconductor Corporation

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## August 1987

Dallas and Amp, Inc., formed an R&D partnership to solve applications problems with semiconductor technology.

## December 1987

Dallas filed a suit against Maxim Integrated Products. The suit was in response to warnings by Maxim that Dallas is violating certain receiver/transmitter patents held by Maxim.

## December 1987

Dallas reported fourth-quarter revenue of \$9.8 million and a net income of \$1.5 million for the period ending December 31, 1987. Fiscal 1987 revenue was \$30.7 million and net income was \$2.6 million, which included an extraordinary benefit of \$954,000.

## ALLIANCES

### Thomson-Mostek

January 1986

Thomson-Mostek (TCMC) was given royalty-free rights to second-source Dallas' multiport memory. In exchange for these rights, Dallas received an option to purchase a percentage of the products from Thomson. Dallas also received laser production equipment from Thomson and received technical information on TCMC's MK4501 FIFO.

## PRODUCTS

### SRAMs

16K, 64K, 256K, and 1024K Nonvolatile SRAMs, and a 1024K Serial RAM

### Multiport Memory Chips

512x9, 1024x9, 2048x9, and 4096x9 FIFOs and a quad-port Serial RAM

### Microcontrollers

8-Bit Soft MCUs, 8-Bit Time MCUs, CMOS Microcontrollers, Evaluation Kits, Development Kits

### Linear Telecommunications Circuits

Transceivers, Line Monitor and Line Interfaces, Network Interfaces, ADPCM Processors, Receiver Buffers

### Timekeeping Devices

Clocks, Timekeepers, Clock plus NV SRAMs, Clock plus RAMs

### Intelligent Sockets

Lithium-powered sockets—inserted CMOS RAMs become nonvolatile, some with timekeepers

## Xecom

May 1987

Dallas and Xecom signed a three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families. The companies also agreed on the joint development of and manufacture of future modem-related products, the area of Xecom's expertise.

## Amp

August 1987

Dallas and Amp, Inc., formed an R&D partnership that will develop innovative interconnect techniques.

## MANUFACTURING

### Technology

3.0- to 0.6-micron CMOS  
6-inch wafers

### Facilities

Dallas, TX

150,000 sq. ft.

Manufacturing area and a 10,420-square-foot  
Class 1 clean room

60,000 sq. ft.

Warehouse, offices

# Dallas Semiconductor Corporation

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## Silicon Timed Circuits

5-Tap, 10-Tap, 3-in-1, and 7-in-1 Delay Lines

## Security Products

Electronic Security Devices, Encrypted Keys, Time Keys, Electronic Keys

## User-Insertable Memory

Memory Cartridges, Electronic Key Adaptors, Electronic Tags, PC Ports

## Integrated Lithium Battery Backup

Lithium-powered NV controllers, Power Packs, Power Monitors, NVRAM Controllers

## Systems Extensions

RS-232 Transceivers, Serial Ports, BankSwitches, Configurators, Micro Monitors, Micro Managers

## SipStick Prefabs

FIFO, SRAM, DRAM, DAA, ADPCM, SoftModem, and Micro Packaging Options

## Wireless Products

Proximity Key and Tags, Micro Power Receiver/Interpreters, Byte-wide to Serial Converters, RF Communicators, Wireless SipSticks, Starter Kits

## Teleservicing Components

TeletMicro Cartridges, Teleservicing Kits, 212A Modem Modules, Data Access Arrangements, Modem Evaluation Kits

## OTHER INFORMATION

Dallas Semiconductor's PR firm is Simon McGarry.

# Dolphin Integration SA

8, Chemin des Clos-ZIRST

38240 MEYLAN, France

33 (76) 41-10-96

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 20

## BACKGROUND

Dolphin Integration SA provides design, marketing, and fabrication subcontracting for selected niche market ICs and related software. The Company was launched as a design center and has developed a set of portable design rules for 2- to 1-micron CMOS technology. Dolphin's design rules adapt to any silicon foundry's process. Dolphin has enlarged its catalog of design rules to include analog technologies using double-poly from 3.0 to 1.5 micron. The Company has also developed signal-processing and protocol ICs.

## BOARD

(Name and Affiliation)

Michael Depeyrot, Chairman  
Dolphin Integration SA, President

Jean Gouliardon  
SAGEM International

Michael Capart  
EPICEA

Bernard Michelon  
SOGINNOVE

Pierre Faurre  
SAGEM, Chairman

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Michael Depeyrot  
Thomson Semiconductors, VP Engr

## PRODUCTS

### Developmental Tools

VAX Network with Three Families  
Tektronix X115, MicroVAX II, and COMPAQ 396  
ECAD Software (ICAP and MASKAP)  
LoF Cell Generator

## OTHER INFORMATION

Dolphin Integration does not employ a PR firm.

## FINANCING

### 1985

Initial

\$600,000

EPICEA, SAGEM, SOGINNOVE, and  
founders

## ALLIANCES

Dolphin has entered an agreement with a  
CAD/CAM group in California.

## SERVICES

ASIC Design

## MANUFACTURING

### Technology

DIGIT—2.0- to 1.0-micron double-metal CMOS  
DIANA—3.0- to 1.5-micron analog CMOS  
DIXIE—Mixed high-power (BiMOS) and low-  
voltage CMOS

### Facilities

Not available

**The DSP Group Inc.**  
1900 Powell Street, Suite 1120  
Emeryville, CA 94608  
415/655-7311  
Fax: 415/655-7537

**ESTABLISHED: October 1988**

**NO. OF EMPLOYEES: N/A**

## **BACKGROUND**

The DSP Group Inc. was founded in October 1988 to develop technologies for a variety of applications, specializing in digital signal processing. The Company currently offers products in the telecommunications market. The DSP Group develops algorithms using digital signal processing as applied to voice/speech modification and enhancement.

The Company has a variety of technologies that it embeds in general-purpose digital signal processing chips. These chips are sold to OEMs, mostly high-volume consumer product manufacturers. DSP Group technologies, which can be used individually or in combinations, include noise reduction, voice-activated switching, voice compression, echo cancellation, voice recognition, and voice synthesis.

The DSP Group's current and future product offerings reflect these technologies. The Company currently is shipping telephone answering machine chip sets and cellular telephone chip sets. By the end of 1990, the company plans to have dictating equipment chip sets and integrated telephone/facsimile chip sets in volume production.

To date, the DSP Group has raised nearly \$4.5 million in three rounds of financing, provided by private, corporate, and venture capital sources. All manufacturing is subcontracted; design and headquarters operations are located in the Company's Emeryville, California, facility. The DSP Group also has a subsidiary located in Israel.

## **BOARD**

(Name and Affiliation)

Davibi Gilo  
The DSP Group, President

Donald Yost  
Dey Corporation/The DSP Group  
Herman Fialkou  
PolyVenture  
Shelton Wert  
Investor Group—Minneapolis

## **COMPANY EXECUTIVES** (Position and Name)

**President**  
Davibi Gilo  
**VP R&D**  
Shabtai Albersberg  
**VP Mktg**  
Don Yost (Acting)  
**VP Finance**  
Gibi Bartak  
**GM Israel Operations**  
Zvi Slomimski

## **FINANCING**

Round 1  
\$1.2M  
Davibi Gilo  
Round 2  
\$750,000  
PolyVenture  
Round 3  
\$750,000  
Minneapolis Group  
Round 4  
\$1.8M  
Marubun-Japan

## **MANUFACTURING**

### **Technology**

DSP subcontracts all manufacturing.

# **The DSP Group Inc.**

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## **Facilities**

Emeryville, CA

Design, marketing, headquarters

Israel

R&D

## **PRODUCTS**

Telephone Answering Machine Chip Sets

Cellular Telephone Chip Sets

Digitating Equipment Chip Sets

Integrate Telephone/Fax Chip Sets

## **OTHER INFORMATION**

The DSP Group's PR firm is Paul Pease.

# Edsun Laboratories, Inc.

564 Main Street  
Waltham, MA 02154  
617/647-9300

ESTABLISHED: 1984

NO. OF EMPLOYEES: N/A

## BACKGROUND

Edsun Laboratories was formed in 1984 by Steve Edelson. Edsun currently offers memory and modem controller chips as well as a chip used in PC accelerator boards. Edsun's flagship product, however, is the Continual Edge Graphics (CEG) color-palette DAC chip. The Company's mission is to enhance the graphics capability of PCs, workstations, and other display environments dramatically through its patented CEG technology.

Edsun's DAC chip is designed to improve the performance of VGA-based PC graphics dramatically. The Company claims that it will enhance the effective resolution of a 640 x 480-pixel screen to the equivalent of a 2,000 x 2,000-pixel screen. Edsun also claims that the chip will increase the effective number of colors in an 8-bit system from 256 to 700,000. It will smooth jagged PC graphics to the point where they rival those seen on high-resolution monitors used in engineering workstations or CAD/CAM systems. This new chip will allow existing graphics boards to be upgraded without modification or redesign. The circuit achieves high-resolution simulation by determining a shading value for the edge pixel and blending the shades to the new appropriately weighted color, giving the appearance of a perfectly smooth edge.

Edsun subcontracts all fab and assembly operations to outside companies. The Company conducts some test operations in-house. Although Edsun will continue to support its other existing products, the Company will focus on the development of a family of CEG products in the future. The Company plans to eventually offer CEG for PCs, laptops, and workstations.

## BOARD

(Name and Affiliation)

\* Steve Edelson, Chairman  
Edsun Laboratories

Richard Simon

Edsun Laboratories, President

Ted Dintersmith

Aegis Funds, General Partner

Jerry Fishman

Analog Devices, Executive VP

Peter Santeusanlo

Hambro International Ventures Fund

## COMPANY EXECUTIVES

(Position and Name)

President

Richard Simon

VP R&D

George Heron

\*Founder

## FINANCING

July 1988

Amount not available

Hambro International Ventures Fund, Aegis  
Venture Funds

## ALLIANCES

Edsun has licensed its CEG technique to Dubner Computer Systems and Calcomp.

## MANUFACTURING

Technology

Not available

Facilities

Waltham, MA

10,000 sq. ft.

Design, test, marketing

## **Edsun Laboratories, Inc.**

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### **PRODUCTS**

Edsun Continual-Edge graphics  
Microchannel Memory Controller (EL2010)  
Microchannel Modem Controller (EL2050)  
Accelerator Board Chip (EL286-88)

### **OTHER INFORMATION**

Edsun Laboratories does not employ a PR firm.

**Elantec, Inc.**  
1996 Tarob Court  
Milpitas, CA 95035  
408/945-1323

ESTABLISHED: July 1983

NO. OF EMPLOYEES: 155

## BACKGROUND

Elantec, Inc., designs, manufactures, and markets high-performance analog circuits using dielectric-isolation (DI) monolithic and hybrid technologies. The circuits are designed to be used in military and high-performance commercial applications. The Company supplies products to more than 25 military OEMs.

Elantec concentrates on high-performance analog IC and hybrid solutions and has identified a niche for very high speed operational amplifiers and buffers in video, page scanner, and fast radar systems. Advanced technologies are employed, including dielectric isolation, which allows very high speed npn and pnp transistors in the same chip.

Initially, Elantec offered alternatively sourced products for National Semiconductor's high-performance multichip amplifiers. In 1985, Elantec introduced its first proprietary monolithic IC that uses both dielectric- and junction-isolation processing techniques. Early in 1986, Elantec expanded into alternatively sourced versions of Harris Semiconductor's components that use a complementary bipolar dielectric-isolation process. Harris-sourced devices include op amps and buffers. Elantec also is developing proprietary devices such as a servo loop controller. In the long term, the Company is considering data acquisition circuits.

One of the key strengths of the Company has been its military program. Elantec's facilities have been qualified by more than 25 major military OEMs including General Dynamics, Hughes, IBM, and Lockheed. The Company's facilities comply with MIL-STD-M38510, MIL-STD-1772A, and MIL-STD-883, Revision C. Elantec was the fourth among approximately 20 companies in the world to be certified to produce hybrid devices to MIL-STD-1772A. Elantec also places a great deal of emphasis

on reliability and has adopted a two-for-one guarantee under which a part that fails is replaced with two good devices.

In December 1987, Elantec announced that its wafer fabrication facility in Milpitas, California, is operational. The facility uses its proprietary dielectric-isolation process and is capable of producing 2,000 4-inch wafers per month. Initially, the facility will produce 3-inch wafers. Elantec manufactures all military products onshore, with some commercial assembly done in Southeast Asia.

European operations are managed from London, and Japanese sales are handled by Internix, a Japanese distributor. Marshall, Wyle, and Zeus are signed as North American distributors. Elantec also has regional sales offices in Dallas, Texas, and in Boston, Massachusetts.

## BOARD

(Name and Affiliation)

Tom Winter

Burr, Egan, Deleage

George Sarlo

Walden Capital Corporation

Jim Diller

Sierra Semiconductor

David O'Brien

Elantec, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**

David O'Brien

PMI, President/CEO

**VP Marketing**

Dean Coleman

National Semiconductor, Analog Mktg Mgr



## Elantec, Inc.

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### VP Operations

Richard Corbin  
PMI, VP Technology

### VP Sales

Ralph Granchelli  
Teledyne Semiconductor, Ntl Sales Mgr

### VP Engineering Design

Barry Siegel  
National Semiconductor, Std Hybrid

## FINANCING

### July 1983

Round 1  
\$2.7M  
Venture capital

### August 1984

Round 2  
\$3.1M  
ALTA-Berkeley Eurofund; Associated Venture Investors; BNP Venture Capital Corporation; Burr, Egan, Deleage & Co.; International Industrial Interests; Murray Electronics; Pacific Technology Ventures; Paribaven; Thorn EMI Venture Fund; Walden Capital Corporation

### August 1985

Round 3  
\$2.5M  
Original investors, Jean Claude Asscher, Paribas Technology, Hytec Investment

### December 1986

Round 4  
\$7.8M  
Capital Riksa Trust, CEI, Cypress Fund, Harvard Management, Morgan-Holland, Sequoia Capital, St. James Venture Capital Fund, U.S. Venture Partners, and others

### September 1988

Round 5  
\$7.3M  
First Century Partners; Merrill Lynch Venture Capital; Inman & Bowman; Sequoia Capital; U.S. Venture Partners; Morgan-Holland; Burr, Egan, Deleage; Walden Associates; Associated Venture Investors; and Harvard Management

## RECENT HIGHLIGHTS

### March 1987

Elantec offered the EL2017J/883B monolithic closed-loop servo controller that features both precision linear and high-current switching modes of operation.

### May 1987

Elantec offered the EL2020, a 50-MHz current-feedback amplifier that is optimized for video and other applications, with gains between -10 and +10.

### September 1987

David O'Brien joined Elantec as president and chief executive officer, and Richard Corbin joined as vice president of operations. Mr. O'Brien replaced Al Vindasius, who left the Company to pursue other interests.

### November 1987

Elantec signed an agreement allowing Micro Power to market Elantec's FET power buffers.

### December 1987

Elantec announced that its wafer fabrication facility is operational.

## ALLIANCES

### Micro Power

November 1987  
Elantec reached a joint agreement under which Micro Power will market Elantec's FET power buffers (expired).

## MANUFACTURING

### Technology

5-micron bipolar  
4-inch wafers

### Facilities

Milpitas, CA  
30,000 total sq. ft.  
Corporate offices and manufacturing  
8,500 sq. ft.  
Class 1,000 clean room

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**PRODUCTS**

<b>Device</b>	<b>Description</b>
EL2003/2033	Video Line Driver
EL2004	350-MHz FET Buffer
EL2005	High-Accuracy Buffer
EL2006	Precision High-Speed FET Amplifier
EL2007	Precision Servo Driver
ED2015	350-MHz Quad PNP
EN2016	300-MHz Quad NPN
EL2017	Servo Controller
EL2018	Fast, High-Voltage Comparator with Latch
EL2019	Fast, High-Voltage Comparator with Master/Slave Flip-Flop
EL2020	50-MHz Current-Mode Feedback Amplifier
EL2022	165-MHz Current-Mode Feedback Amplifier
EL2039/2040	Very High Slew, Wideband Op Amp
EL2190	Wideband, Fast-Settling Op Amp
ELH0002	100mA Current Buffer
ELH0021	1A Power Op Amp
ELH0032	High-Speed FET Op Amp
ELH0033	High-Speed FET Buffer
ELH0041	200mA Power Amp
ELH101	2A Power Op Amp
EDH0006	Current Driver
EDH0008	High-Voltage, High-Current Driver
EHA2500	Precision, High-Slew-Rate Op Amps
EHA2520	Uncompensated, High-Slew-Rate Op Amps
EHA2539	Very High Slew, Wideband Op Amp
EHA2600	Wide-Bandwidth, High-Impedance Op Amp
EHA2620	Wide-Bandwidth, Uncompensated Op Amps
EHA2540	Very High Slew Rate Op Amp
EHA5190	Wideband, Fast-Settling Op Amp
EHOS100	125-MHz Buffer
EHOS200	200-MHz Buffer
EL2031	550-MHz Buffer
EHA2400	4-Channel Programmable Amplifier
EL2021	Monolithic Pin Driver

**OTHER INFORMATION**

Elantec's PR firm is Independent Public Relations Associates.

# Electronic Technology Corporation

Wholly Owned Subsidiary of J-TEC

ISU Research Park

2501 North Loop Drive

Ames, IA 50010-8284

515/296-7000

Fax: 515/296-7001

ESTABLISHED: December 1983

NO. OF EMPLOYEES: 14

## BACKGROUND

Electronic Technology Corp. (ETC) provides linear and digital design with an emphasis on linear products. The Company also provides complete fabrication, packaging, and test services and guarantees that production units will be 100 percent compatible with prototypes.

ETC was funded initially by a midwestern consortium of venture organizations. ETC's primary customer base is in the midwestern corridor (extending from the eastern slopes of the Rockies to the Ohio Valley). The Company plans to become the midwest's major supplier and has a close working relationship with the Micro Electronics Research Center at Iowa State University in Ames.

ETC has agreements for foundry services with Exar and Gould Semiconductor. In October 1985, the Company signed an agreement with NCR to establish design centers for cell-based ICs.

## BOARD

(Name and Affiliation)

Theodore Johnson, Chairman  
J-TEC, President

Len A. van der Have  
Electronic Technology Corporation

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Len A. van der Have  
Datalinear, VP Marketing

## Dir Technology

William A. Burkland  
Micro Electronics Research Center, Associate  
Scientist

## Dir Operations

Scott P. Yeager  
NCR, Field Service Engineer

## Dir Quality Assurance

Barbi Jo Cosgrove  
Bournes, Inc., Quality Assurance Eng

## Fin Mgr

Lynn A. Sackett  
Clyde Industries, Accountant

## FINANCING

1983  
Initial  
\$2.0M  
State and venture capital

## ALLIANCES

Exar  
December 1983  
Exar provides foundry services for ETC.

## AMI

1984  
ETC and AMI signed agreements covering 3.0- and 5.0-micron, single-layer metal CMOS gate arrays. AMI provides foundry services.

## NCR

October 1985  
ETC agreed with NCR to establish design centers for standard cell ICs and to design standard cells for NCR (expired).

# Electronic Technology Corporation

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## U.S. Government

March 1989

Prime contractor—federal government contract

## SERVICES

Custom Design

Manufacturing

Packaging

Test

Military Standard Testing

## MANUFACTURING

### Technology

2.0-, 5.0- and 9.5-micron CMOS

Bipolar

### Facilities

Ames, IA

7,850 sq. ft.

Total space

500 sq. ft.

Class 100 clean room

## PRODUCTS

Industry-Standard (20V) Array with 11 Arrays

High-Voltage (75V) Array with 1 Array

BiFET (36V) Arrays with 3 Arrays

Cellular (20V) Array with 1 Array

2.0-micron Bipolar Digital

5.0-micron Cell Custom Linear Digital/Bipolar

1.25 to 9.0-micron CMOS Digital

8.0-micron PMOS

## OTHER INFORMATION

ETC does not employ a PR firm.

## Epitaxx Inc.

3490 U.S. Route One  
Princeton, NJ 08540  
609/452-1188  
Fax: 609/452-0824

ESTABLISHED: 1984

NO. OF EMPLOYEES: 50

### BACKGROUND

Epitaxx Inc. produces indium gallium arsenide phosphide (InGaAsP) light-emitting diodes, lasers, and photodetectors for fiber-optic and infrared instrumentation applications. The Company also supplies InGaAsP using a proprietary crystal growth technique called vapor phase epitaxy (VPE), which allows the elements to be deposited from gases. Custom services include 2,000 and 2,500nm photodiodes, detector arrays, and pulsed laser diodes. Epitaxx sells its components to telecommunications vendors, such as GTE and ITT, and to fiber-optic companies such as Fibercom and Plantronics Wilcom.

In order to expand its products, Epitaxx conducts R&D sponsored by industry and the government. The following are some of the Company's development activities:

- InGaAs linear arrays for use in spectroscopy and imaging and airborne communication
- Extended-range sources and detectors for optical sensors and transoceanic communications applications
- InGaAs avalanche photodiodes for optical communications and sensors, range finding, and instrumentation applications
- 5mm InGaAs visible response (500 to 1,700nm) detectors for optical test and calibration and temperature sensors

The Company was founded by Dr. Gregory Olsen and Dr. Vladimir Ban, former research scientists at the RCA David Sarnoff Research Laboratories in Princeton, New Jersey. The founders developed the VPE applications while employed there.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Dr. Gregory Olsen  
RCA, Scientist

#### Exec VP

\*Dr. Vladimir Ban  
RCA, Scientist

#### Marketing VP

Yves Dzialowski  
General Optronics, Foreign Sales Manager

#### Finance VP

James Coleman  
Lenox China, Account Exec

\*Founder

### FINANCING

March 1984

Round 1

\$1.5M

DSV Partners, Warburg Pincus

### RECENT HIGHLIGHTS

February 1988

Epitaxx announced that the Company was selected by the NASA Goddard Space Flight Center for a Phase-II Small Business Innovative Research (SBIR) contract to develop large-area InGaAs photodetectors for the 500 to 1,700nm spectral range.

# Epitaxx Inc.

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## March 1988

Epitaxx announced that the Company was awarded a \$50,000, Phase-I SBIR contract by NASA's Goddard Space Flight Center to develop a linear array of InGaAs detectors. The array will have a minimum of 32 elements (30 x 30 microns each) and will be installed in a commercial multiplexer readout. Epitaxx plans to apply for a Phase-II program based on linear arrays of InGaAs detectors that are sensitive over the 0.8- through 2.2-micron spectral range.

- Large-area (0.5 to 3.0mm) InGaAs detectors for gyroscopes, gas sensors, space photography, SWIR detection, and fiber-optic test instrumentation
- High-speed, small-area, planar InGaAs PIN photodiodes for light-wave and range-finding receivers

## April 1988

Epitaxx exhibited the following infrared components at CLEO '88:

- Edge-emitting LEDs (1,300 and 1,550nm) in a low-cost pigtailed package for local communication and optical instrumentation

## ALLIANCES

Not available

## MANUFACTURING

### Technology

InGaAs

## PRODUCTS

Device	Description
Epitaxx 1300 ETX60B	High-Power LEDs, 1,550 and 1,300nm PIN InGaAs Photodetector, Low Capacitance and High Speed, 1,300 and 1,550nm
ETX75/100/300 ETX75F/100F	InGaAs PIN Photodetectors, 900 to 1,700nm, with High Responsivity InGaAs Fibered Photodetectors with Low Dark Current and Capacitance, 1,300 and 1,550nm
ETX500/1000/2000	InGaAs Photodetectors, for Low Noise Measurements of Long Wavelengths (900 to 1,700nm)
ETX3000	Large-Area (3mm) InGaAs Photodetector for Low Noise Detection in the 0.8- to 1.7-Micron Spectral Range
ETX2550 ETX-Array	InGaAs 2.5-micron 256 element InGaAs Detector Array

## OTHER INFORMATION

Epitaxx does not employ a PR firm.

# European Silicon Structures

Headquarters  
Industriestraße 17  
8034 Germering, West Germany  
089/8 49 39 0  
Telex: 089/8 49 39 20

Hollybank House  
Mount Lane  
Bracknell, Berkshire  
England  
0344/525252  
Fax: 0344/59412

72-78 Grande Rue  
92310 Sevres, France  
01/46264495  
Fax: 01/45071423

ESTABLISHED: September 1985

NO. OF EMPLOYEES: 150

## BACKGROUND

European Silicon Structures (ES2) was formed to design, develop, and offer quick-turn silicon prototyping and low-volume production (less than 50,000 units) of application-specific ICs for the European marketplace. The Company's objectives are to make ASIC design and production capability available to European systems manufacturers, generate a CAD product line, and offer fast turnaround with the use of e-beam technology.

The Company's Solo 1000 is based on Lattice Logic's ChipSmith system, and the Solo 2000 is based on the SDA Systems family of integrated CAD tools. Solo 1000 enables designers to produce full-custom and optimized designs and is available on PC AT-based hardware and UNIX-based workstations. Solo 2000 incorporates compiled macro blocks, which include RAM, ROM, PLA, ALU, and others. The Company's capability includes PLDs, optimized arrays, cell-based ICs, and handcrafted custom devices and circuits that will meet MIL-STD-38510 Class-B compliance.

In January 1987, ES2 introduced the ECDM20 CMOS, a process demonstrating subnanosecond gate delay performance. The n-well process features 5V digital CMOS; an epitaxial substrate for high latch-up immunity; and single-poly, two-layer metal using 10 masking steps. All processing is conducted using Perkin-Elmer Aeble 150 e-beam lithography equipment that is now operational.

ES2 is incorporated in Luxembourg and headquartered in Munich, West Germany. ES2's design automation technology is being developed by its software technology division located in Bracknell, England. The Company's manufacturing technology division is responsible for silicon manufacturing, which is conducted in Rousset, France, near Aix-en-Provence.

In November 1987, ES2 was granted a loan of \$9 million by the Banque International and the European Investment Bank. The funds are being used to build ES2's production plant, called the Rousset Technology Center, at Rousset in southern France. The four-year loan is part of a larger financing package that could total \$18 million. The manufacturing division also operates the Aeble 150 machine at the Exel Microelectronics plant in San Jose, California.

In 1987, ES2 acquired Lattice Logic and turned the Silicon Valley design arm of Lattice Logic into an ES2 design center named United Silicon Structures that serves the United States. Also in late 1987, ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

Through its own R&D and in conjunction with industrial partners and universities, ES2 is developing proprietary silicon compilation tools and is working to establish a set of standards for the European market.

# European Silicon Structures

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## BOARD

(Name and Affiliation)

Robert Wilmot, Cochairman  
Wilmot Enterprises

Robert Heikes, Cochairman  
Entrepreneur

Jean-Luc Grand-Clement  
European Silicon Structures, CEO

Pierre Lesieur  
European Silicon Structures, VP Finance

Viscount Etienne Davignon  
Societe Generale de Belgique, Director

Albert Kloezen  
EuroVenture, Benelux, Managing Director

Elserino Piol  
Ing. C. Olivetti & Co., Executive Vice President

Klaus Volkholz  
Philips International BV, Director of Corporate  
Planning

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

CEO/Mng Dir  
Jean-Luc Grand-Clement  
Motorola, VP Europe Group

VP Fin/Admin  
Pierre Lesieur  
Motorola, Dir Finance

VP/Dir Ops  
Rod Attwooll  
TI, Mng Dir Bedford

VP/Mfg  
Bernard Pruniaux  
Thomson CSF, Dir Opns

VP/Dir S/W Tech  
John Gray  
Lattice Logic, Founder/Mng Dir

VP/Dir S. Europe  
J.P. Demange  
National Semiconductor, Dir Strat Mktg

VP/Dir Central Europe  
H.P. Friedrich  
N/A, Mng Dir

## Wfr Fab Mgr

Francis Courreges  
Sierra Semiconductor, Prod Eng Mgr

## Dir Technology

Eric Demoulin  
Thomson-CSF, Dir MOS Tech

## FINANCING

### 1985

\$5.0M

Advent, London; Techno-Venture Mgmt. Corp.

### December 1985

\$25.0M

Brown-Boveri and CIE (Switzerland), Ing.  
C. Olivetti & Co. (Italy), N.V. Philips (the  
Netherlands), Saab-Scandia AB (Sweden)

### January 1986

\$5.0M

British Aerospace

### November 1986

\$9.0M

Banque International a Luxembourg; European  
Investment Bank

## ALLIANCES

### Lattice Logic

1985

ES2 signed an agreement with Lattice Logic  
to market Lattice's logic compiler in Europe.

1987

ES2 acquired Lattice Logic. ES2 had been  
marketing Lattice Logic's compilers in Europe  
since 1985.

### British Aerospace

January 1986

British Aerospace invested \$5 million in ES2.

### SDA Systems

January 1986

ES2 signed an agreement to market SDA  
Systems' design systems throughout Europe  
and to use them in a number of planned  
design centers.



# European Silicon Structures

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## Philips-Elcoma/Texas Instruments

May 1986

ES2, Philips-Elcoma, and Texas Instruments (TI) agreed to cooperate on the SystemCell standard cell library.

February 1987

ES2, Philips, and TI signed an agreement covering manufacturing of the SystemCell. TI and Philips would supply volume parts; ES2 would provide prototypes and low-volume quantities.

## Philips

February 1988

ES2 and Philips announced an agreement that ensures rapid prototyping and high volumes of ASICs for customers worldwide implemented in Philips' standard 1.5u dual-layer metal CMOS process.

## Mitsui & Co.

October 1987

ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

## United Silicon Structures

January 1988

ES2 established US2, a U.S. partner.

## SERVICES

Quick-turn ASIC prototyping  
Low-volume production

## MANUFACTURING

### Technology

2.0-micron, double-metal CMOS  
1.25-micron, double-metal (1988)  
E-beam on 5-inch wafers

### Facilities

Munich, West Germany  
Headquarters

Bracknell, England  
11,800 sq. ft.

Software products

Rousset, France  
16,147 sq. ft.

Manufacturing, assembly, test

8,600 sq. ft.

Fab area

## PRODUCTS

### Development Tools

Device	Description
Solo 1000	A Low-Cost Development System with up to 5,000 Gates: Schematic Capture, Simulation, Layout, Back Annotation
Solo 2000	Advanced Software, Full-Custom Modules for ASICs with up to 150,000 Transistors: Structure Compiler, 250 Cells, Module Generators, Test Analyzer, Simulation, Automatic Place and Route

## OTHER INFORMATION

ES2's PR firm is Bood and Partners.

## Exel Microelectronics Inc.

2150 Commerce Drive  
San Jose, CA 95131  
408/432-0500  
Fax: 408/432-8710

ESTABLISHED: February 1983

NO. OF EMPLOYEES: 280

### BACKGROUND

Exel Microelectronics Inc. designs, develops, and manufactures nonvolatile memory and microcomponent devices for the EDP, industrial controls, automotive, telecommunications, military, and robotics markets.

The Company leveraged its proprietary EEPROM expertise into a broad base of EE technology-based, high-performance, low-power products including bipolar PROM replacements, UV-EPROM replacements, and PLDs. Exel was the first to offer high-density, 55ns CMOS, 16K EEPROMs and was one of the first to move into 6-inch wafer production. In the long term, Exel plans to develop microcomponent products with on-chip EEPROM memory.

In February 1986, Exel Microelectronics was acquired by Exar Integrated Circuits for \$5.5 million. In August 1988, Rohm Co., Ltd., acquired 81 percent of Exel from Exar. Exel now is an operating unit of Rohm.

### BOARD

Kozo Sato, Chairman of the Board  
Kenichiro (Ken) Sato  
Yoshiaki Odani  
Takashi (Todd) Kobayashi  
Edwin M.W. Chow

### COMPANY EXECUTIVES

(Position and Name)

President/Secretary  
Takashi Kobayashi

Vice President  
Edwin M.W. Chow

CFO  
Shigeru (Fred) Sasa

### FINANCING

#### February 1983

Initial  
\$1.0M  
Sirjan L. Tandon

#### July 1983

Round 1  
\$5.5M  
Private Placement

Round 1  
\$5.5M  
Lease Line

#### September 1984

Round 2  
\$10.5M  
BancBoston Ventures; Bay Partners; CH Partners; Chase Manhattan; Crown Advisors, Ltd.; Hambrecht & Quist; Horsley Keogh & Assoc.; Hutton Venture; IBM Retirement Fund; Montgomery Securities; Orange Nassau; Paribas Technology; Prudential-Bache; Riordan Venture Mgmt; Rothschild, Unterberg & Towbin Ventures; J.F. Shea & Co.; TA Assoc.; 3i Ventures

#### August 1985

\$13.5M  
Cable, Howse, & Cozadd; Hambrecht & Quist; Horsley Keogh & Assoc.; TA Associates

#### February 1986

\$5.5M  
Acquired by Exar Corporation

#### August 1988

\$40.0M  
Rohm acquired 81 percent of Exel

#### June 1989

\$6.5M  
Remaining 19 percent of Exel acquired by Rohm.

# Exel Microelectronics Inc.

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## RECENT HIGHLIGHTS

### February 1986

Exar completed its \$5 million acquisition of Exel.

### October 1987

Exel's Class 10 CMOS fabrication facility met MIL-STD-883C specifications. The first devices to be compliant with this specification are the XL2864B 8Kx8 EEPROM and the XL78C800 EPLD.

### November 1987

Exel offered the XL46HC64, a CMOS 64K EEPROM with a 35ns access time. The device can be erased in 10 milliseconds and reprogrammed and retested at least 10,000 times.

## ALLIANCES

### Samsung Semiconductor 1983

Samsung entered into a joint development project to act as a second source for Exel's forthcoming 16K EEPROMs (expired).

### May 1985

The prior Samsung agreement was extended to include second-sourcing for 64K EEPROMs.

### Paribas Technology

September 1984

Paribas took part in second-round financing.

### Oki Electric

March 1985

Oki is a second source for Exel's 2Kx8 NMOS EEPROM and produces 64K EEPROMs.

### Exar

February 1986

Exar completed its \$5.5 million acquisition of Exel.

## MANUFACTURING

### Technology

NMOSE2	2.0-micron design rules
CMOSE2	1.5-micron design rules
EXCMOS3	1.5-micron, dual-metal
5-inch wafers	

### Facilities

San Jose, CA	62,500 sq. ft.
	12,000 sq. ft.
	Class 10 clean room

## PRODUCTS

### EEPROM

Device	Organization	Process	Delay (ns)
XL2804A	512x8	NMOS	250
XL2816A	2Kx8	NMOS	250
XL2817A	2Kx8	NMOS	200
XL2864A	8Kx8	NMOS	200
XL2865A	8Kx8	NMOS	200

### CMOS PROM

XL46C15	2Kx8	CMOS	55
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### Programmable Logic Device

78C800	CMOS ERASIC Family, 600 to 800 Gates
XL93C46	1K Serial CMOS EEPROM
XL26008	PLD development system (ERASIC family)
XL26002	PLD software—MultiMap/MultiSim

## OTHER INFORMATION

Exel does not employ a PR firm.

# Gazelle Microcircuits, Inc.

2300 Owen Street  
Santa Clara, CA 95054  
408/982-0900  
Fax: 408/982-0222

ESTABLISHED: June 1986

NO. OF EMPLOYEES: 53

## BACKGROUND

Gazelle Microcircuits, Inc., was founded to design and market high-performance, digital LSI and VLSI GaAs ICs for high-volume commercial applications such as computation, communication, and military/aerospace. The Company is concentrating on product design and marketing development and does not plan to invest in a wafer fabrication facility.

Gazelle's product strategy is to offer high-yielding, low-cost circuits of large-scale complexity, using existing GaAs fabrication processes. The Company will concentrate on developing unique circuit design approaches to differentiate its performance-oriented devices.

The Company was formed by ex-GigaBit Logic executives Andrew Graham and David MacMillan. In January 1987, Jerry Crowley left Oki Semiconductor, where he was vice chairman and founder, to head Gazelle. In March 1988, Thomas Andrade joined Gazelle as vice president of technology from Pacific Monolithics where he was manager of semiconductor development. Mr. Andrade is responsible for identifying and qualifying the foundries and processes used to fabricate Gazelle's circuits. Before joining Pacific Monolithics, he developed the first of Avantek's microwave IC process and transferred it into volume manufacturing. He was a member of the research staff at IBM, where he did basic research on GaAs fabrication processes and materials. He also did work on NMOS processes, much of which was funneled into the VHSIC project.

In February 1988, Gazelle moved into its new 22,000-square-foot headquarters in Santa Clara, California. The facility is used for engineering development, circuit design, product evaluation, and marketing operations. Gazelle also has an option on an adjoining 24,000-square-foot space.

Gazelle has signed pacts with several U.S. manufacturers to supply GaAs wafers to the firms and plans to offer TTL-replacement devices in 1988.

## BOARD

(Name and Affiliation)

Jerry R. Crowley, Chairman

Gazelle Microcircuits, Inc., President/CEO

\*David MacMillan

Gazelle Microcircuits, Inc., Vice President

E. Floyd Kvamme

Kleiner, Perkins, Caufield & Byers, General Partner

Philip Young

Dillon Read—Concord Partners, Managing Director

David Hathaway

Venrock Associates, General Partner

Steve Sharp

Power Integrations, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Jerry Crowley

Oki Semiconductor, Vice Chairman

### VP Marketing

David MacMillan

GigaBit Logic, Product Manager

### VP Engineering

\*Andrew Graham

GigaBit Logic, Dir of Memory Development

### VP Technology

Thomas Andrade

Pacific Monolithics, Mgr Semi Dev

### VP Sales

John Randall

Signetics, Dir Sales

# Gazelle Microcircuits, Inc.

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**VP Operations**  
George Schneer  
Intel, VP Operations

\*Founder

## FINANCING

**August 1986**  
Seed  
\$0.9M  
Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers

**April 1987**  
Round 1  
\$5.5M  
Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates

**August 1987**  
Lease Line  
\$1.5M  
Comdisco, Ventures

**April 1988**  
Lease Line  
\$2.5M  
Comdisco Ventures

## PRODUCTS

Part No.	Description
GA22VP10-7 GA22VP10-10	24-Pin PLD Superset with Improved Output Macrocells
GA22V10-7 GA22V10-10	24-Pin PLD Superset with Output Macrocells
GA23S8-7 GA23S8-10	20-Pin-Based Sequencer with Output Macrocells and six Buried Registers

## OTHER INFORMATION

Gazelle's PR firm is Franson and Associates, Inc.

**September 1988**

**Round 2**

**\$6.8M**

Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates; Harvard Management Co. Inc.; JAFCO Ltd.

## ALLIANCES

**TriQuint**

**September 1988**

Gazelle Microcircuits announced a two-year, \$16.9 million gallium arsenide manufacturing contract with TriQuint Semiconductor, Inc., a subsidiary of Textronix.

## MANUFACTURING

**Technology**

GaAs

**Facilities**

Santa Clara, CA

22,000 sq. ft.

Headquarters, engineering, design

The Company also has an option on an adjoining 24,000 square feet of space.

# Genesis Microchip Inc.

2900 John Street  
Markham, Ontario, Canada  
L3R 5G3  
416/470-2742  
Fax: 416/470-2447

ESTABLISHED: January 1987

NO. OF EMPLOYEES: 15

## BACKGROUND

Genesis Microchip Inc. was formed to be a supplier of design services, prototyping, and low-volume quantities of ASICs to the central North American market. Genesis offers gate array, cell-based ICs as well as full-custom design services. Products target the telecommunications, military, and industrial applications markets.

Initially, the Company operates as a Canadian design center for National Semiconductor's CMOS ASIC products under an agreement signed in October 1987. The agreement includes National's gate arrays and cell-based libraries, as well as the full range of design tools. National provides prototyping, volume manufacturing, and assembly and test of all CMOS ASIC devices designed by Genesis, using National's 2.0- and 1.5-micron technologies. National also provides manufacturing for Genesis customers that design custom cells not included in the National libraries.

## BOARD

(Name and Affiliation)

W.L. Stapleton, Chairman  
Corporate Systems Strategies Ltd.

\*Paul M. Russo  
Genesis Microchip Inc., President/CEO

\*William H. White  
Genesis Microchip Inc., Vice President

Jean-Claude Bonhomme  
Investor

Marvin J. Singer  
Armstrong, Schiralli & Dunne

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
Paul M. Russo  
GE, General Manager-MEC

Exec VP  
William H. White  
Harris Semi, Dir Engr Dig Prod

Comptroller  
Peter W. Hawley  
Consultant  
\*Founder

## FINANCING

August 1987  
Round 1  
Undisclosed  
Private investors

November 1987  
Round 2  
Undisclosed  
Private investors

April 1988  
Round 3  
Undisclosed  
Private investors

## ALLIANCES

National  
October 1987  
National Semiconductor and Genesis signed a design center agreement that covers National's gate array and cell-based libraries and design tools. National provides prototyping and production for CMOS ASICs designed by Genesis using National's 2.0- and 1.5-micron technologies. Genesis operates as National's Canadian design center.

## Genesis Microchip Inc.

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### SERVICES

Design  
ASIC prototyping  
Low-volume production

Class 10 clean room. The facility will have the capacity for processing 1.5- and 1.0-micron CMOS double-level metal ASICs on 6-inch wafers. The facility will be optimized for quick-turn, low-volume manufacturing and will support MIL-STD-883 conformance.

### MANUFACTURING

#### Technology

2.0- and 1.5-micron CMOS

Markham, Ontario

4,000 sq. ft.

Administration and design

#### Facilities

Genesis plans to build a 100,000-square-foot Canadian fabrication facility that features a

Hull, Quebec

2,000 sq. ft.

Sales, design

### PRODUCTS

Genesis offers the full range of National's CMOS gate array (2.0-, 1.5-, and 1.0-micron) and cell-based (2.0-micron) families, including analog, RAM/ROM, EEPROM, and MCU cells. In addition, Genesis can design special cells and full-custom ICs as customer-owned tooling designs for manufacture by National Semiconductor.

### OTHER INFORMATION

Genesis Microchip does not employ a PR firm.

**GigaBit Logic, Inc.**  
1908 Oak Terrace Lane  
Newbury Park, CA 91320  
805/499-0610  
Fax: 805/499-2751  
Telex: 6711358

**ESTABLISHED: August 1981**

**NO. OF EMPLOYEES: 120**

## **BACKGROUND**

GigaBit Logic (GBL) designs, develops, manufactures, and markets GaAs standard and application-specific digital ICs capable of 1-GHz to 5-GHz operation. GBL was founded in 1981 by Fred A. Blum and Richard C. Eden. GBL's goal is to be the leader in the commercial digital GaAs IC market, and the company is targeting product segments in the military, mainframe computers, RF communication and instrumentation, and test equipment markets. GBL's strategy is to penetrate high-performance equipment markets by offering products that are five to ten times faster than silicon for comparable prices. GigaBit's sales goal for 1990 is \$50 million.

GBL uses sales representatives, distributors, and a direct sales force to sell its products worldwide. Currently, GBL has sales representatives nationwide and franchised distributors in Japan, West Germany, Italy, France, the United Kingdom, Israel, Canada, Sweden, Denmark, Taiwan, Australia/New Zealand, and South Korea.

## **BOARD**

(Name and Affiliation)

John D. Heightley, Chairman  
GigaBit Logic, Inc., President, CEO  
Heinrich F. Krabbe  
Analog Devices, Inc.  
Richard C. Eden  
GigaBit Logic, Inc.  
David B. Jones  
Interven Partners, Inc.  
Lawrence T. Sullivan  
Analog Devices, Inc.

Mark C. Masur  
O'Donnel & Masur  
Greg Barnum  
Cray Research  
Ole Steen Anderson  
NKT (Denmark)  
Chris C. Ellison  
DFC of New Zealand

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President/CEO**

John D. Heightley  
Inmos, President

### **VP R&D**

Richard C. Eden  
Rockwell, Principal Scientist

### **VP Prod Dev**

Frank S. Lee  
Rockwell, Design Engr Mktg

### **VP Sales**

James Brye  
Vitesse, VP-Marketing/Sales

### **VP Marketing**

Mike Pawlik  
Fairchild, Marketing Mgr

### **VP Finance**

Spencer Brown  
CR Technology, VP-Finance/CEO

### **VP Mfg**

Bryant M. Welch  
Rockwell, Mgr GaAs Technology



# GigaBit Logic, Inc.

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## FINANCING

**March 1982**

Seed

\$1.0M

First Interstate Capital Corp., Riordan Venture Group, Wood River Capital

**November 1982**

Round 1

\$8.1M

Analog Devices Enterprises, First Interstate Capital Corp., and others

**December 1983**

R&D Partnership

\$6.1M

Kidder, Peabody & Company

**February 1985**

Round 2

\$12.1M

Analog Devices Enterprises, GE Venture Corp., Interfirst Venture Corp., First Interstate Capital Corp., Standard Oil Co., Union Venture Corp.

**April 1987**

Recapitalization

\$14.9M

Analog Devices Enterprises, Cray Research, Digital Equipment Corp., DFC New Zealand, FAIC Capital, Fairfield Equity, First Interstate Capital Corp., GE Venture Corp., Hanover Capital, Interfirst Venture, Interven Partners, New Enterprises Associates, Riordan Venture Group

**September 1988**

Round 3

\$4.1M

Analog Devices Enterprises, DFC New Zealand, Interven Partners, Republic Venture, New Enterprises Associates, Union Venture Corp., Riordan, NKT (Denmark), Canaan Venture, Courtland Investment

## RECENT HIGHLIGHTS

**January 1987**

GBL named its president and CEO, John Heightley, chairman of the board. Mr. Heightley takes over the chairman's post from Heinrich Krabbe, who remains a

director. Mr. Krabbe is vice president of new business development for Analog Devices, an investor in GBL.

**January 1987**

Cray Research placed a \$3.2 million foundry order.

**April 1987**

GBL completed a private placement of convertible preferred stock and raised \$14.9 million. The funds were used to recapitalize the company.

**April 1987**

GBL, Seattle Silicon, and Washington Technology Center (WTC) announced that a joint design project resulted in the fabrication of a functional GaAs IC design that is compiler based (see "Alliances").

**May 1987**

GBL announced that Cray Research increased its January 1987 foundry order from \$3.2 million to \$5.5 million. Cray will use the logic and memory devices procured under this order to enter the next phase of development of a GaAs-based parallel processor supercomputer.

**July 1987**

Prisma Corp., a manufacturer of high-speed computers, is planning to build a GaAs-based, 32-bit, real-time computer using GigaBit's logic devices and other ECL-based memory. The machine will incorporate RISC, will implement Ada language, and will offer performance in the 100- to 200-mips range. The first machine is expected to be shipped by the end of 1989. Future systems are expected to use FORTRAN, C, and Lisp. Prisma is a spin-off from Cray Research and is capitalizing on Cray's research into implementing computers with GaAs.

**October 1987**

Tachonics and GBL agreed mutually to second-source GaAs standard and ASIC ICs and to codevelop cell libraries to support future GaAs technologies (see "Alliances").

**October 1987**

GBL achieved profitability.

**January 1988**

Cray placed a \$6.8 million foundry order.

## September 1988

GBL and NKT (Denmark) initiated a joint venture—named GIGA—to serve the Europe and Israel markets for ICs (see “Alliances”).

## November 1988

Cray placed a \$29.3 million foundry order.

## December 1988

GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo, Japan—signed a marketing and product development agreement. Under the pact, GigaBit Logic will market SC Hightech's GaAs IC products throughout the world, excluding Japan. The agreement also provides the opportunity for codevelopment of future generations of GaAs ICs to the two companies. In addition, SC Hightech may provide foundry services for certain high-volume segments of GigaBit Logic's standard product line.

## ALLIANCES

### Kidder, Peabody & Company

December 1983

GBL and Kidder, Peabody & Company formed a research and development partnership to develop four ultrahigh-speed GaAs SRAMs.

### Cray Research

April 1987

Cray Research is a contributor in the \$14.4 million recapitalization of GigaBit Logic. In return, GBL will provide foundry services

for Cray in its development of a GaAs-based parallel processor supercomputer, the CRAY-3.

### Seattle Silicon, Washington Technology Center

April 1987

GBL, Seattle Silicon, and the Washington Technology Center (WTC) announced that their joint design project had resulted in the fabrication of a functional GaAs IC design based on GBL's cell library; Seattle Silicon's compiler; and WTC's design, engineering support, packaging, and test.

### Tachonics

October 1987

GBL and Tachonics agreed mutually to second-source GaAs standard ASIC ICs. GBL also will transfer databases, schematics, and test specs of the PicoLogic cell-based families to Tachonics. The companies will codevelop cell libraries to support future GaAs technologies.

### NKT (Denmark)

September 1988

GBL and NKT initiated a joint venture (GIGA) to serve the Europe and Israel markets for ICs. GIGA will provide a full-support design center and management for GigaBit's distributor network for standard products in Europe. This alliance makes GBL the first U.S. GaAs company to have full ASIC development capability based in Europe.

### SC Hightech Corporation

December 1988

GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo—Japan, signed a marketing and product development agreement.

## PRODUCTS

### PicoLogic Digital and Analog GaAs ICs

#### Gates

Two and three Input NORs, two Input XOR/XNOR/Line Receivers, Dual AO/AOI

#### Drivers/Receivers/Comparators

2:1 Multiplexed Fanout Buffer, 1:4 Fanout Buffer Complementary Driver/Comparator

#### Flip-Flops and Registers

Dual-Precision D Flip-Flop, Quad D Flip-Flops with 2:1 MUXed or XOR Inputs, Octal Register/Shift Register and PN Code Generator

## **GigaBit Logic, Inc.**

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### **MUX/DEMUX/Crosspoint**

Quad 2:1 MUX, 3:8 or Dual 2:4 Decoder/DEMUX, Quad 4:1 or Dual 8:1 MUX, 8x8x1 Expandable Crosspoint Switch, 16x16x1 Crosspoint Switch

### **Counters/Prescalers**

2- and 7-Stage Ripple Counter/Dividers, 4-Bit Synchronous Programmable Counter, Variable Modulus Divider

### **Arithmetic Operations**

Dual 9-Bit Parity Generator/Checker and 8-Bit Equivalence Checker, High-Speed 4-Bit Adder, Carry Lookahead Generator, 32-Bit DDS Phase Accumulator

### **Monolithic FET and Diode Arrays**

15 mA Schottky Diode Array, Single Gate MESFET Array, Dual Gate MESFET Array

### **Fiber Communications Products**

8:1 Time Division MUX, 8:1 Time Division DEMUX, Clock and Data Recovery Circuit, Low Power Clock and Data Recovery, 16G040 Demo Board, Transimpedance Amplifier, Laser Driver, LED Driver

### **Analog/ATE/Instrumentation Products**

Phase/Frequency Comparator, Dual High-Speed Pin Driver

### **NANORAM and NANOROM Memory**

256x4-Bit Registered, Self-Timed Static RAM, 1,024x4-Bit Latched Self-Timed Static RAM, 512x8-Bit Mask Programmable ROM

### **ASIC Products**

SC5000 Standard Cell Library  
SC10000 Standard Cell Library  
GaAs Foundry Services

### **Prototyping and Support**

Evaluation Boards for Transimpedance Amplifiers, Laser Drivers, and LED Drivers, Universal Prototyping Boards (for 36-, 40-, and 68-pin packages), High-Speed Sockets (for 40- and 68-pin leadless chip carriers)

## **OTHER INFORMATION**

GigaBit Logic does not employ a PR firm.

# Harris Microwave Semiconductor, Inc.

1530 McCarthy Blvd.

Milpitas, CA 95035

408/433-2222

Fax: 408/432-3268

ESTABLISHED: June 1980

NO. OF EMPLOYEES: 65

## BACKGROUND

Harris Microwave Semiconductor (HMS), Inc., was formed to develop and manufacture GaAs-based FETs, MMICs, and digital ICs. In addition to offering standard products, the Company offers full and semicustom capabilities and provides foundry services. HMS is a vertically integrated operation of Harris Corporation's Semiconductor Sector. One hundred percent of the Company's funding has been provided by the Harris Corporation.

The Company has capabilities for manufacturing GaAs crystals and wafers as well as ICs, packaged products, and discrete devices. HMS is said to have the world's largest high-purity GaAs ingot-growing capacity, which produces single-crystal GaAs ingots of up to 7 inches in diameter.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

**President/Chief Executive Officer**  
John T. Hartley

**Vice President/General Manager**  
Dr. Joseph Barrera

**Marketing and Sales Director**  
Vic Kovacevic

## FINANCING

Not available

## RECENT HIGHLIGHTS

### July 1987

HMS offered the HMM-10610, a dual-stage, 2- to 6-GHz, 0.5-micron, medium-power monolithic amplifier in die form.

### February 1988

HMS introduced the HMM-10620, a 2- to 6-GHz low-current, cascadable, broadband MMIC amplifier designed to meet the electronic warfare systems' low-current requirements.

### May 1988

HMS introduced the HMM-11810, a 6- to 18-GHz low-current, cascadable broadband MMIC amplifier designed to meet the low current requirements of electronic warfare systems.

### June 1989

HMS introduced the HMR-1100, a GaAs MMIC Pi Attenuator. The MMIC is a practical solution for slope and gain control in a variety of military components such as amplifiers.

## ALLIANCES

Not available

## SERVICES

Foundry

## MANUFACTURING

### Technology

1.0- to 0.5-micron GaAs MESFET  
2-, 3-, and 4-inch wafers

# Harris Microwave Semiconductor, Inc.

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## Facilities

Milpitas, CA  
37,000 sq. ft. total  
15,000 sq. ft. manufacturing space

## PRODUCTS

FETs (available in chip or packaged form)

Device	Description
HMF-0300	2-18 GHz, 125 mW Power
HMF-03100-100	2-20 GHz, Low Noise, Gain
HMF-03100-200	2-20 GHz, Gain/Drive
HMF-03100-300	2-20 GHz, Drive
HMF-0330	2-20 GHz, Low Noise, Low Current
HMF-0600	2-20 GHz, 250mW Power
HMF-0610	2-20 GHz, Gain
HMF-0620	2-14 GHz, High Transconductance
HMF-12000-100	2-16 GHz, 500mW Power
HMF-12000-200	2-16 GHz, 650mW Power
HMF-1210	2-20 GHz, Gain
HMF-24000-100	2-14 GHz, 800mW, Power
HMF-24000-200	2-14 GHz, 1.2W, Power

## MMICs

HMR-11000	Pi Attenuator, DC-18 GHz
HMR-10502	Analog Amplifier, 0.5-5.0 GHz
HMR-10503	Analog Amplifier, 1-5 GHz
HMM-10610	Broadband Amplifier, 2-6 GHz
HMM-10620	Broadband Amplifier, 2-6 GHz, Low Current
HMM-11810	Broadband Amplifier, 6-18 GHz
HMM-11820	Broadband Amplifier, 6-18 GHz, Low Current

## OTHER INFORMATION

Harris Microwave's PR firm is Ketchum Public Relations.

# Headland Technology Incorporated

46221 Landing Parkway

Fremont, CA 94538

408/656-7800

ESTABLISHED: April 1989

NO. OF EMPLOYEES: 200

## BACKGROUND

Headland Technology Inc. was formed in 1988, a result of the merger between G-2 Incorporated and Video Seven. In 1987, LSI Logic Corporation spun off G-2 to sell peripheral logic chip sets for the 80286 and 80386. LSI purchased 20 percent of Video Seven in 1988 and later increased its share to 80 percent. In July 1989, LSI merged G-2 and Video Seven to form Headland Technologies, an independent affiliate of LSI Logic Corporation. Headland maintains separate and independent marketing and engineering organizations. As an affiliate, Headland can draw upon LSI Logic's worldwide manufacturing facilities in the Far East, North America, and Europe. Headland also has access to LSI Logic's 24 design centers located throughout the world. Headland utilizes LSI Logic's HCMOS and BiCMOS process technology, which delivers submicron ICs in mass production.

Headland's initial focus is on the rapidly growing market for graphic and logic products for the IBM PC-compatible market. The G-2/Video Seven merger brings two product focuses under one roof. Video Seven, previously an independent graphics house, will provide Headland with video graphics expertise. In the graphics market, Headland currently offers VGA graphics cards, a single-chip EGA multimode graphics controller, and a VGA chip. Headland plans to offer an 8514A graphics chip set in early 1990 and will also introduce VGA chip sets for flat panel displays. The Company has an existing program with Sun Microsystems to produce a "virtual VGA" card for the 386i workstation. Headland expects to expand this product to other UNIX-based workstations.

Drawing from G-2's focus on PC chip sets, Headland offers a number of logic products. Headland's offerings include a PC AT chip set, a PS/2 Model 30/XT compatible chip, a 386 AT chip set, a 386 SX chip set, and a universal PS/2-compatible chip set. Headland

expects to offer SPARC or MIPS chip sets in the near future.

Headland considers Chips & Technologies and Western Digital to be its two major competitors. Headland sells products to both OEM and retail customers. The Company's products will be sold through a mix of direct sales, independent representatives, and retail distribution. Headland has 8 national and 29 international distributors, as well as 2,100 authorized resellers that were acquired as part of the Video Seven holdings. Headland's strong retail sales channels should give the Company an advantage over its competitors, some of which have no retail distributors.

In 1988, G-2 raised approximately \$19 million in revenue, and Video Seven reached the \$50 million mark. By combining resources and taking advantage of economies of scale, LSI predicts that Headland's revenue could easily triple in 1989 and reach a rate of \$200 million per year early in 1990.

In the future, Headland plans to support the new markets created by the integration of computers with all-digital communications and entertainment (i.e., ISDN, HDTV, interactive video), as well as the markets spurred by higher-performance graphics standards such as VGA and by the arrival of Presentation Manager's graphics environment.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO

William J. O'Meara  
G2, President

### President

Paul Jain  
USI International, President

# Headland Technology Incorporated

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## VP, Manufacturing & Operations

Russ Faust  
Ferix Corp.

## Sr. VP, Research & Development

Don Bryson  
Mouse Systems, VP Sales/Mktg

## VP, Manufacturing & Operations

Bill Sams  
Assisted Technology, VP Mktg

## VP, OEM Sales

Fred Brown  
LSI Logic, Sales

## VP, Retail Sales

Michael Humphress  
Mouse Systems, National Sales Mgr

## VP, Systems Marketing

Greg Reznick  
Mouse Systems, Prod Mgr

## VP, Component Marketing

Elvet Moore  
Kontron, President

## VP, Research & Development

Steve Chan  
LSI Logic, VP ASIC design

## FINANCING

Not available

## PRODUCTS

VEGA Deluxe VGA Card  
VEGA VGA Card  
FastWrite VGA  
V-RAM VGA  
EGA Multimode Graphics Controller  
Advanced VGA Chip

## OTHER INFORMATION

Headland Technology's PR firm is Miller Communications.

## RECENT HIGHLIGHTS

### April 1989

G-2 and Video Seven merged to form  
Headland Technologies, Incorporated.

### July 1989

The Company's name was officially changed  
to Headland Technologies, Incorporated from  
Video Seven, Incorporated.

### July 1989

Headland introduced the Video Seven VGA  
1024i, a high-performance VGA adapter that  
enhances the industry-standard VGA.

## ALLIANCES

Headland is an affiliate of LSI Logic Corporation.

## MANUFACTURING

### Facilities

Fremont, CA  
Headquarters, marketing, test

Cupertino, CA  
Engineering, R&D

# Hittite Microwave Corporation

21 Cabot Road  
Woburn, MA 01801  
617/933-7267  
Fax: 617/932-8903

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 12

## BACKGROUND

Hittite Microwave was formed to market custom and proprietary GaAs MMICs for military and commercial applications. The Hittite team has been involved in all aspects of design, development, and production of monolithic GaAs components, including participation in several Department of Defense GaAs technology development programs.

Hittite's expertise ranges from designing small, single-chip systems to 500-watt, continuous-wave, multichip components and subsystems. Hittite's facility is equipped to conduct design, layout, verification, packaging, and test of GaAs-based components. Wafer fabrication is conducted by foundries.

Hittite is part of the General Dynamics, Honeywell, TRW consortium that is addressing the critical technology, fabrication, and cost issues of inserting microwave/millimeter wave monolithic IC (MIMIC) technology into advanced tactical weapons systems. The team has targeted three main mission areas for MIMIC insertions—smart weapons, electronic warfare, and communications.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### Pres/COO

Frank Paik

Raytheon, Business Dev Mgr

### VP/CEO

\*Yalcin Ayasli

Raytheon Research, Mgr R&D Monolithic ICs

### CFO

Ronald Kaplan

Wang, Controller

\*Founder

## FINANCING

Private

## ALLIANCES

Hittite is part of the General Dynamics, Honeywell, TRW consortium as part of the Department of Defense MIMIC program.

## MANUFACTURING

### Technology

0.5- and 1.0-micron GaAs MESFETs

### Facilities

Woburn, MA

4,800 sq. ft. total

Offices, R&D, assembly, test

400 sq. ft.

Class 10 clean room



# Hittite Microwave Corporation

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## PRODUCTS

Signal Control Components  
Microwave Radar Ranging Systems  
Other proprietary products

## OTHER INFORMATION

Hittite Microwave does not employ a PR firm.

**HNC, Inc.**  
5501 Oberlin Drive  
San Diego, CA 92121  
619/546-8877  
Fax: 619/452-6524

**ESTABLISHED: October 1986**

**NO. OF EMPLOYEES: 40**

## **BACKGROUND**

HNC, Inc. (formerly Hecht-Nielsen Neurocomputers) was formed in October 1986 by Robert Hecht-Nielsen and Todd Gutschow with the goal of becoming the leader in developing neural network products and technology and applying them to practical problems. HNC develops, manufactures, and supplies a complete line of high-speed neural network hardware coprocessors and workstations and an extensive package of neural network software.

Neural networks, modeled loosely after the interconnected nerve cells of the human nervous system, represent an information-processing technology that is radically different from traditional sequentially programmed computers. Rather than relying upon an explicit algorithm to perform desired tasks, a neural network is trained by adapting to repeated examples. For this reason, programming is less complicated—which makes development time shorter.

HNC currently is shipping the ANZA family of neurocomputing systems, which consists of three general-purpose neurocomputing coprocessor boards. The boards are available for the IBM PC AT, the Sun 386i, and Sun-3 and Sun-4 workstations. More than 300 HNC neural network hardware systems have been installed worldwide. HNC currently is developing two CMOS VLSI neural chips that utilize RISC technology. The HNC 100X is a general-purpose neural chip that provides two orders of magnitude increase in performance over current processing techniques. The HNC 103X (patent pending) incorporates both vision and image processing capabilities for complex pattern recognition applications. Both chips will be available during the third quarter of 1990.

HNC is targeting commercial and defense/aerospace markets with its neural network technology.

Customers include Fortune 500 companies with broad application ranges such as industrial inspection systems, financial credit scoring, EKG noise filtering, chemical plant process control, modeling, machinery diagnostics, and database analysis.

The Company markets its products in the United States to end users and OEMs through a direct sales force with offices in San Diego, California, and Falls Church, Virginia. An international network of distributors provides marketing and sales support throughout Europe, the Far East, India, and Australia.

## **BOARD**

(Name and Affiliation)

Oliver Curme  
Battery Ventures

Thomas Farb  
Air Fund

Charles Hertzfeld  
E.S. Jacobs

Burt McGillivary  
Continental Illinois Ventures

Thomas Tranchina  
San Diego Fire Supply

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President**  
Robert L. North  
TRW, Gen Mgr, Elect Sys

**VP, R&D**  
Michael Thiemann  
Four-Pi Systems, VP, Marketing

## HNC, Inc.

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**VP, Mktg**  
Dave Shlager  
Lucid, VP, Sales

**Exec VP**  
Gerald Farmer  
Gould, Dir R&D

**Mkt Comm Mgr**  
Julie Hotz  
Rohr Industries, Marketing Manager

### FINANCING

**October 1986**  
Seed  
\$635,000  
Private

**June 1987**  
Round 1  
\$2.6M  
Battery Ventures

**June 1988**  
Round 2  
\$3.4M  
Battery Ventures, Continental, Illinois Ventures,  
Aetna, E.S. Jacobs, and Ramo Technology

### PRODUCTS

ANZA  
ANZA Plus  
ANZA & ANZA Plus Neurocomputing Workstations  
ANZA Plus/VME  
AXON Neural Network Description Language  
Neural Network Development Toolkit  
ExploreNet Standalone Neural Network Software

### OTHER INFORMATION

HNC's PR firm is Marcom Strategies.

### ALLIANCES

**The Fusion Group**  
September 1989

HNC announced a strategic partnership with The Fusion Group to market software utilities designed to integrate neural computing into financial applications. Under the terms of the agreement, HNC and Fusion will develop software interfaces between HNC's ANZA Plus neurocomputing system and both the Sybase Relational Database Manager and Fusion's Market Data Server (MDS).

### MANUFACTURING

**Technology**

1-micron CMOS

**Facilities**

San Diego, CA  
13,000 sq. ft.  
R&D, marketing, headquarters, manufacturing,  
finance

Falls Church, VA  
Regional office

# Hualon Micro-Electronics Corporation

9th Floor, No. 61, Chung Shan N.  
Road Sec. 2, Taipei, Taiwan R.O.C.  
(02) 562-8813 Ext. 768  
Fax: (02) 531-3241

ESTABLISHED: April 1987

NO. OF EMPLOYEES: 400

## BACKGROUND

Hualon Micro-Electronics Corporation (HMC) was formed to offer telecommunications ICs, consumer ICs, microcomponents, and ASICs. Initially, the Company will use 2-micron CMOS technology to manufacture its products but has plans to develop CMOS technology to the 1-micron level.

Recently, HMC opened a new 269,097-square-foot fabrication facility in the Hsinchu Science-Based Park. The facility is capable of manufacturing 30,000 5-inch wafers per month. The Company plans to reach a capacity of 60,000 5-inch wafers per month by 1991.

HMC was financed by the Hualon Group for about U.S.\$30 million. The Hualon Group's first venture into the IC business was an assembly plant set up in 1984. As its requirements for high-quality ICs that use advanced process technologies increased, the Hualon Group decided to invest in an IC fab.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

Vice President

Andrew Oung

## PRODUCTS

Consumer IC Family

	Device	Description
Clock	HM 3200	Analog Clock
	HM 3203	3-1/2-Digit Alarm Clock
	HM 3204	World Time Clock

## FINANCING

1987

Round 1

U.S. \$30.0M

Hualon Textile

## ALLIANCES

Not available

## MANUFACTURING

### Technology

5.0-micron metal-gate CMOS

2.0- and 3.5-micron silicon-gate CMOS

3.5-micron NMOS

### Facilities

Hsinchu City, Taiwan

269,097 sq. ft.

Total space includes design and manufacturing.

39,900 sq. ft.

Class 1 and Class 10 clean rooms

Hualon announced that its second fab facility in Taiwan will open in September 1990.

# Hualon Micro-Electronics Corporation

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	Device	Description
Watch	HM 3201	3-1/2-Digit LCD Watch
	HM 3202	4-Digit LCD Watch
Home Electronics IC	HM 3701	Touch Dimmer
Calculator	HM 3401	Solar Calculator
Melody	HM 5801	64-Note Simple Melody
	HM 5802	128-Note Simple Melody
	HM 4801	512-Note Simple Melody
	H 66T	64-Note Simple Melody (3-Pin Package)
	H 67T	64-Note Simple Melody (4-Pin Package)
	H 68T	128-Note Doorbell
Voice IC	HM 2005	3-Second PCM
	HM 2005-1	1.5-Second PCM (Piezo)
	HM 2005-2	1.5-Second PCM
	HM 2006	LPC Processor
	HM 2007	Speech Recognition
Organ	HM 5601	Simple Mini-Organ
<b>Microcomponent and Memory IC Family</b>		
System	HM 6667/8	PC AT 16-MHz Zero-Wait Chip Set
Peripheral	HM 666A/B	RS 232x2, Printer Portx2
	HM 82C11	Printer Port
	HM 16450	PC AT Asynchronous Communications Element
	HM 8250	PC XT Asynchronous Communications Element
	HM 6818	PC AT Real-Time Clock
	HM 58167	PC XT Real-Time Clock
	HM 6845/A/B	CRT Controller
Memory	HM 2300/2301	Character Generator
	HM 2333	4Kx8 ROM
	HM 2366	8Kx8 ROM
	HM 23C256	32Kx8 ROM
	HM 6116	2Kx8 SRAM
	HM 6164	8Kx8 SRAM
<b>Telecommunication IC Family</b>		
Telephone Dialers	HM 9100	Pulse Dialer
	HM 9101/9102	Tone/Pulse Dialer
	HM 9105	5-Memory Tone/Pulse Dialer
	HM 9110	10-Memory Tone/Pulse Dialer
	HM 9113	14-Memory Tone/Pulse Dialer
	HM 9114	15-Memory Tone/Pulse Dialer
	HM 9115	Advanced 15-Memory Tone/Pulse Dialer+ARD
	HM 9120	Advanced 20-Memory Tone/Pulse Dialer+ARD
	HM 9187	Tone Dialer

## Hualon Micro-Electronics Corporation

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	<b>Device</b>	<b>Description</b>
<b>Peripheral</b>	HM 2004	Voice Processor
	HM 9200	Call-Progress Tone Decoder
	HM 9202/9203/9204	DTMF Receiver Series

### **OTHER INFORMATION**

Hualon does not employ a PR firm.

**IC Sensors, Inc.**  
1701 McCarthy Blvd.  
Milpitas, CA 95035  
408/432-1800  
Fax: 408/434-6687

**ESTABLISHED: 1982**

**NO. OF EMPLOYEES: 145**

## **BACKGROUND**

IC Sensors, Inc., designs, develops, and manufactures both standard and custom pressure sensors. The Company developed its silicon sensor technology and applied it to design and manufacture a variety of pressure sensors, accelerometers, pressure switches, load sensors, valves and actuators, and other microstructures. The Company's products are used in medical, industrial, automotive, aerospace, and consumer applications.

IC Sensors was formed with funds provided by the founders. The Company received additional funds when it formed a strategic partnership with Borg-Warner. In December 1986, IC Sensors, Inc., and Transensory Devices, Inc., (TDI) completed a merger. TDI was founded in 1982 and developed a micromachining technology that is used to fabricate both custom and standard devices.

In September 1987, IC Sensors introduced a new technology called Silicon Micromachining, which applies semiconductor production techniques to mechanical devices. Micromachined sensors are produced by etching precise micromechanical structures in silicon. As a result, the structure that serves as a mechanical sensing device is also a semiconductor.

The basic elements of the microstructure technology include the photolithographic processes, oxidations, diffusions, thin-film processes, and metallizations common in the IC industry. A number of other processes are used as well, such as wet chemical and dry etch processes, etch stops, double-sided patterning, and multilayer structures.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

(Position and Name)

### **CEO**

\*Donald G. Lynam

### **President**

Dr. James W. Knutti

### **VP, Marketing and Sales**

Frank A. Perrino

### **VP, Engineering**

Henry V. Allen

### **Chief Engineer**

Edward J. Russell

### **VP, Operations**

\*Manuel G. Rossell

### **VP, Finance**

Robert Regalia

\*Founder

## **FINANCING**

Not available

## **RECENT HIGHLIGHTS**

### **June 1987**

IC Sensors offered the 1210 and 1220—two piezoresistive sensors.

### **July 1987**

IC Sensors offered the 2501, a miniature silicon pressure switch that eliminates the need for comparators, external voltage references, and potentiometers.

### **July 1987**

IC Sensors offered the 410, a general-purpose piezoresistive sensor that is mountable on PC boards.

## IC Sensors, Inc.

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### September 1987

IC Sensors introduced a new technology, silicon micromachining, that applies semiconductor production techniques to mechanical devices.

### September 1987

IC Sensors introduced a silicon piezoresistive accelerometer, the Model 3021.

## ALLIANCES

### Borg-Warner Corp.

Borg-Warner does some manufacturing for IC Sensors, Inc.

## MANUFACTURING

### Technology

Not available

### Facilities

Milpitas, CA

34,000 total sq. ft.

Headquarters, manufacturing

9,000 sq. ft.

Fabrication area

## PRODUCTS

Pressure Sensors

Accelerometers

Pressure Switches

Load Sensors

Valves and Actuators

## OTHER INFORMATION

IC Sensors does not employ a PR firm.



# ICI Array Technology, Inc.

1297 Parkmoor Avenue  
San Jose, CA 95126-3448  
408/297-3333  
Fax: 408/297-3763

ESTABLISHED: 1982

NO. OF EMPLOYEES: 130

## BACKGROUND

ICI Array Technology offers a variety of technologies to support development and manufacturing of small-footprint subsystem products. The Company emphasizes designing for manufacturability. Subsystem design is supported with ASIC capability in CMOS gate arrays and cell-based-designed ICs. One of the Company's major strengths is surface-mount technology (SMT) and COB technology offered as part of a totally integrated system.

The Company was founded by William Robson, without venture capital, as Array Technology, Inc. In January 1986, the Company was acquired by Imperial Chemical Industries PLC (ICI), a large U.K. chemical company, and renamed ICI Array Technology. Prior to its acquisition, Array Technology funded all activities from its design and consulting fees.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

### President

Bernie Aronson

### VP, Marketing & Sales

Jack Hullman

### Director of Finance

Erik Simonson

### Director of Engineering

Dennis Morris

### Director of Operations

Rich Frieberger

## Program Manager

\*Brian Tighd

\*Founder

## FINANCING

Not available

## ALLIANCES

### ICI

January 1986

Imperial Chemical Industries Plc (ICI), a large U.K. chemical company, acquired Array Technology.

### National

March 1988

National Semiconductor and ICI Array Technology signed an agreement under which ICI Array will use National's design systems and process specifications to develop proprietary ASICs.

## MANUFACTURING

Multiple offshore and U.S. sources provide CMOS silicon wafers.

## Technology

1.0-, 1.5-, 2.0-, and 3.0-micron, double-layer metal, silicon-gate CMOS designs on Mentor tools

## Facilities

San Jose, CA

50,000 sq. ft.

Administration, design, production

# ICI Array Technology, Inc.

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## PRODUCTS

### CMOS Gate Arrays

Process	Linewidth (micron)	Delay (ns)	Cells
Si-Gate	1.5, 2.0, 3.0	0.5 to 2.0	RAM, ROM

### Digital Gate Arrays

150 to 20,000 gates

### Linear Arrays

### Semicustom Subsystems

## OTHER INFORMATION

ICI Array Technology does not employ a PR firm.

# Innovative Silicon Technology

Wholly Owned Subsidiary of SGS-Thomson

1310 Electronics Drive

Carrollton, TX 75006

214/466-6000

Fax: 214/466-6572

ESTABLISHED: May 1986

NO. OF EMPLOYEES: 160

## BACKGROUND

Innovative Silicon Technology (IST) was formed by SGS-Thomson Microelectronics to meet the growing market demands for advanced ASICs. The Company was formed by Piero Martinotti and others from Motorola to concentrate on quick-turn R&D for the ASIC market. SGS-Thomson, which transferred the assets of its ASIC activities to IST, provides high-volume foundry services, allows access to its design centers by IST engineers and IST customers, and provides sales and marketing support. The assets transferred from SGS-Thomson to IST include technologies, CAD and production hardware and software, R&D capacity, a significant customer base, a consolidated product portfolio, and human resources.

IST conducts R&D, design, prototyping, low-volume production, assembly, and test, and uses 1.2- to 3.0-micron single-, double-, and triple-layer metal and direct-write e-beam technologies. The Company recently opened a new facility in Agrate, Italy, which serves as its worldwide headquarters and includes wafer fabrication and R&D facilities.

Innovative Silicon Technology's products include gate arrays with up to 50,000 gates and a cell-based library with 140 logic cells.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

Chief Executive Officer  
Pierangelo Martinotti

Director of Central Business

Mario Licciardello

Director of R&D

Roberto Fantechi

Europe/Asia Operating Unit Director

Pietro Palella

QC Director

Ignazio Salvemini

Finance Administration Director

Arrigo Gradi

Director of Human Relations

Marco Bartolozzi

## FINANCING

May 1986

Innovative Silicon Technology is wholly owned by SGS-Thomson Microelectronics.

## ALLIANCES

CDI

April 1987

IST and California Devices Inc. (CDI) agreed to a joint product development and second-source agreement covering two families of ASICs using channelless architectures. The first family is a 2-micron, double-metal CMOS with up to 24,000 gates. The second family is based on a 1.5-micron technology and will include more than 100,000 gates.

SDA Systems

May 1987

IST signed an agreement with SDA Systems to develop CAD systems based on SDA technology for use by IST customers.

# Innovative Silicon Technology

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## SERVICES

Quick-turn R&D  
Foundry

Agrate, Italy  
13,500 sq. ft.

Worldwide headquarters, wafer fab, R&D

## MANUFACTURING

### Technology

1.2- to 3.0-micron, double- and triple-layer  
metal CMOS; 4-inch and 6-inch wafers

Innovative Silicon Technology employs SGS-Thomson design centers in France, Italy, Sweden, the United Kingdom, West Germany, Hong Kong, Singapore, South Korea, and Taiwan.

Assembly operations are conducted in SGS-Thomson facilities in Malaysia, Malta, and Singapore.

### Facilities

Carrollton, TX, U.S.  
22,500 sq. ft.

Wafer fab, test, marketing, customer support,  
sales

## PRODUCTS

### Gate Arrays

50,000 Gates; 1.2-Micron, Double-Layer Metal designed for Triple-Layer  
10,000 Gates; 2.0-Micron, Double-Layer Metal  
6,000 Gates; 3.0-Micron, Double-Layer Metal  
2,500 Gates; 3.5-Micron, Single-Layer Metal

### Cell-Based Library

140 Cells; 3.0- and 1.2-Micron, Double-Layer Metal; Fully Compatible with Gate Array Libraries

## OTHER INFORMATION

Innovative Silicon Technology does not employ a PR firm.

# Inova Microelectronics

2220 Martin Avenue  
Santa Clara, CA 95050  
408/980-0730  
Fax: 408/980-1805

ESTABLISHED: December 1983

NO. OF EMPLOYEES: 62

## BACKGROUND

Inova Microelectronics designs, manufactures, and markets ultralarge-scale integrated (ULSI) multichip ICs that use waferscale integration technology developed by the Company. Inova has developed a unique interconnect technology called Inroute. Initially, Inova is using Inroute to integrate multiple memory structures at the wafer level to produce a line of high-density SRAMs.

Inroute is based on an architecture of repeatable slices. (A slice is a row of memory structures.) Slices are repeated on the circuit, including spare slices to allow for defects. A second feature of the Inroute technology is the ability to isolate slices for testing. Working slices are identified and their addresses established by means of fuse-programmable logic. Nonfunctional slices are disconnected through a lacing of fuses so that a defect in a single device does not affect the functionality of the entire circuit. A third feature is the use of a universal second metal layer that can be used for all wafers because all nonfunctional circuits have been disconnected. The technology uses standard fabrication methods and equipment and is transportable to CMOS, BiCMOS, bipolar, GaAs, and VHSIC processes.

Inova's product line focuses on applications where the capability of the system to be integrated requires a large area of silicon. The products typically are characterized by having large repetitive sections of silicon, such as the Company's initial product offerings. In June 1988, Inova began volume shipment of the S128K8, a 1Mb CMOS SRAM. The device is built under a foundry agreement with Sharp, using a 1.2-micron, double-metal, double-poly process. The device, which is comprised of 40 base 4Kx8 slices, targets military accounts that previously have used 1Mb SRAM modules with four 256K parts. In addition to the S128K8, Inova currently is shipping the S32K8, a 256K SRAM. The S32K8 is built with the same 4Kx8

slice used in the 1Mb version. These products will be followed by a family of SRAMs that will be developed through different integrations of the base 4Kx8 slice.

Inova will be developing other ULSI products where a monolithic system solution is not possible with traditional design methods. Applications for these products may include telecommunications, systolic arrays, digital signal processing, and image processing. The Company's product lines serve military, commercial, and industrial markets. Inova has received a DESC Standard Military Drawing for its 70 to 120ns products. Future plans include a 25ns SRAM, available in mid-1990, and product lines containing cache controllers and neural network products. Inova also plans to introduce the first commercially available 4Mb SRAM.

In September 1988, Inova acquired LYNX Technology, a start-up company in the memory product business. LYNX becomes Inova's Colorado Springs division and is responsible for the development of SRAMs. The division in Colorado Springs and headquarters in Santa Clara share responsibility for process and technology development. Dr. Ron Bourassa, previously president and CEO of LYNX, is the vice president and general manager of the Colorado Springs division.

## BOARD

(Name and Affiliation)

Vaemond Crane  
Inova Microelectronics, President

Glenn Penisten  
Alpha Partners

Dan Flamen  
Comann, Howard & Flamen

Pete Thomas  
Institutional Venture Partners

# Inova Microelectronics

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Blair Stewart  
Wilson, Sonsini, Goodrich & Rosati  
Gene Strull  
Westinghouse Electric Corp.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Vaemond Crane  
MIPS Computer Systems, President/CEO

**VP Marketing**  
Doug Mitchell  
Inmos, Dir Technical Marketing

**VP Finance**  
David Garrett  
Stanford Applied Engineering, CFO

**VP Operations, Santa Clara**  
Howard Gopen  
Intel, Wafer Fab Plant Manager

**VP Operations, Colorado Springs**  
Ron Bourassa  
LYNX Technology, President/CEO

## FINANCING

1984  
Seed  
\$2.0M  
Alpha Partners

February 1986  
Round 1  
\$5.3M  
Alpha Partners, Asset Management, Bryan & Edwards, Glenwood Management, Jupiter Partners, Institutional Venture Partners, Paribus Technology, Ritter Partners, Technology Venture Investors

April 1987  
Round 2  
\$2.5M  
Westinghouse Electric Corporation

April 1988  
Round 3  
\$5.0M  
All previous investors

## RECENT HIGHLIGHTS

June 1988  
Inova began shipping the S128K8 1Mb CMOS SRAM.

September 1988  
Inova acquired LYNX Technology, a start-up memory company in Colorado Springs, Colorado.

## ALLIANCES

**United Microelectronic Products**  
November 1985  
Inova and UMP signed a five-year foundry agreement under which UMP will provide base wafers to Inova.

**Westinghouse**  
June 1987  
Westinghouse Electric Corporation invested \$2.5 million in equity and \$2.5 million in lease guarantees. Westinghouse also is working with Inova as part of its strategic long-term technology efforts. The efforts are sponsored by Westinghouse's Advanced Technology Division.

## MANUFACTURING

**Technology**  
1.2-micron CMOS

**Facilities**  
Santa Clara, CA  
12,000 sq. ft.  
Design, test  
Colorado Springs, CO  
8,500 sq. ft.  
Design, process development

## PRODUCTS

Part No.	Device Type	Organization	Access Time
S128K8	1Mb SRAM	128Kx8	70 to 120ns
S32K8	256K SRAM	32Kx8	55 to 100ns

## OTHER INFORMATION

Inova Microelectronics does not employ a PR firm.

# Integrated CMOS Systems, Inc.

440 Oakmead Parkway

Sunnyvale, CA 94086

408/735-1550

Fax: 408/735-9808

ESTABLISHED: October 1984

NO. OF EMPLOYEES: 65

## BACKGROUND

Integrated CMOS Systems (ICS) designs, manufactures, and markets system-level VLSI semiconductors for cost-effective design and production of customer-specific subsystems. ICS provides complete turnkey solutions from design definition to working multichip subsystems.

ICS developed a family of gate array masterslices; advanced, high-pin-count surface-mount packaging; and board-level technology for high-performance, midrange computer systems. The Company's design technology is integrated with a design automation system that can take a description of a system and transform it into an optimized and testable subsystem-level solution.

The Company's future plans include submicron processes, expanded gate array families, and advanced behavioral design implementation.

In March 1988, ICS and Apollo Computer Inc. introduced the series 10000, a new RISC-based workstation based on ICS' subsystem technology. The series 10000 achieves an execution rate of more than one instruction per cycle. The performance is achieved by parallelism among processors using 64-bit data paths and an efficiently coupled set of VLSI devices. ICS contributed system-level design and gate arrays that incorporate level-sensitive scan design (LSSD) test methodology to assure a testable product the first time.

The system uses 10 different 1.5-micron, double-level metal CMOS gate arrays with densities of 30,000+ gates from the ICS10000 Series Family. The implemented chips include a RISC-based integer processor, a floating-point register file, a memory manager, an I/O manager, and a high-speed system bus processor. The ICS10000 has up to 360 configurable I/O pads and comes in packages with up to 340 pins.

The Company's heritage is high-performance, large computer system design and development. ICS' founders came from Amdahl, IBM, and the STC Computer Research Corp., which was set up by Storage Technology.

## BOARD

The Board consists of representatives from the following concerns:

DSV Partners  
Hambrecht & Quist  
Hambro International  
Industrial Technology Research Institute  
(ITRI), Taiwan  
Montgomery Securities  
Venrock Associates

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Lin Wu  
STC Computer Rsch Corp., Sr VP Opns/COO

### Exec VP, Operations

Roy Thiels  
National Semiconductor, Pro Dir CMOS, Gate Arrays

### Chief Techn Officer

Larry Cooke  
STC Computer Research Corporation, Dir Des Automation

### VP Engineering

Jin Shyr  
Daisy, Mgr Prod Tech Support

### VP Strat Plan

Symon Chang  
STC Computer Rsch Corp., Sr Eng Mgr

### VP Mfg

Steve Margoslan  
Interest Corporation, VP Engineering



# Integrated CMOS Systems, Inc.

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## VP Sales

Steve Stephansen  
AMD, Director of Sales

## VP Marketing

Robert G. Andrews  
ZyMOS, Dir Corp Mktg

## VP Finance

Michael J. DelGrosso  
The Bottom Line, Consultant

International; ITRI, Taiwan; Montgomery Securities; Sequoia Capital; Venrock Associates

## ALLIANCES

VLSI Technology, Toshiba  
1985

Toshiba and VLSI began providing foundry services for ICS.

## FINANCING

1985

Round 1

\$2.5M

Hambrecht & Quist, private individuals

May 1987

Round 2

\$5.5M

DSV Partners, Hambro International Venture Fund, Montgomery Securities, Venrock Associates

October 1988

Round 3

\$4.2M

DSV Partners; Hambrecht & Quist; Hambro

## MANUFACTURING

ICS subcontracts wafer fabrication with Toshiba of Japan, Taiwan Semiconductor Cooperative (TSMC), and National Semiconductor in the United States.

## Technology

1.5-micron and 1.0-micron, dual-metal CMOS

## Facilities

Sunnyvale, CA

12,500 sq. ft.

Headquarters and design

Braintree, MA

Sales office

## PRODUCTS

### Gate Arrays

10,000 to 30,000 1.5-micron usable gate, gate arrays (ICS10000 Series)

10,000 up to 60,000 1.0-micron usable gate, gate arrays (ICS15000 Series)

15,000 to 50,000 1.0-micron usable sea-of-gate, gate arrays (IC20000 Series)

## OTHER INFORMATION

Integrated CMOS Systems' PR firm is Thomas Associates.

# Integrated Information Technology

2540 Mission College Blvd., Suite 105

Santa Clara, CA 95054

408/727-1885

Fax: (408) 292-1922

ESTABLISHED: April 1987

NO. OF EMPLOYEES: 23

## BACKGROUND

Integrated Information Technology (IIT) was founded to develop high-performance compute engines for applications in personal computers and other information-processing hardware. IIT's objective is to enhance existing standards of compute engine-based silicon technology for personal computer platforms while embedding additional functionality that will evolve new standards to create new markets for existing and future products and increase information flow in the workplace. The Company was founded in April 1987 by two former Weitek employees, Chi-Shin Wang and Y.W. Sing. Dr. Wang also was a cofounder of Weitek.

The Company currently offers two math coprocessors—the IIT-2C87 and the IIT-3C87—and will begin shipment of its integrated graphics array (IGA) in late 1989. The single-chip IGA is fully compatible with VGA and is downward compatible with EGA, CGA, MGA, and Hercules. In the future, IIT plans to offer a 386 object code-compatible CPU family, a 32-bit controller, and a DSP device.

To date, IIT has received funding in two rounds of financing and has \$2.7 million in current assets, which the Company believes to be significant capital to carry it to positive cash flow with a comfortable margin. Investors were Ascii, General Electronics, Mitsui, and Yamaha. Strategic relationships have also been established with Ascii, Mitsui, and Yamaha. Yamaha is conducting wafer fab operations for IIT; Mitsui and Yamaha serve as IIT's Japanese distribution agents. In addition to wafer fab, IIT subcontracts assembly and test operations; the Company conducts design, marketing, and QA in-house.

## BOARD

(Name and Affiliation)

\*Dr. Chi-Shin Wang  
IIT, President

\*Dr. Y.W. Sing  
IIT, Executive VP

Dick Chang

Samuel Fang

Kazuhiko Nishi  
Ascii, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Dr. Chi-Shin Wang  
Weitek, VP of Engineering

### Executive VP

\*Dr. Y.W. Sing  
Weitek, Manager, Advanced Product  
Development

### VP Marketing & Sales

Gene Parrott  
Cirrus Logic, VP Sales

### VP Operations

Robert Shen  
VTI, Director WW Manufacturing Operations

### Manager Sales Operations

Karen Zelina  
AMD, AT&T Program Manager

### Manager, R&D

Jan Fandrianto  
Weitek, Chief Design Engineer

\*Founder

# Integrated Information Technology

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## FINANCING

1987

Round 1

Undisclosed amount

General Electronics

1988

Round 2

Undisclosed amount

Ascii, Mitsui, Yamaha

**Mitsui**

1989

IIT signed a strategic alliance with Mitsui, giving Mitsui distribution rights for IIT products in Japan.

**Yamaha**

1989

IIT signed a foundry agreement with Yamaha, under which Yamaha will provide wafer fabrication services to IIT.

## ALLIANCES

Ascii

1989

IIT signed a distribution agreement with Ascii, making Ascii a regional distributor of IIT products in Japan.

## MANUFACTURING

**Technology**

1.2- and 1.0-micron CMOS

**Facilities**

IIT subcontracts all wafer fabrication, assembly, and test, while conducting design, marketing, and QA in its Santa Clara facility.

## PRODUCTS

IIT-2C87 Math Coprocessor

IIT-3C87 Math Coprocessor

IGA

## OTHER INFORMATION

IIT's PR firm is Joyce Lekas Public Relations.

# Integrated Logic Systems, Inc.

4445 Northpark Drive, Suite 102

Colorado Springs, CO 80907

719/590-1588

Fax: 719/590-1373

ESTABLISHED: August 1983

NO. OF EMPLOYEES: 15

## BACKGROUND

Integrated Logic Systems, Inc. (iLSi), was formed to design and develop a family of silicon-gate CMOS and software-based design aids.

iLSi introduced new gate array architectures that offer customers state-of-the-art capabilities. iLSi's product line is capable of implementing 45,000-gate designs that can include large complex functions such as ROM, RAM, PLA, PAL, and the 2900 family in a variety of package options.

The Company has licensing and foundry agreements with four major worldwide corporations.

## BOARD

(Name and Affiliation)

Ted Orf, Chairman

Integrated Logic Systems, Inc.

\*Frank Gasparik

Integrated Logic Systems, Inc.

James Shook

Consultant

Gordon Olinger

Consultant

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President

\*Frank Gasparik

Insouth, VP Engineering

Exec VP/CFO

Ted Orf

Attorney

VP Sales/Mktg

Bruce Grieshaber

Honeywell, Nat Sales Mgr

\*Founder

## FINANCING

January 1984

Round 1

\$5.0M

OTC offering

## RECENT HIGHLIGHTS

June 1989

Integrated Logic Systems introduced the Metal Programmed Gate Array (MPGA), which is designed to replace current PLDs and PGAs.

## ALLIANCES

Motorola

June 1986

iLSi licensed its line of gate arrays to Motorola (inactive).

Sumitomo

December 1986

iLSi signed an agreement with Sumitomo Corporation and SC Hightech Center, a design center formed to carry out the agreement. Sumitomo licensed ASIC design technology from iLSi. In addition to gaining royalty payments, iLSi gained rights to use any foundries that Sumitomo uses.

Yamaha

December 1987

Yamaha Corporation purchased a license to manufacture and sell gate arrays based on iLSi technology for an undisclosed amount. Yamaha will pay royalties and provide foundry services.

Oki

April 1988

iLSi signed a technology purchase and licensing agreement with Oki Electric Industry Company, Ltd., for an undisclosed amount. Oki will manufacture and sell gate arrays based on iLSi technology and will provide foundry services.

# Integrated Logic Systems, Inc.

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## MANUFACTURING

### Technology

- 1.5-micron silicon-gate CMOS, double-level metal
- 1.2-micron silicon-gate CMOS, double-level metal under development

### Facilities

- Colorado Springs, CO  
10,000 sq. ft.  
Administration and design
- Boulder, CO  
CAD development

## PRODUCTS

### CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
CA-1500	Si-Gate	1.5	1.0	2,000 to 42,000
15GH	Si-Gate	1.5	1.0	2,500 to 110,000

## OTHER INFORMATION

Integrated Logic Systems does not employ a PR firm.

## Intergraph Advanced Processor Division

2400 Geng Road  
Palo Alto, CA 94303  
415/494-8800  
Fax: 415/856-9224

ESTABLISHED: October 1987

NO. OF EMPLOYEES: 140+

### BACKGROUND

The Intergraph Advanced Processor Division (APD) is a division of Intergraph Corporation and is the result of Intergraph Corporation's acquisition of the Fairchild Advanced Processor Division. The age of the two parent companies normally would exclude the Company from this directory. However, Dataquest believes that, although the division is not a start-up company per se, the operation is the result of a new focus at Fairchild (prior to the acquisition by National) on high-performance MPUs.

APD was acquired in October 1987 for \$6.25 million. APD employs more than 140 people involved in the engineering, manufacturing, sales, and support of the merchant market CLIPPER 32-bit RISC microprocessor. APD was formed in 1982 to develop an advanced MPU based on RISC principles. Howard Sachs formed APD and built the division to bring the new CLIPPER microprocessor to market. The CLIPPER 32-bit MPU family was the first commercially available RISC microprocessor to ship in volume production.

The first-generation CLIPPER RISC MPU is the C200. The C200 operates at either 25 or 33 MHz. The second-generation CLIPPER microprocessor, the C300, delivers twice the performance of the C200 and operates at 40 or 50 MHz. All of the current CLIPPER products are implemented in CMOS process technology. Future CLIPPERs will be implemented in both CMOS and bipolar process technologies. Currently, all of APD's fabrication is contracted to Fujitsu. All assembly and testing is done in-house.

CLIPPER microprocessors are currently used in both interactive computer systems and embedded applications. Interactive systems applications include business systems, engineering and graphics workstations, and board-level products based on

the PC AT bus, VMEbus, and NuBus. As an embedded processor, CLIPPER's primary use is in Raster Image Processing. CLIPPER is also used in a high-speed dedicated database engine.

At this time, APD is the only RISC vendor to offer a full range of binary-compatible CPUs in three formats: individual chips, chip sets, and prepackaged RISC modules.

### BOARD (Intergraph Corporation) (Name and Affiliation)

James Meadlock, Chairman  
Intergraph Corp., CEO  
Roland Brown  
Larry Laster  
Intergraph Corp., Executive VP  
Nancy Meadlock  
Intergraph Corp., Executive VP  
Keith Schonrock  
James Taylor  
Intergraph Corp., Executive VP  
Robert Thurber  
Intergraph Corp., Executive VP

### COMPANY EXECUTIVES (Position, Name, Prior Company, and Prior Position)

**VP and General Manager**  
Howard Sachs  
Fairchild, General Manager

**Director Engineering**  
Tim Robinson  
High Level Hardware

**Director Marketing**  
Ralph Kaplan  
B.I.T., VP of Marketing

# Intergraph Advanced Processor Division

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## Director Software Engineering

John Kellum  
Fairchild

## Director Manufacturing

Steve Rowles  
Fairchild, Director of Manufacturing

## Director QA

Thomas Wehman  
Fairchild, Director of QA

## FINANCING

### October 1987

Acquisition

\$6.25M

Intergraph Corporation acquisition of Fairchild  
Advanced Processor Division

## PRODUCTS

CLIPPER C200 RISC MPU, 25 or 33 MHz

CLIPPER C300 RISC MPU, 40 MHz

CLIPPER C300 RISC MPU, 50 MHz

## OTHER INFORMATION

Intergraph does not employ a PR firm.

## ALLIANCES

### Fujitsu

Early 1987

Intergraph established a foundry agreement with Fujitsu, under which Fujitsu provides wafer fabrication services to the Advanced Processor Division.

## MANUFACTURING

### Technology

1.5-micron CMOS, moving to submicron  
CMOS in 1990

### Facilities

Palo Alto, CA

50,000 sq. ft.

Assembly, test, marketing, QA, administration

# International CMOS Technology, Inc.

2125 Lundy Avenue

San Jose, CA 95131

408/434-0678

Fax: 408/434-0688

ESTABLISHED: October 1983

NO. OF EMPLOYEES: 50

## BACKGROUND

International CMOS Technology, Inc., (ICT) designs, manufactures, and markets CMOS EEPROMs, EPROMs, and EEPLDs. ICT stated that, in 1984, the Company successfully combined the first 5V-only CMOS EEPROM (the 93C46) in volume production.

The Company's current product offerings include the programmable electrically erasable logic (PEEL) family of CMOS PLDs. The PEEL products use the Company's CMOS 1.25- and 2.0-micron EEPROM technology and feature a propagation delay as fast as 15ns. Additional ICT products include serial EEPROMs; a 40ns, 64K CMOS UV-erasable PROM; and a 35ns, 32K UV-erasable PROM that targets the bipolar 24-pin PROM market.

ICT also offers design and development tools. The Company enlisted John Birkner, the inventor of the PAL (a trademark of Monolithic Memories), to create a low-cost, easy-to-use developmental package consisting of design software and a PC-based, software-controlled programmer. ICT gives the software, free of charge, to any party interested in using PEEL devices.

ICT is developing a family of products that will address the high-density PLD and programmable gate array markets. The introduction of these devices will complete a PLD family ranging from 20-pin, 300-gate equivalent PLDs to 40-/68-/84-pin, 10,000-gate programmable gate arrays.

The Company is planning advances in its memory lines as well and is working on process and design shrinks to minimize the access times further and allow for the fabrication of 256K and larger devices.

The Company was founded by Drew Allen Osterman, Dr. Samuel T. Wang, Dhaval J.

Brahmbhatt, and Donald E. Robinson, all of whom were formerly with National Semiconductor Corporation, and Lawrence A. Yaggi, Jr., formerly with Perkin-Elmer. In January 1988, Paul K. Forster joined ICT as its first vice president of sales and marketing.

ICT entered into technology development agreements with Gould Semiconductor and Hyundai Electronics to offset major start-up costs. These agreements provide ICT with operating capital and a significant share of production capacity. The agreements also provide ICT with additional technical support in the form of CAD services and prototype wafer fabrication.

## BOARD

(Name and Affiliation)

\*Drew Allen Osterman, Chairman of the Board  
CEO and President

Paul Reagan, Director

Lee Lunsford, Director

Ali Dad Farmanfarma, Director

\*Dr. Samuel T. Wang, Director  
Vice President of Technology

C.S. Park, Director

\*Lawrence A. Yaggi, Jr.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Drew A. Osterman  
National Semiconductor, Mktg Mgr NV Mem

### VP Technology

\*Dr. Samuel T. Wang  
National Semiconductor, Sr Process Eng Mgr



# International CMOS Technology, Inc.

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## VP Sales/Mktg

Paul K. Forster  
Signetics, Dir Dist Sales

## VP Dsn Engr

\*Dhaval J. Brahmbhatt  
National Semiconductor, Engr Mgr

## VP Operations

\*Donald E. Robinson  
National Semiconductor, Prod Mgr EPROMs

## VP CFO

\*Lawrence A. Yaggi, Jr.  
Perkin-Elmer, Controller

\*Founder

## FINANCING

### 1984

Rounds 1 and 2  
\$5.0M  
Hyundai Electronics Industries

### June 1987

Round 3  
\$2.0M  
Undisclosed institutional investors

### February 1988

Round 4  
\$2.9M  
Undisclosed institutional investors

### June 1989

IPO  
\$3.6M  
Initial public offering

## RECENT HIGHLIGHTS

### January 1987

Asahi Chemical Industry received a license to ICT's technology and will market ICT's EEPROMs.

### June 1987

ICT raised \$2.0 million in third-round financing. The funds were used for additional capital equipment and personnel and for general work-

ing capital. ICT also announced a move to a new 31,000-square-foot facility adjacent to its current site in San Jose, California.

### July 1987

ICT offered four new CMOS UV EPROMs with access times of 35ns, 45ns, and 55ns. The 27CX641 and 27CX642 are organized as 8Kx8, and the 27CX321 and 27CX322 are organized as 4Kx8. The products differ in packaging.

### September 1987

ICT offered the PDS-1 development system for designing and programming PEEL devices. Designers can use either ICT's APEEL compiler or third-party development software. The system includes an editor, a logic assembler, a PLD-to-PEEL translator, a programmer, and a device tester.

### December 1987

ICT offered four new CMOS PLD devices. The 20-pin PEEL153 and 24-pin PEEL173 are plug-in replacements for bipolar FPLA devices. The 20-pin PEEL253 and 24-pin PEEL273 offer architectural enhancements to the PEEL153 and PEEL253, respectively.

### January 1988

ICT signed a nationwide distribution franchise agreement with Marshall Industries.

### February 1988

ICT raised \$2.9 million in fourth-round financing from undisclosed institutional investors.

### June 1989

Initial public offering

## ALLIANCES

### Hyundai

#### October 1983

Hyundai and ICT signed a joint development agreement to develop and produce seven or eight devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs. Hyundai funded ICT's initial product development and allocated 30 percent of its wafer fab capacity for an equity interest in ICT.

# International CMOS Technology, Inc.

## IMP

July 1984

IMP and ICT codeveloped a CMOS EEPROM process (expired).

## Gould

April 1986

ICT will transfer its CMOS EEPROM process semiconductor technology and products to Gould in exchange for foundry services and second-sourcing of PEEL and EEPROM devices. Gould will provide foundry services for ICT's new high-speed CMOS EEPROM family. Both companies will work on new product and technology development including work on PEEL products.

## Asahi Chemical

January 1987

Asahi Chemical Industry received a license

to ICT's technology and will market ICT's EEPROMs.

## AMD

July 1989

ICT and AMD signed an agreement for joint development of a 1Mb EPROM device with an access time of 55ns.

## MANUFACTURING

### Technology

1.25- and 2.00-micron CMOS EE process  
1.0- and 0.8-micron CMOS EE process in the near future

### Facilities

San Jose, CA

31,000 sq. ft.

Headquarters, design, test, marketing, and sales

## PRODUCTS

### Memory

Device	Description
93C46	1K Serial 5V Read/Write EEPROM
93C66	4K Serial 2.5V to 7.0V Read/Write EEPROM
27CX321/322	4Kx8 UV-Erasable PROM, 35ns, 40ns, 45ns
27CX641/642	8Kx8 UV-Erasable PROM, 40ns, 45ns, 55ns

### PEEL Devices

Device	Delay (ns)	Pins	Programmable Array(s)
PEEL18CV8	15	20	AND
PEEL22CV10	25	24	AND
PEEL20CG10	25	24	AND
PEEL153	30	20	AND/OR
PEEL173	30	24	AND/OR
PEEL253	30	20	AND/OR
PEEL273	30	24	AND/OR
PA7024	25	24	Undisclosed
PA7040	25	40	Undisclosed

PDS-1 development system that allows design with either ICT's PEEL logic compiler or third-party software. The system includes editor, logic assembler, logic simulator, PLD-to-PEEL translator, programmer, and device tester.

## OTHER INFORMATION

International CMOS Technology's PR firm is Hayes/Rothwell Public Relations.

# International Microelectronic Products

2830 North First Street

San Jose, CA 95134

408/432-9100

Fax: 408/434-0335

TWX: 910 338 2274

Telex: 499-1041

ESTABLISHED: January 1981

NO. OF EMPLOYEES: 500

## BACKGROUND

International Microelectronic Products (IMP) designs and manufactures mixed analog/digital and complex digital CMOS ASICs. The Company is a full-service vendor with in-house capability that includes cell-based design methods, advanced CAD tools, and high-performance CMOS processes. Products designed by IMP are used primarily in the microcomputer, computer peripherals, and communications markets. IMP's goal is to achieve sales of \$150 million by the early 1990s.

The Company is composed of three business groups. The IMP-Designed IC (IDIC) group performs complete IC design for customers. The Customer-Designed IC (CDIC) group links customers with their own designs and IMP's prototyping and production manufacturing. The Customer Technology Assistance Program (CTAP) supports customers in their long-term ASIC technology development efforts by coordinating technology licensing and joint development efforts for IC development and/or manufacturing capabilities in partnership with IMP.

In May 1986, IMP formed an affiliate company, IMP Europe Limited, headquartered in Swindon, England. IMP Europe's initial activities include custom IC design and applications engineering services for the European market.

In June 1987, IMP completed an initial public offering of 4.5 million shares of common stock that raised \$22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability to redeem Series-A preferred stock and for general corporate purposes.

One of IMP's goals is to maintain a process technology leadership position among ASIC suppliers.

The Company's 2- and 3-micron CMOS processes have the capability to implement various combinations of polysilicon and metal interconnect in p-well or n-well technology. In May 1988, a new 1.2-micron CMOS process and accompanying 1.2-micron analog and digital cell libraries were announced. They are tailored for mixed analog and digital functions on the same chip. The Company's facility uses all-stepper photolithography, gas plasma dry etchers, ion implantation, computer-controlled diffusion, and a computer parameter test process.

The Company's R&D programs currently focus on developing complex analog and digital cells for use in the IMP Design System; semiconductor manufacturing processes and device structures; advanced design software; and advanced networking, communications, and information systems for use in engineering and manufacturing. IMP is working with Silicon Compiler Systems Inc. to develop analog compilation techniques, with a leading university to develop advanced analog cells, and with the Company's IMP Europe affiliate for advances in CAD.

## BOARD

(Name and Affiliation)

\*George W. Gray, Chairman  
International Microelectronic Products

Barry Carrington, Director  
International Microelectronic Products

\*Zvi Grinfas, Director  
International Microelectronic Products

Russell Carson, Director  
Welsh, Carson, Anderson and Stowe

Richard Smith, Director  
Sohio

DuBose Montgomery, Director  
Menlo Ventures

# International Microelectronic Products

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Barry Carrington  
AMI, Sr VP Mfg

### Exec VP/CFO

Charles Isherwood  
AMI, Sr VP Corp Svcs

### Sr VP Ops

Larry Anderson  
NEC, Mfg Manager

### Sr VP Sales

Martin Landin  
Gould AMI, VP Sales

### VP Technology

Dr. Moiz Khambaty  
AMI, CMOS Tech Dev

### VP Materials

Paul Bolinger  
Synertek, Project Manager

### VP Sales

Bob Kromer  
National Semiconductor, Regional Sales Mgr

\*Founder

## FINANCING

### August 1981

Round 1

\$8.8M

IMP management and individuals; Charles River Partnership; Citicorp Venture Capital; Continental Illinois Venture; Harvest Ventures; INCO Securities; Lambda; Menlo Ventures; Robertson, Colman, & Stephens; Vista Ventures; Welsh, Carson, Anderson and Stowe

### 1981

Lease

\$13.0M

Bank of America, Orchard Properties

### August 1982

Round 2

\$7.4M

Initial investors (except IMP management and

individuals); R.W. Allsop; Edinburgh Financial, U.K.; Foster Industries; Murray Johnstone, U.K.; Prudential Nominees, U.K.; Republic Ventures; Robinson Investments; Scottish Development Agency; Stewart Enterprises, U.K.; Toronto Dominion Bank; H.G. Usher, U.K.; Wilmark R&D (Ivory & Sime), U.K.

### June 1983

Round 3

\$14.2M

Same as round 2 (except Stewart Enterprises and Wilmark R&D); IMP management and individuals; Aiken Hume; Alex Brown & Sons; Citibank; Drayton Montagu; GE Pension Fund; Hillman Company; IBM Retirement Trust Fund; Kleinwort Benson; Latigo Ventures; Lombard Odier; Morgan, Grenfell & Co.; Morgan Stanley & Co.; Mutual Benefit Life; Pacific Technology Venture; Robert Fleming & Co.; Schulf, Woltman & Co.; Walter Scott & Partners

### June 1984

Round 4

\$3.0M

National Semiconductor

### August 1984

\$4.0M

Standard Oil of Ohio

### June 1985

\$6.2M

Northern Telecom, Standard Oil of Ohio

### June 1986

£3.0M

CIN Investor Nominees Ltd.; Citicorp Venture Capital Ltd.; Pruventure, Syntech, Grosvenor Technology Fund

### June 1987

\$22.3M

Initial public offering

## RECENT HIGHLIGHTS

### September 1986

Barry Carrington, president, was promoted to CEO from COO. He succeeds George W. Gray, who remains as IMP's chairman of the board.

## International Microelectronic Products

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### June 1987

IMP completed an initial public offering of 4.5 million shares of common stock, raising \$22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability, to redeem Series-A preferred stock, and for general corporate purposes.

### December 1987

IMP reported third-quarter revenue of \$13.1 million for the period ending December 31, 1987. Net income for the period was \$1.8 million, which was a 200 percent increase compared with the comparable quarter a year before.

### May 1988

IMP announced a family of analog and digital 1.2-micron cell libraries and supporting CMOS processes. The ACL-1.2 and DCL-1.2 families can implement analog and digital functions on the same chip and can offer system speeds of 40 MHz. The digital CMOS process, called C1201, and the DCL-1.2 digital cell library became available in May 1988 in the United States and in Europe through IMP Europe. The analog CMOS process, C1202, and the ACL-1.2 analog cell library became available in January 1989.

## ALLIANCES

### Zoran

June 1983

IMP and Zoran codeveloped a CMOS PROM technology.

### IXYS

November 1983

IMP codeveloped a high-voltage CMOS process with IXYS.

### National Semiconductor

1984

IMP and National Semiconductor signed a five-year technology exchange and second-source agreement transferring IMP's standard cell designs in exchange for National's multiple-

layer metal silicon-gate CMOS process, as well as future CMOS processes.

### April 1985

IMP will second-source National's 2-micron gate arrays.

### Micro Linear

June 1984

IMP and Micro Linear codeveloped a 10V CMOS process. IMP provides foundry services for Micro Linear.

### Micro Linear/MBB

August 1986

IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

### ICT

July 1984

IMP and ICT codeveloped a CMOS EEPROM process.

### Iskra

April 1985

IMP and Iskra codeveloped a CMOS analog cell library for which IMP provides foundry services.

### Lattice Logic

May 1986

Lattice Logic's CHIPSMITH Silicon compiler software became available with IMP's design rules.

### Silicon Compilers

June 1986

SCI and IMP announced a strategic alliance to develop analog compilation capability for SCI's Genesil Silicon Development System. SCI will incorporate IMP's 3-micron, double-poly, double-metal process into the Genesil system.

### Lasarray

August 1986

IMP and Lasarray agreed to cooperate on developing a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module. Initial wafers will contain a 2-micron, 2-layer metal CMOS 2,400-gate array with 1.5ns delay.

# International Microelectronic Products

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## Electrolux

November 1987

IMP signed a five-year agreement with Electrolux of Sweden to develop ASIC devices that will be used in home appliances. IMP will also develop CAD tools for Electrolux and its component subsidiary, Electrolux Mecatronik. IMP will manufacture the devices in San Jose, California.

## Mitel

March 1989

Mitel Corporation and International Microelectronic Products (IMP) announced a strategic alliance in communications chips including applications related to integrated services digital network (ISDN). Under the joint technology transfer agreement, Mitel will exchange four communications chip designs for IMP's MxCMOS 1.2 manufacturing process, ACL1.2-DCL1.2 cell libraries, and mixed analog/digital design methodology.

## SERVICES

Foundry  
Design  
Prototyping

## MANUFACTURING

### Technology

3.0-, 2.0-, and 1.2-micron CMOS  
P-well, double-metal, double-poly  
5-inch wafers

### Facilities

San Jose, CA  
110,000 sq. ft.  
Headquarters and manufacturing  
16,000 sq. ft.  
Class 10 clean room

## PRODUCTS

### CMOS Gate Array

Process	Linewidth	Delay	Gates
Si-Gate	2 Microns	1.0ns	800 to 6,000

### CMOS Cell Library

Family	Process	Gate Length	Delay (ns)	Cells
ACL-3	Si-Gate	3.0 Microns	N/A	>40 Analog
DCL-3	Si-Gate	3.0 Microns	3.5	>0 Logic
DCL-2	Si-Gate	2.0 Microns	1.0	>0 Logic, RAM, ROM, PLA
ACL-2	Si-Gate	2.0 Microns	N/A	8 Analog
DCL-1.2	Si-Gate	1.2 Micron	0.3	70 Logic
ACL-1.2	Si-Gate	1.2 Micron	N/A	8

N/A = Not Applicable

### Development Tools

Device	Description
IDS-II	Distributed Processing, Sun-Based Design System for Cell-Based and Full-Custom Products
UNT	Universal Netlist Translator (UNT) that Converts any Gate Array Netlist or Cell-Based Design to an IMP Cell-Based Design
SCF Compiler	Switched Capacitor Filter Compiler Software
SCIL	Standard Cell IC Layout System Software
BIL	Block IC Layout Software

## OTHER INFORMATION

IMP's PR firm is Regis McKenna, Inc.

**Isocom Limited**  
Prospect Way  
Park View Industrial Est.  
Brenda Road  
Hartlepool, Cleveland, England  
(0429) 221431

**Isocom, Inc.**  
256 E. Hamilton Avenue, Suite H  
Campbell, CA 95008  
408/370-2212

ESTABLISHED: November 1982

NO. OF EMPLOYEES: 84

## BACKGROUND

Isocom Limited was formed to design, manufacture, and market optocouplers with the goal of becoming a major participant in the \$80 million military optocoupler market. Marketing efforts were concentrated in the European commercial and industrial markets for the first two years. In 1986, the Company began offering devices to the military market.

The Company's initial products included a range of optocouplers and interrupter switches in single-, dual-, and quad-package configurations. In 1984 and 1985, the product line expanded to include Hewlett-Packard-compatible, high-speed, high-gain optocouplers. Isocom's products, which currently include transistor-output, Darlington-output, AC-input, photo SCRs, TRIACs, and Schmitt Trigger optocouplers, are used in power supplies, telecommunications, instrumentation, and modems. In the second quarter of 1985, the Company became one of the first to offer a range of surface-mount devices.

Isocom was founded by several former Litronix managers and is headquartered in Hartlepool, England, with a U.S. sales and marketing office in Campbell, California. Design, manufacturing, and test are done at the 25,000-square-foot Hartlepool facility. Some assembly is contracted to companies in the Far East.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Colin Rees  
Litronix, Mgr Europe Sales

### Technical Dir

\*Andrew Mann  
Siemens, Prod Mgr Optocoupler Div

### VP Isocom, Inc.

Sam Kaufman  
Siemens, Director of Marketing

\*Founder

## FINANCING

Not available

## MANUFACTURING

### Technology

Silicon  
GaAs  
GaAlAs

### Facilities

Hartlepool, England  
25,000 sq. ft.  
R&D, design, manufacturing, test  
Campbell, CA  
2,000 sq. ft.  
Marketing and sales

# Isocom Limited

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## PRODUCTS

- Minicouplers
- High-Speed/High-Gain Couplers
- High-Isolation Optocouplers
- High-Speed Tristate Optocouplers
- High-Voltage Photo Transistor Couplers
- Switches
- Hybrids
- Visible Lamps
- Visible Displays
- Integrated Displays

## OTHER INFORMATION

Isocom does not employ a PR firm.



## ISSI

680 Amador Lane  
Sunnyvale, CA 94086  
408/733-ISSI (4774)  
Fax: 408/245-ISSI (4774)

ESTABLISHED: October 1988

NO. OF EMPLOYEES: N/A

### BACKGROUND

Integrated Silicon Solution, Inc., (ISSI) was founded in October 1988 by Jimmy Lee, K.Y. Han, and Fu Tseng to develop CMOS semiconductor products that provide superior system-level reliability, price, and performance.

The Company's initial focus is on high-performance SRAMs and cache memory products. First products will include 16K and 64K SRAMs and 16K and 64K cache data RAMs. ISSI will expand its product line to include SRAMs with densities up to 1Mb, cache controllers, and cache tag RAMs. The Company plans to develop BiCMOS TTL RAMs in mid-1990. In the future, ISSI plans to develop EE memories, EEPLDs, and Flash EEPROM devices. ISSI will begin taking bookings in December 1989, with volume production scheduled for mid-February 1990.

ISSI received funding from Wearnes Technology Corporation, the corporate venture capital investment office for the Wearnes Technology Group. The Wearnes Technology Group is a multinational computer and high-technology products manufacturer based in Singapore. The group has a high degree of vertical integration. ISSI will benefit from partnerships with sister companies in the Wearnes Group. Assembly, for instance, will be conducted by a sister company in Indonesia.

ISSI has entered manufacturing agreements with LSI Logic Corporation, Taiwan Semiconductor Manufacture Corporation, and United Microelectronics Corporation. All three of these companies will serve as foundries for ISSI. The Company has licensed technology to UMC and LSI. The Company will conduct R&D, design, test, and marketing operations at its Sunnyvale, California, facility.

### BOARD

(Name and Affiliation)

- \*Jimmy Lee  
ISSI, President
- \*K.Y. Han  
ISSI, VP Engineering
- \*Dr. Fu H. Tseng  
ISSI, VP Technology
- Dr. Richard Yen  
Wearnes Technology Corporation
- Joe Liu  
TechLink, President
- George Liao  
Audix

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

- President**
  - \*Jimmy Lee  
ICI, Engineering Manager
- VP Technology**
  - \*Dr. Fu H. Tseng  
Visic/VTI, Principal Process Staff
- Dir Mktg**
  - Richard Cimino  
Wyle Dist. Grp., Area Sales Manager
- VP Engineering**
  - \*K.Y. Han  
Vitellic, Design Engineering Mgr
- Dir Design Eng**
  - Yun Hwang  
MOSel, Engineering Director
- \*Founder

# ISSI

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## FINANCING

January 1989

Seed

\$800,000

Private, Wearnes Technology Corp.

June 1989

Round 1

\$1.5M

Private, Wearnes Technology Corp.

September 1989

Round 1

\$0.5M

Private, Wearnes Technology Corp.

## ALLIANCES

United Microelectronics Corporation

January 1989

ISSI signed a licensing and manufacturing agreement with UMC that covers ISSI's SRAM and cache product lines.

## PRODUCTS

4Kx4 Sub-15ns (16K)

8Kx8 Sub-20ns (64K)

16Kx4 Sub-20ns (64K)

32Kx8 Sub-25ns (256K)

32Kx8 Low-Power Sub-70ns (256K)

128Kx8 Sub-35ns High-Performance (1Mb)

128Kx8 Low-Power Sub-70ns (1Mb)

## OTHER INFORMATION

ISSI does not employ a PR firm.

Taiwan Semiconductor Manufacturing Corporation

August 1989

ISSI signed a foundry agreement with TSMC.

LSI Logic

September 1989

ISSI signed a licensing and manufacturing agreement with LSI.

## MANUFACTURING

### Technology

1.2-, 1.0-micron single-poly, double-metal CMOS

0.8-micron CMOS available Q1 1990

### Facilities

Sunnyvale, CA

10,000 sq. ft.

R&D, design, test, marketing

# IXYS Corporation

2355 Zanker Road  
San Jose, CA 95131  
408/435-1900

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 70

## BACKGROUND

IXYS designs, manufactures, and markets a specialized line of discrete power MOS devices, VLSI CMOS digital ICs, and CMOS analog ICs. The Company's products are designed for motion control applications in machinery, such as robots and home appliances, and in power conversion equipment, such as precision DC motors and high-voltage switches.

IXYS' smart power products include monolithic current sensing to simplify the design of current-mode switching power supplies. The Company plans to integrate a function that will monitor device junction temperature on the power chip.

IXYS also is working with NASA and other major aerospace companies to provide high-reliability space versions of the technology for all-electric aircraft and space station programs.

## BOARD

(Name and Affiliation)

David Cooper, Chairman  
IXYS Corporation, President/CEO

Jack Carsten, Director  
U.S. Venture Partners

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
David Cooper  
SGS-Thomson, WW Dir Power MOS

Exec VP  
Nathan Zommer  
GE Intersil, Mgr Pwr MOS R&D

Sr VP Power ICs  
Dick Blanchard  
Siliconix, VP Dsn & Tech

VP Worldwide Sales  
Daniel Schwob  
GE, Prod Mktg Mgr

VP Finance/Admin  
Jim Wu  
Siliconix, Controller

VP Marketing  
Edward Day  
Sprague Electric, Regional Sales Mgr

Ops Mgr  
Tony DeCarlo  
Intersil, Dir Custom Svc

Dir Operations  
Walt Buchannan  
G2, Dir Mktg

Chief Operating Officer  
William T. Malanczuk  
National Semiconductor, VP WW Waferfab and Technology

## FINANCING

1983  
Round 1  
\$0.8M  
Fred Adler

October 1985  
Round 2  
\$6.7M  
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership

August 1987  
Round 3  
\$3.0M  
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Oak Investment Partners; U.S. Venture Partners

# IXYS Corporation

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**August 1988**

Round 4

\$6.2M

Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership First Boston; Bay Partners; John F. Shea

## RECENT HIGHLIGHTS

**January 1986**

IXYS offered its first product, the IXSE501, a Shaft Encoder Peripheral Interface IC. The device is a CMOS monolithic two-channel PWM control processor for micro-stepping two-phase stepper motors and other applications.

**June 1986**

IXYS offered a line of MOS insulated-gate transistors (MOSIGTs) developed by Nathan Zommer, who originally developed IGTs while at GE Intersil. The new devices combine the IGT design with polysilicon gate CMOS technology.

**March 1987**

IXYS relocated into a new 53,000-square-foot facility in San Jose, California. The facility, which is six times larger than the Company's former facility, includes an automated line and has capability for custom packaging. IXYS plans to invest between \$2 million and \$3 million in the line over the next two years.

**March 1987**

IXYS offered the IXMS150, a CMOS two-channel PWM control processor.

**August 1987**

IXYS named David Cooper president and chief executive officer. Mr. Cooper takes over the position from Alan Hofstein. Mr. Cooper will focus on expanding the Company's development efforts in power chips, high-voltage ICs, and power modules, with various new product introductions. Before joining IXYS, Mr. Cooper was worldwide director of power and smart power operations for SGS-Thomson, a Milan,

Italy-based chipmaker with annual sales of more than \$1 billion.

**August 1987**

IXYS raised \$3.0 million in third-round financing.

**October 1987**

Dick Blanchard joined IXYS as senior vice president and heads the Company's smart power IC design team. Mr. Blanchard was with Siliconix previously, most recently as vice president of design and advanced technology development. He reports to Mr. Cooper.

**November 1987**

IXYS began offering its power MOSFETs and MOSIGTs in military packages.

**December 1987**

IXYS introduced the MOSBLOC IGBT family of modules, which range from 25A to 200A in both 600V and 1000V versions. The devices are packaged in bipolar Darlington modules, as used by Japanese vendors. The product family is aimed at motor control and other industrial applications that are served by Japanese suppliers. IXYS expects this product family to become its major commercial product line and to account for as much as \$30 million per year in revenue.

**August 1989**

IXYS acquired the ASEA Brown Boveri Power Semiconductor Group in Lampertheim, West Germany.

## ALLIANCES

**IMP**

**November 1983**

IMP and IXYS codeveloped a high-voltage CMOS process.

**Ricoh**

**1984**

IXYS and Ricoh signed a technology exchange for Ricoh to provide wafers; IXYS is providing its power MOSFET HDMOS process (expired).

## Samsung

January 1986

IXYS signed an agreement with Samsung Semiconductor and Telecommunications under which Samsung will receive IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas; the two companies will jointly manufacture IXYS' first smart power products.

## ABB

May 1988

IXYS announced a joint venture agreement with ASEA Brown Boveri Corporation. The agreement is expected to strengthen the marketplace for industrial power control using ABB's patented copper substrate bonding

technology and IXYS' advanced technology in smart power, IGBTs, and Mega MOS.

## MANUFACTURING

### Technology

1.2- to 4.0-micron CMOS HDMOS (high-performance DMOS)  
 5-inch wafers  
 4-inch wafers  
 6-inch wafers

### Facilities

San Jose, CA  
 53,000 sq. ft.  
 Design, manufacturing, hi-rel assembly, test

## PRODUCTS

### PowerFETs

Device	Description
MegaMOS FETs	Large-Scale Monolithic Power MOSFETs
Power MOSFETs	High-Voltage n-Channel and p-Channel MOSFETs
MirrorFETs	Power MOSFET with Monolithic Current Sensing
LIMOFETs	Mega MOSFET with IC Drive Technology
HiPerFETs	Power MOSFET with High DV/DT Ruggedness
MOSIGBTs	Monolithic Power MOSFETs with Bipolar Devices
MOSBLOC Modules	Power MOSFETs or MOSIGBTs

### Integrated Circuits

IXLD426-9	CMOS MOSFET Drivers
IXED0900/1500	CMOS Address Encoder/Decoder
IXMS150	CMOS Monolithic Two-Channel PWM Controller
IXPD610	Digital Pulse-Width Modulator (DPWM)
IXSE501	Shaft Encoder Peripheral Interface (SEPI)
IXSE510	16 Bit (SEPI)
IXBD4410	High Side/Low Side Driver

## OTHER INFORMATION

IXYS' PR firm is Simon McGarry.

# Krysalis Corporation

1135 Kern Avenue  
Sunnyvale, CA 94086  
408/749-7390  
Fax: 408/739-5362

ESTABLISHED: 1985

NO. OF EMPLOYEES: 12

## BACKGROUND

Krysalis was formed to develop and manufacture nonvolatile semiconductor memories, using a CMOS ferroelectric technology. Founders of the Company are Joseph T. Evans, formerly of the U.S. Air Force Weapons Laboratory, and William D. Miller, formerly of Signetics.

The Company plans to market 16K and derivative products as initial process vehicles. The products will feature an access time of 120ns and emphasize radiation-hardened and industrial applications.

Krysalis demonstrated the feasibility of manufacturing the devices with a 512-bit UniRAM memory part using a 3-micron process at Orbit Semiconductor. At this time, Krysalis is shipping a family of latch and register products, evaluation units, and a 4K serial RAM.

In October 1989, National Semiconductor Corporation acquired Krysalis' assets, including all rights to Krysalis' ferroelectric technology. National and Krysalis had previously entered into a technology agreement under which the companies agreed to share technology, product codevelopment, and manufacturing services.

The Company believes that its process can be applied to wide ranges of logic including ASICs, MPUs, and TTL-compatible logic. The ferroelectric technology also is said to be compatible with bipolar, CMOS, and GaAs processes.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President/CEO**  
Dr. James Harris  
Akashic, Pres/CEO

**VP Tech**  
\*William D. Miller  
Signetics, Process Dev

**VP/CFO**  
Neil Hennessey  
Gould NavCom, VP Finance  
\*Founder

## FINANCING

**May 1986**  
Seed  
\$1.0M  
Columbine Venture Fund, Crosspoint Venture Partners, Meadows Ventures, OSOCO Ventures, Weeden Capital Partners

**December 1986**  
Round 1  
\$3.2M  
Initial investors

**October 1989**  
Acquired by National Semiconductor Corporation

## RECENT HIGHLIGHTS

**1987**  
Krysalis set up a small, \$3.0 million materials research laboratory in New Mexico.

**December 1987**  
Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. (See "Alliances" for more details.)

# Krysalis Corporation

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## ALLIANCES

### National Semiconductor December 1987

Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. National will provide product engineering, manufacturing, and marketing support. Initially, National will supply base wafers based on a 2-micron process. Krysalis will complete fabrication of the wafers through packaging, test, and burn-in. Krysalis will conduct its own marketing and sales.

## MANUFACTURING

### Technology

2- and 3-micron

### Facilities

Sunnyvale, CA  
Albuquerque, NM

## PRODUCTS

Family of Latch and Register Products  
Evaluation Units  
4K Serial RAM

## OTHER INFORMATION

Krysalis does not employ a PR firm.

# Kyoto Semiconductor Corporation

418-3, Yodosaime-cho  
Fushimi-ku Kyoto 613, Japan  
075-631-8823  
Fax: 075-631-8291

ESTABLISHED: April 1980

NO. OF EMPLOYEES: 20

## BACKGROUND

Kyoto Semiconductor offers GaAs light-emitting diodes (LEDs), phototransistors, photosensors, and LED displays. The diodes offer twice the efficiency of available units. The heterostructured diodes feature a 23.6 percent light-emitting efficiency at peak wavelengths of 190nm. Four selections of wavelengths are available: 660, 750, 830, and 890.

Kyoto Semiconductor's major customers are Mitsubishi Electric and General Instrument. The Company contracts assembly to companies in Taiwan.

## BOARD

Not available

## PRODUCTS

High Bright LEDs  
Infra LEDs  
Photo TRs  
Photosensors  
LED Displays

## OTHER INFORMATION

Kyoto Semiconductor does not employ a PR firm.

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

**President**  
Jousuke Nakata  
Mitsubishi

## FINANCING

Capitalization: ¥62 million

## MANUFACTURING

Not available

## Facilities

Kyoto, Japan  
Production



# Lattice Semiconductor Corporation

555 N.E. Moore Court  
Hillsboro, OR 97124  
503/681-0118  
Fax: 503/681-3037

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 110

## BACKGROUND

Lattice Semiconductor Corporation (LSC) designs, develops, manufactures, and markets high-performance PLDs using a proprietary EE CMOS technology. LSC has pioneered a line of high-speed PLDs called Generic Array Logic (GAL) as direct pin-for-pin replacements of bipolar PAL devices. The next generation, ispGAL devices, includes in-system programmability that makes logic configurable "on the fly" under software control for robotics and artificial intelligence applications.

LSC has established agreements with National Semiconductor and SGS in Milan, Italy. In exchange for the right to use certain GAL designs, the companies provide wafers and assembly services. The Company conducts all final testing, including quality and reliability testing, at the LSC facility in the United States.

In September 1986, Monolithic Memories, Inc. (MMI), filed a class action suit against LSC and Altera, charging patent infringement of the PAL architecture. LSC filed a \$300 million countersuit charging MMI with abusing the Sherman Act, i.e., trying to destroy the competition. The MMI suit brought negotiations for additional financing, which were in progress, to a standstill. In December 1986, Rahul Sud, president; Jay McBride, general manager; S. Robert Brutbarth, and Kishan C. Sud resigned from LSC. As a result of these events, during 1987, LSC took aggressive actions to restructure the Company and filed a voluntary petition for protection under the Chapter 11 federal bankruptcy law.

On September 28, 1987, LSC's reorganization plan under federal bankruptcy law became effective, marking the Company's exit from Chapter 11. As a result of the restructuring, the

Company raised \$1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson. In November 1987, LSC relocated to a new headquarters in Hillsboro, Oregon, tripling its manufacturing space. Also in November, LSC and MMI settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents in PLDs.

In 1987, LSC signed Arrow Electronics as its authorized U.S. distributor and also signed Almex, in France; Alcom, in the Netherlands; Bacher GmbH, in the Federal Republic of Germany; and Henaco, in Norway. In addition, Lattice signed sales representatives in the United States and the United Kingdom.

## BOARD

(Name and Affiliation)

C. Norman Winningstad, Chairman  
Floating Point Systems, Chairman

Dan Hauer  
S-MOS (Seiko-Epson), President

Harry A. Merlo  
Louisiana Pacific Corp., Chairman/CEO

Roy Pollack  
RCA (retired)

Ole Christian Sand  
Elcon Partners; Oslo Norway

Douglas C. Strain  
Electro Scientific Industries, Vice Chairman

Cyrus Tsui  
Lattice Semiconductor Corp, CEO

# Lattice Semiconductor Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO

Cyrus Tsui  
AMD, VP PLD Div

### VP Finance/Admin

Jan Johannessen  
N/A

### VP Sales

Paul Kollar  
Signetics, Dir Natl Ops

### Dir Marketing

Bill Wiley Smith  
Silicon Systems, Dir Apps

### VP/Operations

Daniel Hu  
AMD, VP Calif Wafer Fab Op

## FINANCING

1983

Round 1

\$1.9M

Datavekst A/S, Norway; Floating Point Systems, Inc.; Louisiana-Pacific Corp.; Harry A. Merio, C. Norman Winningstad, and other corporate stockholders

July 1984

Credit

\$2.7M

Oregon Bank, U.S. National Bank

September 1987

Round 2

\$1.6M

Previous investors

January 1988

Credit

\$1.5M

First Interstate Bank

February 1988

Round 3

\$2.5M

Institutional investors

April 1988

Round 4

\$5.0M

Institutional investors

September 1989

IPO

\$14.0M

Initial public offering

## RECENT HIGHLIGHTS

September 1986

LSC adds Bell Industries of Los Angeles, California, as a distributor.

October 1986

LSC offers GAL16V8-25P and GAL20V8-25P "quarter-power" devices that are 25ns PLDs and operate with only 45 milliamperes. The GALs can be configured into any one of 21 PAL architectures.

October 1986

LSC offered Q11987, an 8Kx8, 64K CMOS SRAM with an access time of 25ns.

April 1987

LSC offered the GAL39V18, a programmable logic device using EE CMOS technology. Maximum delays are 30ns from input to output and 15ns from clock to output.

June 1987

LSC recalled its fast 64K EEPROM product line, which it began sampling in late 1986 due to engineering flaws.

July 1987

LSC filed a voluntary petition for protection under Chapter 11 federal bankruptcy law. The Company cut back on its SRAM development and laid off approximately 15 employees.

September 1987

LSC's reorganization plan under federal bankruptcy law became effective on September 28, 1987, and marked the Company's exit from Chapter 11. As result of the restructuring, the Company raised \$1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson.

# Lattice Semiconductor Corporation

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## November 1987

LSC relocated to a new headquarters in Hillsboro, tripling its manufacturing space.

## November 1987

LSC and Monolithic Memories, Inc., settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

## December 1987

LSC announced a 33 percent reduction on the average selling price of its GAL devices.

## January 1988

LSC, although a privately held company, reported product sales of \$3.4 million for the third quarter ending January 3, 1988. The \$3.4 million was a 93 percent increase over the third-quarter sales the year before. Second-quarter sales, for the period ending September 26, 1987, were \$2.9 million. LSC also reported annual revenue exceeding \$13.5 million.

## ALLIANCES

### Floating Point Systems

1983

LSC and Floating Point Systems agreed to exchange technology for LSC's UltraMOS technology and FPS' DSP and array processor technology. Floating Point Systems gained major equity participation as well as long-term purchasing agreements from LSC. (expired)

### Synertek

July 1984

LSC and Synertek signed a cross-licensing and second-sourcing agreement allowing Synertek to use LSC's UltraMOS process to manufacture a 35ns, 64K SRAM in exchange for a portion of Synertek's production capacity in Santa Cruz, California. (expired)

### VLSI Technology

September 1984 LSC provided technology for CMOS EEPROMs and SRAMs to VLSI Technology in exchange for foundry services at VLSI. (expired)

## Seiko-Epson/S-MOS

January 1986

LSC announced a manufacturing and second-sourcing agreement. Seiko-Epson acquired the license to LSC's 16Kx4 SRAM design and process technology; S-MOS acquired the rights to market the part in North America.

## SGS

February 1987

LSC signed a technology agreement with SGS Semiconductor, giving SGS a license to second-source LSC's GAL products. SGS will manufacture the GAL products for LSC, and both companies will cooperate on the design of future PLD products.

## National Semiconductor

May 1987

National Semiconductor made a minority capital investment in LSC and licensed its GAL technology. The five-year agreement includes co-development of denser architectures of both standard and in-system programmable GALs, as well as a new line of FPLAs and sequencer devices.

## MMI

November 1987

LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

## AMD

May 1989

Lattice signed a new cross-licensing agreement with AMD. Under the agreement, Lattice is licensed to manufacture AMD's industry-standard 22V10 programmable logic device and to use the 22V10 architecture in manufacturing GAL products. AMD is licensed to manufacture GAL devices using Lattice's architecture.

## MANUFACTURING

### Technology

1.1 to 0.9-micron CMOS  
6-inch wafers

### Facilities

Hillsboro, OR  
44,000 sq. ft.  
Design and test

# Lattice Semiconductor Corporation

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## PRODUCTS

### GAL Products

Device	Speed
GAL16V8	10 to 25ns
GAL16V8A	10ns
GAL20V8	10 to 25ns
GAL22V10	15ns
GAL6001	30ns
ispGAL 16Z8	15 to 25ns

### Development Tools

All Devices      Third-Party Development Support from Leading PLD Systems, Both Hardware and Software

## OTHER INFORMATION

LSC's PR firm is KVO, Inc.

## Level One Communications Inc.

105 Lake Forest Way  
Folsom, CA 95630  
916/985-3670  
Fax: 916/985-3512

ESTABLISHED: November 1985

NO. OF EMPLOYEES: 39

### BACKGROUND

Level One Communications Inc. designs, manufactures, and markets system-specific transceivers (transmitters/receivers) and associated peripheral circuits for the twisted-pair, high-speed digital communications market. Products are designed for integrated voice, data, and video communications systems and networks at speeds from 19.2 Kbps to 16.0 Mbps.

Transceivers combine digital and analog circuitry to convert digital impulses into line code, a language that travels more efficiently on twisted-pair wire than nonencoded digital signals. The sending transceiver converts data according to a given line code and transmits it through twisted-pair wires. The transceiver at the receiving end of the line decodes the encoded signals to data.

Level One offers integrated analog and digital ASIC transceiver ICs that can be tailored to specific systems using a modular cell-based approach. To accelerate design time significantly, Level One has developed the LxLIB, a library of predefined mixed analog and digital ICs and functional blocks that can be assembled quickly. Level One also has developed proprietary CAD simulation tools dedicated to transceiver development. The CAD simulation and techniques model the physical-level communications systems and associated transmission lines. The line simulator also is used for automated component testing by providing analog input waveforms to the tester.

Level One's transceiver products are composed of front and back ends. The front end is the transceiver core and contains blocks of cells that perform the analog functions such as pulse shaping, encoding, and timing and data recovery. The back end is the system interface, which handles the digital functions and the interface to each customer's system.

The Level One design team has had extensive experience in PBX transceivers and ISDN devices at companies such as AMD, AT&T Bell Labs, Hitachi, Intel, Mitel, National Semiconductor, and Rockwell.

As of October 1988, the Company had completed four rounds of funding. The seed round was completed in December 1985, when Julian, Cole & Stein, a Los Angeles-based venture capital firm, purchased 38 percent of the Company for \$800,000. In December 1986, Julian, Cole & Stein purchased an additional percentage of the company for \$2 million. The third round brought investments of \$5 million, with lead investors Warburg, Pincus Ventures Inc., and Julian, Cole & Stein. The fourth round of funding resulted from a private placement, arranged by Merrill Lynch Capital Markets, of convertible preferred stock for Julian, Cole & Stein's Strategic Technologies Portfolio. This funding brought an additional \$6.25 million to Level One, which will be used for business expansion, new product development, and general working capital.

The Company leased a 21,000-square-foot facility in Folsom, California, where it conducts R&D and design. Level One has contracted International Microelectronic Products (IMP) and Mitel to manufacture its products. IMP will work closely with Level One to adapt its CMOS process to meet the specific analog and digital requirements of integrated transceivers.

### BOARD:

(Name and Affiliation)

Charles R. Cole  
Julian, Cole & Stein, Partner

James M. Julian  
Julian, Cole & Stein, Partner

Dr. Henry Kressel  
N/A

# Level One Communications Inc.

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Dr. Robert S. Pepper  
Level One Communications, President/CEO

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Dr. Robert Pepper  
RCA, VP/GM Solid State Div

### VP Mktg/Sales

J. Francois Crepin  
LSI Logic, Dir WW Strat Plan

### VP Finance/Admin

\*Terry S. McCoy  
American Continental, Dir Finance

### VP Engineering

Cecil Aswell  
Siemens, Dir Engr

\*Founder

## FINANCING

December 1985

Seed  
\$0.80M  
Julian, Cole, & Stein

December 1986

Round 1  
\$2.00M  
Julian, Cole, & Stein

September 1987

Round 2  
\$5.00M  
Julian, Cole and Stein; Warburg, Pincus  
Ventures Inc

## PRODUCTS

### Device

### Description

LXT200	ISDN STT Interface Transceiver
LXP302	T1/ESF Digital Trunk Interface Circuit
LXP303	CEPT/CRC Digital Trunk Interface Circuit
LXP600	Clock Adapter

September 1988

Round 3  
\$6.25M

Merrill Lynch Capital Markets private placement for Julian, Cole, and Stein. Investors included Ameritech Pension Fund; Delaware State Employees Retirement Fund; The St. Paul Companies; Transamerica Occidental Life Insurance Company

## ALLIANCES

### LTX

1986

Level One was selected to codevelop and field test new ISDN platforms with LTX.

### Mitel

May 1988

Level One and Mitel signed a 5-year joint development and second-source agreement that covers advanced transceivers for T-1 transmission and ISDN markets.

## MANUFACTURING

### Technology

3.0-micron double-poly, double-metal, 5V CMOS

2.0-micron double-poly, double-metal, 5V CMOS

1.5- and 1.2-micron planned

Level One contracts its foundry work to International Microelectronic Products of San Jose, California

### Facilities

Folsom, CA  
21,000 sq. ft.

Administration, design, R&D, and test

**Products under Development**

LXT130	TCM Transceiver (3,000 feet)
LXT134	Quad TCM Transceiver (3,000 feet)
LXT131	TCM Transceiver (6,000 feet)
LXT135	Quad TCM Transceiver (6,000 feet)
LXT300	T1/CEPT Integrated Transceiver
LXT324	T1 Quad Receiver
LXT400	DDS Transceiver

**OTHER INFORMATION**

Level One's PR firm is Regis McKenna, Inc.

# Linear Integrated Systems Inc.

47853 Warm Springs Boulevard

Fremont, CA 94539

415/659-1015

Fax: 415/659-1365

ESTABLISHED: July 1987

NO. OF EMPLOYEES: 50

## BACKGROUND

Linear Integrated Systems Inc. (LIS) designs, manufactures, and markets standard and custom low-noise, precision, linear ICs and high-resolution A/D and D/A converter ICs. The Company's products are designed to serve data acquisition applications in the military, industrial, and medical market sectors. LIS provides ASIC design services using a cell-based design approach. The Company's cell-based library uses an advanced set of automated layout tools that combine cells, process, and software.

LIS began offering products in January 1988 and currently offers 18 products. Future plans include expanding the Company's high-resolution, high-speed, high-accuracy data conversion products; low-noise; high-precision linear ICs products; and additional cell-based designs in both the linear and digital areas. Developments will emphasize military applications with higher levels of radiation hardness.

The Company was founded by John Hall, who founded and served as president of Micro Power Systems. The Company conducts manufacturing and engineering in Fremont, California. Recently, a second facility was completed; it houses design and corporate offices.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*John Hall

Micro Power

### General Manager

Bob Sabo

Micro Power

### Dir Mktg

Richard Hall

Micro Power

\*Pounder

## FINANCING

Not available

## ALLIANCES

Not available

## MANUFACTURING

### Technology

Bipolar linear

1.5- to 5.0-micron high-density CMOS

Both processes are offered with dielectric isolation and the capability to withstand high levels of nuclear radiation.

### Facilities

Fremont, CA

10,000 sq. ft.

Administration, design, manufacturing, test

The Company has an additional 5,000 sq. ft. of dedicated capacity.

## SERVICES

ASIC Design



## **Linear Integrated Systems Inc.**

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### **PRODUCTS**

Precision Low-Noise Linear ICs  
High-Resolution A/D and D/A Converter ICs  
Cell-Based Library of Linear/Digital Cells

### **OTHER INFORMATION**

Linear Integrated does not employ a PR firm.

# Linear Technology Corporation

1630 McCarthy Blvd.  
Milpitas, CA 95035-7487  
408/432-1900

ESTABLISHED: September 1981

NO. OF EMPLOYEES: 450

## BACKGROUND

Linear Technology Corporation (LTC) designs, manufactures, and markets a broad line of standard high-performance linear ICs using silicon gate CMOS and bipolar technologies. The Company markets about 180 linear ICs, with temperature and packaging variations resulting in more than 1,800 device types, one-half of which are proprietary. Products focus on the instrumentation, process control, industrial, and military markets.

The Company specializes in precision products in the analog and analog-to-digital interface markets and also provides proprietary linear functions for its products, including data acquisition products. LTC supplies op amps, voltage regulators, references, data conversion devices, interface devices, monolithic filters, and special-function devices such as temperature sensors. In the future, LTC plans to increase its presence in the converter and interface markets. LTC benefits from the increasing prominence of its proprietary chips and from the absence of Japanese competition.

The Company has a strong presence in the military market, accounting for approximately 10 percent of worldwide sales and about 35 to 40 percent of North American sales. From its beginning, LTC followed a marketing strategy aimed at penetrating the military market. In August 1984, LTC received DESC JAN Class-B qualification and, in 1987, also achieved certification to begin fabrication of JAN Class S-level linear devices for space applications. The first Class-S product is the LM108AH, an operational amplifier that was shipped in 1988.

Linear Technology was founded in 1981 by Robert H. Swanson, Jr., Robert C. Dobkin, Brian E. Hollins, Brent Welling, and Robert Widler from National Semiconductor's linear design group. In September 1982, the manufacturing team was in place and the Company

had moved into its current facility in Milpitas, California. By January 1983, the Company had produced its first wafers.

In May 1986, LTC established a company in Tokyo, Japan, to provide technical services to its Japanese customers. The company, named Linear Technology K.K., is wholly owned by the U.S. parent.

In September 1986, LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas. The Company's previous headquarters were taken over by LTC's expanded design, engineering, and domestic high-reliability assembly and wafer fabrication operations already located in the building.

In 1987, LTC signed an agreement with Texas Instruments, providing the Company with TI's BiCMOS manufacturing, assembly, test, and CAD tools, and a credible second source.

LTC markets its products through a network of independent sales representatives and electronics distributors. The Company also has approximately 1,000 OEM customers, including Compaq, Fujitsu, Honeywell, HP, Hughes, Philips, Raytheon, Rockwell, and Siemens.

## BOARD

(Name and Position)

\*Robert H. Swanson, Jr.

Linear Technology Corporation, President, CEO

Regis McKenna

Regis McKenna, Inc., Chairman

Glenn M. Mueller

Mayfield Fund, General Partner

Thomas S. Volpe

Volpe & Company, Managing Partner

# Linear Technology Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Robert H. Swanson  
NSC, VP/GM Linear IC Ops

### VP Operations

Dr. Clive B. Davies  
NSC, Grp Dir Adv Tech

### VP Engineering

\*Robert C. Dobkin  
NSC, Dir Adv Circuit Dev

### VP Mktg/Sales

William A. Ehrsam  
NSC, Grp Dir Mktg Commun

### VP Finance/CFO

Paul Coghlan  
GenRad, VP/GM Test Prod Div

\*Founder

## FINANCING

### September 1981

Round 1

\$5.0M

Capital Management Services; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Mayfield Fund; Sequoia Capital; Sutter Hill Ventures; Technology Venture Investors

### May 1982

Round 2

\$5.0M

Olivetti, Finance for Industry, and a Hong Kong investor

### Lease

\$9.0M

Greyhound Computer Corp.

### April 1983

Round 3

\$7.0M

Cowen and Company, Greivson Grant, Kemper Financial, Kleinwort Benson, Morgan Stanley, State Farm, Touche Remnant, and others

### Lease

\$9.0M

Greyhound Computer Corp.

### May 1986

Initial public offering  
\$24.0M

## RECENT HIGHLIGHTS

### May 1986

LTC established a Japanese unit to strengthen its technical services to Japanese customers. The unit is Linear Technology K.K. and is wholly owned by LTC in the United States. Robert Swanson was appointed president and Atsushi Nakata, general manager.

### September 1986

LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas.

### December 1986

LTC announced voltage references and other devices in surface-mount packages.

### February 1987

Linear introduced its XH series that includes five linear ICs guaranteed to operate at a temperature range from -125° to +200° centigrade.

### April 1987

LTC offered the LT1030, a bipolar line driver. The quad, low-power, line driver is part of LTC's family of RS-232 driver/receiver circuits. It can be used as an interface, an RS-232 driver, or as a logic-level translator.

### June 1987

LTC offered the LTC1090, a 10-bit CMOS data acquisition system. It includes a software-controlled 8-bit analog multiplexer with sample-and-hold and a 10-bit ADC. The device operates in a full-duplex mode, and a selection feature allows data to be transmitted either most-significant-bit (MSB) first or least-significant-bit (LSB) first.

### July 1987

LTC received QPL Part-1 approvals from DESC for 10 of the company's BiFET and low-noise operational amplifiers and negative adjustable regulators. This brings the number of JAN QPL parts available to 30.

# Linear Technology Corporation

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## ALLIANCES

### Silicon General July 1982

LTC and Silicon General signed a technology exchange and second-source agreement under which Silicon General provides pulse width modulators and two additional circuits and second-sources several high-current series pass regulators developed by LTC; no masks are involved. (expired)

### Teijin/Japan Macnics/Technology Trading June 1983

LTC signed an agreement with Teijin Advanced Products, Japan Macnics, and Technology Trading for distribution in Japan.

### Signetics June 1984

LTC and Signetics signed a three-year agreement granting Signetics the right to purchase die in wafer form and manufacturing rights for three precision op amps and other unnamed products. Signetics provided LTC with certain small-outline packaging services. (expired)

### Interdesign July 1984

LTC and Interdesign entered into a three-year agreement granting Interdesign the right to design IC arrays, using up to three of LTC's processes. LTC also agreed to dedicate foundry capacity to manufacture the Interdesign arrays. (extended)

### Motorola January 1985

Motorola and LTC signed a seven-year agreement granting each other rights to several patents. LTC gained rights to several Motorola patents; Motorola gained rights to patents obtained and filed during the term of the

agreement, which expires in 1991. LTC also will make specific lump-sum payments through 1991.

### National July 1986

National and LTC entered into a patent-licensing agreement granting LTC rights to products under two National BiFET patents. National was granted rights to LTC's BiFET-related patents, including those filed through 1992. LTC pays royalties.

### TI March 1987

LTC and Texas Instruments signed a five-year agreement allowing TI to select six of LTC's circuits every six months for the duration of the agreement. TI will pay LTC \$500,000 every six months and pay royalties for a 10-year period on any LTC circuit that TI produces.

## MANUFACTURING

### Technology

Single-layer polysilicon bipolar  
Single- and double-layer silicon-gate  
(LTCMOS)  
4-inch wafers  
5-inch wafers

### Facilities

Milpitas, CA  
40,600 sq. ft.  
Administration and manufacturing  
20,000 sq. ft.  
Class 10 clean room  
42,000 sq. ft.  
Linear headquarters and test  
Most commercial product assembly is subcontracted to companies in South Korea, Malaysia, Thailand, and Taiwan.

## PRODUCTS

### Regulators

Positive fixed and adjustable regulators ranging from 125mA to 5A.

### Reference

Wide range of references from 1.2V to 10.0V.

# **Linear Technology Corporation**

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## **Op Amps**

LTC offers a complete line of Op Amps and more than 40 different chips.

## **Comparators**

Dual, CMOS Dual, High-Speed and Window Comparators, and Voltage Regulator plus Comparator

## **Filters**

Single, Dual and Triple Filters, Five-Pole, Maximally Flat, Low-Pass Filter, 8th Order, Quad 80-kHz Switched Cap Filter

## **Regulating Pulse-Width Modulators**

Switching Regulator, Switching Regulator Controller, Switching Power Supply Circuit, Oscillator Accuracy

## **Interface Products**

RS-232 Line Driver, Triple RS-232 Driver/Receiver, 5V Powered  
RS-232 Driver/Receivers, Programmable Power Hex  
Translator/Driver/Receiver

## **Data Acquisition Products**

10-Bit Data Acquisition Systems, 10-Bit Serial I/O ADC with Reference Pin of 6-Channel MUX, 10-Bit Serial I/O with 8-Channel MUX

## **Other Products**

Current Source, Voltage Converters, Power Buffer, Reference Diodes, Voltage Inverter, Cold-Junction Compensator Kit for Thermocouples, Sample-and-Hold Amplifier

## **OTHER INFORMATION**

Linear Technology Corporation's PR firm is Tycer, Fultz, & Bellack.

## Logic Devices Inc.

628 E. Evelyn Avenue

Sunnyvale, CA 94086

408/720-8630

Fax: 733/7690

Telex: 172387

ESTABLISHED: 1983

NO. OF EMPLOYEES: 55

### BACKGROUND

Logic Devices Inc. designs, manufactures, and markets very high performance semiconductors using 1.2-micron CMOS process technology. The Company's products address applications that require very high operating speeds and/or low-power operation.

The Company offers a line of high-performance 16K, 64K, and 256K SRAMs; a line of high-performance building block components for DSP applications; and a line of computer interface circuits that implement the SCSI standard. The products are used in military signal-processing systems (radar, sonar, and seeker systems), video and medical imaging systems, array processors and superminicomputers, engineering workstations, telephony systems, and personal computers.

Approximately 30 percent of the Company's sales are products produced in full compliance with MIL-STD-883 Rev. C. In addition, the Company produces a portfolio of custom circuits that address high-end military DSP applications (adaptive FIR filtering) and telecommunications problems such as echo canceling, ADPCM compression, and cross-point switching.

Company operations in Sunnyvale, California, include administration, sales and marketing, engineering, assembly, and high-reliability testing and screening. Commercial products are offered in plastic dual-in-line, leaded chip carriers, and SOIC packaging. Military products are available in leaded and leadless chip carriers, flat packs, and pin grid array packages. Manufacturing operation follows the requirements of MIL-STD-9858, -45662, and -883C. These operations have been audited and approved by many major military systems contractors.

Products are marketed through a network of domestic and international stocking distributors and

manufacturers' representatives, with 103 locations worldwide. U.S. distributors include Cypress Electronics, Falcon, Future, and Milgray. The Company operates direct regional sales offices in Los Angeles, California and New York City, New York.

### BOARD

(Name and Affiliation)

Howard L. Farkas

Farkas Realty, Chairman

William J. Volz

Logic Devices Inc., President

James McAllister

Logic Devices Inc., VP Operations

Burton W. Kantor

Walnut Capital Corp., COB

Albert Morrison

Caplan, Morrison, Brown & Company,  
President

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*William J. Volz

TI, Technical Staff

#### Sr VP Operations

James McAllister

Indy Electronics, Executive VP

#### CFO

Todd Ashford

W.R. Grace, Financial Analyst

#### VP Mktg/Sales

Joe Krouse

IDT, HQ Sales Mgr

# Logic Devices Inc.

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**Nat Sales Manager**  
 Del Valek  
 ITT, Sales Manager

**Dir QA/Rel**  
 Don Taylor  
 Exar, QA Manager

**VP Technology**  
 Tony Bell  
 VLSI Design, Consultant

**VP Strategic Bus**  
 Gary Ater  
 Vitelic Assoc, N/A

**Dir Prod Mktg**  
 Joel Dedrick  
 Texas Instruments, N/A

\*Founder

## PRODUCTS

### SRAMs

Device	Description	Speed
L6116	2Kx8	20ns
L7C161/162/164/165/166	16Kx4	20ns
L7C167	16Kx1	12ns
L7C168 through 172	4Kx4	15ns
L185/186	8Kx8	25ns
L7C187	64Kx1	15ns

### Specialty Memory Circuits

L10C11	18x8-Bit Variable Delay	
LRF07	Three Independent Port 8x8	35ns
LRF08	Five Independent 8x8	35ns
L29C520/521	8-Bit Multilevel Pipeline Registers	22ns
LPR520/521	16-Bit Multilevel Pipeline Registers	22ns
L29C524/525	16-Stage Pipeline Registers	
L29C818	Shadow Register	

### Multipliers

LMU08	8x8 Signed Parallel Multiplier	35ns
LMU8U	8x8 Unsigned Parallel Multiplier	35ns
LMU557/558	8x8 Mixed Parallel Multipliers	60ns
LMU12	12x12 Parallel Multipliers	35ns
LMU112	12x12 Reduced Pincount	50ns
LMU16/216	16x16 Parallel Multipliers	35ns
LMU17/217	16x16 Microprogrammable Multipliers	45ns
LMU18	16x16 Parallel Multiplier with Dedicated 32-Bit Output Port	35ns
LMS12	12x12 Video Multiplier with 26-Bit Adder	40ns

## FINANCING

**November 1988**  
 IPO  
 \$5.4M  
 Initial public offering

## MANUFACTURING

### Technology

1.2- and 1.5-micron CMOS  
 0.9 micron CMOS

### Facilities

Sunnyvale, CA  
 12,500 sq. ft.  
 Administration, sales and marketing, engineering, assembly, high-reliability testing and screening  
 2,500 sq. ft.  
 Clean room

**Multiplier/Accumulator Circuits**

Device	Description	Speed
LMA1009	12x12 Multiplier/Accumulator	45ns
LMA1010/2010	16x16 Multiplier/Accumulators	45ns

**Arithmetic Logic Units**

L29C101	16-Bit Slice (4x2901 & 2902)	35ns
L4C381	16-Bit Cascadable Adder/Subtractor (4x54S381)	26ns
LSH32	32-Bit Cascadable Barrel Shifter/Normalizer	32ns
L10C23	64x1 Digital Correlator	20ns

**Communications Controllers**

L5380	Asynchronous SCSI Controller Chip	4Mbps
L53C80	SCSI Controller	4Mbps

**OTHER INFORMATION**

Logic Devices' PR firm is Faries and Associates.



**Lytel**  
61 Chubb Way  
P.O. Box 1300  
Somerville, NJ 08876  
201/685-2000  
Fax: 201/685-1282

**ESTABLISHED: October 1984**

**NO. OF EMPLOYEES: 130**

## **BACKGROUND**

Lytel was formed to design, develop, and manufacture InGaAsP technology-based electro-optic components for the telecommunications, data communications, and military markets. Products include semiconductor lasers, LEDs, and photo-detectors using an indium phosphide materials technology.

Lytel's first products, introduced in January 1986, were InGaAsP high-power lasers for fiber-optic applications. The Company is focusing on quality, reliability, delivery, and performance.

Lytel occupies a 57,000-square-foot facility that includes a Class 1,000 clean room.

## **BOARD**

Not Available

## **COMPANY EXECUTIVES**

(Position and Name)

### **GM**

Gerald Leehan

### **VP Engineering & Development**

\*Ron Nelson

### **Controller**

Tim Bock

\*Founder

## **PRODUCTS**

InGaAsP High-Power Lasers

LEDs

Optical Data Links

## **OTHER INFORMATION**

Lytel's PR firm is The Jason Group.

## **FINANCING**

1984

Start-up

\$20.0M

AMP

November 1988

N/A

Became a subsidiary of AMP

## **ALLIANCES**

Not available

## **MANUFACTURING**

### **Technology**

InGaAsP

1.3-micron opto components

### **Facilities**

Somerville, NJ

57,000 sq. ft.

Manufacturing, assembly, test

5,000 sq. ft.

Class 1,000 clean room

# Matra-Harris Semiconducteur

La Chantrerie/Route Gachet

B.P. 942

44075 Nantes cedex/France

(40) 303030

Telex: MATHARI 711930 F

ESTABLISHED: 1979

NO. OF EMPLOYEES: 1,000

## BACKGROUND

Matra-Harris Semiconducteur (MHS) designs, manufactures, and markets a broad range of ICs, using bipolar, CMOS, and NMOS process technologies. Its main product strategies center on ASICs, fast SRAMs, microprocessors, and telecommunications circuits.

MHS was formed in 1979 as a joint venture company by Matra of France and Harris Corporation of the United States. Prior to this formal link, Matra and Harris had made agreements for CMOS technology transfers. The agreement was extended in 1980 to include bipolar products.

The Company was supported by the French government in place at that time to develop high technology in France. A 12,000-square-foot factory was built near Nantes, France, and designated as an area for industrial development, which allowed MHS to gain government financial assistance. Initial wafer fabrication began in December 1980.

In 1982, Harris and MHS merged their European-marketing operations outside France (Harris-MHS). The new operation was financed equally by the two partners. Under the 1979 agreement, MHS continues to have exclusive sales rights in France for the Harris line of semiconductors. Conversely, Harris represents MHS exclusively for sales in North America.

Today, Matra-Harris remains the only independent French semiconductor operation not absorbed into the Thomson Group.

The Company's ASIC capability includes a range of matrices with from 250 to 7,500-gates, using CMOS technology and integrated design tools

based on the VAX or IBM PCs. Libraries are available on Daisy, Mentor, and Valid systems.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

### Chairman

Guy Dumas

### Strategist

Jean-Claude Rentlet

### Commercial Dir

Michael Thouvenan

## FINANCING

1979

\$40.0M

Matra S.A. and Harris Corp.

## RECENT HIGHLIGHTS

### December 1986

MHS unveiled eight new products at Wescon/86, including the HM65787, a 64Kx1 SRAM that is the first application of the 0.8-micron process licensed from Cypress Semiconductor.

### June 1987

Intel and Matra-Harris dissolved their joint venture design facility, CIMATEL G.I.E. CIMATEL was formed in 1982 as an equal partnership to design standard VLSI devices for the telecommunications and computer graphics

# Matra-Harris Semiconducteur

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markets. It was jointly owned by Intel and MHS S.A. The dissolution of CIMATEL is due to a reassessment by Intel of its long-range marketing plans. CIMATEL had been responsible for the design of the 82716 video controller, as well as the announced ISDN chip set, the 29C48 combo, and the 29C53 S-transceiver. CIMATEL was located in Paris, France, and employed 26 persons. MHS made employment offers to many CIMATEL employees.

## ALLIANCES

### Intel

March 1981

MHS and Intel signed an agreement covering NMOS circuits and establishing a joint design facility in Nantes called CIMATEL.

June 1987

Intel and MHS dissolved CIMATEL due to a change in Intel's long-range plans. CIMATEL employed 26 persons, many of whom were offered employment at MHS.

### Cypress Semiconductor

October 1985

Cypress transferred masks for its 25ns 4K and 16K SRAMs and provided its 1.2-micron CMOS technology to Matra-Harris. Cypress will receive 2 percent of Matra-Harris stock for an undisclosed amount of cash. A similar deal for the Cypress 0.8-micron process and 64K SRAM is planned.

### Weitek

March 1986

MHS and Weitek signed a technology exchange and foundry agreement. MHS was granted

Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process in exchange for manufacturing a variety of Weitek's products. The companies will also codevelop complex, high-speed logic devices for DSP, telecommunications, and military markets.

### Silicon Compilers

June 1986

MHS and Silicon Compilers Inc. (SCI) will integrate SCI's Genesil silicon design system with MHS' advanced 2-micron, dual-level, metal CMOS process. MHS will also offer prototyping services, volume production, and design services for Genesil users.

### Cypress, Aspen

April 1988

MHS entered into an R&D agreement with Cypress Semiconductor and Aspen Semiconductor. MHS will provide \$4.57 million in contract funding for the development of ultrahigh-speed ECL circuits to be developed by Aspen.

## MANUFACTURING

### Technology

2.5-, 2.0-, 1.2-, and 0.8-micron CMOS  
1- and 2-layer metal  
5-inch wafers

### Facilities

Nantes, France

72,000 sq. ft.

Design, manufacturing in Class 10 clean room, assembly, and test

## PRODUCTS

### CMOS SRAMs

MHS markets 4K, 16K, 64K, and 256K SRAMs in a wide range of configurations, available in I/O multiplexed or separated form.

### Dual-Port SRAMs

CMOS 2Kx8 Synchronous

CMOS 2Kx8

CMOS Dual-Port RAM Controller

## CMOS Linear Arrays

Available in 3-micron, 1-layer metal with 228-1139 gates or in 2-micron, 2-layer metal with 810 to 11,250 gates

## Microcomponents

### MPUs

HMOS 16-Bit MPU; 5, 8 MHz  
CMOS 16-Bit MPU; 5, 8 MHz  
HMOS 8-, 16-Bit MPU; 5, 8 MHz  
CMOS 8-, 16-Bit MPU; 5, 8 MHz

### MCUs

HMOS 8-Bit MCU with 4K ROM  
CMOS 8-Bit MCU with 4K ROM  
HMOS 8-Bit MCU with 8K ROM  
CMOS 8-Bit MCU with 8K ROM  
80C52 8-Bit with 16K ROM

### MPRs

Video Storage Display Device  
Interface

## Telecommunications Circuits

Serial PCM Codec-Filter Family  
CMOS Combo  
CMOS Digital Loop Controller  
X.21 Protocol Controller  
Monolithic CMOS Codec-Filter Serial Interface  
300-Baud Modem

## DSP

16x16 Parallel Multiplier/Accumulator 45ns  
16x16 Parallel Multiplier 45ns

## OTHER INFORMATION

Matra-Harris does not employ a PR firm.

# Maxim Integrated Products, Inc.

120 San Gabriel Drive

Sunnyvale, CA 94086

408/737-7600

ESTABLISHED: May 1983

NO. OF EMPLOYEES: 172

## BACKGROUND

Maxim Integrated Products, Inc., designs, manufactures, and markets a broad range of linear and mixed-signal ICs for the analog market. The Company's objective is to develop and market both industry-standard and proprietary linear ICs using a diversity of process technologies.

Currently, the Company offers 200 products that are available in a number of packaging options including surface-mounted package technology. Products are designed for computer and peripherals, instrumentation, process control, communications, military, factory automation, and medical applications.

The Company sees its primary competitors as Analog Devices and Intersil. The competition with Intersil is intense and is expected to intensify further as the result of a second-source agreement giving Intersil the right to select and license up to 10 circuits designed by the Company.

Maxim was founded by John F. Gifford, Frederick Beck, Dr. Steven Combs, and David J. Fullagar, all former employees of Intersil's Analog IC Product Division. Maxim purchased a 30,000-square-foot facility in Sunnyvale, California, from Si-Fab. In February 1988, the Company completed the sale of 2.3 million shares of common stock. Maxim is using the proceeds to prepay \$3 million in long-term debt incurred when it purchased a new facility in October 1987. The remaining amount will be applied to equipment and other expenses for the new facility. The facility houses the Company's executive offices, engineering, and all services connected with its manufacturing.

The Company's products are sold worldwide through 63 sales representative organizations and electronics distributors. Domestic distributors are Anthem Electronics, Bell Industries, Hall-Mark Electronics, and Pioneer Electronics. In fiscal

1987, approximately 38 percent of sales were from the United States, 37 percent from Europe, 17 percent from Japan, and 8 percent from ROW. Among the Company OEM users are AT&T, Brown Boveri, GEC Card Technology (an affiliate of General Electric Company Plc), Hewlett-Packard, IBM, McDonnell Douglas, NEC, Siemens, and Tokyo Electric Co., Ltd.

## BOARD

(Name and Affiliation)

John F. Gifford

Maxim Integrated Products, Inc., President

Paul Bancroft

Bessemer Venture Partners L.P., Limited Partner

B. Kipling Hagopian

Brentwood Associates, General Partner

Stephen L. Merrill

Merrill, Pickard, Anderson & Eyre, General Partner

James R. Bergman

DSV Associates

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO

\*John F. Gifford

Intersil, President/CEO

VP Mktg/Sales

\*Frederick Beck

Intersil, SR VP WW Sales/Mktg

VP Operations

\*Dr. Steven Combs

GE, Mng Dir Process Tech

VP R&D

\*David J. Fullagar

Intersil, VP Engineering

VP Finance/Admin

John H. Trollman

DEST Corp., VP Finance

\*Founder

# Maxim Integrated Products, Inc.

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## FINANCING

1983

Round 1

\$4.9M

Bessemer Venture Partners; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Venad; overseas venture capital

February 1985

Round 2

\$5.5M

Adler & Co.; Bessemer Venture Partners; Brown Boveri; Brentwood Associates; DSV Partners; De Monet Industries; Merrill, Pickard, Anderson & Eyre

Lease

\$5.3M

Bank of America; Bank of the West

September 1985

Round 3

\$6.4M

Bessemer Venture Partners; BNP Ventures; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Rothschild, Inc.

March 1986

R&D

\$1.2M

Venture Technology Funding

February 1988

IPO

\$7.0M

Initial public offering

## RECENT HIGHLIGHTS

January 1987

Maxim offered a family of RS-232 components designed for specific uses such as digital PBX or modem interfaces. The devices are as follows:

- MAX230 and MAX231 digital PBX interfaces
- MAX232/233/235/236 general-purpose interfaces
- MAX234/237/239 modem interfaces

July 1987

Maxim offered an MPU supervisory circuit that tracks power levels to reset processor functions and switch over to battery backup. The device is designed for laptops and industrial control.

July 1987

Maxim offered the MAX452 family of CMOS video multiplexers/amplifiers.

February 1988

Maxim offered 1.7 million shares of common stock in an initial public offering. Maxim is using the proceeds to prepay \$3 million in long-term debt incurred in the acquisition of its new facility, with the remaining amount going toward equipment and other expenses for the new facility.

## ALLIANCES

Intersil

1984

Maxim and Intersil entered into an agreement that resolved legal proceedings between them. Under the agreement, Maxim granted Intersil the right to select, by July 1989, up to 10 circuits designed by Maxim for manufacture and sale on a royalty basis. Intersil granted Maxim certain rights to Intersil products, trade secrets, and patent rights. Intersil has selected three of Maxim's proprietary products.

April 1986

Maxim and Intersil signed a second-source agreement.

Brown Boveri

February 1985

Maxim agreed to design and manufacture devices for Brown Boveri.

Supertex

April 1988

Maxim and Supertex signed an agreement to jointly market the 690 family of MPU supervisory circuits.

## MANUFACTURING

Technology

Metal-gate CMOS for 1.5 to 18.0V operation  
Metal-gate CMOS for 5 to 40V operation

## Maxim Integrated Products, Inc.

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Silicon-gate CMOS-DMOS for up to 150V operation  
High-density/low-noise, analog silicon-gate CMOS  
Low-noise, precision linear bipolar for up to 44V operation

**Facilities**  
Sunnyvale, CA  
62,000 sq. ft.  
Design and test

### PRODUCTS

#### Multiplexers

RF-Video, Fault-Protected, Differential, and CMOS Analog Multiplexer

#### CMOS Analog Switches

Quad-SPST, Quad-DPST, Dual-DPST, Dual-SPST, Low-Power, Low-Charge, RF-Video, and TTL-Compatible Switches

#### A/D Converters

3.5- and 4.5-Digit Converters, High-Speed, Low-Power or Low-Noise Converters, Available with LED or LCD Drivers, 12-Bit Converter with Three-State Binary Output

#### Op AMPs/Buffers

Low-Power Single, Dual, Triple, and Quad OP Amps, Power Op Amp, Precision Op Amp, Fast and Very Fast Buffer Amp, High-Accuracy Fast Buffer, Superlow-Offset Op Amp, Chopper-Stabilized Op Amps

#### Display Drivers/Counters

4-, 5-, 8-, 10-Digit LCD Decoder/Drivers, 4.5-Digit LCD, High-Speed Counters/Decoders/Drivers

#### Interface

+5V Powered, Dual-RS-232 Transmitter and Receiver

#### Switched Capacitor Filter

Dual, Second-Order, Universal Switch Capacitor Filter

#### Timers/Counters

Programmable or fixed RC Timer/Counter, Low-Power, General-Purpose Timer or Dual Timer

#### Power Supply Circuits

AC/DC Regulators, Fixed/Adjustable Output, Step-Up Switching Regulator, Inverting Switching Regulator, Step-Down Switching Regulator, Positive or Negative Voltage Regulator, Voltage Converter, Under-/Overvoltage Detector MPU Watchdog Battery, Switchover/Reset Generators

#### Voltage References

+10.0V and -10.0V Precision Reference, 1.2V Voltage Reference, +10.0V Voltage Reference, +5.0V Precision Voltage Reference

### OTHER INFORMATION

Maxim does not employ a PR firm.

# MemTech Technology Corporation

3000 Oakmead Village Court

Santa Clara, CA 95051

408/970-8900

Fax: 408/986-0656

ESTABLISHED: December 1986

NO. OF EMPLOYEES: 75

## BACKGROUND

MemTech Technology Corporation is dedicated to the manufacture of bubble memory devices and related products. The Company was formed to acquire the business, principal assets, technology, and R&D capability of Intel Corporation's Magnetic Operation. The Company's leveraged buyout was initiated by the two founders, Richard H. Loeffler and William H. Almond, as well as an additional equity partner, Golodetz Corporation.

The Company is concentrating primarily on military and industrial applications of bubble memory technology. Recently, MemTech won a contract from the Wright-Patterson Air Force Base Avionics Laboratory to conduct work on advanced bubble memory devices. MemTech also works closely with General Electric on the Milstar Satellite program.

MemTech is headquartered in Folsom, California. The Company occupies more than 65,000 square feet of manufacturing space for device manufacture and assembly in Folsom, Santa Clara, and Santa Rosa, California. In addition, MemTech has a network of sales and customer service support operations located throughout the world.

In April 1987, MemTech purchased the Crystal Division of Materials Progress Corporation, the only remaining U.S. supplier of gadolinium gallium garnet (GGG) substrates. GGG are the base materials essential for the manufacture of bubble memory devices.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### Chairman/CEO

\*Richard H. Loeffler  
Helix Systems, Chairman/CEO

### President/COO

\*William H. Almond  
Eaton, GM Microlithography Division

### VP Sales/Mktg

Joseph J. Rutherford  
Materials Progress, VP Mktg/Sales

### VP Technology

Dr. Peter Silverman  
Intel, FAB Manager

\*Founder

## FINANCING

Not available

## ALLIANCES

Not available

## Facilities

Santa Clara, CA  
20,000 sq. ft.

Engineering, assembly, test, marketing, sales,  
component fabrication

Santa Rosa, CA  
13,000 sq. ft.

Crystal products division Tenth-Wave Division



# MemTech Technology Corporation

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## PRODUCTS

### 1Mb Device and Board-Level Products

Device	Description
BPK70AZ	1Mb (128KB), Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
BPK72AZ	1Mb Bubble Memory Prototype Kit
SBX251	Bubble Memory Board (128KB) Bubble Memory
SBC254	Bubble Memory Board (128KB to 512KB capacity)
BCK10	1Mb Bubble Cassette System with interchangeable 128KB Bubble Cassette Cartridges

### 4Mb Device and Board-Level Products

BPK74	4Mb Bubble Memory Subsystem (512KB) Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
SBX261	4Mb Bubble Memory Board SBX Bus Compatible (512KB Capacity)
SBC264	Bubble Memory Board (512KB to 2MB capacity)
PCB75/76	Bubble Memory Card (512KB to 1MB capacity), IBM PC, ST, AT Compatible, and other compatible systems
PCB74	Bubble Memory Expandable Memory Card (512KB to 4MB) IBM, PC, XT, AT Compatible or other compatible systems
BVME164/174	VMEbus Compatible Bubble Memory Boards. Expandible at system level up to 15MB
BCS74	1MB Bubble Memory Cassette System with Multiple Interfaces available, PC, SBX, SCSI, and STD (512KB to 1MB capacity)

## OTHER INFORMATION

MemTech's PR firm is Matthews and Clark.

# Micro Linear Corporation

2092 Concourse Drive

San Jose, CA 95131

408/433-5200

Fax: 408/432-0295

Telex: 275906

ESTABLISHED: October 1983

NO. OF EMPLOYEES: 144

## BACKGROUND

Micro Linear Corporation designs, manufactures, and markets linear and mixed linear/digital ICs, including both proprietary and enhanced second-source products as well as ASICs.

Micro Linear offers standard and semicustom ASICs that use a bipolar process. In addition, Micro Linear offers standard products using a CMOS process. Products are designed primarily for computer peripherals, telecommunications, power supply controls, industrial, and military applications.

Micro Linear also offers a number of computer-aided design (CAD) tools and a portfolio of linear semicustom design methodologies—including mask-programmable analog arrays and standard cells—that simplify the development of both standard and ASIC products containing analog functions.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Art Stabenow

National, Sr VP/Analog Div

### VP Marketing

Charles Gopen

Daisy Systems, GM IC Layout Div

### VP Sales

Tim D. Cox

National, Dir Dist Sales

### VP Engineering

\*Dr. Jim McCreary

Intel, Program Mgr

### VP Finance/Admin

\*Al Castleman, Jr.

MCI/Quantel, VP Finance

### VP Materials/Quality Ops

\*Abe Korgav

SEEQ, Dir Test/Assembly

### VP Mfg Operations

Micheal Morrione

National, Product Line Mgr-Linear Op

\*Founder

## FINANCING

### October 1983

Round 1

\$4.0M

Fairfield Ventures; Founders, Adler & Co.;

Oak Investment Partners; Richard Reardon

Lease

\$3.5M

California First Bank; Western Technology Investors

### November 1985

Round 2

\$12.0M

Round 1 investors, Accel Partners, Grace Ventures, Greenwood Funds, Harvest Ventures, Institutional Venture Partners, International Industrial Interests, Investors in Industry, Kyocera International, Montgomery Bridge Funds, Grine Ventures, International Tadiran, Xerox Venture Capital

Lease

\$3.0M

Burnham Leasing Corp.; California First Bank

## Micro Linear Corporation

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### February 1986

#### Round 3

\$15.0M

Round 1 and 2 investors, Aeneas Venture Corp., First Analysis Corp., GE Pension Fund, Kuwait & Middle East Financial Services, Northern Telecom, Schroeder Ventures, United Eastern Investments, U.S. Venture Partners

#### Lease

\$3.2M

Burnham Leasing, Westinghouse Credit, Phoenix Leasing

### August 1988

#### Round 4

\$10.0M

Round 1, 2, and 3 investors, Concord Partners, Merrill Lynch Venture Capital, Sigma Partners

#### Lease

\$2.6M

Pitney Bowes Credit, GATX Leasing, Phoenix Leasing

## ALLIANCES

### IMP

June 1984

IMP and Micro Linear codeveloped a 10V CMOS process; IMP provides foundry services for Micro Linear.

### Rockwell

1985

Rockwell invested in Micro Linear (\$1.8M cumulatively) and purchases products from Micro Linear.

### Tadiran

1985

Tadiran invested in Micro Linear (\$1.6M cumulatively) and purchases products from Micro Linear.

### Kyocera

1985

Kyocera invested in Micro Linear (\$1.5M

cumulatively) and purchases products from Micro Linear.

### Toko

October 1985

Toko began making bipolar devices for Micro Linear at its Saitama, Japan, plant.

### Northern Telecom

1986

Northern Telecom invested in Micro Linear (\$2.0M cumulatively) and purchases products from Micro Linear.

### Analog Design Tools

July 1986

Micro Linear integrated both its micro- and macrocell libraries into Analog Design Tools' workbench CAE system.

### Daisy Systems

August 1986

Daisy Systems agreed to port Micro Linear's FB300 and FB900 cell libraries to Daisy's workstations.

### IMP/MBB

August 1986

IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

## MANUFACTURING

### Technology

#### Bipolar

20V, 300-MHz, single-layer metal  
12V, 900-MHz, dual-layer metal  
36V, 300-MHz, dual-layer metal  
12V, 3-GHz, dual-layer metal (1989)  
10V, 3.0-micron, dual-layer polysilicon CMOS  
8V, 1.2-micron, dual-poly/dual-metal (1989)

### Facilities

San Jose, CA

48,000 sq. ft.

Design, manufacturing, and test

## PRODUCTS

### Bipolar Analog Arrays

Family	Linewidth (Microns)	Interconnect
FB900	10.0	Single-Layer Metal
FB300	8.0	Dual-Layer Metal
FB3400	8.0	Dual-Layer Metal
FB3600	7.0	Dual-Layer Metal

### Standard Linear Products

Device	Description
Disk Drives	Bipolar Standard and Semicustom ICs for Read/Write, Data Recovery, and Servo Actuator Control
Telecommunications	CMOS Products for Conditioning Analog Phone Lines; Programmable Attenuators, Equalizer, Loopback, and Tone Signaling
Data Converters	12-Bit and 8-Bit ADC with Serial and Parallel Interfaces

### CAD

Micro Linear provides Libraries of Devices and Macro Models for its bipolar ASIC products. The Libraries run on industry-standard platforms such as ViewLogic, Analog Design Tools, and Daisy Workstations.

## OTHER INFORMATION

Micro Linear Corporation's PR firm is Rigoli, Panthalon, Demeter.

# Microwave Monolithics

465 East Easy Street  
Simi Valley, CA 93065  
805/584-6642

ESTABLISHED: April 1982

NO. OF EMPLOYEES: 17

## BACKGROUND

Microwave Monolithics specializes in GaAs monolithic microwave ICs (MMICs) for Department of Defense (DOD) microwave specialty circuits as well as custom GaAs circuits.

The Company is privately held by five partners and completed first-round financing in 1983 through private sources.

Microwave Monolithics did custom GaAs circuit design research and development work for government agencies and OEMs until financing was secured. The Company began producing GaAs MMICs by year-end 1984.

## BOARD

Not available

## PRODUCTS

MMICs

## OTHER INFORMATION

Microwave Monolithics does not employ a PR firm.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Daniel Ch'en  
Rockwell, Mgr M/W Rsch

\*Founder

## ALLIANCES

Not available

## MANUFACTURING

### Technology

0.5-micron GaAs fine-line capability

### Facilities

Simi Valley, CA  
8,000 sq. ft.  
Two Class 100 clean rooms

# Microwave Technology, Inc.

4268 Solar Way  
Fremont, CA 94538  
415/651-6700  
Fax: 415/651-2208

ESTABLISHED: May 1982

NO. OF EMPLOYEES: 160

## BACKGROUND

Microwave Technology, Inc., (MwT) is a vertically integrated manufacturer of GaAs-based microwave components and subassemblies. MwT designs, manufactures, and markets GaAs epitaxial materials, GaAs FET devices, MMICs, hybrid MICs, and microwave components and subassemblies. The Company's products are designed for defense-related applications.

MwT produces both ultralow-noise and medium-power GaAs FETs and AlGaAs HEMT devices for applications ranging from 0.5 GHz to 40.0 GHz. The devices are produced with gate lengths from 0.1 to 0.25 micron. The Company is developing a family of high-performance MMIC products and has completed a series of 2- to 6-GHz MMIC amplifiers. Products in the 2- to 18-GHz and 6- to 16-GHz ranges are in development.

The Company also offers GaAs FET amplifiers from 0.5 to 26.5 GHz that use MMIC and hybrid MIC modules.

In 1987, MwT acquired Monolithic Microsystems, Inc. of Santa Cruz, California. Monolithic Microsystems makes detector log video amplifiers (DLVAs), log video amplifiers (LVAs), and threshold detectors based on proprietary monolithic LVA ICs. Products are used in various EW systems and other defense electronic applications. Monolithic Microsystems will operate as a wholly owned subsidiary of MwT and will continue manufacturing in its 8,200-square-foot Santa Cruz facility.

## BOARD

(Name and Affiliation)

Thomas R. Baruch  
Microwave Technology, Inc., Chairman

Dr. M. Omori  
Microwave Technology, Inc., VP of Engineering  
C.C. Bond  
New Enterprises Associates  
Irwin Federman  
Advanced Micro Devices  
Dr. P. Kaminski  
Hambrecht & Quist

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Joseph Lee  
Litton, President

### VP Finance/CFO

J. Geyton  
Avantek, Div Controller

### VP Materials

A. Herbig  
Avantek, Tech Staff

### VP Engineering/R&D

Dr. Masa Omori  
Avantek, Eng Mgr

### VP Mktg/Sales

David Gray  
EM Systems, Sales Mgr

### VP Ops

John Sorci  
Watkins-Johnson, Subsystems Div Mgr

## FINANCING

August 1983

Round 1  
\$4.8M

Not available  
Round 2  
\$4.3M

# Microwave Technology, Inc.

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June 1985

Round 3

\$1.0M

Investors were the Allstate Insurance Company, Concord Partners, New Enterprise Associates, T. Rowe Price, Sequoia Capital, and U.S. Venture Partners.

## ALLIANCES

Not available

## MANUFACTURING

### Technology

GaAs

### Facilities

Fremont, CA

50,000 sq. ft.

Design, manufacturing

6,000 sq. ft.

Class 1,000 clean room

## PRODUCTS

GaAs Epitaxial Materials

GaAs FET Amplifiers, 0.5 to 26.5 GHz

GaAs MMIC Amplifiers, 2 to 6 GHz

GaAs MIC Microwave Products

Thin-Film Hybrids

Log Amplifiers

Detector Log Video Amplifiers

## OTHER INFORMATION

Microwave Technology, Inc. does not employ a PR firm.

**Mietec N.V.**  
Westerring 15  
9700 Oudenaardé, Belgium  
055-33-2211  
Fax: 055-318-112  
Telex: 85739 MIETEC

**ESTABLISHED: March 1983**

**NO. OF EMPLOYEES: 280**

## **BACKGROUND**

Mietec N.V. designs mixed analog and digital ASICs, using a cell-based library of digital and analog cells. The Company's ASIC products are split into two categories: user-specific ICs (USICs) and application-specific standard products (ASSPs) for dedicated uses.

The Company is capable of designing devices using CMOS (for low-power, high-density applications), BiMOS (for high-voltage applications, 70V), and SBiMOS (a multipurpose technology) processes. A proprietary development software support tool called Mietec Analog/Digital Engineering (MADE) allows the development and simulation of digital and analog functions simultaneously.

Mietec is a joint venture, 49.8 percent of which is owned by Alcatel Bell Telephone Company; 49.2 percent is owned by GIMV, a Flanders regional investment company; and 1.0 percent is owned by a private investment bank. Mietec is a major supplier of the ASIC products for the Alcatel System 12 and is working on the next generation of Alcatel exchanges based on ISDN.

## **BOARD**

Jo Cornu, Chairman

## **COMPANY EXECUTIVES**

(Position, Name, and Prior Company)

### **General Manager/CEO**

Jean-Pierre Liebaut  
Matra-Harris

### **Business Development Manager**

Eric Schutz  
Motorola

### **Director, Marketing & Sales**

Alain Gilot  
Mostek

## **FINANCING**

Investment in the Company totaled \$48.2 million.

## **ALLIANCES**

### **Sprague** 1983

Mietec entered a cross-licensing agreement with Sprague for a BiMOS process.

### **STM** 1987

Mietec, SGS-Thomson, and Alcatel agreed to the transfer of a 1.2-micron CMOS process.

## **MANUFACTURING**

### **Technology**

5.0-, 3.0-, and to 2.4-micron NMOS  
3.0- and 2.4-micron CMOS  
VMOS  
BiCMOS  
Single and double-layer metal

### **Facilities**

#### **Oudenaarde, Belgium**

The manufacturing center is situated on a 40,000-square-meter site with 10,000 square meters of floor space. A wafer fab is equipped with more than 2,000 square meters of clean rooms, of which 400 square meters are Class 10. Potential capacity is 150,000 wafers per year. The fab is suitable for technologies of 1 micron or lower.



## **Mietec N.V.**

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### **Brussels, Belgium**

The customer design center includes VAX 8500, VAX 750, MICROVAX, Tektronix, GPX2, and Daisy equipment, in addition to VALID workstations.

### **OTHER INFORMATION**

Mietec does not employ a PR firm.

# Modular Semiconductor, Inc.

138 Kifer Court  
Sunnyvale, CA 94086  
408/733-5000  
Fax: 408/733-0224

ESTABLISHED: September 1983

NO. OF EMPLOYEES: 12

## BACKGROUND

Modular Semiconductor, Inc., was founded by individuals from Hewlett-Packard, Signetics, and Synertek to design, develop, manufacture, and market VLSI ICs using a 1.0-micron CMOS process technology.

The Company is focusing on data communications chips, memories, semicustom and custom designs, VMEbus chip sets, and telecommunications products. Modular Semiconductor began manufacturing with a 2-micron CMOS process and is now offering 1.5-micron technology, with plans to use a 1.0-micron process in the near future.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Arockiyaswami Venkidu  
Faraday Electronics, Dir Engr

### Dir Mfg

\*Dr. Lenin Anne  
Hewlett-Packard, Sr Engr

\*Founder

## PRODUCTS

### CMOS SRAM

Device	Description	Access Time (ns)
MS6168	4K x 4	55ns
MS616	16K x 1	55ns

## FINANCING

Not available

## ALLIANCES

### Panatech/Ricoh

November 1984

Modular Semiconductor made a five-year, three-way agreement with Panatech and Ricoh of Japan. Modular provided Ricoh with its CMOS designs and process technology for 16K SRAMs and 256K DRAMs. Ricoh manufactured these devices in Japan and had the rights to market them in Japan. Panatech had the rights to market 16K memories only in North America. (expired)

## MANUFACTURING

### Technology

1.5-micron CMOS  
2.0-micron CMOS

### Facilities

Sunnyvale, CA  
7,000 sq. ft.  
Design

## Modular Semiconductor, Inc.

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### Data Communication

Device	Description
MS16C450/82C50A	PC UART
MS16C451	PC UART with parallel port
MS16C452	PC DUAL UART with parallel port
MS16C453	PC DUAL UART
MS16C454	PC QUAD UART
MS16C550A	PS/2 FIFO UART
MS16C551	PS/2 FIFO UART with parallel port
MS16C552	PS/2 FIFO DUAL UART with parallel port
MS16C553	PS/2 FIFO UART
MS16C554	PS/2 FIFO QUAD UART
MS68/88C681	DUART
MS82C684	QUART

### Bus Interface

MS68C153	VMEbus Interrupter Module
MS68C154	VMEbus Controller
MS68C155	VME Interrupt Generator

### OTHER INFORMATION

Modular Semiconductor does not employ a PR firm.

# Molecular Electronics Corporation

4030 Spencer Street MS108

Torrance, CA 90503-2417

213/214-1485

Fax: 213/542-1270

ESTABLISHED: 1984

NO. OF EMPLOYEES: 12

## BACKGROUND

Molecular Electronics Corporation (MEC) is developing technology for the formation, deposition, and commercial application of biomolecular membranes, or biomembranes, in the fields of electronics, optics, and biomedicine.

A biomembrane is a structural analog of the membrane that surrounds every living cell. MEC's proprietary technology enables the formation and deposition of highly ordered, perfectly uniform organic films onto a variety of substrate surfaces, with thickness control down to 10 angstroms. The Company's technology and know-how include a patented biomembrane production technology called MonoFab, and the molecular engineering and synthesis of biomembrane materials with the desired physical, electronic, optical, and biological properties.

MEC has developed several potential commercial applications of the core biomolecular membrane technology (BMT). The first is an ultrathin, uniform, high-resolution e-beam resist (MonoResist) that has a demonstrated resolution down to 1.0 micron. The second is an ultrathin anti-corrosive lubricant (MonoGuard) for rigid disk magnetic media. The third is a perfectly uniform antireflection coating (MonoArc) for pellicles.

The Company also has demonstrated a 20-angstrom biomembrane dielectric on GaAs devices. Outside of semiconductor applications, the Company has demonstrated unique biocompatible properties of biomembranes as coatings for medical implants, including intra-ocular lenses, and is developing drug delivery and surface-active (binding) sites applications (e.g., biosensors).

The MEC business plan calls for partnerships with corporations on both the electronic and medical applications of its technology. The Company believes that its technology will lead to new classes of organic/inorganic hybrid semiconductors and dielectric spacers for quantum devices in electronics and, ultimately, will represent the key enabling technology for bioelectronics including the biochip.

## BOARD

\*George Reynolds, Chairman  
Dr. Vladimir Rodov  
Dr. Paul Kaminski  
Parker Dale  
Roman Kupchynsky

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President, CEO

\*Dr. Vladimir Rodov  
TRW, N/A

### VP Dir Medical Bus

David Gibson  
Chiron Ophthalmics, Founder/Dir R&D

\*Founder

## FINANCING

Molecular Electronics has raised more than \$5 million in three rounds of financing.

## ALLIANCES

Alliances exist but information is not available.

# **Molecular Electronics Corporation**

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## **MANUFACTURING**

Currently on a pilot scale

### **Facilities**

Torrance, CA

7,500 sq. ft.

Headquarters, R&D lab (including Class 10  
clean room, surface analytic, electronics, and  
chemistry sections)

## **OTHER INFORMATION**

Molecular Electronics Corp. does not employ a PR firm.

# MOS Electronics Corporation

914 West Maud Avenue  
Sunnyvale, CA 94086  
408/733-4556  
Fax: 408/773-8415

ESTABLISHED: September 1983

NO. OF EMPLOYEES: 64

## BACKGROUND

MOS Electronics Corporation (MOSeI) designs, manufactures, and markets CMOS SRAMs and a family of specialty memory products for the dual-port cache control and telecommunications markets. The Company is using its SRAMs to build a base that will enable it to design specialty memories including cache tag RAMs; video RAMs; and radiation-hardened, 6-transistor RAMs.

MOSeI does front-end R&D and marketing at its headquarters in Sunnyvale, California. Hyundai, Sharp, Taiwan Semiconductor, and UMC Manufacturing Corporation provide foundry services. Assembly and test are also subcontracted.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Peter Chen  
Fairchild, Semi Tech Mgr.

### VP Technology

Nasa Tsai  
Fairchild, Sr MTF

### Dir Eng Design

Y.T. Loh  
Saratoga Semiconductor, VP Technology

### VP Sales/Mktg

Bruce Campbell  
Intel, Mktg Mgr

### VP Finance

George Sun  
Delta 79, VP Finance

### Dir of Sales

Eric Nagel  
Intel, Dist Sales Mgr

### Dir of Bus Dev

Jim Summers  
AT&T, Dir of Product Planning

## FINANCING

### 1983

Seed  
\$1.0M  
Founders

### 1984

Round 1  
\$2.0M  
Pacific Electric Wire & Cable (Taiwan)

### 1988

Round 2  
\$3.0M  
Walson Lihwa Corp (Taiwan)

## RECENT HIGHLIGHTS

### January 1987

MOSeI offered the MS6130, a 1Kx8 dual-port RAM for use in 32-bit parallel computer applications, offering a 55ns address access time and a 30ns output enable time for no-wait operation with 25-MHz MPUs.

### March 1987

MOSeI offered the MS7201 CMOS FIFO with access times of 50ns, 65ns, and 120ns.

# MOS Electronics Corporation

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## January 1989

MOSel introduced a cache memory chip jointly developed with Chips & Technologies for 25-MHz 80386 cache memory applications.

## Sharp

### June 1986

MOSel provided a 256K SRAM design based on a 1.2-micron CMOS process. Sharp provides foundry service under a favorable OEM contract.

## ALLIANCES

### Fuji Electric

#### September 1985

Fuji Electric and MOSel signed an agreement whereby Fuji Electric will supply 4-inch and 6-inch wafers using MOSel 1.5 and 2.0-micron process technology. The companies will jointly develop CMOS 16K and 64K SRAMs for MOSel under an OEM contract.

### UMC

#### October 1985

MOSel licensed a 32Kx8 EPROM, a 16K SRAM, and a 1.2-micron process to UMC in Taiwan in exchange for fab capacity.

#### November 1985

Agreement extended to include 1.2-micron technology and 256K SRAM.

### Hyundai

#### February 1986

MOSel provided 8Kx8 and 32Kx8 SRAMs and 1.2- and 1.5-micron CMOS process technologies to Hyundai in exchange for foundry capacity under a discounted OEM contract.

#### March 1988

Agreement extended to include 1MB SCRAM and submicron technology.

## MANUFACTURING

### Technology

MOSel offers five high-performance CMOS (H-BiCMOS) processes and one BiCMOS process with minimum dimensions as follows:

Drawn (Microns)	Effective (Microns)
2.0	1.5
1.5	1.1
1.2	0.8
1.2 BiCMOS*	0.8
1.0*	0.8
0.8*	0.7

\*Under development

### Facilities

#### Sunnyvale, CA

10,000 sq. ft.

Design and test

#### Hsin-Chu, Taiwan

6,000 sq. ft.

Design

## PRODUCTS

### Byte-wide SRAMs

Device	Description	Access Time (ns)
MS6516	2Kx8	45-100
MS6264	8Kx8	35-120
MS62256	32Kx8	25-85
MS88128	128Kx8	45-150*
MS88512	512Kx8	70-100*

\*Under development

# MOS Electronics Corporation

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## Specialty Memories

Device	Description	Access Time (ns)
MS7201	512Kx9 FIFO	50-120
MS6130	1Kx8 Dual Port	55-120
MS6132	2Kx8 Dual Port	55-120
MS82C308	Cache Memory	25 MHz
MS176	Video Color Palette	35, 50 MHz
MSVR35	Voice ROM	3 sec.
MSVR205	Voice ROM	20 sec.

## OTHER INFORMATION

MOSel does not employ a PR firm.



# MOSPEC Semiconductor Corp.

76 Chung Shan Rd, Hsin Shin  
Tainan Taiwan R.O.C.  
Taipei (2)755-6664  
U.S. 213/802-7662  
Fax: Taipei (2)755-6460  
U.S. 213/802-7662

ESTABLISHED: April 1987

NO. OF EMPLOYEES: 300

## BACKGROUND

MOSPEC Semiconductor Corporation is a subsidiary of President Enterprises Corporation, one of the largest companies (No. 7 in total sales) in Taiwan. The Company previously was a fully owned unit of President under the name PECOR. As a result of a joint venture with U.S. company MOSPOWER Technology, Inc., MOSPEC was formed in April 1987.

MOSPEC is the only manufacturer of power devices in Taiwan. Its product lines include bipolar power transistors, Darlingtons, power MOSFETs, Schottky rectifiers, and ultrafast and fast-recovery rectifiers. The Company currently is shipping all of these products. MOSPEC also provides wafer fab and assembly services to other manufacturers on a contract basis. MOSPEC offers 3-micron bipolar and MOSFET process technologies.

The Company's production facilities include an 80,000 square feet plant that houses headquarters, wafer fab, assembly, design, test, and R&D operations.

## BOARD

(Name and Affiliation)

Dr. C.Y. Kao  
President Enterprises Corporation

Dr. M.L. Tarn  
MOSPEC Semiconductor Corporation, president

C.S. Ling  
President Enterprises Corporation

Ming-Yuen Tang  
Kao Chao Brokerage

## COMPANY EXECUTIVES

(Position and Name)

President  
M.L. Tarn

VP, Mktg.  
Ming-Yuen Tang

VP, Finance  
C.T. Chen

R&D Mgr  
W.C. Hsu

P/MC Mgr  
W.N. Teng

## FINANCING

Round 1  
\$7.8M  
Private Placement

Round 2  
\$4.0M  
Private Placement and employees

## ALLIANCES

Not available

## SERVICES

Wafer fab, assembly

# **MOSPEC Semiconductor Corp.**

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## **MANUFACTURING**

### **Technology**

3.0-micron bipolar and MOSFET technologies

### **Facilities**

Tainan, Taiwan

80,000 sq. ft. R&D, manufacturing, assembly,  
marketing, finance, test

## **PRODUCTS**

Bipolar Power Transistors

Power MOSFETs

Schottky, Ultrafast and Fast Recovery Rectifiers

Wafer Foundry

OEM Assembly

## **OTHER INFORMATION**

MOSPEC does not employ a PR firm.

# Multichip Technology Inc.

58 Daggett Drive  
San Jose, CA 95134  
408/432-7000  
Fax: 408/432-7049

ESTABLISHED: February 1988

NO. OF EMPLOYEES: 40

## BACKGROUND

Multichip Technology Inc. was formed in February 1988 to design, develop, and market multichip memory modules for Cypress Semiconductor. Financing was provided by Cypress, which owns 100 percent of the capital stock.

Multichip operates as a wholly owned subsidiary of Cypress Semiconductor Corporation and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Multichip-developed devices are fabricated by Cypress and sold through Cypress' sales organization.

Multichip Technology is engaging in a new approach to system design through multichip modules. Packing multiple chips into a single component reduces board space significantly. Modules create space by allowing chips to be stacked vertically or horizontally and in multiple layers, thus improving system density. By moving devices closer together, modules reduce interconnect capacitance, thus decreasing signal delays.

The Company offers high-performance SRAM modules, which began shipment in June 1988. Offerings include standard and custom products for both military and commercial applications. Multichip currently is developing products for RISC systems based on the SPARC microprocessor. Future multichip modules may integrate other Cypress advanced products such as PLDs, fast SRAMs, PROMs, FIFOs, and dual ports. The Company plans to offer denser and faster memory modules in the future, as well as application-specific modules (i.e., DSP, cache) and standard and custom products implemented using advanced packaging techniques.

## BOARD

(Name and Affiliation)

T.J. Rodgers, Chairman  
President, Cypress Semiconductor

Andy Paul  
President

Lowell Turriff  
VP, Mktg & Sales, Cypress Semiconductor

Roger Ross  
President, Ross Technologies

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Andy Paul  
IDT, Mktg Mgr

VP, R&D  
Marcelo Martinez  
IDT, Eng Dir

VP, Mktg  
Tom Kadlec  
IDT, Mktg Mgr

VP, Finance  
John Green  
AMD, Asst Controller

VP, Mfg  
Jeff Michols  
MET, VP Mfg

## FINANCING

Round 1  
February 1988  
Cypress Semiconductor

## **Multichip Technology Inc.**

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### **ALLIANCES**

Multichip is a wholly owned subsidiary of Cypress Semiconductor Corporation.

### **MANUFACTURING**

#### **Technology**

Surface-mount components of ceramic and/or epoxy laminate substrates.

### **Facilities**

San Jose, CA  
18,000 sq. ft.  
Design, marketing

### **PRODUCTS**

High-performance SRAM modules (standard products and custom products; military and commercial)

### **OTHER INFORMATION**

Multichip does not employ a PR firm.

## nCHIP, Inc.

1971 North Capitol Avenue  
San Jose, CA 95132  
408/945-9991  
Fax: 408/945-0151

ESTABLISHED: December 1987

NO. OF EMPLOYEES: 20

### BACKGROUND

nCHIP was founded in December 1987 to address the performance bottleneck that is building up at the package level. The solution provided by nCHIP is multichip modules. The Company will design and/or manufacture silicon circuit boards, complete multichip modules, and module carriers for high-performance, high-density, and cost-sensitive applications.

nCHIP designs and manufactures custom high-performance, high-density silicon circuit boards (SiCBs) to be used for multichip modules, allowing faster, lighter, more compact, and more reliable systems to be built. Die are mounted directly on the SiCB, eliminating much of the typical package-related capacitances. nCHIP design rules enable dense placement of the ICs, approaching wafer-scale density in memory applications.

In addition to designing the silicon circuit board, nCHIP also provides complete multichip module design, fabrication, and assembly services to assist the systems designer in achieving the benefits of these technologies. The Company provides the module carrier, addresses power dissipation issues using proprietary technologies, and manufactures and delivers a complete, tested application-specific integrated module (ASIM) that is ready for system assembly.

The technology base was developed by nCHIP's founders at Lawrence Livermore National Laboratory (LLNL). While at LLNL, the founders produced functional models for use in a 1989 space mission. More than \$25 million was invested in the development program since 1983.

In 1989, nCHIP selected strategic customers, completed the design of its initial products, and set up a 5-inch wafer production line. In 1990, nCHIP will begin volume production and increase

its customer base. In late 1991, production capacity will be increased with the addition of an 8-inch manufacturing line.

### BOARD

(Name and Affiliation)

Philip Dauber, CEO  
nCHIP, Chairman/CEO

William Davidow  
Mohr, Davidow Ventures, Partner

Bruce McWilliams  
nCHIP, President/COO

F. Gibson Myers  
Mayfield Fund

Richard Newton  
University of California, Berkeley

Martin Titland  
Fairchild Space Company

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**Chairman/CEO**  
Philip Dauber  
Key Computer, President

**President/COO**  
Bruce McWilliams  
LLNL, Program Leader

**VP Operations**  
Luc Bauer  
IDT, VP and General Manager

**VP Technology**  
David Tuckerman  
LLNL, Project Leader

**VP Engineering**  
Kamran Malik  
Key Computer, Dir. of Engineering

## **nCHIP, Inc.**

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### **VP Finance**

Kirk Flatow

Bain & Co., Senior Consultant

### **FINANCING**

**October 1987**

Seed

Private investors

**April 1989**

Seed

Private investors

**August 1989**

Round 1

\$4.2M

Mayfield Fund; Kleiner, Perkins, Caufield &  
Byers; Mohr, Davidow Ventures

### **PRODUCTS**

Circuit Boards

Multichip Modules

### **OTHER INFORMATION**

nCHIP does not employ a PR firm.

### **SERVICES**

Design

Fabrication

Assembly

### **MANUFACTURING**

#### **Technology**

CMOS

5-inch wafers

8-inch wafers in 1991

# NMB Semiconductor Co. Ltd.

9730 Independence Avenue

Chatsworth, CA 91311

818/341-3355

Fax: 818/341-8207

ESTABLISHED: April 1984

NO. OF EMPLOYEES: 75

## BACKGROUND

NMB Semiconductor designs, manufactures, and markets 256K and 1Mb DRAMs and also offers foundry services. The Company was Japan's first start-up to build a VLSI facility capable of fabricating products with submicron geometries. Designs and technology were acquired initially through licensing agreements and technology exchanges with Inmos and other U.S. companies to bring existing processes on-line quickly.

NMB Semiconductor is a Division of NMB Technologies, which is, in turn, a subsidiary of the multinational Minebea Co. Ltd. of Tokyo, Japan. NMB Technologies was formed in early 1988 and consolidates Minebea's U.S. activities, which consist of NMB Semiconductor, Hi-Tek Corp., IMC Components Corp., and NMB Audio Research Corp. NMB Technologies is organized into a Memory Division (NMB Semiconductor), a Keyboard Division (Hi-Tek), an axial fan division (IMC Components), and an Audio Research Division (NMB Audio Research). NMB Technologies conducts the marketing for all products manufactured by the subsidiaries including DRAMs, hybrid ICs, switching power supplies, keyboards, inductors, DC servo and step motors, and AC and DC tube axial cooling fans.

All manufacturing for NMB Semiconductor's DRAMs is conducted by Minebea in a \$250 million, fully automated facility in Tateyama, Japan.

## BOARD

(Name and Affiliation)

Takumi Tamura  
NMB Semiconductor

Masatomo Yuki  
Minebea

Takami Takahashi  
Minebea

Iwao Ishizuka  
Minebea

Goro Ogino  
Minebea

Hidisato Ishikawa  
Minebea

Sadahiko Oki  
Minebea

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Hidisato Ishikawa  
Minebea, Sr Mng Dir

Executive VP  
William C. Connell  
NMB (USA), Vice President

Dir Mfg & R&D  
Shosuke Shinoda  
Matsushita, Dir MOS Process

## FINANCING

1984

Start-up

\$11.11M

Bank of Tokyo, Ltd.; Fuji Bank; Japan Associated Finance Co., Ltd.; K.K. Keiaisha; Kyowa Bank; Long Term Credit Bank of Japan; Minebea Co; Nippon Enterprises Development Corp.; Nippon Investment & Finance Co., Ltd.; Sumitomo Trust & Banking; Takami Takahashi; Takumi Tamura; Tokai Bank

1989

IPO

\$460.0M

Initial public offering

# NMB Semiconductor Co. Ltd.

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## RECENT HIGHLIGHTS

### March 1989

NMB acquired the Composite Recording Head Division of Seagate Technology.

## ALLIANCES

### Minebea Co. 1984

NMB is the subsidiary of and is financed by Minebea Co. Ltd. of Tokyo.

### Inmos

#### June 1984

NMB obtained a five-year license to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the 256K DRAM output. The companies also planned to codevelop the technology for Inmos' 64K and 1Mb DRAMs.

### Vitellic

#### November 1985

Vitellic granted a license to NMB Semiconductor for its 1Mb CMOS DRAM in exchange for one-third of NMB Semiconductor's plant capacity.

### National

#### September 1986

National contracted NMB to manufacture fast

SRAMs at the Tateyama fab. This agreement was canceled.

### TI

#### November 1987

NMB agreed to supply Texas Instruments (TI) with TI-designed, 1Mb field RAMs. Initially, NMB shipped 100,000 units a month.

### Alliance Semiconductor

#### December 1987

Alliance Semiconductor signed a five-year agreement with NMB Semiconductor, covering 256K and 1Mb DRAMs. NMB will manufacture and sell the devices worldwide.

## SERVICES

Silicon Foundry

## MANUFACTURING

### Technology

1.0- to 2.0-micron CMOS  
5-inch wafers

### Facilities

Tateyama, Japan  
200,000 sq. ft.

Total space

43,000 sq. ft.

Class 1 clean room

## PRODUCTS

### DRAMs

Device	Description	Speed
AAA2800	256Kx1 Static Column Mode	60 to 80ns
AAA2801	256Kx1 Page Mode	60 to 80ns
1M100	1Mb x 1 Fast Page Mode	100 to 200ns
1M101	1Mb x 1 Nibble Mode	100 to 200ns
1M102	1Mb x 1 Static Column Mode	100 to 200ns
1M104	256Kx4 Fast Page Mode	100 to 200ns
1M105	256Kx4 Static Column Mode	100 to 200ns
1M200	1Mb x 1 Fast Page Mode	60 to 80ns
1M201	1Mb x 1 Nibble Mode	60 to 80ns
1M202	1Mb x 1 Static Column Mode	60 to 80ns
1M204	256Kx4 Fast Page Mode	60 to 80ns
1M205	256Kx4 Static Column Mode	60 to 80ns

## OTHER INFORMATION

NMB's PR firm is Capital Relations.



**NovaSensor**  
1055 Mission Court  
Fremont, CA 94539  
415/490-9100  
Fax: 415/770-0645  
Telex: 990010

**ESTABLISHED: October 1985**

**NO. OF EMPLOYEES: 105**

## **BACKGROUND**

NovaSensor was formed to develop, manufacture, and market the next generation of solid-state sensors and unique silicon-based mechanical microstructures. In the sensor field, the Company is focusing its design and development efforts on the physical parameters of pressure, acceleration, flow, and force. In the area of silicon-based mechanical microstructures, NovaSensor is focusing its efforts on the development of flow restrictors, programmable microvalves, micro-switches, nozzles, fluidics components, and micropositioners.

The Company was formed by Janusz Bryzek, Joseph R. Mallon, and Kurt Peterson. The team was joined by Phil Barth, a sensor technologist from Stanford University.

The Company is housed in a 32,000-square-foot facility that became operational in the summer of 1987 and includes a 4-inch wafer-processing line, assembly, and test.

First packaged devices were the TO-5 and TO-8 piezoresistive pressure sensors compensated over the range of 0° to 70° centigrade.

In September 1987, IC Sensors filed a suit against NovaSensor, claiming that the firm misappropriated information and trade secrets. The suit also names Mr. Bryzek, NovaSensor's president and CEO, and the former vice president and director at IC Sensors.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **Copresident/CEO**

\*Janusz Bryzek  
IC Sensors, Founder/President

### **Copresident/COO**

\*Joseph R. Mallon  
Kulite Semiconductor, VP Engineering

### **Exec VP Tech**

\*Kurt Peterson  
Transensory Devices, Founder/VP Tech

### **Dir Adv Sensor Dev**

Phil Barth  
Stanford University, Sr Rsch Assoc

### **Mgr of App Engr**

Dilip Vyas  
Sensym, Mgr QA  
\*Founder

## **FINANCING**

NovaSensor was funded by Solarton Electronics Inc., a division of Schlumberger, for an undisclosed amount.

## **ALLIANCES**

Not available

## **MANUFACTURING**

Full-capability wafer fabrication for solid-state sensors, silicon microstructures, and transducer lines on 4-inch wafers. The facility is capable of producing more than 30 million sensors per year.

# **NovaSensor**

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## **Facilities**

**Fremont, CA**

**22,000 sq. ft.**

**Manufacturing**

**3,500 sq. ft.**

**Class 1,000 clean room**

## **PRODUCTS**

**Low-Pressure Sensors (10 inches of water pressure) with High Output and Low Linearity**

**High-Pressure Sensors (up to 10,000 psi)**

**Acceleration Sensors**

**Isolated Metal Diaphragm Transducers**

**On-Chip Laser-Trimable Pressure Transducers**

**Low-Cost Mini-DIP Plastic Package Differential Pressure Sensor**

## **OTHER INFORMATION**

**NovaSensor's PR firm is Roger Grace, Inc.**

## Novix Inc.

19925 Stevens Creek Blvd., Suite 280  
Cupertino, CA 95015  
408/255-2750

ESTABLISHED: March 1984

NO. OF EMPLOYEES: 20

### BACKGROUND

Novix develops and markets MPUs and development tools that implement a FORTH-in-silicon architecture. In 1986, Novix introduced the NC Series of 16-bit MPUs, which are high-level language, direct-execution (no microcode) MPUs. The MPUs are manufactured using 1.25-micron HCMOS and typically perform in excess of 20 mips. Other products include CPU boards, the ND4000 development system, a C compiler, and a FORTH operating environment. The Company states that the approach can be implemented in HCMOS, ECL, and GaAs. A 3-micron CMOS gate array was designed using Novix-developed technology.

Novix designs products for the artificial intelligence, embedded controller, cryptographics, robotics, and machine vision markets. Future plans also include implementing gallium arsenide in its product lines. The Company subcontracts all production and assembly.

Novix founders included Charles Moore, who invented the FORTH language in 1969; John Peers; John Golden; and Robert Murphy. The Company, originally named Technology Industries, was formed when Sysorex Information System, Inc., offered approximately \$1 million to develop devices based on the FORTH "language slice" computing. The combined Sysorex-Technology Industries R&D partnership was renamed Novix Inc.

In October 1986, Novix established an office in Belgium and signed nine European distributors.

In January 1987, John Golden and Robert Murphy formed a new company, named QSD, which applies the FORTH-in-silicon architecture to the military market.

### BOARD

(Name and Affiliation)

John Peers  
Novix Inc.

Ed Mack  
Consultant  
Ron Osborne  
Faultless Starch  
Peter Johnson  
Not Available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
John Peers  
Technology Industries Inc., President

### FINANCING

March 1984  
Round 1  
\$1.0M  
Sysorex International Inc.; Technology Industries Inc.

### RECENT HIGHLIGHTS

#### February 1987

Novix put its 16-bit NC4016 MPU on an STD bus card measuring 4.5 x 6.5 inches. The NB4300 card supports 20-bit addressing and can be used as master or slave bus control.

#### April 1987

Novix introduced the NS4100, a high-speed coprocessor/real-time controller board for IBM PCs or compatibles. The board is built with the Company's NC4016 MPU.

### ALLIANCES

Sysorex  
March 1984  
Sysorex International participated in first-round financing.

## Novix Inc.

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### Harris

July 1986

Harris added the Novix FORTH language MPU to its ASIC library as part of a licensing agreement covering MPU and MCU products based on the FORTH engine.

### Facilities

Cupertino, CA  
6,000 sq. ft.  
Design, test

## MANUFACTURING

### Technology

3- and 1.25-micron CMOS

## PRODUCTS

### Microprocessors

Device	Description	Features
NC4016	16-Bit	64K Words Direct and 128-Gigaword On-Chip Memory Addressing, 10 to 12 mips
NC5116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, 20 to 25 mips
NC6116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, plus UARTS, FIFO, CTC, SCSI, On-Chip Stacks, 20 to 25 mips

### CPU Boards

Device	Description
NB4000	Novix Beta Board with 28K-word RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4100	IBM PC Add-In Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4200	Turbo Frame 4000 with 8K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4300	Novix STD Bus CPU Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH

### Development Tools

Device	Description
ND4000	Standalone System with Disk Controller, 10MB Hard Disk, Power Supply/Case, 360KB Floppy Disk, and Breadboard Development Area
Novix Empress	Comprehensive Superset FORTH-83 Operating Environment
Novix C	Full K and R and ANSI

## OTHER INFORMATION

Novix does not employ a PR firm.

**NSI Logic, Inc.**  
Cedar Hill Business Park  
257-B Cedar Hill Road  
Marlboro, MA 01762

**ESTABLISHED: November 1984**

**NO. OF EMPLOYEES: N/A**

### **BACKGROUND**

NSI Logic Incorporated designs, develops, and markets ASICs and video add-on boards that enhance graphics performance of new and existing IBM PC, PS/2, and compatible computer systems. The Company was founded in 1984 by Nandu Marketkar. Prior to founding NSI, Mr. Marketkar operated Custom Computer Systems.

NSI offers ASICs for the graphics and raster controller segments of the industry and will continue to develop turnkey solutions using state-of-the-art technology in related areas. The Company uses CMOS, MOS, and BiCMOS technologies in its ASIC development, which allows NSI to provide a platform for a broad line of high-performance products for applications in graphics and raster controllers. The Company's ASIC products are marketed to OEMs that build systems and video add-on boards. Primary markets for the Company's board products are owners and buyers of computer systems and value-added resellers (VARs).

### **BOARD**

(Name and Affiliation)

\*Nandu J. Marketkar, Chairman  
NSI Logic, CEO

Jeff Schiebe  
NSI Logic, President

### **PRODUCTS**

<b>VLSI</b>	<b>Controllers</b>
EVC215	EPIC EGA
EVC315	Smart EGA
EVC315CR	Smart EGA PLUS
EVC415A	Smart VGA/8
PS00004	VGA/8 and VGA/16

### **OTHER INFORMATION**

NSI Logic does not employ a PR firm.

Stephen A. Stecyk  
Not Available

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**Chairman & CEO**  
\*Nandu J. Marketkar  
Custom Computer Systems, President

**President & COO**  
Jeff Schiebe  
Masscomp

\*Founder

### **FINANCING**

Not available

### **ALLIANCES**

Not available

### **MANUFACTURING**

#### **Technology**

Not Available

#### **Facilities**

Marlboro, MA  
R&D, marketing

# Oak Technology, Inc.

139 Kifer Court  
Sunnyvale, CA 94086  
408/737-0888  
Fax: 408/737-3838

ESTABLISHED: July 1987

NO. OF EMPLOYEES: 35

## BACKGROUND

Oak Technology, Inc., was founded in 1987 to provide system-level solutions in chip form to the personal computer market. The Company was founded by David Tsang, a founder and president of Data Technology Corporation from 1979 to 1987. Oak Technology provides total silicon solutions to specific application areas by designing, marketing, and supporting OEM customers in their efforts to design and manufacture high-performance systems. By focusing on key growth areas of the personal computer chip market, Oak seeks to become a dominant player in those market segments. In particular, the targeted segments are battery-powered laptops, high-performance 286/386SX desktops, and graphics controller chips.

By focusing exclusively on those areas that present potential for a high growth rate, Oak hopes to avoid direct head-to-head battles with the numerous other chip set companies. While it cannot compete with larger competitors in the breadth of its product offerings, the objective is to aim at one specific piece of the total market and achieve superiority by designing its products to fit that specific need. Oak believes that it can become a performance leader in the laptop market and the specialized desktop market.

Initially, Oak supplied a PS/2 Model 30-compatible chip set and a VGA/Super VGA graphics controller. In the fall of 1989, Oak began to focus on the introduction of a laptop PC chip set, the OakHorizon. A second area of concentration is the VGA graphics controller market. Future products will target high-performance PCs.

Oak's strongest area of expertise is in the design and marketing of its products. For this reason, it focuses its resources in these areas and uses external fabrication facilities both in the United States and in the Pacific Rim to provide high-

volume manufacturing. In this way, Oak is able to take advantage of state-of-the-art manufacturing facilities without massive investment in manpower and capital.

## BOARD

(Name and Affiliation)

\*David Tsang  
Oak Technology, Inc., President  
Richard King  
KBA Venture Partners, Partner  
Wen Ko  
Hewlett-Packard Taiwan, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
\*David Tsang  
Qume, Vice Chairman  
VP, Mktg  
Sukkin Fong  
Harmony Inc., President  
Dir VLSI Design  
Dr. Mou Yang  
VLSI Technology, not available  
Dir Sys Des  
Lloyd Ebusu  
Data Technology, Dir Eng  
Dir Oak-Taiwan  
Abel Lo  
Convergent Technologies, not available  
Dir Ops  
James Ou  
Data Tech Corp., Ops Res Mgr  
\*Founder

# Oak Technology, Inc.

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## FINANCING

July 1987

Round 1

\$1.5M

KBA Venture Partners, Eastpac, private

November 1988

Round 2

\$4.5M

KBA Venture Partners, private

## RECENT HIGHLIGHTS

September 1988

Oak announced a family of CMOS chips for the IBM PS-2 Model 30 that uses high-density VLSI devices for systems logic, data separation, and peripherals. The chip family includes the OTI-031 system controller, the OTI-032 I/O

controller, the OTI-033 floppy disk controller, and the OTI-036 and OTI-037 graphics controllers.

## ALLIANCES

Kanematsu Semiconductor—Oak's Japanese representative

## MANUFACTURING

### Technology

Proprietary Megacell Technology, CMOS

### Facilities

Sunnyvale, CA

Design, marketing, test

## PRODUCTS

OTI-030 Core Logic for 8088/8086

OTI-037 Super VGA Controller

OTI-050 OakHorizon for 286/386-SX

## OTHER INFORMATION

Bailey Associates is Oak Technology's PR firm.

**Opto Diode Corp.**  
750 Mitchell Road  
Newbury Park, CA 91320  
805/499-0335  
Fax: 805/499-8108

**ESTABLISHED: 1981**

**NO. OF EMPLOYEES: 13**

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## **BACKGROUND**

Opto Diode Corp. (ODC) was formed in 1981 by James Kim, formerly with Rockwell's Collins division in Dallas, Texas. ODC offers semicustom high-reliability devices made to customer specifications. The Company is occupying a 10,000-square-foot facility in Newbury Park, California.

ODC had \$1 million in sales in 1985 from GaAs infrared LEDs for solid-state relay and optoelectronics markets. Future plans are to penetrate the U.S. military market and European market.

## **BOARD**

Not available

## **PRODUCTS**

Gallium Aluminum Infrared LEDs

## **OTHER INFORMATION**

Opto Diode does not employ a PR firm.

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

\*James Kim  
Rockwell, Sr Research Engr

\*Founder

## **FINANCING**

Not available

## **ALLIANCES**

Not available



**Opto Tech Corp.**  
32 Industrial East 4th Road  
Science-Based Industrial Park  
Hsinchu, Taiwan  
ROC  
(035) 777-481/3  
Telex: 31592 OPTO TECH

**ESTABLISHED: December 1983**

**NO. OF EMPLOYEES: 100**

## **BACKGROUND**

Opto Tech is offering GaAs-based products, silicon wafers, and photoresistor and photodiode semiconductors. The Company plans to offer small-signal and transmitting transistors, junction FETs, microwave transistors, and fast-recovery and Schottky-barrier diodes. Production began in July 1984.

The Company spun off from Fine Microelectronics and is owned by local investors and the Bank of Communications.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

James Chiu

Petrochemical Industry, President

## **PRODUCTS**

LED

Transistors

Photodiodes

Phototransistors

Infrared Devices

## **OTHER INFORMATION**

Opto Tech does not employ a PR firm.

## **Business Liaison**

S. Shyu

Not available

## **FINANCING**

\$2.5M

Bank of Communications, Fortune Plastic Manufacturing Co., Opto Tech Corp.

## **ALLIANCES**

None

## **MANUFACTURING**

### **Technology**

GaAs

Silicon

### **Facilities**

Hsinchu, Taiwan

9,175 sq. ft.

# Orbit Semiconductor, Inc.

1230 Bordeaux Drive  
Sunnyvale, CA 94086  
408/744-1800  
Fax: 408/747-1263

ESTABLISHED: November 1985

NO. OF EMPLOYEES: 115

## BACKGROUND

Orbit Semiconductor, Inc., specializes in quick-turn, high-reliability foundry work with emphasis on 1.5-micron CMOS including either a double-poly or double-metal process. Other processes include 2.0- to 5.0-micron CMOS, HMOS, single- or double-poly, single- or double-metal, double-poly/double-metal, and multiple-layer poly.

Orbit guarantees single-poly and single-metal CMOS or HMOS in 10 working days or fewer and double-poly or double-metal CMOS in 15 working days or less.

The Company also offers computer-aided design services, which include layout from customer-provided logic drawings, design rule checking, data sizing, and conversion and Versatec plots. Orbit also acts as a prime contractor for providing photoplates.

In late 1979, Comdial Corporation, an Oregon firm that made subsystems for telephone dialing, started the firm as its engineering subsidiary. Comdial acquired an existing facility in 1979 and developed industry-compatible silicon-gate NMOS and CMOS processes. The Company, operating under the name Comdial Semiconductor, began offering foundry services in January 1980 and became the only guaranteed quick-turn fab in the business. One-half of the Company's resources were dedicated to quick-turn services and guaranteed parts within as few as 5 days for NMOS and 10 days for CMOS.

In November 1985, 80 percent of Comdial Semiconductor was acquired by Orbit Instruments, Inc., a supplier to Hughes and other military contractor companies. The management of Comdial Semiconductor retained 20 percent of the Company. In addition to continuing the previous services, Orbit is positioning itself to be

a stronger supplier to high-reliability commercial and military-oriented users. In 1987, Orbit added specialized processing such as p-well radiation-hardened CMOS and CCD manufacturing. The 2-micron radiation-hardened CMOS offers a total dose of radiation up to 1 megarad.

Orbit's North American customers include Amber Engineering, Cardiac Pacemakers, Crystal Semiconductor, Dallas Semiconductor, General Electric, General Motors, Honeywell, Hughes, Intermedics, ITT, Johns Hopkins University, Lotus Designs, Macronix, Martin Marietta, Motorola, RCA, Rockwell, Silicon General, and VLSI Design Associates. The Company's overseas customers include British Petroleum, Tadiran, and Thomson CSF.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Gary Kennedy  
Comdial Semiconductor, VP/GM

### VP Finance

Joseph Wai  
Comdial Semiconductor, Controller

### VP Technology

\*Steve Kam  
Comdial Semiconductor, Dir Technology

### VP Wafer Fab

Al Bettencourt  
Comdial Semiconductor, Process Mgr

\*Founder

# Orbit Semiconductor, Inc.

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## FINANCING

Not available

Prototype Manufacturing  
Volume Manufacturing  
Assembly  
Packaging  
Test

## RECENT HIGHLIGHTS

### March 1988

Orbit ordered \$1.4 million of 1:1 model 1100 lithography systems from General Signal's Ultratech Stepper unit. The order marks the first purchase of steppers by Orbit.

## ALLIANCES

Not available

## SERVICES

CAD  
Foundry: HMOS, CMOS, Charge-Coupled  
Device Processing

## MANUFACTURING

### Technology

1.5-micron silicon-gate, double-poly,  
double-metal CMOS and HMOS  
2.0- to 5.0-micron CMOS single- or  
double-poly, single- or double-metal  
2.0- to 5.0-micron HMOS single- or  
double-poly, single- or double-metal  
4-inch wafers

### Facilities

Sunnyvale, CA  
28,000 sq. ft.  
Manufacturing

## OTHER INFORMATION

Orbit does not employ a PR firm.

## Oxford Computer, Inc.

39 Old Good Hill Road

Oxford, CT 06483

203/881-0891

Fax: 203/888-1146

ESTABLISHED: March 1987

NO. OF EMPLOYEES: 3

### BACKGROUND

Oxford Computer was founded to solve extremely demanding problems in pattern recognition. The initial technical approach was to build massive parallel analog chips that were inspired by neural networks. This approach proved infeasible, but basic lessons about placing processors within specially configured memory chips were learned. Oxford Computer's goal is to reduce the cost dramatically and expand the use of image processing, pattern recognition, and 3-D graphics devices.

A marketing communications campaign was launched in April 1988 that resulted in more than 50 newspaper and magazine articles about Oxford Computer and its technology during the 18 months following its start. As a result of many customer contracts, a family of application-specific, memory-plus-processor chips was defined and shown to be desired. Basic functions include matrix multiplication, convolution, and interpolation. Oxford calls these novel chips Intelligent Memory Chips.

Unlike ordinary memory chips that are limited to information storage, Oxford Computer's Intelligent Memory Chips both store and process information. In addition to their primary function as memory, Intelligent Memory Chips have multiple simple partial processors embedded within. Furthermore, unlike ordinary memory chips that handle only one or a few bits of information at a time, each Intelligent Memory Chip handles strings of hundreds of bits at a time. Although the idea of placing processors within memory chips is an old one, Oxford has devined a family of Intelligent Memory Chips with specific applications in digital signal processing, pattern recognition, and 3-D graphics.

Currently, two products are in development at Oxford Computer. The first is the Intelligent Pattern Recognition Memory Chip. The second product is the Intelligent Convolution Memory Chip, with samples due in spring 1990. Oxford subcontracts all manufacturing and assembly operations and most of its testing.

### BOARD

(Name and Affiliation)

Michael Mulshine  
Osprey Partners

Steven G. Morton  
Oxford Computer

Jack Harding  
Zycad Corporation

Howard Morgan  
ARCA Group, Inc.

Earl Rogers  
Formerly CEO of Precision Monolithics

### COMPANY EXECUTIVES

(Position and Name)

President & Chief Technical Officer  
Steven G. Morton

Corporate Secretary & Treasurer  
Jack Harding

Assistant Secretary  
Frank Marco

### FINANCING

Seed stage from the founder and a private placement.

Start-up financing initiated in the fall of 1989.

## **Oxford Computer, Inc.**

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### **ALLIANCES**

Not available

### **OTHER INFORMATION**

Oxford Computer does not employ a PR firm.

## Pacific Monolithics, Inc.

245 Santa Ana Court  
Sunnyvale, CA 94086  
408/732-8000  
Fax: 408/732-3413

ESTABLISHED: March 1984

NO. OF EMPLOYEES: 120

### BACKGROUND

Pacific Monolithics, Inc., designs and manufactures monolithic ICs (MMICs) based on GaAs, as well as microwave subsystems based on its GaAs MMICs. The Company offers more than 200 microwave macrocells (PM Cells) for semi-custom IC design for consumer, communications, and defense applications. Company strengths include yield-tolerant design techniques, advanced packaging technology, a proprietary CAD/CAE system, and foundry services.

The Company participated as a team member on several contracts for the Department of Defense, including Phase 0 and Phase 1 of the Microwave/Millimeter-Wave IC (MIMIC) program. The contracts were in the areas of communication, radar, electronic warfare, and smart weapons for the army, navy, and air force.

Pacific Monolithics has developed a set of monolithic GaAs subsystem building blocks for microwave signal processing. The Company's ASIC cell library includes amplifiers, mixers, oscillators, couplers, combiners, switches, attenuators, phase shifters, modulators, and demodulators.

In April 1986, Pacific Monolithics introduced three MMIC devices that were offered in 5V, commercial grade, 8-lead, surface-mount packages. The devices were an 0.8- to 3.0-GHz converter, a 3.0- to 6.0-GHz converter, and a 5.0- to 6.0-GHz converter.

In March 1986, the Company relocated from a 10,000-square-foot facility to a 22,000-square-foot facility that can be expanded by an additional 13,000 square feet. Presently, Pacific Monolithics uses several foundry services, including TriQuint and COMSAT.

### BOARD

(Name and Affiliation)

\*Allen Podell, Chairman of the Board

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

Donald A. Bond  
Sanders, VP/GM Microwave

#### SR VP & Director

Allen Podell  
A.F. Podell Assoc., President of Technology

#### VP Bus Dev

Frank Russell  
Avantek, Sales Mgr

#### VP Engr

Pang Ho  
Geotech, President

#### Dir Sys & Plan

\*Doug Lockie  
Strategic Technology, Consultant

\*Founder

### FINANCING

#### August 1985

Round 1

\$5.0M

IAI Venture Partners, Sand Hill Financial Corp., Shaw Ventures, Vanguard Associates

#### September 1986

Round 2

\$3.5M

Institutional Investment Partners, Oak Investment Partners

# **Pacific Monolithics, Inc.**

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## **RECENT HIGHLIGHTS**

### **November 1987**

Pacific Monolithics and TriQuint became team members, with Ford as primary contractor, for contracts that cover smart weapons, radar, and electronic warfare.

### **November 1987**

Pacific Monolithics and TriQuint became team members, with Allied Bendix as prime contractor, for two contracts that cover communications and radar.

## **ALLIANCES**

Not available

## **PRODUCTS**

Channelized Up/Down Converters  
Converters  
Amplifiers  
Oscillators  
Attenuators  
Active Isolators  
Phase Shifters  
Switches  
Synthesizers  
TR Modules  
Single-Chip Radars  
Microwave Sensors  
Expendable Countermeasure Subassemblies

## **OTHER INFORMATION**

Pacific Monolithics does not employ a PR firm.

## **MANUFACTURING**

### **Technology**

GaAs

### **Facilities**

Sunnyvale, CA

35,000 sq. ft.

Lab, manufacturing, administration

6,000 sq. ft.

Class 100 clean room

# Paradigm Technology, Inc.

(Formerly GL Micro Devices)

71 Vista Montana

San Jose, CA 95134

408/954-0500

ESTABLISHED: February 1987

NO. OF EMPLOYEES: 35

## BACKGROUND

Paradigm Technology, Inc., was formed to develop high-performance advanced CMOS products and is in an R&D mode. Norman Godinho and Frank Lee, founders of Paradigm Technology, Inc., also are founders of Integrated Device Technology (IDT). Mr. Godinho served as vice president and general manager of IDT's digital signal processing (DSP) division, and Mr. Lee was codirector of IDT's corporate research and development group.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Terry Holdt  
Linear Corp., Pres.

### VP Technology

\*Norman Godinho  
IDT, VP/GM DSP Div

### VP Prod Dev

\*Frank Lee  
IDT, Codirector Corp R&D

### VP Mktg/Sales

Steve Taylor  
IDT, NE Regional Mgr

### VP Operations

James Doran  
Intel, Plant Manager

### VP Finance/CFO

Richard Henander  
Sigma Circuits, VP Finance

\*Founder

## FINANCING

### February 1987

Round 1

\$2.4M

El Dorado Ventures, Glenwood Management

### May 1989

Round 2

\$9.6M

First-round investors, TA Associates,  
Chesapeake Ventures, Gateway Partners,  
Centennial Funds

## RECENT HIGHLIGHTS

### May 1989

Paradigm relocated from temporary facilities in Santa Clara, California, to its new 62,000-square-foot facility in San Jose. The new facility includes a wafer-fabrication facility dedicated to implementing Paradigm's proprietary design and process technology.

## MANUFACTURING

### Technology

CMOS

### Facilities

San Jose, CA

62,000 sq. ft.

R&D, manufacturing, administration



## **Paradigm Technology, Inc.**

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### **PRODUCTS**

A complete family of high-speed 256Kb SRAM chips, with 1Mb SRAMs expected in early 1990

### **OTHER INFORMATION**

Paradigm's PR firm is Ulevich and Orrange, Inc.

# Performance Semiconductor Corporation

610 East Weddell Drive

Sunnyvale, CA 94089

408/734-8200

Fax: 408/724-0258

ESTABLISHED: 1984

NO. OF EMPLOYEES: 330

## BACKGROUND

Performance Semiconductor Corporation designs, develops, manufactures, and markets high-speed SRAMs, MPUs, and logic devices for military, industrial, and telecommunications applications. The Company was founded by Dr. Thomas A. Longo, David Maxwell, and Gerald Herzog.

Performance Semiconductor is using an advanced single-CMOS process known as performance advanced CMOS engineered (PACE) technology. PACE uses 0.8-micron and 0.7-micron effective channel lengths to give 500ps loaded internal gate delays. PACE also includes two-level metal and epitaxial substrates.

The Company's products include CMOS SRAMs at levels of complexity of 1K to 64K; a 40-MHz, 16-bit MPU that executes the 1750A instruction set; and two support functions, the processor interface circuit (PIC) and MMU combination. In 1987, Performance offered an 8ns 1K SRAM organized as 256x4 and a new series of TTL I/O 16K SRAMs featuring an address access time of between 12ns and 15ns. In 1987, the Company also signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals.

In March 1985, Performance leased a 26,000-square-foot facility where it conducts research and development and all manufacturing. The Company has developed it into a Class 1 facility that uses 6-inch wafers. In 1987, Performance achieved military 883C compliance and shipped both 64K SRAMs and the 1750A processor compliant with the 883C.

In January 1988, Performance announced that it had signed a nationwide franchising agreement with Schweber Electronics, putting in place its North American distributor network. A nation-

wide franchise was previously signed with Zeus Components in July 1987.

## BOARD

(Name and Affiliation)

\*Dr. Thomas A. Longo, Chairman  
Performance Semiconductor Corporation

Robert Zicarelli  
Northwest Venture Partners

B. Kipling Hagopian  
Brentwood Associates

William Bowes  
U.S. Venture Partners

Dr. James Meindl  
Rensselaer Polytechnic Institute

T.J. Connors  
T.J. Connors Company

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President  
\*Dr. Thomas A. Longo  
Schlumberger

VP Ops  
Gene Blanchette  
Raytheon

VP Sales/Mktg  
Les Welborne  
Fairchild

VP Finance  
George Wikle  
Memorex

VP Human Resources  
William Strickland  
Fairchild

VP Product Development  
Dr. Vir Dhaka  
Xerox

# Performance Semiconductor Corporation

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**VP Product Development**  
Dr. John E. Iwersen  
Bell Labs

**VP Reliability & QA**  
Rudy Konegan  
U.S. Air Force

\*Founder

## FINANCING

**October 1984**

Round 1

\$11.3M

Advanced Technology Ventures, Albion Ventures, Arbeit & Co., Asset Mgmt., Brentwood Assoc., DSV Partners, IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital Mgmt., Rotan MOSel Technology Partners, Taylor & Turner, U.S. Venture Partners, Venwest Partners (Westinghouse Electric Corp.), Seymour Cray, Thomas Longo

Lease

\$6.6M

Westinghouse Electric Corp.

**November 1986**

Round 2

\$10.0M

Advanced Technology Ventures, Albion Ventures, Asset Mgmt., Brentwood Assoc., DSV Partners, Harvard Mgmt., IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital, Reynolds Creek Ltd. Partnership, L.F. Rothschild, Taylor & Turner, Unterberg Towbin, U.S. Venture Partners, Venwest Partners, Thomas Longo

**August 1988**

Round 3

\$5.0M

Berkeley International, Brentwood Associates, Cowen and Co., and several officers of Performance Semiconductor Corporation

## RECENT HIGHLIGHTS

**September 1987**

Performance offered the VSI chip, which incorporates bus interface features for intelligent controller applications. The device provides

32-bit VMEbus address decoding as well as interrupt and mailbox facilities.

**November 1987**

Performance presented information on its 40-MHz VHSIC-level PACE 1750A system at the GOMAC conference. The system is a CMOS three-chip set consisting of a CPU, a processor interface chip, and an MMU/combinational support chip. The set is said to provide system performance greater than 2 mips.

**March 1989**

Performance introduced two static RAMs—the P3C3147 and the P3C3148—that use 3.3V rather than 5.0V.

## ALLIANCES

**Westinghouse**

August 1986

Performance fabricated a VHSIC Phase-I, 11,000-gate array designed by the Westinghouse Defense and Electronics Center for the U.S. Air Force Wright Aeronautical Laboratories.

**MIPS Computer Systems**

November 1987

Performance signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals. Performance will also sell the MIPS software environment with the chips.

## MANUFACTURING

**Technology**

1.25-micron CMOS PACE I (0.8-micron effective channel lengths)  
1.00-micron CMOS PACE II (0.7-micron effective channel lengths); all wafers produced have been 6-inch double-metal, epi substrates since 1985.

**Facilities**

Sunnyvale, CA

44,000 sq. ft.

Manufacturing

8,000 sq. ft.

Class 1 clean room

# Performance Semiconductor Corporation

## PRODUCTS

### CMOS SRAMs

Device	Density	Organization	Speed (ns)	Features
P4C422	1K	256x4	8	
P4C147	4K	4Kx1	10	
P4C148	4K	1Kx4	10	
P4C149	4K	1Kx4	10	Fast CS
P4C150	4K	1Kx4	10	Separate I/O, Reset
P4C151	4K	1Kx4	10	Comparator
P4C116	16K	2Kx8	15	300-Mil Package
P4C168	16K	4Kx4	12	
P4C169	16K	4Kx	12	Fast CS
P4C170	16K	4Kx4	12	Output Enable
P4C1682/1681	16K	4Kx4	15	Separate I/O
P4C164	64K	8Kx8	20	300-Mil Package
P4C187	64K	64Kx1	12	
P4C188	64K	16Kx4	20	
P4C198	64K	16Kx4	20	Output Enable
P4C1982/1981	64K	16Kx4	20	Separate I/O
P4C163	72K	8Kx9	20	300-Mil Package
P4C1257	256K	256Kx1	20	

### Pace Logic CMOS Family

- 74PCT273/374 250-MHz Toggle Rates
- 74PCT373/533 Gated Latches
- 74PCT241/244 Bus Drivers
- 74PCT245/545/640/643/645 Transceivers
- 74PCT29818/29521 plus "A" versions of all logic parts

### Microcomponents

PACE 1750A Family	16-Bit MPUs	20-, 30-, and 40-MHz; Includes 32-Bit and 48-Bit Floating-Point Arithmetic Processing
PACEMIPS	R2000A CPU (16-MHz) R2010 FPA (16-MHz) R3000 CPU (25-MHz) R3010 FPA (25-MHz)	

## OTHER INFORMATION

Performance Semiconductor does not employ a PR firm.

# Photonic Integration Research, Inc.

1357 Perry Street  
Columbus, OH 43201  
614/424-3313  
Fax: 614/424-3320

ESTABLISHED: July 1987

NO. OF EMPLOYEES: 6

## BACKGROUND

Photonic Integration Research, Inc., (PIRI) was formed to develop basic optical IC technology for commercial applications. The Company is the result of a joint venture between Nippon Telegraph and Telecommunications (NTT), Mitsubishi Electric Corporation of Japan, and the Batelle Memorial Institute. NTT owns 49 percent of the Company; Mitsubishi owns 41 percent; and Batelle owns 10 percent.

PIRI president, Dr. Tadashi Miyashita, was formerly head of the Optoelectronic Materials Section of the Electronics Materials Department at NTT's Ibaraki Electrical Communications Laboratories. Shigeki Sakaguchi and Shin Sumida also were previously at NTT's Ibaraki Telecommunications Laboratories, where the optical IC technology was invented.

In addition to developing commercial applications for optical waveguide technology, PIRI will also develop applied components that will be made available to equipment manufacturers for use in such end products as optical communications equipment, optical measuring equipment, automobiles, and airplanes. The Company expects advancement in the technology to lead to greater miniaturization and increased utilization of fiber optics.

## PRODUCTS

Optoelectronic Devices  
Custom-Design Optical Devices

## OTHER INFORMATION

PIRI does not employ a PR firm.

PIRI is located in the Batelle Memorial Institute's Columbus, Ohio, facilities.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President  
Dr. Tadashi Miyashita  
NTT

General Manager  
Shigeki Sakaguchi  
NTT

Chief Supervisor  
Shin Sumida  
NTT

## FINANCING

July 1987  
Round 1  
\$10.0M  
Batelle Research Institute, Mitsubishi Electric Corporation, Nippon Telephone & Telegraph

## Plus Logic

1255 Parkmoor Avenue

San Jose, CA 95126

408/293-7587

Fax: 408/298-7587

ESTABLISHED: 1988

NO. OF EMPLOYEES: 27

### BACKGROUND

Plus Logic was incorporated in October 1987. The founding team, which consists of former National Semiconductor founder Roger Smullen and semiconductor industry executives Clayton Marr and Cecil Kaplinsky, was established in January 1988. Plus Logic was formed to solve the system performance, cost, and time-to-market limitations of existing "glue logic" devices. The Company's goal is to become a major player in the ASIC market, targeting the multibillion-dollar field-programmable gate array (FPGA) market with a range of innovative and easy-to-use products and software design tools.

Plus Logic's answer to the problems associated with conventional glue logic lies within its family of FPGAs based on Plus Logic's proprietary PLUS ARRAY architecture. The PLUS ARRAY family of FPGAs combines the flexibility and faster time to market of user configurability, along with the cost and performance required to implement high-speed glue logic.

The PLUS ARRAY architecture provides the high-performance system designer with a way of implementing glue logic that is high in performance (40-MHz system clock rate), integrated (1,000 to 6,000 gates per chip), fast and easy to design (uses standard design tools), predictable in timing (does not require multiple design iterations), and low in cost.

Plus Logic's first family of products is the FPGA2000 family. Three family member parts will be introduced by the end of 1990. Based on a CMOS EPROM technology, the devices are capable of implementing functions of up to 2,000 gates and will support a system clock rate of up to 40 MHz. Plus Logic subcontracts

foundry and assembly services. In addition, the Company conducts in-house testing but also subcontracts a portion of this work.

### BOARD

(Name and Affiliation)

Roger Smullen, Chairman  
Plus Logic, President/CEO

Gordon Russel  
Sequoia Capital, Partner

Jeff Pickard  
Merrill, Pickard, Anderson & Eyre, Partner

Bernard J. Lacroute  
Formerly with Sun Microsystems

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Roger Smullen  
AMCC, CEO/Chairman

#### VP R&D

\*Cecil Kaplinsky  
Katus Technologies, Partner

#### VP Mktg

\*Clayton Marr  
Katus Technologies, Partner

#### VP Finance

Howard Bailey  
MVI, Inc., Founder

#### VP Technology

George Simmons  
Phillips/Signetics, CMOS Tec Dev Mgr

\*Founder

# Plus Logic

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## FINANCING

October 1988

Seed

Not available

Chips & Technologies, Inc.; private investors

January 1989

Round 1

\$5.0M

Sequoia Capital; Merrill, Pickard, Anderson & Eyre; Asset Mgmt Co.; Brentwood Associates; Hook Partners

## MANUFACTURING

### Technology

1.2-micron CMOS

### Facilities:

San Jose, CA

28,000 sq. ft.

Engineering, development, test, marketing, administration

## ALLIANCES

Foundry agreements are in place and will be announced at a later date.

## PRODUCTS

### Silicon Device

#### FPGA 200 Family

2010	4 FBs
2020	8 FBs
2040	16 FBs

### Field-Programmable Subsystem Logic Family

5110	4 FBs and dual-port memory
5210	4 FBs and finite state machine

## OTHER INFORMATION

Plus Logic's PR firm is Maxtec.

# PLX Technology Corporation

625 Clyde Avenue  
Mountain View, CA 94043  
415/960-0448  
Fax: 415/960-0479

ESTABLISHED: May 1986

NO. OF EMPLOYEES: N/A

## BACKGROUND

PLX Technology Corporation was formed to offer CMOS programmable interface devices for MPU-based systems. The Company's first product, introduced in May 1987, was the PLX 448—an erasable programmable logic device (EPLD). The device has electrical and architectural features that are geared specifically for bus interface applications. The PLX 448 includes four 48mA drivers and four 24mA drivers that can drive VMEbus, Nubus, Micro Channel bus, proprietary buses, and memory buses directly. PLX is the only supplier that offers the high-drive capability. The device is fabricated using a 1.5-micron CMOS EPROM process and offers a propagation delay from input to high-drive-current output as low as 25ns.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Michael Salameh  
Hewlett-Packard, Mktg Manager

### VP R&D

Wei-Ti Liu  
AMD, R&D

### VP Prod Plan

D. James Guzy, Jr.  
AMD, R&D

### VP Sales

Don Eitzbach  
Virtual Micro-System, Mktg/Sales

### Mgr Systems Eng

Arthur Chang  
Wyse Technology, Hardware Eng Mgr

### VP Marketing

Gaylord Galiher  
Hewlett-Packard, Marketing Mgr

## FINANCING

### May 1986

Round 1

N/A

Arbor Financial Group; Draper Associates; and others

### March 1988

Round 2

N/A

Initial investors; and others

### August 1989

Round 3

\$1.9M

Arbor Financial Group; Associated Venture Investors; Draper Associates

## ALLIANCES

None

## MANUFACTURING

### Technology

1.5-micron CMOS

1.2-micron CMOS



# PLX Technology Corporation

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## PRODUCTS

Device	Description
PLX 464	PLD with 64mA High-Drive Current
PLX 448	PLD with 24mA and 48mA High-Drive Current
VSB 1200	Master Module Interface Device with Single-Level Arbiter, Bus Requester, Bus Controller
VME 1200/1210/1220	VMEbus Master Controllers with Single-Level System Arbiter, Bus Requester, Driver
VME 2000	VMEbus Slave Module Interface Device
MCA 1200	Micro Channel Bus Controller and Local Arbiter
VSB 2000	VSB Slave Module Interface Device
VME 3000/3010	Interrupt Generators
VME 4000	Interrupt Handler
USB 1400	Multi-Master Bus Controller

### Multibus I

MBI 8289A/8289B      MBI APX 86/88/186 Bus Arbitor IAPX

### Multibus II

PSB 2000/2100      Reply agent controller and reply agent error generator  
LBX 2000/2100      Reply agent controller/reply agent

## OTHER INFORMATION

PLX's PR firm is Robin Eschler Associates.

# Power Integrations Incorporated

411 Clyde Avenue  
Mountain View, CA 94043  
415/960-3572  
Fax: 415/940-1226

ESTABLISHED: May 1988

NO. OF EMPLOYEES: N/A

## BACKGROUND

Power Integrations Incorporated was founded in May 1988 by Dr. Klas Eklund, Arthur Fury, and Steve Sharp to develop, manufacture, and market high-voltage power semiconductors. Using proprietary technology, Power Integrations developed a line of power ICs that integrate low 5-volt circuits with circuits that handle 200 to 400 volts. The Company's products bridge the gap between low-voltage control circuitry and high-voltage peripheral devices.

Power Integrations introduced its first products in June 1989. One is a universal power driver used to control high-voltage peripherals such as relays, solenoids, lamps, and motors from low-voltage control circuitry including CMOS and TTL digital logic and analog signals. The Company also introduced a high-voltage interface and a high-voltage n-channel array. Each of these devices is available with voltage rating of 200 or 300 volts. The n-channel array and the universal power driver are also available with a 400-volt handling capacity. Future products will have high voltage and current ratings.

All of Power Integrations' products are based on CMOS technology. Power Integrations conducts all testing in-house, but wafer fab and assembly operations are conducted by external sources.

## BOARD

(Name and Affiliation)

Dr. William Davidow  
Mohr, Davidow Ventures

Irwin Federman  
Concord Partners

Floyd Kvamme  
Kleiner, Perkins, Caufield & Byers

\*Stephen Sharp  
Not available

Dr. Ed Ross  
Power Integrations

\*Dr. Klas Eklund  
Power Integrations

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Dr. Ed Ross  
Signetics, Sr VP Prod Div Grp

VP R&D  
\*Dr. Klas Eklund  
Data General, Product Manager

VP Mktg  
\*Art Fury  
Micro Linear, VP Mktg & Sales

VP Mfg  
Russ Anderson  
Signetics, VP/Gen Cus Spec Prod Div

\*Founder

## FINANCING

May 1988  
Round 1  
\$3.1M  
Concord Partners; Data General Corporation;  
Kleiner, Perkins, Caufield & Byers; Mohr,  
Davidow Ventures

August 1989  
Round 2  
\$7.5M  
Original investors; Hillman Ventures; Merrill,  
Pickard, Anderson & Eyre

# Power Integrations Incorporated

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## RECENT HIGHLIGHTS

June 1989

Power Integrations, Inc., introduced its first family of products for the high-voltage power IC market. The products include the PWR-DRV1 universal power driver, the PWR-DRV451 through 4 high-voltage interface series, and the PWR-NCH801 high-voltage n-channel array.

## ALLIANCES

None

## PRODUCTS

Universal Power Driver  
High-Voltage Interface  
High-Voltage N-Channel Array

## OTHER INFORMATION

Power Integration's PR firm is Rigoli, Pamphilon, Demeter.

## MANUFACTURING

### Technology

CMOS

### Facilities

Mountain View, CA  
10,400 sq. ft.  
Design, test, marketing

**Powerex, Inc.**  
Hillis Street  
Youngwood, PA 15697  
412/925-7272  
Fax: 412/925-4393

**ESTABLISHED: January 1986**

**NO. OF EMPLOYEES: 500**

## **BACKGROUND**

Powerex, Inc., manufactures and markets thyristors and rectifiers rated greater than 50 amperes. The Company also offers power transistors, Darlington, FETMOD, and MOSBIP modules. Powerex is a service-oriented company, providing just-in-time delivery, and has developed business partnership arrangements with many key customers. The Company has more than 100 accounts, including electric companies, railroads, and government agencies.

Powerex is the result of a joint venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corporation. The purpose of the joint venture was to form a company that would be a leading supplier of power semiconductors in the United States. To create the new entity, Westinghouse combined its semiconductor division with General Electric's high-power rectifier and thyristor business. Mitsubishi contributed working capital and technology for a 10 percent ownership.

The Company is developing high-power semiconductor devices and plans to supply intelligent-power hybrid circuits that combine a power element (e.g., power transistor) with a logic/control element.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

Position, Name, and Prior Company)

**President/CEO**  
Ronald Whigham  
Westinghouse Electric Corporation

## **VP Commercial Op**

Stanley R. Hunt  
Westinghouse Electric Corporation

## **CFO**

J.A. Sibenac  
Westinghouse Electric Corporation

## **VP Operations**

Dave Gillott  
Westinghouse Electric Corporation

## **FINANCING**

Powerex received initial funding from Westinghouse Electric Corporation (45 percent), General Electric Company (45 percent), and Mitsubishi Electric America (10 percent) for an undisclosed amount.

## **1988**

Financing changed to one-third ownership by previously mentioned companies

## **RECENT HIGHLIGHTS**

### **January 1986**

Powerex received licenses and technological know-how for Darlington transistor modules and GTOs from Mitsubishi; it received all thyristor and rectifier technology from Westinghouse, General Electric, and Mitsubishi.

### **August 1986**

Powerex assumed exclusive sales responsibilities for Mitsubishi Darlington transistor modules in North America.

### **August 1986**

Powerex reached an agreement with Mitsubishi to build a world-class automated assembly facility in France for isolated modules.

# Powerex, Inc.

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## September 1987

Powerex purchased GE/RCA's low-power thyristor product line. The Company also signed a technology-licensing agreement with GE/RCA for MOSFET, IGBT, and MCT products and received exclusive sales rights for all MCTs rated greater than 100 amperes.

## December 1987

Powerex started up a new wafer fab in Youngwood. The new fab is capable of producing complex geometry devices. Powerex also produced its first isolated modules for quality conformance testing in France.

## MANUFACTURING

### Technology

R&D  
Design

Assembly  
Test  
Manufacturing

### Facilities

Youngwood, PA  
225,000 sq. ft.  
Wafer fab

Auburn, NY  
Wafer fab

Massey, France  
Wafer fab, assembly

Puerto Rico  
Assembly

Singapore  
Assembly

## PRODUCTS

Standard Rectifiers—High Power  
Fast Recovery Rectifiers  
Phase-Control Thyristors  
Thyristors for Pulse Applications  
Inverter-Grade SCRs  
Reverse Conducting Thyristors  
Gate Turn-Off (GTO) Thyristors  
Triacs  
Thyristor and Diode Modules  
Power Transistor Modules  
Darlington Modules  
FETMOD Isolated MOSFET Modules  
MOSBIP Hybrid Isolated Modules  
IGBT Modules  
Low-Power Product Line

## OTHER INFORMATION

Powerex does not employ a PR firm.

## PromTech

1885 Lundy Avenue, Suite 202  
San Jose, CA 95131  
408/434-9550  
Fax: 408/434-7045

ESTABLISHED: 1984

NO. OF EMPLOYEES: 7

### BACKGROUND

PromTech was formed to combine the high-speed EPROM expertise of the founding members with custom and semicustom design. The Company has been working on contracts to design custom memory devices. PromTech also has developed a 1Mb and 4Mb EPROM in the 70ns access range.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Dr. Paul Ouyang  
Universal Semi, Exec VP

\*Founder

### FINANCING

1984  
Seed  
\$0.2M  
Private

### PRODUCTS

To be announced

### OTHER INFORMATION

PromTech does not employ a PR firm.

### ALLIANCES

1984

PromTech licensed technology to an unnamed Japanese company.

1987

PromTech licensed its EPROM technology to Yamaha Corp. Yamaha will develop a new ASIC standard chip that combines the EPROM technology with its own voice- and image-processing capabilities.

### MANUFACTURING

#### Technology

1.2-, 1.5-, and 2.0-micron single-metal,  
double-poly CMOS

#### Facilities

San Jose, CA  
2,000 sq. ft.  
Administration, design, R&D

## **RAMAX Limited**

**Monash Business Park**

**Level 1, Building 11**

**Business Park Drive**

**Notting Hill VIC 3168**

**Australia**

**(03) 558 9900**

**Fax: (03) 558 9123**

**ESTABLISHED: 1987**

**NO. OF EMPLOYEES: N/A**

### **BACKGROUND**

RAMAX Limited was formed in 1987 to commercialize and produce integrated circuits for global markets based on new nonvolatile memory (NVM) technology. Funding for the Company was provided solely by the Victoria State Government in the form of equity subscription. This funding has allowed RAMAX to acquire rights to this new technology and commence the pursuit of the business opportunities it has identified.

The Company recognizes that the demand for integrated circuits with higher density and higher speed is driving the semiconductor industry toward the use of optical techniques. These techniques are based primarily on active thin-film technologies, and RAMAX has chosen to specialize in this rapidly growing market area.

To realize its market opportunity, RAMAX will develop and commercialize a range of differentiated products based on active thin-film technologies; these products are thin-film ferroelectrics and compound semiconductor epi layers. RAMAX's long-term emphasis will be on compound semiconductor-based (specifically GaAs) integrated circuits—electronic and optoelectronic—that combine the advantages of both the GaAs and thin-film ferroelectric materials. However, market opportunities in silicon NVMs also will be pursued, particularly the replacement of current EEPROMs with ferroelectric versions that offer superior performance characteristics.

The Company formed a joint venture with Epi Materials Ltd. (EML) of the United Kingdom to

enter the epi-treated wafer market in Asia. The product initially will be sourced from EML and primarily will be GaAs-based epi layers that use an enhanced, high-quality, high-yield metalorganic chemical vapor deposition (MOCVD) process developed by EML. Once sufficient sales volume has been generated, the product will be manufactured in Australia.

The silicon NVM market will be approached in two phases. In the first, RAMAX proposes to market the product from an existing European or North American manufacturer into Asia to build marketing capability and understand customer needs before entering the market with its own products. The second phase will be the launch of a new NVM product that offers significantly improved user benefits utilizing thin-film ferroelectrics. A foundry manufacturing strategy will be employed for production.

Initial entry to the GaAs market will be via an agency for products from an existing manufacturer. As with silicon NVMs, this method of entry will allow a marketing capability to be established and the building of customer relationships. The Company then proposes to establish a design facility for standard GaAs products and ultimately design GaAs NVM products utilizing the thin-film ferroelectric technology.

The Company's long-term entry to the optoelectronic IC market will result from the integration of the active thin-film technologies that will allow a new generation of OEICs to be developed.

# RAMAX Limited

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## BOARD

(Name and Affiliation)

Vincent N. Schutze, Chairman  
Dr. David G. Beanland, Director  
Allan G. Tapley, Managing Director

## COMPANY EXECUTIVES

(Position and Name)

Chief Executive Officer  
Allan G. Tapley

Admin. Manager & Company Secretary  
William D. Gleeson

Technology Manager  
R. Bruce Godfrey

## FINANCING

June 1987  
Round 1  
\$8.0M  
State Government of Victoria

## PRODUCTS

MOCVD epi-treated wafers  
Silicon- and GaAs-based NVM and standard products to be announced.

## OTHER INFORMATION

RAMAX does not employ a PR firm.

## ALLIANCES

Ramtron Corp.  
June 1987

RAMAX licensed Ramtron's thin-film ferroelectric NVM technology. RAMAX has worldwide nonexclusive rights with sublicensing on silicon and worldwide exclusive rights with sublicensing on GaAs.

Epi Materials Ltd.  
October 1989

An Australian joint venture was formed to market EML's epi-treated wafers into Asia and ultimately to manufacture epi-treated wafers in Australia.

## SERVICES

Marketing  
Manufacturing



**Ramtron Corporation**  
1873 Austin Bluffs Parkway  
Colorado Springs, CO 80918  
719/594-4455  
Fax: 719/594-4939

**ESTABLISHED: May 1984**

**NO. OF EMPLOYEES: 53**

## **BACKGROUND**

Ramtron Corporation is a technology research, development, and marketing organization founded in 1984 to develop a solution to the inherent problem of volatility in microelectronic circuits.

Ramtron's solution is ferroelectronics. Ferroelectronics merge the ferroelectric effect, known for its nonvolatile storage characteristics, with conventional integrated circuitry. Ferroelectronics produces the world's first true nonvolatile microelectronic memory. In 1987, Ramtron successfully integrated its proprietary lead zirconate titanate (PZT) with a conventional CMOS fabrication process and introduced the world's first ferroelectric random access memory (FRAM). The FRAM combines the benefits of existing memories in a single device: the speed and ease of use of SRAM, the high density and potential low cost of DRAM, and a nonvolatility that equals or exceeds that of EEPROM. FRAMs provide a common memory element that can be used throughout a system, replacing the diverse memory types currently required.

The Company licensed potassium nitrate technology from George Rohrer whose company, Technovation Corporation, owns a minority interest in Ramtron. Newtech Development Corporation of Australia negotiated an agreement with Mr. Rohrer for the patent and formed Ramtron to conduct R&D programs at the University of Colorado in a \$5 million research lab.

Ramtron is actively pursuing strategic partnerships and agreements to accelerate ferroelectric technology insertion in a broad range of applications. Initial markets for the FRAMs include industrial, military, and aerospace applications where nonvolatility is essential. These markets traditionally have used EEPROMs, ROMs, and memories with battery backup. The Company is developing

several applications for its FRAMs, including smart sensors, smartcards, smart tags, smart watches, and smart toys.

## **BOARD**

(Name and Affiliation)

Ross M. Lyndon-James, Chairman  
Ramtron Australia Ltd., Deputy Chairman  
Brian L. Harcourt, Exec Director  
Ramtron Australia Ltd., Managing Director  
Richard L. Horton, Exec Director  
Ramtron Corp., President  
Hilton J. Nicholas, Director  
Ramtron Australia Ltd., Chairman  
A. Geoffrey Lee, Director  
Ramtron Australia Ltd., Director  
Glen R. Madland  
Integrated Circuit Engineering, Chairman  
Dr. Steward S. Flaschen, Director  
Flaschen & Davies, Consultant  
Charles W. Missler, Director  
Resdel Industries, Inc., Chairman & CEO  
Sam Freeman, Director  
Rio Grand Industries, Consultant  
Jack F. Moore, Director  
International Brotherhood of Electrical  
Workers, International Secretary

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

Richard L. Horton  
Honeywell, Dir of Bus Dev

### **Exec VP/COO**

\*Dr. Fred Gnadinger  
INMOS, VP of R&D & Founder

### **VP Finance/Admin**

Jerald Bollinger  
Elcsi, CFO

# Ramtron Corporation

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## VP of Research & Development

S. Sheffield Eaton

INMOS, Project Leader & Founder

\*Founder

## FINANCING

May 1984

Round 1

\$5M

Ramtron Australia Limited

May 1986

Round 2

\$10M

Ramtron Australia Limited

March 1989

Round 3

\$19.5M

National Electrical Contractors Association

## ALLIANCES

### RAMAX Limited

June 1987

RAMAX Limited, an Australian technology company, licensed Ramtron's FRAM technology.

### ITT Semiconductor

June 1988

ITT and Ramtron have a codevelopment and licensing program to develop an advanced submicron ferroelectric manufacturing process.

### NMB Semiconductor

October 1988

NMB and Ramtron have a codevelopment and licensing program to develop a 4Mb DRAM

process technology and products utilizing high dielectric materials.

### TRW

November 1988

TRW and Ramtron have a codevelopment program to develop radiation-hardened nonvolatile memory for aerospace and defense applications.

### Seiko-Epson Corp.

April 1989

Ramtron entered a strategic technology codevelopment alliance with Seiko-Epson. Seiko-Epson will provide Ramtron with manufacturing capacity for FRAM products and will receive sales and distribution rights for FRAM products in Japan and Southeast Asia.

### Alcan Aluminum

June 1989

Ramtron and Alcan signed joint development and stock purchase agreements. The agreements include a 6.5 percent equity investment in Ramtron by Alcan and initiate a joint program focused on the development of advanced ferroelectric materials.

## MANUFACTURING

### Technology

3.0-micron CMOS

1.5-micron CMOS

1.2-micron CMOS (in development)

0.8-micron CMOS (in development)

### Facilities

A 69,000-square-foot facility currently under construction in Colorado Springs, Colorado, will house the headquarters and R&D facility, including wafer fab. It is scheduled for completion in June 1990.

**PRODUCTS**

FM1008	128x8	Available
FM1108	256x8	Available
FM1208	512x8	Available
FM1408	2Kx8 FRAM	Q4 1989
FM1608	8Kx8 FRAM	Future Product
FM1808	32Kx8	Future Product
FM2008	128Kx8	Future Product

**OTHER INFORMATION**

Ramtron does not employ a PR firm.

**S3, Incorporated**  
2933 Bunker Hill Lane, Suite 100  
Santa Clara, CA 95054  
408/986-8144  
Fax: 408/986-1457

ESTABLISHED: January 1989

NO. OF EMPLOYEES: 33

## BACKGROUND

S3, Incorporated, was founded in January 1989 by Diosdado Banatao and Ron Yara, two Chips & Technologies veterans. The Company plans to bring a workstation level of performance to PC compatibles by developing advanced silicon subsystems. S3 is currently in its design phase and is expected to introduce its first products in 1990.

In recent years, Dataquest has identified an industry-wide trend toward the "system on a chip." Of course, the ultimate expression of this trend would be a monolithic system chip that integrates logic and memory into the microprocessor. Although the industry has yet to reach this level of integration, the ASIC revolution allowed for the consolidation of logic through gate arrays and similar devices. More recently, many companies have chosen to optimize system performance by developing specialized logic chip sets. Companies that pursue this approach to increasing system performance have found value in design engineers who possess both IC logic and systems expertise.

S3's design methodology is an example of the application of systems expertise to silicon-based subsystem design. In developing its subsystems, S3 simulates system level operation and then partitions its design into chip-level subsystems. This approach to subsystem design allows high-performance integration while maintaining degrees of flexibility at multiple levels for the end-system designer.

The Company has adopted a strategy of using outside companies for its wafer fabrication needs. This strategy allows S3 the flexibility to choose the most economical process for each chip

design. Without owning its own fab, S3 is not bound to one process technology and therefore can shop around for the best foundry to fit its needs.

## BOARD

(Name and Affiliation)

\*Diosdado P. Banatao  
President & CEO, S3, Incorporated  
Andrew S. Rachleff  
Merrill, Pickard, Anderson & Eyre  
L. John Doerr  
Kleiner, Perkins, Caufield & Byers  
Andrew R. Heller  
Kleiner, Perkins, Caufield & Byers  
William H. Davidow  
Mohr, Davidow Ventures

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Diosdado P. Banatao  
Chips & Technologies, VP/GM

### VP, Mktg

\*Ronald T. Yara  
Chips & Technologies, VP

### Dir, Finance

David K. Hanabusa  
Ashtech, CFO

### Dir, Eng

Robert C. Schopmeyer  
Not available

\*Founder

## **S3, Incorporated**

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### **FINANCING**

April 1989

Round 1

\$6.0M

Merrill, Pickard, Anderson & Eyre; Kleiner,  
Perkins, Caufield & Byers; Mohr, Davidow;  
Sequoia Capital; Mayfield Fund; AVI  
Management Partners

### **MANUFACTURING**

#### **Technology**

1.5-micron CMOS

1.0-micron CMOS

S3 will use foundries for manufacturing.

### **ALLIANCES**

The Company has strategic alliances, but it is not yet in a position to identify them.

### **PRODUCTS**

Silicon Subsystems

### **OTHER INFORMATION**

S3 does not employ a PR firm.

# Samsung Semiconductor, Inc.

3725 North First Street

San Jose, CA 95134

408/980-1630

ESTABLISHED: 1983

NO. OF EMPLOYEES: 250

## BACKGROUND

Samsung Semiconductor, Inc., (formerly Tristar Semiconductor) designs, manufactures, and markets a broad range of products including NMOS and CMOS memories, logic devices, microprocessors and peripherals, and power MOSFETs. The Company began its operations as a DRAM supplier and, through strategic alliances, has licensed designs to expand its product portfolio quickly.

Building on its base of CMOS DRAM technology with the addition of a new 80,000-square-foot R&D facility in San Jose, California, Samsung is amassing a portfolio of proprietary products. In 1988, the Company introduced a 1Mb DRAM; 64K and 256K SRAMs with 70ns, 80ns, and 100ns access times; fast CMOS logic; and PLDs with speeds of 25ns and 35ns, followed later by a 15ns model. Later that year, Samsung introduced 64K EEPROMs and fast SRAMs with access times down to 20ns and densities of up to 256K, microperipherals running at 10 MHz, a DRAM controller, and AC/ACT CMOS standard logic. These products were developed at two Korean R&D facilities, as well as in Samsung's new San Jose R&D center. In addition, the Company will be producing PLD and DRAM controllers in the San Jose facility.

Samsung Semiconductor is a wholly owned subsidiary of Samsung Electronics Co. (SEC), of the Samsung Group, a Korean conglomerate. SST's investment in Samsung totals \$550 million.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

S. Joon Lee

Honeywell, Manager

### VP R&D

Ilbok Lee

NSC, Div Mgr

### VP Mktg/Sales

C.H. Oh

SST, Sr VP

### VP Finance

Won Yang

SST, GM

### Dir Mktg

Orlando Gallegos

Zytex, VP Mktg/Sales

### Dir Sales

Mike Barthmen

Hitachi, Natl Sales Mgr

## FINANCING

1983

Start-up

\$6.0M

Samsung Semiconductor and Telecommunications Ltd. (SST)

1983

Lease

\$7.0M

SST

## RECENT HIGHLIGHTS

### February 1987

Samsung formally opened its \$36 million national headquarters in San Jose, California. The facility, which Samsung purchased for \$5 million, houses administration, R&D operations, and a research fab. Included in the 80,000-square-foot facility is a 12,000-square-foot Class 1 fab with 6-inch wafer processing equipment. Currently, 50 percent of the Company's capacity of 10,000 wafer starts per month is devoted to R&D.

## Samsung Semiconductor, Inc.

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### June 1987

Samsung Semiconductor, GoldStar Semiconductor Inc., and Hyundai Electrical Engineering Co. announced that they are preparing to launch full-scale production of a 1Mb DRAM chip jointly developed by the three South Korean firms in 1986.

### June 1987

Samsung Semiconductor agreed to supply Intel with 64K, 256K, and 1Mb DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea will begin in July.

## ALLIANCES

### SST

1983

Samsung Semiconductor was set up as a U.S. subsidiary of Samsung Co. Ltd., of Korea.

### Exel

1983

Exel granted Samsung a license to second-source its 16K EEPROMs.

May 1985

The agreement was extended to include 64K EEPROMs.

### Micron Technology

June 1983

Samsung obtained a license to manufacture and market Micron's 64K DRAM design in exchange for cash. The agreement was later extended to include Micron's 256K DRAM.

### Micron Technology

July 1986

Samsung acquired a 2.7 percent interest in Micron for \$5 million as part of an out-of-court settlement of a suit brought against Samsung. Micron claimed that Samsung failed to pay for materials and provide certain technology according to a 64K DRAM exchange pact. Micron obtained rights to the Samsung SRAM and EEPROM technologies for a 1 percent royalty, if sales exceeded 1 million units. The prior agreement was terminated.

### Intel

January 1985

Intel granted Samsung a license to second-source certain microcomponents.

June 1987

Samsung agreed to supply Intel with 64K and 256K DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea began in July.

### Zytrex

June 1985

Zytrex and Samsung signed a three-year technology/fab agreement. Samsung second-sourced Zytrex's LSI logic devices; Zytrex provided its proprietary ICE-MOS process. Zytrex is no longer in business.

### Mostek

1986

Mostek and Samsung signed an agreement covering Mostek's 256K DRAM technology.

### IXYS

January 1986

IXYS and Samsung signed an agreement allowing Samsung to receive IXYS' power MOS technology in exchange for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas.

### GoldStar/Hyundai

1986

GoldStar, Samsung, and Hyundai agreed to cooperate on a 1Mb DRAM.

### NCR

January 1989

Samsung and NCR's Microelectronics Division signed a broad technology exchange and license agreement that gives Samsung ASIC capability and gives NCR SRAM capability.

### Quadtree Software Corp.

February 1989

Samsung and Quadtree announced a contract and licensing agreement under which Quadtree is developing full-function software models of Samsung's high-performance DRAM controllers.

**Zilog**

June 1989

Samsung and Zilog signed two licensing agreements that permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 microcontrollers and the Z85C30 Serial Communications Controller.

**MANUFACTURING**

**Technology**

1.0- and 1.5-micron CMOS, NMOS, bipolar  
4-, 5-, and 6-inch wafers

**Facilities**

San Jose, CA  
80,000 sq. ft.  
Administration, R&D, manufacturing

12,000 sq. ft.  
Class 1 clean room

The facility has a capacity of 10,000 wafer starts per month.

**PRODUCTS**

Linear	Device	Description
Op Amps	LM324	Quad Op Amp
	LM358/1458/4558	Dual Op Amp
	LM741	Single Op Amp
	LM386	Low-Voltage Power Amp
Timers	NE555	Single Timer
	NE556	Dual Timer
	KS555	Single Timer
	KS555H	High-Speed Timer
	KS556	Dual Timer
Voltage Regulators	KA33	Precision Voltage Regulator
	LM72	Adjustable Precision
	MC78	Positive Voltage Regulator
	MC79	Negative Voltage Regulator
	KA78S40	Switching Regulator
	KA431	Programmable Precision
Reference		
Comparators	LM311	Single Comparator
	LM339	Quad Comparator
	LM393	Dual Comparator
Data Converters	KS5C02/25C03	8-Bit Successive Aprox Register
	KS25C04	12-Bit Successive Aprox Register
	KSV3100	8-Bit and 10-Bit Flash Converter
	KSV3310	8-, 9-, and 10-Bit DACs
Interface	MC1488/1489	Quad Line RS-232 Receiver
Other	KA2181/2182/2183	Remote Control Preamp
	KA2580/2588	8CH Source Driver
	KA2803	Ground Default Detector
	KA2804	Zero-Voltage Switch



## Samsung Semiconductor, Inc.

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Linear	Device	Description
Telecommunications	LM567	Tone Decoder
	KA2410/2411	Tone Ringer
	KA2412	Subset Amplifier
	KA2413/5805	DTMF
	MC3361	FM IF Amplifier
	KS5804/5805	Pulse Dialer
	KT3170	DTMF Receiver
	KS5820	Tone/Pulse Dialer w/Redial
	KS5822/5823	Repertory Dialers
Transistors	Power MOSFET	
	General-Purpose Transistors	
	Low-Noise Amplifier Transistors	
	High-Voltage Transistors	
	Darlington Transistors	
Logic	KS54/74AHCT Family of Advanced High-Speed CMOS	
	KS54/74HCTLS Family of High-Speed CMOS	
Memory	64K, 128K, 256K, and 1Mb DRAMs	
	16K, 64K, and 256K SRAMs	
	16K and 64K EEPROMs	
	4K and 8K FIFO dual-port buffer memories	

### OTHER INFORMATION

Samsung's PR firm is Roy Twitty & Co.

# Seattle Silicon Corporation

3075 112th Avenue NE

Bellevue, WA 98004

206/828-4422

Fax: 206/827-4224

ESTABLISHED: 1983

NO. OF EMPLOYEES: 90

## BACKGROUND

Seattle Silicon Technology, Inc., was founded during the heyday of ASIC start-ups in 1983. Its initial business strategy has three important points aimed at establishing a unique position in the market. One is to supply silicon compiler software to systems designers with little or no actual experience with integrated circuit design. A second cornerstone of the firm's strategy is to provide process-independent designs, thus making it one of the first ASIC suppliers to base its business on providing tools and support services rather than wafer processing from a captive manufacturing facility. This key point in the strategy allows its customers to establish second sources easily and migrate its designs to newer fabrication processes as they become available. The third point of the Company's strategy is to integrate its software compilers into the familiar design environments of the leading third-party CAE workstations such as those from Digital Equipment Corporation, Tektronix, and Valid.

With its early software product, called Concorde, Seattle Silicon was successful in establishing strategic partnerships with Fortune 100 companies such as Burroughs (now Unysis), General Dynamics, and General Motors. Concorde offered customers an integrated software compiler that allowed input in the form of high-level functional specifications such as block diagrams or Boolean expressions. Process and foundry independence are achieved by referencing a table of process parameters for each foundry. Seattle Silicon claims that its products give customers access to more fabrication processes than any other ASIC supplier.

As the worldwide ASIC business evolved, it fragmented into gate arrays, standard cells, and silicon compilation. The major market acceptance was primarily on gate arrays, with standard cells and silicon compilers well behind. In 1987,

recognizing a need to broaden its business base, Seattle Silicon began adapting its strategy to the evolving ASIC market by building upon early successes. The company now targets selected high-end application segments of the electronics market such as military, high-performance ASICs and mixed analog/digital circuits. The Company learned that many potential customers were not willing to take full responsibility for a chip's performance, so it introduced its "First Silicon" service, where Seattle Silicon guarantees working ASICs from a variety of manufacturing processes.

The Company continues to add processing options to its software and now allows designers to take advantage of the most advanced CMOS, VHSIC, SOS, and GaAs processes. Seattle Silicon believes that in the future of the ASIC industry, companies without a dedicated fab will be the norm rather than the exception; it is among the vanguard in this trend.

## BOARD

(Name and Affiliation)

Stewart Carrell

Diasonics, Inc., Chairman/CEO

Bill Hambrecht

Hambrecht & Quist, General Partner

Amaury Piedra

Seattle Silicon, President/CEO

Paul Kirby

Hill, Kirby, Washing & Carman, General Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President

Amaury Piedra

Fairchild, VP Strategic Alliances

# Seattle Silicon Corporation

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## VP Marketing

Ed Fernandez  
National Semiconductor, Fairchild Analog  
Division

## VP Sales

Dick Braydon  
Fairchild, Technology Marketing Manager

## VP Finance

John Celms  
Amary International, CFO

## VP Design Tools Development Engineering

Robert V. Alessi  
Eastman Kodak, Manager IC Design

## VP First ASIC Operations

Fred Tsang  
Supertex, VP/COO

## VP Software Operations

Bill Moore  
Silvar-Lisco Inc., Dir. R&D

## FINANCING

### February 1985

Round 1  
\$6.2M  
Hill, Kirby & Washing; Canadian Enterprise  
Development Corp.; Hambrecht & Quist;  
Norwest Venture Capital Management; Paragon  
Partners; Olympic Venture Partners; TWB  
Investment Partnership; Rainier Venture  
Partners

### November 1985

Round 2  
\$0.5M  
Previous investors

### Early 1986

R&D Financing  
\$5.0M  
General Motors

### August 1986

R&D Financing  
\$7.0M  
Pru-Tech

### August 1987

Round 3  
\$5.0M  
Hill, Kirby & Washing; Hambrecht & Quist;  
Rainier Venture Partners; Norwest Venture  
Capital Management; Paragon Partners

### August 1988

Round 4  
\$5.1M  
Hill, Kirby & Washing; Hambrecht & Quist;  
Norwest Venture Capital Management

## RECENT HIGHLIGHTS

### February 1988

Seattle Silicon introduced ChipCrafter®, a  
software design tool that will provide fully  
automatic physical design for high-functionality  
ASICs and maintain manufacturing process  
independence.

### August 1988

Seattle Silicon announced the first production  
shipments of ChipCrafter.

### August 1988

Using Seattle Silicon's compiler-based ASIC  
design software, two University of Michigan  
engineering students won first prize in the  
industry-sponsored sixth annual Student VLSI  
Design contest. Four out of the top six designs  
were completed using Seattle Silicon's Concorde  
compiler tool.

## ALLIANCES

### Gould AMI Semiconductors

September 1986  
Seattle Silicon and Gould AMI signed an agree-  
ment that provides systems manufacturers with  
a simplified means of designing ASICs and  
transferring final design data to Gould AMI  
for fabrication. By the agreement, Gould AMI  
provided Seattle Silicon with its proprietary geo-  
metric design rules and performance character-  
istics of selected fabrication processes.

### Burroughs Corp.

August 1986  
Seattle Silicon and Burroughs signed an agree-  
ment to jointly develop a "new-generation  
design system" for integrated circuits.

# Seattle Silicon Corporation

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## **United Technologies Microelectronics Center (UTMC)**

June 1987

Seattle Silicon and UTMC announced their intention to jointly design and fabricate ASICs used in tactical and strategic radiation environments.

## **National Semiconductor**

October 1987

Seattle Silicon and National signed a foundry agreement to qualify National's 1.25- and 1.20-micron VHSIC CMOS processes for design with Concorde, Seattle Silicon's compiler for top-end ASIC designs.

## **Oki Electric**

August 1988

Seattle Silicon and Oki announced an agreement to develop a compiler for a process-

independent, five-port, high-speed (15ns) static RAM module.

## **GigaBit Logic**

June 1989

Seattle Silicon and GigaBit Logic announced the formation of an alliance to develop the design automation industry's first comprehensive set of software tools specifically created for GaAs ASICs.

## **SERVICES**

"First Silicon" production management

## **MANUFACTURING**

### **Technology**

1.2-micron CMOS

## **PRODUCTS**

ChipCrafter design software tool  
ChipCrafter ASIC Expert  
ChipCrafter IC Expert  
Concorde ASIC compiler tool  
User-configured ASICs

## **OTHER INFORMATION**

Seattle Silicon's PR firm is Franson & Associates, Inc.

# SEEQ Technology, Inc.

1849 Fortune Drive  
San Jose, CA 95131  
408/432-7400  
Fax: 408/432-1550

ESTABLISHED: January 1981

NO. OF EMPLOYEES: 530

## BACKGROUND

SEEQ Technology, Inc., designs, manufactures, and markets nonvolatile semiconductor memory devices used in defense electronics, industrial, and data processing applications. SEEQ specializes in EEPROM processes for applications that require both nonvolatility and in-circuit programmability.

SEEQ products are grouped strategically into three classifications: EEPROM products that support nonvolatile memory needs, EEPROM microprocessors, and telecommunication circuits. SEEQ's EEPROMs range in density from 4K to 256K and offer benefits such as page-mode writes, 1M cycle endurance, silicon signature, and DiTrace as standard features. The Company's flash EEPROMs combine in-circuit programmability and the density of UV EPROMs. The Company's 8-bit, single-chip MCUs feature on-board EEPROMs for applications that allow on-chip reprogramming of code and data. SEEQ also offers enhanced Ethernet data link controllers and CMOS Manchester coder/decoder circuits.

SEEQ Technology was founded by Gordon Campbell, Dr. Philip J. Salsbury, Larry T. Jordan, Maria Ligeti, and George Perlegos, all formerly employed by Intel Corporation, and Dan Barbato, who was previously employed by Synertek.

Four domestic and two international sales offices manage a network of sales representatives in the United States, Canada, Europe, and Japan. Three national and three regional distributors serve the United States and Canada.

## BOARD

(Name and Affiliation)

J. Daniel McCranie, Chairman  
SEEQ Technology, Inc.

E. Floyd Kvamme

Kleiner, Perkins, Caufield & Byers

John W. Larson

Brobeck, Phleger & Harrison

Philip Paul

Hillman Ventures

\*Dr. Philip J. Salsbury

SEEQ Technology, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CEO

J. Daniel McCranie

Harris, Grp VP Sales

VP Finance/CFO

Patrick Brennan

NSC, VP/Treasurer

VP Manufacturing

Michael Van Hoy

SGS-Thomson, VP Operations

VP/CTO

\*Dr. Philip J. Salsbury

Intel, Div Dir EEPROMs

VP Strat Accounts

Tom Endicott

Signetics, Mgr Rel & QA

VP Worldwide Sales

Philip Ortiz

CDI, Dir Mktg/Sales

VP/GM Flash Div

Michael Villot

Motorola, Dir Mktg MPUs

VP/Business Development

Ralph Harms

Signetics, Controller

\*Founder

# SEEQ Technology, Inc.

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## FINANCING

March 1981

Initial

\$15.0M

Kleiner, Perkins, Caufield & Byers; Hillman Ventures

September 1983

Initial public offering

\$20.0M

March 1985

Private placement

\$14.0M

October 1986

Private placement

\$6.0M

Bridge Capital; GE Venture Capital; Hillman Ventures; John Hancock; Kleiner, Perkins, Caufield & Byers

November 1988

Private placement

\$4.0M

Monolithic Memories

April 1988

Public offering

\$19.5M

## RECENT HIGHLIGHTS

February 1987

SEEQ reincorporated in Delaware.

April 1987

SEEQ announced the addition of its 27C256 EPROM to military drawing 86063. It was the first time SEEQ ever had parts listed for a military drawing, and it followed the 27C256's compliancy with MIL-STD-883 Rev C, Class B.

April 1987

SEEQ announced its successful demonstration to the Defense Electronics Supply Center (DESC) of SEEQ's compliance with the requirements of MIL-M-38510 and MIL-STD-976. DESC recognized SEEQ as

having reached a level of manufacturing competence in which all phases of design, processing, and testing meet or exceed established standards by DESC.

April 1988

SEEQ introduced the 512K flash EEPROM, first of the generation of high-density flash-type electrically erasable programmable memories.

February 1989

SEEQ announced the industry's first 1Mb flash EEPROM at the 36th ISSCC in New York. The part offers twice the density of other currently available flash EEPROM devices. The 48F010 is available in commercial and military versions.

## ALLIANCES

Amkor

1981

SEEQ signed Amkor to assemble its IC products.

Rockwell

July 1982

SEEQ signed an exclusive licensing agreement to provide its 16K EEPROM and 16K UV EPROM technology to Rockwell. In exchange, Rockwell paid SEEQ \$5.0 million, leased \$5.5 million of SEEQ's equipment, and agreed to pay a 3 percent royalty on sales of these products.

Texas Instruments

August 1982

SEEQ licensed its EEPROM technology to Texas Instruments in exchange for its TMS7000 8-bit MCU.

Silicon Compilers

1983

SEEQ announced that it would manufacture the Silicon Compiler, Inc., (SCI) Ethernet data link controller.

July 1985

SEEQ provided all of its EEPROM designs for integration into SCI's Genesil system. SEEQ will manufacture the EEPROM logic circuits using its 2-micron CMOS process.

## Monolithic Memories

November 1986

Monolithic Memories Inc. (MMI) purchased a 16 percent equity in SEEQ for \$4 million. The two firms also agreed to a joint product and technology program to codevelop four CMOS EEPROM-based PLDs.

## Motorola

December 1986

SEEQ and Motorola signed an engineering development agreement to develop a high-performance EEPROM microcomputer.

## National Semiconductor

October 1987

SEEQ and National Semiconductor signed a four-year exclusive technology licensing and manufacturing agreement. Under the agreement, the two companies share technology and marketing rights to SEEQ's 512K and 1Mb and to National's 256K flash EEPROMs. The agreement was extended October 1988.

June 1989

SEEQ and National scaled back their 1987 agreement to cover only current Flash

technology. SEEQ will continue to develop the next generation of 0.8 $\mu$  Flash chips alone.

## Hamilton-Standard

October 1987

SEEQ signed a \$1.4 million contract to supply CMOS 256K EEPROMs to Hamilton-Standard, a division of UTC. The EEPROMs, configured as 32Kx8, will be used in military flight tape recorders.

## MANUFACTURING

### Technology

2.0-micron, double-poly, floating-gate CMOS  
1.25-micron, double-poly, floating-gate CMOS  
5-inch wafers

### Facilities

San Jose, CA  
120,000 sq. ft.

Administration, design, manufacturing (The SEEQ fab has DESC certification to allow individual parts to achieve JAN qualifications.)

## PRODUCTS

### EEPROMs

16K Latched; 4K, 16K, and 64K Latched and Timed; 64K and 256K Page Mode; High-Speed CMOS 64K and 256K EEPROMs; Timer EEPROM

### Flash

512K and 1024K CMOS Flash EPROMs, 512K and 1024K CMOS Flash EEPROMs

### EPROMs

64K, 128K, 256K CMOS

### Data Communications

Ethernet Data Link Controller, Manchester Code Converters, Advanced Ethernet Data Link Controller

### EEPLD

Registered Asynchronous CMOS EEPLD, Versatile 28-pin CMOS EEPLD

## MILITARY PRODUCTS

### EEPROMs

16K and 64K Latched; 16K and 64K Latched and Timed; 64K and 256K Page Mode, Latched & Timed; High-Speed CMOS Bipolar PROM Replacement; High-Speed CMOS; High-Speed CMOS Bipolar PROM; 1,024K EEPROM

## **SEEQ Technology, Inc.**

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### **EPROMs**

64K, 128K, and 256K EPROMs; 256K CMOS EPROM; DESC SMD-Compliant 64K, 128K, and 256K CMOS UV EPROMs

### **FLASH**

512K and 1,024K CMOS Flash EEPROMs, 512K and 1,024K CMOS Flash EPROMs

### **OTHER INFORMATION**

SEEQ Technology does not employ a PR firm.



## Sensym, Inc.

1255 Reamwood Avenue  
Sunnyvale, CA 94089  
408/744-1500  
Fax: 408/734-0407  
Telex: 176376

ESTABLISHED: October 1982

NO. OF EMPLOYEES: 120

### BACKGROUND

Sensym, Inc., designs, manufactures, and markets a complete line of IC accelerometers and IC pressure sensors and transducers including absolute, differential, and gauge types ranging from 0 to 1 psi to 0 to 5,000 psi. The Company provides devices with a variety of coatings, isolators, and special packages made specifically to handle various media, from dry air to hostile environments such as steam, water, freon, and high humidity. Products are used in many applications including energy management, avionics, medical diagnostics, agrionics, and industrial controls.

Sensym was founded when the principal management of National Semiconductor's transducer group initiated a leveraged buyout from the parent company, with the assistance of venture capital funding. The Company set up its operation in Sunnyvale, California, to provide only United States-built products and offers the National Semiconductor transducer product line as well as numerous product additions. Round two of financing, completed in 1984, assisted in the expansion of Sensym's manufacturing capacity.

In April 1989, Sensym was acquired by FASCO Sensors and Controls Group, a division of FASCO Industries. Sensym became the tenth member of the Sensors and Controls Group, a consortium of FASCO companies that provides temperature, pressure, and position-sensing technology as well as aerospace controls and subsystems.

### BOARD

(Name and Affiliation)

Dennis Dauenhauer  
Sensym, Inc.

Roger J. Barry  
Crosspoint Venture Partners, Partner

Robert L. Cummings  
Robertson, Colman & Stephens, Partner

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO/COO  
Dennis Dauenhauer  
National, Grp Dir Transducers

VP Mktg/Sales  
W. Frederick Jones  
Varian Associates, Div Mgr

VP Hybrid & Semi  
Fred Adamic  
National, Linear Prod Line Mgr Ops

### FINANCING

October 1982  
Round 1  
\$ 1.0M  
Crosspoint Venture Partners; Robertson,  
Colman & Stephens

Round 2  
\$ 1.5M  
Crosspoint Venture Partners; Med-Tec  
Ventures; National Semiconductor; Robertson,  
Colman & Stephens

August 1986  
Round 3  
\$ 1.5M  
Becton & Dickinson

August 1989  
Acquisition  
\$250.0M  
Sensym acquired by FASCO Sensors and  
Controls Group

# Sensym, Inc.

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## RECENT HIGHLIGHTS

### August 1987

Sensym leased 20,405 square feet of research and development space at 1244 Reamwood Avenue, Sunnyvale. The additional space will be used for the development and manufacture of digital electronic tire gauges.

### April 1989

Sensym was acquired by FASCO Sensors and Controls Group.

## ALLIANCES

### Michelin

Sensym has a technology agreement with Michelin of France.

## PRODUCTS AND SERVICES

- Custom Pressure Sensors
- Disposable Blood Pressure Sensors
- Tape Tension Pressure Sensors
- Energy Management Pressure Sensors
- Medical Instrumentation Pressure Sensors
- Barometric Pressure Sensors
- Engine Diagnostic System Sensors
- Accelerometers
- Digital Tire Gauges
- Digital Pressure Gauges
- Sensor-Based Subsystems
- Proprietary and Custom Solid State Sensors for Pressure and Acceleration

## OTHER INFORMATION

Sensym does not employ a PR firm.

## MANUFACTURING

### Technology

- CMOS capabilities
- Bipolar
- 4-inch wafers
- Solid-state sensors
- Sensor-based systems

### Facilities

- Sunnyvale, CA
- 65,000 sq. ft.  
Manufacturing, engineering, administration
- 20,405 sq. ft.  
Corporate offices, R&D, marketing and sales
- 1,500 sq. ft.  
Class 100 clean room

# SID Microelectronics S.A.

Av. Brig. Faria Lima  
1476 - 7. andar 01452  
Sao Paulo, Brazil  
011/210-4033

ESTABLISHED: April 1984

NO. OF EMPLOYEES: 850

## BACKGROUND

SID Microelectronics S.A. designs, manufactures, and markets small and medium transistors and linear devices. The Company plans to introduce hybrid circuits, surface-mounted device technology, metallic-can transistors, ceramic and metal (cermet) ICs, and digital IC assembly. Additional product plans include MOS logic, custom/semicustom ICs, memories, microprocessors, TTL, LIC, and LSI devices. The Company plans to continue support of its design and research and development activities in CMOS.

SID succeeds the RCA-Ford semiconductor manufacturing joint venture in Brazil that closed in 1983. In 1984, SID purchased the IC fab from RCA to produce ICs for the merchant market. SID is the only South American semiconductor manufacturing company with all the manufacturing steps, including wafer production.

## BOARD

(Name and Affiliation)

Matias Machline

Sharp S.A. Equipamentos Electronics

Jose B. Amorim

SID S.A. Servicos Tecnicos

Yuichi Tsukamoto

SHARP S.A. Equipamentos Electronics

Jose Papa, Jr.

FIESP

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President

Matias Machline

Not available

## VP R&D

Adalberto Machado

Ford-Brazil

## VP Finance

Luis Paulo Rosenberg

Not available

## Mng Director

Victor Blatt

CPQD-Telebras

## Indus Director

Wilson L.M. Leal

Siemens

## Planning Mgr

Luiz Mauge

Sharp

## Mktg Mgr

Inacio Hatanaka

RCA

## FINANCING

1984

Initial

\$14.2M

Private investors

## MANUFACTURING

### Technology

3.0-micron bipolar

# **SID Microelectronics S.A.**

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## **PRODUCTS**

Small-Signal Transistors  
Medium-Power Transistors  
Linear ICs

## **OTHER INFORMATION**

SID Microelectronics does not employ a PR firm.

# Sierra Semiconductor Corporation

2075 North Capitol Avenue

San Jose, CA 95132

408/263-9300

Fax: 408/263-3337

Telex: 384467

ESTABLISHED: November 1983

NO. OF EMPLOYEES: 350

## BACKGROUND

Sierra Semiconductor Corporation is a service-oriented supplier of CMOS ASICs with a complementary portfolio of standard products that include memory and linear digital ICs. The Company specializes in designs that combine analog, digital, and/or EEPROM memory technology on one chip. Products target telecommunications, data communications, computers and peripherals, and selected industrial applications.

The Company's proprietary Triple Technology makes the integration of analog, digital, and EEPROM memory on a single IC possible. Sierra's products are fabricated on 5-inch wafers using 1.5-, 2.0-, and 3.0-micron CMOS process technology. Currently, Sierra conducts its own manufacturing and test but occasionally also uses foundries to augment internal capability. A recent joint venture company established in Singapore ensures adequate manufacturing and test resources for the foreseeable future.

Sierra is considered to be strong in circuits combining analog and digital technology and is also considered to have a strong cell library. The Company has an EE cell library—only two other suppliers (NCR and National Semiconductor) have such a library. Sierra's initial strategy was to develop a portfolio of CMOS standard products that demonstrated Sierra's Triple Technology. Sierra's long-term strategy is to expand its custom and cell-based products to 70 percent of sales and identify new markets and applications that benefit from the combination of digital, analog, and EE nonvolatile memory. At the end of 1987, Sierra's sales were about evenly split between standard and custom products.

Sierra has established two joint ventures in the last few years. In June 1986, Sierra formed a corporation in the Netherlands, named Sierra

Semiconductor B.V. The \$9 million in equity funding for the venture came from the Netherlands-based MIP Equity Fund. The headquarters, which opened in October 1986, houses a design center, technical support and services, and marketing and sales for Sierra's standard and cell-based ICs. In January 1987, Dr. Stephen Forte was appointed president of the operation.

In November 1987, Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore named Chartered Semiconductor Pte. Ltd. The company is located at a 170,000-square-foot site in the Singapore Science Park. Initial capacity will be 5,000 6-inch wafers per month. This firm fabricates and tests CMOS wafers and ASIC devices primarily for Sierra and National.

Singapore Technology holds 74 percent of the joint venture company; Sierra holds 17 percent, and National holds the remaining 9 percent. Sierra will contribute its Triple Technology CMOS process and technical management, while National will provide CMOS process technology and technical support to construct the clean room facility. Singapore Technology Corporation also participated in Sierra's third round of financing.

Sierra sells its products through manufacturers' representatives and distributors in North America and Asia. In Europe, the Company sells its products through Sierra Semiconductor B.V., headquartered in the Netherlands, and also through manufacturers' representatives.

## BOARD

(Name and Affiliation)

Donald T. Valentine, chairman  
Sequoia Capital

# Sierra Semiconductor Corporation

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Charlie C. Bass  
Ungermann-Bass

James V. Diller  
Sierra Semiconductor Corporation

Kheng-Nam Lee  
Singapore Technology Corporation, Inc.

Robert J. Schreiner  
Borg-Warner Electronics

Hans Severiens  
MIP Equity Fund

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

James V. Diller  
National, VP MOS Mem Ops

### Pres/Sierra B.V.

Dr. Stephen Forte  
AMI, VP WW Mktg/Sales

### VP Mktg/Sales

John T. Reynolds  
National, Group Mktg Dir

### VP Design

Andrew G. Varadi  
National, VP Technology

### VP Opns

Edward Boleky  
Intel, Mgr Mem Prod

### VP Finance

C. Stephen Cordial  
TI, Div Controller

### Mng Dir Chartered Semi

John Hambridge  
Fairchild, VP Logic Division

## FINANCING

### January 1984

Round 1

\$ 7.7M

Arcscott, Norton & Assoc.; Asset Mgmt.;  
Associated Venture Investors; Bay Partners;

Borg-Warner Electronics; Investors in Industry;  
Mohr, Davidow Ventures; Sequoia Capital;  
Sutter Hill Ventures; Technology Venture  
Investors; Venrock Associates

### April 1985

Round 2

\$15.0M

Initial investors; Bryan and Edwards; Burr,  
Egan, Deleage & Co.; Litton Industries; Suez  
Technology Fund; Tellabs, Inc.

### October 1986

Round 3

\$18.4M

Asset Mgmt.; Associated Venture Investors;  
Bay Partners; Berkeley International; Borg-  
Warner Electronics; Churchill International;  
Hambrecht & Quist; Litton Fund; MIP Equity  
Fund; Mohr, Davidow Ventures; Sequoia  
Capital; Singapore Technology Corporation;  
Suez Technology Fund; Sutter Hill Ventures;  
Technology Venture Investors; Venrock  
Associates

### September 1987

Round 4

\$10.0M

Convertible debentures, Berkeley International

## RECENT HIGHLIGHTS

### June 1986

MIP Equity Fund invested \$9 million in Sierra and Sierra Semiconductor B.V. The latter operates as a design and service center. Additional funding through government grants was assured. In January 1987, Dr. Forte joined Sierra as president of the subsidiary.

### October 1986

Sierra completed third-round financing for \$18.4 million. In addition to discussing an investment, Singapore Technology Corp. and Sierra discussed establishing a joint venture in Singapore for a design center and semiconductor manufacturing facility.

### December 1986

Sierra introduced the SC11270 and SC11289 DTMF receivers.

# Sierra Semiconductor Corporation

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## December 1986

Sierra introduced the SC11401/11402/11403/11404 8-bit video DACs, which are compatible with RS-170 and RS-323 specifications.

## December 1986

Sierra announced that its cell library is now supported on Mentor Graphics workstations.

## January 1987

Sierra and National Semiconductor announced a jointly developed family of 8-bit CMOS MCUs. The first members in the family of flexible controllers are called SC44820, SC44821, and SC44822 by Sierra and COP820C, COP821C, and COP822C by National Semiconductor.

## May 1987

Sierra sampled a CMOS 2,400-bps modem chip set based on its initial 1,200-bps modem chip set, which is second-sourced by VLSI Technology. The SC11006 is the 2,400-bps modem, and the SC11009 and SC11011 are companion controllers. The SC11009 is for parallel bus applications such as the PC XT, AT, or compatibles; and the SC11011 supports RS-232 applications.

## September 1987

Sierra ported the MIXsim behavioral modeling tools to the Mentor Graphics Idea workstation.

## November 1987

Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore and named it Chartered Semiconductor Pte. Ltd.

## ALLIANCES

### National Semiconductor

July 1984

Sierra and National signed a technology exchange agreement that covers selected advanced CMOS products and processes. Sierra leased a facility from National to develop its process and manufacture products using its own equipment and employees.

## November 1987

Sierra, National, and Singapore Technology Corporation formed a joint venture company named Chartered Semiconductor Pte. Ltd. The new firm, located in the Singapore Science Park, will fabricate and test CMOS wafers and ASIC devices primarily for Sierra and National. Initial capacity will be 5,000 6-inch wafers per month. Sierra and National are providing process technology and technical assistance.

## VLSI Technology

January 1985

Sierra and VLSI have an agreement that provides for the exchange of technical information and the mutual sharing of developments in ASIC software, design expertise, and products. VLSI is also a second source for Sierra's custom and analog standard products.

## Mentor Graphics

December 1986

Sierra announced that its cell library is now supported on Mentor Graphics workstations.

September 1987

Sierra's MIXsim behavioral modeling tools are available on Mentor Graphics' Idea workstation.

## MANUFACTURING

### Technology

2.0-micron single- and double-poly, double-metal CMOS

3.0-micron single- and double-poly CMOS

1.5-micron

5-inch wafers

6-inch wafers available in third quarter 1989

### Facilities

San Jose, CA

71,000 sq. ft.

Headquarters, administration, marketing, design, and test

Santa Clara, CA

16,000 sq. ft.

Engineering, wafer fabrication

# Sierra Semiconductor Corporation

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## PRODUCTS

### CMOS Cell Library

Process	Linewidth	Cells
Si-Gate CMOS	2.0-micron	280 Digital Cells, 50 Analog Cells, 25 EEPROM Cells, RAM, ROM, PLA, 2901, Multiplier
Si-Gate CMOS	1.5-micron	250 Digital Cells, 25 Analog Cells, 70-MHz PLL, Video DACs, 9 EEPROM Cells, RAM, ROM, PLA, Data Path, Multiplier

### EEPROMs

Device	Description
SC22001/22002	CMOS 256-Bit Serial EEPROM
SC22011/22012	CMOS 1,024-Bit Serial EEPROM
SC22101	CMOS 128x8 Multiplexed EEPROM
SC22102	CMOS 256x8 Multiplexed EEPROM
SC22104	CMOS 512x8 Multiplexed EEPROM

### Microcomponents

SC44820/44821/44822	8-Bit CMOS MCUs
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### Linear

#### Data Communication

SC11000/11001/11005	CMOS 1,200-Baud Modem Filters
SC11002/SC22003	CMOS 300-Baud Modem
SC11004/SC11014	CMOS 1,200-Baud Modem
SC11006	CMOS 2,400-Baud Modem
SC11007/SC11008	CMOS Modem Controller
SC11009	SC11006 Companion Controller for Parallel Bus
SC11011	SC11006 Companion Controller for RS-232
SC11015	CMOS 1,200-Baud Modem with Programmable Receiver Gain Amplifier

#### Telecommunications

SC11202/11203/11204/11270	DTMF Receiver
SC11270/11289	DTMF Receiver
SC11280/11289/11290	DTMF Transceiver
SC11301/11302	Codec Filter Combo

#### Computer/Peripheral

SC11401/11402/11403/11404	8-Bit Video DACs
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### Developmental Tools

MONTAGE - Systems Integration Software	Design system that permits schematic capture and simulation of mixed signal ASICs by the system's designer
SCDS	Custom Design System
MIXsim	Behavioral Modeling Tools

## OTHER INFORMATION

Sierra Semiconductor does not employ a PR firm.



**Si-Fab Corporation**  
27 Janis Way  
Scotts Valley, CA 95066  
408/438-6800  
Fax: 408/438-6800, Ext. 107

**ESTABLISHED: 1980**

**NO. OF EMPLOYEES: 15**

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## **BACKGROUND**

Si-Fab Corporation provides process design and engineering services as well as quick-turn CMOS foundry services. The Company filed for Chapter 11 protection during the economic downturn in the semiconductor industry and reorganized its management and systems. Consequently, Si-Fab's business outlook and sales have increased substantially.

## **BOARD**

Not available

## **COMPANY EXECUTIVE**

(Position and Name)

### **President**

Leon B. Pearce

## **FINANCING**

Private

## **PRODUCTS**

Aftermarket Technology  
Proprietary Products  
High-Speed SRAM 44-64U

## **OTHER INFORMATION**

Si-Fab does not employ a PR firm.

## **ALLIANCES**

Not available

## **SERVICES**

Custom IC design  
Thin-film coating services  
Metal gate and Si-gate CMOS foundry  
P-channel and n-channel foundry

## **MANUFACTURING**

### **Technology**

1.0- to 1.25-micron SOS, CMOS, NMOS,  
and PMOS  
4-inch and 5-inch wafers

### **Facilities**

Scotts Valley, CA  
12,000 sq. ft.  
Plant  
5,000 sq. ft.  
Clean rooms

## **SIMTEK Corporation**

1465 Kelly Johnson Boulevard, Suite 301  
Colorado Springs, CO 80902  
719/531-9444  
Fax: 719/531-9481

**ESTABLISHED: May 1987**

**NO. OF EMPLOYEES: 30**

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### **BACKGROUND**

SIMTEK Corporation designs, manufactures, and markets advanced nonvolatile memory products. SIMTEK is using proprietary nonvolatile integrated circuit technology, and its first two products are a 256K EPROM and a 64K NVSCRAM. SIMTEK began production of these products in early 1989 and expected its first revenue from them late in 1989.

SIMTEK is using advanced CMOS processes coupled with silicon nitride oxide semiconductor (SNOS) technology. This technology provides high-density, high-performance, reliable, and full-function nonvolatile products.

Initial capitalization was provided by Nippon Steel Corporation of Japan, which owns about 20 percent of the Company and has a seat on the board. Other financing was provided by the founders.

Dr. Richard Petritz, a founder of Mostek and Inmos, serves as chairman and CEO of the Company.

### **OTHER INFORMATION**

SIMTEK does not employ a PR firm.

### **BOARD**

Dr. Richard Petritz  
Dr. Gary Derbenwick  
Mr. Kazuo Takanashi

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

#### **Chairman/CEO**

Dr. Richard Petritz  
Inmos, Founder

#### **COO**

Dr. Gary Derbenwick  
Inmos, Mgr Technology

#### **VP Operations**

Dr. Dennis Ryden  
Inmos, Process Mgr

#### **VP Engineering**

Dr. Ralph Sokel  
Inmos, CAD Development

#### **VP Finance**

William G. Skolout  
RAMTRON, CFO

# Solid State Optronics Inc.

442 Queens Lane  
San Jose, CA 95112  
408/436-1390  
Fax: 408/436-1392

ESTABLISHED: June 1982

NO. OF EMPLOYEES: 5

## BACKGROUND

Solid State Optronics, Inc., designs and manufactures solid-state relays, photoresistors, and thyristors. The Company was founded by Zag Kadah in 1982. Prior to founding the Company, Mr. Kadah was employed at Electro-Trol, Inc., as vice president in charge of the optoelectronics division. In 1979, Mr. Kadah founded Power Interface, a company that pioneered the development of an IC to drive back SCRs in solid-state relays.

The Company subcontracts manufacturing to a company in Asia; assembly is done in the Philippines.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*Zag Kadah  
Elec-Trol, Inc.

## PRODUCTS

Input/Output Modules  
Interrupters  
Photodiodes  
Photo Arrays  
Silicon Photo Detectors  
Solid-State Relays  
Hybrid Optoelectronic Modules

## OTHER INFORMATION

Solid State Optronics' PR firm is QMI.

## Marketing

Sid Kadah  
UC Berkeley

## Financial Officer

Fay Kadah  
Magnex

\*Founder

## FINANCING

Zag Kadah holds 100 percent of the Company.

## ALLIANCES

Not available

## MANUFACTURING

### Technology

Bipolar  
Dielectric isolation  
DMOS  
GaAs and GaAlAs

### Facilities

San Jose, CA  
1,200 sq. ft.  
R&D, design, engineering, and assembly

## **Spectrum Microdevices**

5330A Spectrum Drive

Frederick, MD 21701

301/695-0868

Fax: 301/831-4032

**ESTABLISHED: 1980**

**NO. OF EMPLOYEES: 21**

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### **BACKGROUND**

Spectrum Microdevices is a part of Fairchild Communications & Electronics Company, which, in turn, is part of Fairchild Industries. In 1983, Fairchild acquired a 51 percent share of Insouth, a company that makes large-scale ICs, hybrids, and gate arrays. Fairchild has since increased its holdings to 100 percent.

In 1986, Spectrum Microdevices, then known as Insouth Microsystems, moved from Auburn, Alabama, to Frederick, Maryland. Some members of the management and design group, including General Manager Marvin L. Harding, were transferred to coordinate component manufacturing more closely with Fairchild Communications & Electronics Company in Germantown, Maryland. Fairchild Communications & Electronics Company, Spectrum Microdevices' major customer, manufactures avionics and telecommunications equipment. The move was completed in September 1986, and the Company's name was changed in early 1987.

### **PRODUCTS**

Military Hybrids/Custom Monolithic Assembly and Test  
Surface Mount for Military

### **OTHER INFORMATION**

Spectrum Microdevices does not employ a PR firm.

### **BOARD**

Not available

### **COMPANY EXECUTIVES**

(Position and Name)

**Director Operations**

William K. Bowers

### **FINANCING**

Not available

### **MANUFACTURING**

#### **Technology**

2.0-micron CMOS

#### **Facilities**

Frederick, MD

2,500 sq. ft.

Administration

12,500 sq. ft.

Manufacturing, assembly, test

**Synaptics, Inc.**  
2860 Zanker Road, Suite 105  
San Jose, CA 95134  
408/434-0110  
Fax: 408/434-9819

**ESTABLISHED: 1986**

**NO. OF EMPLOYEES: 7**

## **BACKGROUND**

Synaptics, Inc., was formed to develop a family of neural network interpret circuits for use in intelligent sensors and pattern recognition applications. The Company is in a research stage and does not expect to introduce products for some time.

The Company hopes to develop a device with the ability to sense and process real-world signals in real time and to learn without prior knowledge embedded in its program.

The basic research is guided by a scientific advisory committee chaired by Carver Mead of California Institute of Technology. Professor Mead, a leading force in the development of silicon computer design methodology for VLSI, has been modeling neural networks with analog VLSI systems.

## **BOARD**

Not available

## **OTHER INFORMATION**

Synaptics does not employ a PR firm.

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

\*Federico Faggin  
Cynet Communication, Founder

### **Chairman**

Carver Mead  
California Institute of Technology, Computer  
Science Professor

\*Founder

## **FINANCING**

### **May 1986**

Seed  
\$0.6M  
Avalon Ventures, Sprout Group, Technology  
Venture Investors

### **June 1987**

Round 1  
\$1.5M  
Kleiner, Perkins, Caufield & Byers; Sprout  
Group; Technology Venture Investors

# Synergy Semiconductor Corporation

3450 Central Expressway

Santa Clara, CA 95051

408/730-1313

Fax: 408/737-0831

ESTABLISHED: 1987

NO. OF EMPLOYEES: 48

## BACKGROUND

Synergy Semiconductor Corporation was formed to offer ultrahigh-performance bipolar ECL memory and logic products for the commercial and military markets. The Company is in its product development stage and plans to begin offering ECL bipolar products that will serve the needs of the high-performance computer and ATE markets in the second half of 1988. Its first product will be a 4K memory chip with an access time of less than 5ns.

Synergy was cofounded by Ralph O. Cognac, Larry J. Pollock, George W. Brown, Thomas S. Wong, and E. Marshall Wilder. All of the founders worked together at Advanced Micro Devices, where they developed the advanced bipolar technology called IMOX. Mr. Cognac and Mr. Pollock also played key roles at Integrated Device Technology, a leading supplier of high-speed CMOS memory and logic products.

Kenneth G. Wolf joined the Company as president and CEO in July 1987. Mr. Wolf was previously employed at Motorola for 22 years in management positions. At various times, he was responsible for the bipolar memory, bipolar logic, and ASIC divisions.

In January 1988, Synergy Semiconductor purchased Zoran Corporation's Santa Clara, California, wafer fabrication clean room and a portion of the 50,000-square-foot manufacturing and office facility.

## BOARD

(Name and Affiliation)

Sven E. Simonson, chairman  
Sequoia Capital

\*Ralph O. Cognac  
Synergy Semiconductor Corporation

William J. Harding

J.H. Whitney & Company

Glenn M. Mueller

Mayfield Fund

Kenneth G. Wolf

Synergy Semiconductor Corporation

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Kenneth G. Wolf

Motorola, VP/GM ASIC Div

### VP Prod Ops

\*George W. Brown

AMD, Prod Mgr Bipolar RAMs

### VP Mktg/Sales

\*Ralph O. Cognac

IDT, VP Mktg

### VP Technology

\*Larry J. Pollock

IDT, VP Corp Engr

### VP Prod Dev

\*Thomas S. Wong

AMD, Dsn Mgr Bip RAMs

### VP Mfr Ops

\*E. Marshall Wilder

AMD, Mgr Dir MOS RAMs

\*Founder

## FINANCING

July 1987

Round 1

\$3.9M

Mayfield Fund, Sequoia Capital, Suez  
Technology Fund

# Synergy Semiconductor Corporation

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**February 1988**

Round 2

\$ 9.0M

Broventure Capital Mgmt.; Matrix Partners;  
Mayfield Fund; Menlo Ventures; Merrill,  
Pickard, Anderson & Eyre; Oak Investment  
Partners; Stanford University Engineering;  
Sequoia Capital; J.H. Whitney

**January 1989**

\$8.5M

Revolving Lease Line

## ALLIANCES

Major strategic alliances are as yet unnamed.

## MANUFACTURING

### Technology

1.5-micron bipolar ECL  
4-inch wafers

### Facilities

Santa Clara, CA  
30,000 sq. ft.  
Administration and manufacturing

7,000 sq. ft.  
Class 10 clean room

## PRODUCTS

Synergy's first product is the industry's fastest 1Kx4 bipolar ECL RAM 3ns SY100474 and SY10474 offering 100K and 10K compatible logic levels. These parts feature balanced read/write, elimination of the traditional write recovery glitch, and standard or fast edge rates. They are designed for alpha particle immunity and are available in industry-standard DIP and Flatpack packages.

Synergy plans to offer a complete family of the industry's fastest 1K, 4K, and 16K ECL RAMs as well as several specialized ASM (application-specific RAMs) memories.

Synergy also plans a series of ultrafast logic products in the future.

## OTHER INFORMATION

Synergy Semiconductor does not employ a PR firm.

# Taiwan Semiconductor Manufacturing Company, Limited

1F No. 9, Industriale E. 4th Road  
Science-Based Industrial Park  
Hsinchu, Taiwan  
(035) 961240  
Fax: (035) 942616

North American Office  
3150 Almaden Expressway, Suite 111  
San Jose, CA 95118  
408/978-1322  
Fax: 408/978-1365

ESTABLISHED: 1986

NO. OF EMPLOYEES: 300

## BACKGROUND

Taiwan Semiconductor Manufacturing Company, Limited, (TSMC) was formed to provide one-stop semiconductor manufacturing services including wafer fabrication, probing test, packaging, final test, and burn-in for a wide variety of ICs.

Taiwan's Executive Yuan, or legislature, earmarked funds from its development fund for a 48.0 percent stake in the Company. N.V. Philips has a 27.5 percent share in the \$150 million investment in TSMC and an option to purchase controlling interest in the Company. The remainder is held by other Taiwanese firms.

In 1987, Dr. Morris Chang, former president and chief executive officer of General Instrument Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan, was made chairman of TSMC. Dr. Chang is also chairman of United Microelectronics Corporation. Also in 1987, Jim Dykes joined TSMC as president and chief executive officer. Mr. Dykes had set up General Electric Company's Semiconductor Division. Stephen L. Pletcher, who had been vice president of sales and marketing for GE Semiconductor, was named director of a new North American and European marketing and sales operation of TSMC.

In early 1987, TSMC made its first wafer shipment from its facility, which is capable of producing 10,000 6-inch wafers per month. It is equipped to produce chips, using 1.5-, 2.0-,

and 3.0-micron CMOS and NMOS processes. TSMC began volume production in early 1988.

In December 1987, TSMC received approval to build a second manufacturing facility in Taipei, Taiwan. The new facility, which is scheduled for completion by year-end 1989, will cost about \$220 million and will nearly quadruple the Company's capacity. The planned 65,000-square-foot fab facility will have a production capacity of 30,000 6-inch wafers per month. It is designed for submicron processes; however, initial production will be done via a 1.2-micron process. In the future, TSMC plans to convert a portion of the capacity to 8-inch wafers and also to shrink its processes to the submicron level by 1990.

When the Company begins volume production, it expects approximately 25 percent of its production to be for Philips, 25 percent for Taiwanese firms, and the remainder for U.S. manufacturers.

## BOARD

Dr. Morris Chang, Chairman

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President/CEO  
Klaus Wiemer  
Texas Instruments



# Taiwan Semiconductor Manufacturing Company, Limited

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## VP Operations

F.C. Tseng  
ERSO

## VP Marketing

John Luke  
Monsanto Silicon, VP Sales

## VP Finance

Mient Vinenga  
Philips

## VP Admin

Eddie Mou  
Texas Instruments, Pacific Rim Sales

## FINANCING

1986

Round 1

\$48.0M

Executive Yuan Development Fund (48.3 percent), N.V. Philips (27.5 percent), China American Petrochemical, Formosa Chemicals & Fiber, Formosa Plastics, Nan Ya Plastics, Central Investment Holding Co., Asia Polymer Corp., China General Plastics, Mabuchi Taiwan, USI Far East Corp., Yao Hua Glass, ADI Corp., Tai Yuen Textile, Union Petrochemical

1988

Round 2

\$29.0M

Original investors

1988

Round 3

\$205.0M

Original investors

## OTHER INFORMATION

Taiwan Semiconductor's PR firm is Mastro Dagastine.

## ALLIANCES

### Philips

1986

N.V. Philips has a 27.5 percent share in the \$150 million investment in TSMC, with the remainder held by the government and Taiwanese firms. Philips has an option to purchase controlling interest in the Company.

## SERVICES

Foundry  
Assembly  
Packaging  
Test  
Burn-in

## MANUFACTURING

### Technology

3.0-micron silicon-gate NMOS and CMOS  
p-well  
2.0-, 1.5-, and 1.25-micron silicon-gate CMOS  
n-well  
6-inch wafers  
Submicron processes and 8-inch wafer compatibility planned by 1990

### Facilities

Taiwan

21,000 sq. ft.

Manufacturing, Class 1 and Class 10 clean rooms

A second \$220 million 65,000-square-foot facility is planned for completion in late 1989. The facility will have a production capacity of 36,000 6-inch wafers per month.

# Telcom Devices Corporation

914 Tourmaline Drive  
Newbury Park, CA 91320  
805/499-0335  
Fax: 805/499-8018

ESTABLISHED: 1986

NO. OF EMPLOYEES: 6

## BACKGROUND

Telcom Devices Corporation was formed in early 1986 to offer indium gallium arsenide (InGaAs) photodiodes and indium gallium phosphide (InGaP) light-emitting diodes.

Founders James Kim, Ock-Ky Kim, and Larry Perillo are former Rockwell engineers. Telcom Devices is a subsidiary of Opto Diode Corp. (ODC) and is operating from ODC's facilities in Newbury Park, California. Both companies share clean room and manufacturing space.

Telcom Devices began volume production of its first products in May 1986. The products were InGaAs PIN photodiodes for fiber-optic applications and included the Planar 13PD100 and Planar 15PD100.

## BOARD

Five members (James Kim is Chairman.)

## PRODUCTS

InGaAs Photodiodes and Long-Wavelength LEDs

## OTHER INFORMATION

Telcom Devices Corp. does not employ a PR firm.

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*James Kim  
Rockwell

### VP Engr

\*Ock-Ky Kim  
Rockwell

### Dir Opto Mtls

\*Larry Perillo  
Rockwell

\*Founder

## FINANCING

Not available

## MANUFACTURING

### Facilities

Newbury Park, CA  
10,000 sq. ft.  
Administration, manufacturing

## Three-Five Systems, Inc.

10230 S. 50th Place  
Phoenix, AZ 85044  
602/496-0035  
Fax: 602/496-0168

ESTABLISHED: April 1985

NO. OF EMPLOYEES: 235

### BACKGROUND

Historically, Three-Five Systems, Inc., produced and marketed custom and semicustom products that combine silicon and GaAs technologies for the consumer, industrial, telecommunications, and computer markets. The Company's main product thrust now is custom user interface modules utilizing LED, LCD, and keyboard components.

The Company is headquartered in a 40,000-square-foot facility in Phoenix, Arizona. The facility houses all corporate functions as well as a quick-turn prototype manufacturing area. In 1987, Three-Five consolidated its domestic operations in Phoenix, Arizona, and eliminated a facility in Troy, New York.

The Company was formed via a leveraged buyout of National Semiconductor's Optoelectronics business unit and was named Three-Five Semiconductor. The Company's founders are Frank Shroff, John Gragg, Dennis Riccio, Joe Riccio, and Brent Fox. Three-Five received acquisition funding, which was completed in December 1985, from Continental Illinois Venture Corporation (Chicago, Illinois) and OptoVen of Phoenix, an investment company formed specifically to invest in Three-Five.

In 1987, the Company changed its name from Three-Five Semiconductor Corporation to Three-Five Systems to reflect a shift from a front-end semiconductor emphasis to a broader systems approach. The Company has reorganized into two groups. The optoelectronics group supplies all existing and future standard products, and the display group is responsible for Application-Specific Integrated Displays (ASIDs) as well as other technologies that may be added. In September 1987, Three-Five raised \$5.5 million in second-round financing, which was used to expand its technical staff and facilities to support

the Company's thrust into new opto product areas. In March 1988, Three-Five initiated a further round of financing to support the Company's thrust into LCDs.

Currently, 400 products that were developed by the Company while it was a division of National are offered by Three-Five and include infrared and custom devices. New products include custom LCDs. In the long term, the Company will focus on PLCDs and GaAs-based products, optoelectronics (standard and custom), and integrated optoelectronic ICs. The Company will also focus on display systems, such as LED and LCD, with a higher degree of electronic control.

### BOARD

(Name and Affiliation)

David R. Buchanan  
Chairman

Kenneth M. Julien  
Vice President, Chief Financial Officer

Burt McGillivray  
Vice President, Continental Illinois Venture Corporation

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

David R. Buchanan  
Talos Systems (now Calcomp Digitizer Division), Founder/Chairman/CEO

#### VP Finance/CFO

Kenneth M. Julien  
CerProbe, VP/CFO

#### VP Quality

\*Joseph Riccio  
Motorola, Area Sales Mgr

## Three-Five Systems, Inc.

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### Dir Mktg/Sales

Norman E. Clarke

MCI Telecommunications, National Account  
Manager

### Dir European Ops

Martin Woolfenden

National Semiconductor, Marketing Manager

### Dir Manufacturing

Dr. Carl Derrington

Motorola, Prod Mgr. Sensors

### Dir Materials and Process Technology

Dr. Joseph Morrissy

Alcatel Information Systems, Manufacturing  
Manager

### Dir Engineering

Mike Petera

Alphasil, Elec Design Mgr

\*Founder

March 1988

Round 3

Sears Pension Trust

## MANUFACTURING

### Technology

Liquid Crystal

GaAs

### Facilities

Phoenix, AZ

40,000 sq. ft.

Prototype laboratories, corporate headquarters

Manila, Philippines

Manufacturing, inventory

Swindon, United Kingdom

European headquarters

## FINANCING

September 1987

Round 2

\$5.5M

Continental Illinois Venture Corporation,

National Semiconductor Corp., OptoVen

Partners

## PRODUCTS

Application-Specific Integrated Displays(ASIDs)

Custom User Interface Modules (Displays and Keyboards)

LCD Modules—Standard and Custom

Integrated Displays

Integrated LED Bar Graphs

Infrared

LED Dot Matrix Displays

Visible Lamps and LED Digits

Multidigit LED Displays

Keyboards

## OTHER INFORMATION

Three-Five Systems does not employ a PR firm.

## Togai InfraLogic, Inc.

30 Corporate Park, Suite 107

Irvine, CA 92714

714/975-8522

Fax: 714/975-8524

ESTABLISHED: August 1987

NO. OF EMPLOYEES: 14

### BACKGROUND

Togai InfraLogic, Inc., was founded in August 1987 for the sole purpose of developing fuzzy logic tools and applications. The Company was founded by Dr. Masaki Togai, Carl Perkins, and Rodney J. Corder. The Company is actively developing and marketing fuzzy logic development tools for the commercial market in Japan, North America, and Europe.

Fuzzy logic is a form of multivalued logic that makes it possible for computer-controlled products to make "shades of gray" decisions the way humans do, as opposed to the limited yes-or-no approach dictated by conventional computer logic. In August 1989, Togai InfraLogic introduced the FC110 Digital Fuzzy Processor, the world's first embedded AI processor. The FC110 is a flexible 10-mips RISC processor with a specialized instruction set for fuzzy logic processing targeted at real-time embedded applications such as color copiers and engine controllers. In September 1989, the Company introduced its AT Accelerator board for PC AT based on the FC110. The Company also offers two products designed to facilitate fuzzy logic expert system development—the Fuzzy-C Compiler and the TIL Shell. The latter is a graphical CASE tool for expert system development.

Togai's first major commercial project is a joint development program with Japan's Mitsubishi Heavy Industries to create the world's first fuzzy logic-controlled air conditioning system. The system is designed to outperform the existing PID control for heating/cooling time and overall stability. Designers also anticipate a significant savings in power use resulting from implementation of this system.

### BOARD

(Name and Affiliation)

Professor Lotfi Zaheh  
University of California, Berkeley

Frank Lundberg  
Rockwell—retired

### COMPANY EXECUTIVES

(Position, Name, and Prior Company)

#### President

\*Masaki Togai, PhD  
Rockwell

#### VP, R&D

\*Rodney J. Corder  
Rockwell

#### VP, Mktg

\*Carl Perkins  
Rockwell

#### Dir, Software Dev

Jon Terchrow  
N/A

\*Founder

### FINANCING

1987

Round 1

Less than \$1M

Corporations and private individuals

### RECENT HIGHLIGHTS

#### December 1988

Togai introduced its first fuzzy logic development product—the Fuzzy-C Compiler, a textual tool for developing fuzzy logic expert systems in portable C source code.

## **Togai InfraLogic, Inc.**

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### **May 1989**

Togai's first VLSI processor, rated at 160 million 16-bit operations per second, was released for image classification and sorting, the output of which is managed by fuzzy logic knowledge bases.

### **August 1989**

Togai introduced the FC110 Digital Fuzzy Processor, a 10-mips RISC processor with a specialized instruction set for fuzzy logic processing.

### **September 1989**

Togai introduced its AT accelerator board and its graphical CASE tool for fuzzy logic expert system development.

## **PRODUCTS**

Fuzzy-C Development System  
TIL Shell Graphical Expert System  
Fuzzy Logic AT Accelerator Board (based on its VLSI fuzzy processor)

## **OTHER INFORMATION**

Togai InfraLogic's PR firm is Bond Communications.

## **ALLIANCES**

### **Mitsubishi Heavy Industries**

September 1989

Togai and Mitsubishi Heavy Industries announced the joint development of an air conditioning system based on a fuzzy logic controller.

## **MANUFACTURING**

### **Technology**

Fuzzy logic; 1.5- and 1.0-micron CMOS

### **Facilities**

Irvine, CA  
5,000 sq. ft.  
Design, marketing

# Topaz Semiconductor Inc.

1971 North Capitol Avenue

San Jose, CA 95132-3799

408/942-9100

Fax: 408/942-1174

ESTABLISHED: March 1985

NO. OF EMPLOYEES: 37

## BACKGROUND

Topaz Semiconductor designs and manufactures advanced field-effect transistors (FETs) and CMOS/DMOS ICs. Topaz, a company representing a partial buyout of Semi-Processes, Inc. (SPI), was formed by Thomas Cauge and Bruce Watson. The purchase included DMOS transistor and certain IC designs, and wafer fabrication, test, and finishing equipment. Topaz later acquired the SPI facilities as the result of an agreement to be acquired by Hytek Microsystems, Inc., of Los Gatos, California.

Topaz Semiconductor operates as a wholly owned subsidiary of Hytek Microsystems. Hytek designs and manufactures thick-film hybrid microcircuits. In July 1985, Hytek purchased all the DMOS-related assets of SPI. Hytek's integration of the SPI assets with those of Topaz Semiconductor insures a continued source of SPI products, as well as contribution to the faster expansion of Topaz Semiconductor.

With the financial backing of Hytek, a significant number of new Topaz products has been added. These products include medium-power lateral DMOS discretes (high-voltage and ultralow-leakage n- and p-channel); vertical DMOS discrete products with 20-micron hex-to-hex spacing; and new CMOS/DMOS IC analog switch products for video switching applications. Topaz will focus on high-speed digital and precision analog switching applications for its lateral DMOS devices and on low- to medium-current relay-replacement applications for its vertical DMOS line. Topaz initially has integrated DMOS and CMOS on a single chip. Plans include integrating logic with both lateral and vertical DMOS to allow more user flexibility. Topaz also supplies standard and special high-reliability products that are tested to military requirements.

Topaz subcontracts assembly operations to companies in Thailand, Malaysia, and Taiwan.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Thomas Cauge  
Semi-Processes Inc., VP Opns

### Dir Marketing

\*Bruce Watson  
Semi-Processes Inc., Prod Mktg Mgr

### Dir Engineering

Paul Denham  
Semi-Processes Inc., Engr Mgr

### Dir Sales

Robert Vosburgh  
Marconi Instruments, Sales Mgr

\*Founder

## FINANCING

1985

Seed

\$1.5M

Private

## RECENT HIGHLIGHTS

### March 1987

Topaz offered the CDG2214N, an analog switch with a CMOS-compatible control input. The device combines CMOS and DMOS processes and switches analog signals of  $\pm 10V$  with CMOS logic levels.

# Topaz Semiconductor Inc.

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## April 1987

Topaz offered the CDG201B, a low-insertion-loss quad analog switch that is TTL-compatible and pin- and function-compatible with standard CMOS devices.

## April 1987

Topaz offered the CDG211CJ, a quad single-pole, single-throw analog switch with TTL-compatible control input.

## June 1987

Topaz offered the SD5400 series of DMOS analog switches in 14-lead, small-outline packages. Power dissipation is 546 milliwatts and the series operates from 0 to 70° centigrade.

## June 1987

Topaz offered the SD1202, a 200V, n-channel enhancement-mode vertical D-MOSFET with a high gate standoff of 100V.

## June 1987

Topaz offered the SD1500BD, a 600V enhancement-mode vertical D-MOSFET.

## January 1988

Topaz offered the CDG4460J, a 6-bit digital-controlled attenuator for video frequencies of 10.7 to 30.0 MHz, with attenuation of 0.25dB per step.

## February 1988

Topaz offered the SD220/SD221 series of 60V, 9-ohm/100V, 12-ohm n-channel enhancement-mode lateral D-MOSFETs for ultrahigh-speed display driver applications.

## ALLIANCES

### Hytek Microsystems

July 1985

Topaz was acquired by Hytek Microsystems and operates as a wholly owned subsidiary. Hytek and Topaz cooperate on development of precision, standard hybrid circuits.

## MANUFACTURING

### Technology

3.0-micron and 20.0-micron hex-to-hex spacing  
silicon-gate Vertical DMOS  
5-inch wafers  
Lateral DMOS (3-inch wafers)  
3.0-micron CMOS

### Facilities

San Jose, CA  
30,000 sq. ft. total  
20,000 sq. ft.  
Design, wafer fab, and test  
8,000 sq. ft.  
Class 10 clean room (underhood)

## PRODUCTS

Lateral DMOS FETs  
DMOS Power FETs  
DMOS FET Ultralow Leakage  
High-Voltage DMOS Power FETs  
Vertical DMOS FETs  
Dual-Gate DMOS FETs

DMOS FET Switches  
Ultrahigh-Speed, Low-Cost Switches  
Quad Monolithic SPST CMOS/DMOS Analog Switches  
Dual Monolithic SPST CMOS/DMOS T-Configuration Analog Switch



DMOS FETs 8-Channel Arrays  
Quad DMOS Power FET Arrays  
Quad DMOS FET Driver Arrays  
Quad DMOS FET Analog Switch Arrays  
FET Ultrahigh-Speed Dual Drivers  
4:1 Monolithic CMOS/DMOS Analog Multiplexers

**OTHER INFORMATION**

Topaz does not employ a PR firm.

# TranSwitch Corporation

8 Progress Drive  
Shelton, CT 06484  
203/929-8810  
Fax: 203/926-9453

ESTABLISHED: April 1988

NO. OF EMPLOYEES: 16

## BACKGROUND

TranSwitch was founded in April 1988 to develop telecommunication ICs. The Company will offer chip sets that facilitate synchronous optical network (SONET) multiplexing.

Multiplexing is a foundation of telecommunications data transmission. The purpose of multiplexing is to combine a number of signals into one higher-level signal to accelerate transmission speeds. For example, a T-1 line is the result of the combination of 24 voice channels. Twenty-eight T-1 signals may then be combined to form a T-3 line. Similarly, 24 voice channels are combined to form a DS-1 signal. Next, 28 DS-1 signals can be combined to form a DS-3 line. SONET uses DS-3 lines to build higher-level signals for transmission.

The Company is scheduled to introduce DS-3 VLSI devices in January 1990, followed by the introduction of SONET VLSI devices in April 1990. TranSwitch contracts outside firms for wafer fab and assembly operations. Devices are manufactured using a 1.5-micron CMOS process. TranSwitch has raised more than \$3 million in venture capital financing through two rounds. During the next three years, the Company plans to acquire \$4 million worth of capital equipment and expand its facilities to 20,000 square feet.

## BOARD

(Name and Affiliation)

Dr. S. Flashen  
Independent Consultant

Dr. S. Das  
President, TranSwitch Corporation

Dr. A. Paladino  
Partner, Advanced Tech. Ventures

Dr. C. Lee  
Partner, ABACUS Ventures

I. Wolff  
Partner, Rothschild Ventures

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Dr. S. Das  
Spectrum Digital, President

**Dir, R&D**  
D. Upp  
ITT, Dir, Exploration Sys

**VP, Mktg**  
J. Lane  
Telco Systems, VP, Engineering

**Dir, Finance**  
M. McCoy  
ITT, Controller, ITT-ATC

**Mgr, Ops**  
E. Linke  
Black & Decker, Manager

## FINANCING

**December 1988**  
Round 1  
\$1.7M  
Advanced Technology Ventures, Abacus Ventures, Transtech Ventures, Rothschild Ventures, Merrill Lynch Management Fund

**July 1989**  
Round 2  
\$2.5M  
Initial investors, Connecticut Seed Ventures

## ALLIANCES

None

# **TranSwitch Corporation**

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## **MANUFACTURING**

### **Technology**

1.5-micron CMOS, BiCMOS

### **Facilities**

Shelton, CT

6,500 sq. ft.

Design, test, marketing

## **PRODUCTS**

DS-3 VLSI Devices

SONET VLSI Devices

## **OTHER INFORMATION**

TranSwitch Corporation does not employ a PR firm.

# Triad Semiconductors International

5575 Tech Center Drive  
Colorado Springs, CO 80919  
1-800/228-1874  
Fax: 719/528-8875

ESTABLISHED: September 1988

NO. OF EMPLOYEES: 25

## BACKGROUND

Triad Semiconductors International (Triad) designs, develops, and markets specialty memory ICs for use in high-performance data and algorithmic processors, digital telecommunications and video applications, image/voice synthesis and recognition and other artificial intelligence applications, and advanced industrial instrumentation and control systems. Triad's high-performance specialty memories are based on CMOS technology, but the Company plans to use other technologies if and when appropriate.

The Company has defined 24 products. Initial products include a monolithic 256-color graphics palette chip with RAM and DAC on-chip and a 2Kx9 and 4Kx9 FIFO, 64Kx4 Fast Industry Standard (FIS) latched and registered version. Future product introductions will include a writable control store chip, 1Kx48 CAM, 128Kx8 cached DRAM, and a second-generation monolithic color graphics chip.

The parent company of Triad is registered in the Netherlands. The Company conducts back-end services, such as testing in the Netherlands, and plans to add design activities to serve the EEC market. The Company has a joint venture with Rood Testhouse in Europe to guarantee engineering and test capacity in exchange for business committed by Triad. Operations are centralized in the United States and headquartered in Colorado Springs, Colorado.

Triad has adopted a strategy of developing a worldwide network of corporate alliances with industrial partners to obtain core product designs and then applying its expertise to add value-enhancing features. In October 1987, Triad negotiated an alliance with a Japanese semiconductor manufacturer, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D. Triad

also has foundry alliances with AT&T and Seiko and plans additional alliances with a U.S. and a European company. Assembly is conducted by Lingsen in Taiwan and Swire in Hong Kong.

Applied Marketing Technology, based in the United Kingdom, has been signed as the Company's representatives in the EEC. Other representatives are being set up in the Far East and the United States.

## BOARD

(Name and Affiliation)

Pieter Niessen, Chairman  
Raymond Bullens  
Henk Van der Kwast

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Michael Burton  
Inmos, Mgr Commercial Ops

### Sr VP Sales/Mktg

Bruce Threewitt  
AMD, Dir Prod Dev

### CFO

Jop Van der Wiel  
Not available

\*Founder

## FINANCING

### 1985

Initial  
\$8.0M

AMRO Bank, founders, The Limburg Investment Bank, private placement, grants and subsidies from the Dutch government

# Triad Semiconductors International

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1986  
Round 2  
N/A  
LIOS

1987  
Round 3  
N/A  
Kempen Co.

## ALLIANCES

### Japanese Company

Triad negotiated an agreement with a Japanese semiconductor company, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D.

### AT&T

Triad signed a foundry alliance with AT&T, which is manufacturing the fast latched/registered pipelined memories.

## PRODUCTS

Product	Availability
256-Color Graphics Palette Chip	Q2 1988
16Kx4 Fast Industry Standard (FIS)	Q2 1989
64Kx4 FIS	Q3 1988
64Kx4 Latched and Registered Memory	Q4 1989
Writable Control Store	Q1 1989
1Kx48 LAN CAM	Q2 1990

## OTHER INFORMATION

Triad's PR firm is Ad-Infinitem.

### Seiko

Triad signed a foundry alliance with Seiko, which is manufacturing the monolithic color palette.

### Rood Testhouse

Triad signed an agreement with Rood Testhouse in Europe, guaranteeing engineering and test capacity in exchange for business committed by Triad.

## MANUFACTURING

### Technology

1.2- and 1.5-micron CMOS  
Double-metal, double-poly process  
Double-metal, single-poly process

### Facilities

Colorado Springs, CO  
15,000 sq. ft.  
Corporate headquarters, design  
The Netherlands  
25,000 sq. ft.  
European headquarters

# TriQuint Semiconductor, Inc.

Group 700  
P.O. Box 4935  
Beaverton, OR 97076  
503/644-3535  
Fax: 503/644-3198

ESTABLISHED: January 1984

NO. OF EMPLOYEES: 135

## BACKGROUND

TriQuint designs, develops, manufactures, and markets microwave, linear, and GHz digital GaAs IC components. TriQuint also offers a broad range of foundry services. The Company's products are used in high-performance applications such as fiber-optic telephone communication, high-speed computer interfaces, instruments, and military systems.

The Company evolved from research on GaAs ICs that began in Tektronix Laboratories in 1978. Several of TriQuint's founders were leaders on the Tektronix research team. In 1984, TriQuint was formally established as a majority-owned subsidiary with the entrepreneurial freedom to establish a broad portfolio of long-term manufacturing contracts.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Alan D. Patz  
Tektronix, GM GaAs ICs

### Dir Mktg/Sales

Dennis C. Powers  
Not available

### Mgr QA

Richard Allen  
Tektronix, Div Mfg Mgr

### VP R&D

Dr. Richard Koyama  
Tektronix, Technical Manager

### Dir Finance/Admin

Richard Sasaki  
Tektronix, Financial Mgr

### VP Mfg

Dr. Gordon Roper  
Tektronix, Principal Engr

### VP Digital & Linear Products

Dr. Ajit Rode  
Tektronix, IC Process Engr

### VP Microwave Prod

Philips Snow  
Not available

## RECENT HIGHLIGHTS

### November 1987

TriQuint offered the TQ3000, a 3,000-gate array that features 1,020 cells and 64 I/Os. The TQ3000, which can perform at up to 1 GHz, is produced with a 1-micron GaAs E- and D-MESFET process. The new array is supported by Daisy, Mentor, and Tek/CAE workstations.

### October 1987

TriQuint introduced the TQ6330, an ultrafast pin driver, and the TQ6331 line receiver pair.

### February 1988

TriQuint announced a radio-frequency/large-scale integration (RF/LSI) GaAs IC foundry service named the QED/A process.

### March 1988

TriQuint introduced the QLSI cell-based library, a GHz LSI cell-based library that supports LSI applications of up to 6,000 equivalent gates and toggle rates of up to 2 GHz.

# TriQuint Semiconductor, Inc.

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## May 1988

TriQuint is the first GaAs foundry to manufacture microwave and digital ICs on 4-inch wafers.

## May 1988

TriQuint announced an optimized 0.5-micron microwave foundry process.

## July 1989

TriQuint announced the shipment of wafers and die screened to U.S. Department of Defense Class 5 requirements, the first commercial IC manufacturer to announce availability of this level of screening—permitting satellite systems applications.

## ALLIANCES

### Tektronix

January 1984

Tektronix spun off TriQuint, remaining the parent company and completing a sales agreement with the new subsidiary.

### EEsof

May 1986

EEsof and TriQuint teamed up to incorporate TriQuint's GaAs custom MMIC foundry models into Touchstone, EEsof's minicomputer- and workstation-based MMIC CAD program. Jointly, they developed a GaAs MMIC element library that allows users to simulate microwave ICs, using MMIC components that model components available from TriQuint's custom MMIC foundry facility.

### TRW

June 1987

TRW Components and TriQuint agreed jointly to develop and supply class-S level GaAs devices for space applications. TriQuint will

provide microwave and digital GaAs technology in addition to foundry services.

### MSC

March 1988

Microwave Semiconductor Corporation and TriQuint agreed to provide customers with GDS-II tape interchangeability and equivalent performance for GaAs analog and digital ICs and MMICs.

### Hewlett-Packard

May 1988

TriQuint's MMIC Library of foundry design models are incorporated into Hewlett-Packard Company's microwave CAE design system.

### Gazelle Microcircuits

May 1988

Gazelle Microcircuits signed foundry contract with TriQuint for 4-inch digital wafer production.

## MANUFACTURING

### Technology

- 1.0- and 0.5-micron gate length depletion mode MESFET processes capable of fabricating D-MESFETs VIAs
- 1.0- and 0.5-micron gate length enhancement/depletion mode MESFET processes capable of fabricating E- and D-MESFETs
- 3-inch wafers
- 4-inch wafers

### Facilities

Beaverton, OR

35,000 sq. ft.

Administration, engineering, manufacturing

15,000 sq. ft.

Class 100 clean room

## PRODUCTS

### Foundry

1A/1D Process

1.0-Micron Gate Length Depletion Mode MESFET for D-MESFET, Schottky Diodes, Implanted Resistors, MIM Capacitors, and Airbridge Inductors

HA Process

0.5-Micron Gate Length Depletion Mode MESFET Process for Both 0.5- and 1.0-Micron D-MESFETs, Schottky Diodes, Implanted Resistors, Precision Nichrome Resistors, MIM Capacitors, and Airbridge Inductors

# TriQuint Semiconductor, Inc.

**QED Process** 1.0-Micron Gate Length Enhancement/Depletion Mode MESFET for E- and D-MESFETs, Schottky Diodes, Implanted Resistors, and Airbridge Inductors

**QED/A Process** An Enhanced Version of the QED Process that Allows the Mixing of Low-Power Digital LSI Circuits and Precision Analog Circuits on a Single Die

**3A Process** Optimized 0.5-micron microwave process

## Gate Arrays

Family	Linewidth	Delay	Gates
QLSI	1.0	0.15	2,000; 3,000; 4,000

## Cell-Based Library

Family	Cells
Q-Logic	1,000 Gates, Data Encoders/Decoders, MUX/DEMUX, Counters, Dividers, Prescalers
QLSI	8,000 Gates, ZFL Cells, SCFL Cell Family

## MMICs (Die and Components)

TQ9111	1- to 8-GHz Amplifier
TQ9141	1- to 10-GHz Power Divider
TQ9152	1- to 10-GHz SPDT Switch
TQ9161	1- to 10-GHz Variable Attenuator
TQ9121	0.5 to 20.0-GHz 10w Noise Amplifier
TQ9131	0.5 to 20.0 GHz Active Combiner

## Digital Products

TQ1131	Pgm 8:1, 16:1 MUX
TQ1132	Pgm 1:8, 1:16 DEMUX
TQ1133	4:1 MUX
TQ1134	1:4 DEMUX
TQ1135	12:1 MUX
TQ1136	12:1 DEMUX

## Linear ICs

TQ6330	Pin Driver
TQ6331	Line Receiver
TQ6111-D	8-Bit DAC, 600 Ms/S, Die Form
TQ6111-M	8-Bit DAC, 600 Ms/S, Ceramic Package
TQ6111-BI	8-Bit DAC, 600 Ms/S, Board Module, Instrumentation Version
TQ6111-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
TQ6112-D	8-Bit DAC, 1,000 Ms/S, Die Form
TQ6112-M	8-Bit DAC, 1,000 Ms/S, Ceramic Package
TQ6112-BI	8-Bit DAC, 1,000 Ms/S, Board Module, Instrumentation Version
TQ6112-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
EK-TQ6101	GIGADAC Evaluation Kit

## OTHER INFORMATION

TriQuint's PR firm is Hastings and Humble Public Relations.



# United Microelectronics Corp.

#3 Industrial Road  
Hsinchu City  
Taipei, Taiwan  
(035) 773131  
Telex: 31476 UMCHSC  
Fax: 035 774 767

ESTABLISHED: September 1979

NO. OF EMPLOYEES: 950

## BACKGROUND

United Microelectronics Corp. (UMC) offers gate array and standard cell design services in addition to consumer, telecommunications, memory, and microprocessor ICs. The Company was formed to commercialize ERSO's IC technology and is Taiwan's largest wafer foundry. UMC provides foundry services to major U.S. and domestic IC design companies.

In 1983, UMC funded Unicorn Microelectronics, a design center, in San Jose, California. National Microelectronic Corporation is the U.S. sales and distribution arm for UMC's foundry services and products.

In December 1987, UMC started construction of a \$170 million VLSI plant, with a planned capacity of 30,000 units of 6-inch wafers per month.

In 1987, UMC elected Dr. Morris Chang chairman. Dr. Chang is also the chairman of Taiwan Semiconductor Manufacturing Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan. Dr. Chang was a vice president at Texas Instruments and chief executive officer at General Instrument Corporation.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Robert H.C. Tsao  
ERSO, VP Operations

### VP Operations

Alex I.D. Liu  
ERSO, Production Manager

### VP Marketing

John Hsuan  
ERSO, Marketing Manager

### R&D Director

M.K. Tsai  
ERSO, Design Manager

### Plant Director

Hyley Huang  
ERSO, Process Manager

## FINANCING

### 1979

Round 1  
\$12.5M

Bank of Communications, China Development Corp., Kuang Hua Investment Co., Ministry of Economic Affairs, Orient Semiconductor, Sampo, Teco, Walsin-Lihwa Electric Wire & Cable, Yao Hua Glass Co.

### July 1985

Round 2  
\$7.5M  
Initial public offering

## RECENT HIGHLIGHTS

### November 1986

National Semiconductor filed a suit against UMC charging theft of trade secrets, fraud, breach of contract and fiduciary obligations, unfair competition, conversion, interference, and conspiracy. The suit concerns the marketing by UMC of a real-time clock part and

## United Microelectronics Corp.

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a UART, which National claims was based on designs received from National under a fab agreement. National is seeking \$10 million in damages. UMC filed a countersuit against National in the United States, alleging that National has made false statements in an effort to interfere with UMC's economic relationships.

### December 1987

UMC started construction of its \$170 million VLSI plant II, with a planned capacity of 30,000 units of 6-inch wafers per month.

### January 1988

UMC reported fiscal 1987 sales of \$90 million.

## ALLIANCES

### ERSO

1979

ERSO granted UMC a license for design and process technology for 4-inch silicon wafers.

### AMI

April 1983

Dialer ICs were produced in cooperation with AMI. UMC is also a second source for AMI's products and 5-micron silicon-gate CMOS in Asia.

### Unicorn

January 1985

UMC funded Unicorn for \$2.5 million.

June 1985

UMC and Unicorn agreed to jointly develop a standard cell library and to design cells for data path, memory, I/O, random logic, and complex logic.

### Honeywell/Synertek

July 1985

UMC gained nonexclusive product licenses for 18 ICs formerly produced by Synertek and purchased some Synertek production equipment and inventory from Honeywell. Products covered in this agreement included 4K and 16K SRAMs and 8K, 16K, and 32K ROMs.

Honeywell received \$3 million plus royalties of 3 to 5 percent over the next three years.

### MOSel

October 1985

MOSel transferred rights to a high-speed 2Kx8 SRAM and EEPROM to UMC, additionally providing 1.5- and 2.0-micron processes that were used to bring up the 2-micron CMOS process at UMC.

### TRW

April 1986

UMC successfully developed 1.25-micron VLSI products with TRW.

### SMC

June 1986

UMC signed a contract with SMC to cooperate on a computer IC.

## SERVICES

Design—Gate arrays, standard cell, full custom  
Foundry—CMOS  
Prototype Manufacturing  
Production Manufacturing

## MANUFACTURING

### Technology

5.0- and 2.0-micron silicon-gate NMOS  
3.0- to 1.2-micron single/double metal/poly CMOS  
5.0-micron silicon-/metal-gate CMOS  
18V high-voltage CMOS  
10V poly capacitor analog CMOS  
2.0-micron CMOS EPROM  
4-inch wafers

### Facilities

Taiwan  
92,000 sq. ft.  
Total space  
17,000 sq. ft.  
Wafer fab

## PRODUCTS

### Memory

512x9 and 1,024x9 Parallel FIFOs, ROMs in 4Kx8, 8Kx8, 16Kx8, and 32Kx8 configurations, High-Speed SRAMs in 1Kx4, 2Kx8, 16Kx1, and 4Kx4 configurations, and a 1Kx4 SRAM

### Consumer ICs

Melody Generators, CMOS Calculator, Timer, Clock, and Watch Chips, Voice Control IC, Speech Synthesizer, Encoder/Decoder, Dimmer

### Microcomponents

8-Bit Single-Chip MCUs, 8-Bit MPU, CRT Controller, Video Attributes Controller, Disk Controller, Double-Row Buffer, Floppy Disk Separator, Bus Controllers, RTC, ACIA, VIA, PIA, RAM I/O Timer Array, DUART, EPCI IC, Programmable Interval Timer, Programmable Interrupt Controller, Programmable Peripheral Interface, Clock Generator and Driver, Capacitance Keyboard Encoder

### New Microcomponent Products

System, I/O and FDC Support Chips for PS/2 Model 30, Single-Chip MCGA, Single-Chip FDC for PS/2 Model 30, Two Serial Ports and One Parallel Port, Advanced ACE, CMOS ACE, COS ACE, Single-Chip Monochrome Graphics Adapter, Single-Chip MGA and CGA, Micro Channel Interface Chip, SCSI Bus Controller

### Data Converter ICs

3.5-Digit A/D Converter, Digit A/D Converter, CMOS DAC

### Telecommunications

Simple Pulse Dialer, Repertory Pulse Dialer, Simple Tone Dialer, Tone/Pulse Dialer, T/P Redialer, Repertory T/P Dialer, Slave T/P Dialer, Direct Access Adapter, Crosspoint, DTMF Receiver

### ASICs

Mask Programmable Logic Arrays

### Gate Arrays

3-microns, 300 to 920 gates; 2-microns, 1,200 to 3,000 gates

### Cell-Based Libraries

3.0-Micron, 1 Layer Poly, 1 Layer Metal  
2.0-Micron, 1 Layer Poly, 1 Layer Metal  
1.5-Micron Series, 1 Layer Poly, 2 Layers Metal

### Silicon Compilers

Data Path Module, PLA Module, PAD Module, FIFO Module, RAM Module, ROM Module, Random Logic Module, and User-Specific Module

## OTHER INFORMATION

UMC does not employ a PR firm.

# United Silicon Structures

1971 Concourse Drive  
San Jose, CA 95131  
408/435-1366  
Fax: 408/435-0504

**ESTABLISHED:** September 1987

**NO. OF EMPLOYEES:** 25

## BACKGROUND

United Silicon Structures (US2) was founded in September 1987 by European Silicon Structures (ES2) to serve the U.S. ASIC market by delivering quick-turn, low-cost prototypes and low-volume production runs. US2 perceives the ASIC market as developing to the point where many customers require many different designs with low-volume requirements of each part type. The Company believes that market opportunity is being created for a new type of service-oriented company dedicated to manufacturing prototypes and small production series.

US2 utilizes an e-beam process for direct write production. Fabrication currently is conducted by US2's sister company, ES2, which operates two e-beam systems in a 100,000-square-foot plant in Rousset, France. The technology employed by US2 is compatible with the most popular CAE and CAD platforms, such as those of Mentor Graphics, Cadence Design Systems, and Silicon Compiler Systems. When volume production is required, the company makes use of its foundry contracts with Philips, Signetics, and TSMC.

First-round funding was provided by Advent International; Concord Partners; and Mohr, Davidow Ventures in the amount of \$4.52 million. This venture capital investment represents a 30 percent equity investment in the Company. In addition, ES2 holds 40 percent of the equity stake, while the remaining 30 percent is reserved for US2's key employees.

Within the next three years, US2 will install a North American fab facility. The fab is designed to service the prototyping and low-volume marketplace. US2's new fab facility will also employ an e-beam write-on process.

## BOARD

(Name and Affiliation)

Henri Jarrat  
United Silicon Structures, President/CEO

William Davidow  
Mohr, Davidow Ventures, General Partner

Irwin Federman  
Dillon, Reed & Company, Managing Director

David Brown  
Advent International, Senior Vice President

Jean-Luc Grand-Clement  
European Silicon Structures, Chairman

Werner Koepf  
European Silicon Structures, President/CEO

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO/Chairman

Henri Jarrat  
VTI, President

### Executive VP

Jim Ellick  
CAECO, President

### VP Customer Eng

Ian Mackintosh  
VTI, Dir West Coast Tech Centers

### VP Mktg

Jacques Castaillac  
European Silicon, VP Sales & Mktg Structures

### Dir Customer Eng

Timothy O'Donnell  
National Semiconductor, ASIC App Mgr

### Dir R&D

Robert Heaton  
European Silicon, Design Ctr Mgr Structures

# United Silicon Structures

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## FINANCING

March 1989

Initial

\$4.5M

Advent International; Concord Partners; Mohr,  
Davidow Ventures

## ALLIANCES

### European Silicon Structures

European Silicon Structures is a sister company with which United Silicon Structures shares technology. Partnership agreements are with large volume silicon manufacturers such as National Semiconductor, Philips, Signetics, and TSMC.

## PRODUCTS

Silicon Prototype Services  
Low-Volume Silicon Production  
Entry Level Design Software

## OTHER INFORMATION

US2's PR firm is Miller Communications.

## SERVICES

ASIC prototypes

Low-volume ASIC production

## MANUFACTURING

### Technology

CMOS, n-well, single poly, double metal

2.0 micron

1.5 micron

1.2 micron

1.0 micron (available in 1990)

### Facilities

Rousset, France

100,000 sq. ft.

Manufacturing, test, assembly

## Vadem

1885 Lundy Avenue, Suite 201  
San Jose, CA 95131  
408/943-9301  
Fax: 408/943-9735

ESTABLISHED: 1983

NO. OF EMPLOYEES: 17

### BACKGROUND

Vadem, founded in 1983 by Chikok Shing and Henry Fung, designs, develops, and markets integrated circuits used in DOS-compatible systems. Vadem provides logic chip sets that offer PC XT compatibility, as well as application support chips that add to the core logic and enhance the use of the PC architecture in embedded control applications. Vadem targets the large class of products that incorporate a PC-compatible architecture in the control of computer-based equipment.

Vadem core logic chip sets focus on integrated processors from Intel and NEC, which typically serve the embedded control marketplace. Vadem offers a core logic chip set for the 80186/80C186 processor, which offers performance ranging from 8 to 16 MHz. Vadem's core logic chip sets for the NEC V-40 provide a very low cost PC XT solution at clock speeds of up to 10 MHz.

Vadem's application support chips focus on providing high levels of integration, which lower component count and reduce power consumption for products that use the PC architecture for embedded computer control. Applications that can make excellent use of the PC architecture for embedded controllers include portable or handheld terminals; market-specific terminals such as point-of-sale terminals, ATMs, and ticket and vending machines; PC-compatible intelligent terminals or network workstations; industrial and machine control systems; telecommunications; and home electronics.

Vadem also is involved in many design projects for major corporations. In 1984, Vadem designed the first battery-operated PC-DOS system for Morrow Designs. A modification of this design was licensed to Zenith and became the Z-171 laptop computer. Vadem has established design relationships with Sharp Electronics and Zenith Corporation in the PC area. Vadem currently is

working on additional design projects that will result in new products such as a complete PC engine on a single chip.

### BOARD

(Name and Affiliation)

- \*Chikok Shing  
Vadem, Chairman/CEO
- \*Henry Fung  
Vadem, Vice President of Engineering
- Bob Dilworth  
Metrocom, Inc., CEO
- Samuel Fang  
General Electronics, Inc., Hong Kong,  
Managing Director
- JJ Guo  
SIS, Taiwan, President

### COMPANY EXECUTIVES

(Position, Name, and Prior Company)

- Chairman, CEO
- \*Chikok Shing  
Osborne Computer Corp.
- VP Eng
- \*Henry Fung  
Intel Corporation
- Dir Mktg  
Barney Ichikawa  
David Systems
- Dir ASIC Dev  
Siu Tsang  
Intel Corporation
- Dir Software Eng  
Rich Peters  
Seitor Corporation
- NA Sales Manager  
Howard James  
Prolog Corporation
- \*Founder

# Vadem

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## FINANCING

Vadem is privately held and was funded initially by its founders; the founders and other employees own more than 80 percent of Vadem stock.

## ALLIANCES

Intel

March 1988

Vadem and Intel signed an agreement in which Intel made a small up-front investment in an IBM Model 30 and PC XT-compatible chip set that Vadem is developing.

Intel

September 1988

Vadem and Intel signed a second strategic

alliance focused on Vadem's Model 30 and PC XT-compatible chip set. Under the terms of the five-year agreement, Intel's sales force will refer customers to Vadem for the chip set. Vadem, meanwhile, will market the chip set independently.

## MANUFACTURING

### Technology

CMOS

### Facilities

San Jose, CA

6,000 sq. ft.

R&D, test, marketing

## PRODUCTS

Intel 80C186 Support Products

NEC V-40 Support Products

Application Support Chips

## OTHER INFORMATION

Vadem does not employ a PR firm.

# VIA Technologies, Inc.

(Formerly LOGICSTAR)

4160 B Technology Drive

Fremont, CA 94538

415/651-2796

Fax: 415/659-9057

ESTABLISHED: 1987

NO. OF EMPLOYEES: 20

## BACKGROUND

VIA Technologies, Inc., was formed to design, manufacture, and market high-performance VLSI graphics and local area network (LAN) chips. The Company is addressing the PC AT market and is using a VLSI design methodology to bring products to market quickly.

The Company's initial products are a five-chip PC AT chip set that is pin-for-pin compatible with Chips & Technologies' chip set, a monographics controller, a memory mapper, a dual-channel NRZI encoder/decoder, and a Starlan interface chip. In April 1988, VIA Technologies, Inc., began volume shipments of its chip sets. Future products will include a VGA chip, 386 chip sets, additional disk communications chips, and disk controllers.

The Company has set up joint ventures for design with companies in Japan, Korea, and Taiwan. These agreements may be extended to include manufacturing and marketing at a future time. Foundry services are being provided by companies in the United States, Europe, and Japan.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman, CEO

Don Brooks

Fairchild, President

VP Oper/CFO

Mark Kaleem

OSM Computer, President

VP Engr

Idris Kothari

VLSI, N/A

VP Sales/Mktg

Peyton Cole

Fairchild, N/A

## FINANCING

March 1989

Financing was provided by Fujitsu as part of the strategic alliance covering chip sets for Sun-compatible workstations.

## ALLIANCES

Fujitsu

March 1989

VIA Technologies announced a strategic partnership with Fujitsu Microelectronics to codevelop peripheral chip sets for Sun-compatible workstations.

## MANUFACTURING

### Technology

1.3-micron, double-metal CMOS

### Facilities

Fremont, CA

5,000 sq. ft.

Administration, design



# VIA Technologies, Inc.

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## PRODUCTS

### Current Products

Device	Description
SL2002	Dual-Channel NRZI Encoder/Decoder
SL600X	80286-Based PC AT Chip Set
SL6001	PC AT System Controller
SL6002	PC AT Memory Decode
SL6003	PC AT System Buffer-1
SL6004	PC AT System Buffer-2
SL6005	PC AT System Buffer-3
SL6003C	PC AT System Buffer-1
SL6004C	PC AT System Buffer-2
SL6005C	PC AT System Buffer-3
SL6002A	PC AT Advanced Memory Controller
SL6012	PC AT Memory Mapper
SL5001	Parallel Printer Port
SL5002	Parallel Printer Port with Crystal Oscillator
SL7001	Monographic Controller
SL4000	Starian Interface

### New Products

SL9090	Universal AT Clock Chip
SL9091	Video Clock Chip
SL90XX	FlexSet, PC AT Core Logic (80286/80386SX/80386)
SL9010	System Controller
SL9020	Data Controller
SL9025	Address Controller
SL9030	Universal Peripheral Controller
SL9X5X	PC AT Memory Controllers
SL9150	80286-Based Page Mode
SL9155	80286-Based Cache-Based
SL9250	80386SX-Based Page Mode
SL9255	80386SX-Based Cache-Based
SL9350	80386-Based Page Mode
SL9355	80386-Based Cache-Based

## OTHER INFORMATION

VIA Technologies does not employ a PR firm.

**Vitellic Corporation**  
3910 North First Street  
San Jose, CA 95134-1501  
408/433-6000  
Fax: 408/433-0331

**ESTABLISHED: December 1983**

**NO. OF EMPLOYEES: 180**

## **BACKGROUND**

Vitellic designs, develops, manufactures, and markets high-performance specialty memory devices based on 1.2-micron CMOS manufacturing technology. The Company specializes in application- and customer-specific memory devices. Vitelic was founded by Alex Au, former director of VLSI research at Fairchild Camera and Instrument Corporation.

In 1987, Vitelic established a customer-specific memory business to serve the needs of board-level and system designers. The focus of this department is on supermini, supermicro, and high-performance workstations, as well as graphics and image-processing products.

Vitellic contracts all manufacturing to several Asian manufacturers through various licensing agreements.

## **BOARD**

(Name and Affiliation)

Alex Au  
Vitellic Corporation, President/CEO

Teruaki Aoki  
Sony Corporation, Deputy Senior General Manager

Neill Brownstein  
Bessemer Venture Partners, L.P., General Partner

Kazuo Inamori  
Kyocera Corporation, Chairman

Harry Marshall  
J.H. Whitney & Company, General Partner

David Wang  
Syntek Design Tech Ltd., General Manager

Kunnan Lo  
Kunnan Enterprises Ltd., Founder

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President/CEO**

\*Alex Au  
Fairchild, Dir Research

### **Exec VP**

Will Kauffman  
Intel, VP Quality & Rel

### **VP Sales/Mktg**

Gary Ater  
NMB, VP/GM US Ops

### **VP R&D**

Michael Barry  
Fairchild, Dir CMOS/VLSI Lab

### **SR VP Sourcing Relationships**

John Seto  
Hyundai, Dir Operations

### **SR VP/CFO**

Arthur Wang  
Raychem, GM Malaysia and Thailand

### **SR VP VTC**

Hsing Tuan  
Fairchild, N/A

### **SR VP/GM Taiwan Operations**

Chun Ho  
Exel, Dir Tech Development

### **SR VP Corp Mktg**

James Koo  
Synertech, Dir of Memory Products

### **VP Finance**

Henry Shaw  
Talen Group, Mktg/Sales Director

### **VP General Counsel. Asst. Secretary**

Martin Baker  
Wilson, Sonsini, Goodrich & Rosati, Counselor

### **VP GM SRAM Group**

Raymond Wang  
Victory Computer, President/CEO

# Vitellic Corporation

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## FINANCING

**March 1984**

Seed

\$7.0M

Bessemer Venture Partners, INCO Securities Corp., Kyocera International, Oak Investment Partners, Oxford Venture Fund, Waverley Vencap, J.H. Whitney

**August 1985**

Round 1

\$7.2M

Original investors, Pathfinders Chappell, Sony Corporation

**August 1987**

Round 2

\$2.0M

Bessemer Venture Partners, INCO Venture Capital Management, Kyocera, Oak Investment Partners, Oxford Venture Fund, Sony, Waverley, J.H. Whitney

**January 1989**

Round 3

\$39.0M

Western Digital Corp., Sigma Designs, Hambrecht & Quist Venture Partners, Genoa Systems Corp., Societe Nationale Elf Aquitaine, Mitsui & Co. Ltd., and others

## RECENT HIGHLIGHTS

**April 1989**

Vitellic signed both Schweber Electronics and Almac Electronics as authorized Vitelic distributors. Almac is the major distributor in the Northwest and Schweber is the number three distributor in the United States.

**May 1989**

Vitellic introduced the V63C64, a high-speed 8Kx8 SRAM device with access times of 25ns and an output enable time of 9ns. The full CMOS part is designed for use in cache memory applications in high-end 80386-based PCs and workstations.

**July 1989**

Vitellic introduced the V53C261, a high-performance 64Kx4 video RAM that clocks

256 four-bit words at a serial rate of 33 MHz and has an access time of 80ns.

**August 1989**

Vitellic introduced the V63C329, an 8Kx16 cache data RAM designed for use in large-capacity cache memory applications from 64 Kbytes to 256 Kbytes, for high-performance PCs and workstations.

## ALLIANCES

**Kyocera**

March 1984

Kyocera participated in the first-round financing of Vitelic.

**ERSO**

May 1984

ERSO and Vitelic agreed to codevelop EPROMs and 64K and 256K CMOS DRAMs.

**Sony**

June 1985

Vitellic and Sony signed an agreement giving Sony access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity.

**NMB**

July 1985

Vitellic granted a license for its 1Mb DRAM to NMB in exchange for one-third of NMB's plant capacity.

**Hyundai**

July 1985

Hyundai obtained a license to produce Vitelic memory products in exchange for manufacturing capacity. Vitelic memory products include 64K, 256K, and 1Mb CMOS DRAMs and 16K CMOS SRAMs.

**Philips**

March 1986

Philips and Vitelic agreed to a broad-ranging agreement that gave Vitelic access to Philips' process technology. In exchange, Vitelic would design a family of high-performance CMOS SRAMs for manufacture, use, license, and sale by both companies (expired).

## Sanyo

October 1986

Sanyo and Vitelic would jointly develop a high-speed 64K SRAM family. Sanyo would manufacture the SRAMs, using 1-micron process technology. The agreement includes the manufacture of the products that Vitelic designs for Philips, using Philips' process developed by Tokyo Sanyo.

## Facilities

San Jose, CA

33,000 sq. ft.

Headquarters and design

Taiwan

Under construction

Engineering and test

Japan

N/A

Sales location

## MANUFACTURING

### Technology

2.0- to 1.0-micron CMOS (n-well)

VICMOS III

## PRODUCTS

	Device	Organization	Access Time
CMOS DRAM	V53C256/258	256Kx1	70-100ns
	V53C466/464	64Kx4	70-100ns
	V53C100/102	1Mbx1	80-100ns
	V53C104/105	256Kx4	80-100ns
CMOS SRAM	V63C64	8Kx8	25-45ns
	V61C16	2Kx8	35-70ns
	V61C68	4Kx4	35-55ns
	V61C6	16Kx1	35-55ns
Dual-Port RAM	V61C32	2Kx8	55-90ns
FIFO	V61C01	512x9	25-65ns
	V61C02/3	1Kx9	25-65ns
Video RAM	V53C261	64Kx4	80-100ns
Cache Data RAMs	V63C328	8Kx16	35ns
	V63C308	4Kx16	35ns

## OTHER INFORMATION

Vitellic's PR firm is Thomas Mahon and Associates.

# Vitesse Semiconductor Corporation

741 Calle Plano  
Camarillo, CA 93010  
805/388-3700  
Fax: 408/433-0331

ESTABLISHED: July 1984

NO. OF EMPLOYEES: 103

## BACKGROUND

Vitesse Semiconductor Corporation designs, manufactures, and markets cost-effective digital gallium arsenide (GaAs) large-scale ICs for the high-performance marketplace and offers foundry services on a contract basis. Products are manufactured using enhancement/depletion mode transistors and self-aligned gate technology according to silicon manufacturing techniques. The Company's first products were commercial versions of a family of GaAs ICs, including gate arrays, RAMs, and logic products.

Initially, the Company was organized into two divisions—the Integrated Circuits Division, which was responsible for GaAs IC designs, and the Digital Products Division, which was developing a minisupercomputer product. Early in 1987, the Integrated Circuits Division raised \$10 million, establishing an independent company, and was renamed Vitesse Semiconductor Corporation. Dr. Louis Tomasetta, formerly president of the IC Division, is president and CEO of the new company. Dr. Tomasetta was director and program manager of the \$40 million DARPA GaAs pilot program at Rockwell International.

Vitesse remains in the existing 45,000-square-foot facility and will use the additional funding raised in 1987 to develop additional products and expand into higher-volume production. The building is designed specifically for the production of LSI-level digital ICs in GaAs. Approximately 12,000 square feet have been designated as clean room area, and half of that area is a Class 10 clean room.

In March 1987, Pierre R. Lamond was elected chairman of the board. Mr. Lamond organized the \$10 million financing of Vitesse Semiconductor and also serves on the boards of Convex

Computer, Cypress Semiconductor, and several other private companies. In October 1987, Dr. T.J. Rodgers, president and CEO of Cypress Semiconductor Corporation, joined the board of Vitesse Semiconductor.

Vitesse has established a nationwide network of manufacturers' representatives to sell its foundry services and products. In June 1987, Vitesse signed Zeus as its first distributor to sell its 29G00 family of products.

## BOARD

(Name and Affiliation)

Pierre R. Lamond, Chairman  
Sequoia Capital, General Partner  
Dr. T.J. Rodgers  
Cypress Semiconductor Corp., President  
Jim Cole  
Spectra Enterprise Assoc., Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Dr. Louis Tomasetta  
Rockwell, Dir R&D Center

### Executive VP

\*Patrick Hoffpauir  
VLSI Technology, GM ASIC Ops

### VP Marketing/Sales

David Mooring  
Intel, Mktg Mgr

### VP Sales

Neil Rappaport  
AMCC, Ntl Sales Mgr

### VP Engineering

\*Ira Deyhimy  
Rockwell, Mgr IC Engr

# Vitesse Semiconductor Corporation

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## VP Operations

James Mikkelson  
Hewlett-Packard, Mgr Process Dev

## VP Finance/CFO

Michael A. Russell  
Avicon Intl, VP Finance/CFO

\*Founder

## FINANCING

### February 1987

Round 1  
\$10.0M

Bryan & Edwards; New Enterprises Assoc.;  
The Norton Company; Oxford Venture Corp.;  
Robertson, Colman & Stephens; Sequoia  
Capital; Spectra Enterprises; Walden Capital;  
J.H. Whitney

### January 1988

Round 2  
\$8.1M

Previous investors; Hook Partners; Mohr,  
Davidow Ventures; Morgenthaler Ventures;  
Oak Investment Partners; Singapore  
Development Board

### April 1989

Round 3  
\$7.3M

Previous investors, Aeneas Venture Corp.,  
Security Pacific Capital Corp., Hughes  
Investment Management Co., New Venture  
Partners

## RECENT HIGHLIGHTS

### June 1987

Vitesse offered GaAs versions of the 2900  
family of slice processors, produced through  
a licensing agreement with Advanced Micro  
Devices.

### September 1987

Vitesse offered its first digital GaAs ICs fabri-  
cated with an E- and D-MESFET transistor  
process. They include a family of 1,500- and  
4,500-gate arrays. The arrays are tailored for  
telecom fiber-optic MUX/DEMUX, computer,

backplane, tester, and instrumentation  
applications.

Vitesse also offered the VS12G22E, a 256x4  
SRAM with an access time of 3ns. The device  
is ECL RAM compatible, has 1.5-watt power  
dissipation, and is radiation hardened.

### October 1987

Vitesse announced that Dr. T.J. Rodgers,  
President/CEO of Cypress Semiconductor,  
had joined the board of directors.

### January 1988

Vitesse introduced the VS8001, a 1.25-GHz  
12-to-1 multiplexer, and the VS8002 1-to-12  
demultiplexer with ECL-compatible parallel I/O.  
The devices offer 12-bit parallel-to-serial and  
serial-to-parallel data conversion for communi-  
cations applications. A unique feature is a self-  
test path designed to allow the devices to test  
each other.

### March 1988

Vitesse announced that it has developed the  
VS8010, a MUX/DEMUX with control logic  
that meets the Synchronous Optical Network  
(SONET) standard at the 1.2-Gbit per second  
(Gbps) communications rate.

### November 1988

Vitesse announced the world's first GaAs VLSI  
product, a 10,000-gate array, the VSC 10000.

### January 1989

Vitesse announced a GaAs 22,000-gate array  
using standard cells.

### August 1989

Vitesse announced shipment of its VSC10K  
GaAs gate array to E-Systems for that com-  
pany's high-performance digital signal processor  
series.

## ALLIANCES

### Norton

#### July 1984

The initial investment of \$30 million in Vitesse  
was provided by the Norton Company, a  
\$1.3 billion company of Worcester,  
Massachusetts.

# Vitesse Semiconductor Corporation

## Advanced Micro Devices

November 1985

Vitesse and Advanced Micro Devices (AMD) agreed to develop and manufacture AMD's AM2900 family of MPUs in gallium arsenide.

## TRW

December 1986

Vitesse signed a sales and marketing agreement with TRW Components International Inc. (TRWCI) covering logic, memory, and ASIC products. Vitesse will supply high-performance wafers, die, and packaged devices to TRWCI, which will assemble, test, qualify, and sell to the space-quality, Class-S level market. The companies will also cooperate to solve the radiation problems found in logic and memory products.

## E-Systems

August 1987

Vitesse signed an agreement allowing E-Systems to use Vitesse's proprietary GaAs technology in its current and future programs. E-Systems also has an option to purchase design, packaging, and test technologies. The agreement allows Vitesse to participate in the EW systems market through E-Systems' military programs.

## VLSI Technology

September 1987

Vitesse will develop a GaAs cell library for VLSI's design tools. VLSI will provide technical information and assist in the porting effort.

When the library is completed, both companies will market the tools, which Vitesse will use internally. VLSI will extend the tools to its silicon compiler library; Vitesse will own the library and provide fabrication.

## Ford Microelectronics

October 1987

Vitesse and Ford Microelectronics agreed to second-source each others' IC foundry services. The companies will develop common design rules.

## Fujitsu

November 1989

Vitesse and Fujitsu Ltd. announced an alternate-source agreement with regard to Vitesse's FURY GaAs VLSI gate array family.

## MANUFACTURING

### Technology

GaAs E/D MESFET  
0.8-1.25 microns  
3-inch wafers

### Facilities

Camarillo, CA  
45,000 sq. ft.  
Total space  
10,000 sq. ft.  
Class 10 clean room

## PRODUCTS

### Foundry

LSI Enhancement/Depletion Mode Process, 0.8-Micron Feature Size, Sub-100ps Gate Delays, 3-layer metal

	Device	Description
Gate Arrays	VSC1500	Structured Cell Array
	VSC4500	Gate Array
	VSC10K	Gate Array
	VSC15K	Gate Array
	VCB50K	Standard Cell
SRAMs	VS12G422E	256x4 SRAM, 3, 4, 5ns
	VS12G422T	256x4 SRAM, 4, 6, 8ns, TTL I/O
	VS126476	4Kx1 SRAM 2.5ns Self-Timed

## Vitesse Semiconductor Corporation

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	<b>Device</b>	<b>Description</b>
Microcomponents	VS29G01	4-Bit Slice Processor
	VS29G02	Look-Ahead Carry Generator
	VS29G10	Microcontroller
Standard Products	VS8001	12:1 MUX at 1.2 GHz
	VS8002	1:12 DEMUX at 1.2 GHz
	VS8010	SONET MUX/DEMUX
	VS8004	4:1 MUX at 2.5 Gbps
	VS8005	1:4 DEMUX at 2.5 Gbps

### OTHER INFORMATION

Vitesse's PR firm is Capitol Relations, Inc.



**VTC Incorporated**  
2401 East 86th Street  
Bloomington, MN 55425-2702  
612/851-5200  
Fax: 612/851-5199  
Telex: 857113

**ESTABLISHED: May 1984**

**NO. OF EMPLOYEES: 460**

**BACKGROUND**

VTC Incorporated designs, manufactures, and markets a broad line of high-performance linear and digital ICs, using bipolar and CMOS process technologies. The Company also offers a wide range of semicustom and custom ASICs, as well as a portfolio of standard products for the aerospace, telecommunications, and computer markets.

In the linear area, products include linear signal-processing (LSP) devices and mass storage devices. The signal-processing devices include very fast operational amplifiers, buffers, comparators, transconductance amplifiers, and sample/hold and data converters. These products are the highest-performance products in their respective classes, rivaling expensive hybrid circuits. In the mass storage area, the Company offers a full line of preamplifiers, data separators, channel devices, voltage-controlled oscillators, and tape drive servo controllers. These devices have speeds and features available from only a few suppliers and are aimed at the high-performance end of the market.

VTC is perceived to have very good cell-based libraries in bipolar and CMOS technologies. Products manufactured using the libraries are often modified and turned into standard parts. VTC also provides a complete set of CAD tools supporting its libraries.

The Company is also perceived to have a leadership position in the following linear areas: pre-amplifiers for disk drives and ultrahigh-speed op amps. VTC is expected to have 1988 sales of about \$50 million and plans to be a \$100 million company by 1990.

In the first quarter of 1986, VTC occupied an additional 170,000-square-foot facility. The

facility includes a 30,000-square-foot Class 1/ Class 10 clean room. The Company makes its own masks in a shop equipped with E-Beam technology. Its factories are designed for high-volume production with advanced manufacturing, in-house packaging, and test equipment.

In June 1987, VTC signed a merger agreement under which it became a wholly owned subsidiary of Control Data Corporation, its largest investor and major customer. Terms were not disclosed. Control Data has invested \$56 million in VTC since it was founded and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock.

**BOARD**

(Name and Affiliation)

Larry Jodsaas  
VTC Incorporated, CEO  
Daniel Pennie  
Control Data Corporation  
Robert Lillestrand  
Control Data Corporation  
John Buckner, Chairman  
Control Data Corporation  
Donald Powers  
Control Data Corporation  
Allen Cuccio  
Control Data Corporation

**COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

CEO  
Larry Jodsaas  
Control Data, SR VP Quality

# VTC Incorporated

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## VP/CFO

J.R. Martin  
Fairchild, Div Controller

## VP Operations

E.M. Schnable  
National, Operations Mgr

## VP Engineering

D.A. Orton  
Fairchild, Engr Mgr

## VP Marketing

George Sanders  
Micro Powersystem, Marketing Mgr

## SR VP Sales

Daniel B. Griffith  
Control Data, VP/GM

## FINANCING

From 1984 through 1987, VTC financed its capital equipment and facility requirements with operating leases totaling about \$75 million. In July 1987, employees of VTC, who collectively owned 51 percent of the Company, sold their ownership interest to Control Data Corporation (CDC), giving CDC 100 percent of VTC's common stock.

## RECENT HIGHLIGHTS

### April 1987

VTC was awarded a \$7.5 million contract from the Control Data Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chip-types designed with VTC's 1-micron CMOS standard cell library.

### May 1987

VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by Silicon Compilers Systems Inc. (SCS). VTC will also develop a radiation-hardened cell and other macrocells for the system.

### May 1987

VTC offered the VL3000, a 6-GHz linear/digital bipolar cell library. It allows users to

mix linear and digital circuits on the same chip, without redesigning at the transistor level. The library contains more than 100 predefined linear, digital, and memory functions.

### June 1987

VTC became a wholly owned subsidiary of Control Data Corporation. Terms were not disclosed.

### September 1987

VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

## ALLIANCES

### CDC

#### October 1984

Control Data Corporation invested \$56 million in VTC and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock. The arrangement includes a fabrication technology license.

#### 1987

VTC was awarded a \$7.5 million contract from CDC's Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chips designed with VTC's 1-micron CMOS cell library.

### Silicon Compilers

#### May 1986

VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by SCI. VTC will also develop a radiation-hardened cell for Genesil and additional macrocells for SCI's silicon compiler system.

### IDT

#### January 1987

IDT agreed to allow VTC to second-source its FCT product line of TTL-compatible CMOS logic devices.

## TRW

March 1987

TRW Components International and VTC signed a three-year agreement to cross sample space-quality, Class-S devices. VTC will supply TRW with unpackaged ICs that meet Class-S specs; TRW will assemble, test, qualify, and market the devices. They include radiation-hardened CMOS SRAMs, comparators, amps, and transceivers.

## VME Technology Consortium

September 1987

VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

## MANUFACTURING

### Technology

3.0- and 2.0-micron bipolar linear  
2.0-micron bipolar digital  
1.2- and 1.0-micron two-layer metal CMOS

### Facilities

Bloomington, MN

140,000 sq. ft.

Headquarters, manufacturing

30,000 sq. ft.

Class 1 and Class 10 clean rooms

20,000 sq. ft.

Manufacturing

## PRODUCTS

### Gate Arrays

CMOS and Bipolar/Linear Arrays

### Cell Library

Bipolar cell libraries, 3.0-micron with 170 cells (100 digital, 70 analog), 2.0-micron with 88 cells; ECL or TTL I/O, 2.0-micron with 120 cells (90 digital, 30 analog)

### Silicon Compiler

1.0- and 1.6-micron CMOS Compilers; RAM, ROM, FIFO, and PLA cells

### Linear Signal Processing

Transconductance Amps and Dual-Transconductance Amps, each with or without buffer, 75-MHz Bandwidth

### Video Amplifiers

Low-Noise 733 or 592 Video Amp

### Op Amps

High-Speed, Dual High-Speed, and Quad High-Speed Precision and Fast-Setting Op Amps; Wideband High-Slew Rate, Dual High-Slew Rate, and Quad High-Slew Rate Op Amps; Sample and Hold Amp; Low-Voltage Amp

### Data Converters

8-Bit Video DAC, 200 to 300 MHz; 12-Bit DAC, 125ns Settling Time

### Comparators

Very Fast Comparator, Ultrafast Comparator, TTL Comparator, Ultrafast Dual Comparator, Dual TTL Comparator

### Line Drivers

NTDS Driver/Receiver, Video Line Driver

# VTC Incorporated

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## Mass Storage

Disk Drive Read/Write Preamps: Ferrite Heads, Center-Tapped Thin-Film Heads, Thin-Film Heads, Vertical Heads; Servo Preamps: Ferrite Head, Low-Noise Ferrite Head, Thin-Film Head; Data Separator, Disk Drive Read Channel/Enhanced: Disk Drive Read/Write Channel, Tape Drive Clock Synchronizer; Tape Write Driver; Encoder/Decoder; Write/Servo Phase-Locked Oscillator

## V54/74 FCT/ACT Interface Logic Family (Commercial & Mil Qualified)

Octal and 10-Bit Buffers and Line Drivers; Octal, 9-Bit, and 10-Bit Bus Transceivers; Octal, 9-Bit, and 10-Bit D-Type Transparent Latches; Octal, 9-Bit, and 10-Bit D-Type Edge-Triggered Flip-Flops; Dual 4-Bit D-Type Edge-Triggered Flip-Flops

## OTHER INFORMATION

VTC Incorporated does not employ a PR firm.

# WaferScale Integration, Inc.

47280 Kato Road  
Fremont, CA 94538  
415/656-5400  
Fax: 415/657-5916

ESTABLISHED: August 1983

NO. OF EMPLOYEES: 125

## BACKGROUND

WaferScale Integration, Inc., (WSI) founded by Eli Harari, Terry Leader, and Stephen Su, designs and manufactures high-performance CMOS reprogrammable ICs that incorporate advanced CMOS EPROM capability.

WSI offered an 8Kx8 RPRAM (UV erasable reprogrammable PROM) in the first quarter of 1986. In mid-1987, WSI introduced two 256K CMOS EPROMs that use the Company's patented, self-aligned split-gate EPROM technology. The EPROMs feature an access time of 55ns and provide one- and two-chip program-store solutions for 16- and 32-bit MPU and DSP applications. WSI also supplies high-speed CMOS bit-slice processors and peripheral circuits.

In addition, the Company offers the capability to combine EPROM, SRAM, and complex system logic functions on a single IC in its CMOS macroblock cell library. The macroblock library provides VLSI EPROMs, SRAMs, and a family of high-performance bit-slice processor cells (from 4 bits to 32 bits). The library also contains bit-slice peripherals cells including microprogram controllers, variable pipelines, FIFOs, multipliers, bus registers, and register files.

WSI focuses on high-performance markets that include telecommunications, minicomputers, local area networking, digital signal processing, array processing, high-resolution color graphics, and military avionics and communication. WSI market involvement presently includes 55 percent office automation, 25 percent telecommunications, 15 percent military, and 5 percent other. The Company is directing efforts to balance office automation, telecommunications, and military to roughly 30 percent each by 1990.

WSI has leveraged its partnerships with Altera Corporation, GE Solid State, Intergraph Corpo-

ration, Kyocera Corporation, and Sharp Corporation to invest its capital into advancing its technology and realigning products to match market shifts.

Sharp and GE Solid State have invested in WSI through equity positions, and both companies hold WSI technology licenses. Altera and Intergraph are two additional strategic alliances involving either equity and/or technology. The Kyocera alliance involves equity and distribution of WSI products in Japan.

WSI's products are manufactured at Sharp Corporation's plant at Fukuyama, Japan. The facility produces 5-inch wafers with 1.2-micron CMOS VLSI circuits in a Class 1 clean room environment. In the United States, GE/RCA manufactures circuits for WSI in a Class 10 facility, using 1.0-micron CMOS on 5-inch wafers.

WSI's products are sold worldwide through a sales network that includes a combination of regional and direct sales managers, manufacturers' representative companies, and components distributors.

## BOARD

(Name and Affiliation)

Irwin Federman, Chairman  
WaferScale Integration, Inc., CEO

Harry Marshall  
J.H. Whitney

James Swartz  
Accel Partners

Donald K. Grierson  
General Electric Corporation

Richard Santilli  
RCA Corporation

Henry Kressel  
Warburg Pincus Capital Partners

# WaferScale Integration, Inc.

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO/Acting

Irwin Federman  
Concord Venture, Partner

### VP Finance

Robert J. Barker  
MMT, Mgr Finance

### VP Systems Production

Zel A. Diel  
GigaBit Logic, VP Prod Dev

### VP Process Technology

Yale Ma  
STC Computer, Mgr Wafer Fab Ops

### VP Operations

Steve Sanghi  
Intel, GM Prog Memory Ops

### VP Device

Boaz Eitan  
Intel, Mgr Device Physics

### VP WW Sales

Thomas Branch  
Micro Genesis, Principal

## FINANCING

### February 1984

Round 1

\$16.1M

Accel Partners; Adler & Co.; Bessemer; Genevest (Switzerland); Intergraph; Oak Investment Partners; Robertson, Colman & Stephens; Smith Barney Venture Corp.; Tadiran (U.S.) Inc.; Venture Partners II; Warburg-Pincus; J.H. Whitney

### Lease

Bank of America, Bateman Eichler Leasing Corp., Equitec

### November 1984

Round 2

\$8.5M

Original investors, Baillie Gifford & Co. (Scotland), Continental Illinois Venture Corp.

### April 1986

Round 3

\$13.0M

Original investors, Intergraph Corp., RCA Corporation, Sharp Corporation

### July 1987

Round 4

\$8.0M

Accel Partners; Adler; Bessemer Venture Partners; GE/RCA; Intergraph Corp.; Kyocera; Robertson, Colman & Stephens; Warburg Pincus; J.H. Whitney

## RECENT HIGHLIGHTS

### June 1987

WSI received a patent on its self-aligned, split-gate CMOS EPROM process.

### July 1988

WSI introduced the WS57CS1B, a 16Kx8-bit CMOS PROM, which is user-reprogrammable and consumes one-fourth the power of equivalent bipolar densities.

### July 1988

WSI introduced its "L" series of low-power EPROMs, available in 128Kx8, 64Kx8, and 32Kx8 configurations.

### July 1988

WSI introduced the MAP168 Mappable Memory Subsystem, which functionally integrates a memory subsystem into a single device.

### October 1988

WSI announced the PAC1000, a high-performance, 16-bit microcontroller, the first of WSI's new class of user-configurable Programmable System Devices (PSD).

## ALLIANCES

### Sharp

December 1984

WSI agreed to allow Sharp to use its technology and produce a 64K CMOS EPROM. WSI received manufacturing capacity and royalties. Development and production of 256K CMOS EPROMs were planned.

## October 1985

WSI and Sharp expanded the 1984 agreement to include WSI's 1.6-micron CMOS technology in exchange for royalties and foundry capacity.

## GE/RCA and Sharp

### March 1986

GE/RCA and Sharp signed a five-year agreement with WSI to develop an advanced cell library. WSI's library of LSI macrocells will be combined with cell libraries from GE/RCA and Sharp. The companies also jointly developed 1.0-micron cell libraries, advanced tools, packaging techniques, high-speed EPROMS, and other high-performance standard products. The alliance gives WSI alternative sources of chips and a springboard into the market in Japan.

### July 1987

WSI and GE/RCA expanded the terms of their previous EPROM agreement to include U.S. manufacturing. Under a long-term foundry agreement, WSI will be guaranteed volume capacity at GE/RCA's new 5-inch wafer fab module in Findley, Ohio. WSI will transfer its

1.2-micron fast CMOS EPROM process to Findley. GE/RCA will use the process to manufacture ASIC circuits and second-source some of WSI's EPROM memory products.

## Altera and Sharp

### January 1987

Altera and WSI announced a five-year technology relationship to develop a new family of standalone microsequencer products with wafers manufactured by Sharp of Japan.

## MANUFACTURING

### Technology

SCMOS I: 2.0-micron, double-metal CMOS  
 SCMOS II: 1.0-micron, double-metal CMOS  
 4- and 5-inch wafers

### Facilities

Fremont, CA  
 66,000 sq. ft.  
 Design, test, marketing, sales, administration

## PRODUCTS

### Memory

Device	Organization	Access Time
WS57C191/291	2Kx8 RPRM	45ns
WS57C43	4Kx8 RPRM	35, 55ns
WS57C49	8Kx8 RPRM	35, 55ns
WS57C51	16Kx8 RPRM	40, 70ns
WS27C64	8Kx8 Byte-Wide EPROM	55, 90ns
WS57C128	16Kx8 Byte-Wide EPROM	55, 90ns
WS57C256	32Kx8 Byte-Wide EPROM	55, 90ns
WS57C65	4Kx16 Word-Wide EPROM	55ns
WS57C257	16Kx16 Word-Wide EPROM	55ns

### Microcomponents

WS5901	4-Bit Bit-Slice Processor	43 MHz
WS59016	16-Bit Bit-Slice Processor	432 MHz
WS59032	32-Bit Bit-Slice Processor	25 MHz
WS5910	Microprogram Controller	30 MHz
WS59520	Multilevel Pipeline Register	45 MHz
WS59510	16X16 Multiplier/Accumulator	30ns
WS59820	16-Bit Bidirectional Bus Interface Register	50 MHz

## **WaferScale Integration, Inc.**

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### **ASICs**

**Modular Cell Library**      **Combines EPROM and System Functions with 1.2-Micron Technology to Produce Devices with Sub-1.0ns Delay. Functions Include 4-Bit to 32-Bit Bit-Slice Processors, Microprogram Controllers, Variable Pipelines, FIFOs, Multipliers, Bus Registers, Register Files, ROM, RAM, PLD, 75 Gates, and 26 MSI.**

### **OTHER INFORMATION**

WSI's PR firm is Capithorne and Bellows.



# Weitek Corporation

1060 East Arques Avenue  
Sunnyvale, CA 94086  
408/738-8400  
Fax: 408/739-4374  
Telex: 910-339-9545

ESTABLISHED: 1981

NO. OF EMPLOYEES: 134

## BACKGROUND

Weitek designs, manufactures, and markets digital signal processing circuits for high-performance numerics-processing applications. The Company's goal is to make arithmetic-processing power available on a broad scale to systems developers. The Company's product strategy is to offer a complete range of products, including building blocks that achieve maximum system performance, attached processors for maximum price/performance, and coprocessors for the lowest system cost.

In March 1988, Weitek introduced three new products. The WTL2364 multiplier/WTL2365 ALU chip set is a double-precision vector floating-point processor chip set that implements the IBM 370 Basic Floating-Point Facility standard. It is capable of 32 million floating-point operations per second (mflops) for single-precision operations and up to 16 mflops for double-precision operations. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak rate of 20 mflops for the 100ns speed grade. The floating-point processors each integrate a 64-bit multiplier, a 64-bit ALU, a divide/square-root unit, a 32-word by 64-bit six-port register file, and status and control logic on one chip.

Currently, the Company purchases wafers in the foundry market from VLSI Technology Inc. Long-term wafer processing is guaranteed under agreements with Cypress Semiconductor, Hewlett-Packard Company (HP), and Intel Corporation. Processes available to Weitek are 2.0-micron NMOS and 1.5-micron double-metal CMOS from Intel, 1.2-micron CMOS from HP, 1.2-micron double-metal CMOS from Cypress, and 1.5-micron NMOS and CMOS from VLSI Technology.

Weitek was founded in 1981 by Godfrey Fong, Dr. Edmund Sun, and Dr. Chi-Shin Wang and operated initially as a custom design house specializing in ROMs. In 1985, the Company began offering advanced circuit design semiconductors that use advanced concepts in numerics processing.

## BOARD

(Name and Affiliation)

G. Leonard Baker  
Sutter Hill Ventures  
Arthur J. Collmeyer  
Weitek Corporation  
David House  
Intel Corporation  
Gerald Lodge  
InnoVen Partners  
Arthur Reidel  
Alex Brown  
James Patterson  
Quantum Corporation  
W. Frank King III  
Lotus Development Corp.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Arthur Collmeyer  
Calma, VP/GM Microelec Div  
**VP Sales**  
Robert T. Derby  
Intel, Dir WW Sales/Mktg  
**VP Operations**  
Steven Farnow  
Visic, Dir Ops

# Weitek Corporation

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## VP Marketing

John F. Rizzo  
Apple, Mktg Mgr

## VP Finance

A. Brooke Seawell  
Southwall Tech, VP Finance/Admin

## VP Admin

John Steinhart  
Stanford Univ, Dir Sloan Program

## VP IC R&D

John J. Barnes  
SGS-Thomson, Dir Tech Dev

## FINANCING

### January 1981

Round 1  
\$1.0M  
InnoVen

### February 1982

Round 2  
\$1.3M  
InnoVen, Sutter Hill Ventures

### March 1983

Round 3  
\$2.2M  
InnoVen; Institutional Venture Partners;  
Merrill, Pickard, Anderson & Eyre; Sutter  
Hill Ventures

### January 1986

Round 4  
\$3.0M  
All of the above, Alex Brown, Glynn Capital

### September 1988

IPO  
\$8.4M  
Initial public offering

## RECENT HIGHLIGHTS

### March 1988

Weitek introduced three new products. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak

rate of 20 mflops for the 100ns speed grade. The WTL2364 multiplier and WTL2365 ALU chip set is a double-precision vector floating-point processor chip that implements the IBM 370 Basic Floating-Point Facility standard.

### April 1988

Weitek announced that the WTL1167 floating-point coprocessor is featured as an option in the new Sun 386 workstation family.

### March 1989

Weitek announced the XL-8832 floating-point RISC processor, developed for Digital Equipment Corporation to deliver 3-D graphics performance to Digital's VAXstation 3520 and VAXstation 3540 midrange graphics workstations.

### April 1989

Weitek announced the Abacus 3170 and Abacus 3171, the first single-chip floating-point coprocessors for the SPARC architecture, in speed grades ranging from 20 to 40 MHz.

### May 1989

Weitek introduced the Abacus 4167, a floating-point coprocessor for the Intel 80486 microprocessor that completes math operations five to six times faster than the 486's on-chip floating-point unit.

## ALLIANCES

### Cypress

#### October 1985

Weitek and Cypress made an agreement to jointly develop a series of high-performance VLSI logic circuits designed by Weitek and manufactured using Cypress' 1.2-micron CMOS process. The circuits are designed for telecommunications, graphics, instrumentation, military, and CAD/CAM applications.

### Intel

#### October 1985

Weitek agreed to develop an interface IC that Intel would second-source and for which Intel would provide foundry services on 6-inch NMOS and CMOS wafer-processing equipment.

## NSC

October 1985

National Semiconductor announced that it would design, manufacture, and market an interface chip.

## Step Engineering

March 1986

Step Engineering agreed to produce development tools for the debugging and microcoding of Weitek's floating-point integer processor designs.

## Quadtree

April 1986

Weitek announced that Quadtree Software would develop behavioral simulators for the WTL2264/2265 chip sets.

## Matra-Harris

May 1986

Weitek and MHS signed a technology exchange and foundry agreement. MHS was granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process.

## Hewlett-Packard

May 1987

Hewlett-Packard would incorporate the Weitek model 2264/2265 chip set for high-performance, floating-point computation in current and future HP Precision Architecture computers. HP would manufacture the chip, using a 1.2-micron CMOS process.

## Matsushita

November 1988

Weitek entered into a manufacturing agreement with Matsushita Electric Corporation, whereby Matsushita agreed to manufacture Weitek's higher volume processor and coprocessor products using its 1.2- and 1.5-micron CMOS process technologies. This agreement complements Weitek's existing manufacturing agreements, forged with Hewlett-Packard and VLSI Technology.

## Toshiba

November 1988

Weitek signed an agreement with Toshiba wherein the two companies will cooperate in the development of high-performance numeric semiconductors. As part of the agreement, Weitek will receive manufacturing services from Toshiba's 1.0-micron CMOS and 1.5-micron BiCMOS production processes. Weitek will provide floating-point unit technology to Toshiba for use in certain Toshiba products.

## MANUFACTURING

### Technology

2.0- and 1.5-micron NMOS  
 1.2-micron, one-level metal CMOS  
 1.5-, 1.2-, 1.0-, 0.8-micron, two-level CMOS

### Facilities

Sunnyvale, CA  
 50,000 sq. ft.  
 Administration, design, R&D

## PRODUCTS

### 16-Bit Integer Family

Device	Description	Speed
WTL2516	16x16 Parallel Multiplier	38ns
WTL2517	16x16 Parallel Multiplier	38ns
WTL2010	16x16 Multiplier/Accumulator	45ns
WTL2245	16x16 Multiplier/Accumulator	45ns

### 32-Bit Floating-Point Family

WTL1232/1233	Multiplier/Adder	10 mflops
WTL3132	Data Path Unit	20 mflops
WTL3332	Data Path Unit	20 mflops

# Weitek Corporation

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## 64-Bit Vector Floating-Point Family

Device	Description	Speed
WTL1264/1265	Multiplier/Adder	8 mflops
WTL2264/2265	Multiplier/ALU	20 mflops
WTL2364/2365	Multiplier/ALU, Double-Precision	32 mflops

## 64-Bit Floating-Point Coprocessor Family

WTL1167	80386 Coprocessor	3.5 mflops
WTL1164/1165	Multiplier/Adder/Divider	3.5 mflops
WTL3164	Data Path Unit	100ns, 20 mflops
WTL3364	Data Path Unit	100ns, 20 mflops
Abacus 3167	80386 Coprocessor	20, 25, 33 MHz
Abacus 3168	68020/030 Coprocessor	20, 25, 33 MHz
Abacus SPARC	SPARC Coprocessors	20, 25 MHz
Abacus 3171	SPARC Coprocessors	25, 33, 40 MHz

## XL-Series Family

XL-8000	32-Bit Integer Processor	8 mips
XL-8032	32-Bit Single-Precision Processor	8 mips, 20 mflops
XL-8064	64-Bit Double-Precision Processor	7 mips, 20 mflops
XL-8136	Program Sequencing Unit	
XL-8137	Integer-Processing Unit	
XL-8200	32-Bit Hyperscript Processor	1 mflop
XL-8232	32-Bit Hyperscript Processor	20 mflops
XL-8832	32-Bit Single Precision Processor	20 mflops

## Development Tools for the XL-Series Family

XL-Series C Compiler-Based Software Development Environment  
XL-Series FORTRAN-Based Software Development Environment

PS-8000	XL-Series Prototyping System for the XL-8000
PS-8032	XL-Series Prototyping System for the XL-8032
PS-8064	XL-Series Prototyping System for the XL-8064

Functional Simulators for All Weitek Components

## OTHER INFORMATION

Weitek's PR firm is Regis McKenna, Inc.

# Wolfson Microelectronics Limited

Lutton Court,  
20 Bernard Terrace  
Edinburgh, EH8 9NX Scotland  
031/667-9386  
Fax: 031/667-5176  
Telex: 727659

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 28

## BACKGROUND

Wolfson Microelectronics Limited designs, manufactures, and markets ASICs and specializes in the development of complex mixed analog and digital circuits. The Company offers IC design using semicustom and full-custom approaches including gate arrays with up to 20,000 gates; cell-based libraries in 3.0-, 2.0-, 1.5-, and 1.2-micron CMOS technology; and full-custom design using a range of CMOS and bipolar technologies.

Wolfson Microelectronics Limited evolved from the Wolfson Microelectronics Institute at Edinburgh University. The Company, although completely autonomous, retains its technological links with the academic research activities of the university.

The Company has developed an extensive CAD capability based on a network of Sun workstations to provide an integrated design environment for semicustom and structured custom design. The emphasis of its work has been signal processing. The Company has developed a 2-micron digital library of macro cells with variable parameters for digital designs and an extensive analog library of linear and nonlinear functions.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

**Managing Director**  
David Milne

**Technical Director**  
James Reid

**Finance Manager**  
Neil Hattersley

## FINANCING

Not available

## ALLIANCES

Wolfson has manufacturing arrangements with AMS, Fujitsu, Mietec, and SGS-Thomson dating from 1985.

## MANUFACTURING

### Technology

All processes are for second-sourcing capability.

- 1.2-, 1.5-, 2.0-, 3.0-Micron SPSM/SPDM CMOS Digital Process
- 2.0-Micron SPDM BiMOS Analog Process
- 2.0-Micron SPDM CMOS Analog Process
- 3.0-Micron DPDM/DPSM CMOS Analog Process
- 4.0-Micron DPSM CCD Analog Process
- 5.0-Micron DPSM CMOS Analog Process

# Wolfson Microelectronics Limited

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## PRODUCTS

### Current Products

Device	Description
WM 2020	Dual 15-Pt Tapped Delay Line
WM 2210	Dual 15-Pt Tapped Delay and Integrate
WM 2120	64-Pt Programmable Transversal Filter
WM 2130	256-Pt Programmable Transversal Filter
PWM 213	512-Pt Correlator Module
PWM 215	1,024-Pt VME Correlator Module

### Future Products

WM 3201	Fifth Order, Low-Pass Elliptical Continuous Time Filter; Cutoff 5 KHz to 50 KHz
WM 33XX	Semicustom Switched Capacitor Family
WM 5110	128-Pt Complex Digital Programmable Transversal Filter
WM 5120	Digital Programmable Transversal Filter Controller

## OTHER INFORMATION

Wolfson Microelectronics does not employ a PR firm.

# Xilinx Incorporated

2100 Logic Dr.  
San Jose, CA 95125  
408/559-7778  
Fax: 408/559-7114

ESTABLISHED: February 1984

NO. OF EMPLOYEES: 150

## BACKGROUND

Xilinx Incorporated is a leading supplier of user-programmable gate arrays for the ASIC market. The Xilinx Logic Cell Array (LCA) uses specially designed static memory cells to store logic and interconnection configuration information generated by Xilinx design software.

The Company was founded by James Barnett, Ross Freeman, and Bernard Vonderschmitt, all formerly with Zilog. Xilinx introduced its first logic cell array, which consists of 1,000 to 1,500 equivalent two-input NAND gates, in November 1985. Since then, products with complexities of up to 9,000 gates have been added and are the largest available today. Designs are performed on PC ATs, and Apollo, Digital, and Sun workstations.

The Company has set up several barriers to entry, including patents, extensive development system software, advanced CMOS process technology, and alternative sources. Advanced Micro Devices is a second source of the Company's logic cell arrays and development system. Xilinx has a foundry arrangement with Seiko Epson, which produces the devices in the Suwa, Japan, plant.

The Company's devices and associated development systems are sold by a sales force that includes five sales offices in North America and one each in the United Kingdom and in Japan; 12 field-application engineers; 60 manufacturer's representatives worldwide; 54 North American distributor branches, including Hamilton-Avnet, Marshall, Insight, and Western Microtechnology; and 15 international distributor locations.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Bernard Vonderschmitt  
Zilog, VP/GM IC Div

### VP Admin

\*James Barnett  
Zilog, Prod Line Dir

### VP Eng

\*Ross Freeman  
Zilog, Dir Eng

### VP Sales

R. Scott Brown  
Menlo Corp., VP Sales

### VP Ops

Frank Myers  
Exel, VP Ops

### VP Mktg

Wes Patterson  
VLSI, Dir Ops

### VP Finance/CFO

Gordon Steel  
Pyramid, VP Finance/Admin

\*Founder

## FINANCING

### March 1984

Round 1  
\$2.8M

Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; J.H. Whitney & Co.

### December 1985

Round 2  
\$8.3M

Round 1 investors, Berry Cash Southwest Partnership, InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners

# Xilinx Incorporated

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**January 1987**

Round 3

\$6.4M

Round 1 investors; Fleming Ventures Ltd., InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners, Security Pacific, Monolithic Memories Inc.

**August 1988**

Round 4

\$3.5M

Round 1 investors, others

## RECENT HIGHLIGHTS

**January 1987**

Xilinx raised \$3.4 million in third-round financing.

**October 1987**

Xilinx offered the XC3020, the first in a family of 1.2-micron, user-programmable gate arrays with 1,800 to 2,400 two-input NAND gates and a 40-MHz system clock rate.

**November 1987**

Xilinx introduced the XC3090, a 9,000-gate, user-programmable gate array.

**November 1987**

Xilinx's user-programmable gate arrays are available on Viewlogic Systems' Workview workstation. The support allows design and logic simulation on IBM PC ATs.

**March 1989**

Xilinx introduced the first user-programmable gate arrays to be fully compliant with MIL-STD 883, Class B.

## PRODUCTS

Logic Cell Arrays (LCAs)

Device	Description
XC2064	1,200 gates
XC2018	1,800 gates
XC3020	2,000 gates
XC3030	3,000 gates
XC3042	4,200 gates
XC3064	6,400 gates
XC3090	9,000 gates

## ALLIANCES

**Seiko-Epson**

December 1985

Xilinx and Seiko-Epson agreed to codevelop LCAs and development systems. Seiko-Epson will manufacture the LCAs, using Xilinx's proprietary technology. The companies also agreed on the joint development of Seiko-Epson's CMOS process. Seiko Epson gained nonexclusive marketing rights to the LCA product in Japan.

**MMI/AMD**

June 1986

Xilinx and MMI signed a three-year agreement allowing MMI to manufacture and market Xilinx's LCAs and development system. The first product transferred was the XC2064, a 1,200-gate device. Xilinx will supply future members of the LCA family to MMI as they become available. Xilinx also has given rights to market the XACT development system and the Xactor in-circuit emulator. The two companies will cooperate in extending software support for LCA products.

## MANUFACTURING

**Technology**

1.2-micron double-metal silicon-gate CMOS  
6-inch wafers

**Facilities**

San Jose, CA  
100,000 sq. ft.  
R&D, design, marketing, and test



**XACT Gate Array Development System with In-Circuit Emulation**  
**LCA Development System, Hardware and Software**  
**XC2064, UART Design with Encryption/Decryption**  
**Logic Synthesis Software**

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**OTHER INFORMATION**

Xilinx Inc.'s PR firm is Capithore and Bellows.

**XTAR Corporation**  
9915 Business Park Avenue, Suite C  
San Diego, CA 92131  
619/271-4440

**ESTABLISHED: September 1982**

**NO. OF EMPLOYEES: 9**

**BACKGROUND**

XTAR electronics designs, develops, and manufactures graphics microprocessors, video shift registers, board-level products, and graphics systems. The Company concentrates on the design and development of new products.

XTAR funded the formation of the Company and development through its sales. It has developed a graphics microprocessor (GMP), a video shift register (VSR), and board-level products. Its GMP, a full-custom device, is designed to replace 400 devices with two chips. The VSR uses a standard-cell CMOS process technology. All of XTAR's products were sampled in September 1984, and production quantities were available in the fourth quarter of 1984. XTAR contracts wafer fabrication.

**BOARD**

Not available

**COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President**

Anthony J. Miller  
Universal Research Labs, Dir Engineering

**VP Engr**

Terrence Coleman  
Universal Research Labs, Chief Engineer

**Dir Mktg/Sales**

Richard K. Thistle  
Spectragraphics Corp, Product Mktg Manager

**ALLIANCES**

**Fairchild**

September 1986 Fairchild and XTAR signed an alternate-source agreement for XTAR's X1000/X1002 Graphics MPU chip set, which Fairchild will redesign for manufacture using the FACT (Fairchild Advanced CMOS Technology) fabrication process.

**MANUFACTURING**

**Technology**

3.0-micron CMOS and NMOS  
1.2-micron CMOS  
4-inch wafers

**Facilities**

San Diego, CA  
6,000 sq. ft.  
Design

**PRODUCTS**

Device	Description
X1001/1002	Graphics MPU Chip Set
X1003	Video Shift Register
PG-2000	PC AT Graphics Board - Real-Time 3D Animation
AP-2000	20 MFLOPS 32-Bit Array Processor
Falcon-PC	PC AT Based Real-Time Graphics System -1024 x 1024 or 1024 x 768 -256 Colors from Palette of 4096 or 16.7M -Displays 30,000 Flat-Shaded Polygons/SEC -Fills Polygons AT 160 Million Pixels/SEC

**OTHER INFORMATION**

XTAR's PR firm is Nufter, Smith and Tucker.

## Zoran Corporation

3450 Central Expressway

Santa Clara, CA 94051

408/720-0444

Fax: 408/720-9875

ESTABLISHED: 1983

NO. OF EMPLOYEES: 70

### BACKGROUND

Zoran Corporation designs, manufactures, and markets proprietary systems processors and programmable peripherals devices for the digital signal-processing (DSP) market. The Company is focusing on a unique systems design approach and combines VLSI and DSP to integrate DSP functions on single chips.

In June 1986, the Company offered two digital-filter processors (DFPs) and a vector signal processor (VSP) in addition to hardware support tools for the VSP. During 1987, Zoran offered new VSP devices, including a VLSI product that implements the IEEE 32-bit FFT algorithm and two 25-MHz and 30-MHz products. In addition, Zoran offered an image compression processor (ICP), which is a scaled-down version of the VSP.

To accelerate the implementation of its processors in end-user products, the Company has embedded algorithms and high-level instructions in the hardware. Zoran's integration of software algorithms and optimized hardware in its systems processors provides ease of design, high reliability, high performance, and optimized architectures.

Zoran, a privately held company, was cofounded by Dr. Levy Gerzberg and Yuval Almog. Prior to founding Zoran, Dr. Gerzberg was associate director of and senior research associate at the Stanford University Electronics Laboratory.

Mr. Almog served in management positions at Raychem Corporation where he was responsible for military electronics marketing and resource planning. Zoran's systems approach to products is based on the research conducted by the cofounders.

In December 1987, Dale Williams joined Zoran as president and chief executive officer from Rockwell, replacing John Ekiss who resigned in

May. Mr. Williams was formerly vice president and general manager of Rockwell International's Far East Operations, divisional manager with Intel, and founder of Monolithic Memories. Mr. Williams will be expanding the Company's marketing effort, particularly in Japan, and directing the Company's move into telecommunications and instrumentation products.

In December 1987, Zoran sold its fabrication facility to Synergy Semiconductor for \$4 million in cash and notes. The Company stated that the fab, purchased at low cost from Storage Technology in late 1985, served its purpose of facilitating the rapid development of Zoran's first three product families to get to market quickly. In 1988, many of Zoran's customers entered production, a situation that outstripped the capacity of the R&D fab. The cost of expanding the fab's capacity and upgrading it to a more advanced process technology was not justified in light of the availability of existing foundries worldwide.

In April 1988, Zoran announced that it opened a Far Eastern headquarters facility in Tokyo, Japan. Heading the facility will be General Manager Noboru Iino, formerly Tokyo operational director at Rockwell Semiconductor. Under Mr. Iino's direction, the facility will provide local user-application engineering support, as well as marketing and sales direction. The Company hopes to capture a share of the DSP applications in the growing Japanese data compression market.

Zoran has a direct sales force with offices in Santa Clara and Los Angeles, California; Boston, Massachusetts; Chicago, Illinois; Tokyo, Japan; and Paris, France; and a worldwide network of manufacturers' sales representatives.

### BOARD

Not available

# Zoran Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Dr. Levy Gerzberg  
Stanford Electronics Lab, Assoc Director

### GM Far East Ops

Noboru Iino  
Rockwell International, Tokyo Ops Dir

### GM/European Ops

Jean-Pierre Garnier  
Rockwell International, Euro Ops Dir

\*Founder

## FINANCING

### August 1983

Round 1  
\$3.5M  
Adler & Company; Elron Electronics Industries,  
Ltd., Israel

### 1984

Round 2  
\$1.5M  
Previous investors

### October 1985

Round 3  
\$22.0M  
Previous investors; Concord Partners; Grace  
Ventures Corp.; Investment Advisors, Inc.;  
Kleiner, Perkins, Caufield & Byers; Mitsui &  
Co. Inc. (USA); Montgomery Securities; Vista  
Ventures; Welsh, Carson, Anderson & Stowe

### April 1987

Round 4  
\$6.8M  
Adler & Company; Concord Partners Elron  
Electronics Industries, Ltd.; Grace Ventures  
Corp.; Kleiner, Perkins, Caufield & Byers;  
Mitsui & Co. Inc.; Montgomery Securities;  
Vista Ventures; Welsh, Carson, Anderson &  
Stowe

### May 1988

Harris Corporation bought 10 percent equity in  
Zoran Corporation.

## RECENT HIGHLIGHTS

### December 1986

Zoran offered a low-cost version of its VSP (VSP-10) and two personal computer development boards for the VSP. The VSP-10 is optimized for DSP applications and operates at 10 MHz versus 20 MHz for the VSP-20. The VSP-10 is aimed at instrumentation, medical imaging, and telecommunications applications.

To support the VSP chips, Zoran also introduced two development boards, the VSPX and VSPE, for use with an IBM PC XT or PC AT.

### March 1987

Zoran introduced Support Tool Environment (STE), a development tool kit that addresses VSP and DFP. Zoran embedded the basic algorithms required in fixed, on-chip logic.

### June 1987

Zoran offered an ICP, which is a scaled-down version of the VSP. The device is pin-compatible with the VSP-161, with its instruction set reduced for image applications. The device, which the Company says is the first in the marketplace, targets electronic publishing, satellite, electronic camera, picture data base, and broadcasting applications.

### November 1987

Zoran offered the ZR33891-25, a 25-MHz digital filter processor; and ZR33891-30, a 30-MHz digital filter processor. The devices are upgraded digital filter processors designed for imaging, HDTV, and digital radio applications.

### December 1987

Zoran sold its 50,000-square-foot fabrication facility for \$4 million in cash and notes.

### December 1987

Zoran offered the ZR34161 VSP in a 52-pin, ceramic J-leaded package. The device is available in 15-, 20-, and 25-MHz speeds.

### April 1988

Zoran announced that it has opened a Far Eastern headquarters facility in Tokyo, Japan.

**ALLIANCES**

**IMP**

June 1983

IMP and Zoran codeveloped a CMOS PROM technology.

**Toshiba**

January 1988

Zoran and Toshiba agreed to a technology and manufacturing alliance.

**SGS-Thomson**

March 1988

Zoran and SGS-Thomson agreed to a technology and manufacturing alliance.

**MANUFACTURING**

**Technology**

1.0- to 2.0-micron, two-level metal CMOS  
4-inch, 5-inch, and 6-inch wafers

**Facilities**

Santa Clara, CA

Headquarters, design

Haifa, Israel

Design center

Tokyo, Japan

Marketing/Sales

Paris, France

Marketing/Sales

**PRODUCTS**

**Digital Filter Products**

**Device**

**Description**

ZR33491	Four Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33881	Eight Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33891	Eight Cells; 9x9-Bit Arithmetic; 15, 20, 25, 30 MHz
ZR37381	16 Beat ALU Compatible with the LDI ALU
ZR33771	2D Converter 3x3 Symmetrical 40 MHz to 7x7 10 MHz Video rate

**Vector Signal Processors**

ZR34161	16-Bit Block Floating-Point DSP; 20, 25 MHz
ZR34325	32-Bit IEEE Floating-Point DSP; 25 MHz
ZR34322	32-Bit Block Floating-Point DSP; 20, 25, 30 MHz

**Image Compression Processor**

ZR36010	Discrete Cosine Transform Processor; 20, 25, 30 MHz
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**Development Tool Hardware**

VSPX	ZR34161 Array Processor Board for IBM AT, 16K RAM, 10 MHz
VSPA	ZR34161 Array Processor Board for IBM XT, 16K RAM, 20 MHz
VSPD	ZR34161 Array Processor Board for IBM AT, 64K RAM, 20 MHz, I/O
DFPB	ZR39481/881 Digital Filter Board for IBM AT; 15, 20 MHz
ZRPD	ZR34325 Development System for the ZR34325 Floating-Point Processor

**Development Tool Software**

VSPS	ZR34161 Simulator
VSPA	ZR34161 Assembler
DFPS	Digital Filter Design Software
ZSPS	ZR34325 Software Tool Package

# Zoran Corporation

---


## Board/Subsystem

ZR73650 IEB (Image Engineering Board), AT-Compatible Board that supports development of imaging algorithms

## OTHER INFORMATION

Zoran Corp. does not employ a PR firm.

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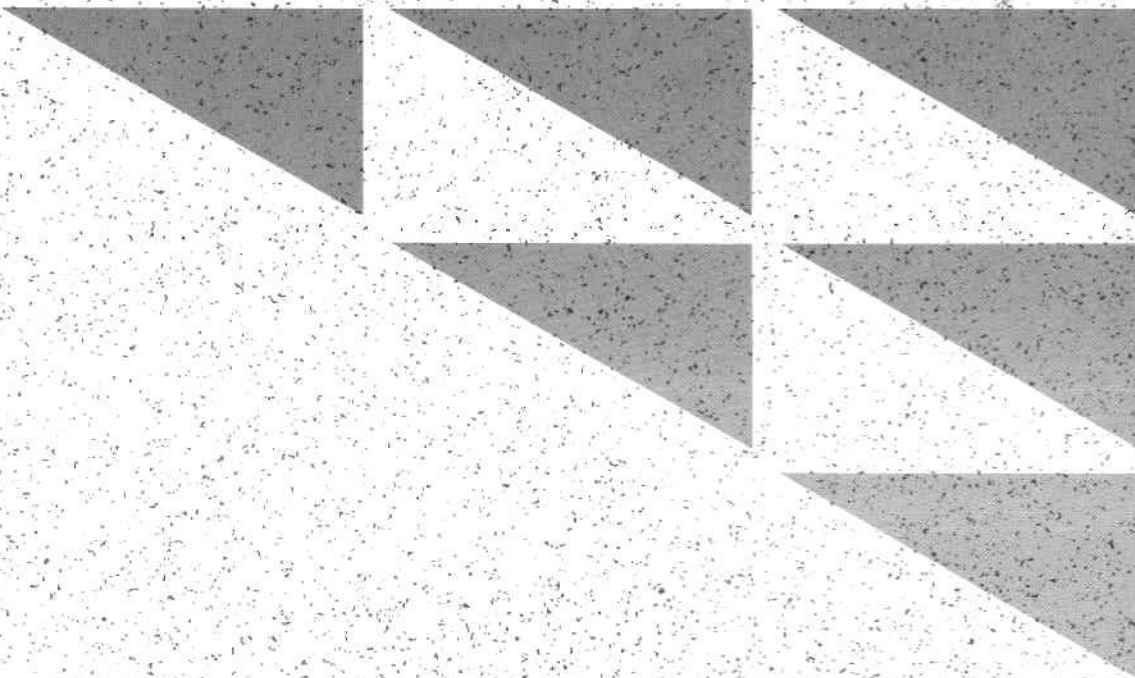
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# *A Decade of Semiconductor Start-Ups*

*Third Edition*



**353**

*A Strategic Analysis Report*



Dataquest

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*A Decade of Semiconductor Start-Ups*  
*Third Edition*

*Technology Products Group*

*Published by Dataquest Incorporated*

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January 1990

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# *A Decade of Semiconductor Start-Ups*

## **Introduction**

During the last ten years, there has been an explosion of new activity in the semiconductor industry. Dataquest has identified 170 start-ups formed between 1979 and 1989. These start-ups are developing new niche markets and technologies that did not exist only a few years ago. Several new companies already have become \$100 million operations. In the 1990s, some may well become \$1 billion companies. Although several start-ups have failed, the ranks were quickly replenished by a host of newcomers. As new technologies and applications emerge, Dataquest expects to see many more start-ups in Europe, Asia, and the United States by the year 2000.

Dataquest believes that it is crucial to watch these swiftly moving start-ups—the industry's barometers of change—because they represent emerging new technologies, markets, and applications.

For our client's convenience, Dataquest has prepared *A Decade of Semiconductor Start-Ups—Third Edition*, a compendium of information about these start-ups. The information contained in this directory was gathered through surveys, telephone interviews, and publicly available material. Some of the text was integrated directly from background information provided by the companies. This report, updated regularly, provides the following information:

- Historical trends in start-up activity
- Key factors of successful start-ups
- Venture capital financing information
- Strategic alliances
- Technology trends (memory, microprocessors, digital signal processing (DSP), application-specific ICs (ASICs), GaAs, linear/analog, and others as they emerge)
- Company profiles

## **Definition of a Start-Up**

Dataquest defines a start-up as a semiconductor manufacturer that designs and ships finished products in the merchant or captive sectors; they need not have in-house wafer fabrication facilities. Because of the high cost of state-of-the-art plants and equipment, we observe that most start-ups use silicon foundries to reduce up-front costs. The start-up completes the circuit designs, sends the masks to foundries for fabrication, and may or may not complete packaging in-house. Most start-ups conduct in-house testing.

Because a company must first ship a product to be considered a start-up, Dataquest does not include design houses in its definition of a start-up. However, Dataquest does include captive manufacturers under the start-up title, provided they have begun operations during the past 10 years. We also consider semiconductor operations of large corporations to be start-up activities if the corporation was not previously involved in semiconductor activity.

For purposes of this directory, a start-up's age will not exceed 10 years. After a company is 10 years old, Dataquest no longer considers it a start-up, and the company is dropped from the book. Also, many of the companies profiled in previous editions have become highly successful operations. For this reason, we have created the concept of the graduate—a company that has become too large to be considered a start-up. To become a graduate, a company must exceed \$100 million in revenue *twice* in its lifetime. A list of graduates is shown in Table 2c.

## **Historical Trends**

The semiconductor industry is a vibrant industry that has gone through numerous business cycles and technology developments during its 30-year history. Dataquest observes that the industry has

had the following six distinct phases since the early 1950s:

- Establishment of the industry under Bell Labs and Shockley Transistor (1947 to 1957)
- Domination by Fairchild, National Semiconductor, Raytheon, Signetics, and other early start-ups (1957 to 1967)
- A boom in start-up companies such as AMD, Intel, and MMI that offered NMOS standard products (1968 to 1974)
- Consolidation of the industry through mergers and acquisitions (1975 to 1979)
- A boom in ASIC start-ups in 1982 and 1983; high-performance CMOS and GaAs start-ups in 1984; and HCMOS, DSP, ASICs, PC chip sets, and telecommunications IC start-ups (1985 to 1988)
- A second consolidation of the industry through mergers, acquisitions, and fab agreements

As shown in Figure 1, there have been three waves of semiconductor start-ups, each triggered by new process technologies. During the mid-1950s, companies such as Fairchild, Shockley Transistors, and Texas Instruments, all specializing in tran-

sistors and PMOS technology, rose to prominence. In the late 1960s, AMD, Intel, National, and others introduced NMOS technology. Since the late 1970s, a third wave of start-ups has developed next-generation technologies such as high-performance CMOS and GaAs processes; gate arrays, standard cells and silicon compilers for IC design; DSP, power transistors, and graphics and telecommunications ICs.

Historically, Dataquest has observed the following major trends in semiconductor start-up activity:

- A 12- to 15-year period between waves of start-ups, suggesting a technology life cycle that takes this amount of time to progress from initial research to commercialization and then to a gradual decline
- Technological and market leadership by key start-ups within a decade of existence
- Consolidation, acquisition, and a shakeout of start-ups following each peak of start-up activity
- A rapid loss of market share among older companies that are unable to compete with start-ups in emerging technologies
- Successively larger waves of start-up companies and increasing competition

Figure 1

Start-Up Activity by Year  
(1957-1989)

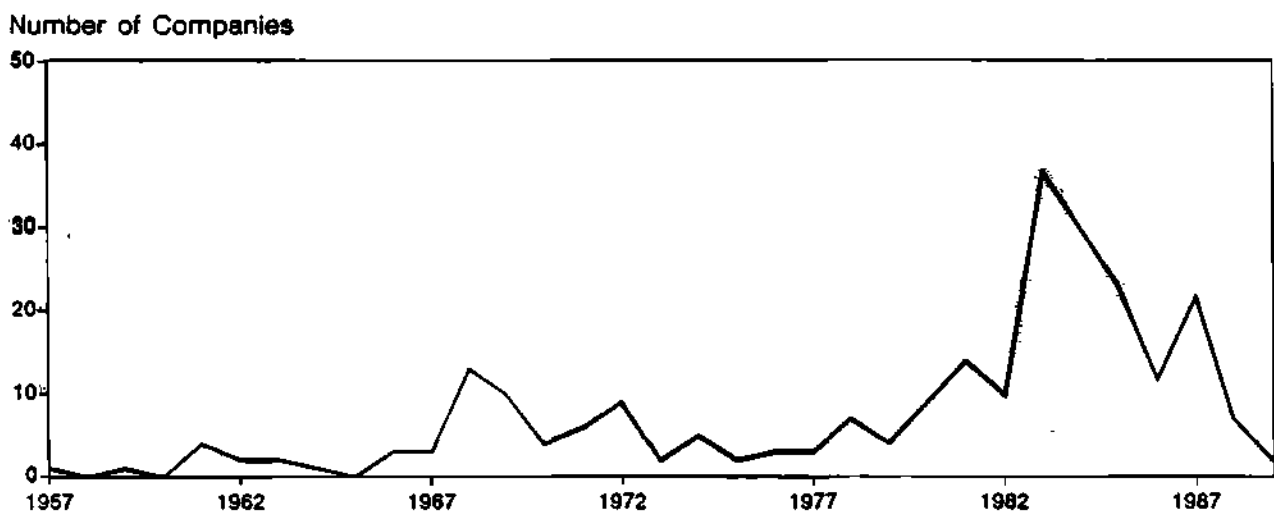
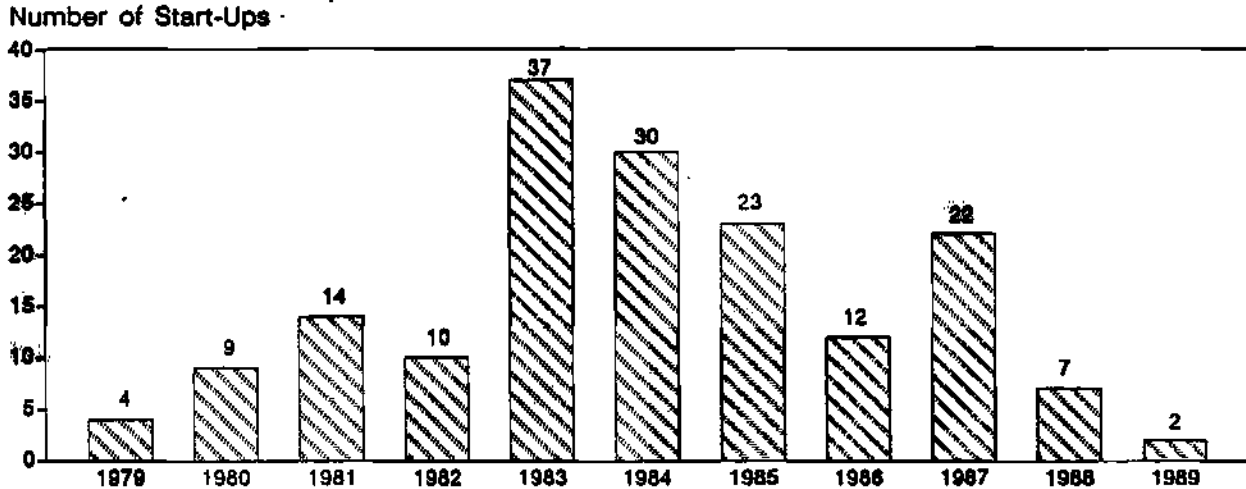




Figure 2  
Semiconductor Start-Ups by Year  
1979-1989



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Source: Dataquest  
January 1990

- An emphasis on niche market strategies involving proprietary designs, CAD software, and excellent service
- Dispersion of start-up activity outside Silicon Valley due to the growing role of noncomputer applications, venture capital newcomers, and foreign government sponsorship

The latest wave of start-ups, which peaked in 1983, gradually is slowing down as existing start-ups commercialize their products and seek new rounds of financing. Figure 2 shows start-up activity for the 1979 through 1989 period. After a slow year in 1986, 1987 was strong, with the introduction of 22 new companies. Although the figures for 1988 have not been finalized, it appears at this time that 1988 will be a slower year than 1987 in terms of the number of start-ups. Dataquest believes that the industry has entered another phase of consolidations, mergers, and failures. This market shakeout occurs as niche markets become crowded and companies search for new directions in technology, products, and applications. In the mid-to-late 1990s, however, we anticipate a fourth wave of start-ups that will be involved with GaAs, optoelectronics, artificial intelligence (AI), parallel processors, three-dimensional ICs, voice recognition and synthesis, bioelectronics, and other emerging fields. These start-ups will become the

major technology drivers as we enter the 21st century.

### Start-Up Activity, 1988 and 1989

In 1988 and 1989, start-up activity in the semiconductor industry fell off quite substantially. In 1988, Cypress Semiconductor developed another satellite, Multichip Technology, which specializes in multichip memory modules. In 1989, Video Seven and G-2, two affiliates of LSI Logic, merged to form Headland Technology. Also in 1989, two executives from Chips and Technologies left to form S3, Inc., which will specialize in silicon subsystems. Overall, Dataquest identified only seven start-ups in 1988 and two so far in 1989. Because Dataquest does not identify a company as a viable entity until significant financing is secured or until a product is introduced, it is likely that the number of start-ups for 1988 and 1989 will increase as more companies meet Dataquest's definition of a start-up.

One of the main reasons for the decline in start-up activity is the lack of venture funding available for semiconductor start-ups. Beginning in 1987, the venture capital community has become increasingly disenchanted with the semiconductor industry. It is becoming extremely difficult for a new company to secure the venture financing necessary to bring a product to market. Without venture funding, many start-ups never get off the ground.

In addition, many of the niches that start-ups have recently pursued are becoming quite crowded. The markets for ASICs and fast SRAMs are especially so; start-up fatality rates are rising and entry rates are falling as a consequence. Start-ups, therefore,

currently are searching for new niches to inhabit, and Dataquest expects start-up activity to be limited until a market with significant growth potential is uncovered.

Tables 1a through 1k list start-up activity by year.

**Table 1a**  
**Start-Up Activity by Year—1989 (2)**

Company	Location	Product
Headland Technologies, Inc.	Fremont, CA	Micros
S3, Inc.	Santa Clara, CA	Micros

Source: Dataquest  
January 1990

**Table 1b**  
**Start-Up Activity by Year—1988 (7)**

Company	Location	Product
Advanced Hardware Architectures	Moscow, ID	Micros
ISSI	Sunnyvale, CA	Memory
Multichip Technology	San Jose, CA	Memory
Plus Logic	San Jose, CA	ASICs
Power Integrations	Mt. View, CA	Analog
The DSP Group	Emeryville, CA	DSP
TranSwitch	Shelton, CT	Telecom

Source: Dataquest  
January 1990

**Table 1c**  
**Start-Up Activity by Year—1987 (22)**

Company	Location	Product
ACC Microelectronics	Santa Clara, CA	Micros
Aspen Semiconductor	San Jose, CA	Memory, ASICs
Chartered Semiconductor	Singapore	ASICs, foundry
Cree Research	Durham, NC	Discretes
Genesis Microchip	Canada	ASICs
G-2 Incorporated (Merged into Headland)	Milpitas, CA	Micros
Hualon Micro-Electronics Corp.	Taiwan	Analog, ASICs, micros, telecom
Integrated Information Technology	Santa Clara, CA	Micros

(Continued)

Table 1c (Continued)  
Start-Up Activity by Year—1987 (22)

Company	Location	Product
Intergraph Adv. Processor Div.	Palo Alto, CA	Micros
Linear Integrated Systems	Fremont, CA	Analog
MOSPEC Semiconductor	Taiwan	Discretes, foundry
nCHIP	San Jose, CA	Multichip modules
Oak Technology	Sunnyvale, CA	Micros
Oxford Computer	Oxford, CT	Memory
Paradigm Technology (formerly GL Micro Devices)	San Jose, CA	Memory
Photonic Integration Research	Columbus, OH	Opto
RAMAX	Australia	Memory
SIMTEK Corp.	Colorado Springs	Memory
Synergy Semiconductor	Santa Clara, CA	Memory
Togai InfraLogic	Irvine, CA	Fuzzy logic
US2	San Jose, CA	ASICs
VIA Technologies, Inc. (Formerly LOGICSTAR)	Fremont, CA	Micros

Source: Dataquest  
January 1990

Table 1d  
Start-Up Activity by Year—1986 (12)

Company	Location	Product
Advanced Microelectronic Products	San Jose, CA	Discretes
BKC International Electronics	Lawrence, MA	Discretes
Gazelle Microcircuits	Santa Clara, CA	GaAs
HNC, Inc.	San Diego, CA	Neural networks
Innovative Silicon Technology	Carrollton, TX	ASICs
MemTech Technology Corp.	Santa Clara, CA	Bubble memory
PLX Technology Corp.	Mt. View, CA	ASICs
Powerex, Inc.	Youngwood, PA	Discretes
Synaptics, Inc.	San Jose, CA	Neural networks
TSMC	Taiwan	Foundry
Telcom Devices Corp.	Newbury Park, CA	GaAs
Triad Semiconductors	Colorado Springs, CO	Memory

Source: Dataquest  
January 1990

**Table 1e**  
**Start-Up Activity by Year—1985 (23)**

Company	Location	Product
ABM Semiconductor <sup>1</sup>	San Jose, CA	GaAs opto
Actel Corp.	Sunnyvale, CA	ASICs
Acumos	San Jose, CA	ASICs
Advanced Linear	Sunnyvale, CA	Linear
Alliance Semiconductor	San Jose, CA	Memory
ANADIGICS	Warren, NJ	GaAs analog and digital
Catalyst Semiconductor	Santa Clara, CA	Memory
Chips & Technologies <sup>2</sup>	San Jose, CA	Micros
Dolphin Integration	France	ASICs
ES2	West Germany	ASICs
GAIN Electronics <sup>1</sup>	Somerville, NJ	GaAs ASICs
Hittite Microwave	Woburn, MA	GaAs MMICs
Intercept <sup>1</sup>	Sunnyvale, CA	ASICs
Krysalis <sup>3</sup>	Sunnyvale, CA	Ferroelectric memory
Level One Communications	Folsom, CA	Telecom
NovaSensor	Fremont, CA	IC sensors
Orbit Semiconductor	Sunnyvale, CA	Foundry
Sahni <sup>4</sup>	Sunnyvale, CA	ASICs
Saratoga Semiconductor <sup>5</sup>	Cupertino, CA	BiCMOS memory
Tachonics <sup>1</sup>	Plainsboro, NJ	GaAs
Three-Five Systems	Phoenix, AZ	GaAs opto
Topaz Semiconductor	San Jose, CA	Discrete, linear
Wolfson Microelectronics	Scotland	ASICs, DSP

<sup>1</sup>Inactive<sup>2</sup>Graduate<sup>3</sup>Acquired<sup>4</sup>Closed<sup>5</sup>Chapter 11Source: Dataquest  
January 1990

**Table 1f**  
**Start-Up Activity by Year—1984 (30)**

Company	Location	Product
Advanced Power Technology	Bend, OR	Power MOSFETs
ATMEL	San Jose, CA	ASICs, memory, linear
Austek Microsystems	Australia	Micros
Celeritek	San Jose, CA	GaAs FETs, MMICs
Cirrus Logic	Milpitas, CA	Micros
Crystal Semiconductor	Austin, TX	Linear
Custom Arrays	Sunnyvale, CA	ASICs
Dallas Semiconductor	Dallas, TX	Memory, linear, micros
Edsun Laboratories	Waltham, MA	Micros
Epitaxx Inc.	Princeton, NJ	GaAs opto
Integrated CMOS Systems	Sunnyvale, CA	ASICs

(Continued)

Table 1f (Continued)  
Start-Up Activity by Year—1984 (30)

Company	Location	Product
Integrated Power Semi <sup>1</sup>	Scotland	Linear
Lytel	Somerville, NJ	GaAs opto
Molecular Electronics	Torrance, CA	Bioelectronics
NMB Semiconductor	Chatsworth, CA	Memory, foundry
NSI Logic	Marlboro, MA	Micros
Novix	Cupertino, CA	Micros
Pacific Monolithics	Sunnyvale, CA	GaAs MMICs
Performance	Sunnyvale, CA	Memory, micros, logic
PromTech	San Jose, CA	Memory
Quasel Taiwan <sup>2</sup>	Taiwan	Memory
Ramtron	Colorado Springs, CO	Ferroelectric memory
SID Microelectronics	Brazil	Discretes, linear
Silicon Microsystems <sup>1</sup>	San Jose, CA	Memory
TMMIC <sup>3</sup>	Mt. View, CA	GaAs MMIC
TriQuint Semiconductor	Beaverton, OR	GaAs analog/digital
Vitesse Semiconductor	Camarillo, CA	GaAs digital, foundry
VTC	Bloomington, MN	Linear, ASICs, foundry
Wafer Technology <sup>4</sup>	Rancho Palos Verdes, CA	Logic
Xilinx	San Jose, CA	ASICs

<sup>1</sup>Acquired<sup>2</sup>Hybrid<sup>3</sup>Removed<sup>4</sup>ClosedSource: Dataquest  
January 1990

Table 1g  
Start-Up Activity by Year—1983 (37)

Company	Location	Product
Altera	Santa Clara, CA	ASICs
Asahi Kasei Microsystems	Japan	ASICs, linear, micros, memory
BIT	Beaverton, OR	DSP
Brooktree	San Diego, CA	Linear
Calmos Systems	Canada	ASICs, DSP, linear, memory
Calogic	Fremont, CA	Linear, ASICs
Custom Silicon	Lowell, MA	ASICs
Cypress Semiconductor <sup>1</sup>	San Jose, CA	Memory, ASICs, DSP
Elantec	Milpitas, CA	Linear
Electronic Technology	Ames, IA	ASICs
Exel Microelectronics	San Jose, CA	Memory, micros, ASICs
Hyundai America <sup>2</sup>	Santa Clara, CA	Memory
iLSi	Colorado Springs, CO	ASICs
ICT	San Jose, CA	Memory, ASICs
Inova	Santa Clara, CA	Memory

(Continued)

Table 1g (Continued)  
Start-Up Activity by Year—1983 (37)

Company	Location	Product
Iridian <sup>2</sup>	Chatsworth, CA	GaAs FETs
IXYS	San Jose, CA	Power FETs, ICs
Laserpath <sup>2</sup>	Sunnyvale, CA	ASICs
Lattice Semiconductor	Hillsboro, OR	ASICs
Logic Devices	Sunnyvale, CA	Memory, DSP, micros
Maxim Integrated Products	Sunnyvale, CA	Linear
Micro Linear	San Jose, CA	ASICs, linear
Mietec N.V.	Belgium	ASICs
Modular Semiconductor	Santa Clara, CA	Memory, micros
MOS Electronics	Sunnyvale, CA	Memory
Opto Tech	Taiwan	GaAs opto
Samsung Semiconductor	San Jose, CA	Linear, discretcs, logic, memory
Seattle Silicon	Bellevue, WA	ASICs
Sierra Semiconductor	San Jose, CA	ASICs, memory, micros, linear
S-MOS Systems <sup>1</sup>	San Jose, CA	Memory, micros, ASICs, linear
Texet <sup>2</sup>	Allen, TX	Discretcs
Vadem	San Jose, CA	Micros
Vatic <sup>3</sup>	Mesa, AZ	ASICs
Visic <sup>4</sup>	San Jose, CA	Memory
Vitellic	San Jose, CA	Memory
WaferScale Integration	Fremont, CA	Memory, ASICs, micros
Zoran	Santa Clara, CA	DSP

<sup>1</sup>Graduate

<sup>2</sup>Closed

<sup>3</sup>Merged

<sup>4</sup>Acquired

Source: Dataquest  
January 1990

Table 1h  
Start-Up Activity by Year—1982 (10)

Company	Location	Product
Array Devices <sup>1</sup>	San Diego, CA	ASICs
Custom MOS Arrays <sup>2</sup>	Milpitas, CA	ASICs
IC Sensors	Milpitas, CA	Pressure sensors
ICI Array Technology	San Jose, CA	ASICs
Isocom	England	Opto
Microwave Monolithics	Simi Valley, CA	GaAs MMICs
Microwave Technology	Fremont, CA	GaAs FETs, MMICs
Sensym	Sunnyvale, CA	IC sensors
Solid State Optronics	San Jose, CA	Opto
XTAR	San Diego, CA	Micros

<sup>1</sup>Closed

<sup>2</sup>Merged

Source: Dataquest  
January 1990

**Table 1i**  
**Start-Up Activity by Year—1981 (14)**

Company	Location	Product
Adaptec	Milpitas, CA	Micros
Barvon Research <sup>1</sup>	Milpitas, CA	ASICs
GigaBit Logic	Newbury Park, CA	GaAs ASICs, logic, memory
IMP	San Jose, CA	ASICs
LTC	Milpitas, CA	Linear
LSI Logic <sup>2</sup>	Milpitas, CA	ASICs, DSP, micros
Opto Diode	Newbury Park, CA	GaAs LEDs
Panatech Semi <sup>1</sup>	Santa Clara, CA	ASICs
SEEQ Technology	San Jose, CA	Memory, micros
Signal Processor <sup>1</sup>	Salt Lake City, UT	DSP
Silicon Systems <sup>1</sup>	Tustin, CA	Linear, micros
Telmos <sup>3</sup>	Sunnyvale, CA	ASICs, linear, opto
Weitek	Sunnyvale, CA	DSP
Zytrex <sup>3</sup>	Sunnyvale, CA	Memory, logic

<sup>1</sup>Acquired<sup>2</sup>Graduate<sup>3</sup>ClosedSource: Dataquest  
January 1990

**Table 1j**  
**Start-Up Activity by Year—1980 (9)**

Company	Location	Product
California Micro Devices	Milpitas, CA	ASICs, linear
Comlinear	Ft. Collins, CO	Analog
Harris Microwave Semiconductor	Milpitas, CA	GaAs FETs, MMICs
IDT <sup>1</sup>	Santa Clara, CA	Memory, logic, DSP, micros
Kyoto Semiconductor	Japan	Optoelectronics
Si-Fab	Scotts Valley, CA	Foundry
Spectrum Microdevices	Frederick, MD	ASICs
Trilogy <sup>2</sup>	Cupertino, CA	Waferscale integration
VLSI Design Assoc. <sup>3</sup>	Campbell, CA	Micros

<sup>1</sup>Graduate<sup>2</sup>Sold semiconductor operations<sup>3</sup>Now AvasemSource: Dataquest  
January 1990

Table 1k  
Start-Up Activity by Year—1979 (4)

Company	Location	Product
AMCC	San Diego, CA	ASICs
Matra-Harris	France	ASICs, memory, micros
United Microelectronics	Taiwan	Linear, micros, memory, foundry
VLSI Technology <sup>1</sup>	San Jose, CA	ASICs, memory, micros

<sup>1</sup>Graduate

Source: Dataquest  
January 1990

## The Driving Factors

Why was there such a strong surge in semiconductor start-up activity in the late 1970s and early 1980s? Semiconductor start-ups faced increasingly expensive plant and equipment costs, growing competition from Asia, and a depressed market in 1981 and 1982. Yet a record number of semiconductor companies were started in 1983. Dataquest believes that the following factors drove this explosion of activity:

- The infusion of venture capital
- The strong start-up activity in computers, telecommunications, design workstations, and consumer electronics, all of which required state-of-the-art ICs
- The proliferation of specialized market niches that required fast turnaround times
- A growing number of experienced engineers and managers frustrated by the sluggishness of innovation within larger companies
- More user-friendly CAD systems and support software
- Worldwide fabrication facility overcapacity and silicon foundries that allowed start-up companies to defer fabrication investments
- The entry of U.S., Japanese, South Korean, and Taiwanese companies with sizeable financing
- The growing demand for higher-performance ICs with reduced power consumption (i.e., CMOS)

During the early 1980s, Dataquest observed a mismatch between U.S. and foreign vendors that specialized in NMOS processes and the growing demand for CMOS ASICs, memory, logic devices, and other new products. Start-ups were quickly able to fill these market gaps by emphasizing advanced process technologies, design, and focused marketing.

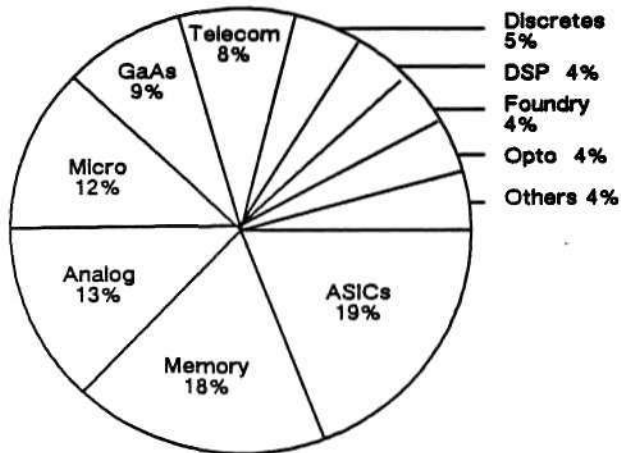
## The Third Wave

The third wave of start-ups differs from previous start-up generations because of the sheer variety and number of companies, which makes generalizations difficult. However, Dataquest notes that the following several trends may have a major impact on the industry:

- More start-ups are being located outside Silicon Valley, especially in the Southwest and East Coast of the United States, and in Europe.
- Increasingly, start-ups are using silicon foundries as an alternative to building their own fabs, which shortens time to market and allows these companies the opportunity to focus on IC design, product development, and marketing.
- Increasingly, Asian silicon foundries are being used because of their high-quality wafers and an apparent lack of interest among U.S. vendors to compete.
- Numerous strategic alliances are occurring between start-ups and Asian companies to develop, manufacture, market, and distribute products jointly.



**Figure 3**  
**Semiconductor Start-Up Product Lines**



0005344-3

Source: Dataquest  
January 1990

- More corporate investors and government backers throughout the world are participating in start-ups.
- Most start-ups have chosen to be niche players, where profit margins tend to be higher; and most are concentrated in fast-growing markets, such as ASICs, microcomponents (especially microperipherals), and telecommunications.

The third wave of start-up companies offers a wide variety of products, as shown in Figure 3. Application-specific ICs (ASICs) and high-performance CMOS memory and logic are attracting most of the attention. The microcomponent segment has grown substantially during the past two years; it currently represents 12 percent of semiconductor start-up product lines.

One of the fastest-growing product areas is the PC peripheral chip set market. The market for logic chip sets has attracted a host of new entrants in 1988 and 1989 and is approaching the saturation point. Dataquest expects a similar growth pattern in

the other peripheral chip set markets (e.g., graphics, communication, mass storage, modem, and fax). Dataquest also expects significant growth in the market for telecommunications ICs.

Dataquest has recognized very little growth in the GaAs market segment. Two companies, GAIN Electronics and Tachonics, have failed, and we have not identified any new GaAs start-ups. The technology still is in its developmental stages, and it may be quite some time before it gains wide acceptance.

## Keys to Success

The third wave of start-ups share many common characteristics. In general, the more successful companies tend to be as follows:

- Highly focused, flexible, and able to move quickly out of stagnant markets and into high-growth markets
- Willing to develop new markets and educate users about their products and design services
- Positioned at the leading edge because of their advanced process technologies and proprietary CAD software
- Resourceful in attracting venture capital from U.S. and foreign venture capitalists, corporate investors, and OEMs
- Aggressive in building strategic alliances to develop new applications jointly and secure wafer fab capacity, especially in Asia

Of course, not all recent start-ups fit this profile. Some companies are failing and are being acquired because of faulty management, weak finances, or poor product planning and marketing. Table 2a lists the companies that are no longer operating or have filed for Chapter 11 protection. Table 2b lists those companies that have been acquired by or merged with another company. Table 2c is a list of companies that have graduated from start-up status by achieving \$100 million in annual sales twice in their lifetimes.

Table 2a

## Companies That Are No Longer Operating

Company	Year Formed	Location	Product
ABM	1985	San Jose, CA	GaAs opto
Array Devices	1982	San Diego, CA	ASICs
GAIN Electronics	1985	Somerville, NJ	GaAs ASICs
Hyundai America	1983	Santa Clara, CA	Memory
Intercept Microelectronics	1985	Sunnyvale, CA	ASICs
Iridian	1983	Chatsworth, CA	GaAs FETs
Laserpath	1983	Sunnyvale, CA	ASICs
Sahni	1985	Sunnyvale, CA	ASICs
Saratoga Semiconductor	1985	Cupertino, CA	BiCMOS memory
Tachonics	1985	Plainsboro, NJ	GaAs
Telmos	1981	Sunnyvale, CA	ASICs, linear
Texet	1983	Allen, TX	Discretets
Trilogy	1980	Cupertino, CA	Waferscale
Wafer Tech	1984	Rancho Palos Verdes, CA	Logic
Zytrex	1981	Sunnyvale, CA	CMOS logic

Source: Dataquest  
January 1990

Table 2b

## Companies That Have Been Acquired or Merged

Company/Year Formed	Product	Acquired by	Year Acquired
Barvon Research (1981)	ASICs	Sipex	1988
Custom MOS Arrays (1982)	ASICs	CMD	1986
Exel Microelectronic (1983)	Memory, micros, ASICs	Exar	1986
G-2 Incorporated (1987)	Micros	Headland	1989
Integrated Power Semiconductor (1984)	Linear	Seagate	1987
Krysalis (1985)	NV memory	National	1989
Panatech (1981)	ASICs	Ricoh	1987
Signal Processor (1981)	DSP	Analog Devices	1983
Silicon Microsystems (1984)	Memory	Austek	1986
Silicon Systems (1981)	Micros	TDK	1989
Vatic (1983)	ASICs	Thomson-Mostek	1986
Visic (1983)	Memory	VLSI Technology	1986
VTC (1984)	Linear, ASICs, foundry	Control Data	1987

Source: Dataquest  
January 1990

**Table 2c**  
**Companies That Have "Graduated" from Start-Up Status**

Company	Year Formed	Location	Product
Chips & Technologies	1985	San Jose, CA	Micros
Cypress Semiconductor	1983	San Jose, CA	Memory, ASICs, DSP
IDT	1980	Santa Clara, CA	Memory, logic, DSP, micros
LSI Logic	1981	Milpitas, CA	ASICs, DSP, micros
S-MOS Systems, Inc.	1983	San Jose, CA	Memory, micros, ASICs, linear
VLSI Technology	1979	San Jose, CA	ASICs, memory, micros

Source: Dataquest  
January 1990

**Table 3**

**Geographic Dispersion of Start-Up Companies**

Silicon Valley	75
Southwest United States	21
Northwest United States	7
Midwest United States	3
Northeast United States	11
Southeast United States	2
ROW	18
<b>Total</b>	<b>137</b>

Source: Dataquest  
January 1990

**Geographic Dispersion of Start-Up Companies**

Silicon Valley still leads with the number of semiconductor start-ups, but other areas are beginning to attract more start-ups. As shown in Table 3, 75 of the 137 companies identified in this book are located in Silicon Valley. This figure translates to 55 percent of these start-ups. In recent years, Dataquest has noticed a trend toward location outside Silicon Valley due to the increased availability of local financing and government

support. Figure 4 shows the geographic concentration of start-ups in the United States.

Dataquest anticipates more worldwide start-up activity due to growing public and private interest in promoting venture capitalism and entrepreneurialism. In the future, we expect the following regions to become increasingly active:

- The East Coast of the United States, especially New Jersey ("Gallium Gulch"), Maryland ("Bioelectronics Center"), and North Carolina ("Research Triangle")
- The Southwest United States, especially Austin and Dallas, Texas
- Europe, especially Scotland, West Germany, and France
- Israel
- Asia, especially Taiwan, China, Singapore, Malaysia, and India

By the year 2000, we expect to see a semiconductor industry that is not so concentrated in existing areas, but is much more global in scope. The trend toward closer vendor/user ties will accelerate this global shift. Because of the grass roots nature of start-ups, they will have a significant impact on the direction of regional industries and economies.

Tables 4a through 4g list start-up companies by location and region.

Figure 4  
Geographic Concentration of Start-Up Activity



0005344-4

Source: Dataquest  
January 1990

Table 4a  
Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
ACC Microelectronics	Santa Clara	1987
Actel Corp.	Sunnyvale	1985
Acumos	San Carlos	1985
Adaptec	Milpitas	1981
Advanced Linear Devices	Sunnyvale	1985
Advanced Microelectronic Products	San Jose	1986
Alliance Semiconductor	San Jose	1985
Altera Corporation	Santa Clara	1983
Aspen Semiconductors	San Jose	1987
ATMEL Corporation	San Jose	1984
Avasem Corporation	San Jose	1980
California Micro Devices	Milpitas	1980
Calogic Corp.	Fremont	1983
Catalyst Semiconductor	Santa Clara	1985
Celeritek	San Jose	1984
Cirrus Logic	Milpitas	1981
Custom Arrays Corp.	Sunnyvale	1984
The DSP Group	Emeryville	1988
Elantec	Milpitas	1983
Exel Microelectronics	San Jose	1983
Gazelle Microcircuits	Santa Clara	1986
Harris Microwave Semiconductor	Milpitas	1980
Headland Technologies, Inc.	Fremont	1989
IC Sensors	Milpitas	1982
ICI Array Technology	San Jose	1982
Inova Microelectronics Corp.	Santa Clara	1983
Integrated CMOS Systems	Sunnyvale	1984
Integrated Information Technology	Santa Clara	1987
Intergraph—Adv. Processor Div.	Palo Alto	1987
International CMOS Technology	San Jose	1983
IMP	San Jose	1981
Isocom Ltd.	Campbell	1982
ISSI	Sunnyvale	1988
IXYS Corp.	San Jose	1983
Krysalis Corp.	Sunnyvale	1985
Linear Integrated Systems	Fremont	1987
Linear Technology Corp.	Milpitas	1981
Logic Devices Inc.	Sunnyvale	1983
Maxim Integrated Products	Sunnyvale	1983
MemTech Technology Corp.	Santa Clara	1986
Micro Linear Corp.	San Jose	1983
Microwave Technology, Inc.	Fremont	1982
Modular Semiconductor	Sunnyvale	1983
MOS Electronics Corp.	Sunnyvale	1983
Multichip Technology	San Jose	1988
nCHIP, Inc.	San Jose	1987
NovaSensor	Fremont	1985
Novix	Cupertino	1984
Oak Technology, Inc.	Sunnyvale	1987

(Continued)

Table 4a (Continued)  
Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
Orbit Semiconductor	Sunnyvale	1985
Pacific Monolithics	Sunnyvale	1984
Paradigm Technology	San Jose	1987
Performance Semiconductor	Sunnyvale	1984
Plus Logic	San Jose	1988
PLX Technology Corp.	Mountain View	1986
Power Integrations	Mountain View	1988
PromTech	San Jose	1984
Samsung Semiconductor, Inc.	San Jose	1983
SEEQ Technology, Inc.	San Jose	1981
Sierra Semiconductor	San Jose	1984
Si-Fab Corp.	Scotts Valley	1981
Sensym, Inc.	Sunnyvale	1982
Solid State Optronics	San Jose	1982
S3	Santa Clara	1989
Synaptics, Inc.	San Jose	1986
Synergy Semiconductor Corp.	Santa Clara	1987
Topaz Semiconductor	San Jose	1985
US2	San Jose	1987
Vadem	San Jose	1983
VIA Technologies	Fremont	1987
Vitellic Corp.	San Jose	1983
WaferScale Integration	Fremont	1983
Weitek Corp.	Sunnyvale	1980
Xilinx Inc.	San Jose	1984
Zoran Corp.	Santa Clara	1983

Source: Dataquest  
January 1990

Table 4b  
Start-Ups in the Southwest (21)

Company	Location	Date Formed
AMCC	San Diego, CA	1979
Brooktree Corp.	San Diego, CA	1983
Comlinear Corp	Ft. Collins, CO	1980
Crystal Semiconductor	Austin, TX	1984
Dallas Semiconductor	Dallas, TX	1984
GigaBit Logic	Newbury Park, CA	1981
HNC	San Diego, CA	1986
Innovative Silicon Technology	Carrollton, TX	1986
Integrated Logic Systems	Colorado Springs, CO	1983
Microwave Monolithics	Simi Valley, CA	1982
Molecular Electronics Corp.	Torrance, CA	1984
NMB Technologies	Chatsworth, CA	1984

(Continued)

**Table 4b (Continued)**  
**Start-Ups in the Southwest (21)**

Company	Location	Date Formed
Opto Diode Corp.	Newbury Park, CA	1981
Ramtron Corp.	Colorado Springs, CO	1984
SIMTEK Corp.	Colorado Springs, CO	1987
Telcom Devices Corp.	Newbury Park, CA	1986
Three-Five Systems, Inc.	Phoenix, AZ	1985
Togai InfraLogic	Irvine, CA	1987
Triad Semiconductors	Colorado Springs, CO	1986
Vitesse Semiconductor	Camarillo, CA	1984
XTAR Corp.	San Diego, CA	1982

Source: Dataquest  
January 1990

**Table 4c**  
**Start-Ups in the Northwest (7)**

Company	Location	Date Formed
Advanced Hardware Architectures	Moscow, ID	1988
Advanced Power Technology, Inc.	Bend, OR	1984
Bipolar Integrated Technology	Beaverton, OR	1983
Lattice Semiconductor	Hillsboro, OR	1983
Level One Communications	Folsom, CA	1985
Seattle Silicon Corp.	Bellevue, WA	1983
TriQuint Semiconductor	Beaverton, OR	1984

Source: Dataquest  
January 1990

**Table 4d**  
**Start-Ups in the Midwest (3)**

Company	Location	Date Formed
Electronic Technology Corp.	Ames, IA	1983
Photonic Integration Research	Columbus, OH	1987
VTC Inc.	Bloomington, MN	1984

Source: Dataquest  
January 1990

**Table 4e**  
**Start-Ups in the Northeast (11)**

Company	Location	Date Formed
ANADIGICS	Warren, NJ	1985
BKC International	Lawrence, MA	1986
Custom Silicon	Lowell, MA	1983
Edsun Laboratories	Waltham, MA	1984
Epitaxx Inc.	Princeton, NJ	1984
Hittite Microwave Corp.	Woburn, MA	1985
Lytel	Somerville, NJ	1984
NSI Logic	Marlboro, MA	1984
Oxford Computer	Oxford, CT	1987
Powerex	Youngwood, PA	1986
TranSwitch	Shelton, CT	1988

Source: Dataquest  
 January 1990

**Table 4f**  
**Start-Ups in the Southeast (2)**

Company	Location	Date Formed
Cree Research	Durham, NC	1987
Spectrum Microdevices	Frederick, MD	1980

Source: Dataquest  
 January 1990

**Table 4g**  
**Start-Ups in the ROW Region (18)**

Company	Location	Date Formed
Asahi Kasei Microsystems	Japan	1983
Austek Microsystems	Australia	1984
Calmos Systems	Canada	1983
Chartered Semiconductor	Singapore	1987
Dolphin Integration	France	1985
European Silicon Structures	West Germany	1985
Genesis Microchip	Canada	1987
Hualon Micro-Electronics Corp.	Taiwan	1987
Kyoto Semiconductor Corp.	Japan	1980
Matra-Harris Semiconducteur	France	1979
Mietec N.V.	Belgium	1983
MOSPEC Semiconductor Corp.	Taiwan	1987
Opto Tech Corp.	Taiwan	1983
RAMAX Ltd.	Australia	1987
SID Microelectronics	Brazil	1984
TSMC	Taiwan	1986
UMC	Japan	1979
Wolfson Microelectronics Ltd.	Scotland	1985

Source: Dataquest  
 January 1990



## Success Factors

As competition intensifies in the semiconductor industry, building a successful start-up company will become increasingly difficult. What are the key factors that will distinguish the winners from the losers? Based on the track records of existing companies and our discussions with venture capitalists, Dataquest believes that the following factors are critical:

- **Management**
  - A strong management team, top-notch engineers, and excellent marketing managers
  - A unique business strategy with achievable goals including a clear definition of a customer's problem to be solved, rather than technology looking for an application
  - A stable source of financing that will allow sustained operation for five to eight years—maybe longer in a new market
- **Product Development**
  - Access to leading-edge processing expertise
  - Access to quality CAD software and support tools
  - Close relations with customer base
- **Manufacturing**
  - An experienced operations manager and strong in-house manufacturing knowledge
  - A silicon foundry agreement during initial years
  - A plan to ensure access to a state-of-the-art wafer fabrication facility
- **Marketing**
  - Global marketing perspective
  - Highly focused marketing plan
  - Asia monitoring capability (especially Japan)
  - A plan for overseas sales, marketing, and distribution agreements in the second or third year of production

Absolutely critical for success is the building of a strong management team. Successful new companies are those that attract talented and experi-

enced personnel to fill positions in key areas including development, manufacturing, and international operations. Companies with only one or two of these positions filled with first-rate managers usually have trouble during the product commercialization phase. In general, the start-ups most likely to fail are those that are strong in technology but weak in marketing, manufacturing, and general management. Many companies are built around engineers who do not have the breadth of management and marketing experience required to run a company successfully.

The lack of marketing intelligence is another common pitfall. Most start-ups concentrate on the U.S. market and ignore overseas markets until they attain a certain sales volume. Unfortunately, these companies overlook significant sales opportunities and emerging foreign competitors. Dataquest believes that a global posture is critical for start-up companies, especially with the growing competition from European and Asian companies.

In evaluating start-up companies, we believe the following questions should be asked:

- What are the prior achievements of key officers and managers?
- Is the product line unique or a significant improvement over its competitors? Is it diversified enough to withstand fierce price competition?
- How much does the start-up invest in R&D?
- Does the start-up have plans to conduct joint research with universities and strategic partners?
- What is the start-up's marketing strategy? Is it domestic only or a global strategy?
- Is the start-up planning foundry agreements and/or plant construction? What is the timing?
- If the start-up has an agreement with an Asian company, is it giving away the store?
- Is the company prepared to respond to rapid technological innovation?

## Financing

The start-ups in this directory have raised more than \$2 billion in venture funding so far. In addition, public offerings have made up an additional \$1.2 billion to start-up capital stock. The 1989

public offering totals are skewed by a \$460 million public offering for NMB Semiconductor. Tables 5a and 5b contain information regarding public offerings by start-ups. Table 5a lists initial public offerings including company, date, and amount raised. Table 5b lists all public offerings by

start-ups. Figure 5 shows start-up financing by year, highlighting monies raised by public offerings and those raised by other means. Table 6 contains to-date totals for funding by start-up and provides information regarding the source of funds for each company.

**Table 5a**  
**Initial Public Offerings by Start-Ups**

Company	Date	Amount
VLSI Technology	February 1983	\$ 53.0M
LSI Logic	May 1983	\$160.0M
ZyMOS Corp.	July 1983	\$ 46.9M
SEEQ	September 1983	\$ 20.0M
Integrated Devices Technology	February 1984	\$ 16.1M
United Microelectronics	July 1985	\$ 7.5M
Linear Technology Corp.	May 1986	\$ 24.0M
Cypress Semiconductor	June 1986	\$ 72.0M
California Micro Devices	October 1986	\$ 5.2M
Chips & Technologies	October 1986	\$ 11.3M
IMP	June 1987	\$ 22.3M
Dallas Semiconductor	September 1987	\$ 35.1M
Maxim Integrated Products	February 1988	\$ 7.0M
Altera Corp.	March 1988	\$ 15.0M
Weitek Corp.	September 1988	\$ 8.35M
Logic Devices	November 1988	\$ 5.4M
NMB Semiconductor	September 1989	\$460.0M
Cirrus Logic	June 1989	\$ 24.0M
International CMOS Technology	June 1989	\$ 3.6M
Lattice	November 1989	\$ 14.0M

Source: Dataquest  
January 1990

**Table 5b**  
**Public Offerings by Start-Ups**

Company	Date	Amount
VLSI Technology	February 1983	\$ 53.0M
LSI Logic	May 1983	\$160.0M
ZyMOS Corp.	July 1983	\$ 46.9M
SEEQ	September 1983	\$ 20.0M
Integrated Logic Systems	January 1984	\$ 5.0M
Integrated Device Technology	February 1984	\$ 16.1M
Micron Technology	June 1984	\$ 25.0M
Micron Technology	May 1985	\$ 25.0M
United Microelectronics	July 1985	\$ 7.5M
VLSI Technology	April 1986	\$ 33.0M
Linear Technology Corp.	May 1986	\$ 24.0M
Cypress Semiconductor	June 1986	\$ 72.0M
Adaptec, Inc.	June 1986	\$ 10.0M
Micron Technology	August 1986	\$ 13.4M

(Continued)

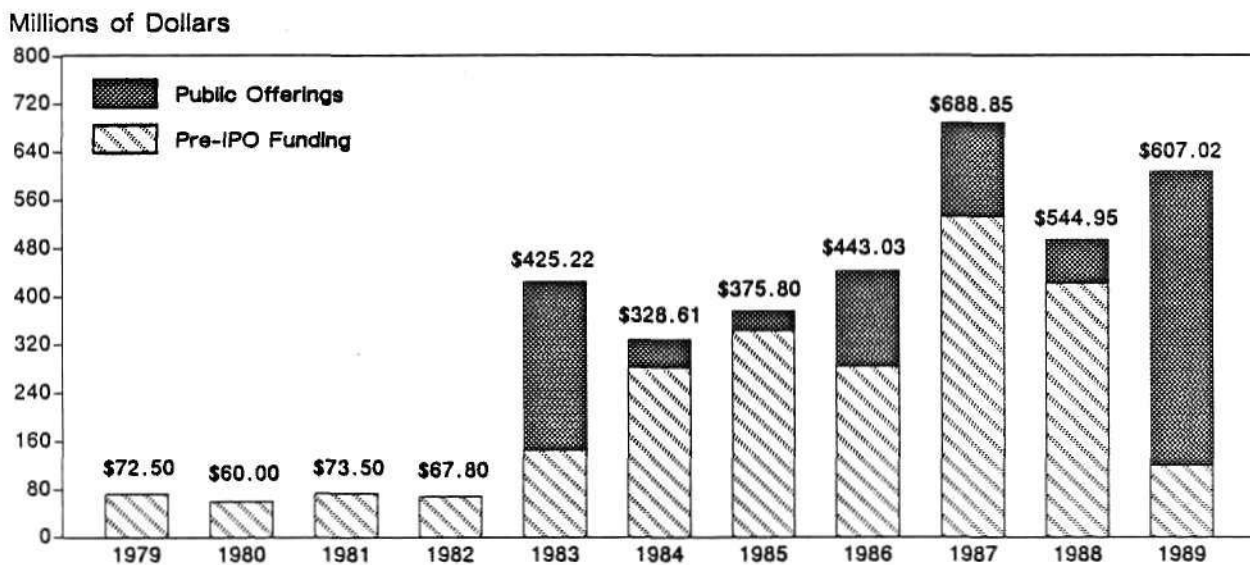
**Table 5b (Continued)**  
**Public Offerings by Start-Ups**

Company	Date	Amount
California Micro Devices	October 1986	\$ 5.2M
Chips & Technologies	October 1986	\$ 11.3M
LSI Logic	April 1987	\$ 21.0M
Xicor	April 1987	\$ 22.8M
Cypress Semiconductor	June 1987	\$ 39.8M
IMP	June 1987	\$ 22.3M
Chips & Technologies	July 1987	\$ 15.5M
Dallas Semiconductor	September 1987	\$ 35.1M
Maxim Integrated Products	February 1988	\$ 7.0M
Xicor	March 1988	\$ 17.0M
Altera Corp.	March 1988	\$ 15.0M
SEEQ	April 1988	\$ 19.5M
Weitek Corp.	September 1988	\$ 8.35M
Logic Devices	November 1988	\$ 5.4M
NMB Semiconductor	1989	\$460.0M
International CMOS Technology	June 1989	\$ 3.6M
Cirrus Logic	June 1989	\$ 24.0M
Lattice	Filed September 1989	N/A

N/A = Not Available

Source: Dataquest  
January 1990

**Figure 5**  
**Start-Up Financing by Year**  
**1979-1989**



0005344-5

Source: Dataquest  
January 1990

**Table 6**  
**Capitalization by Company to Date**  
**(Millions of Dollars)**

Company	Amount	Sources
Actel Corp.	\$ 19.70	Venture capital, private corporate
Advanced Power Technology	\$ 13.80	Venture capital
Altera Corp.	\$ 42.90	Lease, venture capital, public offering
ANADIGICS	\$ 29.00	Venture capital, corporate
AMCC	\$ 22.00	Venture capital, corporate
Aspen Semiconductor	\$ 7.40	Corporate
ATMEL	\$ 3.30	Venture capital
Austek Microsystems	\$ 6.70	Venture capital
Bipolar Integrated Technology	\$ 56.10	Lease, government, venture capital, corporate
BKC International	\$ 2.52	Private, loan
Brooktree	\$ 30.90	Venture capital, corporate
California Micro Devices	\$ 5.20	Public offering
Calmos Systems	\$ 5.50	Private
Calogic Corp.	\$ 0.02	Private
Catalyst Semiconductor	\$ 4.50	Private
Celeritek	\$ 8.40	Venture capital
Chartered Semiconductor	\$ 40.00	Corporate
Cirrus Logic	\$ 51.60	Public offering, venture capital, corporate
Cree Research	\$ 3.00	N/A
Crystal Semiconductor	\$ 31.20	Venture capital, corporate
Custom Arrays	\$ 2.35	Corporate, private
Dallas Semiconductor	\$ 74.40	Public offering, bond, venture capital
Dolphin Integration	\$ 0.60	Corporate, private
Elantec, Inc.	\$ 23.40	Venture capital, corporate
Electronic Technology Corp.	\$ 2.00	Venture capital, government
Epitaxx Inc.	\$ 1.50	Venture capital
ES2	\$ 44.00	Corporate, venture capital
Exel Microelectronics	\$ 36.00	Private, corporate, venture capital
Gazelle Microcircuits	\$ 17.20	Venture capital
GigaBit Logic	\$ 46.30	Venture capital, corporate
HNC	\$ 6.63	Private, venture capital
Hualon Micro-Electronics	\$ 30.00	Corporate
IMP	\$ 81.90	Public offering, venture capital, corporate, lease
Inmos	\$100.00	Government, venture capital
Inova	\$ 14.80	Venture capital, corporate
Integrated CMOS Systems	\$ 12.20	Venture capital, private
Integrated Logic Systems	\$ 5.00	Public offering
International CMOS Technology	\$ 13.50	Venture capital, public offering, corporate
ISSI	\$ 2.80	Corporate, private, venture capital
IXYS	\$ 16.70	Venture capital, private
Krysalis	\$ 4.20	Venture capital
Lattice	\$ 15.20	Public offering, credit, private, venture capital
Level One Communications	\$ 14.05	Venture capital, private
Logic Devices	\$ 5.40	Public offering

(Continued)

Table 6 (Continued)

Capitalization by Company to Date  
(Millions of Dollars)

Company	Amount	Sources
Linear Technology Corp.	\$ 59.00	Lease, corporate, venture capital, public offering
Lytel	\$ 20.00	Corporate
Matra-Harris Semiconducteur	\$ 40.00	Corporate
Maxim Integrated Products	\$ 30.30	Public offering, venture capital, lease, corporate
Micro Linear Corp.	\$ 53.30	Lease, venture capital corporate
Micron Technology	\$151.90	Private, public offerings
Microwave Technology	\$ 10.10	Venture capital, corporate
MOSel	\$ 6.00	Corporate, private
MOSPEC	\$ 11.75	Private
nCHIP	\$ 4.80	Venture capital, private
NMB	\$471.11	Public offering, private
Novix Inc.	\$ 1.00	Venture capital
Oak Technology	\$ 6.00	Venture capital, private
Pacific Monolithics	\$ 8.50	Venture capital
Paradigm Technology	\$ 12.60	Venture capital
Performance Semiconductor	\$ 32.90	Venture capital, private, lease
Photonic Integration Research	\$ 10.00	Corporate, private
Plus Logic	\$ 5.00	Venture capital
PLX Technology	\$ 1.90	Venture capital
Power Integrations	\$ 10.60	Venture capital, corporate
PromTech	\$ 0.20	Private
RAMAX	\$ 0.85	Government
Ramtron	\$ 34.50	Corporate
S3	\$ 6.00	Venture capital
Samsung Semiconductor	\$ 13.00	Venture capital, corporate
Seattle Silicon	\$ 28.80	Venture capital, corporate
SEEQ	\$ 82.50	Public offerings, venture capital, corporate, private
Sensym	\$ 14.20	Venture capital, corporate
SID Microelectronics	\$ 14.20	Private
Sierra Semiconductor	\$ 51.10	Venture capital, corporate
Synaptics	\$ 2.10	Venture capital
Synergy Semiconductor	\$ 12.90	Venture capital, private
TSMC	\$282.00	Venture capital, corporate, government
Three-Five Systems	\$ 5.50	Venture capital, corporate
Togai InfraLogic	\$ 4.20	Venture capital
United Microelectronics	\$ 20.00	Public offering, corporate, government
US2	\$ 4.52	Venture capital
Vitellic	\$ 55.20	Venture capital, corporate
Vitesse Semiconductor	\$ 25.40	Venture capital, government
WaferScale Integration	\$ 45.60	Venture capital, corporate
Weitek Corp.	\$ 15.85	Public offering, venture capital
Xilinx	\$ 21.00	Venture capital, corporate
Zoran	\$ 33.80	Venture capital, corporate

N/A = Not Available

Source: Dataquest  
January 1990

## Venture Capital

Beginning in 1983, venture capital funding of semiconductor start-ups grew at a substantial rate. In 1986, funding slowed in the face of an industry recession. The industry recovered in 1987 and attracted new venture financing. Since that time, however, the venture capital community has shown declining interest in the semiconductor industry. The prevailing feeling among venture capital investors is that U.S. start-ups cannot compete with Japanese companies. In addition, the 1987 stock market crash has caused lower stock valuations industrywide, which is causing investors to think twice about floating their start-up companies on the stock market. Despite the fact that the stock market has recovered from the crash to post all-time highs, high-tech stocks remain in disfavor. Without a strong stock market as a means of recovering investment costs, many venture capitalists are choosing to stay out of this uncertain market.

Dataquest has identified a similar pattern among European investors as well. European investors are choosing to fund medium-size companies rather than start-ups. The venture capital industry is looking to back companies that want to acquire or buy stakes in small electronics companies. This method avoids the cost and risk of flotation and often provides a higher return on investment.

Japanese venture capitalists typically are more conservative than investors in the United States.

Japanese companies rarely invest in start-ups; investors in Japan are more likely to invest in established companies. Japanese venture capitalists also tend not to fund high-tech companies and now are finding significant return in service industries, which support Japan's growing affection for leisure activities.

During the past few years, Dataquest has identified a general increase in total venture capital funding worldwide. Despite this fact, we are witnessing a growing disenchantment with the semiconductor industry among venture capitalists. This disenchantment is causing start-ups to seek new funding alternatives such as private placements or large loans. For this reason, Dataquest predicts a decline in start-up activity for the near future.

## Venture Capital Companies

Of the 115 companies that released funding information to Dataquest, 61 companies reported the use of venture capital funding. This number may actually be much higher because, in many cases, profiled companies provided limited financial information. Dataquest identified 331 venture capital companies that provided funding to start-ups between 1979 and 1989. Thirty-four companies have been involved in five or more rounds of financing. Table 7 provides information about the 66 venture capitalists that were involved in three or more rounds of financing during this period.

Table 7

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Hambrecht & Quist (17)	VLSI Technology	December 1980
	LTC	September 1981
	Xilinx	March 1984
	Austek Microsystems	July 1984
	Exel Microelectronics	September 1984
	Crystal Semiconductor	October 1984
	Integrated CMOS Systems	1985
	Seattle Silicon	February 1985
	Exel Microelectronics	August 1985
	Gazelle Microcircuits	August 1986
	Sierra Semiconductor	October 1986
	Gazelle Microcircuits	April 1987
	Seattle Silicon	August 1987

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

<b>Venture Capital Firm</b>	<b>Company</b>	<b>Date</b>
<b>Hambrecht &amp; Quist (Continued)</b>	<b>Seattle Silicon</b>	<b>August 1988</b>
	<b>Gazelle Microcircuits</b>	<b>September 1988</b>
	<b>Integrated CMOS Systems</b>	<b>October 1988</b>
	<b>Vitellic</b>	<b>January 1989</b>
<b>Kleiner, Perkins, Caufield &amp; Byers (17)</b>	<b>VLSI Technology</b>	<b>December 1980</b>
	<b>LSI Logic</b>	<b>January 1981</b>
	<b>SEEQ</b>	<b>March 1981</b>
	<b>LTC</b>	<b>September 1981</b>
	<b>Cypress Semiconductor</b>	<b>April 1983</b>
	<b>Xilinx</b>	<b>March 1984</b>
	<b>Zoran Corp.</b>	<b>October 1985</b>
	<b>Crystal Semiconductor</b>	<b>February 1986</b>
	<b>Gazelle Microcircuits</b>	<b>August 1986</b>
	<b>SEEQ</b>	<b>October 1986</b>
	<b>Gazelle Microcircuits</b>	<b>April 1987</b>
	<b>Synaptics</b>	<b>June 1987</b>
	<b>Power Integrations</b>	<b>May 1988</b>
	<b>Gazelle Microcircuits</b>	<b>September 1988</b>
<b>S3, Inc.</b>	<b>April 1989</b>	
<b>Merrill, Pickard, Anderson &amp; Eyre (13)</b>	<b>nCHIP</b>	<b>August 1989</b>
	<b>Power Integrations</b>	<b>August 1989</b>
	<b>LSI Logic</b>	<b>February 1982</b>
	<b>Maxim Integrated Products</b>	<b>1983</b>
	<b>Weitek Corporation</b>	<b>March 1983</b>
	<b>Cypress Semiconductor</b>	<b>April 1983</b>
	<b>Dallas Semiconductor</b>	<b>June 1984</b>
	<b>Maxim Integrated Products</b>	<b>February 1985</b>
	<b>Maxim Integrated Products</b>	<b>September 1985</b>
	<b>Saratoga Semiconductor</b>	<b>May 1986</b>
<b>Synergy Semiconductor</b>	<b>February 1988</b>	
<b>Gazelle Microcircuits</b>	<b>September 1988</b>	
<b>Plus Logic</b>	<b>January 1989</b>	
<b>S3</b>	<b>April 1989</b>	
<b>Power Integrations</b>	<b>August 1989</b>	
<b>Sequoia Capital (12)</b>	<b>LTC</b>	<b>September 1981</b>
	<b>LSI Logic</b>	<b>February 1982</b>
	<b>Cypress Semiconductor</b>	<b>April 1983</b>
	<b>Microwave Technology</b>	<b>August 1983</b>
	<b>Sierra Semiconductor</b>	<b>January 1984</b>
	<b>Elantec, Inc.</b>	<b>December 1986</b>
	<b>Vitesse Semiconductor</b>	<b>February 1987</b>
	<b>Synergy Semiconductor</b>	<b>July 1987</b>
	<b>Elantec, Inc.</b>	<b>September 1988</b>
	<b>Integrated CMOS Systems</b>	<b>October 1988</b>
<b>Plus Logic</b>	<b>January 1989</b>	
<b>S3</b>	<b>April 1989</b>	

(Continued)

Table 7 (Continued)  
 Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Adler & Company (11)	AMCC	April 1979
	IXYS Corp.	1983
	AMCC	March 1983
	Zoran Corp.	August 1983
	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Maxim Integrated Products	February 1985
	IXYS Corp.	October 1985
	IXYS Corp.	August 1987
	AMCC	September 1987
Oak Investment Partners (11)	IXYS Corp.	August 1988
	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Vitellic	March 1984
	Dallas Semiconductor	June 1984
	IXYS Corp.	October 1985
	Pacific Monolithics	September 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	Vitesse Semiconductor	January 1988
Robertson, Colman & Stephens (10)	Synergy Semiconductor	February 1988
	IXYS Corp.	August 1988
	IMP	August 1981
	Sensym	October 1982
	AMCC	March 1983
	WaferScale Integration	February 1984
	Cirrus Logic	March 1984
	Cypress Semiconductor	April 1984
	Sensym	May 1984
	Cirrus Logic	May 1985
U.S. Venture Partners (10)	Vitesse Semiconductor	February 1987
	AMCC	September 1987
	AMCC	March 1983
	Microwave Technology	August 1983
	Performance Semiconductor	October 1984
	IXYS Corp.	October 1985
	Micro Linear Corp.	February 1986
	Elantec, Inc.	December 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
Brentwood Associates (9)	IXYS Corp.	August 1988
	Elantec, Inc.	September 1988
	Maxim Integrated Products	1983
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
Cirrus Logic	May 1985	

(Continued)



Table 7 (Continued)  
Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Brentwood Associates (Continued)	California Devices	August 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	June 1986
	Performance Semiconductor	August 1988
	Plus Logic	January 1989
Mayfield Fund (8)	LSI Logic	January 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Cypress Semiconductor	August 1985
	Celeritek, Inc.	August 1986
	Synergy Semiconductor	July 1987
	S3	April 1989
Mohr, Davidow Ventures (8)	nCHIP	August 1989
	Sierra Semiconductor	January 1984
	Actel Corp.	June 1986
	Vitesse Semiconductor	January 1988
	Power Integrations	May 1988
	US2	March 1989
	S3	April 1989
	nCHIP	August 1989
Burr, Egan, Deleage & Co. (7)	Power Integrations	August 1989
	Elantec, Inc.	August 1984
	Sierra Semiconductor	April 1985
	IXYS Corp.	October 1985
	Celeritek, Inc.	August 1986
	IXYS Corp.	August 1987
	IXYS Corp.	August 1988
DSV Partners (7)	Elantec, Inc.	September 1988
	Maxim Integrated Products	1983
	Epitaxx Inc.	March 1984
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Integrated CMOS Systems	May 1987
New Enterprise Associates (7)	Integrated CMOS Systems	October 1988
	Microwave Technology, Inc.	August 1983
	Dallas Semiconductor	February 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	Dallas Semiconductor	April 1987
	GigaBit Logic	April 1987
Technology Venture Investors (7)	GigaBit Logic	September 1988
	LTC	September 1981
	Sierra Semiconductor	January 1984
	Altera Corp.	April 1984
	Cirrus Logic	May 1985

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Technology Venture Investors (Continued)	Inova	February 1986
	Synaptics	May 1986
	Synaptics	June 1987
Venrock Associates (7)	VLSI Technology	December 1980
	Sierra Semiconductor	January 1984
	Celeritek, Inc.	March 1985
	Gazelle Microcircuits	April 1987
	Integrated CMOS Systems	May 1987
	Gazelle Microcircuits	September 1988
Advanced Technology Ventures (6)	Integrated CMOS Systems	October 1988
	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	Performance Semiconductor	October 1984
	Actel Corp.	October 1985
	Actel Corp.	June 1986
Alex Brown & Sons (6)	Togai InfraLogic	December 1988
	IMP	June 1983
	ANADIGICS	April 1985
	Weitek	January 1986
	Dallas Semiconductor	March 1986
	Dallas Semiconductor	April 1987
	ANADIGICS	January 1989
Concord Partners (6)	Microwave Technology	August 1983
	Zoran Corp.	October 1985
	Power Integrations	May 1988
	Micro Linear	August 1989
	US2	March 1989
Crosspoint Venture Partners (6)	Power Integrations	August 1989
	Sensym	October 1982
	Laserpath	June 1983
	Sensym	May 1984
	Laserpath	July 1985
	Krysalis	May 1986
Harvard Management (6)	Krysalis	December 1986
	Cypress	March 1985
	BIT	May 1986
	Performance Semiconductor	November 1986
	Elantec	December 1986
	Elantec	September 1988
J.H. Whitney (6)	Gazelle Microcircuits	September 1988
	Cypress	April 1983
	WaferScale	February 1984
	Vitellic	March 1984
	Xilinx	March 1984
	Vitesse	February 1987
	Synergy	February 1988

(Continued)

Table 7 (Continued)  
 Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Rothschild Ventures (6)	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	ANADIGICS	April 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	August 1988
Bessemer Venture Partners (5)	Togai InfraLogic	December 1988
	Maxim Integrated Products	1983
	WaferScale Integration	February 1984
	Vitellic	March 1984
	Maxim Integrated Products	February 1985
Grace Ventures (5)	Maxim Integrated Products	September 1985
	IXYS	October 1985
	Zoran Corp.	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
Harvest Ventures (5)	IXYS	August 1988
	IMP	August 1981
	IXYS	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
Hillman Ventures (5)	IXYS	August 1988
	SEEQ	March 1981
	IMP	June 1983
	SEEQ	October 1986
	Actel Corp.	August 1988
J.F. Shea & Company (5)	Power Integrations	August 1989
	Advanced Power Technology	N/A
	Altera	April 1984
	Dallas Semiconductor	June 1984
	Exel Microelectronics	September 1984
Matrix Partners (5)	IXYS	August 1988
	AMCC	March 1983
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
	AMCC	September 1987
Sutter Hill Ventures (5)	Synergy Semiconductor	February 1988
	LSI Logic	January 1981
	LTC	September 1981
	Weitek Corp.	February 1982
	Sierra Semiconductor	January 1984
Accel Partners (4)	Celeritek	March 1985
	AMCC	March 1983
	WaferScale Integration	February 1984
	Micro Linear	November 1985
	AMCC	September 1987

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Associated Venture Investors (4)	Sierra Semiconductor	January 1984
	Elantec	August 1984
	Elantec	September 1988
	PLX Technology	August 1989
Bay Partners (4)	Sierra Semiconductor	January 1984
	Exel Microelectronics	September 1984
	California Devices	August 1985
	IXYS	August 1988
Continental Illinois Venture Corp. (4)	IMP	August 1981
	WaferScale Integration	November 1984
	Three-Five Systems	September 1987
	HNC	June 1988
John Hancock Venture Capital (4)	Dallas Semiconductor	June 1984
	California Devices	September 1986
	SEEQ	October 1986
	Saratoga Semiconductor	March 1987
Julian, Cole & Stein (4)	Advanced Power Technology	N/A
	Level One	December 1985
	Level One	December 1986
	Level One	September 1987
Norwest Venture Capital Management (4)	Seattle Silicon	February 1985
	Actel Corp.	June 1986
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
Republic Ventures (4)	IMP	August 1982
	Dallas Semiconductor	June 1984
	BIT	May 1986
	GigaBit Logic	September 1988
Riordan Venture Group (4)	GigaBit Logic	March 1982
	Exel Microelectronics	September 1984
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Union Venture Corp. (4)	IDT	June 1983
	GigaBit Logic	February 1985
	BIT	May 1986
	GigaBit Logic	September 1988
Venture Growth Associates (4)	AMCC	March 1983
	Altera Corp.	April 1984
	Dallas Semiconductor	June 1984
	AMCC	September 1987
Alan Patricof Associates (3)	ANADIGICS	April 1985
	California Devices	August 1985
	ANADIGICS	January 1989

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
Alpha Partners (3)	Altera Corp.	June 1983
	Inova	1984
	Inova	February 1986
Arthur D. Little (3)	IXYS	October 1985
	ANADIGICS	November 1986
	IXYS	August 1988
Berkeley International (3)	Crystal Semiconductor	June 1987
	Sierra Semiconductor	September 1987
	Performance Semiconductor	August 1988
Berry Cash Southwest Partnership (3)	Crystal Semiconductor	October 1984
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
Bryan & Edwards (3)	Sierra Semiconductor	April 1985
	Inova	February 1986
	Vitesse	February 1987
Cowen & Company (3)	LTC	April 1983
	BIT	July 1987
	Performance Semiconductor	August 1988
Fairfield Venture Partners (3)	Micro Linear	October 1983
	ANADIGICS	April 1985
	BIT	July 1986
GE Venture Capital Corp. (3)	ANADIGICS	April 1985
	Laserpath	July 1985
	SEEQ	October 1986
Hambro International Venture Fund (3)	Integrated CMOS Systems	May 1987
	Edsun Labs	July 1988
	Integrated CMOS Systems	October 1988
Hill, Kirby & Washing (3)	Seattle Silicon	February 1985
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
HLM Partners (3)	Dallas Semiconductor	March 1986
	Saratoga Semiconductor	March 1987
	Dallas Semiconductor	April 1987
Hook Partners (3)	California Devices	October 1986
	Vitesse Semiconductor	January 1988
	Plus Logic	January 1989
InnoVen (3)	Weitek Corp.	January 1981
	Weitek Corp.	February 1982
	California Devices	August 1985
Merrill Lynch Venture Capital (3)	California Devices	August 1985
	Micro Linear	August 1988
	Elantec	September 1988

(Continued)

**Table 7 (Continued)**  
**Leading Venture Investors in Start-Ups**

Venture Capital Firm	Company	Date
New Venture Partners (3)	Dallas Semiconductor	June 1984
	Cirrus Logic	June 1987
	Vitesse Semiconductor	April 1989
Rainier Venture Partners (3)	Seattle Silicon	February 1985
	Xilinx	December 1985
	Seattle Silicon	August 1987
Robert Fleming Investment Management (3)	AMCC	March 1983
	IMP	June 1983
	Cypress	April 1984
Shaw Venture Partners (3)	Pacific Monolithics	August 1985
	Actel Corp.	October 1985
	Actel Corp.	June 1986
Sprout Group (3)	Synaptics	May 1986
	Synaptics	June 1987
	Actel Corp.	August 1988
TA Associates (3)	Exel Microelectronics	September 1984
	Exel Microelectronics	August 1985
	Paradigm Technology	May 1989
Warburg, Pincus Ventures (3)	WaferScale Integration	February 1984
	Epitaxx Inc.	March 1984
	Level One	September 1987
Weeden Capital Partners (3)	Krysalis	May 1986
	Krysalis	December 1986
	BIT	April 1988
Welsh, Carson, Anderson & Stowe (3)	IMP	August 1981
	Altera Corp.	April 1984
	Zoran Corp.	October 1985

N/A = Not Available

Source: Dataquest  
January 1990

## Strategic Alliances

An important development in the start-up area is the proliferation of licensing and joint-development agreements with established companies. At a time when venture capital has become increasingly scarce, small companies often are under pressure for near-term funding. In addition to seeking funds, start-ups are entering strategic alliances for a variety of other reasons, such as the following:

- To avoid the prohibitive costs of a fab
- To increase production capacity

- To defray increasing product development costs
- To strengthen product portfolios
- To increase a worldwide presence
- To protect the start-up from the danger of obsolescence of a process technology by entering fab agreements

Strategic alliances can be valuable to both start-up companies and larger companies. Large companies often enter into alliances with technology-rich start-ups as a way of entering emerging markets. Through agreements with large companies,

start-ups are able to take advantage of the manufacturing, marketing, and financial power of large companies. Table 8 lists the advantages of strategic alliances to start-ups.

Until recently, companies that sought access to new technologies or markets often would resort to acquisition. Acquisition arrangements, however, can be ill-conceived, inefficient, and unsuccessful. Acquisitions frequently trigger a flight of top engineers and lower employee morale in the acquired company.

Corporate partners are seeking something more than mere dollar gains. Agreements include access to technology, designs, and guaranteed production.

To accomplish strategic objectives, companies are considering a broader range of limited and focused cooperative agreements, such as the following:

- Minority equity investments
- Technology licensing
- Joint marketing
- Joint ventures
- All or part of manufacturing

Figure 6 shows the number of start-up alliances per year for the period 1979 through 1989. Tables 9a through 9k list start-up alliances by year.

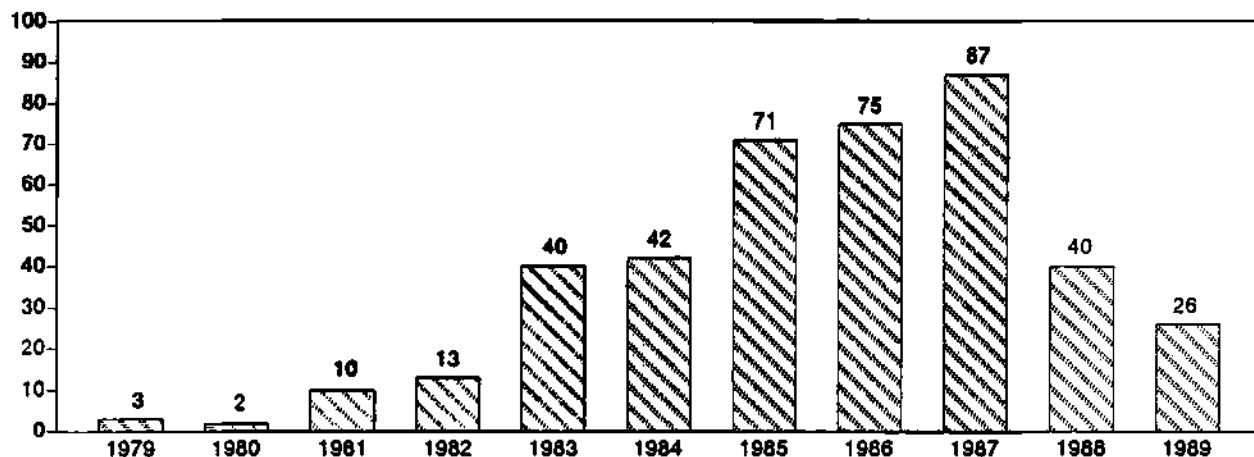
Table 8

Advantages of Start-Up Strategic Alliances

Offense	Defense
Secure technologies	Work with potential rivals
Gain access to markets	Keep out competitors
Rapid market entry	Monitor technology and market trends
Fill in product portfolios	Cut production costs
Foundry capacity	Financial viability
Cash infusions	
Greater product acceptance	
Ease trade frictions	
<b>Pitfalls and Problems of Alliances</b>	
<b>Management</b>	
Language and cultural differences	
Management styles	
Conflicting business goals	
Unequal levels of commitment	
Differing negotiating styles	
<b>Technology</b>	
Giving away the store	
Receiving little in return	
Stuck with a nonindustry standard	
<b>Market</b>	
Quarrels over territory	
Loss of overseas expansion potential	
Encroachment into U.S. market	

**Figure 6**  
**Alliances by Year**  
**1979-1989**

Number of Alliances



0006344-6

Source: Dataquest  
 January 1990

**Table 9a**  
**1989 Alliances (26)**

Companies	Description
ACC Microelectronics Motorola	April 1989—Motorola to second-source the ACC82020 and ACC82300 chip sets and cache controller and tag RAM to be introduced in late 1989
Crystal Semiconductor Analogic	June 1989—Analogic to become VAR of the Crystal ADC product line
HNC Fusion Group	September 1989—Partnership to market software utilities designed to integrate neural computing into financial applications
ICT AMD	July 1989—ICT and AMD to codevelop 1Mb EPROM with an access time of 55ns
IIT Ascii	1989—Ascii to distribute IIT products in Japan
IIT Mitsui	1989—Mitsui to distribute IIT products in Japan
IIT Yamaha	1989—Yamaha to provide wafer fab services to IIT
IMP Mitel	March 1989—Mitel to exchange four communications chip designs for IMP's 1.2-micron MxCMOS process, ACL1.2-DCL1.2 cell libraries, and mixed A/D design methodology

(Continued)



Table 9a (Continued)

## 1989 Alliances (26)

Companies	Description
ISSI UMC	January 1989—Licensing and manufacturing agreement with UMC, which will provide foundry services to ISSI
ISSI TSMC	August 1989—TSMC to provide foundry services to ISSI
ISSI LSI Logic	September 1989—Licensing and manufacturing agreement, LSI to provide foundry services to ISSI
Lattice AMD	May 1989—Cross-licensing agreement: Lattice gained rights to AMD's 22V10 PLD and the use of 22V10 architecture in manufacturing Generic Array Logic devices. AMD to manufacture GAL devices using Lattice's architecture
Oxford Computer Scan Graphics	September 1989—Joint development of image scanning devices using Oxford's "Intelligent Memory Chip" technology
RAMAX Epi Materials	October 1989—RAMAX to market EML's epi-treated wafers into Asia
Ramtron Seiko-Epson	April 1989—S-E to help finance FRAM basic development. Joint development of submicron CMOS FRAM production process
Ramtron Alcan Aluminum	June 1989—Ramtron and Alcan to codevelop advanced ferroelectric materials. Alcan made 6.5 percent equity investment in Ramtron
SEEQ National	June 1989—SEEQ and National scale back 1987 agreement to cover only current flash technology. SEEQ to continue to develop 0.8-micron flash chips alone
Samsung NCR	January 1989—Technology exchange and license agreement gives Samsung ASIC capability and NCR SRAM capability
Samsung Zilog	June 1989—Two licensing and marketing agreements permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 MCUs and the Z85C30 Serial Communications Controller
Samsung Quadtree Software	February 1989—Quadtree to develop full-function software models of Samsung's high-performance DRAM controllers
Seattle Silicon GigaBit Logic	June 1989—Seattle Silicon and GBL to develop comprehensive set of design software tools for GaAs ASICs
Togai InfraLogic Mitsubishi	September 1989—Togai and Mitsubishi Heavy Industries to codevelop air conditioning system based on fuzzy logic controller
VIA Technologies Fujitsu	March 1989—Partnership to codevelop peripheral chip sets for Sun-compatible workstations

**Table 9b**  
**1988 Alliances (40)**

<b>Companies</b>	<b>Description</b>
Actel Corp. Texas Instruments	November 1988—TI to alternate source Actel's ACT 1 family of gate arrays and resell the Action Logic System, Actel's CAE system. Actel gains access to TI's EPIC 1 CMOS wafer processing technology and manufacturing capabilities
AMCC Plessey	January 1988—Jointly develop high-performance ECL gate arrays with up to 14,000 gates
Adaptec Chips & Technologies	October 1988—Joint introduction of a series of products for IBM PS/2 Models 50-, 60-, and 80-compatibles
Adaptec Chips & Technologies	January 1988—Adaptec and Chips to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80
BIT Arizona Microtek	July 1988—BIT and AZM to codevelop custom ICs using BIT's high-performance BIT-1 technology. AZM will serve as independent design house to develop LSI designs for BIT customers
Brooktree Analog Devices	January 1988—Analog Devices to second-source Brooktree's video DACs
Calmos Siltronics	February 1988—Calmos' acquisition of Siltronics' bipolar component business for \$500,000
Catalyst Semiconductor Oki	November 1988—Oki to second-source the CAT35C102 and CAT35C202 serial EEPROMs
Cirrus Logic Award Software	July 1988—Award to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets
Cirrus Logic Phoenix Technologies	September 1988—Phoenix will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus
Cree General Instrument	August 1988—Cree and GI agreed to codevelop and manufacture silicon-based rectifiers
Custom Arrays Teledyne	February 1988—Custom and Teledyne to codevelop a new family of BiCMOS semicustom and cell-based libraries
ES2 Philips	February 1988—Philips to provide foundry services on its 1.5-micron CMOS line
ES2 US2	January 1988—ES2 establishes US2, a U.S.-based affiliate
GAIN Interface Tech	March 1988—GAIN to supply personalized versions of its GFL gate array product family
GBL Cray Research	January 1988—Cray placed \$6.5 million foundry offer
Gazelle TriQuint	September 1988—TriQuint to manufacture GaAs devices for Gazelle; \$16.9 million contract

(Continued)

**Table 9b (Continued)**  
**1988 Alliances (40)**

<b>Companies</b>	<b>Description</b>
GigaBit Logic NKT (Denmark)	September 1988—GBL and NKT form GIGA to serve European and Israel markets for ICs
GigaBit Logic SC Hightech	December 1988—GBL to market SC Hightech's GaAs ICs worldwide, excluding Japan. Provides opportunity for codevelopment of GaAs ICs in the future. SC Hightech may provide foundry services to GBL
ICI Array National	March 1988—ICI Array Technology to use National Semiconductor's design systems and process specifications to develop proprietary ASICs
IXYS ABB	May 1988—IXYS and ASEA Brown Boveri form joint venture to strengthen industrial power control marketplace using ABB's patented copper substrate bonding technology and IXYS' smart power, IGBTs, and MegaMOS expertise
LSI Logic Sun	March 1988—LSI Logic to manufacture, market, modify, and enhance MPU-related components, software, and systems using Sun's SPARC
LSI Logic ITI	March 1988—Imaging Technology Inc. (ITI) to design a new generation of imaging products using LSI Logic's L64200 series of real-time image processing chips
Level One Mitel	May 1988—Joint development agreement
Matra-Harris Aspen Cypress	April 1988—R&D agreement. MHS to provide \$4.57M in funding, and technical and design expertise for development of ultrahigh-speed ECL circuits to be developed by Aspen
Maxim Supertex	April 1988—Agreed to jointly develop 690 family of MPU supervisory circuits
Micron Intel	March 1988—Intel to market Micron DRAMs under Intel's label, beginning with 256K products
Micron SMC	April 1988—Micron's purchases 1.6 million shares of Standard Microsystems Corp. (SMC) common stock at \$6.03 per share
Ramtron ITT Semiconductor	June 1988—Codevelopment program to develop submicron ferroelectric manufacturing process
Ramtron NMB Semiconductor	October 1988—Codevelopment and licensing program to develop 4Mb DRAM process technology and products utilizing Ramtron's ferroelectric materials
Ramtron TRW	November 1988—Codevelopment program to develop rad-hard NV memory for aerospace and defense applications
Seattle Silicon Oki	August 1988—Seattle Silicon and Oki to codevelop a compiler for a process-independent, five-port, high-speed SRAM module
TriQuint MSC	March 1988—Microwave Semiconductor Corporation (MSC) and TriQuint to provide interchangeable GDS-II tape with equivalent performance for GaAs analog and digital ICs and MMICs

(Continued)

Table 9b (Continued)

## 1988 Alliances (40)

Companies	Description
VLSI Technology Harris	April 1988—Codevelop a rad-hard gate array and future commercial and nonrad-hard military gate arrays
VLSI Technology Sanyo	April 1988—Sanyo to manufacture and market VLSI Technology's 32-bit ACORN RISC Machine IC family worldwide
Vadem Intel	March 1988—Intel invests in IBM Model 30 and PC XT-compatible chip set that Vadem is developing
Vadem Intel	September 1988—Intel to refer customers to Vadem for Vadem's PC chip set
Zoran Toshiba	January 1988—Technology and manufacturing alliance
Zoran SGS-Thomson	March 1988—Technology and manufacturing alliance
iLSi Oki	April 1988—Oki to manufacture and sell gate arrays based on iLSi technology and provide foundry service

Source: Dataquest  
January 1990

Table 9c

## 1987 Alliances (87)

Companies	Description
ANADIGICS Bendix	June 1987—Contract from Bendix Aerospace to develop CAD tools for the DOD's MMIC program
ATMEL Sanyo Electric	1987—ATMEL and Sanyo signed a foundry contract to produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs
Adaptec SCO	October 1987—Adaptec and the Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system
Adaptec Conner Peripherals	October 1987—Adaptec to supply disk controller ICs to Conner Peripherals
Alcatel Mietec SGS-Thomson	1987—Alcatel, Mietec, SGS-Thomson—transfer of a 1.2-micron CMOS process
Alliance NMB	December 1987—Five-year agreement covering 256K and 1Mb DRAMs; NMB to manufacture and sell the devices worldwide
Altera WSI Sharp	January 1987—Codevelop a family of standalone microsequencer products with wafers manufactured by Sharp of Japan

(Continued)

**Table 9c (Continued)**  
**1987 Alliances (87)**

Companies	Description
Altera Cypress	June 1987—Codevelop a family of CMOS EPLDs
Asahi Kasei Crystal Semi	January 1987—Asahi Chemical's acquisition of an 8 percent share in Crystal for approximately \$4 million; Asahi Kasei to manufacture and market Crystal's devices for the far eastern market
Asahi Kasei ICT	January 1987—Asahi Kasei's receipt of a license to ICT's technology; Asahi Kasei to market ICT's EEPROMs
Aspen Cypress	December 1987—Cypress' guaranteed \$7.4 million to Aspen, a wholly owned subsidiary of Cypress, which will fabricate and sell ECL devices
Austek ZyMOS	October 1987—ZyMOS licensed to make and sell the Austek Microcache as part of the POACH chip set
BIT Sun	July 1987—Sun's license of a bipolar 32-bit RISC MPU to BIT
Batelle Institute Photonic MEC NTT	July 1987—The Batelle Institute, Mitsubishi Electric Corporation (MEC), and NTT—formation of Photonic Integration
CDI IST	April 1987—Joint product development and second-source agreement covering two families of ASICs using channelless architectures
CMD Tachonics	March 1987—Tachonics to manufacture commercial and military GaAs ICs using CMD cell design and tools in the 1.0- to 0.5-micron range
CMD Telefonica	November 1987—Joint venture agreement to form a company named California Micro Devices SA in Spain
Calmos Samsung	January 1987—Calmos' license of its 8200 series of devices to Samsung in exchange for a foundry commitment
Catalyst Oki Electric	March 1987—Previous agreement extended to include a wide range of CMOS EEPROMs
Chartered National Sierra STC	October 1987—National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation established joint-venture company, Chartered Semiconductor Corporation
Cirrus Logic WDC	January 1987—Cirrus Logic's license of a custom Winchester disk drive controller IC to Western Digital Corporation
Cirrus Logic DIA-Semicon	October 1987—DIA-Semicon Systems to distribute new and existing products in Japan
Cirrus Logic Award Software	November 1987—Award Software to develop a VGA graphics BIOS and demonstration board for Cirrus Logic's GD510/520 VGA chip set

(Continued)

Table 9c (Continued)

## 1987 Alliances (87)

Companies	Description
Cypress Sun	July 1987—Joint development of a CMOS RISC MPU product line based on Sun's SPARC
Cypress Matra-Harris	December 1987—Prior agreement extended to include manufacture and marketing of five Cypress 64K SRAMs
Dallas Xecom	May 1987—Three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families
Dallas AMP	August 1987—Dallas and AMP R&D partnership to develop interconnect techniques
ES2 Lattice Logic	1987—ES2's acquisition of Lattice Logic
ES2 Philips	February 1987—ES2, Philips, and TI joint agreement for the manufacture of the SystemCell; TI and Philips to supply volume parts, ES2 to provide prototypes and low-volume quantities
ES2 Mitsui & Co.	October 1987—ES2 and Mitsui & Co. joint purchase of a Japanese software and design company called Best, which will market ES2's products in Japan
Elantec Micro Power	November 1987—Micro Power to market Elantec's FET power buffers
G-2 LSI Logic	July 1987—LSI Logic's establishment of G-2 as a wholly owned subsidiary; LSI Logic to provide macrocells, megacells, and gate arrays
Genesis National	October 1987—Design center and manufacturing agreement
GigaBit Logic Tachonics	October 1987— Mutual second-sourcing of GaAs standard and ASIC products developed by each other
GigaBit Logic Cray Research	January 1987—Cray Research's \$3.3 million foundry order
GigaBit Logic Cray Research	May 1987—Cray Research's January order increased from \$3.2 million to \$5.5 million
GigaBit Logic Seattle Silicon WTC	April 1987—GBL, Seattle Silicon, and the Washington Technology Center (WTC) to form a joint design project and fabricate a functional, compiler-based GaAs IC design
IDT VTC	January 1987—IDT to second-source VTC's FCT product line
IDT MIPS Computer	November 1987—IDT to manufacture MIPS Computer's complete line of 32-bit RISC MPUs
IMP Electrolux	November 1987—Five-year agreement with Electrolux to develop ASIC devices for home appliances

(Continued)

Table 9c (Continued)  
1987 Alliances (87)

Companies	Description
IST SDA Systems	May 1987—SDA Systems to develop CAD systems for use by Innovative Silicon Technology's (IST's) customers
Inova Westinghouse	June 1987—Westinghouse Advanced Technology Division to work with Inova in long-term strategic planning areas
Intergraph Fujitsu	Early 1987—Fujitsu to provide wafer fabrication services to Intergraph's Advanced Processor Division
Krysalis National	December 1987—Seven-year agreement with National Semiconductor to pursue UniRAM technology jointly
LSI Logic Stellar Computer	January 1987—LSI Logic to supply custom ASICs to Stellar Computer for use in a graphics supercomputer
LSI Logic Aida Corp.	January 1987—Aida Corp. to incorporate LSI Logic's gate array libraries into its design automation tools
LSI Logic ZyCAD Corp.	February 1987—LSI Logic's acquisition of the marketing rights to a customized version of ZyCAD's Logic Evaluator circuit design accelerators
LSI Logic Case Technology	March 1987—Joint development to allow LSI Logic's schematic libraries to be designed on Case Technology's workstations
LSI Logic Sun	April 1987—LSI Logic and Sun's joint establishment of an ASIC laboratory project at San Jose State University
LSI Logic Logic Automation	May 1987—Joint development to incorporate LSI Logic's channeled gate arrays on Logic Automation's Mentor Graphics workstations
LSI Logic Asix Systems	June 1987—LSI Logic's licensing of its ASIC design verification software to Asix Systems Corp.
LSI Logic Video Seven	July 1987—LSI Logic's acquisition of 20 percent of Video Seven for \$7 million in cash
LSI Logic ACT	August 1987—Joint venture company named Inter-Act Corporation, which will develop and market software/hardware development system for the MIL-STD-1750 embedded system market
LSI Logic MIPS Computer	November 1987—LSI Logic to manufacture and market MIPS Computer Systems' entire family of circuits, including its 32-bit RISC MPU and floating point coprocessor
LTC TI	March 1987—Five-year agreement allowing TI to select six LTC circuits every six months; TI to pay royalties
Lattice SGS	February 1987—LSC's licensing of its GAL products to SGS Semiconductor; both companies to cooperate on future PLD products
Lattice National	April 1987—National Semiconductor's minority investment in LSC and licensing of its GAL technology
Lattice MMI	November 1987—LSC's licensing of MMI's patent; exchange of rights to worldwide patents in PLDs

(Continued)

Table 9c (Continued)

## 1987 Alliances (87)

Companies	Description
Matra-Harris Intel	June 1987—CIMATEL dissolved by Intel
NMB TI	November 1987—NMB to manufacture and supply TI with TI-designed 1Mb field RAMs
Pacific Monolithics TriQuint Ford	November 1987—PM and TriQuint are team members with Ford for smart weapons, radar, electronic warfare contracts
Pacific Monolithics TriQuint Allied-Bendix	November 1987—PM and TriQuint are team members with Allied-Bendix for two communications and radar contracts
Performance MIPS Computer	November 1987—Performance to manufacture and market MIPS Computer Systems' 32-bit RISC MPU, floating-point coprocessor, and other peripherals
PromTech Yamaha	1987—PromTech's licensing of its EPROM technology to Yamaha Corp., which will combine it with voice- and image-processing capabilities
RAMAX Ramtron	June 1987—RAMAX's licensing of ferroelectric process technology from Ramtron
SEEQ National	October 1987—Four-year agreement to develop and market a new family of CMOS flash EEPROMs
SEEQ Hamilton-Standard	October 1987—SEEQ to supply 256K EEPROMs to Hamilton-Standard
Samsung Intel	June 1987—Samsung to supply Intel with 64K and 256K DRAMs, which Intel will sell under its own label
Seattle Semiconductor National	October 1987—National's 1.25-micron and 1.20-micron VHSIC CMOS processes qualified for design with Concorde, Seattle Silicon' ASIC compiler
Seattle Silicon UTMC	June 1987—Seattle Silicon and UTMC to jointly design and fabricate ASICs used in tactical and strategic radiation environments
Sierra Mentor Graphics	September 1987—Sierra's MIXsim behavioral modeling tools available on Mentor Graphics' Idea workstation
TriQuint TRW	June 1987—Jointly develop and supply Class-S level GaAs devices for space applications
VLSI Technology Visic	1987—VLSI's acquisition of Visic for approximately \$525,000
VLSI Technology TCMC	March 1987—Agreement covering second-sourcing and product development for memory designs including FIFOs, dual-port RAMs, cache-tag RAMs, and SRAMs

(Continued)



**Table 9c (Continued)**  
**1987 Alliances (87)**

<b>Companies</b>	<b>Description</b>
VLSI Technology Zilog	May 1987—VLSI to second-source Zilog's Super8 MCU and FIFOs
VLSI Technology GE Solid State	July 1987—GE to produce and market VLSI's VGT10 and VGT100 families of CMOS gate arrays
VLSI Technology Daisy Systems	November 1987—Gate array design kit offered for Daisy's CAE workstation
VLSI Technology Oak Technology	November 1987—Codevelop IBM PS/2 logic chips, using VLSI Technology's software tools
VTC Control Data	1987—VTC became a wholly owned subsidiary of Control Data (CDC); VTC's award of a \$7.5 million contract from CDC's Government Systems Division to supply ASIC chips
VTC TRW	March 1987—TRW Components International and VTC to cross sample space-quality, Class-S devices including rad-hard CMOS SRAMs, comparators, amps, and transceivers
VTC VME Technology	September 1987—VTC's contract to design, develop, and manufacture a VMEbus interface IC (VMIC) for the VME Technology Consortium
Vitesse E-Systems	August 1987—E-systems to use Vitesse's GaAs technology in its current and future programs
Vitesse Ford	October 1987—Vitesse and Ford Microelectronics to mutually second-source each other's IC foundry services
Vitesse VLSI Technology	September 1987—Vitesse to develop a GaAs cell library for VLSI's design tools
WSI GE/RCA	July 1987—Prior agreement expanded to include EPROM manufacturing
Weitek HP	May 1987—Hewlett-Packard to manufacture and incorporate the Weitek model 2264/65 chip set in current and future HP Precision Architecture computers
Xicor Intel	June 1987—R&D agreement terminated; cross-licensing and royalty obligations remain in force
ZyMOS Intel	November 1987—Intel to market ZyMOS' POACH AT system logic set bundled with its 80286 MPU, which will be sold as 82X3X multifunctional peripherals
iLSi Yamaha	December 1987—Yamaha's purchase of a license for iLSi's gate arrays in exchange for royalties and foundry service

Source: Dataquest  
 January 1990

**Table 9d**  
**1986 Alliances (75)**

Companies	Description
Actel Corp. Data General	June 1986—Joint development agreement covering gate arrays and a fab arrangement
Altera Data I/O FutureNet	May 1985—OEM marketing agreement with Data I/O's FutureNet for the DASH schematic capture packages
BIT Raytheon	July 1986—Joint development of ASICs
Brooktree Fairchild	April 1986—Broad-ranging partnership combining Brooktree's D/A conversion technology with Fairchild's manufacturing capability
CMD CMA	September 1986—Merger of CMD and Custom MOS Arrays (CMA)
CMD Fuji	November 1986—CMD's licensing of HCMOS gate array and cell-based design technology to Fuji Photo Film for \$1 million
CSi Motorola	August 1986—CSi to act as the northwestern independent design center for Motorola
CSi NCR	September 1986—NCR's licensing of CSi's cell-based library
Catalyst Thomson-CSF	1986—Catalyst and Thomson to conduct R&D in France
Catalyst Oki Electric	July 1986—Long-term R&D of NVRAMs for ASICs, using CMOS EPROMs and EEPROMs
Chips National	November 1986—National Semiconductor to manufacture CMOS ICs for Chips & Technologies under fabrication agreement
Cirrus Logic Silicon Systems	October 1986—Cirrus Logic's and Silicon Systems' exchange of controller and buffer manager functions
Custom Array Teledyne	1986—Joint development agreement for a new family of BiCMOS semi-custom and cell-based libraries
Dallas Thomson-Mostek	January 1986—Thomson-Mostek's receipt of Dallas' multiport memory in exchange for laser production equipment and TCMC's MK4501 FIFO
ES2 British Aerospace	January 1986—British Aerospace investment of \$5 million
ES2 SDA Systems	January 1986—ES2 to market SDA Systems' design systems throughout Europe and to use them in design centers
ES2 Philips TI	May 1986—ES2, Philips-Elcoma, and Texas Instruments—cooperation on the SystemCell cell-based library
Exel Microelectronics Exar	February 1986—Exar's completion of the \$5.5 million acquisition of Exel
GAIN NTT	September 1986—Technology transfer giving GAIN access to NTT's self-aligned implantation for N+layer translator (SAINT) technology

(Continued)

**Table 9d (Continued)**  
**1986 Alliances (75)**

Companies	Description
ICI Array ICI	January 1986—Imperial Chemical Industries Plc—acquisition of Array Technology
ICT Gould Semiconductor	April 1986—ICT's transfer of its CMOS EEPROM technology and products in exchange for foundry service and second-sourcing of PEEL and EEPROM devices
IMP Lattice Logic	May 1986—Lattice Logic's CHIPSMITH Silicon compiler software available with IMP's design rules
IMP Silicon Compilers	June 1986—SCI and IMP to develop analog compilation capability for SCI's Genesis Silicon Development
IMP Micro Linear MBB	August 1986—IMP and Micro Linear—agreement to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period
IMP Lasarray	August 1986—IMP and Lasarray to cooperate on a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module
IXYS Samsung	January 1986—Samsung's receipt of IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high current power MOS devices in Samsung facility
LSI Logic Raytheon	January 1986—Raytheon to second-source LSI Logic's LL700 Series of logic arrays; LSI Logic will provide its LDS software system to design and produce the logic arrays
LSI Logic Master Images	March 1986—LSI Logic's acquisition of a 20 percent equity interest in Master Images, a photomask supplier
LSI Logic Sun	April 1986—LSI Logic to sell and use internally Sun Microsystems' workstation and advanced schematic capture system
LSI Logic STC	May 1986—LSI Logic's acquisition of a majority stake in STC's semiconductor division
LTC National	July 1986—Patent licensing agreement Linear Technology Corp. (LTC) rights to products under two national BiFET patents; National was granted rights to LTC's BiFET-related patents
Lattice Seiko-Epson	January 1986—Seiko-Epson licensed to Lattice's high-speed 64K SRAM
MOSel Hyundai	February 1986—MOSel—8Kx8 and 1Mb SRAMs and 1.2- and 1.5-micron CMOS processes provided to Hyundai in exchange for a foundry commitment
MOSel Sharp	June 1986—MOSel—a 256K SRAM design based on a 1.2-micron CMOS process provided to Sharp, which provided 256K SRAMs
Matra-Harris Silicon Compilers	June 1986—MHS to integrate its 2-micron, double-metal CMOS process with Silicon Compilers' Genesis silicon design systems

(Continued)

**Table 9d (Continued)**  
**1986 Alliances (75)**

<b>Companies</b>	<b>Description</b>
Matra-Harris Weitek	March 1986—Matra-Harris Semiconducteur's (MHS) receipt of Weitek's 16-bit integer multiplier product family; Weitek has preferred access to the MHS CMOS process in exchange for foundry services
Maxim Intersil	April 1986—Second-source agreement
Micro Linear Analog Design	July 1986—Micro Linear to integrate its micro and macrocell libraries into Analog Design tools' workbench CAE system
Micro Linear Daisy Systems	November 1986—Daisy Systems to port Micro Linear's cell libraries to its workstations
Micron Samsung	July 1986—Samsung's purchase of a 2.7 percent interest in Micron for \$5 million as part of an out-of-court settlement; Micron received Samsung SRAM and EEPROM technologies for a 1.0 percent royalty
NMB National	September 1986—NMB to manufacture fast SRAMs; this agreement is no longer in effect
Novix Harris	July 1986—The Novix FORTH language MPU included in Harris' ASIC library
Performance Westinghouse	August 1986—Performance to fabricate a VHSIC Phase-I, 11,000-gate gate array designed by the Westinghouse Defense and Electronics Center
Powerex Westinghouse Mitsubishi	1986—Powerex formed by Westinghouse, GE, and Mitsubishi Electric; Powerex received licenses and technology from the companies
S-MOS. Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems, using Seiko-Epson's CMOS process
SEEQ AMD/MMI	November 1986—Monolithic Memories acquisition of 16 percent of SEEQ for \$4 million; jointly develop CMOS EEPROM-based PLDs
SEEQ Motorola	December 1986—Engineering development agreement to develop an EEPROM microcomputer
Samsung Mostek	1986—Agreement covering Mostek's 256K DRAM technology
Samsung Goldstar Hyundai	1986—Samsung, Goldstar, and Hyundai to cooperate on a 1Mb DRAM
Seattle Silicon Gould AMI	September 1986—Gould AMI provides Seattle Silicon with proprietary geometric design rules and performance characteristics of selected fab processes
Seattle Silicon Burroughs	August 1986—Seattle Silicon and Burroughs to jointly develop a new-generation design system for ICs
Sierra Mentor Graphics	December 1986—Sierra's cell library supported on Mentor Graphics' workstations

(Continued)

Table 9d (Continued)

## 1986 Alliances (75)

Companies	Description
Silicon Systems Ferranti	February 1986—SSi to second-source Ferranti's data conversion ICs in the United States
Silicon Systems Telmos Universal	August 1986—Universal's second-source agreement between Telmos and Silicon Systems acquired for the fabrication of analog/digital arrays
Silicon Systems RCA	February 1986—RCA to second-source SSI's monolithic modem ICs; RCA gained rights to SSI's analog CMOS process; SSI gained rights to RCA's digital 2-micron CMOS process; RCA also agreed to supply SSI with CMOS wafers over three years
Silicon Systems Oki Electric	September 1986—Oki to second-source SSI's K-series modems; Oki will pay royalties, furnish DSP chips, and provide foundry services
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems using Seiko-Epson's CMOS process
TSMC Philips	1986—N.V. Philips' 27.5 percent interest in Taiwan Semiconductor Manufacturing Corp. and option to purchase controlling interest in the company
TriQuint EEsof	May 1986—EEsof to incorporate TriQuint's custom GaAs MMIC foundry models into Touchstone, a minicomputer and workstation-based MMIC CAD program
UMC TRW	April 1986—Joint development of 1.25-micron VLSI products
UMC SMC	June 1986—Contract to cooperate on computer ICs
VLSI Technology Mosaic Systems	1986—Joint agreement to build die and plug them together on the Mosaic process
VLSI Technology Intel	1986—Codeveloped a single-chip interface for the Intel-based Multibus II system bus architecture
VLSI Technology Acorn Computer	May 1986—Codeveloped a single chip, 32-bit RISC MPU, and associated controller chips
VTC Silicon Compilers	May 1986—VTC to provide its 1.6- and 1.0-micron two-layer metal CMOS processes to users of Genesil; VTC to develop a rad-hard cell for Genesil
Vitellic Philips	March 1986—Vitellic's access to Philips' process technology; Vitellic to design a family of high-performance CMOS SRAMs
Vitellic Sanyo	October 1986—Jointly develop a high-speed 64K SRAM family; Sanyo will manufacture the SRAMs

(Continued)

**Table 9d (Continued)**  
**1986 Alliances (75)**

<b>Companies</b>	<b>Description</b>
Vitesse TRW	December 1986—Vitesse to supply TRW with high-performance wafers, die, and packaged devices, which TRW will assemble, test, qualify, and sell to the space quality, Class-S level market
WSI GE/RCA Sharp	March 1986—GE/RCA and Sharp have a five-year agreement with WSI to jointly develop an advanced cell library
Weitek Step Engineering	March 1986—Step Engineering to produce development tools for debugging and microcoding of Weitek's floating-point integer processor designs
Weitek Quadtree	April 1986—Quadtree Software to develop behavioral simulators for the WTL2264/2265 chip set
Weitek Matra-Harris	May 1986—Technology exchange and foundry agreement. MHS granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to MHS' CMOS process in exchange to manufacturing a variety of Weitek products
XTAR Fairchild	September 1986—Fairchild to alternate-source XTAR's X1000/X2000 graphics MPU chip set, which Fairchild will redesign and manufacture using its FACT fabrication process
Xilinx MMI/AMD	June 1986—MMI/AMD to manufacture and market Xilinx's Logic Cell Arrays and development system
ZyMOS Daewoo Corp.	April 1986—Controlling interest in ZyMOS acquired by Daewoo Corp.
iLSi Motorola	June 1986—iLSi's licensing of its line of gate arrays to Motorola
iLSi Sumitomo	December 1986—Sumitomo's licensing of ASIC design technology from iLSi exchange for royalty payments and foundry services

Source: Dataquest  
January 1990

**Table 9e**  
**1985 Alliances (71)**

<b>Companies</b>	<b>Description</b>
AMCC Sanders	February 1985—Sanders to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only
AMCC Seiko-Epson	May 1985—AMCC and Seiko-Epson entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process was merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process

(Continued)

**Table 9e (Continued)**  
**1985 Alliances (71)**

Companies	Description
Altera Intel	June 1985—Extension of 1984 agreement with Intel for two years; includes additional products using Intel's CHMOS process and its evolutions
Altera P-CAD Systems	February 1985—Marketing agreement with P-CAD Systems
ATMEL General Instrument	March 1985—ATMEL technology provided to GI for fab capacity; this agreement is no longer in effect
Barvon Research Micron Technology	November 1985—Micron's acquisition of a 16 percent equity interest in Barvon to design ASICs for Micron
Brooktree Toshiba	1985—Brooktree's Technology licensed by Toshiba for consumer digital audio applications
CMD TRW	July 1985—TRW to manufacture HCMOS gate arrays in its JAN-qualified fab, using CMD/CMA's 1.2-micron design rules
CSi Viewlogic	October 1985—Custom Silicon's (CSi's) cell-based library offered on Viewlogic's Workview workstation
Catalyst Zilog	December 1985—Joint development and second-sourcing agreement; initial product will be a version of Zilog's Z8 MCU
Chips Toshiba Yamaha Fujitsu	November 1985—Foundry services from these companies subcontracted by Chips & Technologies
Cirrus Logic AMD	September 1985—Cirrus Logic's development of an MCU for AMD in exchange for foundry services
Cypress Matra-Harris	October 1985—Cypress masks for its SRAMs and 1.2-micron CMOS process transferred to MHS, which received 2 percent of Cypress' stock for \$25 million
Cypress Weitek	October 1985—Joint development of a series of VLSI logic circuits designed by Weitek and manufactured by Cypress
ES2 Lattice Logic	1985—ES2 to market Lattice's logic compiler in Europe
ETC NCR	October 1985—Electronic Technology Corp. (ETC) to establish design centers and design cell-based ICs for NCR
Exel Microelectronics Samsung	May 1985—Prior agreement extended to include second-source Exel's 2Kx8 NMOS EEPROM
GAIN Mitsui	1985—Mitsui's acquisition of 30 percent interest in GAIN

(Continued)

Table 9e (Continued)

## 1985 Alliances (71)

Companies	Description
ICS VLSI Technology Toshiba	1985—VLSI Technology and Toshiba to provide foundry services for Integrated CMOS Systems (ICS)
ICS Universal	1985—Cooperative gate array agreement to personalize wafers and designs supplied by ICS
IDT Internix	April 1985—Sales contract for Internix to sell IDT's products in Japan
IMP Iskra	April 1985—IMP's and Iskra's codevelopment of a CMOS analog cell library for which IMP provides foundry services
IMP National	April 1985—IMP to second-source National's 2-micron gate arrays
Inmos NMB/Minebea	March 1985—NMB/Minebea to ship 50 percent of its 256K DRAM output to Inmos
Inova UMP	November 1985—UMP to provide wafers to Inova
LSI Logic Toshiba	June 1985—Four-year joint venture to develop a 50,000-gate sea-of-gates array
LSI Logic C. Itoh	April 1985—C. Itoh to sell LSI Logic's products in Japan
LSI Logic Kawasaki Steel	August 1985—Formed joint-venture gate array company in Japan, Nihon Semiconductor
LTC Motorola	January 1985—Agreement granting each company rights to a number of patents
MOSel UMC	October 1985—MOSel's EEPROM, a 2Kx8 SRAM, and a 2-micron process transferred to UMC in exchange for fab capacity
MOSel Fuji Electric	September 1985—Fuji Electric supplied 4- and 6-inch wafers, using MOSel 1.5- and 2.0-micron processes; companies to jointly develop CMOS 16K and 64K SRAMs for MOSel
Maxim Brown Boveri	February 1985—Maxim to design and manufacture devices for Brown Boveri
Micro Linear Rockwell	1985—Rockwell's \$1.2 million investment in Micro Linear and receipt of ASIC linear product technology; Rockwell provides wafers
Micro Linear Toko	October 1985—Toko to make bipolar devices for Micro Linear at its Saitama, Japan, plant
NMB Vitellic	November 1985—A 1Mb CMOS DRAM license granted to NMB's plant capacity

(Continued)



Table 9e (Continued)  
1985 Alliances (71)

Companies	Description
Quasel Taiwan ERSO	May 1985—Technology license
Ramtron General Motors	1985—Contract with General Motors to demonstrate ferroelectric feasibility in special applications such as space and automotive
S-MOS Siliconix	November 1985—Agreement allowing Siliconix to produce 1.5- and 2.0-micron gate arrays designed by Seiko-Epson and S-MOS
SEEQ Silicon Compilers	July 1985—All EEPROM designs provided by SEEQ for integration into SCI's Genesil System
Samsung Intel	January 1985—Samsung licensed to second-source certain Intel micros
Samsung Exel Microelectronics	May 1985—Prior agreement extended to include 64K EEPROMs
Samsung Zytrex	June 1985—LSI Logic devices and proprietary ICE-MOS process provided to Zytrex: Zytrex is no longer in business
Sierra VLSI Technology	January 1985—Sierra Semiconductor licensed by VLSI for IC software design tools in exchange for Sierra's cell-based designs
Silicon Systems Rogers	November 1985—Joint venture to design, manufacture, and market value-added intelligent flexible subsystems, called SMARTFLEX Systems
Tachonics Grumman	July 1985—Tachonics became a subsidiary of the Grumman Corporation
Topaz Hytek	July 1985—Topaz acquired by Hytek Microsystems; Hytek and Topaz cooperated on developing precision standard hybrid circuits
UMC Unicorn	January 1985—Unicorn, a design center based in Silicon Valley, funded by UMC for \$2.5 million; joint development of a cell library
UMC Honeywell Synertek	July 1985—Nonexclusive product licenses gained by UMC for 18 ICs formerly produced by Synertek
Universal Edsun Laboratories	September 1985—Joint development with Edsun Laboratories for computer-related CMOS products
VLSI Technology Rockwell	1985—Jointly develop erasable programmable logic arrays
VLSI Technology Honeywell Synertek	April 1985—Rights to a CRT controller, interface circuits, 40 SRAMs, and a 16K ROM acquired by VLSI
VLSI Technology National	April 1985—National Semiconductor CMOS EPROM technology supplied to VLSI; VLSI manufactured the part and supplied wafers

(Continued)

**Table 9e (Continued)**  
**1985 Alliances (71)**

<b>Companies</b>	<b>Description</b>
VLSI Technology Nihon Teksei	June 1985—Sales contract to sell mainly standard product LSIs into the Japanese market
VLSI Technology Daisy Systems	June 1985—VLSI's design tools and silicon compilers available on CHIPMASTER and SILICONMASTER workstations
VLSI Technology Zilog	June 1985—Zilog licensed to use VLSI's design software; cooperate to develop megacell versions of Zilog products
VLSI Technology Hewlett-Packard	October 185—Hewlett-Packard to use selected VLSI design tools on HP workstations
VLSI Technology MEM	1985—VLSI's process technology, which will be used by VLSI installed by Microelectronics-Marin (MEM)
VLSI Technology Olivetti	1985—Joint design center in Italy
VLSI Technology Bull Group	1985—VLSI's design technology licensed by Bull to develop computer products
VLSI Technology University of Louvain	1985—Agreement to install VLSI's IC design methodology to teach advanced IC design to students
Vitellic Sony	June 1985—Sony's access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity
Vitellic Hyundai	July 1985—Hyundai obtains license to Vitelic memory products in exchange for manufacturing capacity
Vitesse AMD	November 1985—Jointly develop and manufacture AMD's AM2900 family of MPUs in GaAs
WSI Sharp	October 1985—Prior agreement extended to include WSI's 1.6-micron CMOS technology
Weitek Intel	October 1985—Weitek to develop an interface IC that Intel will second-source; Intel to provide foundry services
Weitek National	October 1985—National to design, manufacture, and market an interface chip
Xicor Intel	August 1985—R&D technology exchange agreement to develop EEPROMs; both companies cross-licensed their EEPROM technology
Xilinx Seiko-Epson	December 1985—Codevelop logic cell arrays and development systems; Seiko-Epson to manufacture; jointly develop Seiko-Epson's CMOS process
ZyMOS General Instrument	April 1985—Extended agreement for an additional three years; covers cell library and foundry services
ZyMOS Source III	September 1985—ZyMOS to provide foundry services for Source III

**Table 9f**  
**1984 Alliances (42)**

<b>Companies</b>	<b>Description</b>
AMCC Honeywell	August 1984—Honeywell to second-source AMCC's Q700 gate arrays and to alternative-source bipolar gate arrays
Altera Intel	August 1984—CHMOS EPROM fabrication technology and foundry services provided by Intel; Altera provided its EPLD design, test, and development support
Calogic Koki Company	December 1984—Koki to sell Calogic's CMOS data bus driver ICs in Japan
Custom Arrays ATAC-Diffusion	1984—ATAC to operate a design center and conduct marketing for Custom Arrays in Europe
Custom Arrays Ferranti-Interdesign	1984—The MM family is the result of a joint venture with Ferranti, which also acts as a second source
Custom Arrays Interdesign	1984—Jointly developed the MM family of linear arrays
Custom Silicon FutureNet	March 1984—CSI's cell-based design available on the FutureNet DASH design system
ETC Gould-AMI	1984—Agreement for 3- and 5-micron single-layer metal CMOS gate arrays; AMI provides foundry services
ICT IMP	July 1984—Codevelopment of a CMOS EEPROM process
IMP National	1984—Five-year technology exchanges and second-sourcing agreement covering IMP's cell-based designs and National's CMOS process
IMP Micro Linear	June 1984—Codevelopment of a 10V CMOS process; IMP provides foundry services
IXYS Ricoh	1984—Wafers provided by Ricoh; IXYS provided its power MOSFET HDMOS process
Inmos NMB	June 1984—NMB to produce the Inmos 256K CMOS DRAM for an initial sum and royalties; NMB will also cooperate on the Inmos 64K and 1Mb DRAMs
Inmos Thorn-EMI	1984—Thorn-EMI's acquisition of 76 percent of Inmos
Inmos Hyundai	December 1984—Hyundai—\$6 million payment for the Inmos 256K DRAM technology
LSI Logic AMD	August 1984—Jointly develop CMOS standard cell definitions and a library for design of large-scale ICs
LSI Logic Intersil	February 1984—Agreement covering LSI Logic's HCMOS process logic arrays and Intersil's CMOS gate array family

(Continued)

Table 9f (Continued)

## 1984 Alliances (42)

Companies	Description
LTC Signetics	June 1984—Signetics to purchase die in wafer form and receive manufacturing rights for three precision op amps and other products; Signetics provided LTC with certain small outline packaging services
LTC Interdesign	July 1984—The right to design IC arrays, using up to three of LTC's processes, and dedicated foundry capacity to manufacture the Interdesign designs granted by LTC
Lattice Synertek	July 1984—Cross-licensing and second-sourcing agreement covering Lattice's UltraMOS process in exchange for Synertek's production capacity
Lattice VLSI Technology	September 1984—Lattice CMOS EEPROM and SRAM technology provided to VLSI in exchange for foundry services
Maxim Intersil	1984—Agreement to exchange products as part of a legal settlement
Micron National	November 1984—A license to manufacture and sell Micron's 64K DRAM purchased by National for about \$5 million
Modular Ricoh	November 1984—Modular Semiconductor CMOS designs and processes for a 16K SRAM and 256K DRAM provided to Ricoh
NMB Minebea	1984—NMB is the subsidiary of and is financed by Minebea
NMB Inmos	June 1984—NMB to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the output
Novix Sysorex	March 1984—Sysorex International participant in first-round financing
PromTech Japanese Company	1984—PromTech licensed technology
S-MOS IMI	April 1984—Two-year agreement with International Microcircuits Inc. (IMI) to second-source 2-micron CMOS gate arrays and share cell-based libraries
Sierra National	July 1984—Technology exchange covering selected CMOS products and processes; Sierra leased a facility from National
TriQuint Tektronix	January 1984—TriQuint is a subsidiary of Tektronix
VLSI Technology Visic	February 1984—VLSI Technology and Visic to design and market CMOS 64Kx1 and 16Kx4 CMOS DRAMs
VLSI Technology Fairchild	May 1984—Joint development and second-source of Fairchild's 2-micron CMOS gate arrays

(Continued)

Table 9f (Continued)  
1984 Alliances (42)

Companies	Description
VLSI Technology Silicon Compilers	October 1984—VLSI licensing of Silicon Compilers' RasterOp graphics processor chip in exchange for foundry services for customers who design circuits using SCI's design systems
VLSI Technology Western Digital	1984—Joint agreement to develop CMOS versions of propriety WD products and second-source several of WD's products; VLSI provides foundry support for three years
VTC CDC	October 1984—Control Data Corp. (CDC) invests \$56 million in VTC; the arrangement includes a fabrication technology license
Vitellic Kyocera	March 1984—Kyocera participated in first-round financing
Vitellic ERSO	May 1984—ERSO and Vitellic to codevelop EPROMs and 64K and 256K CMOS DRAMs
Vitesse Norton Company	July 1984—The initial investment of \$30 million provided by the Norton Company
WSI Sharp	December 1984—Sharp to produce a 64K CMOS EPROM for manufacturing capacity and royalties licensed by WSI
ZyMOS Intel	July 1984—ZyMOS ZyP design automation system provided for Intel's CHMOS II process; ZyMOS to manufacture Intel's 80C49 8-bit MCU

Source: Dataquest  
January 1990

Table 9g  
1983 Alliances (40)

Companies	Description
AMCC Signetics	September 1983—AMCC and Signetics to exchange future families of gate arrays and processes
AMCC Daisy Systems	February 1983—The Q-700 gate array family on Gatemaster supported by Daisy
Acrian Bharat	1983—Acrian technology transferred to Bharat Electronics Limited
Asahi Kasei Hitachi Limited	1983—Hitachi Limited's advanced CMOS process technology licensed by Asahi Kasei
BIT Analog Devices	1983—Equity investment
CDI Olympus Optical	January 1983—CDI gate array technology transferred to Olympus Optical Co.

(Continued)

**Table 9g (Continued)**  
**1983 Alliances (40)**

<b>Companies</b>	<b>Description</b>
CDI Western Microtechnology	1983—CDI's gate arrays sold through Western Microtechnology's design center
CMD/CMA Ricoh	1983—Joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and cell-based ICs
CMD/CMA Micro Innovators	January 1983—Merge of CMD/CMA with Micro Innovators, a team of custom MOS/LSI designers
Custom Silicon NCR	November 1983—CSI to design and recall NCR's cell-based and gate array products in New England
Cypress MMI/AMD	June 1983—Cypress 1.2-micron CMOS process and warrants received by MMI/AMD in exchange for loan guarantees
ETC Exar	December 1983—Foundry services provided by Exar
Exel Microelectronics Samsung	1983—Samsung Semiconductor license to second-source its 16K EEPROMs granted by Exel
GBL Kidder, Peabody	December 1983—R&D partnership to develop four ultrahigh-speed GaAs SRAMs
ICT Hyundai	October 1983—International CMOS Technology (ICT) and Hyundai to jointly develop devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs; Hyundai allocated 30 percent of its wafer fab capacity for an equity interest in ICT
IMP Zoran	June 1983—Codevelopment of a CMOS PROM technology
IMP IXYS	November 1983—Codevelopment of a high-voltage CMOS process
Inmos General Instrument	October 1983—Inmos' 8Kx8 EEPROM licensed by General Instrument
Inmos Intel	December 1983—Intel and Inmos to develop consistent specifications on 64K and 256K CHMOS DRAMs
LSI Logic RCA	April 1983—RCA to second-source LSI Logic's 5000 Series
LSI Logic SGS	April 1983—SGS licensed by LSI as an LSI 500 Series and CAD software alternative source
LSI Logic Toshiba	June 1983—Jointly developed a channelless compacted array
LTC Teijin Japan Macnics Technology Trading	June 1983—Agreements for distribution in Japan

(Continued)

Table 9g (Continued)

## 1983 Alliances (40)

Companies	Description
Lattice Floating Point Systems	1983—Lattice UltraMOS technology provided in exchange for FSP's DSP and array processor technologies; FSP also made an equity investment
Micron ITT/STC	January 1983—ITT/STC granted a worldwide license by Micron to manufacture and sell 64K DRAMs
Micron Samsung	June 1983—Samsung granted a license by Micron to manufacture and market Micron's 64K and 256K DRAMs in exchange for cash
Micron Commodore	August 1983—Commodore licensed by Micron to produce a 64K DRAM; this agreement is no longer in effect
Mietec Sprague	1983—Cross-licensing agreement with Sprague for a BiMOS process
Samsung SST	1983—Samsung Semiconductor is the U.S. subsidiary of Samsung Semiconductor and Telecommunications (SST)
S-MOS Seiko-Epson	1983—S-MOS affiliated with Seiko-Epson, which holds 30 percent of S-MOS
SEEQ Silicon Compilers	1983—SEEQ to manufacture SCI's Ethernet data link controller
UMC AMI	April 1983—Dialer ICs produced in cooperation with AMI
Universal Siliconix	June 1983—Siliconix to set up a design center for Universal's gate arrays in Swansea, Wales
Universal Western Digital	August 1983—Western Digital to second-source Universal's CMOS gate arrays
VLSI Technology Ricoh	1983—Technology exchange for NMOS and CMOS mask ROMs
VLSI Technology KIET	1983—VLSI's 32K ROM technology licensed by KIET in exchange for foundry services
VLSI Technology Texas Instruments	July 1983—VLSI to second-source TI's TME4500A DRAM controller and developer of its 256K DRAM controller
VLSI Technology Wang Labs	November 1983—Wang purchased 15 percent of VLSI's stock for \$34 million
ZyMOS Intel	January 1983—ZyMOS ZyP CAD system provided for Intel's CHMOS I process; codevelop a cell library
ZyMOS General Instrument	August 1983—GI to use ZyP software and Zy40000 to design the Zy4000 cell library

Table 9h  
1982 Alliances (13)

Companies	Description
AMCC Sorep	January 1982—AMCC and Sorep to design, assemble, test, and market gate arrays in France
AMCC Thomson-CSF	July 1982—Thomson-CSF to alternate-source and develop AMCC's bipolar Q-700 series of gate arrays
Acrian Communications Transistor	1982—Acrian acquisition of Communications Transistors Corp.
CDI Telmos	1982—CDI's linear CMOS products licensed by Telmos
CDI Corintech	October 1982—Corintech, a thick-film manufacturer, to make and sell CDI gate arrays in Britain
CMD/CMA Ricoh	Ricoh wafers provided to CMD/CMA
CMD/CMA Racal	1982—CMD/CMA to manufacture and sell Racal's CMOS gate arrays in the United States
LSI Logic AMD	January 1982—A five-year license to manufacture the LCA 1200 Series of ECL macrocell arrays received by AMD
LSI Logic Fujitsu	1982—Agreement covering HCMOS gate arrays
LTC Silicon General	July 1982—Technology exchange and second-sourcing agreement; Silicon General provided PWMs and two additional circuits and second-sources several high-current series pass regulators developed by LTC
SEEQ Rockwell	July 1982—SEEQ 16K EEPROM and 16K UV EPROM technology provided to Rockwell for cash, a lease, and a royalty
SEEQ TI	August 1982—SEEQ EEPROM licensed to TI in exchange for TI's TMS7000 8-bit MCU
Universal Siliconix	December 1982—Second source for Universal's 5-micron ISO-5 and 3-micron ISO CMOS gate arrays
VLSI Technology Ricoh	1982—All wafers provided by Ricoh

Source: Dataquest  
January 1990

Table 9i  
1981 Alliances (10)

Companies	Description
Barvon Research Ricoh	1981—Foundry services provided by Ricoh
Barvon Research Goldstar	1981—Foundry services provided by Goldstar; joint development of an analog/digital CAD
CDI LSI Logic	July 1981—CDI's HC Series of gate arrays exchanged for LSI Logic's LDS1 CAD system

(Continued)



**Table 9i (Continued)**  
**1981 Alliances (10)**

<b>Companies</b>	<b>Description</b>
CDI Giltspur	November 1981—A U.K. design center for CDI gate arrays established by Giltspur, a supplier of MPUs
Inmos TI	October 1981—Agreement for 64K DRAMs
LSI Logic Toshiba	August 1981—Joint development of a family of 1,000- to 10,000-gate CMOS arrays
Matra-Harris Intel	March 1981—Agreement covering NMOS circuits and a joint design facility, named Cimatel, in Nantes, France
SEEQ Amkor	1981—IC products assembled by Amkor
VLSI Technology Bendex	August 1981—Warrant guarantee for 14 percent of VLSI Technology preferred stock; \$2 million R&D funding, \$15 million equipment lease line
ZyMOS Intermedics	November 1981—Additional financing from Intermedics for \$4 million

Source: Dataquest  
January 1990

**Table 9j**  
**1980 Alliances (2)**

<b>Companies</b>	<b>Description</b>
CDI AMI	1980—CDI HC series licensed to AMI
VLSI Technology Amkor	1980—Assembly for VLSI Technology's IC products provided by Amkor

Source: Dataquest  
January 1990

**Table 9k**  
**1979 Alliances (3)**

<b>Companies</b>	<b>Description</b>
AMCC Signetics	April 1979—Signetics to alternate-source the Q700 Quick-Chip series
UMC ERSO	1979—ERSO granted UMC a license for design and process technology for 4-inch silicon wafers
ZyMOS Intermedics	1979—Financing from Intermedics, Inc., for \$10 million and lease guarantee for \$5 million; ZyMOS supplied custom ICs

Source: Dataquest  
January 1990

## Start-Up Affiliations

In addition to strategic alliances, many start-ups have agreed to affiliations or acquisitions and have even acquired the assets of former companies. A number of companies in this directory are the result of joint ventures of other larger companies. Start-ups are a part of acquisitions and affiliations for the following reasons:

- To gain financial backing

- To exploit technologies developed at parent companies
- To gain mobility to enter new product markets
- To enlarge product lines
- To penetrate markets in other areas

Table 10 shows a list of start-up companies that either have been acquired, are affiliated with other companies, or have acquired other companies.

Table 10

Start-Up Company Affiliates or Subsidiaries of Larger Companies

Company	Affiliation
Aspen Semiconductor	Subsidiary of Cypress Semiconductor
Austek	Acquired Silicon Microsystems (1986)
Chartered Semiconductor	Joint Venture among National Semiconductor, Singapore Technology Corp., and Sierra Semiconductor
Crystal Semiconductor	Acquired Texas Micro-Circuit (1984)
Custom Arrays	Subsidiary of ATAC
Electronic Technology Corp.	Subsidiary of J-TEC
Exel Microelectronics	Acquired by Rohm (1988)
Harris Microwave	Subsidiary of Harris Corp.
Headland Technology	Affiliate of LSI Logic
ICI Array Technology	Acquired by ICI Plc (1986)
Intergraph Advanced Processor Division	Division of Intergraph Corp., acquired via acquisition of Fairchild Advanced Processor Division (1987)
IXYS	Acquired ASEA Brown Boveri Power Semiconductor Group (1989)
Krysalis Corporation	Acquired by National Semiconductor (1989)
Matra-Harris Semiconducteur	Joint venture between Matra and Harris Corp.
MemTech Technology Corp.	Acquired Crystal Division of Materials Progress Corp. (1987)
Microwave Technology, Inc.	Acquired Monolithic Microsystems (1987)
MOSPEC Semiconductor	Subsidiary of President Enterprises Corp.
Multichip Technology	Subsidiary of Cypress Semiconductor
NMB Semiconductor	Division of NMB Technologies, which is a subsidiary of Minebea Co. Ltd. of Tokyo
NMB Semiconductor	Acquired Composite Recording Head Division of Seagate Technology
Orbit Semiconductor	Comdial was acquired by Orbit Instruments in 1985 and was renamed Orbit Semiconductor
Powerex, Inc.	Joint Venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corp.
Ramtron Corp.	Subsidiary of Newtech Development Corp.
Samsung Semiconductor	Subsidiary of Samsung Electronics Co., of the Samsung Group, a South Korean conglomerate
Sensym, Inc.	Acquired by Fasco Sensors & Controls (1989)
Spectrum Microdevices	Part of Fairchild Communications & Electronics

(Continued)

**Table 10 (Continued)**  
**Start-Up Company Affiliates or Subsidiaries of Larger Companies**

Company	Affiliation
Telecom Devices	Subsidiary of Opto Diode Corp.
Three-Five Systems	Formed via leveraged buyout of National Semiconductor's Optoelectronics business unit (1985)
Topaz Semiconductor	Subsidiary of Hytek Microsystems
TriQuint Semiconductor	Subsidiary of Tektronix
United Silicon Structures	Affiliate of ES2
VTC Incorporated	Subsidiary of Control Data Corp.

Source: Dataquest  
January 1990

## Technology Trends

### General Trends

Start-up companies in the United States historically have been at the leading edge of new product and process technology trends. The newest wave of start-up companies offer leading-edge process technologies, but many start-ups are subcontracting to external fabs. Many start-ups currently are planning products with submicron geometries, using advanced CMOS and BiCMOS technologies.

CMOS requires less power and generates less heat than bipolar and NMOS. Designers therefore can pack more circuits and functions onto a single chip, providing better price performance. Other advantages of CMOS that make it applicable for very large scale integration (VLSI) are broad operating temperature ranges, superior noise immunity, and improved electrostatic discharge protection. It also is a very versatile process technology that can be applied to both analog and digital circuits and can be combined with bipolar technologies to result in hybrid technologies such as BiCMOS. Most start-ups currently use a CMOS process technology.

Some other innovative technologies include bipolar ECL, BiCMOS, GaAs, and the Josephson Junction that IBM abandoned. Dataquest has identified many companies that are developing GaAs processes, and a few start-ups are beginning to explore BiCMOS. In fact, Aspen Semiconductor currently is offering BiCMOS ECL RAMs and PLDs.

Many of the companies also are taking a systems approach to designing ICs, an activity that mainline

companies have not traditionally pursued. In recent years, Dataquest has identified a trend toward the "system on a chip." The ultimate expression of this idea would be a monolithic system chip that integrates logic and memory into the microprocessor. As companies pursue higher system performance through the use of ASICs and specialized peripheral chip sets, we have noticed that these companies find value in design engineers who possess both IC logic and systems expertise.

Current changes in the marketplace present the following challenges:

- Technology barriers as the industry approaches 0.5-micron design rules
- A demand for specialized chips with smaller overall markets
- Development costs of memory products that will reach as much as \$100 million
- Rising costs for manufacturing equipment

To meet these challenges, companies are doing the following:

- Developing increasingly sophisticated computer and software tools
- Developing other technologies such as GaAs
- Focusing on end-use markets
- Emphasizing service

Table 11 lists the start-up companies alphabetically along with the product markets in which they participate.

**Table 11**  
**Alphabetical List of Start-Up Companies and Product Lines**

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
ACC						x	
Actel Corp.		x					
ANADIGICS				x			
ATMEL	x				x		Telecom
Acumos		x					
Adaptec						x	
AHA						x	
Advanced Linear	x						
AMP							Discrete
Advanced Power							Discrete
Alliance					x		
Altera		x					
AMCC		x					
Asahi Kasei	x	x			x	x	Telecom
Aspen		x			x		
Austek					x		
Avasem		x					
BKC							Discrete
BIT			x				
Brooktree	x						
CMD		x					
Calmos	x	x	x		x	x	Telecom
Calogic	x	x					
Catalyst					x	x	
Celeritek	x			x			Discrete
Chartered		x					Foundry
Cirrus Logic						x	
Comlinear	x						
Cree							Discrete
Crystal	x						Telecom
Custom Arrays	x						
Custom Silicon		x					
Dallas	x		x		x	x	Telecom
Dolphin		x					
DSP Group			x				
Exel Microelectronics		x			x		Telecom
Edsun						x	
Elantec	x						
ETC		x					
Epitaxx Inc.				x			Opto
ES2		x					
Gazelle				x			
Genesis		x					
GigaBit		x		x	x		Foundry
Harris				x			
Headland						x	

(Continued)

Table 11 (Continued)

## Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Hecht-Nielson							Neural network
Hittite				x			
Hualon	x				x	x	Telecom
IC Sensors	x						
ICI Array		x					
ISSI					x		
IXYS							Discrete
IST		x					
Inova					x		
Integrated CMOS		x					
IIT						x	
Integrated Logic		x					
Intergraph APD						x	
ICT		x			x		
IMP		x					
Isocom							Opto
Krysalis					x		
Kyoto				x			Opto
Lattice		x					
Level One							Telecom
LIS	x						
LTC	x						
Logic Devices			x		x	x	
Lytel				x			Opto
Matra-Harris		x	x		x	x	Telecom
Maxim	x						
MemTech							Opto
Micro Linear	x	x					
M/W Monolithics			x				
M/W Technology	x			x			
Mietec		x					
Modular					x	x	Telecom
MOSel					x		
MOSPEC							Discrete, foundry
Multichip nCHIP					x		Multichip modules
NMB					x		Foundry
NovaSensor	x						
Novix						x	
NSI						x	
Oak Technology					x		
Opto Diode				x			Opto

(Continued)

Table 11 (Continued)

## Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Opto Tech				x			Opto, discrete Foundry
Orbit							
Oxford					x		
PLX Technology	x						
Pacific Mono.				x			
Paradigm					x		
Performance					x	x	
Photonic Integration							Telecom
Plus Logic		x					
Power Integ.	x						
Powerex							Discrete
PromTech					x		
RAMAX					x		
Ramtron					x		
S3						x	
SEEQ					x		
SID	x						Discrete
SIMTEK					x		
Samsung	x				x		Discrete, telecom
Seattle Silicon		x					
Sensym	x						
Si-Fab							Foundry
Sierra	x	x			x		Telecom Discrete
Solid State							
Spectrum		x					
Synaptics							Neural network
Synergy					x		
TSMC							Foundry
Telcom Devices				x			Opto
Three-Five				x			
Togai							Fuzzy logic
Topaz							Discrete
TranSwitch							Telecom
TriQuint				x			
Triad					x		
UMC	x	x			x	x	Foundry, telecom
US2		x					
VIA Technologies						x	
VTC	x	x					
Vadem						x	
Vitellic					x		

(Continued)

**Table 11 (Continued)**  
**Alphabetical List of Start-Up Companies and Product Lines**

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Vitesse		x		x	x	x	
WaferScale		x			x		
Weitek			x				
Wolfson		x					
XTAR						x	
Xilinx		x					
Zoran			x				

Source: Dataquest  
January 1990

## Product Analysis

### Emerging Technology Companies

Start-up companies in the United States historically have been at the leading edge of new trends in product and process technology. Many of the start-ups in this directory follow this same pattern. Table 12 lists some of the emerging technology companies and the areas in which they are developing.

### ASICs

ASICs are transforming the electronics industry. System manufacturers are shifting their procurement content from standard ICs to ASICs. The

functions of the standard ICs are being put into cell libraries used by system designers to incorporate a number of specific functions on one chip, thus providing a "single-chip system solution." This design methodology provides system manufacturers with a technique to accomplish the following:

- Reduce system size
- Reduce system cost
- Improve system security
- Reduce system development time
- Improve system performance
- Improve system reliability

**Table 12**  
**Emerging Technology Companies**

Company	Technology/Product
Cree Research	Silicon carbide discretes
HNC	Neural network ICs
Krysalis	Ferroelectric memory
Molecular Electronics	Biomembranes (bioelectronics)
Photonic Integration	Optoelectronic ICs
RAMAX	Ferroelectric memory
Ramtron	Ferroelectric memory
Synaptics	Neural network ICs
Togai InfraLogic	Fuzzy logic processors

Source: Dataquest  
January 1990

ASICs were a \$7.4 billion market in 1988 and are projected to be a \$17.8 billion market by 1994. More than 59 percent of all logic ICs consumed during 1988 were ASICs; the ASIC market consists of the following four product categories:

- Programmable logic devices (PLDs)
- Gate arrays
- Cell-based ICs (CBICs)
- Full-custom ICs

With the development of industry standards in the gate array segment, gate arrays have become a

commodity product. As a result, companies with high-volume manufacturing capabilities, especially Japanese companies, now are dominating the market. More start-ups are entering the PLD market because there are no standards, it is a more fragmented market, and companies can protect their products with patented architectures. To survive, start-ups must avoid products that require large manufacturing muscle and develop strong ties with the customer. The key to success in this market is to provide a unique ASIC solution. This solution may take the form of a unique architecture or the development of cells for specific applications, such as telecommunications. Table 13 lists the companies that participate in the ASIC market.

Table 13  
Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Actel Corp.	x				
Acumos	x				
Altera				x	
AMCC	x				
Asahi Kasei	x		x		
Aspen				x	
Avasem			x		
Calmos	x		x		
Calogic	x				
CMD	x		x		
Custom Arrays		x			
Custom Silicon	x				
Dolphin			x		
ETC		x			
ES2					x
Exel Microelectronics				x	
Genesis	x		x		
GigaBit			x		
ICI Array	x	x			
IST	x		x		
ICS	x				
iLSi	x				
ICT				x	
IMP	x		x		
Lattice				x	
Matra-Harris		x			
Micro Linear		x			
Mietec			x		
PLX				x	
Plus Logic				x	

(Continued)



Table 13 (Continued)  
Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Seattle Silicon			x		x
Sierra			x		
Spectrum Micro	x				
UMC	x		x	x	x
US2					x
VTC	x		x		x
WaferScale			x		
Xilinx				x	

Source: Dataquest  
January 1990

### Analog ICs

The term "analog" defines electrical signals that have the property (or potential) of being continuously variable and that do not represent encoded numerical values. From 1988 through 1993, Dataquest predicts a compound annual growth rate (CAGR) of 12.4 percent for the analog IC market. Historically, analog ICs have grown well, between 16 and 20 percent in revenue during the last 10 years. The need to interface between the digital world and the real world has driven this growth. The need for accuracy, an easier means of design, and higher speed and precision also have been large factors. We expect these factors to continue to drive growth. Of great interest to the future growth of analog ICs, however, will be the development of analog ASIC circuitry, as employed in arrays and cell libraries.

Companies that offer analog products are concentrating on high-growth products, particularly analog ASICs, data converters, and telecom-specific products. A very specialized niche is the IC sensor segment. Three companies that offer sensor products are IC Sensors, NovaSensor, and Sensym.

Application-specific analog ICs, another analog approach, are expected to be a key area. Companies that can design cost-effective and reliable analog and digital circuits on a single chip will be able to provide a valuable service to the market. Companies that currently offer analog array design services are listed in the subsection entitled "ASICs."

Product segments in the analog marketplace include the following:

- Operational amplifiers
- Comparator products
- Consumer circuits
- Data conversion products
- Interface products
- Voltage regulators/voltage references
- Sensor products

Telecommunications ICs, which constitute an additional analog market segment, are listed separately in the subsection entitled "Telecommunications."

Dataquest believes that analog ASICs and telecom IC products will be the only areas that will show growth in 1989. In the long range (i.e., 1988 through 1993), Dataquest anticipates strong growth in the areas of analog ASICs, data converters, and telecom ICs. The CAGRs for each of these segments are 21.4 percent, 17.3 percent, and 16.2 percent, respectively. Major markets for analog ICs include data processing, communications, industrial, military, consumer, and transportation/automotive.

Table 14 lists the participants in the market for analog ICs.

Table 14  
Companies That Offer Analog ICs

	Op Amps	Comparators	Consumer	Data Conv.	Interface	Regulators/ References	Sensors
ALD	x	x					
Asahi Kasei				x			
ATMEL				x	x		
Avasem				x			
Brooktree	x		x	x			
Calmos	x			x			
Calogic	x					x	
Celeritek	x						
Comlinear	x			x			
Crystal	x			x			
Dallas					x		
Elantec	x	x			x		
Hualon			x				
IC Sensors							x
LIS				x			
LTC	x	x		x	x	x	
Maxim	x			x	x	x	
Micro Linear				x	x		
Microwave Technology	x						
NovaSensor							x
Power Integrations				x			
Samsung	x	x		x	x	x	
Sensym							x
Sierra				x			
Topaz				x	x		
UMC			x	x			
VTC	x	x		x	x		

Source: Dataquest  
January 1990

## Digital Signal Processing

The digital signal processing (DSP) market is a fast-growing area with many niche market opportunities for innovative start-up companies. DSP applications have emerged as consumers of substantial numbers of ICs, particularly in the communications and military market segments, which currently represent approximately 75 percent of all DSP applications. However, technology and products are migrating quickly into mainstream commercial and consumer areas.

DSP products, as defined by Dataquest, comprise four categories: single-chip DSP microprocessors, microprogrammable devices, special-function cir-

cuits, and ASIC DSP products. DSP microprocessors are analogous to the MPUs used in the PC environment; the main difference is that their architectures are optimized to solve digital signal processing problems. Microprogrammable products are used to build customized architectures to solve high-performance problems and include multipliers, multipliers/accumulators, sequencers, and other traditional bit-slice products. Special-function devices include modems, codecs, filters, and speech- and image-processing devices. ASIC DSP products use a cell-based approach and are designed specifically for DSP applications.

Table 15 shows the companies that participate in the DSP market.

**Table 15**  
**Companies That Offer DSP Products**

	DSP MPU	Microprogrammable	Special Function
BIT		x	
Calmos			x
Dallas	x		
The DSP Group			x
Logic Devices		x	
Matra-Harris		x	
Weitek		x	
Wolfson		x	
Zoran	x		x

Source: Dataquest  
 January 1990

### Discrete Semiconductors

The term "discrete" refers to a packaged semiconductor device that has a single function, meaning that one or several functioning circuits are in the package. Technically, optoelectronic devices belong in this category, but for the purpose of this directory, we are treating them separately.

Dataquest divides the discrete market into seven separate categories: small signal and power transistors; small signal, power, and zener diodes; thyristors; and other discretes. Power field-effect transistors (FETs) are included as a separate category because many of the newer companies are

concentrating in this area. FETs differ from most bipolar transistors in that they are voltage-controlled rather than current-controlled devices. FETs are available in two types: junction types (JFETs) and metal oxide types (MOSFETs).

The value of the discrete market was \$7.5 billion in 1988. The discrete market grew at a CAGR of 13.4 percent from 1982 through 1987. We believe that the CAGR will be considerably less from 1988 through 1993, at 7 percent. The strongest product growth is expected to be in the power device and other discrete categories. Table 16 shows the companies that participate in the discrete semiconductor market.

**Table 16**  
**Companies That Offer Discrete Products**

	Diodes	Transistors	Power FETs	Thyristors	Others
AMPi			x		
APT			x		
BKC International	x				
Celeritek		x			
Cree Research	x				
IXYS			x		x
MOSPEC		x	x		
Powerex	x			x	
SID		x			
Samsung		x	x		
Topaz			x		

Source: Dataquest  
 January 1990

**Table 17**  
**Companies That Offer Foundry Services**

Company	Location
Chartered Semiconductor	Singapore
GigaBit Logic	United States
MOSPEC Semiconductor	Taiwan
NMB Semiconductor	Japan
Orbit Semiconductor	United States
Si-Fab Corporation	United States
Taiwan Semiconductor Manufacturing	Taiwan
UMC	Taiwan

Source: Dataquest  
January 1990

### Foundry

The companies listed in Table 17 offer semiconductor foundry services. GigaBit Logic, MOSPEC, and NMB also offer other products and services. The most recently formed company is Chartered Semiconductor Corporation, which was formed as a joint venture among National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation to establish a technology base in Singapore.

### Gallium Arsenide

Gallium arsenide (GaAs) and other III-V compound semiconductors have made a slow transition from the laboratory to commercial applications. Users of supercomputers, telecommunications hardware, instrumentation, and consumer products are discovering major benefits in performance and improved functionality by taking advantage of this space-age technology. The worldwide market for GaAs semiconductors surpassed the \$2.5 billion mark in 1988, up from 1987 shipments of an estimated \$2.2 billion to more than \$2.7 billion. The predominant devices were discrete optoelectronics; ICs make up less than 10 percent of these figures. GaAs is projected to exceed \$4 billion by 1992; however, less than 30 percent of this value will be in ICs.

#### Advantages of GaAs over Silicon

The following are advantages that GaAs semiconductors have over silicon:

- Circuit switching 3 to 10 times faster

- Speed/power product 5 to 6 times more efficient
- Relative insensitivity to temperature and power supply variations
- Upper temperature limit of 350°C versus 175°C
- Superior levels of radiation tolerance
- Integrated optoelectronics on a single chip
- Wider range of resistivity due to semi-insulating substrates

#### Disadvantages of GaAs versus Silicon

The disadvantages of GaAs semiconductors compared with silicon are as follows:

- Higher wafer cost (typically 20 times or more)
- Lower level of digital circuit integration at a given point in time
- Lack of volume-production parametric test capability
- Design tasks more difficult; fewer expert engineers

GaAs has potentially wide-range applications in military, communications, and data processing market segments. Although GaAs is not likely to replace silicon in the foreseeable future as the workhorse semiconductor material, we do expect substantial growth in the GaAs market.

The following are potential GaAs IC applications:

- Telecommunications: opto and microwave electronics
- Computers and peripherals
- Instrumentation
- Consumer electronics
- Robotics
- Automotive
- Military/government

GaAs products are segmented into the following classifications:

- Analog ICs—MIC amps, MIC converters, frequency multipliers, ASICs
- Digital ICs—Logic, memory, ASIC, dividers, cost models
- Optoelectronics—LEDs, lasers, detectors, photovoltaic cells, isolators, couplers, integrated opto devices

- Discretes—Small-signal transistors, power FETs

Table 18 shows the participants in the gallium arsenide market.

### Memory

Because it is very difficult for a start-up to compete in a commodity market such as DRAMs or slow SRAMs, most memory start-ups are entering niche markets. It is important for a start-up to enter a market that matches its abilities. For this reason, many new memory companies have chosen to enter the market for fast SRAMs. This market is well suited to start-up participants for the following reasons:

- It offers good margins.
- It requires a strong process technology.
- It requires strong technical support.
- It requires close customer contact, which is necessary to design products to fit client needs.
- It does not require a large fab.

Table 18  
Companies That Offer GaAs Products

	Analog MMICs	Digital Linear	RAMs	ASICs	Std. Logic	Discretes	Opto
ANADIGICS	x	x					
Celeritek	x	x				x	
Epitaxx Inc.							x
Gazelle				x			
GigaBit		x	x	x	x		
HMS	x	x			x	x	
Hittite	x						
Isocom							x
Kyoto							x
Lytel							x
M/W Monolithics	x						
M/W Technology	x	x					
Opto Diode							x
Opto Tech						x	x
Pacific	x	x		x			
Telecom Devices							x
Three-Five							x
TriQuint	x	x		x	x		
Vitesse		x	x	x	x		

Source: Dataquest-  
January 1990

Most start-ups are well positioned to meet the success requirements in the fast SRAM market. U.S. companies have a particular advantage over Japanese companies in one crucial area: U.S. companies are able to establish much closer contact with their U.S. clients because of their domestic production capability. The goal of most start-ups is to become niche players. To sustain success with a niche strategy, however, the company must dominate the niche.

Other niches that start-ups are pursuing include the high-speed EPROM and EEPROM markets and other nonvolatile memory markets such as ferroelectric memory. In addition, a number of start-ups are positioning themselves in markets for specialty memories such as FIFO and dual-port devices.

Table 19 lists the participants in the memory product market.

Table 19  
Companies That Offer Memory Products

	DRAM	SRAM	ROM	EPROM	EEPROM	FIFO	Others
Alliance	x	x					
Asahi Kasei		x	x				
Aspen		x					
ATMEL				x	x		x
Austek							x
Calmos		x					
Catalyst		x		x	x		
Dallas		x				x	x
Exel							x
GigaBit		x					
Hualon		x	x				
ISSI		x					
Inova		x					
ICT				x	x		
Krysalis							x
Logic Devices		x				x	x
Matra-Harris		x					x
Modular		x					
MOSel		x				x	x
Multichip		x					
NMB	x						
Oxford							x
Paradigm		x					
Performance			x				
PromTech				x			
RAMAX							x
Ramtron							x
Samsung	x	x			x		
SEEQ				x	x		
Sierra					x		
SIMTEK							x
Synergy		x					
Triad		x					x
UMC		x				x	
Vitellic	x	x				x	x
Vitesse		x					
WaferScale				x			

Source: Dataquest  
January 1990

## Microcomponents

Microcomponent products generally command higher ASPs than other ICs, frequently are sole-sourced, and have fostered the development of high-end niche markets. Start-up companies are offering graphics controllers, hard and floppy disk controllers, CRT controllers, and peripheral chip sets. A small number of start-ups are producing microprocessors, but the microprocessor market is dominated by larger companies such as Intel and Motorola.

During the past two years, the logic chip set market has been the fastest-growing segment of the microcomponent market. Worldwide, there were only 6 PC logic chip set vendors in 1987. In 1988, the number of vendors climbed to 13, a figure that continues to grow. Many of these new entrants are start-ups. Dataquest believes that the rapid increase in new entrants and capacity has carried this market to the point of saturation. We expect this saturation to lead to aggressive price competition,

causing vendors to look for penetration of these products into new applications and markets. At this point, the growth rate of chip set shipments will be tied directly to the growth rate of PC shipments. The CAGR for chip set shipments from 1989 to 1993 is estimated to be only 12.2 percent. This growth level should attract fewer new entrants and cause some participants to exit the industry.

Dataquest believes that this rapid market saturation is bound to be repeated in each of the PC peripheral chip set markets—logic, graphics, communications, mass storage, modem, and fax—as established chip set and semiconductor companies follow one another into these most obvious product-line extensions. The graphics chip set market already is showing signs of saturation, marked by severe pricing pressure. At the same time, apparently low barriers to entry invite many new market participants.

Table 20 lists the companies that offer microcomponent products.

Table 20  
Companies That Offer Microcomponent Products

	MPU	MCU	MPR Commun.	Mass Storage	Sys. Support	Key/Display
ACC Micro					x	
Adaptec				x		
Asahi Kasei		x				
Avasem					x	
Calmos	x			x	x	
Catalyst		x				
Cirrus Logic			x	x		x
Dallas		x			x	x
Edsun			x		x	x
Headland						x
Hualon			x		x	x
IIT	x					x
Intergraph APD	x					
Logic Devices			x		x	
Matra-Harris	x	x			x	x
Modular					x	
Novix	x					
NSI Logic						x
Oak Technology					x	x
Performance	x				x	
SEEQ	x				x	
S3					x	
UMC	x	x		x	x	x
XTAR						x

Source: Dataquest  
January 1990

## Optoelectronics

Optoelectronics is a field that combines the technologies of optics and electronics. Visible devices, including light-emitting device (LED) lamps and LED displays, are the market segments concerned with the interactions between light-emitting and filtering devices and electronics. LEDs are commodity products. Optocouplers and other opto areas are more customized products. Both of these products are growing at a faster pace than LEDs. Other opto areas include products such as photodiodes and phototransistors, solar cells, infrared lamps, lasers, and CCD sensors.

Dataquest divides the optoelectronics market into four separate categories: LED lamps, LED displays, optoelectronic couplers, and other optoelectronic devices. The total market for optoelectronics grew at a rate of 15.8 percent compounded annually from 1982 through 1987. Dataquest expects this growth rate to continue at the lesser rate of 11.4 percent compounded annually from 1988 through 1993. Price pressure in the industry is eroding dollar growth, although new technologies and applications continue. The optoelectronics

segment is being fueled by the communications and computer industries, which use light as a medium for communication. Optoelectronics also are heavily used in the consumer market.

Table 21 lists the companies that offer optoelectronic products.

## Telecommunications ICs

The telecommunication IC market is growing faster than the analog IC market, of which it is a segment. In fact, Dataquest predicts a CAGR of 16.2 percent for the telecom IC segment in the 1988 through 1993 period. One factor driving the growth of telecommunication ICs is the need to automate the office by linking personal computers. Another factor is the need to communicate faster, farther, and in a variety of ways, including satellites and facsimile machines. The demand for better and faster communication also is spurring the development of new devices such as line interfaces and switch arrays.

Table 22 lists the companies that offer telecommunications ICs.

Table 21  
Companies That Offer Optoelectronic Products

	Light Emitting	Light Sensing	Others
Cree Research	x		
Epitaxx Inc.	x	x	
Isocom			Optocouplers
Kyoto	x	x	
Lytel	x		Lasers
Opto Diode	x		
Opto Tech	x		Photodiodes Phototransistors
Solid State Telcom Devices	x	x	Photodiodes

Source: Dataquest  
January 1990



Table 22  
Companies That Offer Telecommunications ICs

	Dialer	Modem	UART/ DUART	Line Interface	Codec/ Filter	Switch Array	Others
Asahi Kasei					x		
ATMEL					x		
CMD	*				x		
Calmos					x		x
Crystal	x	x		x			x
Dallas			x				
Exel			x				
Hualon	x						x
Level One				x			
Matra-Harris		x		x	x		
Modular			x				
Photonic							x
Samsung	x				x		x
Sierra	x	x			x		
Topaz						x	
TranSwitch							x
UMC	x		x				

Source: Dataquest  
January 1990

## Company Profiles

Dataquest has profiled 137 semiconductor start-ups in the following subsection. The data for these profiles were collected through personal and telephone interviews, surveys, and publicly available material. Some of the text was integrated verbatim

from background information provided by the companies.

The 1990 edition contains some information not included in earlier editions of this directory. The asterisks (\*) in the board of directors and company executives sections denote company founders. At the end of each profile, the name of the company's PR firm is listed if one exists.

# ACC Microelectronics Corporation

3295 Scott Blvd., Suite #400

Santa Clara, CA 95054

408/980-0622

Fax: 408/980-0626

ESTABLISHED: February 1987

NO. OF EMPLOYEES: 50

## BACKGROUND

ACC Microelectronics Corporation was established in February 1987 to design, produce, and market VLSI devices for advanced computer and communication products. The Company was founded by W.T. Chiang, a designer of the Intel 80386. ACC is concentrating on developing VLSI circuit device chip sets to be used as "gap bridging" solutions in several major application areas such as communications, computer systems controllers, and computer system board integration.

The Company has developed a full line of high-performance products, including nine chip sets and 15 individual chips. These products include a single-chip turbo-IBM PC XT-compatible peripheral controller, a single-chip floppy disk controller for XT, AT, PS/2 Model 30, and PS/2 Models 50, 60, 70, and 80-compatible computers, a 386 chip set, and a 386SX chip set. ACC's target markets include OEMs, distributors, and value-added integrators of computer and communication systems.

In April 1989, ACC announced a strategic alliance with Motorola's Semiconductor Products Sector. The agreement allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers. Previously, ACC and Motorola announced an alternate-source licensing agreement for the ACC3200 series of disk controllers.

In the future, ACC Microelectronics will offer a complete line of system-level VLSI chip set solutions for advanced computers and communications.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*W.T. Chiang  
Intel, Senior Manager

### VP Eng

Mark Shieu  
Amiga, Director

### Dir Prod Mktg

Jack Yuan  
Genoa, Prod Mktg Mgr

\*Founder

## FINANCING

ACC Microelectronics is privately financed.

## RECENT HIGHLIGHTS

### November 1989

ACC introduced a four-device chip set for IBM PC AT-compatible computer systems. The new ACC-82021 chip set operates at up to 20 MHz and supports Intel 80286 and 80386SX microprocessors.

### November 1989

ACC announced its three-device ACC-82300 chip set for IBM PC AT-compatible computer systems. The new chip set operates at 20 or 25 MHz and supports the Intel 80386 microprocessor.

### November 1989

ACC introduced the ACC-82030 single-chip AT controller. The new highly integrated controller chip is packaged in a unique 256-pin surface mount device developed by Motorola as part of ACC's earlier agreement with Motorola.

# ACC Microelectronics Corporation

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## ALLIANCES

**Motorola**  
April 1989

ACC and Motorola announced a strategic alliance that allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers.

Motorola also gained second-source rights to a cache controller and a tag RAM developed by ACC.

## MANUFACTURING

### Technology

1.5- and 1.0-micron CMOS

### Facilities

Santa Clara, CA  
Design, test

## PRODUCTS

Single Chip XT—ACC1000  
Single Floppy Disk Controller—ACC3201  
386SX AT Chip Set—ACC82020  
386 AT Chip Set—ACC82300

## OTHER INFORMATION

ACC's PR firm is Shotwell Public Relations.

# Actel Corporation

955 E. Arquez Avenue

Sunnyvale, CA 94086

408/739-1010

Fax: 408/739-1540

ESTABLISHED: October 1985

NO. OF EMPLOYEES: 60

## BACKGROUND

Actel Corporation designs, manufactures, and markets user-configurable integrated solutions for the design and implementation of ICs in electronic systems.

The Company was founded by Amr Mohsen, a former Intel program manager of advanced technology development.

Actel has developed a CMOS gate array based on proprietary architecture and customer-configurable interconnect technologies. Customers can map applications instantly with Actel's design automation systems, which includes development software and system hardware.

In 1987, Actel received \$750,000 in follow-on funding, bringing first-round financing to \$9.1 million. In March 1988, William Davidow, an Intel veteran and well-known venture capitalist, was elected chairman of Actel.

## BOARD

(Name and Affiliation)

William H. Davidow, Chairman  
Mohr, Davidow Ventures

\*Amr Mohsen  
Actel Corporation

Carver Mead  
California Institute of Technology

Jos Henkens  
Advanced Technology Ventures

Vahe Sarkissian  
Data General Corporation

Ed Zshau  
Censtor Corporation

John East  
Actel, President/CEO

Robert G. Spencer  
Hillman Ventures

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
John East  
AMD, VP Logic Products

VP Operations  
Paul Franklin  
MMI, GM-Memory, Digital & Logic Divisions

Sr VP Sales/Mktg  
M. Douglas Rankin  
Signetics, VP WW Sales

VP Finance  
Richard S. Mora  
HHB, VP Finance

VP Engineering  
Jeff M. Schlageter  
AMD, Managing Dir Peripheral Products

\*Founder

## FINANCING

October 1985  
Initial  
\$0.5M  
Private, Advanced Technology Capital, Shaw  
Venture Partners

June 1986  
Round 1  
\$9.1M  
Advanced Technology Ventures; Brentwood  
Associates; Mohr, Davidow Ventures; Norwest  
Venture Capital; Oak Associates; Shaw Venture  
Partners; Data General

# Actel Corporation

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**August 1988**

Round 2

\$9.3M

Hillman Ventures, Sprout, DLJ Ventures,  
Rothschild Ventures, Equity Venture Capital,  
Hughes Aircraft

agreement with Data General that allowed Data General to design and develop semiconductor products based on Actel's technology. In return, Data General supplied Actel with use of test equipment, wafer fabrication, and engineering facilities (expired).

## RECENT HIGHLIGHTS

**February 1988**

Actel introduced the ACT 1 family of FPGAs, which can be designed, programmed, and tested from a 386-based PC in a matter of hours.

**July 1988**

Actel disclosed technical details of its Programmable Low Impedance Circuit Element (PLICE) antifuse nonvolatile interconnect, a strategic technology important to the company's thrust into desktop-configurable products.

**Texas Instruments**

November 1988

Actel and TI signed a seven-year technology and licensing agreement. Under the pact, TI will alternate-source the ACT 1 family of gate arrays and resell the Action Logic System (ALS)—Actel's fully-automatic CAE system. Actel will gain access to TI's advanced EPIC 1 CMOS wafer-processing technology and manufacturing capabilities.

## ALLIANCES

**Data General**

1986

Actel signed a three-year joint development

## MANUFACTURING

**Technology**

CMOS

**Facilities**

Sunnyvale, CA

30,000 sq. ft.

R&D, development, marketing, administration

## PRODUCTS

A family of field-programmable Gate Arrays supported by a design automation system

Gate Arrays

Device	Description
Act 1010	1,200-gate FPA
Act 1020	2,000-gate FPA
Action Logic TM System	Development hardware and software

## OTHER INFORMATION

Actel's PR firm is Tsantes and Associates.

**Acumos, Inc.**  
 1531 Industrial Road  
 San Carlos, CA 94070  
 415/591-1488  
 Fax: 415/591-1483

**ESTABLISHED: 1985**

**NO. OF EMPLOYEES: 15**

**BACKGROUND**

Acumos, Inc., specializes in analog-to-digital arrays, small-to-medium high-drive and high-voltage arrays, and analog switching arrays that incorporate both CMOS and DMOS switches. The Company offers both full-custom and standard cell devices.

In 1987, Acumos offered the A300 gate array that incorporates analog and digital functions. The device, which is a PLD replacement part, is designed for voice filtering, robotics, magnetic disk drive applications, and communications markets. The Company plans later introductions of specialty high-voltage products.

In 1985, the Company acquired Semi Processes Inc.'s gate array assets, including inventory, wafers, and test equipment. The Company is servicing SPI's customer base for low-density CMOS gate arrays in the 50- to 700-gate range.

Acumos subcontracts manufacturing and assembly with U.S. and offshore companies. The Company plans to sell into the Japanese and U.S. markets.

**BOARD**

Not available

**PRODUCTS**

Gate Arrays

Device	Linewidth	Gates	Description
7001/7004/7005	4-micron	100 to 700	High 15V Output Drive Digital Gate Arrays, Typical 3ns Delay
D315-D3120 Series	3-micron	150 to 1,200	Typical 2ns Delay
A300	4-micron	300	Analog/Digital Array with Op Amps, Resistors, Capacitors, Comparators, 5ns-Internal Gate Delay
CD01/CD02		30-100	CMOS/DMOS Monolithic Gate Array

**OTHER INFORMATION**

Acumos does not employ a PR firm.

**COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President**

\*Man Shek Lee  
 GTE, Mgr IC Design

**VP**

\*Chieh Chang  
 GTE, Sr Design Engr

\*Founder

**FINANCING**

Not available

**ALLIANCES**

None

**MANUFACTURING**

**Technology**

3.0-, 4.0-, 5.0-micron silicon-gate CMOS

**Facilities**

San Carlos, CA  
 4,000 sq. ft.  
 Design and test

## **Adaptec, Inc.**

691 S. Milpitas Boulevard

Milpitas, CA 95035

408/945-8600

Fax: 408/262-1845

**ESTABLISHED: May 1981**

**NO. OF EMPLOYEES: 567**

### **BACKGROUND**

Adaptec, Inc., is one of the leading suppliers of high-performance input/output (I/O) solutions. Product offerings include proprietary VLSI circuits, a broad line of small computer systems interface (SCSI) host adapters and enhanced small device interface (ESDI) disk controller boards for personal computers, local area network (LAN) interface units, a family of SCSI test and development systems, and imaging systems controller products. Adaptec stock is traded over the counter under the NASDAQ symbol ADPT.

Adaptec designs full-custom, semicustom, and gate array circuits in NMOS, CMOS, and bipolar technologies in geometries ranging from 4.0- to 1.0-micron. Products are targeted to customers in three segments of the microcomputer market: the personal computer market; the multiuser systems, network file server, and engineering workstation market; and the supercomputer market for scientific and business applications. Adaptec also designs and manufactures host adapters and controller boards for the AT, Micro Channel and, soon, extended industry standard architecture (EISA) bus architecture microcomputers.

Adaptec is one of the leaders in the SCSI industry with chips, boards, test and development systems, software support, and communication products. The Company eventually will apply the interface to its laser printer controller boards. Adaptec's SCSI protocol chip has been incorporated into a host adapter made by IBM, and its controller chips have been selected by peripheral customers such as Conner, Hitachi, Quantum, Seagate, Seiko-Epson, and Sony. Adaptec has won contracts for its board products from microcomputer makers such as Nokia, Tandy, Unisys, and Zenith. Additionally, the Company's network interface unit, the Nodem, was "blessed" by Apple Computer and featured in the introduction of Apple's Macintosh Portable.

The Company subcontracts all IC production; however, it also performs final test on all products to maintain the quality and reliability of its devices. High-volume board products are assembled in Singapore by Adaptec's wholly owned manufacturing entity, Adaptec Manufacturing Singapore (AMS).

Adaptec markets and distributes controller boards and circuits to a broad spectrum of computer and disk drive manufacturers, a number of reseller channels, and domestic and international industrial distributors. The Company has 15 manufacturers' representative organizations, 5 industrial distributors, and 19 international distributors.

### **BOARD**

(Name and Affiliation)

John G. Adler

Adaptec, Inc., President/CEO

Lawrence B. Boucher

Adaptec, Inc., Chairman

Robert J. Loarie

Lawrence, WPG Partners, General Partner

David F. Marquardt

Technology Venture Investors, General Partner

B. J. Moore

Outlook Technology Inc., President

W. Ferrell Sanders

Asset Management Co., Senior Associate

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President/CEO**

John G. Adler

Amdahl, VP Product Dev

## **Adaptec, Inc.**

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### **VP Engineering**

Larry Sasscer  
Amdahl, Mgr Channel Dev

### **VP/GM**

Jeffrey A. Miller  
Intel, Mktg Mgr/MPU Ops

### **VP Finance/CFO**

Paul Hansen  
Raychem, Asst Controller

### **VP Systems**

Bernard G. Nieman  
Shugart, Project Manager

### **VP Sales**

Roger McLean  
Imagen Corp., VP OEM Sales/Mktg

### **VP Mfg**

Gary J. Weitz  
Finnigan, General Manager

### **VP Peripheral Products**

G. Venkatesh  
Commodore Int'l, Director of Mktg

turing Singapore, manufactures surface-mount controllers.

### **October 1987**

Adaptec signed a \$5 million contract to supply Conner Peripherals with disk controller ICs during 1988.

### **1988**

Adaptec introduced the industry's first PS/2 Micro Channel disk controllers.

### **June 1988**

Adaptec announced a major corporate restructuring. Under the new plan, the Company is organized into four major groups: Test and Development Systems, Chips, Boards, and Communications Products. Each group is nearly autonomous, with separate marketing, management, and profit-and-loss responsibility.

### **July 1989**

Adaptec established a regional sales and support office in Singapore, headed by K.S. Yeo, regional sales manager.

## **FINANCING**

### **June 1986**

IPO  
\$10.0M  
Initial public offering

## **RECENT HIGHLIGHTS**

### **1979**

Adaptec founders created SCSI.

### **1983**

Adaptec introduced the industry's first programmable disk controller chips.

### **1984**

Adaptec introduced the industry's first multitasking disk controllers/host adapters.

### **January 1987**

Adaptec established a subsidiary in Singapore. The new company, called Adaptec Manufac-

## **ALLIANCES**

### **SCO**

#### **October 1987**

Adaptec signed an agreement with The Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system.

### **Chips & Technologies**

#### **January 1988**

Adaptec and Chips & Technologies aligned to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80.

## **MANUFACTURING**

### **Technology**

4.0- to 1.0-micron NMOS, CMOS, bipolar



**Facilities**

Milpitas, CA  
100,000 sq. ft.  
Administration, development

Singapore  
45,000 sq. ft.  
Manufacturing

**PRODUCTS**

**Integrated Circuit Products**

Device	Description
AIC-010F	10-Mbps Programmable Storage Controller
AIC-011F	15- and 24-Mbps Programmable Storage Controller
AIC-250F	MFM Encoder/Decoder
AIC-270F	2,7 RLL Encoder/Decoder
AIC-300F	Dual-Port Buffer Controller
AIC-301	Enhanced Dual-Port Buffer Controller
AIC-500	SCSI Interface Circuit
AIC-560	PC AT Interface Chip
AIC-610F	10-Mbps Integrated Programmable Storage Controller
AIC-6110	Single-Chip Synchronous SCSI Controller
AIC-6160	Single-Chip PC AT Mass Storage Controller
AIC-6190	Single-Chip Micro Channel Mass Storage Controller
AIC-6225	33-Mbps (1,7 RLL) Data Separator
AIC-6250	20MB Host Transfer with SCSI Protocol Circuit

**Board Products**

**SCSI Host Adaptors**

AHA-1540	PC AT-to-SCSI Host Adaptor
AHA-1542	PC AT-to-SCSI Host Adaptor
AHA-1640	Micro Channel-to-SCSI Host Adaptor

**Hard Disk Controllers**

ACB-231X	AT-to-ST412/506 MFM Hard Disk Controller, 5 Mbps
ACB-237X	AT-to-ST412/506 RLL Hard Disk Controller, 7.5 Mbps
ACB-232X	AT-to-ESDI NRZ Hard Disk Controller, 10 Mbps
ACB-232XB-8	AT-to-ESDI NRZ Hard Disk Controller, 15 Mbps
ACB-2610	Micro Channel-to-ST412/506 MFM Hard Disk Controller
ACB-2670	Micro Channel-to-ST412/506 RLL Hard Disk Controller
ACB-2620	Micro Channel-to-ESDI Hard Disk Controller

**SCSI Test and Development Systems**

SDS-1	SCSI Development System with Initiator Emulation
SDS-2	SCSI Development System with Target and Initiator Emulation
SDS-3	Synchronous SCSI Development System with Target and Initiator Emulation

**SCSI-to-LAN Interface Unit**

Modem	Connects SCSI-based PCs to Ethernet
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**OTHER INFORMATION**

Adaptec does not employ a PR firm.

# Advanced Hardware Architectures, Inc.

P.O. Box 9669  
Moscow, ID 83843  
208/883-8000  
Fax: 208/882-0105

ESTABLISHED: February 1988

NO. OF EMPLOYEES: 25

## BACKGROUND

Advanced Hardware Architectures (AHA) was formed in 1988 to develop VLSI products based on a proprietary sorting and error-correction technologies developed by the Idaho Research Foundation. The Company's first products are a family of high-speed, single-chip Reed-Solomon encoder/decoder chips and a family of sorter coprocessor boards. AHA implements its patented sorting and error-correction technologies with very high speed hardware architectures.

AHA is the first commercial venture of the Idaho Research Foundation, the high-technology development arm of the University of Idaho. The Company is headed by John Overby, who joined AHA after holding the position of CEO with Advanced Input Devices.

The Company uses both CMOS and GaAs process technologies for its current product offerings and will use other technologies as the need arises. All of the Company's wafer fabrication operations are contracted to outside firms. AHA plans to set up a small fab of its own eventually. The Company currently operates two facilities in Moscow, Idaho, that total 10,000 square feet. AHA's future product focus will continue to be proprietary sorting and coding products. The Company plans to expand its capacity to allow for rapid product growth.

## BOARD

(Name and Affiliation)

John Overby  
Advanced Hardware Architectures, President

Dr. Richard Callahan  
Idaho Research Foundation, Inc.

Dr. Gary Maki  
UI/Microelectronics Research Center

Steve Shinn  
Investor

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
John Overby  
A.I.D., President and CEO

**VP Finance**  
Gordon Scott  
A.I.D., COO and CFO

**VP Sorting Products**  
Dr. J. Shovic  
University of Idaho/MRC, Research

**VP Coding Products**  
Dr. Pat Owsley  
University of Idaho/MRC, Research

## FINANCING

Advanced Hardware Architectures has had three rounds of financing, which totaled more than \$1 million.

## ALLIANCES

None

## MANUFACTURING

### Technology

CMOS, GaAs, and others as needed

### Facilities

Moscow, ID  
Two locations that total 10,000 sq. ft.  
R&D, marketing, test

## **Advanced Hardware Architectures, Inc.**

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### **PRODUCTS**

PerFEC Series—Very High Speed, Single-Chip Reed-Solomon Encoder/Decoder Chips  
Aha!Sort Series—Sorter Coprocessor Boards

### **OTHER INFORMATION**

Advanced Hardware Architectures' PR firm is Hanna-Wheeler.

PerFEC and Aha!Sort are trademarks of Advanced Hardware Architectures, Inc.

# Advanced Linear Devices, Inc.

1180 F. Mariloma Way  
Sunnyvale, CA 94086  
408/720-8737  
Fax: 408/720-8297

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 10

## BACKGROUND

Advanced Linear Devices, Inc., (ALD) designs, develops, manufactures, and markets linear ICs for low-power, low-voltage precision applications. Products are manufactured using a proprietary silicon-gate CMOS technology optimized for 5V operation. They are used for industrial control and electronic instrumentation, computer and peripheral equipment, medical instrumentation, telecommunications, aerospace, and military systems.

The Company offers two product lines. A series of about 25 standard products that include timers/oscillators, op amps, comparators, and n-channel and p-channel MOSFETs.

The second product line, which was offered in March 1988, is a Function-Specific Standard Cell Linear Program for the design of custom and semicustom ICs. The library includes timers/oscillators, op amps, comparators, and MOSFETs, as well as diodes, resistors, and capacitors. The program consists of a kit of 86 standard ICs of 20 different types and a design manual. Customers use the parts to bread board the desired circuit, then return the working design to ALD, which then designs the circuit.

ALD subcontracts wafer fabrication to two foundries in the United States and assembly to contractors in the Far East. ALD conducts all wafer probe, sort, and final test at its facility in Sunnyvale, California. In 1987, ALD put in place its U.S. and Canadian network of sales representatives and established a U.S. distributor network.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Robert Chao  
Supertex, VP Product

### VP Product Opns

\*Larry Iverson  
Supertex, Mgr Process Engr

### VP Mktg/Sales

\*Michael O'Neal  
Micropower, VP Mktg/Sales

\*Founder

## FINANCING

Not available

## RECENT HIGHLIGHTS

### April 1986

ALD offered its first product, the ALD55 monolithic CMOS timer. It features 500ns monostable mode and 2-MHz astable mode operation.

### August 1986

ALD offered the ALD2301 silicon-gate CMOS dual comparator with typical response time of 650ns.

### November 1986

ALD offered the ALD1502/2502/4501 family of quad CMOS timers that operate on 2V to 12V supplies. The series is available in commercial and military grades.

### March 1987

ALD offered the ALD2701 CMOS dual rail-to-rail op amp. The device operates from single or dual supplies and input and output signal levels both extended to the supply voltage rails.

# Advanced Linear Devices, Inc.

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## March 1988

ALD offered the function-specific standard cell ASIC approach for linear ICs.

## ALLIANCES

Not available

## Facilities

Sunnyvale, CA  
10,000 sq. ft.  
Manufacturing  
Design, test  
Administration

## MANUFACTURING

### Technology

3.0-, 5.0-micron silicon-gate CMOS

## PRODUCTS

Device	Description
ALD1701	CMOS, Rail-to-Rail, Micropower Amplifier
ALD1702	CMOS, Rail-to-Rail, Oscillation Resistant Amplifier
ALD1703	CMOS, Low-Cost Amplifier
ALD1704	CMOS, Low-Cost, JFET-Replacement Amplifier
ALD1706	CMOS, Rail-to-Rail, Very Low Power Amplifier
ALD2701	Dual, CMOS, Rail-to-Rail, Micropower Amplifier
ALD4701	Quad, CMOS, Rail-to-Rail, Micropower Amplifier
ALD2301	Dual, CMOS, Open Collector Output Comparator w/Drivers
ALD4302	Quad, CMOS, Push-Pull Outputs Comparator w/Drivers
ALD555/1502/1504	Single-Precision Timer/Oscillator
ALD2502/2504	Dual-Precision Timer/Oscillator
ALD4501/4503	Quad-Precision Timer/Oscillator
ALD1101	Dual N MOSFET Transistors
ALD1102	Dual P MOSFET Transistors
AID555-1	One-volt Single Timer/Oscillator

## OTHER INFORMATION

ALD does not employ a PR firm.

## **Advanced Microelectronic Products, Inc.**

1/F #17 Industriale E. 2nd Road  
Hsinchu, Taiwan

North American Headquarters  
1887 O'Toole Avenue, Ste. C-111  
San Jose, CA 95131  
408/727-8880  
Fax: 408/727-6320

ESTABLISHED: June 1986

NO. OF EMPLOYEES: N/A

### **BACKGROUND**

Advanced Microelectronic Products, Inc. (AMPi), was formed to design, manufacture, and market power MOSFETs. The Company is implementing a three-pronged strategy. Initially, the Company entered the market with standard, functional equivalents to International Rectifier's line of leading power MOSFETs. Concurrently, it designed value-added products from its standard product line. Future plans involve using proprietary technology to offer smart power devices.

In August 1986, the Company produced its first prototype product, the IRF450 power amplifier. By April 1987, the Company readied its line of International Rectifier-compatible products and opened its North American headquarters in Santa Clara.

AMPi has established relationships with ERSO (Taiwan), which will conduct manufacturing, and Lingsen (Taiwan) and New Era (Hong Kong), which will perform assembly for AMPi.

Sales representatives have been signed in the United States, Canada, and the Far East.

### **BOARD**

(Name and Affiliation)

Bob Jih, Chairman of the Board  
Advanced Microelectronic Products, CEO

### **COMPANY EXECUTIVES**

(Position and Name)

President  
James Yen

CEO  
Bob Jih

CFO  
H.K. Hu

### **FINANCING**

Not available

### **ALLIANCES**

Not available

### **MANUFACTURING**

#### **Technology**

3-micron MOS

#### **Facilities**

Santa Clara, CA  
Design, marketing

Hsinchu, Taiwan  
Headquarters, engineering, manufacturing,  
assembly, test

# Advanced Microelectronic Products, Inc.

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## PRODUCTS

Device	Voltage	Drain Source (Amps)	Current Package
AM0610LL/AM2222LM	60	15.0, 19.0	TO-92
AM10KLM/AM2222LM	60	0.25, 0.3	TO-237
AM4000 Family	100 to 500	18.0 to 56.0	AMPAK-04
IRF100-400	60 to 500	12.0 to 33.0	TO-3
IRF500-800/BUZ	50 to 500	1.3 to 30.0	TO-220AB

## OTHER INFORMATION

AMPi does not employ a PR firm.

# Advanced Power Technology, Inc.

405 S.W. Columbia Street

Bend, OR 97702

503/382-8028

Fax: 503/388-0364

ESTABLISHED: June 1984

NO. OF EMPLOYEES: 70

## BACKGROUND

Advanced Power Technology (APT) designs, manufactures, and markets low-cost, high-power MOSFETs for advanced electric power switching applications, such as data processing and telecommunications equipment, defense systems, and variable-speed electric motors.

APT has developed a family of large-die MOSFETs that match the power and price advantages of low-speed thyristors and bipolar transistors with equivalent switching speeds. The MOSFETs feature lower on resistance and lower input capacitance, achieved with a metal-gate and 6-micron feature sizes. APT has also reduced manufacturing costs by developing a simpler MOSFET design that reduces the number of masks required.

The Company's future plans include developing a line of hybrids and insulated gate bipolar transistors (IGBTs).

## BOARD

(Name and Affiliation)

Charles Cole, Chairman

Julian, Cole & Stein, General Partner

Leib Orlanski

Freshman, Marantz, Orlanski, Cooper and Klein, Attorney, Partner

Patrick Sireta

Advanced Power Technology, Inc.,  
President/CEO

Ed Snape

The Vista Group, General Partner

Dave Stein

Julian, Cole & Stein, General Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO

Patrick Sireta  
TI, VP CMOS Div

VP Marketing

Barry Chenes  
PowerTek, VP Sales

VP Operations

John Hess  
SEEQ, Dir Operations

CFO

Robert M. Holburn  
TI, Ctr WW MOS Mem

VP Engr

Dah Wen Tsang  
Theta-J, Dir Research

Sales Manager

Terry Bowman  
Micron, VP Sales/Mktg

## FINANCING

1985  
Seed  
\$0.4M

1985  
Round 1  
\$2.5M

1986/1987  
Round 2  
\$8.1M



# Advanced Power Technology, Inc.

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1988

Round 3

\$2.8M

Major investors include Julian, Cole & Stein; The Vista Group; Orien Ventures; 1st Chicago Investment Advisors; Sunwestern Ventures Company; J.F. Shea Company; and Mitsui & Company (U.S.A.), Inc.

## RECENT HIGHLIGHTS

October 1986

First prototype MOSFETs produced.

March 1987

Internal wafer fabrication facility became fully operational.

June 1987

APT shipped its first sample MOSFETs for evaluation.

December 1987

First production MOSFETs were shipped to customers.

February 1989

APT introduced the world's most powerful MOSFET, Monster MOS. It can supply 10KW through a single full-bridge configuration.

## ALLIANCES

Not available

## MANUFACTURING

### Technology

5-micron metal-gate MOS  
4-inch wafers

### Facilities

The Company conducts all manufacturing in its Bend, Oregon, facility. Assembly for military products is done in the United States; other assembly is conducted by companies overseas.

Bend, OR

31,750 sq. ft.

Total area

18,250 sq. ft.

Administration, assembly, test

13,500 sq. ft.

R&D, engineering, wafer fabrication (including 4,000 sq. ft. Class 10 clean room)

## PRODUCTS

Device	Vds Volts	Id cont. Amps	Idm Amps	Available
AP35XX	350	7.5 to 183.0	30.0 to 732.0	Now
APT40XX	400	7.5 to 183.0	30.0 to 732.0	Now
APT45XX	450	6.5 to 152.0	26.0 to 608.0	Now
APT50XX	500	6.5 to 152.0	26.0 to 608.0	Now
APT55XX	550	5.3 to 122.0	10.6 to 488.0	Now
APT60XX	600	5.3 to 122.0	10.6 to 488.0	Now
APT75XX	750	4.0 to 91.0	16.0 to 364.0	Now
APT80XX	800	4.0 to 91.0	16.0 to 364.0	Now
APT90XX	900	3.0 to 76.0	12.0 to 304.0	Now
APT100XX	1,000	3.0 to 76.0	12.0 to 304.0	Now

## OTHER INFORMATION

APT does not employ a PR firm.

# Alliance Semiconductor

1930 Zanker Road  
San Jose, CA 95112  
408/436-1860

ESTABLISHED: 1985

NO. OF EMPLOYEES: 1,000

## BACKGROUND

Alliance Semiconductor was formed to design, manufacture, and market SRAMs and DRAMs. The Company is using a 1.2-micron CMOS planar process which, when combined with architectural innovations, produces value-added high-speed devices.

In December 1987, Alliance offered the AS4C188 16Kx4 SRAM that features access times of 25ns, 30ns, and 35ns. In 1988, the Company introduced a pair of 1Mb DRAMs in 1Mbx1 and 256Kx4 configurations. Products are designed for superminis, workstations, and other computing applications using 32-bit MPUs running at 20-MHz or better.

The Company's future plans are to offer FIFOs and other specialty memories, and to encourage designers to consider the high-speed DRAMs as complete replacements for cache memories.

Alliance has signed agreements to have some of its DRAMs manufactured by NMB Semiconductor in Japan, while the SRAMs are being manufactured by Goldstar in South Korea.

Alliance is now manufacturing 1Mb DRAMs in its new Lee's Summit, Missouri, facility.

## BOARD

(Name and Affiliation)

N.D. Reddy, Chairman  
Alliance Semiconductor

C.N. Reddy  
Alliance Semiconductor

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*N.D. Reddy  
Modular Semiconductor, President

### VP Sales/Mktg

Robert Reid  
Oki Semiconductor, SR VP

### VP Engineering

\*C.N. Reddy  
Cypress Texas Instruments, SRAM Dsn Mgr

\*Founder

## FINANCING

The Company has financed its developmental activity with private investment and seed funding from its offshore corporate partners.

### March 1989

\$1.2M  
UtiliCorp United

\$1.2M  
Hallmark

\$0.2M  
Kansas City Valve & Fitting Co.

\$0.2M  
Black and Veatch

\$0.1M  
Dunn Industries

Tax credits, loan guarantees, grants  
\$2.27M  
State of Missouri

Letter of credit  
\$3.0M  
Private investor

## RECENT HIGHLIGHTS

### March 1989

Alliance agreed to lease manufacturing facilities outside Kansas City, Missouri, from AT&T.

# Alliance Semiconductor

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## ALLIANCES

### NMB

December 1987

Alliance Semiconductor signed a five-year agreement with NMB Semiconductor covering 256K and 1Mb DRAMs. NMB will manufacture the devices and sell them worldwide.

## Facilities

Kansas City, MO

120,000 total sq. ft.

Manufacturing

45,000 sq. ft.

Used for Class 10 clean room

## MANUFACTURING

### Technology

1.2- and 1.0-micron CMOS

## PRODUCTS

Device	Description	Speed
AS4C188	16Kx4 SRAM	25, 30, 35ns
AS4C1000	1Mbx1 DRAM	60, 70, 80ns
AS44C256	256Kx4 DRAM	60, 70, 80ns

## OTHER INFORMATION

Alliance does not employ a PR firm.

# Altera Corporation

2610 Orchard Parkway  
San Jose, CA 95134-2020  
408/984-2800  
Fax: 408/296-3140

ESTABLISHED: June 1983

NO. OF EMPLOYEES: 225

## BACKGROUND

Altera Corporation designs, manufactures, and markets user-configurable EPROM-based ICs and associated CAE development systems and is focused entirely on developing this market. Altera invented and was the first company to ship electrically programmable logic devices (EPLDs).

The Company's products are specified for operation over commercial, industrial, and military operating ranges. The predominant users are manufacturers that supply equipment for the industrial, office automation, and telecommunications markets as well as military and aerospace contractors. Altera is qualified to supply devices to the requirements of MIL-STD-883 Revision C.

Altera's CAE tools and user-configurable devices allow design engineers to create custom logic functions on the IBM PC. Wafers using 1.0- and 0.8-micron CMOS technology are obtained through technology agreements. This strategy allows Altera to concentrate on architecture, circuit design, software, and service, which has earned the Company a reputation for providing excellent service and easy-to-use CAD software. The Company's goals are to achieve \$100 million in annual sales in 1990 and to be recognized as the technology leader in the user-configurable IC market.

In March 1988, Altera amended its registration statement for an initial public offering of 4 million shares of common stock at \$5.50 per share. Of the shares being offered, 1 million were sold by certain selling shareholders. The statement was originally filed in October 1987. Net proceeds will be used principally for working capital and for repayment of long-term debts.

In 1987, Altera began offering function-specific EPLDs. The StandAlone Microsequencer (SAM)

family integrates 448 words of EPROM memory with a microcoded sequencer and pipelined register for microcoded state machines and sequencer applications. The Buster family of configurable bus interface peripheral devices combines a programmable bus interface, PLD, and storage elements in a single device.

In January 1988, Altera introduced three new products for the IBM PS/2 add-in board market. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface, the EPB2002 direct memory access (DMA) arbitration chip integrates the additional logic needed for DMA capability, and the MCMAP provides software design support. The interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems. Add-in boards are licensed and encouraged by IBM and serve to add functions not included in the basic computers such as expanded memory, communications interfaces, peripheral equipment, and other functions as fax and voice mail.

The Company markets its products in North America, Europe, Australia, the Far East, and the Pacific Rim through direct sales offices and a network of distributors and sales representatives. Altera's distributors include Hall-Mark, Lionex, Pioneer, Quality Components, Schweber Electronics, and Wyle in the United States, and Future Electronics and Semad in Canada.

## BOARD

Rodney Smith  
Michael Ellison  
Paul Newhagen  
T. Peter Thomas

# Altera Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Rodney Smith  
Fairchild, GM/Linear Div

### VP Marketing

David A. Laws  
AMD, VP Bus Dev

### VP Sales

John Duffy  
Fairchild, VP Sales/Mktg

### VP/IC Engr

\*Robert F. Hartmann  
Source III, President

### VP Technology

\*Dr. James Sansbury  
Hewlett-Packard, Production Mgr

### VP Finance

\*Paul Newhagen  
Source III, Controller/CFO

### VP Operations

Bipin Shah  
Fairchild, Operations Mgr

### VP Software Engr

Clive McCarthy  
Fairchild, Marketing Mgr

### Mgr Human Res

John Waller  
Zoran, Mgr Human Res

\*Founder

## FINANCING

### June 1983

Round 1  
\$1.3M  
Alpha Partners

### April 1984

Round 2  
\$6.0M  
Allstate Investments; Cable, Howse & Cozadd;

F. Eberstadt & Company Inc.; John F. Shea;  
Technology Venture Investors; Welsh, Carson,  
Anderson & Stowe; Venture Growth Associates

Lease  
\$2.0M  
Bank of America

### March 1985

Round 3  
\$9.9M  
Original investors; Analog Devices Ent.;  
Citibank N.A.; DeMuth, Folger, & Terhune  
Venture Capital; Institutional Venture Partners;  
Parker Drilling Company

Lease  
\$2.0M  
Bank of America

### May 1986

Round 4  
\$5.0M  
European investors

Lease  
\$1.7M  
Bank of America

### March 1988

\$15.0M  
Initial public offering

## RECENT HIGHLIGHTS

### November 1986

Altera achieved full compliance to the Class B requirements of MIL-STD-883, Revision C for the EP310 and EP1210 devices. All other Altera devices in most package styles are available screened and environmentally tested to the MIL-STD specifications while compliancy requirements are being satisfied.

### February 1987

Altera and Monolithic Memories, Inc., (MMI) settled the patent infringement suit brought against Altera by MMI. Altera agreed to the entry of a consent of judgment and the parties agreed to license each other under certain patents in the programmable logic field.

## March 1987

Altera offered the StandAlone Microsequencer (SAM) family of EPLDs. The devices are user-configurable ICs designed for complex state machines and high-performance controller applications operating up to 30 MHz. These are the first products resulting from the Company's agreement with WaferScale Integration.

## March 1987

Altera's LogiCaps now supports IBM's EGA and the Hercules graphics controllers. Altera also reduced the price of LogiCaps from \$950 to \$695.

## October 1987

Altera introduced two families of function-specific EPLDs. SAM for complex state machines and high-performance controllers, and Buster for user-configurable MPU peripherals.

## January 1988

Altera announced three new products for IBM PS/2 add-in boards. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface. The EPB2002 is a direct memory access (DMA) arbitration chip that integrates the additional logic needed for DMA capability. The MCMMap provides software design support. The EPB2001 interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems.

## March 1988

Altera amended its registration statement for an IPO of 4 million shares of common stock at \$5.50 per share, originally filed in October 1987. Of the shares being offered, 1 million were being sold by certain shareholders. The net proceeds will be used principally for working capital and for repayment of long-term debt.

## ALLIANCES

### Intel

August 1984

Altera signed a five-year technology exchange

agreement with Intel. Intel provided CHMOS EPROM fabrication technology and foundry services; Altera provided its EPLD design and test technology and software and hardware development support. Intel will be an alternate source for the CHMOS EPLDs. Both companies cooperate on developing support tools for EPLD development systems.

### June 1985

The agreement with Intel was extended for two additional years and includes additional products using Intel's CHMOS process and its evolutions.

### P-CAD Systems

February 1985

Altera entered a marketing agreement with Personal CAD Systems, Inc., which called for combining P-CAD's PC-CAPS, used for schematic capture, and PC-LOGs, a logic simulator, with Altera's A+PLUS and LogicMap software (expired).

### Data I/O FutureNet

May 1985

Altera entered an OEM marketing agreement with Data I/O's FutureNet for the DASH series of schematic capture packages (expired).

### Cypress

June 1987

Cypress Semiconductor and Altera signed a five-year agreement to develop a family of CMOS EPLDs. The 5,000-gate family is named MAX for Multiple Array Matrix. Altera is providing architecture, circuit design, and software support. Cypress is providing 0.8-micron CMOS EPROM process, manufacturing, and marketing support.

### WSI

January 1987

Altera Corporation and WaferScale Integration, Inc., (WSI) announced a five-year technology agreement focused on the development of new, high-performance, user-configurable logic products. Altera will provide architecture, circuit design, and software support for the new family of products. WSI will contribute its strengths in high-speed CMOS process and EPROM memory device development. Wafers will be provided by Sharp of Japan.

# Altera Corporation

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## Texas Instruments

July 1988

Altera Corporation and Texas Instruments (TI) announced the signing of a long-term agreement that encompasses a seven-year technology exchange and supply agreement for high-performance, high-density, user-configurable integrated circuits. Altera will provide architecture, circuit design, and software technology. TI will make available worldwide manufacturing capabilities and its high-voltage EPIC advanced CMOS process.

## MANUFACTURING

Untested wafers are provided through technology exchange agreements with Intel, WaferScale/Sharp, Cypress Semiconductor, and other foundry

relationships. Assembly operations are subcontracted to two vendors. Volume production assembly is conducted in the Far East; quick-turn and prototype assembly is performed locally. Assembled components are final tested, burned-in, marked, packed, and shipped at Altera.

## Technology

1.2-micron CHMOS  
0.8- and 1.0-micron CMOS EPROM

## Facilities

Santa Clara, CA  
52,000 sq. ft.  
Administration, engineering, manufacturing, marketing

## PRODUCTS

### User-Configurable ICs

Part No.	Description	Speed
EP3XX	300-gate EPLD	35, 40 MHz
EP6XX	600-gate EPLD	26, 45 MHz
EP9XX	900-gate EPLD	26, 45 MHz
EP12XX	1,200-gate EPLD	28 MHz
EP18XX	2,100-gate EPLD	20 MHz
EPS448	StandAlone Microsequencer (SAM)	30 MHz
EPB1400	Configurable Peripheral (Buster)	25 MHz
EPB2001	Microchannel Interface Chip	
EPB2002	DMA Arbitration Chip	
EPM5032	32 Macrocell 88 MHz EPLD	88 MHz
EPM5128	128 Macrocell 50 MHz EPLD	50 MHz

Most of the above are available in commercial, military, and industrial temperature ranges in a variety of speed grades. The components are offered in both ceramic and plastic dip packages and J-lead surface-mount packages. Pin-grid array packages are also available.

## Design Tools

Part No.	Description
PLDS2	Development System for EP Series Devices
A+Plus	Software Logic Compilers for Programmable Logic
LogiCaps	Schematic Capture
PLSME	State Machine Software
PLFSIM	Simulation Software
PLSLIB	TTL Macrofunction Library
MCMAP	IBM PS/2 Micro Channel Interface Software Support
PLDS-SAM	Development System for SAM Devices
SAM+PLUS	SAM Design Processor
Hardware	Hardware Programming Units and Package Adaptors
PLCAD-SUPREME	Development system for EP Series Devices
PLCAD-ENCORE	Development system for EP Series Devices and EPM Devices
PLDS-MAX	Development system for EPM Series Devices

Altera's development systems run on Daisy Systems Corporation's Personal LOGICIAN workstation, and on more than 18 personal computers including AT&T, COMPAQ Plus, COMPAQ Deskpro, Columbia, Columbia Portable, Corona, IBM PC/XT/AT, IBM Portable, ITT XTRA, Leading Edge, MAD 86186, Panasonic SR. Partner, Televideo, Sperry, ISI Model 5160, Zenith 100 and 151 PC, and Intersil System PC.

## OTHER INFORMATION

Altera's PR firm is Paul Franson Associates.



## ANADIGICS, Inc.

35 Technology Drive

Box 4915

Warren, NJ 07060

201/668-5000

Telex: 510-600-5741

Fax: 201/668-5068

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 70

### BACKGROUND

ANADIGICS, Inc., designs, manufactures, and markets gallium arsenide (GaAs) analog and digital ICs for the telecommunications, military, and instrumentation markets. The Company is currently offering RF microwave and signal conditioning amplifiers, A/D converters, dividers, and multiplexers/demultiplexers. In addition, ANADIGICS offers GaAs services and designs both catalog and custom GaAs ICs, as well as custom hybrid assemblies, including fiber-optic data links.

The founders are Ronald Rosenzweig and George Gilbert, who cofounded Microwave Semiconductor Corporation, and Dr. Charles Huang, who was director of GaAs R&D and wafer fabrication services at Avantek.

The Company's strategy is to establish its own niche in producing GaAs ICs for high-frequency analog and digital applications in the defense and communications markets.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

\*Ronald Rosenzweig  
Microwave Semiconductor Corporation,  
President

#### Exec VP/COO

\*George Gilbert  
Microwave Semiconductor Corporation, Exec  
VP Opns

#### VP Engr

\*Dr. Charles Huang  
Avantek, Dir GaAs R&D

#### Dir Sales/Mktg

Michael P. Gagnon  
TRW LSI Products, Mgr Strat Plan.

#### Dir Finance

John Lyons  
General Electric, Dir Finance

\*Founder

### FINANCING

#### April 1985

##### Round 1

\$10.0M

Alan Patricof Associates, NY; Alex Brown & Sons; Fairfield Ventures; General Electric Venture Capital; Orange Nassau; Rothschild Inc.; Smith Barney Venture Capital

##### Lease

\$10.0M

GE Credit Corp., EQUITEC, and others

#### November 1986

##### Round 2

\$10.0M

First-round investors; Arthur D. Little Co.; Century IV Fund; Englehard Corp.; Memorial Drive Fund; Metropolitan Life Insurance Co.

# ANADIGICS, Inc.

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## January 1989

Round 3

\$9.0M

Thomson-C.S.F. Ventures; Canaan Venture Partners (formerly GE Venture); Philadelphia Ventures (formerly Century IV); Smith, Barney, Harris, Upham; Atlas Associates, Inc.; Alan Patricof Associates; Alex Brown and Sons; Metropolitan Life Insurance; Memorial Drive Trust

## RECENT HIGHLIGHTS

### January 1987

ANADIGICS offered the AOP3510 350-MHz unity gain stable GaAs op amp in commercial and military grades. The device has a bandwidth of 70 MHz and a settling time of 20ns.

### March 1987

ANADIGICS offered the AWA20601 and ADA25001 wideband MMIC gain amplifiers. The Company also offered the ADV3040 4-to-1 divider.

### June 1987

ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

### July 1987

ANADIGICS offered the ACP10010 comparator for ATE and high-speed fiber-optic receivers.

### September 1987

ANADIGICS offered the ATA30010, a 3-GHz transimpedance amplifier.

### January 1988

ANADIGICS introduced the ALD30010, a 3-GHz laser driver.

### February 1988

ANADIGICS was awarded a \$500,000 contract from the navy to develop a chip set for X-band radars.

## March 1988

ANADIGICS completed the first stage of a \$4 million equity financing. Investors were ABS Ventures, Alan Patricof Associates Inc., Alex Brown Emerging Growth, Canaan Venture Limited Partnership, Century IV Partners, Fairfield Ventures, First Century Partnership III, Investments Orange Nassau, Memorial Drive Trust, Metropolitan Life, and Rothschild Inc.

## April 1989

ANADIGICS introduced two new transimpedance amplifiers, the ATA03010 and the ATA30011.

## ALLIANCES

### Bendix

June 1987

ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

## SERVICES

GaAs IC design  
GaAs foundry  
Assembly  
Test

## MANUFACTURING

### Technology

1.0m and 0.5m-GaAs MESFET

Low-power D-MESFET process technologies will be available in the future.

### Facilities

Warren, NJ

55,000 sq. ft.

Design, test, manufacturing, administration

10,000 sq. ft.

Clean room

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**PRODUCTS**

<b>Device</b>	<b>Description</b>
AOP1510	Op Amp, 150 MHz
AOP3510	Monolithic Op Amp, 350 MHz
AWA20601	10dB Gain Amplifier, 2 to 6 GHz
ACP10010	Comparator, 1.0ns Typical Delay
ADA25001/25002	25dB Gain Amplifier, 3 GHz
ADV3040	4-to-1 Divider
ALD30010	Laser Driver, 3 GHz
ATA30011	Transimpedance Amplifier, 3 GHz
APS30010	Phase Splitter, 3 GHz
ATA0310	Transimpedance 300-MHz Amplifier
ASW40010	DC—4-GHz Spdt switch
ASW80010	DC—8-GHz Spdt switch fiber optic receiver products
AAR10010	1-GHz, 1,330nm Analog Receiver
AAR10015	1-GHz, 800nm Analog Receiver
AAR10020	1-GHz, High-Output, 1,300nm Analog Receiver
AAR10025	1 GHz, High-Output, 800nm Analog Receiver
ADR16010	1.6-Gbps, 1,300nm Digital Receiver
ADR16015	1.6-Gbps, 800nm Digital Receiver
ADR16020	1.6-Gbps, ECL Output, 1,300nm Digital Receiver
ADR16025	1.6-Gbps, ECL Output, 800nm Digital Receiver
ADR16030	1.6-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR16035	1.6-Gbps, 800nm Digital Rcvr/Clock Recovery
ADR12030	1.2-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR12035	1.2-Gbps, 800nm Digital Rcvr/Clock Recovery

**OTHER INFORMATION**

ANADIGICS' PR firm is Norm Fenichel.

# Applied Micro Circuits Corporation

6195 Lusk Boulevard

San Diego, CA 92121

619/450-9333

Fax: 619/450-9885

ESTABLISHED: April 1979

NO. OF EMPLOYEES: 225

## BACKGROUND

Applied Micro Circuits Corporation (AMCC) specializes in the design and manufacture of high-speed ECL gate arrays. In 1987, the Company began offering BiCMOS gate arrays. AMCC targets its products at OEMs that make industrial instruments, high-performance computers, electronic warfare systems, test equipment, graphics hardware, and telecommunications equipment.

AMCC is a privately held company that was formed by Howard Bobb and Joe Mingione, who had previously been American Microsystems Inc.'s chairman of the board and marketing manager, respectively. AMCC was founded in Cupertino, California, but later acquired Solitron Devices' 32,000-square-foot facility in San Diego. After converting it to run 4-inch wafers, AMCC's fab facility became operational late in 1981. Under the leadership of Roger Smullen, AMCC refocused its efforts in 1983 to the high-performance array marketplace. Mr. Smullen replaced the founders as president and CEO.

There are 29 sales representative organizations with more than 90 sales people that handle AMCC's gate arrays in North America, Europe, Israel, and the Far East.

## BOARD

(Name and Affiliation)

Roger A. Smullen, Chairman  
Plus Logic

William K. Bowes, Jr.  
U.S. Venture Partners

F.K. Fluegel  
Matrix Partners, L.P.

Franklin P. Johnson  
Asset Management Corporation

Albert Martinez  
Applied Micro Circuits Corp.

Gregorio Reyes  
ASET

Arthur Stabenow  
Micro Linear

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
Albert Martinez  
TRW, VP/GM LSI Products Div

VP Finance/Admin  
Joel O. Holliday  
Spin Physics, VP Finance

VP Mktg/Sales  
A. C. D'Augustine  
Inmos, Dir. Worldwide Sales

VP Operations  
Don Schrock  
Burr-Brown, VP/GM Data Products Div

VP Engineering  
Ray Yuen  
National Semiconductor, Design Manager

## FINANCING

April 1979  
Round 1  
\$5.0M

Fred Adler & Co., Ampersand Associates,  
International Industrial Investments Inc.,  
Kimball Organ, Timex

# Applied Micro Circuits Corporation

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## March 1983

### Round 2

\$5.0M

Accel Capital; Adler & Co.; Asset Mgmt. Co.; Harrison Capital; International Industrial Investments (France); Kemper; Matrix Partners; Oak Investment Partners II; Prime Capital; Robert Fleming Ltd.; Robertson, Colman & Stephens; US Ventures; Venture Growth Associates

## September 1987

### Round 3

\$12.0M

Accel Capital; Adler & Co.; Asset Mgmt. Co.; Eberstadt Fleming Venture Capital; Harrison Capital; International Industrial Investments (France); Jamieson & Co.; Kemper; Kimball Manufacturing; Matrix Partners; Oak Investment Partners; Olivetti; PaineWeber Ventures; PM Investment; Prime Capital; Robertson, Colman & Stephens; Time, Inc.; US Venture Partners; Venture Growth Associates

## RECENT HIGHLIGHTS

### May 1987

AMCC offered the Q5000 Series of bipolar products and entered the BiCMOS logic array market with its Q14000 series. The Q14000 is the result of a two-year joint development agreement with Seiko-Epson.

### July 1987

AMCC named Albert Martinez president and chief executive officer, filling a vacancy that had existed since March 1987 when former president Jonathon K. Yu left the Company. Mr. Martinez was most recently vice president and general manager of TRW's LSI Product Division in La Jolla, California.

### September 1987

AMCC completed a private sale of \$12 million in convertible preferred stock. The funds are being used to reduce short-term borrowing and provide working capital for anticipated growth, including expansion into its recently completed facility in San Diego, California.

## September 1987

AMCC moved into its new corporate facility in San Diego. The 100,000-square-foot building, on a 6.5-acre site, houses engineering, marketing, and administrative staff. The additional facility brings AMCC's total space to 121,000-square-feet, which includes a Class 10 fab and production facility.

## January 1988

AMCC and Plessey signed an agreement to jointly develop a family of high-performance ECL gate arrays. The arrays, which range up to 18,000-gates, will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

## June 1988

AMCC announced a major contract with Datatape, Inc., for seven logic array circuits. This contract is expected to be worth \$3 million to \$4 million over the next two years.

## ALLIANCES

### Signetics

#### April 1979

Signetics and AMCC agreed to allow Signetics to provide alternate sourcing of the Q700 Quick-Chip series. AMCC was licensed to market designs for Signetics' 8A-1200 gate array family.

#### September 1983

AMCC and Signetics signed an extension of the prior agreement that covers a technology transfer of future gate array families and junction-isolated and oxide-isolation processes.

### Thomson-CSF

#### July 1982

AMCC signed an agreement with Thomson-CSF under which Thomson-CSF provided alternate sourcing and will develop AMCC's high-performance, bipolar Q-700 series of gate arrays. AMCC received \$1 million over five years.

### Daisy

#### February 1983

Daisy offered support for AMCC's Q-700 gate array family on its Gatemaster gate array development system; AMCC provided the design software.

# Applied Micro Circuits Corporation

**Honeywell**  
August 1984

Honeywell signed an agreement to second source AMCC's Q700 series gate arrays and to alternate source AMCC's bipolar gate arrays.

**Sanders**  
February 1985

Sanders agreed to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only.

**Seiko-Epson**  
May 1985

Seiko and AMCC entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process is merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process.

**Plessey**  
January 1988

AMCC and Plessey agreed to jointly develop a family of high-performance ECL gate arrays up

to 16,000 gates. It will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

## MANUFACTURING

### Technology

2.0-, 3.0-, and 5.0-micron double-level-metal bipolar  
1.5-micron BiCMOS  
Three-level fine pitch metal  
4-inch wafers

### Facilities

San Diego, CA  
116,000 sq. ft.  
Administration, marketing, development, manufacturing  
5,000 sq. ft.  
Class 10 clean room

## PRODUCTS

### ECL Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
Q700	Bipolar	5.0	0.9	250 to 1,000
Q1500	Bipolar	5.0	0.9	1,500 to 1,700
Q3500	Bipolar	3.0	0.6	1,300 to 3,500
Q5000	Bipolar	2.0	0.3	1,300 to 5,000
Q20000	Bipolar	1.0	0.1	1,000 to 16,000

### BiCMOS Gate Arrays

Q14000	BiCMOS	1.5	0.7	2,160 to 13,440
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### Foundry

Process	Minimum Geometries	Number of Base Layers	Number of Metal Layers/Pitch	Wafer Size
Bipolar Junction				
Isolated	5.0-micron	7	2/10, 16	4"
Bipolar Oxide Isolated	3.0-micron	10	2/7, 10	4"
Bipolar Oxide Isolated	2.0-micron	10	3/5.5, 8.0, 15	4"
BiCMOS Oxide Isolated	1.5-micron	11	3/4.5, 6, 7	4"

## OTHER INFORMATION

AMCC does not employ a PR firm.

# Asahi Kasei Microsystems Co., Ltd.

Imperial Tower 1-1  
Uchisaiwai-cho 1-chome  
Chiyoda-ku, Tokyo, Japan  
03/507-2371  
Fax: 03/591-2567

ESTABLISHED: June 1983

NO. OF EMPLOYEES: N/A

## BACKGROUND

Asahi Kasei Microsystems Co., Ltd., manufactures and markets memory, application-specific ICs, linear, and microcontroller products. The Company was originally founded as Asahi Microsystems, Inc., by Asahi Chemical of Japan and American Microsystems Inc. (AMI) in June 1983. The Company focused on the design and marketing of custom and ASICs based on AMI technology.

In 1986, the Company became a wholly owned subsidiary of Asahi Chemical and changed its name to Asahi Kasei Microsystems. Asahi Kasei Microsystems has established an Electronics Research Laboratory in Atsugi, Japan, to develop new bipolar and CMOS process technologies and new applications, and plans to set up a manufacturing facility in two years.

The Company has established technical ties with Hitachi Ltd. for the acquisition of its advanced CMOS process technology. Asahi Kasei will manufacture and market Crystal's devices for the Far Eastern market, and International CMOS Technology (ICT) will market its EEPROMs.

AMI manufactures all the custom and standard products it develops and Hitachi manufactures its digital ICs. The Company manufactures new products developed through its tie-up with ICT on a small scale at an Atsugi plant.

## BOARD

Not available

## COMPANY EXECUTIVES

Not available

## FINANCING

Not available

## ALLIANCES

### Hitachi

Asahi Kasei has licensed Hitachi Limited's advanced CMOS process technology.

### Crystal Semiconductor

Asahi Kasei will manufacture and market Crystal's devices for the Far East market.

### ICT

Asahi Kasei will market International CMOS Technology's (ICT) EEPROMs.

## MANUFACTURING

### Technology

2- and 3-micron CMOS

### Facilities

Not available

# Asahi Kasei Microsystems Co., Ltd.

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## PRODUCTS

### SRAMs

Device	Description	Speed (ns)
AKM6264	64K 8Kx8	100, 120, 150
AKM6287	64K 64Kx1	45, 55, 70
AKM6288	64K 16Kx4 (In Development)	25, 35, 45
AKM62256	256K 32Kx8	85, 100, 120, 150
AKM6207	256K 256Kx1 (In Development)	35, 45
AKM6208	256K 64Kx4 (In Development)	35, 45
AKM66203	1Mb Module 128Kx8	100, 120, 150

### ROMs

AKN623257/8	256K 32Kx8	150, 200
AKN62321	1Mb 128Kx8	150, 200
AKN62312	2Mb 256Kx8	200
AKN62412	2Mb 256Kx8/128Kx16	200
AKN62304	512Kx8	200
AKN62404	512Kx8/256Kx16	200

### Gate Arrays

Family	Gates	Typical Internal Delay (ns)
AK61H	448 to 2,560	2.0
AK62B	4,032 to 7,136	1.8
AK62H	4,309 to 24,020	0.7

### Cell-Based Library

Device	Description
Digital Cells	CPU/Peripheral Cells—Clock Generator, Bus Controller, DMA Controller, Programmable Counter/Timer, Multiplier Memory Cells—ROM, RAM
Analog Cells	Op Amps, A/D Converter, SCF Filters

### Microcontrollers

AKMC4608	4-Bit Telephone Chip with DTMF Generator, LCD Driver, Real-Time Clock, 8Kx10 ROM, 1Kx4 RAM
AKMC4678	4-Bit Answering Machine Chip with DTMF Receiver, 8Kx10 ROM, 512x4 RAM
AKMC4919	4-Bit General-Purpose MCU with 1 microsecond of Instruction Time, 16Kx10 ROM, 992x4 RAM

### Linear ICs

CS31412	A/D Converter
CS7008	Programmable Universal Filter

## OTHER INFORMATION

Asahi Kasei Microsystems does not employ a PR firm.



# Aspen Semiconductor Corporation

58 Daggett Drive  
San Jose, CA 95134  
408/432-7050  
Fax: 408/943-2741

ESTABLISHED: December 1987

NO. OF EMPLOYEES: 35

## BACKGROUND

Aspen Semiconductor Corporation was formed in December 1987 to design and develop ultrahigh-speed ECL-compatible memory and PLD products with subthree nanosecond access times. The Company was formed and financed by Cypress Semiconductor Corporation and operates as a wholly owned subsidiary of Cypress.

Aspen is the brainchild of Cypress chief T.J. Rodgers, who has also established Multichip Technology and Ross Technology as Cypress subsidiaries. Rodgers' plan is to establish a number of small satellite companies under Cypress' control as an alternative to the large corporation. Hopefully, this type of organization will help maintain an aggressive start-up mentality within the corporation. Cypress provided the initial \$7.4 million in financing and has an option to repurchase the Company at any time.

Aspen currently offers four ECL RAM products and four ECL PLDs. All of these devices are manufactured using a 0.8-micron BiCMOS process at Cypress' fabrication facilities. Aspen currently is shipping 1K and 4K SRAMs and plans to introduce a 64K device in Q1 1990. All Aspen-developed products are marketed by Cypress and sold under the Cypress logo. ECL RAMs and PLDs will be the basis of the Aspen product line in the future. New products currently are under development but no indication has been given as to the nature of these products.

## BOARD

(Name and Affiliation)

Dr. T.J. Rodgers, Chairman  
Cypress Semiconductor Corp., President/CEO

L.J. Sevin  
Sevin-Rosen Management Company, President

Larry Sonsini  
Wilson, Sonsini, Goodrich and Rosati, Partner

Robert C. Lutz

Aspen Semiconductor Corporation, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO

Robert C. Lutz  
AMD, Director

Dir Marketing

David C. Ford  
Actel, Director of Mktg

## FINANCING

December 1987

Round 1

\$7.4M

Cypress Semiconductor

## ALLIANCES

Cypress

December 1987

Cypress provided initial funding in the amount of \$7.4 million. Aspen operates as a wholly owned subsidiary of Cypress and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Aspen-developed devices will be fabricated by Cypress and sold through Cypress' sales organization.

## MANUFACTURING

Technology

0.8-micron BiCMOS  
1.0, 0.8-micron bipolar

Facilities

San Jose, CA  
12,000 sq. ft.  
Administrative, design, development, marketing

# Aspen Semiconductor Corporation

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## PRODUCTS

### ECL RAMs

10/100E422	256x4	3ns
10/100E422L	256x4	5 to 7ns low power
10/100E474	1Kx4	3ns
10/100E474L	1Kx4	5 to 7ns low power

### ECL PLDs

10/100E301	16P8	3, 4, 6ns
10/100E302	16P4	2.5, 4.0 6.0ns
10/100E301L	16P8	4, 6ns low power
10/100E302L	16P4	4, 6ns low power

## OTHER INFORMATION

Aspen does not employ a PR firm.

# ATMEL Corporation

2125 O'Nel Drive  
San Jose, CA 95131  
408/441-0311

ESTABLISHED: December 1984

NO. OF EMPLOYEES: 152

## BACKGROUND

ATMEL (Advanced Technology-Memory & Logic) specializes in the design, manufacture, and marketing of high-speed EPROM, Flash EPROM, EEPROM, EPLD, and analog products. The Company's products are manufactured using a CMOS technology with geometries as low as 1-micron combined with two-layer metal and silicide processes.

ATMEL was founded by George Perlegos, Gust Perlegos, and T.C. Wu with private funds. Its first products were a CMOS 64K EEPROM at 120 to 450ns and a CMOS 256K EPROM operating at 120 to 250ns. They were followed by a CMOS 512K EPROM operating at 120 to 250ns. Currently, ATMEL offers additional EPROM, EEPROM, EPLD, 5-volt only Flash EPROM, and analog devices in a variety of organizations and densities.

In 1987, ATMEL introduced a line of linear products, including the AT76C10 programmable amplifier/delay equalizer, which is designed for use in modem and data communication equipment.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*George Perlegos  
SEEQ, VP Engineering

### VP Technology

\*Dr. T.C. Wu  
SEEQ, Process Dev Mgr

### VP/General Manager

\*Dr. Gust Perlegos  
SEEQ, Engr Manager

### VP Finance

Raymond Ostby  
Intel, Ctr Europe Ops

### VP Sales

Jack Peckham  
Semi Processes, Dir Sales/Mktg

### VP Plan & Info Sys

Mikes Sisois  
Qronos, VP Prod Dev

### VP Marketing

B. Jeffrey Katz  
Intel, Dir of Mktg

\*Founder

## FINANCING

December 1987

Round 2

\$3.3M

Institutional Venture Partners

## RECENT HIGHLIGHTS

June 1989

ATMEL agreed to purchase Honeywell's Solid State Electronics Division in Colorado Springs, Colorado. The facilities contain three wafer-fabrication areas, including a 6-inch facility, and related assembly, testing, and engineering facilities.

## ALLIANCES

### General Instrument

March 1985

ATMEL provided technology for its OTP EPROM, UV EPROM, and EEPROM in exchange for fab capacity at GI's plant in Chandler, Arizona (expired).

### Sanyo Electric

1987

ATMEL and Sanyo signed a foundry contract under which Sanyo will produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs.

# ATMEL Corporation

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## MANUFACTURING

### Technology

1.25-micron two-level-metal CMOS  
1.00-micron two-level-metal CMOS

### Facilities

San Jose, CA  
100,000 sq. ft.

Administration, engineering, design, test, sales  
and marketing

Colorado Springs, CO

250,000 sq. ft.

Fabrication, assembly, test, and engineering

## PRODUCTS

### High-Speed EPROM

Device	Density	Organization	Speed (ns)
27H64	64K	8Kx8	45-90
27HC256	256K	32Kx8	55-120
27HC1024	1Mb	64Kx16	55-120

### EPROM

27C128	128K	16Kx8	120-250
27C256	256K	32Kx8	120-250
27C512	512K	64Kx8	120-250
27C513	512K	4x16Kx8	150-250
27C1024	1Mb	64Kx16	150-250
27C010	1Mb	128Kx8	150-250

### CMOS PROM

28HC191/291	16K	2Kx8	35-90
27HC641/642	64K	8Kx8	35-90

### EPROM (5-volt only Flash EPROM)

29C256	256K	32Kx8	150-250
29C010	1Mb	128Kx8	150-250

### High-Speed EEPROM

28HC16	16K	2Kx8	45-120
28HC64	64K	8Kx8	55-120
28HC256	256K	32Kx8	70-120

### EEPROM

28C04	4K	512x8	150-350
28C16/17	16K	2Kx8	150-350
28C64	64K	8Kx8	150-350
28PC64	64K	8Kx8 Paged	150-350
28C256	256K	32Kx8	150-350
28C010	1Mb	128Kx8	150-350
28C1024	1Mb	64Kx16	120-250

**EPLD**

<b>Device</b>	<b>Gates</b>	<b>Speed (ns)</b>
22V10	500	15-40
V750	750	30-40
V2500	2,500	35-45
V5000	5,000	30-40

**Linear**

<b>Device</b>	<b>Description</b>
76C10	Programmable Telephone Line Delay Equalizer/Amplifier
76C171, 176	Triple 6-Bit color palette DAC; 50-65 MHz

**OTHER INFORMATION**

ATMEL does not employ a PR firm.

## **Austek Microsystems Pty. Inc.**

2903 Bunker Hill Lane #201

Santa Clara, CA 95054

408/988-8556

Fax: 408/988-0818

## **Austek Microsystems Pty. Ltd.**

Technology Park, Adelaide

South Australia 5095, Australia

8/260-0155

Fax: 8/260-8261

**ESTABLISHED: July 1984**

**NO. OF EMPLOYEES: 85**

### **BACKGROUND**

Austek designs, manufactures, and markets VLSI components for the cache controller and digital signal processor markets. The Company was founded in 1984 as a design source and supplier of VLSI components. From 1984 to 1987, Austek developed custom products for Australian and U.S. customers. Through these programs, the Company gained considerable expertise in cache architectures, digital signal processing, and floating point processing. Austek has built on these experiences to establish itself as supplier of proprietary standard products to the high-performance cache memory and DSP markets.

The Company was the first to introduce integrated cache controllers for the 30386 (the A38152 in June 1987) and 80286 (the A28285 in November 1988). Its first DSP product, the A41102 frequency domain processor (FDP), was introduced in November 1988; the FDP implements the fast Fourier transform and is used in imaging and instrumentation applications.

Austek designs and fabricates system level design examples incorporating its products for customer evaluation purposes and to provide its customers with tools to reduce their product development cycle time.

Austek subcontracts wafer fabrication to Hewlett-Packard and VLSI Technology in the United States and Ricoh in Japan. High-volume assembly is subcontracted to Indy and Pantronix in the United States, Anam in Korea, and Seiko-Epson in Japan. Austek qualifies and tests each product in-house.

Austek is a privately held Delaware corporation and has two main facilities. One is in Santa Clara, California, where activities include corporate headquarters, marketing, sales, applications

engineering, the cache products business unit, and manufacturing. The other, located in Adelaide, Australia, focuses on product development, CAD, the DAP products business unit, and advanced development.

### **BOARD**

(Name and Affiliation)

A.C. Summers, Chairman  
Bennett and Fisher Ltd.

Denis L. Redfern  
Austek Microsystems, President and CEO

Dr. Ivan Sutherland  
Evans & Sutherland, Cofounder

Roger Buckeridge  
CP Ventures, Director

Jos Henkens  
Advanced Technology Ventures, General Partner

Barry Hilson  
Australia Industry Development Corporation

Dr. J. Craig Mudge  
Austek Microsystems, Director Advanced Development

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President and CEO**  
Denis Redfern  
Wormald Data Systems, Division Manager

**VP Sales**  
George Adler  
AMD, VP Sales—West

**VP Marketing**  
Roger Fisher  
TI, Strategic Marketing Manager

# Austek Microsystems Pty. Inc./Ltd.

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## VP Engineering

Geoff Smith  
CSIRO, Engineering Manager

## VP Manufacturing

John Gloekler  
NSC, Product Engineering Manager

## CFO and VP Finance

Steve Pekarthy  
Ultron Labs, VP F & A

## Dir Advanced Development

Dr. J. Craig Mudge  
DEC, Director VLSI

## FINANCING

### July 1984

Round 1

\$6.7M

Advanced Technology Ventures, Hambrecht and Quist, Rothschild Ventures, Caznove Ltd., Newmarket Ltd., Australian Industry Development Corp., Bennett and Fisher, and other individual investors

### November 1986

Round 2

\$6.4M

Original investors

### March 1988

Round 3

\$3.2M

Original investors

### September 1989

Round 4

\$1.3M

Original investors

## RECENT HIGHLIGHTS

### August 1989

Austek offered the A38202 Microcache cache controller for systems using Intel's 80386.

### September 1989

Austek offered the A38204 Burst Mode Memory Controller for systems using Intel's 80386 and Austek's A38202 Microcache. This device is a companion to the A38202.

### November 1989

Austek and Western Digital signed a letter of intent whereby Western Digital will use Austek cache controllers in its system logic products.

### December 1989

Austek offered the A38202SX Microcache, cache controller for systems using Intel's 80386SX.

## ALLIANCES

### ZyMOS

October 1987

Austek and ZyMOS cooperated in the marketing and sales of Austek's A38152 Microcache with the ZyMOS POACH chip set for Intel 80386-based systems.

## SERVICES

VLSI and system design

VLSI manufacturing management

VLSI test

## MANUFACTURING

### Technology

1.0-, 1.2- and 1.5-micron double-metal CMOS

### Facilities

Santa Clara, CA

10,000 sq. ft.

Adelaide, Australia

20,000 sq. ft.

**PRODUCTS**

<b>Device</b>	<b>Description</b>
A38152	Microcache cache controller for Intel 80386, 32Kb cache size, 16, 20, and 25 MHz
A29285	Microcache cache controller for Intel 80286, 32Kb and 64Kb cache sizes, 20 and 25 MHz
A38202	Microcache cache controller for Intel 80386, 32Kb, 64Kb, and 128Kb cache sizes, 25 and 33 MHz
A38204	Burst mode memory controller for Intel 80386 and Austek A30202 systems, implements burst fills and two-level write buffer, 25 and 33 MHz
A41102	Frequency domain processor, implementing the fast Fourier transform, 40 MHz

**OTHER INFORMATION**

Austek Microsystems employs Joyce Lekas Public Relations as its PR firm.



**Avasem Corporation**  
(Formerly: VLSI Design Associates)  
1271 Parkmoor Avenue  
San Jose, CA 95126  
408/297-1201  
Fax: 408/925-9460

**ESTABLISHED: May 1980**

**NO. OF EMPLOYEES: 48**

## BACKGROUND

Avasem Corporation was formed to provide application-specific IC design, prototyping, and production services for electronic systems OEMs. The Company specializes in mixed analog and digital devices. Products are developed using the Company's standard cells and automated design tools. Proprietary design rules allow for multi-source wafer fabrication. The Company has established strategic alliances with production foundries.

In 1984, the Company introduced its first standard IC product—the V3829 floppy disk separator. The offering was followed by the V8500, a SCSI bus interface device introduced in 1986, and the V8580, a SCSI bus host device introduced in 1987. In March 1988, the Company announced the VDA-176, the first product in a family of RAMDAC devices. The device features a 256x18 SRAM color look-up table with triple 6-bit D/A converters for use as a color palette in computer graphics systems. A pipeline design allows pixel rates of up to 80 MHz. A pixel word mask allows displayed colors to be changed in a single write cycle, rather than by modifying the look-up table.

## BOARD

\*Mark R. Guidry, Chairman, President, CFO  
Carolyn C. Guidry, Secretary  
Richard S. Miller, VP Analog Products  
K. Venkateswaran, VP Digital Products

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CFO

\*Mark Guidry  
Fairchild Semiconductor, Manager

### VP Analog Prod

Richard Miller  
Fairchild Semiconductor, Manager

### VP Digital Prod

K. Venkateswaran  
Fairchild Semiconductor, Manager

### CFO

Mike Cleland  
ICT Array Technology, Manager

\*Founder

## FINANCING

Initial capital was provided by founders, receivable financing by Saratoga National Bank.

## SERVICES

Design  
Prototypes  
High-Rel Processing  
Test

## MANUFACTURING

### Technology

1.2- to 5.0-micron CMOS

### Facilities

San Jose, CA  
27,000 sq. ft.  
Design and test

# Avasem Corporation

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## PRODUCTS

Device	Description
V3829	Floppy Disk Separator
V8500	SCSI Bus Interface Device
V8580	SCSI Bus Host Device
V3676	Color Palette RAMDAC
V2116	2Kx8 CMOS SRAM
V2102	256Kx8 CMOS SRAM
V8520	Winchester Disk Controller

## OTHER INFORMATION

Avasem does not employ a PR firm.

# Bipolar Integrated Technology

1050 Northwest Compton Drive  
Beaverton, OR 97006  
503/629-5490

ESTABLISHED: July 1983

NO. OF EMPLOYEES: 165

## BACKGROUND

Bipolar Integrated Technology, Inc. (BIT), designs, manufactures, and markets high-performance bipolar VLSI computational building blocks for the high-end digital signal processing (DSP) and data processing markets.

The Company's founders include George Wilson, Kenneth Schlotzhauer, James Pickett, Kenneth Giles, and Les Soltesz. Steve Cooper recently joined BIT as president and chief executive officer. Mr. Cooper was most recently president and COO at Silicon Systems.

BIT has developed a VLSI bipolar process named BIT1. The process is based on 2-micron lithography and polysilicon self-aligning techniques. BIT1 density is said to be comparable to 1.5-micron CMOS and is five times denser than existing bipolar ECL.

The Company's ECL and TTL products include 16x16 integer multipliers, 16x16 multiplier-accumulators, five-port register files, and a floating-point multiplier/ALU 2-chip set. BIT has also developed ECL gate arrays with Raytheon and will produce a bipolar 32-bit RISC MPU as a result of an agreement with Sun Microsystems.

BIT has established a nationwide network of sales representatives and has opened sales offices in Norcross, Georgia, and in Saratoga and Costa Mesa, California.

## BOARD

(Name and Affiliation)

\*George Wilson, Chairman  
Bipolar Integrated Technology, CTO

Stephen E. Cooper  
Bipolar Integrated Technology, President &  
CEO

Larry Sullivan  
Analog Devices Enterprises

Wayne Kingsley  
InterVen Partners

Jeff Watts  
Union Venture Corp.

Dr. William Lattin  
Logic Automation, Pres/CEO

Randall R. Lunn  
Fairfield Ventures, General Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CTO  
\*George Wilson  
Tektronix, Sr Engr/Bip Div

President/CEO  
Stephen E. Cooper  
Silicon Systems, President/COO

VP Tech Dev  
\*Dr. Kenneth Schlotzhauer  
Tektronix, Sr Engr

VP Mktg  
Chris DeMonico  
TI, Strat Mktg Mgr VLSI Products

VP Finance  
\*Kenneth Giles  
Columbian Co., VP Finance

VP Engr  
John Deignan  
Intel, Design Mgr

VP Operations  
Kevin Stewart  
VTC, Operations Mgr

\*Founder

# Bipolar Integrated Technology

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## FINANCING

1983

Seed

\$0.3M

Analog Devices, Inc.

May 1984

Start-up

\$3.7M

Analog Devices, Inc.; First Interstate Venture Capital; BancBoston Ventures

Lease

\$3.4M

Bank of Boston

\$4.1M

Oregon State Revenue Bond

May 1986

Round 1

\$7.7M

Original investors, Harvard Mgmt. Co., Raytheon Company, Republic Ventures, Union Venture Corp.

July 1986

Round 2

\$2.5M

Fairfield Venture Partners, InterVen

July 1987

Round 3

\$10.0M

Round 1 & 2 investors, Cowen & Co., DFC Ventures, Manufacturers Hanover, Pell Rudman & Co.

April 1988

Round 4

\$11.2M

Round 3 investors, Bancorp Hawaii, Sun Microsystems, Weeden Capital Mgmt.

June 1988

Round 5

\$13.5M

Oxford Partners, New England Capital Corp., Analog Devices, Raytheon Co., InterVen Partners

## RECENT HIGHLIGHTS

November 1986

BIT offered two 16x16 fixed-point multiplier/accumulators, the B3011 and B2011. The B3011 is an ECL version and the B2011 is a TTL version.

November 1986

BIT sampled the B3210 1K register file with a typical read-cycle time of 6ns.

February 1987

BIT offered a chip set that consists of a floating-point multiplier and a floating-point ALU and offers 60-mflop performance for nonpipelined 64-bit operations. The B3110 multiplier and B3210 ALU are ECL 10KH compatible. The B2110 multiplier and B2120 ALU are TTL versions.

July 1987

BIT signed an agreement with Sun Microsystems to produce a bipolar 32-bit RISC MPU.

October 1987

Stephen E. Cooper was elected chairman of the board and CEO of BIT.

January 1988

BIT was selected by *Electronic Business* magazine as one of the 38 "hot" electronics industry start-ups. The results were based on a poll of 125 leading venture capitalists.

## ALLIANCES

Analog Devices

1983

Analog Devices participated in all rounds of BIT financing.

Raytheon

July 1986

Raytheon and BIT agreed to jointly develop VLSI ECL gate arrays and standard cell devices using the BIT1 process. Raytheon will use its CAD/CAE facilities, and BIT will perform wafer fabrication with Raytheon marketing the resulting products.

# Bipolar Integrated Technology

## Sun Microsystems

July 1987

Sun Microsystems licensed BIT to produce a 32-bit bipolar RISC MPU using its BIT1 process. The part uses Sun's scalable processor architecture (SPARC) developed for workstation applications. BIT has full marketing rights including software support. BIT plans to offer a higher performance RISC SPARC chip in 1989 using its BIT2 process.

## Arizona Microtek

July 1988

BIT and AZM agreed to develop custom ICs using BIT's high-performance BIT-1 technology. AZM will act as an independent design house providing complete capabilities to develop

custom LSI designs for current and future BIT customers.

## MANUFACTURING

### Technology

1.2-micron bipolar

### Facilities

Beaverton, OR

46,000 sq. ft.

Design and manufacturing

6,000 sq. ft.

Class 10 clean room

## PRODUCTS

Device	Description	Clocked Multiply Time
B3018	ECL 16x16 Integer Multiplier	13ns
B2018	TTL 16x16 Integer Multiplier	19ns
B3011	ECL 16x16 Multiplier-Accumulator	15ns
B2011	TTL 16x16 Multiplier-Accumulator	16ns
B3210	ECL 64x18-bit Five-Port Register File	7ns
B2210	TTL 64x18-bit Five-Port Register File	16ns
B3110/2110	2-Chip Set Floating-Point Multiplier	50ns
B3120/2120	Floating-Point ALU	25ns

## OTHER INFORMATION

BIT's PR firm is KVO, Inc.

# BKC International Electronics, Inc.

6 Lake Street  
Lawrence, MA 01841  
508/681-0392  
Fax: (508) 681-9135

ESTABLISHED: January 1986

NO. OF EMPLOYEES: 100

## BACKGROUND

BKC International Electronics was founded in 1985 by three former ITT Semiconductor Employees, who purchased the germanium diode line and hi-rel test lab from ITT in 1985 and began operations in 1986. The Company produces a wide range of high-reliability discrete semiconductors, including small signal switching diodes, zener diodes, rectifiers, and germanium diodes.

By February 1, 1986, BKC had received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types approved and manufactured by ITT. In November 1986, BKC announced the purchase of the silicon wafer fab facility from ITT. The purchase included all the equipment, process, and quality specifications and procedures necessary to produce JAN, JANTX, and JANTXV switching diodes and zener diodes. Final approval from DESC was granted April 29, 1987.

To date, the Company has raised \$2.5 million in financing through bank loans and the private sale of common stock. BKC conducts operations in an 80,000 square foot plant in Lawrence, Massachusetts, which houses design, wafer fab, assembly and test operations. During the next three years, the Company plans to increase wafer fab capabilities to include mesa construction. In the future, BKC plans to add new discrete semiconductors such as 5W zeners, Schottky diodes and rectifiers, switching rectifiers, and transient suppressors to its product lines.

## BOARD

Not Available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
\*Gerald T. Billadeau  
ITT, CFO

**VP Marketing**  
\*John L. Campbell  
ITT, Sales

**VP Operations**  
\*William J. Kady  
ITT

\*Founder

## FINANCING

**1985-1989**  
Bank Loans  
\$2.0M Total  
Comfed Savings Bank

**1985, 1986, 1987**  
Multiple offerings  
Private sale of common stock  
\$525,000  
Private investors

## RECENT HIGHLIGHTS

**February 1986**  
BKC received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types previously approved and manufactured by ITT.

**November 1986**  
BKC announced the purchase of the silicon wafer fab facility from ITT.

# **BKC International Electronics, Inc.**

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## **MANUFACTURING**

### **Technology**

BKC uses Planar, mesa, and germanium gold bonding process technologies.

### **Facilities**

Lawrence, MA

80,000 sq. ft.

Headquarters, wafer fab, assembly, test, design

## **PRODUCTS**

Small Signal Switching Diodes

Zener Diodes

Rectifiers

Germanium Diodes

## **OTHER INFORMATION**

BKC does not employ a PR firm.

# Brooktree Corporation

9950 Barnes Canyon Road

San Diego, CA 92121

619/452-7580

Fax: 619/452-1249

Telex: 383596

ESTABLISHED: 1983

NO. OF EMPLOYEES: 290

## BACKGROUND

Brooktree Corporation designs, develops, and markets high-performance data conversion devices. The Company currently offers a complete line of VIDEODACs, which are D/A converters designed for use in video applications; RAMDACs, which are a combination of VIDEODACs and a color look-up table on one chip; and other related products. Brooktree's products are based on the Brooktree Matrix, a proprietary design technology that allows the combination of analog and digital processes on a single chip. The Company uses standard CMOS or bipolar manufacturing processes.

One of the founders of Brooktree was Dr. Henry Katzenstein, who developed the Brooktree Matrix. The Matrix is a fundamental advance in data conversion architecture and was the initial impetus for the formation of the Company. James Bixby, president of the Company, previously was director of engineering at Spin Physics, a division of Eastman Kodak. While at Spin Physics, Mr. Bixby developed a high-speed motion analysis system.

In November 1987, Brooktree acquired Manx Engineering Corp., a small company that has developed specialized hardware for document compression/decompression. The acquisition gives Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

Brooktree also intends to broaden its customer base with the addition of a product line aimed at ATE and instrumentation applications. The Company is currently offering a series of timing vernier ICs for ATE use.

## BOARD

(Name and Affiliation)

\*Myron Eichen, Chairman  
Brooktree Corporation  
James Bixby  
Brooktree Corporation  
\*Ellsworth Roston  
Roston and Schwartz  
Sid Webb  
Titan Corporation  
Jack Savidge  
Venture Strategies  
F. Duwaine Townsend  
Ventana Corporation  
Bill Mobratten  
Independent

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

James Bixby  
Spin Physics, Dir Engr

### VP/Chief Scientist

\*Henry Katzenstein  
Quantrad, VP/Ch Scientist

### VP/CFO

William Peavey  
Monitor Labs, VP Finance/CFO

### VP

Steve Ou  
Rockwell, Dir Dev Engr

### VP Distribution

Joseph Santen  
Burr-Brown, GM Data Conv

### VP/Sales

Richard Lee  
Mostek, VP Sales



# Brooktree Corporation

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## VP/GM Components

Charles Long  
GE, VP/GM

## VP Strat Plan

Stewart Kelly  
Intel, Strat Bus Chrmm

## VP Human Resources

Bob Zabaronick  
Cipher Data Prod, P Human Rescs

## VP/Dir Subsystems

Jeffrey Teza  
Integrated Circuit Engineering, Mgr Custom  
Design

\*Founder

## FINANCING

### January 1982

Start-up  
\$0.4M  
Founders

### Late 1982-Early 1983

Seed  
\$0.3M  
Management, private investors

### Summer 1983

Round 1  
\$0.7M  
Management, private investors

### Early 1985

Round 2  
\$5.0M  
Institutional investor

### Summer 1985

Round 3  
\$5.0M  
Institutional investor

### Early 1986

Round 4  
\$10.0M  
Institutional investor, individual and foreign  
investors, Fairchild Semiconductor

### Early 1987

Round 5  
\$5.0M  
Institutional investor

### Late 1987

Round 6  
\$5.0M  
Shintech (a division of Shin-Etsu), individual  
and foreign investors

## RECENT HIGHLIGHTS

### July 1987

Brooktree offered radio-frequency identification (RF ID) chips that are being used to automate tool changing. The chips are a mix of on-chip logic, PROMs, and communication components that identify the right tool so the host computer can direct its attachment.

### November 1987

Brooktree acquired Manx Engineering Corp., a small company that developed specialized hardware for document compression/ decompression. The acquisition gave Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

### January 1988

Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

## ALLIANCES

### Toshiba 1985

Toshiba signed a royalty-bearing licensing agreement to utilize Brooktree technology for consumer digital audio applications.

### Fairchild April 1986

Brooktree and Fairchild signed a broad-ranging partnership coupling Brooktree's D/A conversion technology with Fairchild's manufacturing capability. Fairchild made an equity investment and provides foundry services (expired April 1988).

## Analog Devices

January 1988

Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

## Facilities

San Diego, CA  
73,000 sq. ft.

Headquarters, design, development, test

## MANUFACTURING

### Technology

3.0-, 2.0-, 1.2-micron Silicon-Gate  
Double-Metal CMOS  
2.0-, 1.5-micron ECL bipolar

## PRODUCTS

### Video DACs

Device	Description	Clock Rate (MHz)
Bt101	Triple 8-Bit, Pipelined Operation	50, 30
Bt102	Single 8-Bit, 0, 7.5, or 10 IRE Pedestal	75
Bt103	Triple 4-Bit, Pipelined Operation	75, 30
Bt106	Single 8-Bit, Pipelined Operation	50, 30
Bt107	Single 8-Bit, 2:1 Multiplexed Pixel Inputs	400
Bt108	Single 8-Bit, Pipelined Operation	400, 300, 200
Bt109	Triple 8-Bit, Pin Compatible to TDC1318	250

### Imaging

Device	Description	Conv. Rate (MHz)
Bt208	8-Bit Flash Video A/D Converter	15, 18
Bt251	Single-Channel 8-Bit Image Digitizer	15
Bt253	Triple-Channel 8-Bit Image Digitizer	15

### RAMDACs

Bt450	Triple 4-Bit, 16x12 Dual-Port Color Palette RAM	70, 50, 30
Bt451	Triple 4-Bit, 256-Word Dual-Port Color Palette RAM	25, 110, 80
Bt453	Triple 4-Bit, 256-Word Color Palette RAM	66, 40
Bt454	Triple 4-Bit 16x12 Color Palette RAM	170, 110
Bt457	Single 8-Bit, 256x8 Dual-Port Color Palette RAM	125, 100, 80
Bt461	Single 8-Bit, Multiplexed TTL Pixel Ports	170, 110, 80
Bt471	Triple 6-Bit, 256x18 Color Palette RAM	80, 50, 35
Bt473	Triple 8-Bit True Color, 256-Word Palette	35, 50, 66, 80
Bt476	Triple 6-Bit, 256-Word Color Palette	35, 50, 66
Bt478	Triple 6/8-Bit, 256-Word Color Palette	35, 50, 66, 80
Bt459	Triple 8-Bit, 256-Word Color Palette with Cursor	80, 110, 135
Bt492	Single 8-Bit, 256-Word Palette, 100K ECL	360

# Brooktree Corporation

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## Graphics Peripheral Devices

Device	Description	Conv. Rate (MHz)
Bt401-404	256x8 Pipelined SRAM, Optional 3x8 Overlay Registers, 10KH and 100K ECL Compatible	250
Bt424	40-Bit Multi-Tap Shift Register, 10KH ECL/TTL Compatible	250
Bt431	64x64 User Definable Cursor 35 MHz per 5 pixels	
Bt438	Clock Generator Chip for 125-MHz CMOS RAMDACs	250
Bt439	Clock Generator/Synchronizer Chip for Single Channel 125-MHz CMOS RAMDACs	150
Bt501/502	Octal ECL/TTL Bidirectional Transceiver/Translator, 10KH and 100K ECL Compatible	N/A

## D/A Converters

Device	Description	Settling Time
Bt104	Monolithic Single 12-bit, Unlatched Data Inputs	40ns
Bt105	Monolithic Single 12-bit, Latched Version of Bt104	40ns
Bt110	Monolithic Octal 8-bit, Standard MPU Bus Interface	100ns

## ATE Devices

Device	Description
Bt601	Dynamically Programmed Timing Edge Vernier, 10KH ECL Compatible
Bt602	Programmable Timing Edge Vernier, 20ps Resolution, 10KH ECL Compatible
Bt603	Programmable Timing Edge Delay, 20ns to 200ns span, 10KH ECL Compatible
Bt604	125-MHz 10KH ECL Compatible Dynamically Programmed Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt605	125-MHz 10KH ECL Compatible Programmable Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt606	Programmable Timing Edge Delay, 20ns to 200ns Span
Bt687	Ultrafast ECL Dual Comparator

## Military Devices

Bt101/883	MIL-STD-883C Version of Bt101 VIDEODAC, 30-MHz Clock Rate
Bt102/883	MIL-STD-883C Version of Bt102 VIDEODAC, 66-MHz Clock Rate
Bt453	MIL-STD-883C Version of Bt453 RAMDAC, 40-MHz Clock Rate, 40-Pin Ceramic Sidebrazed DIP Package
Bt458/883	MIL-STD-883C Version of Bt458 RAMDAC, 100-MHz Clock Rate, 84-Pin Ceramic PGA Package

## OTHER INFORMATION

Brooktree's PR firm is Rigoli, Pamphilon, Demeter.

# California Micro Devices Corporation

215 Topaz Street  
Milpitas, CA 95035-2398  
408/263-3214  
Fax: 408/263-7846

ESTABLISHED: 1980

NO. OF EMPLOYEES: 300

## BACKGROUND

California Micro Devices Corporation (CMD) designs, manufactures, and markets a wide range of high-performance electronic components through its thin-film, ASIC, and microcircuits divisions. The components are marketed to military, aerospace, medical, computer, and communications customers.

CMD was formed originally in 1980 to acquire the assets of Capsco Sales, Inc., a thin-film company founded in 1976. In 1982, CMD established Custom MOS Arrays (CMA), which designed, manufactured, and marketed HCMOS cell-based ICs and gate arrays in the 200- to 2,000-gate range. In September 1986, CMD and CMA merged into one company. Dr. Handel H. Jones, formerly president of CMA, became president and COO of the new company.

CMA operates as the ASIC division of CMD and produces primarily gate array and cell-based ICs based on 2.5-, 2.0-, and 1.25-micron HCMOS technologies, with complexities of from 100 to 20,000 gates. The Company has adapted its cell-based designs to analog and digital products and has increased the level of integration by depositing precision thin film onto the ICs.

The thin-film division designs and manufactures precision resistive products including networks, capacitors, and metallized substrates for both hybrid and microwave applications. The division also produces nonimpact, high-density, color ink-jet printheads. In November 1985, the Company introduced its proprietary SX resistor chip materials for high-performance applications that require precision resistance and stability characteristics.

In August 1987, CMD acquired the assets of GTE Communication Systems' Microcircuits Division for \$14.5 million. The acquisition covered all of Microcircuits' assets including

inventory, receivables, trade payables, intellectual properties, five acres of land, silicon wafer foundry and test facilities, and personnel. In the transaction, GTE Communication Systems also granted a preferred vendor status to CMD and a license to proprietary technology in custom chips.

The division, which operates as the Microcircuits Division of CMD, offers custom telecommunication circuits, MPU and peripherals ICs, and gate arrays used in telecommunications systems. R&D efforts focus on products in the telecommunications arena. About 60 percent of sales is into the telecommunications market, 20 percent in the personal computer market, with the remainder from foundry business. The division provides about 50 percent of its production to support the internal requirements of GTE Communications Systems.

In January 1989, CMD formed the Vanguard Semiconductor Division, which will be run by former Aspen founder/president/CEO Narpat Bhandari.

## BOARD

(Name and Affiliation)

- \*Chan M. Desaigoudar, Chairman  
California Micro Devices Corporation, CEO
- James P. Burgess  
Cambur Company, President
- Dr. C. Lester Hogan  
Fairchild Instruments, Former  
Vice Chairman, President & CEO
- Dr. Handel H. Jones  
International Business Strategies, Chairman
- Dr. Angel G. Jordan  
Carnegie-Mellon University, Provost
- Stuart Schube  
Acorn Ventures, Inc., President

# California Micro Devices Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO

Chan M. Desaigoudar  
ITT Semiconductor, Far East Sales Dir

### CFO/VP Finance, Asst Secretary

Steven J. Henke  
Monsanto, Div Controller

### VP/GM Microcircuits Div

Dr. Tarsaim L. Batra  
Gould/AMI, Director Process Technology

### VP Technology, Pres—Vanguard Semiconductor

Narpat Bhandari  
Aspen Semiconductor (Div of Cypress Semiconductor), Founder, Pres and CEO

### VP/GM Thin Film Division

Satish Kumar  
United Supertek, Dir of Mktg

### VP Sales and Tactical Mktg

Stephen R. Pass  
Linear Technology, VP Sales

### VP Foundry and Int'l Ops

Zia H. Malik  
LSI Logic, Mgr Technical Liaison

\*Founders

## FINANCING

October 1986

\$5.2 M  
Initial public offering

## RECENT HIGHLIGHTS

September 1986

CMD and Custom MOS Arrays merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

October 1986

CMD made an initial public offering of 1 million shares of common stock at \$6 per share. The offering raised \$5.2 million.

August 1987

CMD acquired the assets of GTE Microcircuits Division.

November 1987

CMD offered the G8870, a CMOS DTMF receiver that is a combination decoder and filter. The device is said to detect all 16 DTMF tone pairs and convert them into code.

August 1988

California Micro Devices announced that it entered into an agreement with Gould Inc. to acquire the assets and assume selected liabilities of American Microsystems Inc., a wholly owned subsidiary of Gould Inc., for approximately \$70 million in cash.

January 1989

California Micro Devices announced the formation of Vanguard Semiconductor Division.

## ALLIANCES

Ricoh

1982  
Ricoh provided wafers to CMA.

1983

CMD signed a joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and standard cells.

Racal

January 1982  
Racal agreed to allow CMA to design, manufacture, and sell Racal's new 5-micron silicon-gate CMOS gate arrays in the United States.

Micro Innovators

January 1983  
CMA merged with Micro Innovators, Inc., to acquire a team of seasoned custom MOS/LSI designers and expand its product line to include standard cell and full-custom designs in silicon-gate CMOS at both 5- and 3-micron geometries.

TRW

July 1985  
TRW agreed to manufacture HCMOS gate arrays of from 500 to 25,000 gates in its JAN-qualified fab, using CMA's 1.2-micron design rules. TRW will use the rules internally for its DSP products.

# California Micro Devices Corporation

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## CMA

September 1986

CMD and CMA merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

## Fuji Photo Film

November 1986

CMD signed an agreement with Fuji Photo Film Co., Ltd., under which CMD will license its HCMOS gate array and cell-based design technology for \$1 million. Fuji Photo Film will use the technology internally in image- and information-processing equipment.

## Tachonics

March 1987

CMD signed an agreement with Tachonics Corporation that calls for Tachonics to manufacture commercial and military GaAs ICs at its foundry in New Jersey. CMD will provide cell design and tools in the 1.0- to 0.5-micron range. Initial products will be GaAs gate arrays in the 500- to 2,500-gate range and with radiation-hardened capability.

## Telefonica

November 1987

CMD and Telefonica signed a joint venture agreement to form a company named California

Micro Devices SA in Spain. CMD plans to invest about \$2 million and will own approximately one-third of the company. CMD SA will offer thin-film passive components for hybrid assemblies, gate arrays, cell-based ICs, and nonimpact printhead substrates. CMD and Telefonica will also jointly develop ASICs. CMD will provide technology and training.

## MANUFACTURING

### Technology

1.25-, 1.5-, 2.0-, and 2.5-micron HCMO  
Silicon-gate, single- and dual-layer metal  
4-inch and 6-inch wafers

### Facilities

Milpitas, CA  
40,000 sq. ft.  
Total space

15,000 sq. ft.  
Class 1,000 clean room

Tempe, AZ  
46,000 sq. ft.  
Manufacturing, test—Class 1,000

20,000 sq. ft.  
Clean room—Class 100 & 10

## PRODUCTS

### CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
C1000	Si-Gate	1.5	0.8	5,000 to 18,000
C2000	Si-Gate	2.0	2.0, 1.25	200 to 3,100
C3000	Si-Gate	2.5	2.5	1,500 to 10,500
C5000	Si-Gate	1.25	0.4	500 to 25,000

### CMOS Cell Library

Process	Linewidth (Microns)	Delay (ns)	Cells
Si-Gate	1.25	0.25	120 gates, 200 MSI, RAM, ROM, PLA, 2901 Family, DMA Controllers, UART, USART
Si-Gate	2.0	1.2	Same as above
Si-Gate	2.5	2.5	Same as above

# California Micro Devices Corporation

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## Linear

G8870  
G8912

CMOS DTMF Receiver that Combines Decoder and Filter  
PCM Filter

## OTHER INFORMATION

California Micro Devices does not employ a PR firm.

# Calmos Systems, Inc.

20 Edgewater Street  
Kanata, Ontario, Canada K2L 1V8  
613/836-1014  
Fax: 613/831-1742  
Telex: 053-4501

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 65

## BACKGROUND

Calmos Systems designs, develops, and markets a variety of devices, including VHSIC-level products that use CMOS and bipolar processes. The Company's CMOS products consist of the CA80C85B MPU and the 8000 series of peripherals, including SCSI and SCC devices. The bipolar product line is centered on a family of wireless components for cellular radio and pager applications. The Company also offers fast-turn prototyping and low-volume production runs that use e-beam technology.

In February 1988, Calmos acquired Siltronic's bipolar IC line. The acquisition adds about \$2.5 million to Calmos' sales, which were \$2 million in 1987. Calmos has purchased Siltronic's assets, especially the equipment for testing and assembly of the circuits.

Calmos hired about 24 of Siltronic's key employees, including founder and Vice President Gyles Panther, doubling the size of Calmos' work force.

The Siltronic product line consists of FM receiver chips for data and cellular radio applications, a delta codec chip based on an exponentially variable step-size algorithm, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

The Company participates in a EUREKA, a European consortium R&D project and is working with European Silicon Structures (ES2) to exploit the technology in ASIC design. Calmos, together with ES2, offers quick-turn prototyping using direct-write e-beam technology, which can implement several design projects on the same wafer.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Dr. Adam Chowanec  
Commodore, VP Technology

### VP R&D

John Roberts  
Mosaid, Dir Mktg

### VP Sales/Mktg

William Woodley  
Mosaid, VP/Bus Mgr

### VP Finance/GM

D. Rosati  
Cognos, Controller

### VP Engineering and Technology

Andrew Herrington  
Amiga, Dir Engineering

### GM Manufacturing

S. Henthorn  
Siltronic, Dir Mfg

## FINANCING

Not available

Round 1

\$1.0M

Private

Not available

Round 2

\$0.4M

Private



# Calmos Systems, Inc.

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Not available

Round 3

\$3.6M

Private and grants

November 1987

Round 4

\$0.5M

Private

## RECENT HIGHLIGHTS

January 1987

Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

September 1987

Calmos announced that it has developed a prototype of a public-key data-encryption system implemented on a chip. The chip uses an algorithm developed at the University of Waterloo in Ontario that allows encryption by exponentiation at speeds of several hundred bits per second.

November 1987

Calmos received a federal contribution of more than \$3 million from the Canadian DRIE to join the EUREKA program. The project involves the expansion of the Company's headquarters located in Kanata, Ontario, to include packaging and test facilities for semiconductor products and the expansion of its CAE system.

February 1988

Calmos acquired Siltronics' bipolar component business for \$500,000. Siltronics' product line consists of FM receiver chips, a codec chip,

DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

## ALLIANCES

Samsung

January 1987

Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

European Silicon Structures

February 1987

Calmos formed an alliance with ES2 to offer quick-turn prototyping.

Siltronics

February 1988

Calmos acquired Siltronics' bipolar component business for \$500,000. The product line consists of FM receiver chips, a codec chip, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

## SERVICES

Prototyping

Low-Volume Production

## MANUFACTURING

### Technology

2.0- and 3.0-micron CMOS

0.9- to 1.5-micron CMOS VHSIC

3.0- and 5.0-micron bipolar

### Facilities

Kanata, Ontario, Canada

20,000 sq. ft.

Manufacture, test, design

## PRODUCTS

ASICs

Device	Description
CMOS Gate Arrays	228 to 1,000 Gates, 2ns Typical Delay
Structured Cell Library	80 Cells Including 4-Bit Adders Shift Registers
Macro Cell Library	RAM, ROM, Dual-Port RAM, 29C01, 80C85, and 8200 Series of Peripherals

**Microcomponents**

Device	Description	Speed
CA80C85B	8-Bit MPU with Extended Instruction Set	3 to 5 MHz
CA80C85S	CA80C85B with Static Operation (2Q88)	6 to 10 MHz
<b>8000 Series Peripherals</b>		
CA82C12	8-Bit MPU	8 to 10 MHz
CA82C37A	Static DMA Controller	5 to 10 MHz
CA82C54	Static Interval Timer	8 to 10 MHz
CA82C55A	Static Peripheral Interface	5 to 10 MHz
CA82C59A	Static Interrupt Controller	5 to 10 MHz
CA82C84A	Static Clock Generator/Driver	8 to 10 MHz
CA82C88	Static Bus Controller	5 to 10 MHz
CA53C80	Static SCSI Interface Controller	1.5 to 3.0 Mbps
CA34C168	Real-Time Data Encryption Processor	300 Kbps

**DSP**

CA29C128	Digital FIR Filter Controller	25 MHz
DFS001-P	PC Board with Programmable FIR Filter and with Software Interface	
FIRCALC-PC	FIR Filter CAD Program	

**Memory**

CA16C08	2Kx8 SRAM	25ns
CA16C09	2Kx9 SRAM	25ns
CA64C08	8Kx8 SRAM	35ns
CA64C09	8Kx9 SRAM	35ns

**Bipolar IC Product Line**

**Communications Circuits**

S422	FM Receiver
S412	Cellular Radio Receiver
S404/406	FM Receiver Two-Chip Set
S408/410	FM Receiver for Data
S2842	Delta Codec

**Power Supply Circuits**

S420/424	Low-Voltage DC-DC Converters
S2862	Power Supply Monitor

**Specialty Circuits**

S416	Programmable Monolithic Diode Matrix
S2854	MPU Control Circuit
S144	Triple Op Amp

**OTHER INFORMATION**

Calmos does not employ a PR firm.

# Calogic Corporation

237 Whitney Place  
Fremont, CA 94539  
415/656-2900

ESTABLISHED: July 1983

NO. OF EMPLOYEES: 50

## BACKGROUND

Calogic Corporation designs, develops, and manufactures DMOS analog products, CMOS and bipolar linear products, and gate arrays. The Company also builds fabrication facilities and markets semiconductor equipment.

The Company was founded without venture capital. From 1985 to 1987, it initially concentrated on foundry contracts and building mini fabrication facilities using its own facility as a model. Calogic has set up fabrication facilities for Data Linear, Microwave Device Modules, and other foreign companies.

In the first quarter of 1988, Calogic began ramping up its proprietary line of linear products, which includes op amps, reference, and regulators.

Calogic achieved a positive cash flow within its first year of operation. The Company is profitable, with sales of about \$5 million and continues to grow at a rate of approximately 50 to 100 percent per year.

## BOARD

(Name and Affiliation)

- \*Manny Del Arroz, Chairman
- \*Dr. Charlie Allen, Consultant

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

- President**  
Manny Del Arroz  
Intel, Process Manager
- \*Founder

## FINANCING

- 1983  
Initial  
\$0.025M  
Private

## ALLIANCES

- Koki Company  
December 1984  
Calogic and Koki reached an agreement regarding the sale of Calogic's CMOS data bus driver ICs by Koki in Japan. (expired)

## MANUFACTURING

### Technology

- 3-micron DMOS
- 5.0- to 3.0-micron metal-gate CMOS
- 3.0-micron bipolar linear with thin film
- High-Speed Complementary Bipolar on DI

### Facilities

- Fremont, CA  
30,000 sq. ft.  
Design, manufacturing, and test
- 7,000 sq. ft.  
Including a Class 100 clean room

# Calogic Corporation

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## PRODUCTS

- Op Amps
- Regulators
- References
- DMOS FET
- CMOS MPR
- DMOS Switching Arrays
- J Fet
- High-Speed Buffer Amplifiers
- Current Feedback Amplifiers
- Other Linear Analog Products

## OTHER INFORMATION

Calogic does not employ a PR firm.

# Catalyst Semiconductor, Inc.

2231 Calle De Luna  
Santa Clara, CA 95054  
408/748-7700  
Fax: 408/980-8209  
Telex: 5106017631

ESTABLISHED: October 1985

NO. OF EMPLOYEES: 52

## BACKGROUND

Catalyst Semiconductor, Inc., was formed to design, develop, and manufacture leading-edge, nonvolatile memories as well as to provide this technology to application-specific and peripherals ICs. This design base is directed toward consumer, industrial, and military applications.

The Company was founded by B.K. Marya, previously the founder and CEO of Exel Microelectronics, Inc. Its long-term strategy is to gain ASIC leadership through the use of nonvolatile memory technology.

## BOARD

(Name and-Affiliation)

\*B.K. Marya

Catalyst Semiconductor, president

George Pottorff

Pottorff, MacFarlane & Associates, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

B.K. Marya

Exel, President

### Exec VP

Stephen Michael

GE Solid State, VP Custom ICs

### VP Corp Dev

Hide Tanigami

Exel, Bus Dev/Japan

### Dir European Sales

Barry Stanley

Mostek, Sales/Manager

### Dir American Sales

Thomas Malgesini

Intel, Field Sales Engineer

### Dir Tactical Mktg

Reggie Huff

Exar, Sales Mgr

### Dir Strat Mktg

Nick Samaras

National, Mktg Mgr

\*Founder

## FINANCING

October 1985

Round 1

\$4.5M

Private placement

## RECENT HIGHLIGHTS

January 1987

Catalyst offered the CAT93C46 and CAT59C11, two CMOS 1K serial EEPROMs. The devices offer selectable serial memory organization and automatic write instruction.

March 1987

Catalyst and Oki Electric extended a previous agreement to include a wide range of CMOS EEPROMs. The agreement includes 1K serial EEPROMs; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs.

April 1987

Stephen Michael, formerly vice president of GE Semiconductor's Custom Integrated Circuit Department, joined Catalyst as executive vice president and COO. He has responsibility for all day-to-day operations.

June 1987

Catalyst offered the CAT62C580, a CMOS 8-bit MCU with 16K of EEPROM on-chip.

## Catalyst Semiconductor, Inc.

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The device also includes 3 Kbytes of mask-programmable ROM and 128 bytes of data RAM.

### June 1987

Catalyst offered the KASK 52580 program development and evaluation system for the CAT62C580 single-chip, 8-bit MCU. The system runs on the IBM PC AT or compatible MS-DOS machines.

### July 1987

Catalyst offered its first CMOS SRAMs. The CAT71C256 and CAT71C256L are low-power 32Kx8 devices with an access/cycle time of 85ns. The CAT71C88 is a 16Kx4 SRAM with an access time of 45ns.

### Sept. 1987

Catalyst sampled a 1Mb EPROM with an access time of 120nsCAT27010.

### October 1987

Catalyst introduced the CAT28C16A and CAT28C17A, its first 16K EEPROMs. Both are organized as 2Kx8 and offer a 150ns access time.

## 1988 Developments

Catalyst introduced the CAT28C64A and CAT28C65A 64K EEPROMs.

Catalyst introduced the CAT35C102 and CAT35C202 2-Kbit serial EEPROMs.

Catalyst introduced the CAT35C104 and CAT35C204 4-Kbit serial EEPROMs.

Catalyst offered the CAT62C780, a CMOS 8-bit MCU with 8K of EEPROM on-chip. The device also includes 6Kbytes of mask-programmable ROM and 192 bytes of data RAM.

Catalyst introduced the CAT35C704 and CAT35C804 Secure Access Serial EEPROMs. These unique memories offer password-protected access to data and feature configuration.

Catalyst introduced its first military temperature device with the CAT27HC256. This is a 256-Kbit EPROM that provides 55ns access

times. It also is available in industrial and commercial temperature grades as well as a low-power version, the CAT27HC256L.

Catalyst introduced a CMOS 1-Mbit EPROM, the CAT27C210, configured as 64Kx16 for 16- and 32-bit processor applications.

## ALLIANCES

### Zilog

#### December 1985

Catalyst and Zilog entered into a joint development and second-source agreement for user-programmable standard products. The Companies' initial effort will be a version of Zilog's Z8 microcontroller with on-chip, electrically alterable capabilities that use Zilog's 1.25-micron, n-well CMOS process.

### Thomson CSF

#### 1986

Catalyst and Thomson will conduct research and development in France.

### Oki Electric

#### July 1986

Catalyst and Oki entered into an agreement that calls for long-term research and development of NVRAMs for ASICs using CMOS EPROMs and EEPROMs. Terms include a nonexclusive marketing agreement.

#### March 1987

Catalyst and Oki Electric extended the previous agreement to include a wide range of CMOS EEPROMs. The two companies planned a joint introduction of a 1K serial EEPROM; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs by the end of 1987.

#### November 1988

Catalyst and Oki signed an agreement that gives Oki a second-source license to sell the Catalyst 2K CMOS serial EEPROM, the CAT35C102, and the CAT35C202 on a worldwide basis.

### Seiko

#### February 1987

Catalyst and Seiko Instruments signed a technology exchange and foundry agreement.

**MANUFACTURING**

**Technology**

1.2-micron design rules  
 Double-metal, double-poly CMOS  
 Submicron technology in development

**Facilities**

Santa Clara, CA  
 20,000 sq. ft.  
 Offices, test

**PRODUCTS**

**CMOS SRAM**

**Device**

**Description**

CAT71C256	32Kx8
CAT71C256L	32Kx8 (low-power version)

**CMOS NVRAMs**

CAT22C10	64x4
CAT22C12	256x4
CAT24C44	16x16 Serial RAM

**CMOS EPROMs**

CAT27HC256	32Kx8
CAT27HC256L	32Kx8 (low power)
CAT27C210	1 Mbit (64Kx16)

**NMOS EPROMs**

CAT2764A	8Kx8 (OTP)
CAT27128A	16Kx8 (OTP)
CAT27256	32Kx8 (OTP)
CAT27512	64Kx8 (OTP)
CAT27010	1 Mbit (128Kx8) OTP and UV versions

**Parallel CMOS EEPROMs**

CAT28C16A/28C17A	2Kx8
CAT28C64A/28C65A	8Kx8
CAT28C256	64Kx8

**Serial CMOS EEPROMs**

CAT93C46/59C11	1K Serial
CAT35C102/CAT35C202	2K Serial
CAT35C104/CAT35C204	4K Serial
CAT35C704/CAT35C804	4K Secure Access Serial

**Microcontrollers (SmartCard Chips)**

CAT62C580	8-Bit MCU, 16K of EEPROM on-chip, 3 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM
CAT62C780	8-bit MCU, 8K of EEPROM on-chip, 6 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM

**Development Tools**

EASE 62580	A Program Development and Evaluation System for the CAT62C580 Single-Chip, 8-Bit MCU
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**OTHER INFORMATION**

Catalyst's PR firm is John Ranavicks.

**Celeritek, Inc.**  
617 River Oaks Parkway  
San Jose, CA 95134  
408/433-0335  
Fax: 408/433-0991

ESTABLISHED: 1984

NO. OF EMPLOYEES: 110

## BACKGROUND

Celeritek, Inc., designs, manufactures, and markets GaAs FETs, MMICs, and custom subsystems such as up/down converters for military and commercial applications.

The Company has developed a thin-film microwave amplifier technology and manufactures many of its low-noise and medium-power GaAs FETs in-house. All microwave amplifier thin-film circuits use a high-energy sputtering process for reliable and repeatable metal adhesion. The Company can also manufacture silicon MOS capacitors. Celeritek uses a family of standard amplifier modules that can be combined and aligned to achieve customer-specific specifications.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Tamer Hussein  
Granger Assoc., VP Operations

### VP Amp Ops

\*Gary Policky  
Avantek, Mgr Adv Dev M/W

### VP SC Ops

\*Ross Anderson  
Avantek, Mgr GaAs Dev

### VP Finance

\*John Beman  
ROLM, Controller

### VP Marketing

\*Robert Jones  
Avantek, Dir Marketing

\*Founder

## FINANCING

### March 1985

Round 1  
\$3.2M  
Greylock Management, Sutter Hill, Venrock Associates

### August 1985

Follow-on  
\$1.0M  
Original investors

### August 1986

Round 2  
\$4.2M  
Original investors; Burr, Egan, Deleage; Glynn Ventures; Mayfield Fund; Morgan Stanley

## RECENT HIGHLIGHTS

### July 1987

Celeritek leased 23,860 square feet of R&D space in San Jose, California.

### December 1987

Avantek filed a suit against Celeritek and two of its founders, Tamer Hussein and Ross Anderson, charging theft of trade secrets.

## ALLIANCES

None

## MANUFACTURING

### Technology

GaAs



# Celeritek, Inc.

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## Facilities

San Jose, CA

23,860 sq. ft.

Research and development  
and manufacturing

1,000 sq. ft.

Class 100 clean room

## PRODUCTS

### Low-Noise Amplifiers

Family	Frequency	Power Output
CMA Series	0.5 to 18.0 GHz	+18 dBm
CMT Series	2 to 18 GHz	+18 dBm
CMT Series	18 to 40 GHz	+10 dBm

### Medium-Power Amplifiers

CPA Series	6 to 18 GHz	+27 dBm
CPT Series	6 to 18 GHz	+30 dBm

### Microsize Connectorless Amplifiers

240/400 Series	2 to 18 GHz
520 Series	0.5 to 4.0 GHz

### MMIC Chips

CMM-2 Amp	2 to 6 GHz
CMM-4 Amp	2 to 18 GHz
CMS-12 Switch	DC to 18 GHz

### GaAs FETs

CF004-02	2 to 40 GHz	+13 dBm
CF003-01	2 to 20 GHz	+22 dBm
CF010-01	2 to 18 GHz	+28 dBm

### Integrated Assemblies

Frequency Converters  
Switched Amplifiers  
Log Amplifiers

## OTHER INFORMATION

Celeritek does not employ a PR firm.

# Chartered Semiconductor Pte Ltd.

3-Lim Teck Kim Road  
STC Building 10-02  
Singapore 0208  
Phone: 65-320-7271

ESTABLISHED: October 1987

NO. OF EMPLOYEES: N/A

## BACKGROUND

Chartered Semiconductor Pte Ltd. is a result of a joint venture among National Semiconductor Corporation, Singapore Technology Corporation, and Sierra Semiconductor Corporation. Singapore Technology holds 74 percent of the Company, Sierra holds 17 percent, and National holds the remaining 9 percent. Total initial investment in the facility and equipment was about \$40 million.

The Company, which is located at a 170,000-square-foot site in the Singapore Science Park, will initially fabricate and test CMOS wafers and ASIC devices primarily for Sierra Semiconductor and National Semiconductor. Chartered Semiconductor began construction in October 1987 and began its first wafer starts in Q2 1989. The facility fabricates submicron devices in a Class 1 clean room with an initial capacity of 5,000 6-inch wafers per month. The facility will be capable of generating about \$50 million in revenue per year.

Sierra is contributing its proprietary Triple Technology CMOS process, technical management, and training. National is providing CMOS process technology, technical training, and technical support in the construction and start-up of the clean-room facility. Singapore engineers have been training at Sierra's San Jose, California, facility for more than two years. Tom Klein, vice president and founder of Sierra, will supervise the facility construction and start-up of the manufacturing process. Sierra's Triple Technology is capable of integrating analog, digital, and EE memory on one chip.

## BOARD

(Name and Affiliation)

Ming Seong Lim, chairman

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Managing Director  
B. John Hambridge  
Fairchild, VP Logic Division

## FINANCING

Oct. 1987  
Round 1  
\$40.0M  
National Semiconductor Corporation; Sierra Semiconductor Corporation; Singapore Technology Corporation

## ALLIANCES

National, Sierra, Singapore  
Oct. 1987  
National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation cooperated in a joint venture to form Chartered Semiconductor.

## SERVICES

Foundry  
Manufacturing

## MANUFACTURING

### Technology

Submicron CMOS  
6-inch wafers

### Facilities

Singapore  
170,000 sq. ft.  
Manufacturing

The Company started wafer production in Q2 1989. The facility includes a Class 1 clean room and has an initial capacity of 5,000 wafers per month.

## **Chartered Semiconductor Pte Ltd.**

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### **PRODUCTS (Planned)**

CMOS Wafers  
ASIC Devices

### **OTHER INFORMATION**

Chartered Semiconductor does not employ a PR firm.

**Cirrus Logic, Inc.**  
1463 Centre Pointe Drive  
Milpitas, CA 95035  
408/945-8300

ESTABLISHED: 1984

NO. OF EMPLOYEES: 175

## BACKGROUND

Cirrus Logic, Inc., designs, manufactures, and markets optimized mass storage controllers, communications controllers, and graphics controller chips for data communications, mass storage control, and display/graphics control applications. The Company's VLSI circuits use a proprietary silicon compilation technique and can be designed as standard products, as well as market- and customer-specific derivatives.

Cirrus Logic is the commercial follow-on to Patil Systems, a research laboratory founded in 1981. In 1984, financing was received from Nazem & Company of New York, and Cirrus Logic acquired Patil Systems.

Cirrus Logic developed a proprietary IC design method called Storage/Logic Array (S/LA) to design custom ICs in design times equivalent to those for standard cells with the density and performance of full-custom devices. Suhas Patil invented the S/LA concept, a type of silicon compilation technology with supporting CAD tools for logic design, simulation, and automatic layout.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Michael Hackworth  
Signetics, Sr VP

### Exec VP/Strat Ops

Kamran Elahian  
CAE Systems, Founder/President

## VP R&D

\*Dr. Suhas Patil, Chairman  
Patil Systems, Founder

## VP Engineering

Kenyon Mei  
Intel, GM OEM Comm

## VP Manufacturing

Michael L. Canning  
Teledyne, President/GM

## VP Marketing

George Alexy  
Intel, Mktg Mgr MPUs

## VP Finance

Marilyn Guerrieri  
Zitel, Dir Finance

## VP Sales

Bill Caparelli  
VLSI Technology, VP Sales/Mktg.

\*Founder

## FINANCING

### March 1984

Seed  
\$1.6M  
Nazem & Company; Robertson, Colman & Stephens

### May 1985

Round 1  
\$7.5M  
Brentwood Associates; Nazem & Company; New Enterprise Associates; Robertson, Colman & Stephens; Technology Venture Investors

### May 1986

Round 2  
\$3.0M  
Previous investors; Institutional Venture Partners

# Cirrus Logic, Inc.

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## November 1986

Round 3

\$4.5M

Previous investors; Kuwait & Middle East Financial; New York Life Insurance

## June 1987

Round 4

\$11.0M

Previous investors; Berkeley Development Capital; Evergreen Management Partners; New Venture Partners; T.R. Technology Investment; UNC Ventures

## June 1989

IPO

\$24.0M

Initial public offering

## RECENT HIGHLIGHTS

### June 1987

Cirrus Logic raised \$11.0 million in funding. The funds were used to expand manufacturing and test capabilities, with the intent of doubling test capacity. Cirrus Logic also purchased \$1.5 million worth of Sun Microsystems workstations for its design centers.

### October 1987

Cirrus Logic offered the CL-GD510/520, a video graphics array device for the IBM PS/2-compatible market. A custom version of the device was developed in part with Video Seven.

### November 1987

Cirrus Logic offered the CL-SH135 CMOS enhanced Winchester hard-disk formatter chip.

Cirrus Logic offered the CL-SH250, a CMOS single-chip SCSI disk controller that consists of a formatter, buffer manager, and SCSI bus interface.

### December 1987

Cirrus Logic announced that it had begun volume production of the CL-GD510/520 chip set.

### April 1988

Cirrus Logic offered the CL-SH260, a CMOS single-chip PC XT/AT-compatible disk controller that consists of a formatter, buffer manager, and PC XT/AT bus interface.

## July 1988

Cirrus Logic announced a family of single-chip controllers, the RPX family, for raster printer acceleration. The first two chips in the RPX family are designed as coprocessors specifically to enhance the speed and reduce the systems costs of laser printers.

## ALLIANCES

### AMD

#### September 1985

Cirrus Logic and AMD agreed to a technology exchange wherein Cirrus Logic will use silicon-compiled, 1.6-micron, double-metal CMOS-processed wafers to develop an MCU for AMD. AMD provides foundry services. (completed)

### Silicon Systems

#### October 1986

Cirrus Logic and Silicon Systems agreed to exchange controller and buffer manager functions and mutually second-source the devices. Both chips will be processed with a 2-micron CMOS technology. (completed)

### WDC

#### January 1987

Cirrus Logic licensed a custom Winchester disk drive controller IC to WDC, which gained indirect access to the product when it acquired Adaptive Data Systems, Inc., a board manufacturer.

### DIA-Semicon Systems

#### October 1987

Cirrus Logic signed an agreement with DIA-Semicon Systems in Japan to distribute new and existing products in Japan. Cirrus Logic began sales of its Winchester disk controller chip set in Japan. DIA-Semicon Systems was founded in 1986 and is 80 percent owned by Mitsubishi Electric Corporation.

### Award Software

#### November 1987

Award Software, Inc., of Los Gatos, California, agreed to develop a VGA graphics Basic I/O System (BIOS) and demonstration board for Cirrus Logic's GD510/520 VGA chip set. The agreement includes a complete hardware and software solution for PS/2-compatible graphics.

July 1988

Award announced an agreement to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets.

**Phoenix Technologies Ltd.**

September 1988

Phoenix Technologies will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus Logic.

**Facilities**

Milpitas, CA

50,000 sq. ft.

Administration, engineering, design, and marketing

10,000 sq. ft.

Class 1,000 clean room (test facility)

**MANUFACTURING**

**Technology**

3.0-micron NMOS and CMOS

1.2-, 1.5-, and 2.0-micron, double-metal CMOS

**PRODUCTS**

**Mass Storage Controllers**

Device	Description
CL-SH120	CMOS Buffer Storage Manager
CL-SH130	CMOS Winchester Hard Disk Formatter
CL-SH135	CMOS Enhanced Winchester Hard-Disk Formatter
CL-SH250	SCSI Disk Controller with Formatter, Buffer Manager
CL-SH260	Disk Controller with Formatter, Buffer Manager, XT/AT Bus Interface

**Display Controller**

CL-GD510A/520A	Video Graphics Array—IBM New Generation
CL-GD610/620	Controller chips for laptop computers
CL-GD315	Laser printer coprocessors
CL-GD340	Laser printer coprocessors
CL-CD180	Multichannel communications controller (8 channel)

**OTHER INFORMATION**

Cirrus Logic does not employ a PR firm.

# Comlinear Corporation

4800 Wheaton Drive  
Fort Collins, CO 80525  
303/226-0500  
Fax: 303/226-0564

ESTABLISHED: 1980

NO. OF EMPLOYEES: 150

## BACKGROUND

Comlinear Corporation, located in Fort Collins, Colorado, was formed in 1980 by David Nelson, a former Hewlett-Packard employee. The original technical staff and management were drawn heavily from Hewlett-Packard. Comlinear is a manufacturer and supplier of high-performance analog signal processing components. Comlinear's amplifier products include high-speed hybrid and monolithic operational amplifiers, buffers, and clamping amplifiers. Converter products include track/hold amplifiers, A/D converters, and D/A converters. The corporate philosophy is to focus development on products that make a significant contribution toward solving customer problems.

Comlinear Corporation is housed in a custom-built facility, which is DESC certified to MIL-STD-1772. This facility houses the manufacturing, quality assurance, R&D, administration, and marketing operations for the Company.

Comlinear's proprietary signal processing components are sold worldwide to a diverse group of commercial, industrial, and military customers.

Application areas include communications (satellite systems, radar, fiber optics), avionics (electronic countermeasures, instrumentation), video (high-resolution displays, video processing, and distribution), and automatic test equipment.

## BOARD

(Name and Affiliation)

David Nelson, Chairman  
Comlinear Corp., CEO

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President, CFO

Barry Rowan  
Hewlett-Packard, Finance

### VP R&D

John Farnbach  
Hewlett-Packard, R&D Manager

### Executive VP Marketing

David Ford  
Hewlett-Packard, Product Manager

### VP QA

Bob Vinton  
National Semiconductor, Quality Manager--  
Mil. Aero.

### VP Manufacturing

Hal Chase  
Hewlett-Packard, Manager--Hybrid Products

### CEO, Director Advanced Products

\*David Nelson  
Hewlett-Packard

\*Founder

## FINANCING

Not available

## ALLIANCES

### TRW LSI

May 1988

Comlinear and TRW LSI agreed to a joint development of high-resolution, high-speed data conversion products.

# Comlinear Corporation

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## MANUFACTURING

### Facilities

Ft. Collins, CO

50,000 sq. ft.

Design, manufacturing, test, administration

## PRODUCTS

Op Amps

Unity Gain Buffer Amplifiers

Linear (Video) Amplifiers

Track & Hold Amplifiers

Encased Amplifiers

A/D Converters

D/A Converters

## OTHER INFORMATION

Comlinear's PR firm is Tallant/Yates.



## Cree Research Inc.

2810 Meridian Parkway

Durham, NC 27713

919/361-5709

Fax: 919/361-4630

ESTABLISHED: 1987

NO. OF EMPLOYEES: N/A

### BACKGROUND

Cree Research Inc. was formed to develop, design, manufacture, and market discrete devices using silicon carbide (SiC) technology developed at North Carolina State University (NCSU). Founders of the Company are Eric Hunter; Calvin H. Carter, Jr.; Neal Hunter; John A. Edmond; and John Palmour—all former research team members at the university. Cree Research has obtained exclusive worldwide rights on the university's 10 U.S. SiC patents and on any future filings.

Initially, the Company is focusing on simple devices—diodes and blue LEDs that have immediate benefit to customers in aircraft engine applications, deep well drilling, and digital color imaging. Prototypes were introduced in April 1988.

In November 1987, the Company raised \$500,000 in financing to fund itself through the prototype stage. In March 1988, \$2.5 million was raised in first-round financing. The funds are being used to establish an 8,200-square-foot manufacturing facility, which was completed in July 1988.

The Company has won contracts with the Department of Defense, has set up arrangements for assembly and test services, and is discussing arrangements with major semiconductor manufacturers.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

Eric Hunter

MKS Instruments, District Sales Mgr

### Dir Technology

Calvin H. Carter

NCSU, Assoc Professor

### FINANCING

#### November 1986

Seed

\$0.5M

Not available

#### March 1988

Round 1

\$2.5M

Not available

### ALLIANCES

#### GI

August 1988

Cree and GI entered into a joint-development program to develop and manufacture silicon-based rectifiers.

### SERVICES

Assembly

Test

### MANUFACTURING

#### Technology

MESFETs and MOSFETs on silicon carbide

#### Facilities

Durham, NC

10,000 sq. ft.

Development, design, manufacturing

## **Cree Research Inc.**

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### **PRODUCTS**

#### **Diodes**

**High-Temperature pn, 350° Centigrade with Reverse-Bias Leakage Current of less than 1 nanoamp at +125V**

#### **Blue LEDs**

### **OTHER INFORMATION**

**Cree Research does not employ a PR firm.**

# Crystal Semiconductor Corp.

4210 South Industrial Road  
P.O. Box 17847  
Austin, TX 78760  
512/445-7222  
TWX: 910-874-1352  
Fax: 512/445-7581

ESTABLISHED: October 1984

NO. OF EMPLOYEES: 100

## BACKGROUND

Crystal Semiconductor Corp. develops, manufactures, and markets advanced smart analog ICs that combine analog and digital functions on a single CMOS device for the telecommunications/data communications, instrumentation, and industrial automation market segments.

Crystal is a privately held company founded by Michael J. Callahan and James H. Clardy. Crystal acquired the assets and technology of Texas Micro-Circuit Engineering, a company that Michael Callahan founded and served as president.

Crystal is developing three product lines for a variety of niche markets: telecommunications/data communications including PCM transceivers and data communications transceivers; digitally enhanced analog-to-digital and digital-to-analog data acquisition products; and signal-conditioning and application-specific filters.

In April 1986, Crystal Semiconductor announced its first product, the CSC8870B, a DTMF receiver. The circuit can be used in telephone-answering machines and credit card verification systems. In June 1986, the CSC7008 Universal Filter and Crystal-ICE Filter Development System was offered. The development system is a PC-based system that incorporates filter synthesis, coefficient-generation software, and an in-circuit emulator (ICE).

Crystal Semiconductor markets its products through the combined efforts of a direct sales force and a worldwide network of manufacturers' representatives and distributors.

## BOARD

(Name and Affiliation)

- H. Berry Cash, Chairman  
Berry Cash Southwest Partnership
- L.J. Sevin  
Sevin, Rosen Management Company
- \*James H. Clardy  
Crystal Semiconductor
- \*Michael J. Callahan  
Crystal Semiconductor
- \*Dietrich R. Erdmann  
Sevin, Rosen Management Company
- Steven Sharp  
Independent Venture Cap., Megatest  
Power Integrations Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

James H. Clardy  
Harris, VP WW Ops

### VP Engineering

Michael J. Callahan  
Texas Micro-Circuit, Founder/Pres

### VP Marketing

Craig H. Ensley  
Rockwell, Director Mktg

### VP Technology

Eric J. Swanson  
AT&T, Telecom Engr Mgr

### VP Sales

Alan R. Schuele  
Cypress Semiconductor, Regional Sales Mgr

\*Founder

# Crystal Semiconductor Corp.

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## FINANCING

**October 1984**

Round 1

\$4.5M

Berry Cash Southwest Partnership; Dietrich Erdmann; Hambrecht & Quist; The Hill Partnership; InterWest Partners; Republic Investment Co.; Sevin, Rosen Management Company

**February 1986**

Round 2

\$6.7M

Original investors; Coronado Venture Fund; Crown Associates; Kleiner, Perkins, Caufield & Byers; Rho Management Company; Rust Ventures

**January 1987**

Equity

\$15.0M

Asahi Chemical

**June 1987**

Round 3

\$5.0M

Berkeley International

## RECENT HIGHLIGHTS

**January 1987**

Asahi Chemical acquired an 8 percent share in Crystal for about \$4 million. Asahi Kasei Microsystems, a subsidiary of Asahi Chemical, will manufacture and market Crystal's devices for the Far Eastern market. The agreement gives Crystal an aggregate financial package of \$15 million.

**April 1987**

Crystal offered the CS61534 analog line interface, which combines the analog transmit and receive line interface functions for T1/CEPT applications. The device features a programmable line driver and on-chip data-and-timing recovery circuit.

**April 1987**

Crystal offered the CS5016 16-bit, self-calibrating D/A converter featuring conversion

time of 16 microseconds, MPU interface, three-state output buffers, and digitally selectable unipolar or bipolar output ranges.

**May 1987**

Crystal offered the CSZ511X Series of 12-, 14-, and 16-bit successive approximation A/D converters for DSP systems.

**September 1987**

Crystal offered the CS7820 8-bit A/D self-contained converter with a 1.36-microsecond conversion time.

**October 1987**

Crystal offered the CS3112 self-calibrating, 12-bit, 1-microsecond track-and-hold amplifier.

**December 1987**

Crystal offered the CS5012-7 self-calibrating, 12-bit, 100-KHz sampling A/D converter with on-chip sample-and-hold amplifier.

**January 1988**

Crystal offered the CSZ5412 monolithic 12-bit, 1-MHz, self-calibrating A/D converter with on-chip track-and-hold amplifier, MPU interface, three-state output, and overrange output.

**August 1989**

Crystal reported its first quarterly profit since the company was founded in 1984.

## ALLIANCES

**Asahi Chemical**

January 1987

Asahi Chemical acquired an 8 percent share in Crystal for about \$4 million.

**Analogic Corp.**

June 1989

Crystal Semiconductor and Analogic Corp. signed a strategic alliance which established Analogic as a value-added re-seller of the Crystal ADC line.

## MANUFACTURING

### Technology

- 2.0-, 3.0-micron CMOS silicon-gate
- 2-layer poly structure, single layer of metal

### Facilities

- Austin, TX
- 25,000 sq. ft.
- Design and test

Crystal is planning a production facility in 1990. Currently, Orbit Semiconductor and International Microelectronic Products in the United States, Mitel Semiconductor of Canada, and Asahi Chemical of Japan provide foundry services.

## PRODUCTS

### Jitter Attenuators

- T1 1.5-MHz and CCITT 2.0-MHz Jitter Attenuators, 4.5- to 8.5-MHz Token-Ring Jitter Attenuators

### DTMF Receivers

### Fiber-Optic Transmitters/Receivers

- Optimodem, Fiber-Optic T1 Transmitter/Receivers, LEDs

### Analog Data Converters

- Crystal offers a full line of 12-, 14-, 16-, and 20-Bit A/D converters, with varying speeds and operating frequencies.

### Amplifiers

- Quad, 1-microsecond Acquisition Time, Track and Hold
- Single, 1-microsecond Acquisition Time, Track and Hold

### Filters

- Universal Digitally Programmable Switched-Capacitor Filter, ICE Development System

### Evaluation Boards

- Available for all product lines

### ISDN Primary Rate Line Interfaces

- T1 (1.544 MHz and PCM-30 (2.048 MHz) Line Interfaces, T1 Analog Interface

### ISDN Primary Rate Transceiver

- T1 Transceiver

### Military Devices

- 12-, 14-, and 16-microsecond A/D Converters

## OTHER INFORMATION

Crystal Semiconductor does not employ a PR firm.

# Custom Arrays Corporation

525 Del Rey Avenue  
Sunnyvale, CA 94086  
408/749-1166  
Fax: 408/749-1718  
Telex: 510-600-5119

ESTABLISHED: October 1984

NO. OF EMPLOYEES: 10

## BACKGROUND

Custom Arrays Corporation was formed to design and manufacture analog bipolar linear arrays that are supported by a CAE design software environment and run on MS-DOS on a PC AT hardware platform. The Company also offers quick-turn prototyping services.

The Company's founder is Pierre R. Irissou, who also serves as the Company president and the vice president of research and development. Mr. Irissou remains a board member of ATAC, which has exclusive marketing rights for Custom Arrays' products in France. In October 1987, the Company merged with a blind-pool public corporation and is listed on the pink sheets and traded OTC. The Company is incorporated in Nevada; however, all operations are conducted in Sunnyvale, California.

The Company's short-term strategy is to offer quick turnaround on prototypes based on its MM and MV families of bipolar arrays. The MM family consists of nine arrays with 2 to 28 macrocells. The MV family consists of five arrays with 4 to 20 macrocells. Both families are a result of a joint development venture with Ferranti-Interdesign, located in Scotts Valley, California.

The Company's long-term strategy is to expand its bipolar array offerings to include thin-film technology options, including laser-trim capability. Custom Arrays is developing new arrays based on a high-voltage BiCMOS process compatible with thin-film technology.

Custom Arrays has expanded its facilities to support in-house reticle and mask manufacture, direct-step-on-wafer (DSW) photolithography,

wafer processing for metal patterning and top-glass passivation, dice-package assembly, and full-production testing at both the wafer and package level.

## BOARD

(Name and Affiliation)

B. Bornette, Chairman  
ELF Aquitaine, France  
\*Pierre R. Irissou  
Custom Arrays Corporation  
George Krautner  
Custom Arrays Corporation  
Emmanuel Celerier  
SOFIPA, France  
Herve Thiriez  
Independent

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President/CEO**  
\*Pierre R. Irissou  
ATAC Diffusion S.A., Managing Director

**Exec VP**  
George Krautner  
Ferranti-Interdesign, VP Mktg/Sales

**VP Finance**  
William Hass  
Ferranti-Interdesign, VP Finance

**VP Corporate Development**  
Arun Pande  
Not available

\*Founder

# Custom Arrays Corporation

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## FINANCING

October 1984

Seed

\$300,000

ATAC Diffusion S.A. (division of ELF  
Aquitaine)

October 1986

Seed

\$500,000

SOFIPA (investment division of ELF  
Aquitaine)

July 1987

Seed

\$400,000

FINAXIA, private investors

October 1987

Seed

\$145,000

Merger with Venture Nexus, Inc.

May 1988

Seed

\$500,000

Societe Financiere Internationale de  
Participations

Gaz et Eaux

\$500,000

## PRODUCTS

### Linear Arrays

MM Family of 20V Bipolar Analog Arrays with 2 to 28 Macrocells

MV Family of 40V Bipolar Analog Arrays with 4 to 20 Macrocells

### Development Tools

B-SPICE

Circuit (SPICE) Simulator (PC 386)

LIBERTY

MM and MV Layout and Verification Software

PC-PG

Mask File Translator for Pattern Generation

LIKE

Cell-Based IC Design Software

## OTHER INFORMATION

Custom Arrays Corporation's PR firm is Joyce Lekas Associates.

## ALLIANCES

### ATAC-Diffusion

1984

ATAC operates a design center and conducts  
marketing for Custom Arrays in Europe.

### Ferranti-Interdesign

1984

The MM family is the result of a joint develop-  
ment venture with Ferranti-Interdesign, Inc.  
Ferranti-Interdesign acts as a second source.

### Teledyne

February 1988

Custom Arrays entered into a joint develop-  
ment agreement with Teledyne Semiconductor  
for a new family of BiCMOS semicustom and  
cell-based libraries. The technology will feature  
operating voltage levels of 18V.

## SERVICES

Quick-turn prototyping

## MANUFACTURING

### Technology

Bipolar

BiCMOS

### Facilities

Sunnyvale, CA

12,000 sq. ft.

Manufacture, assembly, test

## Custom Silicon Inc.

600 Suffolk Street  
Lowell, MA 01854  
617/454-4600  
Fax: 617/458-4931

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 25

### BACKGROUND

Custom Silicon Inc. (CSI) was formed to serve the low-volume and high-complexity ASIC markets by acting as a "time-shared captive semiconductor division" to companies in regional markets. It acts as a value-added reseller of wafer fabrication capacity through its strategic relationships with major semiconductor manufacturers.

CSI's approach is one of extremely vertical marketing that focuses on applications. CSI offers 2- and 3-micron CMOS gate arrays and standard cells that are supported on Mentor, Daisy, FutureNet, and VIEWlogic workstations. CSI currently produces devices with up to 14,000 gates and planned to add a family of CMOS and bipolar linear arrays in the first quarter of 1987.

CSI is the ASIC distribution channel for NCR Corporation for both New England and the Pacific Northwest; it is also the northeastern independent design center for Motorola. In September 1986, WSI NCR licensed CSI's standard cell library that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863 gates. CSI's library was built from NCR's existing library.

CSI's sales strategy is to build a network of regional operations to act as distribution channels for major manufacturers that serve the engineering-intensive segments of the ASIC market.

### BOARD

(Name and Affiliation)

Albert P. Belle Isle  
Custom Silicon Inc.

Richard A. Charpie  
Paine Webber Ventures

David W. Guinther  
Custom Silicon Inc.

Sumner Kaufman  
Kaufman & Co.

Kenneth J. Revis  
Turner Revis Associates

Henry R. Shean  
Custom Silicon Inc.

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Albert P. Belle Isle  
Wang, Vice President

**VP R&D**  
Donald L. Gay  
Wang, Program Mgr

**VP Marketing**  
David W. Guinther  
Wang, Program Dir

**VP Finance**  
Henry R. Shean  
Wang, Controller R&D

**VP Sales**  
Robert J. Brown, Jr.  
SGS, VP Sales

### FINANCING

April 1983  
Seed  
\$0.1M  
Kaufman & Co.; private investors



# Custom Silicon Inc.

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**February 1984**

Round 1

\$1.1M

Bank of New England; First Chicago; Turner  
Revis Associates

**June 1985**

Round 2

\$2.8M

Original investors; Massachusetts Capital  
Resource Company; Paine Webber Ventures

**VIEWlogic**

October 1985

CSi offered its standard cell library on  
VIEWlogic's Workview PC-based workstation.  
The library includes 165 digital primitives and  
7,400 TTL macrocells.

**Motorola**

August 1986

CSi agreed to act as the northeastern  
independent design center for Motorola.

## ALLIANCES

**NCR**

November 1983

CSi and NCR entered into an exclusive tech-  
nology licensing and sourcing agreement under  
which CSi will design and resell cell-based and  
gate array products in New England. The prod-  
ucts use NCR's 3.0-micron CMOS and NMOS  
technologies. NCR provides manufacturing.

September 1986

NCR licensed CSi's standard cell library that  
includes 342 TTL macrocells and microcom-  
puter building blocks of up to 5,863 gates.  
CSi's library was built from NCR's existing  
library.

**FutureNet**

March 1984

CSi offered its standard cell library on the  
FutureNet DASH design system.

## SERVICES

Wafer fabrication agent

## MANUFACTURING

### Technology

3.0-, 2.0-, and 1.5-micron CMOS and bipolar

### Facilities

Lowell, MA  
12,000 sq. ft.  
Design

CSi has a long-term licensing and sourcing  
agreement with NCR, which provides preferred  
access to multiple manufacturing facilities.

## PRODUCTS

### CMOS Standard Cells

Device	Description
Micro Blocks Family	200 Cells Including Adders, ALUs, Multiplexers; Dual-Port RAMs; Multiplexers, Shift Registers; and Three-State Bus Drivers
TTL Macro Cells	Encoders, Decoders, Adders, Shift Registers, Multiplexers, Counters
Supercells	ROM, RAM, EEPROM, PLA, MPU, Timer, SCSI Controller
Analog Cells	General-Purpose Op Amp and Comparator, 8-Bit A/D and D/A Converter, Current-Bias Generator, Analog Switch, Oscillators

### CMOS Gate Arrays

Family	Linewidth (Microns)	Delay (ns)	Gates
HCA 6200	2.0	1.9	2,430 to 4,860
HCA 6300	3.0	2.5	648 to 2,295
HCA 62A00	2.0	1.1	600 to 8,558

**CMOS Standard Cells (Continued)**

**Bipolar Gate Arrays**

<b>Family</b>	<b>Technology</b>	<b>Delay (ns)</b>	<b>Gates</b>
MCA ECL	ECL	0.5	652 to 2,500
MCA ALS	TTL	1.1	500 to 2,800
MCA ETL	Mixed ECL/TTL	1.1	2,950

**OTHER INFORMATION**

Custom Silicon does not employ a PR firm.

# Dallas Semiconductor Corporation

4350 Beltwood Parkway

Dallas, TX 75244

214/450-0400

Fax: 214/450-0470

ESTABLISHED: February 1984

NO. OF EMPLOYEES: 500

## BACKGROUND

Dallas Semiconductor Corporation designs, manufactures, and markets low-power CMOS memory, linear, and microcontroller circuits and subsystem products. The Company is an applications-oriented supplier that uses proprietary late-definition techniques to customize wafers after test and characterization. This flexibility, called soft silicon, is achieved through the use of lithium power sources, direct laser writing, high-energy ion implantation, and subsystem integration.

The resulting products offer OEMs the advantage of adding functionality without the redesign of existing systems. Some of the more innovative products are the Company's intelligent sockets, which add features such as nonvolatility and timekeeping ability; timekeeping circuits, which replace up to 20 discrete components in the IBM PC AT and PS/2-compatible computers; silicon timed circuits, which replace crystal and discrete components and feature-precise, system-signal timing; security products, which protect software from unauthorized use; teleservicing products that provide the capability to perform remote software upgrades and service equipment anywhere in the world over the telephone line; chips that provide the structure for two-way data transmission through the air, resulting in wireless, automatic identification; and a family of modular chip-laden subassemblies that snap into locking connectors for rapid construction of electronic systems.

In August 1984, Dallas purchased Commodore's Texas plant for \$3.5 million. Until early 1987, the Company purchased all wafers and completed its late-definition technique at its plant in Texas. In 1987, Dallas completed construction of a \$10 million wafer fabrication facility adjacent to its headquarters. The facility was expanded in 1988 to increase capacity. It includes a

10,420-square-foot, Class 1 clean room and has the capacity to produce 6-inch CMOS wafers with geometries down to 0.6-micron. Currently, Dallas processes about 90 percent of its wafer needs.

Dallas Semiconductor ships its wafers to assembly contractors in the Philippines and Korea for separation and packaging. It conducts burn-in and final testing on its devices and conducts its own subsystem assembly.

Dallas markets to OEMs in the United States, Canada, Europe, and Asia. The Company uses a direct sales force, worldwide distributors, and authorized manufacturers' representatives.

## BOARD

(Name and Affiliation)

\*C. Vin Prothro, Chairman  
Dallas Semiconductor Corporation

\*John Smith, Jr.  
Dallas Semiconductor Corporation

Chao C. Mai  
Dallas Semiconductor Corporation

M.D. Sampels  
Worsham, Forsythe, Sampels, and Wooldridge

Richard L. King  
Ventech Partners, L.P.

C. Richard Kramlich  
New Enterprises Associates

Carmelo J. Santoro  
Silicon System, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*John Smith, Jr.  
Mostek, Facilities Dir

# Dallas Semiconductor Corporation

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## CEO

\*C. Vin Prothro  
Mostek, President, CEO, Chairman

## VP Mfg

\*Chao Mai  
Mostek, VP R&D

## VP Mktg & Prod

\*Michael Bolan  
Southwest Ent., Mgr Tech Planning  
Development

## VP Sales

Sandy Scherpenberg  
Mostek, Applications Engineer

## Controller

Michael Pate  
Arthur Young & Co., Senior Auditor

\*Founder

## FINANCING

### February 1984

Seed  
\$2.0M  
Abingworth Ltd., New Enterprises Associates,  
Southwest Enterprises Associates; Ventech  
Partners

### June 1984

Round 1  
\$10.8M  
Initial investors; Arscott, Norton & Assoc.;  
Crossroads Capital; First Source Capital Corp.;  
John Hancock Venture Capital Fund LP;  
Merrill, Pickard, Anderson & Eyre; New  
Venture Partners; Oak Investment Partners;  
Republic Venture Group; J.F. Shea &  
Company; Venture Growth Associates

### Industrial Bond

\$6.5M  
Republic Bank, Dallas

### March 1986

Round 2  
\$15.0M  
Previous investors, British Petroleum Ventures,  
Alex Brown & Sons, Emerging Growth Stocks,  
HLM Partners, Merifin N.V.

### April 1987

Round 3  
\$5.0M  
Abingworth Ltd., Alex Brown & Sons, British  
Petroleum Ventures, Emerging Growth Stocks,  
HLM Partners, Merifin N.V., New Enterprise  
Associates, Southwest Enterprises Associates, T.  
Rowe Price, Threshold Fund, Ventech Partners

### September 1987

\$35.1M  
Initial public offering

## RECENT HIGHLIGHTS

### Q1 1987

Dallas began producing wafers in a newly  
constructed, \$10 million wafer fabrication  
facility adjacent to its headquarters.

### February 1987

Dallas offered the DS2167 digital signal  
processor (DSP) said to double the link of  
full-duplex telephone transmission lines. The  
DS2167 combines a DSP with the adaptive  
differential pulse code modulation (ADPCM)  
standard.

### March 1987

Dallas offered the DS5000 8-bit CMOS soft  
MCU, which features nonvolatile technology  
designed to preserve all information in the  
absence of power.

### October 1987

Dallas offered 3.75 million shares of common  
stock at \$9 per share in an initial offering and  
raised \$36 million. The proceeds will be used  
for capital equipment and general corporate  
purposes.

### October 1987

Dallas offered the DS1207 CMOS Timekey  
circuit designed to control access to PC soft-  
ware packages for specified periods of time.

### May 1987

Dallas and Xecom signed a second-source  
agreement covering Xecom's modem products  
and development kits and Dallas' SmartSocket  
and SmartWatch families. The companies will  
also cooperate on developing and manufac-  
turing future modem-related products, the  
area of Xecom's expertise.

# Dallas Semiconductor Corporation

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## August 1987

Dallas and Amp, Inc., formed an R&D partnership to solve applications problems with semiconductor technology.

## December 1987

Dallas filed a suit against Maxim Integrated Products. The suit was in response to warnings by Maxim that Dallas is violating certain receiver/transmitter patents held by Maxim.

## December 1987

Dallas reported fourth-quarter revenue of \$9.8 million and a net income of \$1.5 million for the period ending December 31, 1987. Fiscal 1987 revenue was \$30.7 million and net income was \$2.6 million, which included an extraordinary benefit of \$954,000.

## ALLIANCES

### Thomson-Mostek

January 1986

Thomson-Mostek (TCMC) was given royalty-free rights to second-source Dallas' multiport memory. In exchange for these rights, Dallas received an option to purchase a percentage of the products from Thomson. Dallas also received laser production equipment from Thomson and received technical information on TCMC's MK4501 FIFO.

## PRODUCTS

### SRAMs

16K, 64K, 256K, and 1024K Nonvolatile SRAMs, and a 1024K Serial RAM

### Multiport Memory Chips

512x9, 1024x9, 2048x9, and 4096x9 FIFOs and a quad-port Serial RAM

### Microcontrollers

8-Bit Soft MCUs, 8-Bit Time MCUs, CMOS Microcontrollers, Evaluation Kits, Development Kits

### Linear Telecommunications Circuits

Transceivers, Line Monitor and Line Interfaces, Network Interfaces, ADPCM Processors, Receiver Buffers

### Timekeeping Devices

Clocks, Timekeepers, Clock plus NV SRAMs, Clock plus RAMs

### Intelligent Sockets

Lithium-powered sockets—inserted CMOS RAMs become nonvolatile, some with timekeepers

## Xecom

May 1987

Dallas and Xecom signed a three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families. The companies also agreed on the joint development of and manufacture of future modem-related products, the area of Xecom's expertise.

## Amp

August 1987

Dallas and Amp, Inc., formed an R&D partnership that will develop innovative interconnect techniques.

## MANUFACTURING

### Technology

3.0- to 0.6-micron CMOS  
6-inch wafers

### Facilities

Dallas, TX  
150,000 sq. ft.  
Manufacturing area and a 10,420-square-foot Class 1 clean room  
60,000 sq. ft.  
Warehouse, offices

# Dallas Semiconductor Corporation

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## Silicon Timed Circuits

5-Tap, 10-Tap, 3-in-1, and 7-in-1 Delay Lines

## Security Products

Electronic Security Devices, Encrypted Keys, Time Keys, Electronic Keys

## User-Insertable Memory

Memory Cartridges, Electronic Key Adaptors, Electronic Tags, PC Ports

## Integrated Lithium Battery Backup

Lithium-powered NV controllers, Power Packs, Power Monitors, NVRAM Controllers

## Systems Extensions

RS-232 Transceivers, Serial Ports, BankSwitches, Configurators, Micro Monitors, Micro Managers

## SipStick Prefabs

FIFO, SRAM, DRAM, DAA, ADPCM, SoftModem, and Micro Packaging Options

## Wireless Products

Proximity Key and Tags, Micro Power Receiver/Interpreters, Byte-wide to Serial Converters, RF Communicators, Wireless SipSticks, Starter Kits

## Teleservicing Components

TeleMicro Cartridges, Teleservicing Kits, 212A Modem Modules, Data Access Arrangements, Modem Evaluation Kits

## OTHER INFORMATION

Dallas Semiconductor's PR firm is Simon McGarry.

# Dolphin Integration SA

8, Chemin des Clos-ZIRST  
38240 MEYLAN, France  
33 (76) 41-10-96

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 20

## BACKGROUND

Dolphin Integration SA provides design, marketing, and fabrication subcontracting for selected niche market ICs and related software. The Company was launched as a design center and has developed a set of portable design rules for 2- to 1-micron CMOS technology. Dolphin's design rules adapt to any silicon foundry's process. Dolphin has enlarged its catalog of design rules to include analog technologies using double-poly from 3.0 to 1.5 micron. The Company has also developed signal-processing and protocol ICs.

## BOARD

(Name and Affiliation)

Michael Depeyrot, Chairman  
Dolphin Integration SA, President

Jean Gouliardon  
SAGEM International

Michael Capart  
EPICEA

Bernard Michelon  
SOGINNOVE

Pierre Faurre  
SAGEM, Chairman

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Michael Depeyrot  
Thomson Semiconductors, VP Engr

## PRODUCTS

### Developmental Tools

VAX Network with Three Families  
Tektronix X115, MicroVAX II, and COMPAQ 396  
ECAD Software (ICAP and MASKAP)  
LoF Cell Generator

## OTHER INFORMATION

Dolphin Integration does not employ a PR firm.

## FINANCING

1985

Initial

\$600,000

EPICEA, SAGEM, SOGINNOVE, and  
founders

## ALLIANCES

Dolphin has entered an agreement with a  
CAD/CAM group in California.

## SERVICES

ASIC Design

## MANUFACTURING

### Technology

DIGIT—2.0- to 1.0-micron double-metal CMOS  
DIANA—3.0- to 1.5-micron analog CMOS  
DIXIE—Mixed high-power (BiMOS) and low-  
voltage CMOS

### Facilities

Not available

**The DSP Group Inc.**  
1900 Powell Street, Suite 1120  
Emeryville, CA 94608  
415/655-7311  
Fax: 415/655-7537

**ESTABLISHED: October 1988**

**NO. OF EMPLOYEES: N/A**

## **BACKGROUND**

The DSP Group Inc. was founded in October 1988 to develop technologies for a variety of applications, specializing in digital signal processing. The Company currently offers products in the telecommunications market. The DSP Group develops algorithms using digital signal processing as applied to voice/speech modification and enhancement.

The Company has a variety of technologies that it embeds in general-purpose digital signal processing chips. These chips are sold to OEMs, mostly high-volume consumer product manufacturers. DSP Group technologies, which can be used individually or in combinations, include noise reduction, voice-activated switching, voice compression, echo cancellation, voice recognition, and voice synthesis.

The DSP Group's current and future product offerings reflect these technologies. The Company currently is shipping telephone answering machine chip sets and cellular telephone chip sets. By the end of 1990, the company plans to have dictating equipment chip sets and integrated telephone/facsimile chip sets in volume production.

To date, the DSP Group has raised nearly \$4.5 million in three rounds of financing, provided by private, corporate, and venture capital sources. All manufacturing is subcontracted; design and headquarters operations are located in the Company's Emeryville, California, facility. The DSP Group also has a subsidiary located in Israel.

## **BOARD**

(Name and Affiliation)

Davibi Gilo  
The DSP Group, President

Donald Yost  
Dey Corporation/The DSP Group

Herman Fialkou  
PolyVenture

Shelton Wert  
Investor Group—Minneapolis

## **COMPANY EXECUTIVES** (Position and Name)

**President**  
Davibi Gilo

**VP R&D**  
Shabtai Albersberg

**VP Mktg**  
Don Yost (Acting)

**VP Finance**  
Gibi Bartak

**GM Israel Operations**  
Zvi Slomimski

## **FINANCING**

Round 1  
\$1.2M  
Davibi Gilo

Round 2  
\$750,000  
PolyVenture

Round 3  
\$750,000  
Minneapolis Group

Round 4  
\$1.8M  
Marubun-Japan

## **MANUFACTURING**

### **Technology**

DSP subcontracts all manufacturing.



# **The DSP Group Inc.**

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## **Facilities**

Emeryville, CA

Design, marketing, headquarters

Israel

R&D

## **PRODUCTS**

Telephone Answering Machine Chip Sets

Cellular Telephone Chip Sets

Digitating Equipment Chip Sets

Integrate Telephone/Fax Chip Sets

## **OTHER INFORMATION**

The DSP Group's PR firm is Paul Pease.

# Edsun Laboratories, Inc.

564 Main Street  
Waltham, MA 02154  
617/647-9300

ESTABLISHED: 1984

NO. OF EMPLOYEES: N/A

## BACKGROUND

Edsun Laboratories was formed in 1984 by Steve Edelson. Edsun currently offers memory and modem controller chips as well as a chip used in PC accelerator boards. Edsun's flagship product, however, is the Continual Edge Graphics (CEG) color-palette DAC chip. The Company's mission is to enhance the graphics capability of PCs, workstations, and other display environments dramatically through its patented CEG technology.

Edsun's DAC chip is designed to improve the performance of VGA-based PC graphics dramatically. The Company claims that it will enhance the effective resolution of a 640 x 480-pixel screen to the equivalent of a 2,000 x 2,000-pixel screen. Edsun also claims that the chip will increase the effective number of colors in an 8-bit system from 256 to 700,000. It will smooth jagged PC graphics to the point where they rival those seen on high-resolution monitors used in engineering workstations or CAD/CAM systems. This new chip will allow existing graphics boards to be upgraded without modification or redesign. The circuit achieves high-resolution simulation by determining a shading value for the edge pixel and blending the shades to the new appropriately weighted color, giving the appearance of a perfectly smooth edge.

Edsun subcontracts all fab and assembly operations to outside companies. The Company conducts some test operations in-house. Although Edsun will continue to support its other existing products, the Company will focus on the development of a family of CEG products in the future. The Company plans to eventually offer CEG for PCs, laptops, and workstations.

## BOARD

(Name and Affiliation)

\*Steve Edelson, Chairman  
Edsun Laboratories

Richard Simon

Edsun Laboratories, President

Ted Dintersmith

Aegis Funds, General Partner

Jerry Fishman

Analog Devices, Executive VP

Peter Santeusanlo

Hambro International Ventures Fund

## COMPANY EXECUTIVES

(Position and Name)

**President**

Richard Simon

**VP R&D**

George Heron

\*Founder

## FINANCING

**July 1988**

Amount not available

Hambro International Ventures Fund, Aegis  
Venture Funds

## ALLIANCES

Edsun has licensed its CEG technique to Dubner Computer Systems and Calcomp.

## MANUFACTURING

**Technology**

Not available

**Facilities**

Waltham, MA

10,000 sq. ft.

Design, test, marketing

## **Edsun Laboratories, Inc.**

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### **PRODUCTS**

Edsun Continual-Edge graphics  
Microchannel Memory Controller (EL2010)  
Microchannel Modem Controller (EL2050)  
Accelerator Board Chip (EL286-88)

### **OTHER INFORMATION**

Edsun Laboratories does not employ a PR firm.

**Elantec, Inc.**  
1996 Tarob Court  
Milpitas, CA 95035  
408/945-1323

**ESTABLISHED:** July 1983

**NO. OF EMPLOYEES:** 155

## **BACKGROUND**

Elantec, Inc., designs, manufactures, and markets high-performance analog circuits using dielectric-isolation (DI) monolithic and hybrid technologies. The circuits are designed to be used in military and high-performance commercial applications. The Company supplies products to more than 25 military OEMs.

Elantec concentrates on high-performance analog IC and hybrid solutions and has identified a niche for very high speed operational amplifiers and buffers in video, page scanner, and fast radar systems. Advanced technologies are employed, including dielectric isolation, which allows very high speed npn and pnp transistors in the same chip.

Initially, Elantec offered alternatively sourced products for National Semiconductor's high-performance multichip amplifiers. In 1985, Elantec introduced its first proprietary monolithic IC that uses both dielectric- and junction-isolation processing techniques. Early in 1986, Elantec expanded into alternatively sourced versions of Harris Semiconductor's components that use a complementary bipolar dielectric-isolation process. Harris-sourced devices include op amps and buffers. Elantec also is developing proprietary devices such as a servo loop controller. In the long term, the Company is considering data acquisition circuits.

One of the key strengths of the Company has been its military program. Elantec's facilities have been qualified by more than 25 major military OEMs including General Dynamics, Hughes, IBM, and Lockheed. The Company's facilities comply with MIL-STD-M38510, MIL-STD-1772A, and MIL-STD-883, Revision C. Elantec was the fourth among approximately 20 companies in the world to be certified to produce hybrid devices to MIL-STD-1772A. Elantec also places a great deal of emphasis

on reliability and has adopted a two-for-one guarantee under which a part that fails is replaced with two good devices.

In December 1987, Elantec announced that its wafer fabrication facility in Milpitas, California, is operational. The facility uses its proprietary dielectric-isolation process and is capable of producing 2,000 4-inch wafers per month. Initially, the facility will produce 3-inch wafers. Elantec manufactures all military products onshore, with some commercial assembly done in Southeast Asia.

European operations are managed from London, and Japanese sales are handled by Internix, a Japanese distributor. Marshall, Wyle, and Zeus are signed as North American distributors. Elantec also has regional sales offices in Dallas, Texas, and in Boston, Massachusetts.

## **BOARD**

(Name and Affiliation)

Tom Winter

Burr, Egan, Deleage

George Sarlo

Walden Capital Corporation

Jim Diller

Sierra Semiconductor

David O'Brien

Elantec, Inc.

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

David O'Brien

PMI, President/CEO

### **VP Marketing**

Dean Coleman

National Semiconductor, Analog Mktg Mgr

## Elantec, Inc.

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### VP Operations

Richard Corbin  
PMI, VP Technology

### VP Sales

Ralph Granchelli  
Teledyne Semiconductor, Ntl Sales Mgr

### VP Engineering Design

Barry Siegel  
National Semiconductor, Std Hybrid

## FINANCING

### July 1983

Round 1  
\$2.7M  
Venture capital

### August 1984

Round 2  
\$3.1M  
ALTA-Berkeley Eurofund; Associated Venture Investors; BNP Venture Capital Corporation; Burr, Egan, Deleage & Co.; International Industrial Interests; Murray Electronics; Pacific Technology Ventures; Paribaven; Thorn EMI Venture Fund; Walden Capital Corporation

### August 1985

Round 3  
\$2.5M  
Original investors, Jean Claude Asscher, Paribas Technology, Hytec Investment

### December 1986

Round 4  
\$7.8M  
Capital Riksa Trust, CEI, Cypress Fund, Harvard Management, Morgan-Holland, Sequoia Capital, St. James Venture Capital Fund, U.S. Venture Partners, and others

### September 1988

Round 5  
\$7.3M  
First Century Partners; Merrill Lynch Venture Capital; Inman & Bowman; Sequoia Capital; U.S. Venture Partners; Morgan-Holland; Burr, Egan, Deleage; Walden Associates; Associated Venture Investors; and Harvard Management

## RECENT HIGHLIGHTS

### March 1987

Elantec offered the EL2017J/883B monolithic closed-loop servo controller that features both precision linear and high-current switching modes of operation.

### May 1987

Elantec offered the EL2020, a 50-MHz current-feedback amplifier that is optimized for video and other applications, with gains between -10 and +10.

### September 1987

David O'Brien joined Elantec as president and chief executive officer, and Richard Corbin joined as vice president of operations. Mr. O'Brien replaced Al Vindasius, who left the Company to pursue other interests.

### November 1987

Elantec signed an agreement allowing Micro Power to market Elantec's FET power buffers.

### December 1987

Elantec announced that its wafer fabrication facility is operational.

## ALLIANCES

### Micro Power

November 1987  
Elantec reached a joint agreement under which Micro Power will market Elantec's FET power buffers (expired).

## MANUFACTURING

### Technology

5-micron bipolar  
4-inch wafers

### Facilities

Milpitas, CA  
30,000 total sq. ft.  
Corporate offices and manufacturing  
8,500 sq. ft.  
Class 1,000 clean room

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**PRODUCTS**

<b>Device</b>	<b>Description</b>
EL2003/2033	Video Line Driver
EL2004	350-MHz FET Buffer
EL2005	High-Accuracy Buffer
EL2006	Precision High-Speed FET Amplifier
EL2007	Precision Servo Driver
ED2015	350-MHz Quad PNP
EN2016	300-MHz Quad NPN
EL2017	Servo Controller
EL2018	Fast, High-Voltage Comparator with Latch
EL2019	Fast, High-Voltage Comparator with Master/Slave Flip-Flop
EL2020	50-MHz Current-Mode Feedback Amplifier
EL2022	165-MHz Current-Mode Feedback Amplifier
EL2039/2040	Very High Slew, Wideband Op Amp
EL2190	Wideband, Fast-Settling Op Amp
ELH0002	100mA Current Buffer
ELH0021	1A Power Op Amp
ELH0032	High-Speed FET Op Amp
ELH0033	High-Speed FET Buffer
ELH0041	200mA Power Amp
ELH101	2A Power Op Amp
EDH0006	Current Driver
EDH0008	High-Voltage, High-Current Driver
EHA2500	Precision, High-Slew-Rate Op Amps
EHA2520	Uncompensated, High-Slew-Rate Op Amps
EHA2539	Very High Slew, Wideband Op Amp
EHA2600	Wide-Bandwidth, High-Impedance Op Amp
EHA2620	Wide-Bandwidth, Uncompensated Op Amps
EHA2540	Very High Slew Rate Op Amp
EHA5190	Wideband, Fast-Settling Op Amp
EHOS100	125-MHz Buffer
EHOS200	200-MHz Buffer
EL2031	550-MHz Buffer
EHA2400	4-Channel Programmable Amplifier
EL2021	Monolithic Pin Driver

**OTHER INFORMATION**

Elantec's PR firm is Independent Public Relations Associates.

# Electronic Technology Corporation

Wholly Owned Subsidiary of J-TEC

ISU Research Park

2501 North Loop Drive

Ames, IA 50010-8284

515/296-7000

Fax: 515/296-7001

ESTABLISHED: December 1983

NO. OF EMPLOYEES: 14

## BACKGROUND

Electronic Technology Corp. (ETC) provides linear and digital design with an emphasis on linear products. The Company also provides complete fabrication, packaging, and test services and guarantees that production units will be 100 percent compatible with prototypes.

ETC was funded initially by a midwestern consortium of venture organizations. ETC's primary customer base is in the midwestern corridor (extending from the eastern slopes of the Rockies to the Ohio Valley). The Company plans to become the midwest's major supplier and has a close working relationship with the Micro Electronics Research Center at Iowa State University in Ames.

ETC has agreements for foundry services with Exar and Gould Semiconductor. In October 1985, the Company signed an agreement with NCR to establish design centers for cell-based ICs.

## BOARD

(Name and Affiliation)

Theodore Johnson, Chairman  
J-TEC, President

Len A. van der Have  
Electronic Technology Corporation

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Len A. van der Have  
Datalinear, VP Marketing

### Dir Technology

William A. Burkland  
Micro Electronics Research Center, Associate  
Scientist

### Dir Operations

Scott P. Yeager  
NCR, Field Service Engineer

### Dir Quality Assurance

Barbi Jo Cosgrove  
Bournes, Inc., Quality Assurance Eng

### Fin Mgr

Lynn A. Sackett  
Clyde Industries, Accountant

## FINANCING

1983

Initial

\$2.0M

State and venture capital

## ALLIANCES

### Exar

December 1983

Exar provides foundry services for ETC.

### AMI

1984

ETC and AMI signed agreements covering 3.0- and 5.0-micron, single-layer metal CMOS gate arrays. AMI provides foundry services.

### NCR

October 1985

ETC agreed with NCR to establish design centers for standard cell ICs and to design standard cells for NCR (expired).

# Electronic Technology Corporation

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## U.S. Government

March 1989

Prime contractor—federal government contract

## SERVICES

Custom Design  
Manufacturing  
Packaging  
Test  
Military Standard Testing

## PRODUCTS

Industry-Standard (20V) Array with 11 Arrays  
High-Voltage (75V) Array with 1 Array  
BiFET (36V) Arrays with 3 Arrays  
Cellular (20V) Array with 1 Array  
2.0-micron Bipolar Digital  
5.0-micron Cell Custom Linear Digital/Bipolar  
1.25 to 9.0-micron CMOS Digital  
8.0-micron PMOS

## OTHER INFORMATION

ETC does not employ a PR firm.

## MANUFACTURING

### Technology

2.0-, 5.0- and 9.5-micron CMOS  
Bipolar

### Facilities

Ames, IA  
7,850 sq. ft.  
Total space  
500 sq. ft.  
Class 100 clean room



## Epitaxx Inc.

3490 U.S. Route One  
Princeton, NJ 08540  
609/452-1188  
Fax: 609/452-0824

ESTABLISHED: 1984

NO. OF EMPLOYEES: 50

### BACKGROUND

Epitaxx Inc. produces indium gallium arsenide phosphide (InGaAsP) light-emitting diodes, lasers, and photodetectors for fiber-optic and infrared instrumentation applications. The Company also supplies InGaAsP using a proprietary crystal growth technique called vapor phase epitaxy (VPE), which allows the elements to be deposited from gases. Custom services include 2,000 and 2,500nm photodiodes, detector arrays, and pulsed laser diodes. Epitaxx sells its components to telecommunications vendors, such as GTE and ITT, and to fiber-optic companies such as Fibercom and Plantronics Wilcom.

In order to expand its products, Epitaxx conducts R&D sponsored by industry and the government. The following are some of the Company's development activities:

- InGaAs linear arrays for use in spectroscopy and imaging and airborne communication
- Extended-range sources and detectors for optical sensors and transoceanic communications applications
- InGaAs avalanche photodiodes for optical communications and sensors, range finding, and instrumentation applications
- 5mm InGaAs visible response (500 to 1,700nm) detectors for optical test and calibration and temperature sensors

The Company was founded by Dr. Gregory Olsen and Dr. Vladimir Ban, former research scientists at the RCA David Sarnoff Research Laboratories in Princeton, New Jersey. The founders developed the VPE applications while employed there.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Dr. Gregory Olsen  
RCA, Scientist

#### Exec VP

\*Dr. Vladimir Ban  
RCA, Scientist

#### Marketing VP

Yves Dzialowski  
General Optronics, Foreign Sales Manager

#### Finance VP

James Coleman  
Lenox China, Account Exec

\*Founder

### FINANCING

March 1984

Round 1

\$1.5M

DSV Partners, Warburg Pincus

### RECENT HIGHLIGHTS

February 1988

Epitaxx announced that the Company was selected by the NASA Goddard Space Flight Center for a Phase-II Small Business Innovative Research (SBIR) contract to develop large-area InGaAs photodetectors for the 500 to 1,700nm spectral range.

## Epitaxx Inc.

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### March 1988

Epitaxx announced that the Company was awarded a \$50,000, Phase-I SBIR contract by NASA's Goddard Space Flight Center to develop a linear array of InGaAs detectors. The array will have a minimum of 32 elements (30 x 30 microns each) and will be installed in a commercial multiplexer readout. Epitaxx plans to apply for a Phase-II program based on linear arrays of InGaAs detectors that are sensitive over the 0.8- through 2.2-micron spectral range.

- Large-area (0.5 to 3.0mm) InGaAs detectors for gyroscopes, gas sensors, space photography, SWIR detection, and fiber-optic test instrumentation
- High-speed, small-area, planar InGaAs PIN photodiodes for light-wave and range-finding receivers

### April 1988

Epitaxx exhibited the following infrared components at CLEO '88:

- Edge-emitting LEDs (1,300 and 1,550nm) in a low-cost pigtailed package for local communication and optical instrumentation

### ALLIANCES

Not available

### MANUFACTURING

#### Technology

InGaAs

### PRODUCTS

Device	Description
Epitaxx 1300 ETX60B	High-Power LEDs, 1,550 and 1,300nm PIN InGaAs Photodetector, Low Capacitance and High Speed, 1,300 and 1,550nm
ETX75/100/300 ETX75F/100F	InGaAs PIN Photodetectors, 900 to 1,700nm, with High Responsivity InGaAs Fibered Photodetectors with Low Dark Current and Capacitance, 1,300 and 1,550nm
ETX500/1000/2000	InGaAs Photodetectors, for Low Noise Measurements of Long Wavelengths (900 to 1,700nm)
ETX3000	Large-Area (3mm) InGaAs Photodetector for Low Noise Detection in the 0.8- to 1.7-Micron Spectral Range
ETX2550 ETX-Array	InGaAs 2.5-micron 256 element InGaAs Detector Array

### OTHER INFORMATION

Epitaxx does not employ a PR firm.

# European Silicon Structures

Headquarters  
Industriestraße 17  
8034 Germering, West Germany  
089/8 49 39 0  
Telex: 089/8 49 39 20

Hollybank House  
Mount Lane  
Bracknell, Berkshire  
England  
0344/525252  
Fax: 0344/59412

72-78 Grande Rue  
92310 Sevres, France  
01/46264495  
Fax: 01/45071423

ESTABLISHED: September 1985

NO. OF EMPLOYEES: 150

## BACKGROUND

European Silicon Structures (ES2) was formed to design, develop, and offer quick-turn silicon prototyping and low-volume production (less than 50,000 units) of application-specific ICs for the European marketplace. The Company's objectives are to make ASIC design and production capability available to European systems manufacturers, generate a CAD product line, and offer fast turnaround with the use of e-beam technology.

The Company's Solo 1000 is based on Lattice Logic's ChipSmith system, and the Solo 2000 is based on the SDA Systems family of integrated CAD tools. Solo 1000 enables designers to produce full-custom and optimized designs and is available on PC AT-based hardware and UNIX-based workstations. Solo 2000 incorporates compiled macro blocks, which include RAM, ROM, PLA, ALU, and others. The Company's capability includes PLDs, optimized arrays, cell-based ICs, and handcrafted custom devices and circuits that will meet MIL-STD-38510 Class-B compliance.

In January 1987, ES2 introduced the ECDM20 CMOS, a process demonstrating subnanosecond gate delay performance. The n-well process features 5V digital CMOS; an epitaxial substrate for high latch-up immunity; and single-poly, two-layer metal using 10 masking steps. All processing is conducted using Perkin-Elmer Aeble 150 e-beam lithography equipment that is now operational.

ES2 is incorporated in Luxembourg and headquartered in Munich, West Germany. ES2's design automation technology is being developed by its software technology division located in Bracknell, England. The Company's manufacturing technology division is responsible for silicon manufacturing, which is conducted in Rousset, France, near Aix-en-Provence.

In November 1987, ES2 was granted a loan of \$9 million by the Banque International and the European Investment Bank. The funds are being used to build ES2's production plant, called the Rousset Technology Center, at Rousset in southern France. The four-year loan is part of a larger financing package that could total \$18 million. The manufacturing division also operates the Aeble 150 machine at the Exel Microelectronics plant in San Jose, California.

In 1987, ES2 acquired Lattice Logic and turned the Silicon Valley design arm of Lattice Logic into an ES2 design center named United Silicon Structures that serves the United States. Also in late 1987, ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

Through its own R&D and in conjunction with industrial partners and universities, ES2 is developing proprietary silicon compilation tools and is working to establish a set of standards for the European market.

# European Silicon Structures

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## BOARD

(Name and Affiliation)

Robert Wilmot, Cochairman  
Wilmot Enterprises

Robert Heikes, Cochairman  
Entrepreneur

Jean-Luc Grand-Clement  
European Silicon Structures, CEO

Pierre Lesieur  
European Silicon Structures, VP Finance

Viscount Etienne Davignon  
Societe Generale de Belgique, Director

Albert Kloezen  
EuroVenture, Benelux, Managing Director

Elserino Piol  
Ing. C. Olivetti & Co., Executive Vice President

Klaus Volkholz  
Philips International BV, Director of Corporate  
Planning

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

CEO/Mng Dir  
Jean-Luc Grand-Clement  
Motorola, VP Europe Group

VP Fin/Admin  
Pierre Lesieur  
Motorola, Dir Finance

VP/Dir Ops  
Rod Attwooll  
TI, Mng Dir Bedford

VP/Mfg  
Bernard Pruniaux  
Thomson CSF, Dir Opns

VP/Dir S/W Tech  
John Gray  
Lattice Logic, Founder/Mng Dir

VP/Dir S. Europe  
J.P. Demange  
National Semiconductor, Dir Strat Mktg

VP/Dir Central Europe  
H.P. Friedrich  
N/A, Mng Dir

## Wfr Fab Mgr

Francis Courreges  
Sierra Semiconductor, Prod Eng Mgr

## Dir Technology

Eric Demoulin  
Thomson-CSF, Dir MOS Tech

## FINANCING

### 1985

\$5.0M

Advent, London; Techno-Venture Mgmt. Corp.

### December 1985

\$25.0M

Brown-Boveri and CIE (Switzerland), Ing.  
C. Olivetti & Co. (Italy), N.V. Philips (the  
Netherlands), Saab-Scandia AB (Sweden)

### January 1986

\$5.0M

British Aerospace

### November 1986

\$9.0M

Banque International a Luxembourg; European  
Investment Bank

## ALLIANCES

### Lattice Logic

1985

ES2 signed an agreement with Lattice Logic  
to market Lattice's logic compiler in Europe.

1987

ES2 acquired Lattice Logic. ES2 had been  
marketing Lattice Logic's compilers in Europe  
since 1985.

### British Aerospace

January 1986

British Aerospace invested \$5 million in ES2.

### SDA Systems

January 1986

ES2 signed an agreement to market SDA  
Systems' design systems throughout Europe  
and to use them in a number of planned  
design centers.

## Philips-Elcoma/Texas Instruments

May 1986

ES2, Philips-Elcoma, and Texas Instruments (TI) agreed to cooperate on the SystemCell standard cell library.

February 1987

ES2, Philips, and TI signed an agreement covering manufacturing of the SystemCell. TI and Philips would supply volume parts; ES2 would provide prototypes and low-volume quantities.

## Philips

February 1988

ES2 and Philips announced an agreement that ensures rapid prototyping and high volumes of ASICs for customers worldwide implemented in Philips' standard 1.5 $\mu$  dual-layer metal CMOS process.

## Mitsui & Co.

October 1987

ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

## United Silicon Structures

January 1988

ES2 established US2, a U.S. partner.

## SERVICES

Quick-turn ASIC prototyping  
Low-volume production

## MANUFACTURING

### Technology

2.0-micron, double-metal CMOS  
1.25-micron, double-metal (1988)  
E-beam on 5-inch wafers

### Facilities

Munich, West Germany  
Headquarters

Bracknell, England  
11,800 sq. ft.  
Software products

Rousset, France  
16,147 sq. ft.  
Manufacturing, assembly, test  
8,600 sq. ft.  
Fab area

## PRODUCTS

### Development Tools

Device	Description
Solo 1000	A Low-Cost Development System with up to 5,000 Gates: Schematic Capture, Simulation, Layout, Back Annotation
Solo 2000	Advanced Software, Full-Custom Modules for ASICs with up to 150,000 Transistors: Structure Compiler, 250 Cells, Module Generators, Test Analyzer, Simulation, Automatic Place and Route

## OTHER INFORMATION

ES2's PR firm is Bood and Partners.

# Exel Microelectronics Inc.

2150 Commerce Drive

San Jose, CA 95131

408/432-0500

Fax: 408/432-8710

ESTABLISHED: February 1983

NO. OF EMPLOYEES: 280

## BACKGROUND

Exel Microelectronics Inc. designs, develops, and manufactures nonvolatile memory and microcomponent devices for the EDP, industrial controls, automotive, telecommunications, military, and robotics markets.

The Company leveraged its proprietary EEPROM expertise into a broad base of EE technology-based, high-performance, low-power products including bipolar PROM replacements, UV-EPROM replacements, and PLDs. Exel was the first to offer high-density, 55ns CMOS, 16K EEPROMs and was one of the first to move into 6-inch wafer production. In the long term, Exel plans to develop microcomponent products with on-chip EEPROM memory.

In February 1986, Exel Microelectronics was acquired by Exar Integrated Circuits for \$5.5 million. In August 1988, Rohm Co., Ltd., acquired 81 percent of Exel from Exar. Exel now is an operating unit of Rohm.

## BOARD

Kozo Sato, Chairman of the Board  
Kenichiro (Ken) Sato  
Yoshiaki Odani  
Takashi (Todd) Kobayashi  
Edwin M.W. Chow

## COMPANY EXECUTIVES

(Position and Name)

**President/Secretary**  
Takashi Kobayashi

**Vice President**  
Edwin M.W. Chow

**CFO**  
Shigeru (Fred) Sasa

## FINANCING

**February 1983**

Initial

\$1.0M

Sirjan L. Tandon

**July 1983**

Round 1

\$5.5M

Private Placement

Round 1

\$5.5M

Lease Line

**September 1984**

Round 2

\$10.5M

BancBoston Ventures; Bay Partners; CH Partners; Chase Manhattan; Crown Advisors, Ltd.; Hambrecht & Quist; Horsley Keogh & Assoc.; Hutton Venture; IBM Retirement Fund; Montgomery Securities; Orange Nassau; Paribas Technology; Prudential-Bache; Riordan Venture Mgmt; Rothschild, Unterberg & Towbin Ventures; J.F. Shea & Co.; TA Assoc.; 3i Ventures

**August 1985**

\$13.5M

Cable, Howse, & Cozadd; Hambrecht & Quist; Horsley Keogh & Assoc.; TA Associates

**February 1986**

\$5.5M

Acquired by Exar Corporation

**August 1988**

\$40.0M

Rohm acquired 81 percent of Exel

**June 1989**

\$6.5M

Remaining 19 percent of Exel acquired by Rohm.

# Exel Microelectronics Inc.

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## RECENT HIGHLIGHTS

### February 1986

Exar completed its \$5 million acquisition of Exel.

### October 1987

Exel's Class 10 CMOS fabrication facility met MIL-STD-883C specifications. The first devices to be compliant with this specification are the XL2864B 8Kx8 EEPROM and the XL78C800 EPLD.

### November 1987

Exel offered the XL46HC64, a CMOS 64K EEPROM with a 35ns access time. The device can be erased in 10 milliseconds and reprogrammed and retested at least 10,000 times.

## ALLIANCES

### Samsung Semiconductor

1983

Samsung entered into a joint development project to act as a second source for Exel's forthcoming 16K EEPROMs (expired).

May 1985

The prior Samsung agreement was extended to include second-sourcing for 64K EEPROMs.

## PRODUCTS

### EEPROM

Device	Organization	Process	Delay (ns)
XL2804A	512x8	NMOS	250
XL2816A	2Kx8	NMOS	250
XL2817A	2Kx8	NMOS	200
XL2864A	8Kx8	NMOS	200
XL2865A	8Kx8	NMOS	200

### CMOS PROM

XL46C15	2Kx8	CMOS	55
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### Programmable Logic Device

78C800	CMOS ERASIC Family, 600 to 800 Gates
XL93C46	1K Serial CMOS EEPROM
XL26008	PLD development system (ERASIC family)
XL26002	PLD software—MultiMap/MultiSim

## OTHER INFORMATION

Exel does not employ a PR firm.

### Paribas Technology

September 1984

Paribas took part in second-round financing.

### Oki Electric

March 1985

Oki is a second source for Exel's 2Kx8 NMOS EEPROM and produces 64K EEPROMs.

### Exar

February 1986

Exar completed its \$5.5 million acquisition of Exel.

## MANUFACTURING

### Technology

NMOSE2	2.0-micron design rules
CMOSE2	1.5-micron design rules
EXCMOS3	1.5-micron, dual-metal
5-inch wafers	

### Facilities

San Jose, CA	62,500 sq. ft.
	12,000 sq. ft.
	Class 10 clean room

# Gazelle Microcircuits, Inc.

2300 Owen Street  
Santa Clara, CA 95054  
408/982-0900  
Fax: 408/982-0222

ESTABLISHED: June 1986

NO. OF EMPLOYEES: 53

## BACKGROUND

Gazelle Microcircuits, Inc., was founded to design and market high-performance, digital LSI and VLSI GaAs ICs for high-volume commercial applications such as computation, communication, and military/aerospace. The Company is concentrating on product design and marketing development and does not plan to invest in a wafer fabrication facility.

Gazelle's product strategy is to offer high-yielding, low-cost circuits of large-scale complexity, using existing GaAs fabrication processes. The Company will concentrate on developing unique circuit design approaches to differentiate its performance-oriented devices.

The Company was formed by ex-GigaBit Logic executives Andrew Graham and David MacMillan. In January 1987, Jerry Crowley left Oki Semiconductor, where he was vice chairman and founder, to head Gazelle. In March 1988, Thomas Andrade joined Gazelle as vice president of technology from Pacific Monolithics where he was manager of semiconductor development. Mr. Andrade is responsible for identifying and qualifying the foundries and processes used to fabricate Gazelle's circuits. Before joining Pacific Monolithics, he developed the first of Avantek's microwave IC process and transferred it into volume manufacturing. He was a member of the research staff at IBM, where he did basic research on GaAs fabrication processes and materials. He also did work on NMOS processes, much of which was funneled into the VHSIC project.

In February 1988, Gazelle moved into its new 22,000-square-foot headquarters in Santa Clara, California. The facility is used for engineering development, circuit design, product evaluation, and marketing operations. Gazelle also has an option on an adjoining 24,000-square-foot space.

Gazelle has signed pacts with several U.S. manufacturers to supply GaAs wafers to the firms and plans to offer TTL-replacement devices in 1988.

## BOARD

(Name and Affiliation)

Jerry R. Crowley, Chairman  
Gazelle Microcircuits, Inc., President/CEO  
\*David MacMillan  
Gazelle Microcircuits, Inc., Vice President  
E. Floyd Kvamme  
Kleiner, Perkins, Caufield & Byers, General Partner  
Philip Young  
Dillon Read—Concord Partners, Managing Director  
David Hathaway  
Venrock Associates, General Partner  
Steve Sharp  
Power Integrations, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Jerry Crowley  
Oki Semiconductor, Vice Chairman

### VP Marketing

David MacMillan  
GigaBit Logic, Product Manager

### VP Engineering

\*Andrew Graham  
GigaBit Logic, Dir of Memory Development

### VP Technology

Thomas Andrade  
Pacific Monolithics, Mgr Semi Dev

### VP Sales

John Randall  
Signetics, Dir Sales



# Gazelle Microcircuits, Inc.

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**VP Operations**  
George Schneer  
Intel, VP Operations

\*Founder

## FINANCING

**August 1986**  
Seed  
\$0.9M  
Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers

**April 1987**  
Round 1  
\$5.5M  
Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates

**August 1987**  
Lease Line  
\$1.5M  
Comdisco, Ventures

**April 1988**  
Lease Line  
\$2.5M  
Comdisco Ventures

## PRODUCTS

Part No.	Description
GA22VP10-7 GA22VP10-10	24-Pin PLD Superset with Improved Output Macrocells
GA22V10-7 GA22V10-10	24-Pin PLD Superset with Output Macrocells
GA23S8-7 GA23S8-10	20-Pin-Based Sequencer with Output Macrocells and six Buried Registers

## OTHER INFORMATION

Gazelle's PR firm is Franson and Associates, Inc.

**September 1988**  
Round 2  
\$6.8M

Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates; Harvard Management Co. Inc.; JAFCO Ltd.

## ALLIANCES

**TriQuint**  
September 1988  
Gazelle Microcircuits announced a two-year, \$16.9 million gallium arsenide manufacturing contract with TriQuint Semiconductor, Inc., a subsidiary of Textronix.

## MANUFACTURING

### Technology

GaAs

### Facilities

Santa Clara, CA  
22,000 sq. ft.

Headquarters, engineering, design

The Company also has an option on an adjoining 24,000 square feet of space.

# Genesis Microchip Inc.

2900 John Street  
Markham, Ontario, Canada  
L3R 5G3  
416/470-2742  
Fax: 416/470-2447

ESTABLISHED: January 1987

NO. OF EMPLOYEES: 15

## BACKGROUND

Genesis Microchip Inc. was formed to be a supplier of design services, prototyping, and low-volume quantities of ASICs to the central North American market. Genesis offers gate array, cell-based ICs as well as full-custom design services. Products target the telecommunications, military, and industrial applications markets.

Initially, the Company operates as a Canadian design center for National Semiconductor's CMOS ASIC products under an agreement signed in October 1987. The agreement includes National's gate arrays and cell-based libraries, as well as the full range of design tools. National provides prototyping, volume manufacturing, and assembly and test of all CMOS ASIC devices designed by Genesis, using National's 2.0- and 1.5-micron technologies. National also provides manufacturing for Genesis customers that design custom cells not included in the National libraries.

## BOARD

(Name and Affiliation)

W.L. Stapleton, Chairman  
Corporate Systems Strategies Ltd.

\*Paul M. Russo  
Genesis Microchip Inc., President/CEO

\*William H. White  
Genesis Microchip Inc., Vice President

Jean-Claude Bonhomme  
Investor

Marvin J. Singer  
Armstrong, Schiralli & Dunne

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO  
Paul M. Russo  
GE, General Manager-MEC

Exec VP  
William H. White  
Harris Semi, Dir Engr Dig Prod

Comptroller  
Peter W. Hawley  
Consultant

\*Founder

## FINANCING

August 1987  
Round 1  
Undisclosed  
Private investors

November 1987  
Round 2  
Undisclosed  
Private investors

April 1988  
Round 3  
Undisclosed  
Private investors

## ALLIANCES

National  
October 1987  
National Semiconductor and Genesis signed a design center agreement that covers National's gate array and cell-based libraries and design tools. National provides prototyping and production for CMOS ASICs designed by Genesis using National's 2.0- and 1.5-micron technologies. Genesis operates as National's Canadian design center.

## Genesis Microchip Inc.

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### SERVICES

Design  
ASIC prototyping  
Low-volume production

Class 10 clean room. The facility will have the capacity for processing 1.5- and 1.0-micron CMOS double-level metal ASICs on 6-inch wafers. The facility will be optimized for quick-turn, low-volume manufacturing and will support MIL-STD-883 conformance.

### MANUFACTURING

#### Technology

2.0- and 1.5-micron CMOS

Markham, Ontario

4,000 sq. ft.

Administration and design

#### Facilities

Genesis plans to build a 100,000-square-foot Canadian fabrication facility that features a

Hull, Quebec

2,000 sq. ft.

Sales, design

### PRODUCTS

Genesis offers the full range of National's CMOS gate array (2.0-, 1.5-, and 1.0-micron) and cell-based (2.0-micron) families, including analog, RAM/ROM, EEPROM, and MCU cells. In addition, Genesis can design special cells and full-custom ICs as customer-owned tooling designs for manufacture by National Semiconductor.

### OTHER INFORMATION

Genesis Microchip does not employ a PR firm.

**GigaBit Logic, Inc.**  
1908 Oak Terrace Lane  
Newbury Park, CA 91320  
805/499-0610  
Fax: 805/499-2751  
Telex: 6711358

**ESTABLISHED: August 1981**

**NO. OF EMPLOYEES: 120**

## **BACKGROUND**

GigaBit Logic (GBL) designs, develops, manufactures, and markets GaAs standard and application-specific digital ICs capable of 1-GHz to 5-GHz operation. GBL was founded in 1981 by Fred A. Blum and Richard C. Eden. GBL's goal is to be the leader in the commercial digital GaAs IC market, and the company is targeting product segments in the military, mainframe computers, RF communication and instrumentation, and test equipment markets. GBL's strategy is to penetrate high-performance equipment markets by offering products that are five to ten times faster than silicon for comparable prices. GigaBit's sales goal for 1990 is \$50 million.

GBL uses sales representatives, distributors, and a direct sales force to sell its products worldwide. Currently, GBL has sales representatives nationwide and franchised distributors in Japan, West Germany, Italy, France, the United Kingdom, Israel, Canada, Sweden, Denmark, Taiwan, Australia/New Zealand, and South Korea.

## **BOARD**

(Name and Affiliation)

John D. Heightley, Chairman  
GigaBit Logic, Inc., President, CEO  
Heinrich F. Krabbe  
Analog Devices, Inc.  
Richard C. Eden  
GigaBit Logic, Inc.  
David B. Jones  
Interven Partners, Inc.  
Lawrence T. Sullivan  
Analog Devices, Inc.

Mark C. Masur  
O'Donnel & Masur  
Greg Barnum  
Cray Research  
Ole Steen Anderson  
NKT (Denmark)  
Chris C. Ellison  
DFC of New Zealand

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President/CEO**  
John D. Heightley  
Inmos, President

**VP R&D**  
Richard C. Eden  
Rockwell, Principal Scientist

**VP Prod Dev**  
Frank S. Lee  
Rockwell, Design Engr Mktg

**VP Sales**  
James Brye  
Vitesse, VP-Marketing/Sales

**VP Marketing**  
Mike Pawlik  
Fairchild, Marketing Mgr

**VP Finance**  
Spencer Brown  
CR Technology, VP-Finance/CEO

**VP Mfg**  
Bryant M. Welch  
Rockwell, Mgr GaAs Technology

# GigaBit Logic, Inc.

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## FINANCING

### March 1982

#### Seed

\$1.0M

First Interstate Capital Corp., Riordan Venture Group, Wood River Capital

### November 1982

#### Round 1

\$8.1M

Analog Devices Enterprises, First Interstate Capital Corp., and others

### December 1983

#### R&D Partnership

\$6.1M

Kidder, Peabody & Company

### February 1985

#### Round 2

\$12.1M

Analog Devices Enterprises, GE Venture Corp., Interfirst Venture Corp., First Interstate Capital Corp., Standard Oil Co., Union Venture Corp.

### April 1987

#### Recapitalization

\$14.9M

Analog Devices Enterprises, Cray Research, Digital Equipment Corp., DFC New Zealand, FAIC Capital, Fairfield Equity, First Interstate Capital Corp., GE Venture Corp., Hanover Capital, Interfirst Venture, Interven Partners, New Enterprises Associates, Riordan Venture Group

### September 1988

#### Round 3

\$4.1M

Analog Devices Enterprises, DFC New Zealand, Interven Partners, Republic Venture, New Enterprises Associates, Union Venture Corp, Riordan, NKT (Denmark), Canaan Venture, Courtland Investment

## RECENT HIGHLIGHTS

### January 1987

GBL named its president and CEO, John Heightley, chairman of the board. Mr. Heightley takes over the chairman's post from Heinrich Krabbe, who remains a

director. Mr. Krabbe is vice president of new business development for Analog Devices, an investor in GBL.

### January 1987

Cray Research placed a \$3.2 million foundry order.

### April 1987

GBL completed a private placement of convertible preferred stock and raised \$14.9 million. The funds were used to recapitalize the company.

### April 1987

GBL, Seattle Silicon, and Washington Technology Center (WTC) announced that a joint design project resulted in the fabrication of a functional GaAs IC design that is compiler based (see "Alliances").

### May 1987

GBL announced that Cray Research increased its January 1987 foundry order from \$3.2 million to \$5.5 million. Cray will use the logic and memory devices procured under this order to enter the next phase of development of a GaAs-based parallel processor supercomputer.

### July 1987

Prisma Corp., a manufacturer of high-speed computers, is planning to build a GaAs-based, 32-bit, real-time computer using GigaBit's logic devices and other ECL-based memory. The machine will incorporate RISC, will implement Ada language, and will offer performance in the 100- to 200-mips range. The first machine is expected to be shipped by the end of 1989. Future systems are expected to use FORTRAN, C, and Lisp. Prisma is a spin-off from Cray Research and is capitalizing on Cray's research into implementing computers with GaAs.

### October 1987

Tachonics and GBL agreed mutually to second-source GaAs standard and ASIC ICs and to codevelop cell libraries to support future GaAs technologies (see "Alliances").

### October 1987

GBL achieved profitability.

### January 1988

Cray placed a \$6.8 million foundry order.

## September 1988

GBL and NKT (Denmark) initiated a joint venture—named GIGA—to serve the Europe and Israel markets for ICs (see “Alliances”).

## November 1988

Cray placed a \$29.3 million foundry order.

## December 1988

GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo, Japan—signed a marketing and product development agreement. Under the pact, GigaBit Logic will market SC Hightech's GaAs IC products throughout the world, excluding Japan. The agreement also provides the opportunity for codevelopment of future generations of GaAs ICs to the two companies. In addition, SC Hightech may provide foundry services for certain high-volume segments of GigaBit Logic's standard product line.

## ALLIANCES

### Kidder, Peabody & Company

December 1983

GBL and Kidder, Peabody & Company formed a research and development partnership to develop four ultrahigh-speed GaAs SRAMs.

### Cray Research

April 1987

Cray Research is a contributor in the \$14.4 million recapitalization of GigaBit Logic. In return, GBL will provide foundry services

for Cray in its development of a GaAs-based parallel processor supercomputer, the CRAY-3.

### Seattle Silicon, Washington Technology Center April 1987

GBL, Seattle Silicon, and the Washington Technology Center (WTC) announced that their joint design project had resulted in the fabrication of a functional GaAs IC design based on GBL's cell library; Seattle Silicon's compiler; and WTC's design, engineering support, packaging, and test.

### Tachonics

October 1987

GBL and Tachonics agreed mutually to second-source GaAs standard ASIC ICs. GBL also will transfer databases, schematics, and test specs of the PicoLogic cell-based families to Tachonics. The companies will codevelop cell libraries to support future GaAs technologies.

### NKT (Denmark)

September 1988

GBL and NKT initiated a joint venture (GIGA) to serve the Europe and Israel markets for ICs. GIGA will provide a full-support design center and management for GigaBit's distributor network for standard products in Europe. This alliance makes GBL the first U.S. GaAs company to have full ASIC development capability based in Europe.

### SC Hightech Corporation

December 1988

GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo—Japan, signed a marketing and product development agreement.

## PRODUCTS

### PicoLogic Digital and Analog GaAs ICs

#### Gates

Two and three Input NORs, two Input XOR/XNOR/Line Receivers, Dual AO/AOI

#### Drivers/Receivers/Comparators

2:1 Multiplexed Fanout Buffer, 1:4 Fanout Buffer Complementary Driver/Comparator

#### Flip-Flops and Registers

Dual-Precision D Flip-Flop, Quad D Flip-Flops with 2:1 MUXed or XOR Inputs, Octal Register/Shift Register and PN Code Generator

## **GigaBit Logic, Inc.**

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### **MUX/DEMUX/Crosspoint**

Quad 2:1 MUX, 3:8 or Dual 2:4 Decoder/DEMUX, Quad 4:1 or Dual 8:1 MUX, 8x8x1 Expandable Crosspoint Switch, 16x16x1 Crosspoint Switch

### **Counters/Prescalers**

2- and 7-Stage Ripple Counter/Dividers, 4-Bit Synchronous Programmable Counter, Variable Modulus Divider

### **Arithmetic Operations**

Dual 9-Bit Parity Generator/Checker and 8-Bit Equivalence Checker, High-Speed 4-Bit Adder, Carry Lookahead Generator, 32-Bit DDS Phase Accumulator

### **Monolithic FET and Diode Arrays**

15 mA Schottky Diode Array, Single Gate MESFET Array, Dual Gate MESFET Array

### **Fiber Communications Products**

8:1 Time Division MUX, 8:1 Time Division DEMUX, Clock and Data Recovery Circuit, Low Power Clock and Data Recovery, 16G040 Demo Board, Transimpedance Amplifier, Laser Driver, LED Driver

### **Analog/ATE/Instrumentation Products**

Phase/Frequency Comparator, Dual High-Speed Pin Driver

### **NANORAM and NANOROM Memory**

256x4-Bit Registered, Self-Timed Static RAM, 1,024x4-Bit Latched Self-Timed Static RAM, 512x8-Bit Mask Programmable ROM

### **ASIC Products**

SC5000 Standard Cell Library  
SC10000 Standard Cell Library  
GaAs Foundry Services

### **Prototyping and Support**

Evaluation Boards for Transimpedance Amplifiers, Laser Drivers, and LED Drivers, Universal Prototyping Boards (for 36-, 40-, and 68-pin packages), High-Speed Sockets (for 40- and 68-pin leadless chip carriers)

## **OTHER INFORMATION**

GigaBit Logic does not employ a PR firm.

# Harris Microwave Semiconductor, Inc.

1530 McCarthy Blvd.  
Milpitas, CA 95035  
408/433-2222  
Fax: 408/432-3268

ESTABLISHED: June 1980

NO. OF EMPLOYEES: 65

## BACKGROUND

Harris Microwave Semiconductor (HMS), Inc., was formed to develop and manufacture GaAs-based FETs, MMICs, and digital ICs. In addition to offering standard products, the Company offers full and semicustom capabilities and provides foundry services. HMS is a vertically integrated operation of Harris Corporation's Semiconductor Sector. One hundred percent of the Company's funding has been provided by the Harris Corporation.

The Company has capabilities for manufacturing GaAs crystals and wafers as well as ICs, packaged products, and discrete devices. HMS is said to have the world's largest high-purity GaAs ingot-growing capacity, which produces single-crystal GaAs ingots of up to 7 inches in diameter.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

**President/Chief Executive Officer**  
John T. Hartley

**Vice President/General Manager**  
Dr. Joseph Barrera

**Marketing and Sales Director**  
Vic Kovacevic

## FINANCING

Not available

## RECENT HIGHLIGHTS

### July 1987

HMS offered the HMM-10610, a dual-stage, 2- to 6-GHz, 0.5-micron, medium-power monolithic amplifier in die form.

### February 1988

HMS introduced the HMM-10620, a 2- to 6-GHz low-current, cascadable, broadband MMIC amplifier designed to meet the electronic warfare systems' low-current requirements.

### May 1988

HMS introduced the HMM-11810, a 6- to 18-GHz low-current, cascadable broadband MMIC amplifier designed to meet the low current requirements of electronic warfare systems.

### June 1989

HMS introduced the HMR-1100, a GaAs MMIC Pi Attenuator. The MMIC is a practical solution for slope and gain control in a variety of military components such as amplifiers.

## ALLIANCES

Not available

## SERVICES

Foundry

## MANUFACTURING

### Technology

1.0- to 0.5-micron GaAs MESFET  
2-, 3-, and 4-inch wafers



# Harris Microwave Semiconductor, Inc.

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## Facilities

Milpitas, CA  
37,000 sq. ft. total  
15,000 sq. ft. manufacturing space

## PRODUCTS

FETs (available in chip or packaged form)

Device	Description
HMF-0300	2-18 GHz, 125 mW Power
HMF-03100-100	2-20 GHz, Low Noise, Gain
HMF-03100-200	2-20 GHz, Gain/Drive
HMF-03100-300	2-20 GHz, Drive
HMF-0330	2-20 GHz, Low Noise, Low Current
HMF-0600	2-20 GHz, 250mW Power
HMF-0610	2-20 GHz, Gain
HMF-0620	2-14 GHz, High Transconductance
HMF-12000-100	2-16 GHz, 500mW Power
HMF-12000-200	2-16 GHz, 650mW Power
HMF-1210	2-20 GHz, Gain
HMF-24000-100	2-14 GHz, 800mW, Power
HMF-24000-200	2-14 GHz, 1.2W, Power

## MMICs

HMR-11000	Pi Attenuator, DC-18 GHz
HMR-10502	Analog Amplifier, 0.5-5.0 GHz
HMR-10503	Analog Amplifier, 1-5 GHz
HMM-10610	Broadband Amplifier, 2-6 GHz
HMM-10620	Broadband Amplifier, 2-6 GHz, Low Current
HMM-11810	Broadband Amplifier, 6-18 GHz
HMM-11820	Broadband Amplifier, 6-18 GHz, Low Current

## OTHER INFORMATION

Harris Microwave's PR firm is Ketchum Public Relations.

# Headland Technology Incorporated

46221 Landing Parkway

Fremont, CA 94538

408/656-7800

ESTABLISHED: April 1989

NO. OF EMPLOYEES: 200

## BACKGROUND

Headland Technology Inc. was formed in 1988, a result of the merger between G-2 Incorporated and Video Seven. In 1987, LSI Logic Corporation spun off G-2 to sell peripheral logic chip sets for the 80286 and 80386. LSI purchased 20 percent of Video Seven in 1988 and later increased its share to 80 percent. In July 1989, LSI merged G-2 and Video Seven to form Headland Technologies, an independent affiliate of LSI Logic Corporation. Headland maintains separate and independent marketing and engineering organizations. As an affiliate, Headland can draw upon LSI Logic's worldwide manufacturing facilities in the Far East, North America, and Europe. Headland also has access to LSI Logic's 24 design centers located throughout the world. Headland utilizes LSI Logic's HCMOS and BiCMOS process technology, which delivers submicron ICs in mass production.

Headland's initial focus is on the rapidly growing market for graphic and logic products for the IBM PC-compatible market. The G-2/Video Seven merger brings two product focuses under one roof. Video Seven, previously an independent graphics house, will provide Headland with video graphics expertise. In the graphics market, Headland currently offers VGA graphics cards, a single-chip EGA multimode graphics controller, and a VGA chip. Headland plans to offer an 8514A graphics chip set in early 1990 and will also introduce VGA chip sets for flat panel displays. The Company has an existing program with Sun Microsystems to produce a "virtual VGA" card for the 386i workstation. Headland expects to expand this product to other UNIX-based workstations.

Drawing from G-2's focus on PC chip sets, Headland offers a number of logic products. Headland's offerings include a PC AT chip set, a PS/2 Model 30/XT compatible chip, a 386 AT chip set, a 386 SX chip set, and a universal PS/2-compatible chip set. Headland

expects to offer SPARC or MIPS chip sets in the near future.

Headland considers Chips & Technologies and Western Digital to be its two major competitors. Headland sells products to both OEM and retail customers. The Company's products will be sold through a mix of direct sales, independent representatives, and retail distribution. Headland has 8 national and 29 international distributors, as well as 2,100 authorized resellers that were acquired as part of the Video Seven holdings. Headland's strong retail sales channels should give the Company an advantage over its competitors, some of which have no retail distributors.

In 1988, G-2 raised approximately \$19 million in revenue, and Video Seven reached the \$50 million mark. By combining resources and taking advantage of economies of scale, LSI predicts that Headland's revenue could easily triple in 1989 and reach a rate of \$200 million per year early in 1990.

In the future, Headland plans to support the new markets created by the integration of computers with all-digital communications and entertainment (i.e., ISDN, HDTV, interactive video), as well as the markets spurred by higher-performance graphics standards such as VGA and by the arrival of Presentation Manager's graphics environment.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO

William J. O'Meara  
G2, President

### President

Paul Jain  
USI International, President

# Headland Technology Incorporated

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## VP, Manufacturing & Operations

Russ Faust  
Ferix Corp.

## Sr. VP, Research & Development

Don Bryson  
Mouse Systems, VP Sales/Mktg

## VP, Manufacturing & Operations

Bill Sams  
Assisted Technology, VP Mktg

## VP, OEM Sales

Fred Brown  
LSI Logic, Sales

## VP, Retail Sales

Michael Humphress  
Mouse Systems, National Sales Mgr

## VP, Systems Marketing

Greg Reznick  
Mouse Systems, Prod Mgr

## VP, Component Marketing

Elvet Moore  
Kontron, President

## VP, Research & Development

Steve Chan  
LSI Logic, VP ASIC design

## FINANCING

Not available

## PRODUCTS

VEGA Deluxe VGA Card  
VEGA VGA Card  
FastWrite VGA  
V-RAM VGA  
EGA Multimode Graphics Controller  
Advanced VGA Chip

## OTHER INFORMATION

Headland Technology's PR firm is Miller Communications.

## RECENT HIGHLIGHTS

### April 1989

G-2 and Video Seven merged to form  
Headland Technologies, Incorporated.

### July 1989

The Company's name was officially changed  
to Headland Technologies, Incorporated from  
Video Seven, Incorporated.

### July 1989

Headland introduced the Video Seven VGA  
1024i, a high-performance VGA adapter that  
enhances the industry-standard VGA.

## ALLIANCES

Headland is an affiliate of LSI Logic Corporation.

## MANUFACTURING

### Facilities

Fremont, CA  
Headquarters, marketing, test  
Cupertino, CA  
Engineering, R&D

# Hittite Microwave Corporation

21 Cabot Road  
Woburn, MA 01801  
617/933-7267  
Fax: 617/932-8903

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 12

## BACKGROUND

Hittite Microwave was formed to market custom and proprietary GaAs MMICs for military and commercial applications. The Hittite team has been involved in all aspects of design, development, and production of monolithic GaAs components, including participation in several Department of Defense GaAs technology development programs.

Hittite's expertise ranges from designing small, single-chip systems to 500-watt, continuous-wave, multichip components and subsystems. Hittite's facility is equipped to conduct design, layout, verification, packaging, and test of GaAs-based components. Wafer fabrication is conducted by foundries.

Hittite is part of the General Dynamics, Honeywell, TRW consortium that is addressing the critical technology, fabrication, and cost issues of inserting microwave/millimeter wave monolithic IC (MIMIC) technology into advanced tactical weapons systems. The team has targeted three main mission areas for MIMIC insertions—smart weapons, electronic warfare, and communications.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### Pres/COO

Frank Paik

Raytheon, Business Dev Mgr

### VP/CEO

\*Yalcin Ayasli

Raytheon Research, Mgr R&D Monolithic ICs

### CFO

Ronald Kaplan

Wang, Controller

\*Founder

## FINANCING

Private

## ALLIANCES

Hittite is part of the General Dynamics, Honeywell, TRW consortium as part of the Department of Defense MIMIC program.

## MANUFACTURING

### Technology

0.5- and 1.0-micron GaAs MESFETs

### Facilities

Woburn, MA

4,800 sq. ft. total

Offices, R&D, assembly, test

400 sq. ft.

Class 10 clean room

# Hittite Microwave Corporation

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## PRODUCTS

Signal Control Components  
Microwave Radar Ranging Systems  
Other proprietary products

## OTHER INFORMATION

Hittite Microwave does not employ a PR firm.

## HNC, Inc.

5501 Oberlin Drive  
San Diego, CA 92121  
619/546-8877  
Fax: 619/452-6524

ESTABLISHED: October 1986

NO. OF EMPLOYEES: 40

### BACKGROUND

HNC, Inc. (formerly Hecht-Nielsen Neurocomputers) was formed in October 1986 by Robert Hecht-Nielsen and Todd Gutschow with the goal of becoming the leader in developing neural network products and technology and applying them to practical problems. HNC develops, manufactures, and supplies a complete line of high-speed neural network hardware coprocessors and workstations and an extensive package of neural network software.

Neural networks, modeled loosely after the interconnected nerve cells of the human nervous system, represent an information-processing technology that is radically different from traditional sequentially programmed computers. Rather than relying upon an explicit algorithm to perform desired tasks, a neural network is trained by adapting to repeated examples. For this reason, programming is less complicated—which makes development time shorter.

HNC currently is shipping the ANZA family of neurocomputing systems, which consists of three general-purpose neurocomputing coprocessor boards. The boards are available for the IBM PC AT, the Sun 386i, and Sun-3 and Sun-4 workstations. More than 300 HNC neural network hardware systems have been installed worldwide. HNC currently is developing two CMOS VLSI neural chips that utilize RISC technology. The HNC 100X is a general-purpose neural chip that provides two orders of magnitude increase in performance over current processing techniques. The HNC 103X (patent pending) incorporates both vision and image processing capabilities for complex pattern recognition applications. Both chips will be available during the third quarter of 1990.

HNC is targeting commercial and defense/aerospace markets with its neural network technology.

Customers include Fortune 500 companies with broad application ranges such as industrial inspection systems, financial credit scoring, EKG noise filtering, chemical plant process control, modeling, machinery diagnostics, and database analysis.

The Company markets its products in the United States to end users and OEMs through a direct sales force with offices in San Diego, California, and Falls Church, Virginia. An international network of distributors provides marketing and sales support throughout Europe, the Far East, India, and Australia.

### BOARD

(Name and Affiliation)

Oliver Curme  
Battery Ventures

Thomas Farb  
Air Fund

Charles Hertzfeld  
E.S. Jacobs

Burt McGillivray  
Continental Illinois Ventures

Thomas Tranchina  
San Diego Fire Supply

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Robert L. North  
TRW, Gen Mgr, Elect Sys

VP, R&D  
Michael Thiemann  
Four-Pi Systems, VP, Marketing

## HNC, Inc.

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**VP, Mktg**  
Dave Shlager  
Lucid, VP, Sales

**Exec VP**  
Gerald Farmer  
Gould, Dir R&D

**Mkt Comm Mgr**  
Julie Hotz  
Rohr Industries, Marketing Manager

### FINANCING

October 1986  
Seed  
\$635,000  
Private

June 1987  
Round 1  
\$2.6M  
Battery Ventures

June 1988  
Round 2  
\$3.4M  
Battery Ventures, Continental, Illinois Ventures,  
Aetna, E.S. Jacobs, and Ramo Technology

### PRODUCTS

ANZA  
ANZA Plus  
ANZA & ANZA Plus Neurocomputing Workstations  
ANZA Plus/VME  
AXON Neural Network Description Language  
Neural Network Development Toolkit  
ExploreNet Standalone Neural Network Software

### OTHER INFORMATION

HNC's PR firm is Marcom Strategies.

### ALLIANCES

**The Fusion Group**  
September 1989

HNC announced a strategic partnership with The Fusion Group to market software utilities designed to integrate neural computing into financial applications. Under the terms of the agreement, HNC and Fusion will develop software interfaces between HNC's ANZA Plus neurocomputing system and both the Sybase Relational Database Manager and Fusion's Market Data Server (MDS).

### MANUFACTURING

#### Technology

1-micron CMOS

#### Facilities

San Diego, CA  
13,000 sq. ft.

R&D, marketing, headquarters, manufacturing,  
finance

Falls Church, VA  
Regional office

# Hualon Micro-Electronics Corporation

9th Floor, No. 61, Chung Shan N.  
Road Sec. 2, Taipei, Taiwan R.O.C.  
(02) 562-8813 Ext. 768  
Fax: (02) 531-3241

ESTABLISHED: April 1987

NO. OF EMPLOYEES: 400

## BACKGROUND

Hualon Micro-Electronics Corporation (HMC) was formed to offer telecommunications ICs, consumer ICs, microcomponents, and ASICs. Initially, the Company will use 2-micron CMOS technology to manufacture its products but has plans to develop CMOS technology to the 1-micron level.

Recently, HMC opened a new 269,097-square-foot fabrication facility in the Hsinchu Science-Based Park. The facility is capable of manufacturing 30,000 5-inch wafers per month. The Company plans to reach a capacity of 60,000 5-inch wafers per month by 1991.

HMC was financed by the Hualon Group for about U.S.\$30 million. The Hualon Group's first venture into the IC business was an assembly plant set up in 1984. As its requirements for high-quality ICs that use advanced process technologies increased, the Hualon Group decided to invest in an IC fab.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

Vice President  
Andrew Oung

## PRODUCTS

Consumer IC Family

	Device	Description
Clock	HM 3200	Analog Clock
	HM 3203	3-1/2-Digit Alarm Clock
	HM 3204	World Time Clock

## FINANCING

1987  
Round 1  
U.S. \$30.0M  
Hualon Textile

## ALLIANCES

Not available

## MANUFACTURING

### Technology

5.0-micron metal-gate CMOS  
2.0- and 3.5-micron silicon-gate CMOS  
3.5-micron NMOS

### Facilities

Hsinchu City, Taiwan  
269,097 sq. ft.  
Total space includes design and manufacturing.  
39,900 sq. ft.  
Class 1 and Class 10 clean rooms  
Hualon announced that its second fab facility in Taiwan will open in September 1990.



## Hualon Micro-Electronics Corporation

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	Device	Description
Watch	HM 3201	3-1/2-Digit LCD Watch
	HM 3202	4-Digit LCD Watch
Home Electronics IC	HM 3701	Touch Dimmer
Calculator	HM 3401	Solar Calculator
Melody	HM 5801	64-Note Simple Melody
	HM 5802	128-Note Simple Melody
	HM 4801	512-Note Simple Melody
	H 66T	64-Note Simple Melody (3-Pin Package)
	H 67T	64-Note Simple Melody (4-Pin Package)
	H 68T	128-Note Doorbell
Voice IC	HM 2005	3-Second PCM
	HM 2005-1	1.5-Second PCM (Piezo)
	HM 2005-2	1.5-Second PCM
	HM 2006	LPC Processor
	HM 2007	Speech Recognition
Organ	HM 5601	Simple Mini-Organ
<b>Microcomponent and Memory IC Family</b>		
System	HM 6667/8	PC AT 16-MHz Zero-Wait Chip Set
Peripheral	HM 666A/B	RS 232x2, Printer Portx2
	HM 82C11	Printer Port
	HM 16450	PC AT Asynchronous Communications Element
	HM 8250	PC XT Asynchronous Communications Element
	HM 6818	PC AT Real-Time Clock
	HM 58167	PC XT Real-Time Clock
	HM 6845/A/B	CRT Controller
Memory	HM 2300/2301	Character Generator
	HM 2333	4Kx8 ROM
	HM 2366	8Kx8 ROM
	HM 23C256	32Kx8 ROM
	HM 6116	2Kx8 SRAM
	HM 6164	8Kx8 SRAM
<b>Telecommunication IC Family</b>		
Telephone Dialers	HM 9100	Pulse Dialer
	HM 9101/9102	Tone/Pulse Dialer
	HM 9105	5-Memory Tone/Pulse Dialer
	HM 9110	10-Memory Tone/Pulse Dialer
	HM 9113	14-Memory Tone/Pulse Dialer
	HM 9114	15-Memory Tone/Pulse Dialer
	HM 9115	Advanced 15-Memory Tone/Pulse Dialer+ARD
	HM 9120	Advanced 20-Memory Tone/Pulse Dialer+ARD
	HM 9187	Tone Dialer

# Hualon Micro-Electronics Corporation

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	<b>Device</b>	<b>Description</b>
<b>Peripheral</b>	HM 2004	Voice Processor
	HM 9200	Call-Progress Tone Decoder
	HM 9202/9203/9204	DTMF Receiver Series

## **OTHER INFORMATION**

Hualon does not employ a PR firm.

**IC Sensors, Inc.**  
1701 McCarthy Blvd.  
Milpitas, CA 95035  
408/432-1800  
Fax: 408/434-6687

ESTABLISHED: 1982

NO. OF EMPLOYEES: 145

## BACKGROUND

IC Sensors, Inc., designs, develops, and manufactures both standard and custom pressure sensors. The Company developed its silicon sensor technology and applied it to design and manufacture a variety of pressure sensors, accelerometers, pressure switches, load sensors, valves and actuators, and other microstructures. The Company's products are used in medical, industrial, automotive, aerospace, and consumer applications.

IC Sensors was formed with funds provided by the founders. The Company received additional funds when it formed a strategic partnership with Borg-Warner. In December 1986, IC Sensors, Inc., and Transensory Devices, Inc., (TDI) completed a merger. TDI was founded in 1982 and developed a micromachining technology that is used to fabricate both custom and standard devices.

In September 1987, IC Sensors introduced a new technology called Silicon Micromachining, which applies semiconductor production techniques to mechanical devices. Micromachined sensors are produced by etching precise micromechanical structures in silicon. As a result, the structure that serves as a mechanical sensing device is also a semiconductor.

The basic elements of the microstructure technology include the photolithographic processes, oxidations, diffusions, thin-film processes, and metallizations common in the IC industry. A number of other processes are used as well, such as wet chemical and dry etch processes, etch stops, double-sided patterning, and multilayer structures.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

### CEO

\*Donald G. Lynam

### President

Dr. James W. Knutti

### VP, Marketing and Sales

Frank A. Perrino

### VP, Engineering

Henry V. Allen

### Chief Engineer

Edward J. Russell

### VP, Operations

\*Manuel G. Rossell

### VP, Finance

Robert Regalia

\*Founder

## FINANCING

Not available

## RECENT HIGHLIGHTS

### June 1987

IC Sensors offered the 1210 and 1220—two piezoresistive sensors.

### July 1987

IC Sensors offered the 2501, a miniature silicon pressure switch that eliminates the need for comparators, external voltage references, and potentiometers.

### July 1987

IC Sensors offered the 410, a general-purpose piezoresistive sensor that is mountable on PC boards.

## IC Sensors, Inc.

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### September 1987

IC Sensors introduced a new technology, silicon micromachining, that applies semiconductor production techniques to mechanical devices.

### September 1987

IC Sensors introduced a silicon piezoresistive accelerometer, the Model 3021.

## ALLIANCES

### Borg-Warner Corp.

Borg-Warner does some manufacturing for IC Sensors, Inc.

## MANUFACTURING

### Technology

Not available

### Facilities

Milpitas, CA

34,000 total sq. ft.

Headquarters, manufacturing

9,000 sq. ft.

Fabrication area

## PRODUCTS

Pressure Sensors

Accelerometers

Pressure Switches

Load Sensors

Valves and Actuators

## OTHER INFORMATION

IC Sensors does not employ a PR firm.

# ICI Array Technology, Inc.

1297 Parkmoor Avenue  
San Jose, CA 95126-3448  
408/297-3333  
Fax: 408/297-3763

ESTABLISHED: 1982

NO. OF EMPLOYEES: 130

## BACKGROUND

ICI Array Technology offers a variety of technologies to support development and manufacturing of small-footprint subsystem products. The Company emphasizes designing for manufacturability. Subsystem design is supported with ASIC capability in CMOS gate arrays and cell-based-designed ICs. One of the Company's major strengths is surface-mount technology (SMT) and COB technology offered as part of a totally integrated system.

The Company was founded by William Robson, without venture capital, as Array Technology, Inc. In January 1986, the Company was acquired by Imperial Chemical Industries PLC (ICI), a large U.K. chemical company, and renamed ICI Array Technology. Prior to its acquisition, Array Technology funded all activities from its design and consulting fees.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

### President

Bernie Aronson

### VP, Marketing & Sales

Jack Hullman

### Director of Finance

Erik Simonson

### Director of Engineering

Dennis Morris

### Director of Operations

Rich Frieberger

## Program Manager

\*Brian Tighd

\*Founder

## FINANCING

Not available

## ALLIANCES

### ICI

January 1986

Imperial Chemical Industries Plc (ICI), a large U.K. chemical company, acquired Array Technology.

### National

March 1988

National Semiconductor and ICI Array Technology signed an agreement under which ICI Array will use National's design systems and process specifications to develop proprietary ASICs.

## MANUFACTURING

Multiple offshore and U.S. sources provide CMOS silicon wafers.

## Technology

1.0-, 1.5-, 2.0-, and 3.0-micron, double-layer metal, silicon-gate CMOS designs on Mentor tools

## Facilities

San Jose, CA

50,000 sq. ft.

Administration, design, production

# ICI Array Technology, Inc.

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## PRODUCTS

### CMOS Gate Arrays

Process	Linewidth (micron)	Delay (ns)	Cells
Si-Gate	1.5, 2.0, 3.0	0.5 to 2.0	RAM, ROM

### Digital Gate Arrays

150 to 20,000 gates

### Linear Arrays

### Semicustom Subsystems

## OTHER INFORMATION

ICI Array Technology does not employ a PR firm.

# Innovative Silicon Technology

Wholly Owned Subsidiary of SGS-Thomson

1310 Electronics Drive

Carrollton, TX 75006

214/466-6000

Fax: 214/466-6572

ESTABLISHED: May 1986

NO. OF EMPLOYEES: 160

## BACKGROUND

Innovative Silicon Technology (IST) was formed by SGS-Thomson Microelectronics to meet the growing market demands for advanced ASICs. The Company was formed by Piero Martinotti and others from Motorola to concentrate on quick-turn R&D for the ASIC market. SGS-Thomson, which transferred the assets of its ASIC activities to IST, provides high-volume foundry services, allows access to its design centers by IST engineers and IST customers, and provides sales and marketing support. The assets transferred from SGS-Thomson to IST include technologies, CAD and production hardware and software, R&D capacity, a significant customer base, a consolidated product portfolio, and human resources.

IST conducts R&D, design, prototyping, low-volume production, assembly, and test, and uses 1.2- to 3.0-micron single-, double-, and triple-layer metal and direct-write e-beam technologies. The Company recently opened a new facility in Agrate, Italy, which serves as its worldwide headquarters and includes wafer fabrication and R&D facilities.

Innovative Silicon Technology's products include gate arrays with up to 50,000 gates and a cell-based library with 140 logic cells.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

Chief Executive Officer  
Pierangelo Martinotti

### Director of Central Business

Mario Licciardello

### Director of R&D

Roberto Fantechi

### Europe/Asia Operating Unit Director

Pietro Palella

### QC Director

Ignazio Salvemini

### Finance Administration Director

Arrigo Gradi

### Director of Human Relations

Marco Bartolozzi

## FINANCING

### May 1986

Innovative Silicon Technology is wholly owned by SGS-Thomson Microelectronics.

## ALLIANCES

### CDI

April 1987

IST and California Devices Inc. (CDI) agreed to a joint product development and second-source agreement covering two families of ASICs using channelless architectures. The first family is a 2-micron, double-metal CMOS with up to 24,000 gates. The second family is based on a 1.5-micron technology and will include more than 100,000 gates.

### SDA Systems

May 1987

IST signed an agreement with SDA Systems to develop CAD systems based on SDA technology for use by IST customers.

# Innovative Silicon Technology

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## SERVICES

Quick-turn R&D  
Foundry

Agrate, Italy  
13,500 sq. ft.

Worldwide headquarters, wafer fab, R&D

## MANUFACTURING

### Technology

1.2- to 3.0-micron, double- and triple-layer  
metal CMOS; 4-inch and 6-inch wafers

Innovative Silicon Technology employs SGS-Thomson design centers in France, Italy, Sweden, the United Kingdom, West Germany, Hong Kong, Singapore, South Korea, and Taiwan.

Assembly operations are conducted in SGS-Thomson facilities in Malaysia, Malta, and Singapore.

### Facilities

Carrollton, TX, U.S.  
22,500 sq. ft.

Wafer fab, test, marketing, customer support,  
sales

## PRODUCTS

### Gate Arrays

50,000 Gates; 1.2-Micron, Double-Layer Metal designed for Triple-Layer  
10,000 Gates; 2.0-Micron, Double-Layer Metal  
6,000 Gates; 3.0-Micron, Double-Layer Metal  
2,500 Gates; 3.5-Micron, Single-Layer Metal

### Cell-Based Library

140 Cells; 3.0- and 1.2-Micron, Double-Layer Metal; Fully Compatible with Gate Array Libraries

## OTHER INFORMATION

Innovative Silicon Technology does not employ a PR firm.



# Inova Microelectronics

2220 Martin Avenue  
Santa Clara, CA 95050  
408/980-0730  
Fax: 408/980-1805

ESTABLISHED: December 1983

NO. OF EMPLOYEES: 62

## BACKGROUND

Inova Microelectronics designs, manufactures, and markets ultralarge-scale integrated (ULSI) multichip ICs that use waferscale integration technology developed by the Company. Inova has developed a unique interconnect technology called Inroute. Initially, Inova is using Inroute to integrate multiple memory structures at the wafer level to produce a line of high-density SRAMs.

Inroute is based on an architecture of repeatable slices. (A slice is a row of memory structures.) Slices are repeated on the circuit, including spare slices to allow for defects. A second feature of the Inroute technology is the ability to isolate slices for testing. Working slices are identified and their addresses established by means of fuse-programmable logic. Nonfunctional slices are disconnected through a lacing of fuses so that a defect in a single device does not affect the functionality of the entire circuit. A third feature is the use of a universal second metal layer that can be used for all wafers because all nonfunctional circuits have been disconnected. The technology uses standard fabrication methods and equipment and is transportable to CMOS, BiCMOS, bipolar, GaAs, and VHSIC processes.

Inova's product line focuses on applications where the capability of the system to be integrated requires a large area of silicon. The products typically are characterized by having large repetitive sections of silicon, such as the Company's initial product offerings. In June 1988, Inova began volume shipment of the S128K8, a 1Mb CMOS SRAM. The device is built under a foundry agreement with Sharp, using a 1.2-micron, double-metal, double-poly process. The device, which is comprised of 40 base 4Kx8 slices, targets military accounts that previously have used 1Mb SRAM modules with four 256K parts. In addition to the S128K8, Inova currently is shipping the S32K8, a 256K SRAM. The S32K8 is built with the same 4Kx8

slice used in the 1Mb version. These products will be followed by a family of SRAMs that will be developed through different integrations of the base 4Kx8 slice.

Inova will be developing other ULSI products where a monolithic system solution is not possible with traditional design methods. Applications for these products may include telecommunications, systolic arrays, digital signal processing, and image processing. The Company's product lines serve military, commercial, and industrial markets. Inova has received a DESC Standard Military Drawing for its 70 to 120ns products. Future plans include a 25ns SRAM, available in mid-1990, and product lines containing cache controllers and neural network products. Inova also plans to introduce the first commercially available 4Mb SRAM.

In September 1988, Inova acquired LYNX Technology, a start-up company in the memory product business. LYNX becomes Inova's Colorado Springs division and is responsible for the development of SRAMs. The division in Colorado Springs and headquarters in Santa Clara share responsibility for process and technology development. Dr. Ron Bourassa, previously president and CEO of LYNX, is the vice president and general manager of the Colorado Springs division.

## BOARD

(Name and Affiliation)

Vaemond Crane  
Inova Microelectronics, President  
Glenn Penisten  
Alpha Partners  
Dan Flamen  
Comann, Howard & Flamen  
Pete Thomas  
Institutional Venture Partners

# Inova Microelectronics

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**Blair Stewart**  
Wilson, Sonsini, Goodrich & Rosati

**Gene Strull**  
Westinghouse Electric Corp.

**April 1988**  
Round 3  
\$5.0M  
All previous investors

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Vaemond Crane  
MIPS Computer Systems, President/CEO

**VP Marketing**  
Doug Mitchell  
Inmos, Dir Technical Marketing

**VP Finance**  
David Garrett  
Stanford Applied Engineering, CFO

**VP Operations, Santa Clara**  
Howard Gopen  
Intel, Wafer Fab Plant Manager

**VP Operations, Colorado Springs**  
Ron Bourassa  
LYNX Technology, President/CEO

## FINANCING

**1984**  
Seed  
\$2.0M  
Alpha Partners

**February 1986**  
Round 1  
\$5.3M  
Alpha Partners, Asset Management, Bryan & Edwards, Glenwood Management, Jupiter Partners, Institutional Venture Partners, Paribus Technology, Ritter Partners, Technology Venture Investors

**April 1987**  
Round 2  
\$2.5M  
Westinghouse Electric Corporation

## RECENT HIGHLIGHTS

**June 1988**  
Inova began shipping the S128K8 1Mb CMOS SRAM.

**September 1988**  
Inova acquired LYNX Technology, a start-up memory company in Colorado Springs, Colorado.

## ALLIANCES

**United Microelectronic Products**  
November 1985  
Inova and UMP signed a five-year foundry agreement under which UMP will provide base wafers to Inova.

**Westinghouse**  
June 1987  
Westinghouse Electric Corporation invested \$2.5 million in equity and \$2.5 million in lease guarantees. Westinghouse also is working with Inova as part of its strategic long-term technology efforts. The efforts are sponsored by Westinghouse's Advanced Technology Division.

## MANUFACTURING

**Technology**  
1.2-micron CMOS

**Facilities**  
Santa Clara, CA  
12,000 sq. ft.  
Design, test  
Colorado Springs, CO  
8,500 sq. ft.  
Design, process development

## PRODUCTS

Part No.	Device Type	Organization	Access Time
S128K8	1Mb SRAM	128Kx8	70 to 120ns
S32K8	256K SRAM	32Kx8	55 to 100ns

## OTHER INFORMATION

Inova Microelectronics does not employ a PR firm.

# Integrated CMOS Systems, Inc.

440 Oakmead Parkway

Sunnyvale, CA 94086

408/735-1550

Fax: 408/735-9808

ESTABLISHED: October 1984

NO. OF EMPLOYEES: 65

## BACKGROUND

Integrated CMOS Systems (ICS) designs, manufactures, and markets system-level VLSI semiconductors for cost-effective design and production of customer-specific subsystems. ICS provides complete turnkey solutions from design definition to working multichip subsystems.

ICS developed a family of gate array masterslices: advanced, high-pin-count surface-mount packaging; and board-level technology for high-performance, midrange computer systems. The Company's design technology is integrated with a design automation system that can take a description of a system and transform it into an optimized and testable subsystem-level solution.

The Company's future plans include submicron processes, expanded gate array families, and advanced behavioral design implementation.

In March 1988, ICS and Apollo Computer Inc. introduced the series 10000, a new RISC-based workstation based on ICS' subsystem technology. The series 10000 achieves an execution rate of more than one instruction per cycle. The performance is achieved by parallelism among processors using 64-bit data paths and an efficiently coupled set of VLSI devices. ICS contributed system-level design and gate arrays that incorporate level-sensitive scan design (LSSD) test methodology to assure a testable product the first time.

The system uses 10 different 1.5-micron, double-level metal CMOS gate arrays with densities of 30,000+ gates from the ICS10000 Series Family. The implemented chips include a RISC-based integer processor, a floating-point register file, a memory manager, an I/O manager, and a high-speed system bus processor. The ICS10000 has up to 360 configurable I/O pads and comes in packages with up to 340 pins.

The Company's heritage is high-performance, large computer system design and development. ICS' founders came from Amdahl, IBM, and the STC Computer Research Corp., which was set up by Storage Technology.

## BOARD

The Board consists of representatives from the following concerns:

DSV Partners  
Hambrecht & Quist  
Hambro International  
Industrial Technology Research Institute  
(ITRI), Taiwan  
Montgomery Securities  
Venrock Associates

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Lin Wu

STC Computer Rsch Corp., Sr VP Opns/COO

### Exec VP, Operations

Roy Thiels

National Semiconductor, Pro Dir CMOS, Gate Arrays

### Chief Techn Officer

Larry Cooke

STC Computer Research Corporation, Dir Des Automation

### VP Engineering

Jin Shyr

Daisy, Mgr Prod Tech Support

### VP Strat Plan

Symon Chang

STC Computer Rsch Corp., Sr Eng Mgr

### VP Mfg

Steve Margoslan

Interest Corporation, VP Engineering

# Integrated CMOS Systems, Inc.

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## VP Sales

Steve Stephansen  
AMD, Director of Sales

## VP Marketing

Robert G. Andrews  
ZyMOS, Dir Corp Mktg

## VP Finance

Michael J. DelGrosso  
The Bottom Line, Consultant

International; ITRI, Taiwan; Montgomery Securities; Sequoia Capital; Venrock Associates

## ALLIANCES

VLSI Technology, Toshiba  
1985

Toshiba and VLSI began providing foundry services for ICS.

## FINANCING

### 1985

Round 1

\$2.5M

Hambrecht & Quist, private individuals

### May 1987

Round 2

\$5.5M

DSV Partners, Hambro International Venture Fund, Montgomery Securities, Venrock Associates

### October 1988

Round 3

\$4.2M

DSV Partners; Hambrecht & Quist; Hambro

## MANUFACTURING

ICS subcontracts wafer fabrication with Toshiba of Japan, Taiwan Semiconductor Cooperative (TSMC), and National Semiconductor in the United States.

## Technology

1.5-micron and 1.0-micron, dual-metal CMOS

## Facilities

Sunnyvale, CA

12,500 sq. ft.

Headquarters and design

Braintree, MA

Sales office

## PRODUCTS

### Gate Arrays

10,000 to 30,000 1.5-micron usable gate, gate arrays (ICS10000 Series)

10,000 up to 60,000 1.0-micron usable gate, gate arrays (ICS15000 Series)

15,000 to 50,000 1.0-micron usable sea-of-gate, gate arrays (IC20000 Series)

## OTHER INFORMATION

Integrated CMOS Systems' PR firm is Thomas Associates.

# Integrated Information Technology

2540 Mission College Blvd., Suite 105

Santa Clara, CA 95054

408/727-1885

Fax: (408) 292-1922

ESTABLISHED: April 1987

NO. OF EMPLOYEES: 23

## BACKGROUND

Integrated Information Technology (IIT) was founded to develop high-performance compute engines for applications in personal computers and other information-processing hardware. IIT's objective is to enhance existing standards of compute engine-based silicon technology for personal computer platforms while embedding additional functionality that will evolve new standards to create new markets for existing and future products and increase information flow in the workplace. The Company was founded in April 1987 by two former Weitek employees, Chi-Shin Wang and Y.W. Sing. Dr. Wang also was a cofounder of Weitek.

The Company currently offers two math coprocessors—the IIT-2C87 and the IIT-3C87—and will begin shipment of its integrated graphics array (IGA) in late 1989. The single-chip IGA is fully compatible with VGA and is downward compatible with EGA, CGA, MGA, and Hercules. In the future, IIT plans to offer a 386 object code-compatible CPU family, a 32-bit controller, and a DSP device.

To date, IIT has received funding in two rounds of financing and has \$2.7 million in current assets, which the Company believes to be significant capital to carry it to positive cash flow with a comfortable margin. Investors were Ascii, General Electronics, Mitsui, and Yamaha. Strategic relationships have also been established with Ascii, Mitsui, and Yamaha. Yamaha is conducting wafer fab operations for IIT; Mitsui and Yamaha serve as IIT's Japanese distribution agents. In addition to wafer fab, IIT subcontracts assembly and test operations; the Company conducts design, marketing, and QA in-house.

## BOARD

(Name and Affiliation)

\*Dr. Chi-Shin Wang  
IIT, President

\*Dr. Y.W. Sing  
IIT, Executive VP

Dick Chang

Samuel Fang

Kazuhiko Nishi  
Ascii, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President

\*Dr. Chi-Shin Wang  
Weitek, VP of Engineering

Executive VP

\*Dr. Y.W. Sing  
Weitek, Manager, Advanced Product  
Development

VP Marketing & Sales

Gene Parrott  
Cirrus Logic, VP Sales

VP Operations

Robert Shen  
VTI, Director WW Manufacturing Operations

Manager Sales Operations

Karen Zelina  
AMD, AT&T Program Manager

Manager, R&D

Jan Fandrianto  
Weitek, Chief Design Engineer

\*Founder

# Integrated Information Technology

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## FINANCING

1987

Round 1

Undisclosed amount  
General Electronics

1988

Round 2

Undisclosed amount  
Ascii, Mitsui, Yamaha

## ALLIANCES

Ascii

1989

IIT signed a distribution agreement with Ascii, making Ascii a regional distributor of IIT products in Japan.

## PRODUCTS

IIT-2C87 Math Coprocessor

IIT-3C87 Math Coprocessor

IGA

## OTHER INFORMATION

IIT's PR firm is Joyce Lekas Public Relations.

Mitsui

1989

IIT signed a strategic alliance with Mitsui, giving Mitsui distribution rights for IIT products in Japan.

Yamaha

1989

IIT signed a foundry agreement with Yamaha, under which Yamaha will provide wafer fabrication services to IIT.

## MANUFACTURING

### Technology

1.2- and 1.0-micron CMOS

### Facilities

IIT subcontracts all wafer fabrication, assembly, and test, while conducting design, marketing, and QA in its Santa Clara facility.

# Integrated Logic Systems, Inc.

4445 Northpark Drive, Suite 102

Colorado Springs, CO 80907

719/590-1588

Fax: 719/590-1373

ESTABLISHED: August 1983

NO. OF EMPLOYEES: 15

## BACKGROUND

Integrated Logic Systems, Inc. (iLSi), was formed to design and develop a family of silicon-gate CMOS and software-based design aids.

iLSi introduced new gate array architectures that offer customers state-of-the-art capabilities. iLSi's product line is capable of implementing 45,000-gate designs that can include large complex functions such as ROM, RAM, PLA, PAL, and the 2900 family in a variety of package options.

The Company has licensing and foundry agreements with four major worldwide corporations.

## BOARD

(Name and Affiliation)

Ted Orf, Chairman  
Integrated Logic Systems, Inc.

\*Frank Gasparik  
Integrated Logic Systems, Inc.

James Shook  
Consultant

Gordon Olinger  
Consultant

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Frank Gasparik  
Insouth, VP Engineering

### Exec VP/CFO

Ted Orf  
Attorney

### VP Sales/Mktg

Bruce Grieshaber  
Honeywell, Nat Sales Mgr

\*Founder

## FINANCING

January 1984

Round 1

\$5.0M

OTC offering

## RECENT HIGHLIGHTS

June 1989

Integrated Logic Systems introduced the Metal Programmed Gate Array (MPGA), which is designed to replace current PLDs and PGAs.

## ALLIANCES

Motorola

June 1986

iLSi licensed its line of gate arrays to Motorola (inactive).

Sumitomo

December 1986

iLSi signed an agreement with Sumitomo Corporation and SC Hightech Center, a design center formed to carry out the agreement. Sumitomo licensed ASIC design technology from iLSi. In addition to gaining royalty payments, iLSi gained rights to use any foundries that Sumitomo uses.

Yamaha

December 1987

Yamaha Corporation purchased a license to manufacture and sell gate arrays based on iLSi technology for an undisclosed amount. Yamaha will pay royalties and provide foundry services.

Oki

April 1988

iLSi signed a technology purchase and licensing agreement with Oki Electric Industry Company, Ltd., for an undisclosed amount. Oki will manufacture and sell gate arrays based on iLSi technology and will provide foundry services.



# Integrated Logic Systems, Inc.

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## MANUFACTURING

### Technology

- 1.5-micron silicon-gate CMOS, double-level metal
- 1.2-micron silicon-gate CMOS, double-level metal under development

### Facilities

- Colorado Springs, CO  
10,000 sq. ft.  
Administration and design
- Boulder, CO  
CAD development

## PRODUCTS

### CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
CA-1500	Si-Gate	1.5	1.0	2,000 to 42,000
15GH	Si-Gate	1.5	1.0	2,500 to 110,000

## OTHER INFORMATION

Integrated Logic Systems does not employ a PR firm.

## Intergraph Advanced Processor Division

2400 Geng Road  
Palo Alto, CA 94303  
415/494-8800  
Fax: 415/856-9224

ESTABLISHED: October 1987

NO. OF EMPLOYEES: 140+

### BACKGROUND

The Intergraph Advanced Processor Division (APD) is a division of Intergraph Corporation and is the result of Intergraph Corporation's acquisition of the Fairchild Advanced Processor Division. The age of the two parent companies normally would exclude the Company from this directory. However, Dataquest believes that, although the division is not a start-up company per se, the operation is the result of a new focus at Fairchild (prior to the acquisition by National) on high-performance MPUs.

APD was acquired in October 1987 for \$6.25 million. APD employs more than 140 people involved in the engineering, manufacturing, sales, and support of the merchant market CLIPPER 32-bit RISC microprocessor. APD was formed in 1982 to develop an advanced MPU based on RISC principles. Howard Sachs formed APD and built the division to bring the new CLIPPER microprocessor to market. The CLIPPER 32-bit MPU family was the first commercially available RISC microprocessor to ship in volume production.

The first-generation CLIPPER RISC MPU is the C200. The C200 operates at either 25 or 33 MHz. The second-generation CLIPPER microprocessor, the C300, delivers twice the performance of the C200 and operates at 40 or 50 MHz. All of the current CLIPPER products are implemented in CMOS process technology. Future CLIPPERs will be implemented in both CMOS and bipolar process technologies. Currently, all of APD's fabrication is contracted to Fujitsu. All assembly and testing is done in-house.

CLIPPER microprocessors are currently used in both interactive computer systems and embedded applications. Interactive systems applications include business systems, engineering and graphics workstations, and board-level products based on

the PC AT bus, VMEbus, and NuBus. As an embedded processor, CLIPPER's primary use is in Raster Image Processing. CLIPPER is also used in a high-speed dedicated database engine.

At this time, APD is the only RISC vendor to offer a full range of binary-compatible CPUs in three formats: individual chips, chip sets, and prepackaged RISC modules.

### BOARD (Intergraph Corporation) (Name and Affiliation)

James Meadlock, Chairman  
Intergraph Corp., CEO  
Roland Brown  
Larry Laster  
Intergraph Corp., Executive VP  
Nancy Meadlock  
Intergraph Corp., Executive VP  
Keith Schonrock  
James Taylor  
Intergraph Corp., Executive VP  
Robert Thurber  
Intergraph Corp., Executive VP

### COMPANY EXECUTIVES (Position, Name, Prior Company, and Prior Position)

VP and General Manager  
Howard Sachs  
Fairchild, General Manager  
Director Engineering  
Tim Robinson  
High Level Hardware  
Director Marketing  
Ralph Kaplan  
B.I.T., VP of Marketing

# **Intergraph Advanced Processor Division**

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## **Director Software Engineering**

John Kellum  
Fairchild

## **Director Manufacturing**

Steve Rowles  
Fairchild, Director of Manufacturing

## **Director QA**

Thomas Wehman  
Fairchild, Director of QA

## **FINANCING**

### **October 1987**

Acquisition

\$6.25M

Intergraph Corporation acquisition of Fairchild  
Advanced Processor Division

## **PRODUCTS**

CLIPPER C200 RISC MPU, 25 or 33 MHz

CLIPPER C300 RISC MPU, 40 MHz

CLIPPER C300 RISC MPU, 50 MHz

## **OTHER INFORMATION**

Intergraph does not employ a PR firm.

## **ALLIANCES**

### **Fujitsu**

Early 1987

Intergraph established a foundry agreement with Fujitsu, under which Fujitsu provides wafer fabrication services to the Advanced Processor Division.

## **MANUFACTURING**

### **Technology**

1.5-micron CMOS, moving to submicron  
CMOS in 1990

### **Facilities**

Palo Alto, CA

50,000 sq. ft.

Assembly, test, marketing, QA, administration

## International CMOS Technology, Inc.

2125 Lundy Avenue

San Jose, CA 95131

408/434-0678

Fax: 408/434-0688

ESTABLISHED: October 1983

NO. OF EMPLOYEES: 50

### BACKGROUND

International CMOS Technology, Inc., (ICT) designs, manufactures, and markets CMOS EEPROMs, EPROMs, and EEPLDs. ICT stated that, in 1984, the Company successfully combined the first 5V-only CMOS EEPROM (the 93C46) in volume production.

The Company's current product offerings include the programmable electrically erasable logic (PEEL) family of CMOS PLDs. The PEEL products use the Company's CMOS 1.25- and 2.0-micron EEPROM technology and feature a propagation delay as fast as 15ns. Additional ICT products include serial EEPROMs; a 40ns, 64K CMOS UV-erasable PROM; and a 35ns, 32K UV-erasable PROM that targets the bipolar 24-pin PROM market.

ICT also offers design and development tools. The Company enlisted John Birkner, the inventor of the PAL (a trademark of Monolithic Memories), to create a low-cost, easy-to-use developmental package consisting of design software and a PC-based, software-controlled programmer. ICT gives the software, free of charge, to any party interested in using PEEL devices.

ICT is developing a family of products that will address the high-density PLD and programmable gate array markets. The introduction of these devices will complete a PLD family ranging from 20-pin, 300-gate equivalent PLDs to 40-/68-/84-pin, 10,000-gate programmable gate arrays.

The Company is planning advances in its memory lines as well and is working on process and design shrinks to minimize the access times further and allow for the fabrication of 256K and larger devices.

The Company was founded by Drew Allen Osterman, Dr. Samuel T. Wang, Dhaval J.

Brahmbhatt, and Donald E. Robinson, all of whom were formerly with National Semiconductor Corporation, and Lawrence A. Yaggi, Jr., formerly with Perkin-Elmer. In January 1988, Paul K. Forster joined ICT as its first vice president of sales and marketing.

ICT entered into technology development agreements with Gould Semiconductor and Hyundai Electronics to offset major start-up costs. These agreements provide ICT with operating capital and a significant share of production capacity. The agreements also provide ICT with additional technical support in the form of CAD services and prototype wafer fabrication.

### BOARD

(Name and Affiliation)

\*Drew Allen Osterman, Chairman of the Board  
CEO and President

Paul Reagan, Director

Lee Lunsford, Director

Ali Dad Farmanfarma, Director

\*Dr. Samuel T. Wang, Director  
Vice President of Technology

C.S. Park, Director

\*Lawrence A. Yaggi, Jr.

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Drew A. Osterman  
National Semiconductor, Mktg Mgr NV Memos

#### VP Technology

\*Dr. Samuel T. Wang  
National Semiconductor, Sr Process Eng Mgr

# International CMOS Technology, Inc.

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## VP Sales/Mktg

Paul K. Forster  
Signetics, Dir Dist Sales

## VP Dsn Engr

\*Dhaval J. Brahmbhatt  
National Semiconductor, Engr Mgr

## VP Operations

\*Donald E. Robinson  
National Semiconductor, Prod Mgr EPROMs

## VP CFO

\*Lawrence A. Yaggi, Jr.  
Perkin-Elmer, Controller

\*Founder

## FINANCING

1984

Rounds 1 and 2  
\$5.0M  
Hyundai Electronics Industries

June 1987

Round 3  
\$2.0M  
Undisclosed institutional investors

February 1988

Round 4  
\$2.9M  
Undisclosed institutional investors

June 1989

IPO  
\$3.6M  
Initial public offering

## RECENT HIGHLIGHTS

January 1987

Asahi Chemical Industry received a license to ICT's technology and will market ICT's EEPROMs.

June 1987

ICT raised \$2.0 million in third-round financing. The funds were used for additional capital equipment and personnel and for general work-

ing capital. ICT also announced a move to a new 31,000-square-foot facility adjacent to its current site in San Jose, California.

July 1987

ICT offered four new CMOS UV EPROMs with access times of 35ns, 45ns, and 55ns. The 27CX641 and 27CX642 are organized as 8Kx8, and the 27CX321 and 27CX322 are organized as 4Kx8. The products differ in packaging.

September 1987

ICT offered the PDS-1 development system for designing and programming PEEL devices. Designers can use either ICT's APEEL compiler or third-party development software. The system includes an editor, a logic assembler, a PLD-to-PEEL translator, a programmer, and a device tester.

December 1987

ICT offered four new CMOS PLD devices. The 20-pin PEEL153 and 24-pin PEEL173 are plug-in replacements for bipolar FPLA devices. The 20-pin PEEL253 and 24-pin PEEL273 offer architectural enhancements to the PEEL153 and PEEL253, respectively.

January 1988

ICT signed a nationwide distribution franchise agreement with Marshall Industries.

February 1988

ICT raised \$2.9 million in fourth-round financing from undisclosed institutional investors.

June 1989

Initial public offering

## ALLIANCES

Hyundai

October 1983

Hyundai and ICT signed a joint development agreement to develop and produce seven or eight devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs. Hyundai funded ICT's initial product development and allocated 30 percent of its wafer fab capacity for an equity interest in ICT.

# International CMOS Technology, Inc.

## IMP

July 1984

IMP and ICT codeveloped a CMOS EEPROM process (expired).

## Gould

April 1986

ICT will transfer its CMOS EEPROM process semiconductor technology and products to Gould in exchange for foundry services and second-sourcing of PEEL and EEPROM devices. Gould will provide foundry services for ICT's new high-speed CMOS EEPROM family. Both companies will work on new product and technology development including work on PEEL products.

## Asahi Chemical

January 1987

Asahi Chemical Industry received a license

to ICT's technology and will market ICT's EEPROMs.

## AMD

July 1989

ICT and AMD signed an agreement for joint development of a 1Mb EPROM device with an access time of 55ns.

## MANUFACTURING

### Technology

1.25- and 2.00-micron CMOS EE process  
1.0- and 0.8-micron CMOS EE process in the near future

### Facilities

San Jose, CA

31,000 sq. ft.

Headquarters, design, test, marketing, and sales

## PRODUCTS

### Memory

Device	Description
93C46	1K Serial 5V Read/Write EEPROM
93C66	4K Serial 2.5V to 7.0V Read/Write EEPROM
27CX321/322	4Kx8 UV-Erasable PROM, 35ns, 40ns, 45ns
27CX641/642	8Kx8 UV-Erasable PROM, 40ns, 45ns, 55ns

### PEEL Devices

Device	Delay (ns)	Pins	Programmable Array(s)
PEEL18CV8	15	20	AND
PEEL22CV10	25	24	AND
PEEL20CG10	25	24	AND
PEEL153	30	20	AND/OR
PEEL173	30	24	AND/OR
PEEL253	30	20	AND/OR
PEEL273	30	24	AND/OR
PA7024	25	24	Undisclosed
PA7040	25	40	Undisclosed

PDS-1 development system that allows design with either ICT's PEEL logic compiler or third-party software. The system includes editor, logic assembler, logic simulator, PLD-to-PEEL translator, programmer, and device tester.

## OTHER INFORMATION

International CMOS Technology's PR firm is Hayes/Rothwell Public Relations.

## International Microelectronic Products

2830 North First Street

San Jose, CA 95134

408/432-9100

Fax: 408/434-0335

TWX: 910 338 2274

Telex: 499-1041

ESTABLISHED: January 1981

NO. OF EMPLOYEES: 500

### BACKGROUND

International Microelectronic Products (IMP) designs and manufactures mixed analog/digital and complex digital CMOS ASICs. The Company is a full-service vendor with in-house capability that includes cell-based design methods, advanced CAD tools, and high-performance CMOS processes. Products designed by IMP are used primarily in the microcomputer, computer peripherals, and communications markets. IMP's goal is to achieve sales of \$150 million by the early 1990s.

The Company is composed of three business groups. The IMP-Designed IC (IDIC) group performs complete IC design for customers. The Customer-Designed IC (CDIC) group links customers with their own designs and IMP's prototyping and production manufacturing. The Customer Technology Assistance Program (CTAP) supports customers in their long-term ASIC technology development efforts by coordinating technology licensing and joint development efforts for IC development and/or manufacturing capabilities in partnership with IMP.

In May 1986, IMP formed an affiliate company, IMP Europe Limited, headquartered in Swindon, England. IMP Europe's initial activities include custom IC design and applications engineering services for the European market.

In June 1987, IMP completed an initial public offering of 4.5 million shares of common stock that raised \$22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability to redeem Series-A preferred stock and for general corporate purposes.

One of IMP's goals is to maintain a process technology leadership position among ASIC suppliers.

The Company's 2- and 3-micron CMOS processes have the capability to implement various combinations of polysilicon and metal interconnect in p-well or n-well technology. In May 1988, a new 1.2-micron CMOS process and accompanying 1.2-micron analog and digital cell libraries were announced. They are tailored for mixed analog and digital functions on the same chip. The Company's facility uses all-stepper photolithography, gas plasma dry etchers, ion implantation, computer-controlled diffusion, and a computer parameter test process.

The Company's R&D programs currently focus on developing complex analog and digital cells for use in the IMP Design System; semiconductor manufacturing processes and device structures; advanced design software; and advanced networking, communications, and information systems for use in engineering and manufacturing. IMP is working with Silicon Compiler Systems Inc. to develop analog compilation techniques, with a leading university to develop advanced analog cells, and with the Company's IMP Europe affiliate for advances in CAD.

### BOARD

(Name and Affiliation)

- \*George W. Gray, Chairman  
International Microelectronic Products
- Barry Carrington, Director  
International Microelectronic Products
- \*Zvi Grinfas, Director  
International Microelectronic Products
- Russell Carson, Director  
Welsh, Carson, Anderson and Stowe
- Richard Smith, Director  
Sohio
- DuBose Montgomery, Director  
Menlo Ventures

## International Microelectronic Products

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### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

Barry Carrington  
AMI, Sr VP Mfg

#### Exec VP/CFO

Charles Isherwood  
AMI, Sr VP Corp Svcs

#### Sr VP Ops

Larry Anderson  
NEC, Mfg Manager

#### Sr VP Sales

Martin Landin  
Gould AMI, VP Sales

#### VP Technology

Dr. Moiz Khambaty  
AMI, CMOS Tech Dev

#### VP Materials

Paul Bolinger  
Synertek, Project Manager

#### VP Sales

Bob Kromer  
National Semiconductor, Regional Sales Mgr

\*Founder

### FINANCING

#### August 1981

Round 1

\$8.8M

IMP management and individuals; Charles River Partnership; Citicorp Venture Capital; Continental Illinois Venture; Harvest Ventures; INCO Securities; Lambda; Menlo Ventures; Robertson, Colman, & Stephens; Vista Ventures; Welsh, Carson, Anderson and Stowe

#### 1981

Lease

\$13.0M

Bank of America, Orchard Properties

#### August 1982

Round 2

\$7.4M

Initial investors (except IMP management and

individuals); R.W. Allsop; Edinburgh Financial, U.K.; Foster Industries; Murray Johnstone, U.K.; Prudential Nominees, U.K.; Republic Ventures; Robinson Investments; Scottish Development Agency; Stewart Enterprises, U.K.; Toronto Dominion Bank; H.G. Usher, U.K.; Wilmark R&D (Ivory & Sime), U.K.

#### June 1983

Round 3

\$14.2M

Same as round 2 (except Stewart Enterprises and Wilmark R&D); IMP management and individuals; Aiken Hume; Alex Brown & Sons; Citibank; Drayton Montagu; GE Pension Fund; Hillman Company; IBM Retirement Trust Fund; Kleinwort Benson; Latigo Ventures; Lombard Odier; Morgan, Grenfell & Co.; Morgan Stanley & Co.; Mutual Benefit Life; Pacific Technology Venture; Robert Fleming & Co.; Schulf, Woltman & Co.; Walter Scott & Partners

#### June 1984

Round 4

\$3.0M

National Semiconductor

#### August 1984

\$4.0M

Standard Oil of Ohio

#### June 1985

\$6.2M

Northern Telecom, Standard Oil of Ohio

#### June 1986

£3.0M

CIN Investor Nominees Ltd.; Citicorp Venture Capital Ltd.; Pruventure, Syntech, Grosvenor Technology Fund

#### June 1987

\$22.3M

Initial public offering

### RECENT HIGHLIGHTS

#### September 1986

Barry Carrington, president, was promoted to CEO from COO. He succeeds George W. Gray, who remains as IMP's chairman of the board.



## International Microelectronic Products

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### June 1987

IMP completed an initial public offering of 4.5 million shares of common stock, raising \$22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability, to redeem Series-A preferred stock, and for general corporate purposes.

### December 1987

IMP reported third-quarter revenue of \$13.1 million for the period ending December 31, 1987. Net income for the period was \$1.8 million, which was a 200 percent increase compared with the comparable quarter a year before.

### May 1988

IMP announced a family of analog and digital 1.2-micron cell libraries and supporting CMOS processes. The ACL-1.2 and DCL-1.2 families can implement analog and digital functions on the same chip and can offer system speeds of 40 MHz. The digital CMOS process, called C1201, and the DCL-1.2 digital cell library became available in May 1988 in the United States and in Europe through IMP Europe. The analog CMOS process, C1202, and the ACL-1.2 analog cell library became available in January 1989.

## ALLIANCES

### Zoran

June 1983

IMP and Zoran codeveloped a CMOS PROM technology.

### IXYS

November 1983

IMP codeveloped a high-voltage CMOS process with IXYS.

### National Semiconductor

1984

IMP and National Semiconductor signed a five-year technology exchange and second-source agreement transferring IMP's standard cell designs in exchange for National's multiple-

layer metal silicon-gate CMOS process, as well as future CMOS processes.

April 1985

IMP will second-source National's 2-micron gate arrays.

### Micro Linear

June 1984

IMP and Micro Linear codeveloped a 10V CMOS process. IMP provides foundry services for Micro Linear.

### Micro Linear/MBB

August 1986

IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

### ICT

July 1984

IMP and ICT codeveloped a CMOS EEPROM process.

### Iskra

April 1985

IMP and Iskra codeveloped a CMOS analog cell library for which IMP provides foundry services.

### Lattice Logic

May 1986

Lattice Logic's CHIPSMITH Silicon compiler software became available with IMP's design rules.

### Silicon Compilers

June 1986

SCI and IMP announced a strategic alliance to develop analog compilation capability for SCI's Genesil Silicon Development System. SCI will incorporate IMP's 3-micron, double-poly, double-metal process into the Genesil system.

### Lasarray

August 1986

IMP and Lasarray agreed to cooperate on developing a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module. Initial wafers will contain a 2-micron, 2-layer metal CMOS 2,400-gate array with 1.5ns delay.

# International Microelectronic Products

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## Electrolux

November 1987

IMP signed a five-year agreement with Electrolux of Sweden to develop ASIC devices that will be used in home appliances. IMP will also develop CAD tools for Electrolux and its component subsidiary, Electrolux Mecatronik. IMP will manufacture the devices in San Jose, California.

## Mitel

March 1989

Mitel Corporation and International Microelectronic Products (IMP) announced a strategic alliance in communications chips including applications related to integrated services digital network (ISDN). Under the joint technology transfer agreement, Mitel will exchange four communications chip designs for IMP's MxCMOS 1.2 manufacturing process, ACL1.2-DCL1.2 cell libraries, and mixed analog/digital design methodology.

## SERVICES

Foundry  
Design  
Prototyping

## MANUFACTURING

### Technology

3.0-, 2.0-, and 1.2-micron CMOS  
P-well, double-metal, double-poly  
5-inch wafers

### Facilities

San Jose, CA  
110,000 sq. ft.  
Headquarters and manufacturing  
16,000 sq. ft.  
Class 10 clean room

## PRODUCTS

### CMOS Gate Array

Process	Linewidth	Delay	Gates
Si-Gate	2 Microns	1.0ns	800 to 6,000

### CMOS Cell Library

Family	Process	Gate Length	Delay (ns)	Cells
ACL-3	Si-Gate	3.0 Microns	N/A	>40 Analog
DCL-3	Si-Gate	3.0 Microns	3.5	>0 Logic
DCL-2	Si-Gate	2.0 Microns	1.0	>0 Logic, RAM, ROM, PLA
ACL-2	Si-Gate	2.0 Microns	N/A	8 Analog
DCL-1.2	Si-Gate	1.2 Micron	0.3	70 Logic
ACL-1.2	Si-Gate	1.2 Micron	N/A	8

N/A = Not Applicable

### Development Tools

Device	Description
IDS-II	Distributed Processing, Sun-Based Design System for Cell-Based and Full-Custom Products
UNT	Universal Netlist Translator (UNT) that Converts any Gate Array Netlist or Cell-Based Design to an IMP Cell-Based Design
SCF Compiler	Switched Capacitor Filter Compiler Software
SCIL	Standard Cell IC Layout System Software
BIL	Block IC Layout Software

## OTHER INFORMATION

IMP's PR firm is Regis McKenna, Inc.

**Isocom Limited**  
Prospect Way  
Park View Industrial Est.  
Brenda Road  
Hartlepool, Cleveland, England  
(0429) 221431

**Isocom, Inc.**  
256 E. Hamilton Avenue, Suite H  
Campbell, CA 95008  
408/370-2212

ESTABLISHED: November 1982

NO. OF EMPLOYEES: 84

## BACKGROUND

Isocom Limited was formed to design, manufacture, and market optocouplers with the goal of becoming a major participant in the \$80 million military optocoupler market. Marketing efforts were concentrated in the European commercial and industrial markets for the first two years. In 1986, the Company began offering devices to the military market.

The Company's initial products included a range of optocouplers and interrupter switches in single-, dual-, and quad-package configurations. In 1984 and 1985, the product line expanded to include Hewlett-Packard-compatible, high-speed, high-gain optocouplers. Isocom's products, which currently include transistor-output, Darlington-output, AC-input, photo SCRs, TRIACs, and Schmitt Trigger optocouplers, are used in power supplies, telecommunications, instrumentation, and modems. In the second quarter of 1985, the Company became one of the first to offer a range of surface-mount devices.

Isocom was founded by several former Litronix managers and is headquartered in Hartlepool, England, with a U.S. sales and marketing office in Campbell, California. Design, manufacturing, and test are done at the 25,000-square-foot Hartlepool facility. Some assembly is contracted to companies in the Far East.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Colin Rees  
Litronix, Mgr Europe Sales

### Technical Dir

\*Andrew Mann  
Siemens, Prod Mgr Optocoupler Div

### VP Isocom, Inc.

Sam Kaufman  
Siemens, Director of Marketing

\*Founder

## FINANCING

Not available

## MANUFACTURING

### Technology

Silicon  
GaAs  
GaAlAs

### Facilities

Hartlepool, England  
25,000 sq. ft.  
R&D, design, manufacturing, test  
Campbell, CA  
2,000 sq. ft.  
Marketing and sales

# Isocom Limited

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## PRODUCTS

- Minicouplers
- High-Speed/High-Gain Couplers
- High-Isolation Optocouplers
- High-Speed Tristate Optocouplers
- High-Voltage Photo Transistor Couplers
- Switches
- Hybrids
- Visible Lamps
- Visible Displays
- Integrated Displays

## OTHER INFORMATION

Isocom does not employ a PR firm.

# ISSI

680 Amador Lane  
Sunnyvale, CA 94086  
408/733-ISSI (4774)  
Fax: 408/245-ISSI (4774)

ESTABLISHED: October 1988

NO. OF EMPLOYEES: N/A

## BACKGROUND

Integrated Silicon Solution, Inc., (ISSI) was founded in October 1988 by Jimmy Lee, K.Y. Han, and Fu Tseng to develop CMOS semiconductor products that provide superior system-level reliability, price, and performance.

The Company's initial focus is on high-performance SRAMs and cache memory products. First products will include 16K and 64K SRAMs and 16K and 64K cache data RAMs. ISSI will expand its product line to include SRAMs with densities up to 1Mb, cache controllers, and cache tag RAMs. The Company plans to develop BiCMOS TTL RAMs in mid-1990. In the future, ISSI plans to develop EE memories, EEPLDs, and Flash EEPROM devices. ISSI will begin taking bookings in December 1989, with volume production scheduled for mid-February 1990.

ISSI received funding from Wearnes Technology Corporation, the corporate venture capital investment office for the Wearnes Technology Group. The Wearnes Technology Group is a multinational computer and high-technology products manufacturer based in Singapore. The group has a high degree of vertical integration. ISSI will benefit from partnerships with sister companies in the Wearnes Group. Assembly, for instance, will be conducted by a sister company in Indonesia.

ISSI has entered manufacturing agreements with LSI Logic Corporation, Taiwan Semiconductor Manufacture Corporation, and United Microelectronics Corporation. All three of these companies will serve as foundries for ISSI. The Company has licensed technology to UMC and LSI. The Company will conduct R&D, design, test, and marketing operations at its Sunnyvale, California, facility.

## BOARD

(Name and Affiliation)

- \*Jimmy Lee  
ISSI, President
- \*K.Y. Han  
ISSI, VP Engineering
- \*Dr. Fu H. Tseng  
ISSI, VP Technology
- Dr. Richard Yen  
Wearnes Technology Corporation
- Joe Liu  
TechLink, President
- George Liao  
Audix

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

- President
    - \*Jimmy Lee  
ICI, Engineering Manager
  - VP Technology
    - \*Dr. Fu H. Tseng  
Visic/VTI, Principal Process Staff
  - Dir Mktg
    - Richard Cimino  
Wyle Dist. Grp., Area Sales Manager
  - VP Engineering
    - \*K.Y. Han  
Vitellic, Design Engineering Mgr
  - Dir Design Eng
    - Yun Hwang  
MOSel, Engineering Director
- \*Founder

# ISSI

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## FINANCING

January 1989

Seed

\$800,000

Private, Wearnes Technology Corp.

June 1989

Round 1

\$1.5M

Private, Wearnes Technology Corp.

September 1989

Round 1

\$0.5M

Private, Wearnes Technology Corp.

## ALLIANCES

United Microelectronics Corporation

January 1989

ISSI signed a licensing and manufacturing agreement with UMC that covers ISSI's SRAM and cache product lines..

## PRODUCTS

4Kx4 Sub-15ns (16K)

8Kx8 Sub-20ns (64K)

16Kx4 Sub-20ns (64K)

32Kx8 Sub-25ns (256K)

32Kx8 Low-Power Sub-70ns (256K)

128Kx8 Sub-35ns High-Performance (1Mb)

128Kx8 Low-Power Sub-70ns (1Mb)

## OTHER INFORMATION

ISSI does not employ a PR firm.

Taiwan Semiconductor Manufacturing Corporation

August 1989

ISSI signed a foundry agreement with TSMC.

LSI Logic

September 1989

ISSI signed a licensing and manufacturing agreement with LSI.

## MANUFACTURING

### Technology

1.2-, 1.0-micron single-poly, double-metal CMOS

0.8-micron CMOS available Q1 1990

### Facilities

Sunnyvale, CA

10,000 sq. ft.

R&D, design, test, marketing

# IXYS Corporation

2355 Zanker Road  
San Jose, CA 95131  
408/435-1900

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 70

## BACKGROUND

IXYS designs, manufactures, and markets a specialized line of discrete power MOS devices, VLSI CMOS digital ICs, and CMOS analog ICs. The Company's products are designed for motion control applications in machinery, such as robots and home appliances, and in power conversion equipment, such as precision DC motors and high-voltage switches.

IXYS' smart power products include monolithic current sensing to simplify the design of current-mode switching power supplies. The Company plans to integrate a function that will monitor device junction temperature on the power chip.

IXYS also is working with NASA and other major aerospace companies to provide high-reliability space versions of the technology for all-electric aircraft and space station programs.

## BOARD

(Name and Affiliation)

David Cooper, Chairman  
IXYS Corporation, President/CEO

Jack Carsten, Director  
U.S. Venture Partners

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

David Cooper  
SGS-Thomson, WW Dir Power MOS

### Exec VP

Nathan Zommer  
GE Intersil, Mgr Pwr MOS R&D

### Sr VP Power ICs

Dick Blanchard  
Siliconix, VP Dsn & Tech

### VP Worldwide Sales

Daniel Schwob  
GE, Prod Mktg Mgr

### VP Finance/Admin

Jim Wu  
Siliconix, Controller

### VP Marketing

Edward Day  
Sprague Electric, Regional Sales Mgr

### Ops Mgr

Tony DeCarlo  
Intersil, Dir Custom Svc

### Dir Operations

Walt Buchanan  
G2, Dir Mktg

### Chief Operating Officer

William T. Malanczuk  
National Semiconductor, VP WW Waferfab and Technology

## FINANCING

### 1983

Round 1  
\$0.8M  
Fred Adler

### October 1985

Round 2  
\$6.7M  
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership

### August 1987

Round 3  
\$3.0M  
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Oak Investment Partners; U.S. Venture Partners

## IXYS Corporation

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### August 1988

Round 4

\$6.2M

Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership First Boston; Bay Partners; John F. Shea

## RECENT HIGHLIGHTS

### January 1986

IXYS offered its first product, the IXSE501, a Shaft Encoder Peripheral Interface IC. The device is a CMOS monolithic two-channel PWM control processor for micro-stepping two-phase stepper motors and other applications.

### June 1986

IXYS offered a line of MOS insulated-gate transistors (MOSIGTs) developed by Nathan Zommer, who originally developed IGTs while at GE Intersil. The new devices combine the IGT design with polysilicon gate CMOS technology.

### March 1987

IXYS relocated into a new 53,000-square-foot facility in San Jose, California. The facility, which is six times larger than the Company's former facility, includes an automated line and has capability for custom packaging. IXYS plans to invest between \$2 million and \$3 million in the line over the next two years.

### March 1987

IXYS offered the IXMS150, a CMOS two-channel PWM control processor.

### August 1987

IXYS named David Cooper president and chief executive officer. Mr. Cooper takes over the position from Alan Hofstein. Mr. Cooper will focus on expanding the Company's development efforts in power chips, high-voltage ICs, and power modules, with various new product introductions. Before joining IXYS, Mr. Cooper was worldwide director of power and smart power operations for SGS-Thomson, a Milan,

Italy-based chipmaker with annual sales of more than \$1 billion.

### August 1987

IXYS raised \$3.0 million in third-round financing.

### October 1987

Dick Blanchard joined IXYS as senior vice president and heads the Company's smart power IC design team. Mr. Blanchard was with Siliconix previously, most recently as vice president of design and advanced technology development. He reports to Mr. Cooper.

### November 1987

IXYS began offering its power MOSFETs and MOSIGTs in military packages.

### December 1987

IXYS introduced the MOSBLOC IGBT family of modules, which range from 25A to 200A in both 600V and 1000V versions. The devices are packaged in bipolar Darlington modules, as used by Japanese vendors. The product family is aimed at motor control and other industrial applications that are served by Japanese suppliers. IXYS expects this product family to become its major commercial product line and to account for as much as \$30 million per year in revenue.

### August 1989

IXYS acquired the ASEA Brown Boveri Power Semiconductor Group in Lampertheim, West Germany.

## ALLIANCES

### IMP

November 1983

IMP and IXYS codeveloped a high-voltage CMOS process.

### Ricoh

1984

IXYS and Ricoh signed a technology exchange for Ricoh to provide wafers; IXYS is providing its power MOSFET HDMOS process (expired).



## Samsung

January 1986

IXYS signed an agreement with Samsung Semiconductor and Telecommunications under which Samsung will receive IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas; the two companies will jointly manufacture IXYS' first smart power products.

## ABB

May 1988

IXYS announced a joint venture agreement with ASEA Brown Boveri Corporation. The agreement is expected to strengthen the marketplace for industrial power control using ABB's patented copper substrate bonding

technology and IXYS' advanced technology in smart power, IGBTs, and Mega MOS.

## MANUFACTURING

### Technology

1.2- to 4.0-micron CMOS HDMOS (high-performance DMOS)

5-inch wafers

4-inch wafers

6-inch wafers

### Facilities

San Jose, CA

53,000 sq. ft.

Design, manufacturing, hi-rel assembly, test

## PRODUCTS

### PowerFETs

Device	Description
MegaMOS FETs	Large-Scale Monolithic Power MOSFETs
Power MOSFETs	High-Voltage n-Channel and p-Channel MOSFETs
MirrorFETs	Power MOSFET with Monolithic Current Sensing
LIMOFETs	Mega MOSFET with IC Drive Technology
HiPerFETs	Power MOSFET with High DV/DT Ruggedness
MOSIGBTs	Monolithic Power MOSFETs with Bipolar Devices
MOSBLOC Modules	Power MOSFETs or MOSIGBTs

### Integrated Circuits

IXLD426-9	CMOS MOSFET Drivers
IXED0900/1500	CMOS Address Encoder/Decoder
IXMS150	CMOS Monolithic Two-Channel PWM Controller
IXPD610	Digital Pulse-Width Modulator (DPWM)
IXSE501	Shaft Encoder Peripheral Interface (SEPI)
IXSE510	16 Bit (SEPI)
IXBD4410	High Side/Low Side Driver

## OTHER INFORMATION

IXYS' PR firm is Simon McGarry.

# Krysalis Corporation

1135 Kern Avenue  
Sunnyvale, CA 94086  
408/749-7390  
Fax: 408/739-5362

ESTABLISHED: 1985

NO. OF EMPLOYEES: 12

## BACKGROUND

Krysalis was formed to develop and manufacture nonvolatile semiconductor memories, using a CMOS ferroelectric technology. Founders of the Company are Joseph T. Evans, formerly of the U.S. Air Force Weapons Laboratory, and William D. Miller, formerly of Signetics.

The Company plans to market 16K and derivative products as initial process vehicles. The products will feature an access time of 120ns and emphasize radiation-hardened and industrial applications.

Krysalis demonstrated the feasibility of manufacturing the devices with a 512-bit UniRAM memory part using a 3-micron process at Orbit Semiconductor. At this time, Krysalis is shipping a family of latch and register products, evaluation units, and a 4K serial RAM.

In October 1989, National Semiconductor Corporation acquired Krysalis' assets, including all rights to Krysalis' ferroelectric technology. National and Krysalis had previously entered into a technology agreement under which the companies agreed to share technology, product codevelopment, and manufacturing services.

The Company believes that its process can be applied to wide ranges of logic including ASICs, MPUs, and TTL-compatible logic. The ferroelectric technology also is said to be compatible with bipolar, CMOS, and GaAs processes.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President/CEO**  
Dr. James Harris  
Akashic, Pres/CEO

**VP Tech**  
\*William D. Miller  
Signetics, Process Dev

**VP/CFO**  
Neil Hennessey  
Gould NavCom, VP Finance

\*Founder

## FINANCING

**May 1986**  
Seed  
\$1.0M  
Columbine Venture Fund, Crosspoint Venture Partners, Meadows Ventures, OSCCO Ventures, Weeden Capital Partners

**December 1986**  
Round 1  
\$3.2M  
Initial investors

**October 1989**  
Acquired by National Semiconductor Corporation

## RECENT HIGHLIGHTS

**1987**  
Krysalis set up a small, \$3.0 million materials research laboratory in New Mexico.

**December 1987**  
Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. (See "Alliances" for more details.)

# Krysalis Corporation

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## ALLIANCES

### National Semiconductor

December 1987

Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. National will provide product engineering, manufacturing, and marketing support. Initially, National will supply base wafers based on a 2-micron process. Krysalis will complete fabrication of the wafers through packaging, test, and burn-in. Krysalis will conduct its own marketing and sales.

## MANUFACTURING

### Technology

2- and 3-micron

### Facilities

Sunnyvale, CA  
Albuquerque, NM

## PRODUCTS

Family of Latch and Register Products  
Evaluation Units  
4K Serial RAM

## OTHER INFORMATION

Krysalis does not employ a PR firm.

# Kyoto Semiconductor Corporation

418-3, Yodosai-me-cho  
Fushimi-ku Kyoto 613, Japan  
075-631-8823  
Fax: 075-631-8291

ESTABLISHED: April 1980

NO. OF EMPLOYEES: 20

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## BACKGROUND

Kyoto Semiconductor offers GaAs light-emitting diodes (LEDs), phototransistors, photosensors, and LED displays. The diodes offer twice the efficiency of available units. The heterostructured diodes feature a 23.6 percent light-emitting efficiency at peak wavelengths of 190nm. Four selections of wavelengths are available: 660, 750, 830, and 890.

Kyoto Semiconductor's major customers are Mitsubishi Electric and General Instrument. The Company contracts assembly to companies in Taiwan.

## BOARD

Not available

## PRODUCTS

- High Bright LEDs
- Infra LEDs
- Photo TRs
- Photosensors
- LED Displays

## OTHER INFORMATION

Kyoto Semiconductor does not employ a PR firm.

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

**President**  
Jousuke Nakata  
Mitsubishi

## FINANCING

Capitalization: ¥62 million

## MANUFACTURING

Not available

## Facilities

Kyoto, Japan  
Production

# Lattice Semiconductor Corporation

555 N.E. Moore Court  
Hillsboro, OR 97124  
503/681-0118  
Fax: 503/681-3037

ESTABLISHED: April 1983

NO. OF EMPLOYEES: 110

## BACKGROUND

Lattice Semiconductor Corporation (LSC) designs, develops, manufactures, and markets high-performance PLDs using a proprietary EE CMOS technology. LSC has pioneered a line of high-speed PLDs called Generic Array Logic (GAL) as direct pin-for-pin replacements of bipolar PAL devices. The next generation, ispGAL devices, includes in-system programmability that makes logic configurable "on the fly" under software control for robotics and artificial intelligence applications.

LSC has established agreements with National Semiconductor and SGS in Milan, Italy. In exchange for the right to use certain GAL designs, the companies provide wafers and assembly services. The Company conducts all final testing, including quality and reliability testing, at the LSC facility in the United States.

In September 1986, Monolithic Memories, Inc. (MMI), filed a class action suit against LSC and Altera, charging patent infringement of the PAL architecture. LSC filed a \$300 million countersuit charging MMI with abusing the Sherman Act, i.e., trying to destroy the competition. The MMI suit brought negotiations for additional financing, which were in progress, to a standstill. In December 1986, Rahul Sud, president; Jay McBride, general manager; S. Robert Brutbarth, and Kishan C. Sud resigned from LSC. As a result of these events, during 1987, LSC took aggressive actions to restructure the Company and filed a voluntary petition for protection under the Chapter 11 federal bankruptcy law.

On September 28, 1987, LSC's reorganization plan under federal bankruptcy law became effective, marking the Company's exit from Chapter 11. As a result of the restructuring, the

Company raised \$1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson. In November 1987, LSC relocated to a new headquarters in Hillsboro, Oregon, tripling its manufacturing space. Also in November, LSC and MMI settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents in PLDs.

In 1987, LSC signed Arrow Electronics as its authorized U.S. distributor and also signed Almex, in France; Alcom, in the Netherlands; Bacher GmbH, in the Federal Republic of Germany; and Henaco, in Norway. In addition, Lattice signed sales representatives in the United States and the United Kingdom.

## BOARD

(Name and Affiliation)

C. Norman Winningstad, Chairman  
Floating Point Systems, Chairman

Dan Hauer  
S-MOS (Seiko-Epson), President

Harry A. Merlo  
Louisiana Pacific Corp., Chairman/CEO

Roy Pollack  
RCA (retired)

Ole Christian Sand  
Elcon Partners; Oslo Norway

Douglas C. Strain  
Electro Scientific Industries, Vice Chairman

Cyrus Tsui  
Lattice Semiconductor Corp, CEO

# Lattice Semiconductor Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO

Cyrus Tsui  
AMD, VP PLD Div

### VP Finance/Admin

Jan Johannessen  
N/A

### VP Sales

Paul Kollar  
Signetics, Dir Natl Ops

### Dir Marketing

Bill Wiley Smith  
Silicon Systems, Dir Apps

### VP/Operations

Daniel Hu  
AMD, VP Calif Wafer Fab Op

## FINANCING

### 1983

Round 1  
\$1.9M  
Datavekst A/S, Norway; Floating Point Systems, Inc.; Louisiana-Pacific Corp.; Harry A. Merlo, C. Norman Winningstad, and other corporate stockholders

### July 1984

Credit  
\$2.7M  
Oregon Bank, U.S. National Bank

### September 1987

Round 2  
\$1.6M  
Previous investors

### January 1988

Credit  
\$1.5M  
First Interstate Bank

### February 1988

Round 3  
\$2.5M  
Institutional investors

### April 1988

Round 4  
\$5.0M  
Institutional investors

### September 1989

IPO  
\$14.0M  
Initial public offering

## RECENT HIGHLIGHTS

### September 1986

LSC adds Bell Industries of Los Angeles, California, as a distributor.

### October 1986

LSC offers GAL16V8-25P and GAL20V8-25P "quarter-power" devices that are 25ns PLDs and operate with only 45 milliamperes. The GALs can be configured into any one of 21 PAL architectures.

### October 1986

LSC offered Q11987, an 8Kx8, 64K CMOS SRAM with an access time of 25ns.

### April 1987

LSC offered the GAL39V18, a programmable logic device using EE CMOS technology. Maximum delays are 30ns from input to output and 15ns from clock to output.

### June 1987

LSC recalled its fast 64K EEPROM product line, which it began sampling in late 1986 due to engineering flaws.

### July 1987

LSC filed a voluntary petition for protection under Chapter 11 federal bankruptcy law. The Company cut back on its SRAM development and laid off approximately 15 employees.

### September 1987

LSC's reorganization plan under federal bankruptcy law became effective on September 28, 1987, and marked the Company's exit from Chapter 11. As result of the restructuring, the Company raised \$1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson.

# Lattice Semiconductor Corporation

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## November 1987

LSC relocated to a new headquarters in Hillsboro, tripling its manufacturing space.

## November 1987

LSC and Monolithic Memories, Inc., settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

## December 1987

LSC announced a 33 percent reduction on the average selling price of its GAL devices.

## January 1988

LSC, although a privately held company, reported product sales of \$3.4 million for the third quarter ending January 3, 1988. The \$3.4 million was a 93 percent increase over the third-quarter sales the year before. Second-quarter sales, for the period ending September 26, 1987, were \$2.9 million. LSC also reported annual revenue exceeding \$13.5 million.

## ALLIANCES

### Floating Point Systems

1983

LSC and Floating Point Systems agreed to exchange technology for LSC's UltraMOS technology and FPS' DSP and array processor technology. Floating Point Systems gained major equity participation as well as long-term purchasing agreements from LSC. (expired)

### Synertek

July 1984

LSC and Synertek signed a cross-licensing and second-sourcing agreement allowing Synertek to use LSC's UltraMOS process to manufacture a 35ns, 64K SRAM in exchange for a portion of Synertek's production capacity in Santa Cruz, California. (expired)

### VLSI Technology

September 1984 LSC provided technology for CMOS EEPROMs and SRAMs to VLSI Technology in exchange for foundry services at VLSI. (expired)

## Seiko-Epson/S-MOS

January 1986

LSC announced a manufacturing and second-sourcing agreement. Seiko-Epson acquired the license to LSC's 16Kx4 SRAM design and process technology; S-MOS acquired the rights to market the part in North America.

## SGS

February 1987

LSC signed a technology agreement with SGS Semiconductor, giving SGS a license to second-source LSC's GAL products. SGS will manufacture the GAL products for LSC, and both companies will cooperate on the design of future PLD products.

## National Semiconductor

May 1987

National Semiconductor made a minority capital investment in LSC and licensed its GAL technology. The five-year agreement includes co-development of denser architectures of both standard and in-system programmable GALs, as well as a new line of FPLAs and sequencer devices.

## MMI

November 1987

LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

## AMD

May 1989

Lattice signed a new cross-licensing agreement with AMD. Under the agreement, Lattice is licensed to manufacture AMD's industry-standard 22V10 programmable logic device and to use the 22V10 architecture in manufacturing GAL products. AMD is licensed to manufacture GAL devices using Lattice's architecture.

## MANUFACTURING

### Technology

1.1 to 0.9-micron CMOS  
6-inch wafers

### Facilities

Hillsboro, OR  
44,000 sq. ft.  
Design and test

# Lattice Semiconductor Corporation

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## PRODUCTS

### GAL Products

Device	Speed
GAL16V8	10 to 25ns
GAL16V8A	10ns
GAL20V8	10 to 25ns
GAL22V10	15ns
GAL6001	30ns
ispGAL 16Z8	15 to 25ns

### Development Tools

All Devices      Third-Party Development Support from Leading PLD Systems, Both Hardware and Software

## OTHER INFORMATION

LSC's PR firm is KVO, Inc.



## Level One Communications Inc.

105 Lake Forest Way

Folsom, CA 95630

916/985-3670

Fax: 916/985-3512

ESTABLISHED: November 1985

NO. OF EMPLOYEES: 39

### BACKGROUND

Level One Communications Inc. designs, manufactures, and markets system-specific transceivers (transmitters/receivers) and associated peripheral circuits for the twisted-pair, high-speed digital communications market. Products are designed for integrated voice, data, and video communications systems and networks at speeds from 19.2 Kbps to 16.0 Mbps.

Transceivers combine digital and analog circuitry to convert digital impulses into line code, a language that travels more efficiently on twisted-pair wire than nonencoded digital signals. The sending transceiver converts data according to a given line code and transmits it through twisted-pair wires. The transceiver at the receiving end of the line decodes the encoded signals to data.

Level One offers integrated analog and digital ASIC transceiver ICs that can be tailored to specific systems using a modular cell-based approach. To accelerate design time significantly, Level One has developed the LxLIB, a library of predefined mixed analog and digital ICs and functional blocks that can be assembled quickly. Level One also has developed proprietary CAD simulation tools dedicated to transceiver development. The CAD simulation and techniques model the physical-level communications systems and associated transmission lines. The line simulator also is used for automated component testing by providing analog input waveforms to the tester.

Level One's transceiver products are composed of front and back ends. The front end is the transceiver core and contains blocks of cells that perform the analog functions such as pulse shaping, encoding, and timing and data recovery. The back end is the system interface, which handles the digital functions and the interface to each customer's system.

The Level One design team has had extensive experience in PBX transceivers and ISDN devices at companies such as AMD, AT&T Bell Labs, Hitachi, Intel, Mitel, National Semiconductor, and Rockwell.

As of October 1988, the Company had completed four rounds of funding. The seed round was completed in December 1985, when Julian, Cole & Stein, a Los Angeles-based venture capital firm, purchased 38 percent of the Company for \$800,000. In December 1986, Julian, Cole & Stein purchased an additional percentage of the company for \$2 million. The third round brought investments of \$5 million, with lead investors Warburg, Pincus Ventures Inc., and Julian, Cole & Stein. The fourth round of funding resulted from a private placement, arranged by Merrill Lynch Capital Markets, of convertible preferred stock for Julian, Cole & Stein's Strategic Technologies Portfolio. This funding brought an additional \$6.25 million to Level One, which will be used for business expansion, new product development, and general working capital.

The Company leased a 21,000-square-foot facility in Folsom, California, where it conducts R&D and design. Level One has contracted International Microelectronic Products (IMP) and Mitel to manufacture its products. IMP will work closely with Level One to adapt its CMOS process to meet the specific analog and digital requirements of integrated transceivers.

### BOARD:

(Name and Affiliation)

Charles R. Cole

Julian, Cole & Stein, Partner

James M. Julian

Julian, Cole & Stein, Partner

Dr. Henry Kressel

N/A

# Level One Communications Inc.

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Dr. Robert S. Pepper  
Level One Communications, President/CEO

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Dr. Robert Pepper  
RCA, VP/GM Solid State Div

### VP Mktg/Sales

J. Francois Crepin  
LSI Logic, Dir WW Strat Plan

### VP Finance/Admin

\*Terry S. McCoy  
American Continental, Dir Finance

### VP Engineering

Cecil Aswell  
Siemens, Dir Engr

\*Founder

## FINANCING

### December 1985

Seed  
\$0.80M  
Julian, Cole, & Stein

### December 1986

Round 1  
\$2.00M  
Julian, Cole, & Stein

### September 1987

Round 2  
\$5.00M  
Julian, Cole and Stein; Warburg, Pincus  
Ventures Inc

## PRODUCTS

Device	Description
LXT200	ISDN STT Interface Transceiver
LXP302	T1/ESF Digital Trunk Interface Circuit
LXP303	CEPT/CRC Digital Trunk Interface Circuit
LXP600	Clock Adapter

### September 1988

Round 3  
\$6.25M

Merrill Lynch Capital Markets private placement for Julian, Cole, and Stein. Investors included Ameritech Pension Fund; Delaware State Employees Retirement Fund; The St. Paul Companies; Transamerica Occidental Life Insurance Company

## ALLIANCES

### LTX

1986

Level One was selected to codevelop and field test new ISDN platforms with LTX.

### Mitel

May 1988

Level One and Mitel signed a 5-year joint development and second-source agreement that covers advanced transceivers for T-1 transmission and ISDN markets.

## MANUFACTURING

### Technology

3.0-micron double-poly, double-metal, 5V CMOS  
2.0-micron double-poly, double-metal, 5V CMOS  
1.5- and 1.2-micron planned  
Level One contracts its foundry work to International Microelectronic Products of San Jose, California

### Facilities

Folsom, CA  
21,000 sq. ft.  
Administration, design, R&D, and test

**Products under Development**

LXT130	TCM Transceiver (3,000 feet)
LXT134	Quad TCM Transceiver (3,000 feet)
LXT131	TCM Transceiver (6,000 feet)
LXT135	Quad TCM Transceiver (6,000 feet)
LXT300	T1/CEPT Integrated Transceiver
LXT324	T1 Quad Receiver
LXT400	DDS Transceiver

**OTHER INFORMATION**

Level One's PR firm is Regis McKenna, Inc.

# Linear Integrated Systems Inc.

47853 Warm Springs Boulevard

Fremont, CA 94539

415/659-1015

Fax: 415/659-1365

ESTABLISHED: July 1987

NO. OF EMPLOYEES: 50

## BACKGROUND

Linear Integrated Systems Inc. (LIS) designs, manufactures, and markets standard and custom low-noise, precision, linear ICs and high-resolution A/D and D/A converter ICs. The Company's products are designed to serve data acquisition applications in the military, industrial, and medical market sectors. LIS provides ASIC design services using a cell-based design approach. The Company's cell-based library uses an advanced set of automated layout tools that combine cells, process, and software.

LIS began offering products in January 1988 and currently offers 18 products. Future plans include expanding the Company's high-resolution, high-speed, high-accuracy data conversion products; low-noise, high-precision linear ICs products; and additional cell-based designs in both the linear and digital areas. Developments will emphasize military applications with higher levels of radiation hardness.

The Company was founded by John Hall, who founded and served as president of Micro Power Systems. The Company conducts manufacturing and engineering in Fremont, California. Recently, a second facility was completed; it houses design and corporate offices.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*John Hall

Micro Power

### General Manager

Bob Sabo

Micro Power

### Dir Mktg

Richard Hall

Micro Power

\*Founder

## FINANCING

Not available

## ALLIANCES

Not available

## MANUFACTURING

### Technology

Bipolar linear

1.5- to 5.0-micron high-density CMOS

Both processes are offered with dielectric isolation and the capability to withstand high levels of nuclear radiation.

### Facilities

Fremont, CA

10,000 sq. ft.

Administration, design, manufacturing, test

The Company has an additional 5,000 sq. ft. of dedicated capacity.

## SERVICES

ASIC Design

## **Linear Integrated Systems Inc.**

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### **PRODUCTS**

Precision Low-Noise Linear ICs  
High-Resolution A/D and D/A Converter ICs  
Cell-Based Library of Linear/Digital Cells

### **OTHER INFORMATION**

Linear Integrated does not employ a PR firm.

# Linear Technology Corporation

1630 McCarthy Blvd.  
Milpitas, CA 95035-7487  
408/432-1900

ESTABLISHED: September 1981

NO. OF EMPLOYEES: 450

## BACKGROUND

Linear Technology Corporation (LTC) designs, manufactures, and markets a broad line of standard high-performance linear ICs using silicon gate CMOS and bipolar technologies. The Company markets about 180 linear ICs, with temperature and packaging variations resulting in more than 1,800 device types, one-half of which are proprietary. Products focus on the instrumentation, process control, industrial, and military markets.

The Company specializes in precision products in the analog and analog-to-digital interface markets and also provides proprietary linear functions for its products, including data acquisition products. LTC supplies op amps, voltage regulators, references, data conversion devices, interface devices, monolithic filters, and special-function devices such as temperature sensors. In the future, LTC plans to increase its presence in the converter and interface markets. LTC benefits from the increasing prominence of its proprietary chips and from the absence of Japanese competition.

The Company has a strong presence in the military market, accounting for approximately 10 percent of worldwide sales and about 35 to 40 percent of North American sales. From its beginning, LTC followed a marketing strategy aimed at penetrating the military market. In August 1984, LTC received DESC JAN Class-B qualification and, in 1987, also achieved certification to begin fabrication of JAN Class S-level linear devices for space applications. The first Class-S product is the LM108AH, an operational amplifier that was shipped in 1988.

Linear Technology was founded in 1981 by Robert H. Swanson, Jr., Robert C. Dobkin, Brian E. Hollins, Brent Welling, and Robert Widler from National Semiconductor's linear design group. In September 1982, the manufacturing team was in place and the Company

had moved into its current facility in Milpitas, California. By January 1983, the Company had produced its first wafers.

In May 1986, LTC established a company in Tokyo, Japan, to provide technical services to its Japanese customers. The company, named Linear Technology K.K., is wholly owned by the U.S. parent.

In September 1986, LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas. The Company's previous headquarters were taken over by LTC's expanded design, engineering, and domestic high-reliability assembly and wafer fabrication operations already located in the building.

In 1987, LTC signed an agreement with Texas Instruments, providing the Company with TI's BiCMOS manufacturing, assembly, test, and CAD tools, and a credible second source.

LTC markets its products through a network of independent sales representatives and electronics distributors. The Company also has approximately 1,000 OEM customers, including Compaq, Fujitsu, Honeywell, HP, Hughes, Philips, Raytheon, Rockwell, and Siemens.

## BOARD

(Name and Position)

- \*Robert H. Swanson, Jr.  
Linear Technology Corporation, President, CEO
- Regis McKenna  
Regis McKenna, Inc., Chairman
- Glenn M. Mueller  
Mayfield Fund, General Partner
- Thomas S. Volpe  
Volpe & Company, Managing Partner

# Linear Technology Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Robert H. Swanson  
NSC, VP/GM Linear IC Ops

### VP Operations

Dr. Clive B. Davies  
NSC, Grp Dir Adv Tech

### VP Engineering

\*Robert C. Dobkin  
NSC, Dir Adv Circuit Dev

### VP Mktg/Sales

William A. Ehrsam  
NSC, Grp Dir Mktg Commun

### VP Finance/CFO

Paul Coghlan  
GenRad, VP/GM Test Prod Div

\*Founder

## FINANCING

### September 1981

Round 1

\$5.0M

Capital Management Services; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Mayfield Fund; Sequoia Capital; Sutter Hill Ventures; Technology Venture Investors

### May 1982

Round 2

\$5.0M

Olivetti, Finance for Industry, and a Hong Kong investor

### Lease

\$9.0M

Greyhound Computer Corp.

### April 1983

Round 3

\$7.0M

Cowen and Company, Greivson Grant, Kemper Financial, Kleinwort Benson, Morgan Stanley, State Farm, Touche Remnant, and others

### Lease

\$9.0M

Greyhound Computer Corp.

### May 1986

Initial public offering  
\$24.0M

## RECENT HIGHLIGHTS

### May 1986

LTC established a Japanese unit to strengthen its technical services to Japanese customers. The unit is Linear Technology K.K. and is wholly owned by LTC in the United States. Robert Swanson was appointed president and Atsushi Nakata, general manager.

### September 1986

LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas.

### December 1986

LTC announced voltage references and other devices in surface-mount packages.

### February 1987

Linear introduced its XH series that includes five linear ICs guaranteed to operate at a temperature range from -125° to +200° centigrade.

### April 1987

LTC offered the LT1030, a bipolar line driver. The quad, low-power, line driver is part of LTC's family of RS-232 driver/receiver circuits. It can be used as an interface, an RS-232 driver, or as a logic-level translator.

### June 1987

LTC offered the LTC1090, a 10-bit CMOS data acquisition system. It includes a software-controlled 8-bit analog multiplexer with sample-and-hold and a 10-bit ADC. The device operates in a full-duplex mode, and a selection feature allows data to be transmitted either most-significant-bit (MSB) first or least-significant-bit (LSB) first.

### July 1987

LTC received QPL Part-1 approvals from DESC for 10 of the company's BiFET and low-noise operational amplifiers and negative adjustable regulators. This brings the number of JAN QPL parts available to 30.

## ALLIANCES

### Silicon General

July 1982

LTC and Silicon General signed a technology exchange and second-source agreement under which Silicon General provides pulse width modulators and two additional circuits and second-sources several high-current series pass regulators developed by LTC; no masks are involved. (expired)

### Teijin/Japan Macnics/Technology Trading

June 1983

LTC signed an agreement with Teijin Advanced Products, Japan Macnics, and Technology Trading for distribution in Japan.

### Signetics

June 1984

LTC and Signetics signed a three-year agreement granting Signetics the right to purchase die in wafer form and manufacturing rights for three precision op amps and other unnamed products. Signetics provided LTC with certain small-outline packaging services. (expired)

### Interdesign

July 1984

LTC and Interdesign entered into a three-year agreement granting Interdesign the right to design IC arrays, using up to three of LTC's processes. LTC also agreed to dedicate foundry capacity to manufacture the Interdesign arrays. (extended)

### Motorola

January 1985

Motorola and LTC signed a seven-year agreement granting each other rights to several patents. LTC gained rights to several Motorola patents; Motorola gained rights to patents obtained and filed during the term of the

agreement, which expires in 1991. LTC also will make specific lump-sum payments through 1991.

### National

July 1986

National and LTC entered into a patent-licensing agreement granting LTC rights to products under two National BiFET patents. National was granted rights to LTC's BiFET-related patents, including those filed through 1992. LTC pays royalties.

### TI

March 1987

LTC and Texas Instruments signed a five-year agreement allowing TI to select six of LTC's circuits every six months for the duration of the agreement. TI will pay LTC \$500,000 every six months and pay royalties for a 10-year period on any LTC circuit that TI produces.

## MANUFACTURING

### Technology

Single-layer polysilicon bipolar  
Single- and double-layer silicon-gate  
(LTCMOS)  
4-inch wafers  
5-inch wafers

### Facilities

Milpitas, CA  
40,600 sq. ft.  
Administration and manufacturing  
20,000 sq. ft.  
Class 10 clean room  
42,000 sq. ft.  
Linear headquarters and test  
Most commercial product assembly is subcontracted to companies in South Korea, Malaysia, Thailand, and Taiwan.

## PRODUCTS

### Regulators

Positive fixed and adjustable regulators ranging from 125mA to 5A.

### Reference

Wide range of references from 1.2V to 10.0V.



# **Linear Technology Corporation**

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## **Op Amps**

LTC offers a complete line of Op Amps and more than 40 different chips.

## **Comparators**

Dual, CMOS Dual, High-Speed and Window Comparators, and Voltage Regulator plus Comparator

## **Filters**

Single, Dual and Triple Filters, Five-Pole, Maximally Flat, Low-Pass Filter, 8th Order, Quad 80-kHz Switched Cap Filter

## **Regulating Pulse-Width Modulators**

Switching Regulator, Switching Regulator Controller, Switching Power Supply Circuit, Oscillator Accuracy

## **Interface Products**

RS-232 Line Driver, Triple RS-232 Driver/Receiver, 5V Powered

RS-232 Driver/Receivers, Programmable Power Hex

Translator/Driver/Receiver

## **Data Acquisition Products**

10-Bit Data Acquisition Systems, 10-Bit Serial I/O ADC with Reference Pin of 6-Channel MUX, 10-Bit Serial I/O with 8-Channel MUX

## **Other Products**

Current Source, Voltage Converters, Power Buffer, Reference Diodes, Voltage Inverter, Cold-Junction Compensator Kit for Thermocouples, Sample-and-Hold Amplifier

## **OTHER INFORMATION**

Linear Technology Corporation's PR firm is Tycer, Fultz, & Bellack.

## Logic Devices Inc.

628 E. Evelyn Avenue  
Sunnyvale, CA 94086

408/720-8630

Fax: 733/7690

Telex: 172387

ESTABLISHED: 1983

NO. OF EMPLOYEES: 55

### BACKGROUND

Logic Devices Inc. designs, manufactures, and markets very high performance semiconductors using 1.2-micron CMOS process technology. The Company's products address applications that require very high operating speeds and/or low-power operation.

The Company offers a line of high-performance 16K, 64K, and 256K SRAMs; a line of high-performance building block components for DSP applications; and a line of computer interface circuits that implement the SCSI standard. The products are used in military signal-processing systems (radar, sonar, and seeker systems), video and medical imaging systems, array processors and superminicomputers, engineering workstations, telephony systems, and personal computers.

Approximately 30 percent of the Company's sales are products produced in full compliance with MIL-STD-883 Rev. C. In addition, the Company produces a portfolio of custom circuits that address high-end military DSP applications (adaptive FIR filtering) and telecommunications problems such as echo canceling, ADPCM compression, and cross-point switching.

Company operations in Sunnyvale, California, include administration, sales and marketing, engineering, assembly, and high-reliability testing and screening. Commercial products are offered in plastic dual-in-line, leaded chip carriers, and SOIC packaging. Military products are available in leaded and leadless chip carriers, flat packs, and pin grid array packages. Manufacturing operation follows the requirements of MIL-STD-9858, -45662, and -883C. These operations have been audited and approved by many major military systems contractors.

Products are marketed through a network of domestic and international stocking distributors and

manufacturers' representatives, with 103 locations worldwide. U.S. distributors include Cypress Electronics, Falcon, Future, and Milgray. The Company operates direct regional sales offices in Los Angeles, California and New York City, New York.

### BOARD

(Name and Affiliation)

Howard L. Farkas  
Farkas Realty, Chairman

William J. Volz  
Logic Devices Inc., President

James McAllister  
Logic Devices Inc., VP Operations

Burton W. Kantor  
Walnut Capital Corp., COB

Albert Morrison  
Caplan, Morrison, Brown & Company,  
President

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
\*William J. Volz  
TI, Technical Staff

**Sr VP Operations**  
James McAllister  
Indy Electronics, Executive VP

**CFO**  
Todd Ashford  
W.R. Grace, Financial Analyst

**VP Mktg/Sales**  
Joe Krouse  
IDT, HQ Sales Mgr

# Logic Devices Inc.

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**Nat Sales Manager**  
 Del Valek  
 ITT, Sales Manager

**Dir QA/Rel**  
 Don Taylor  
 Exar, QA Manager

**VP Technology**  
 Tony Bell  
 VLSI Design, Consultant

**VP Strategic Bus**  
 Gary Ater  
 Vitelic Assoc, N/A

**Dir Prod Mktg**  
 Joel Dedrick  
 Texas Instruments, N/A

\*Founder

## PRODUCTS

### SRAMs

Device	Description	Speed
L6116	2Kx8	20ns
L7C161/162/164/165/166	16Kx4	20ns
L7C167	16Kx1	12ns
L7C168 through 172	4Kx4	15ns
L185/186	8Kx8	25ns
L7C187	64Kx1	15ns

### Specialty Memory Circuits

L10C11	18x8-Bit Variable Delay	
LRF07	Three Independent Port 8x8	35ns
LRF08	Five Independent 8x8	35ns
L29C520/521	8-Bit Multilevel Pipeline Registers	22ns
LPR520/521	16-Bit Multilevel Pipeline Registers	22ns
L29C524/525	16-Stage Pipeline Registers	
L29C818	Shadow Register	

### Multipliers

LMU08	8x8 Signed Parallel Multiplier	35ns
LMU8U	8x8 Unsigned Parallel Multiplier	35ns
LMU557/558	8x8 Mixed Parallel Multipliers	60ns
LMU12	12x12 Parallel Multipliers	35ns
LMU112	12x12 Reduced Pincount	50ns
LMU16/216	16x16 Parallel Multipliers	35ns
LMU17/217	16x16 Microprogrammable Multipliers	45ns
LMU18	16x16 Parallel Multiplier with Dedicated 32-Bit Output Port	35ns
LMS12	12x12 Video Multiplier with 26-Bit Adder	40ns

## FINANCING

**November 1988**  
 IPO  
 \$5.4M  
 Initial public offering

## MANUFACTURING

### Technology

1.2- and 1.5-micron CMOS  
 0.9 micron CMOS

### Facilities

Sunnyvale, CA  
 12,500 sq. ft.  
 Administration, sales and marketing, engineering, assembly, high-reliability testing and screening  
 2,500 sq. ft.  
 Clean room

**Multiplier/Accumulator Circuits**

Device	Description	Speed
LMA1009	12x12 Multiplier/Accumulator	45ns
LMA1010/2010	16x16 Multiplier/Accumulators	45ns

**Arithmetic Logic Units**

L29C101	16-Bit Slice (4x2901 & 2902)	35ns
L4C381	16-Bit Cascadable Adder/Subtractor (4x54S381)	26ns
LSH32	32-Bit Cascadable Barrel Shifter/Normalizer	32ns
L10C23	64x1 Digital Correlator	20ns

**Communications Controllers**

L5380	Asynchronous SCSI Controller Chip	4Mbps
L53C80	SCSI Controller	4Mbps

**OTHER INFORMATION**

Logic Devices' PR firm is Faries and Associates.

**Lytel**  
61 Chubb Way  
P.O. Box 1300  
Somerville, NJ 08876  
201/685-2000  
Fax: 201/685-1282

**ESTABLISHED: October 1984**

**NO. OF EMPLOYEES: 130**

## **BACKGROUND**

Lytel was formed to design, develop, and manufacture InGaAsP technology-based electro-optic components for the telecommunications, data communications, and military markets. Products include semiconductor lasers, LEDs, and photo-detectors using an indium phosphide materials technology.

Lytel's first products, introduced in January 1986, were InGaAsP high-power lasers for fiber-optic applications. The Company is focusing on quality, reliability, delivery, and performance.

Lytel occupies a 57,000-square-foot facility that includes a Class 1,000 clean room.

## **BOARD**

Not Available

## **COMPANY EXECUTIVES**

(Position and Name)

### **GM**

Gerald Leehan

### **VP Engineering & Development**

\*Ron Nelson

### **Controller**

Tim Bock

\*Founder

## **PRODUCTS**

InGaAsP High-Power Lasers

LEDs

Optical Data Links

## **OTHER INFORMATION**

Lytel's PR firm is The Jason Group.

## **FINANCING**

**1984**

Start-up

\$20.0M

AMP

**November 1988**

N/A

Became a subsidiary of AMP

## **ALLIANCES**

Not available

## **MANUFACTURING**

### **Technology**

InGaAsP

1.3-micron opto components

### **Facilities**

Somerville, NJ

57,000 sq. ft.

Manufacturing, assembly, test

5,000 sq. ft.

Class 1,000 clean room

# Matra-Harris Semiconducteur

La Chantrerie/Route Gachet

B.P. 942

44075 Nantes cedex/France

(40) 303030

Telex: MATHARI 711930 F

ESTABLISHED: 1979

NO. OF EMPLOYEES: 1,000

## BACKGROUND

Matra-Harris Semiconducteur (MHS) designs, manufactures, and markets a broad range of ICs, using bipolar, CMOS, and NMOS process technologies. Its main product strategies center on ASICs, fast SRAMs, microprocessors, and telecommunications circuits.

MHS was formed in 1979 as a joint venture company by Matra of France and Harris Corporation of the United States. Prior to this formal link, Matra and Harris had made agreements for CMOS technology transfers. The agreement was extended in 1980 to include bipolar products.

The Company was supported by the French government in place at that time to develop high technology in France. A 12,000-square-foot factory was built near Nantes, France, and designated as an area for industrial development, which allowed MHS to gain government financial assistance. Initial wafer fabrication began in December 1980.

In 1982, Harris and MHS merged their European marketing operations outside France (Harris-MHS). The new operation was financed equally by the two partners. Under the 1979 agreement, MHS continues to have exclusive sales rights in France for the Harris line of semiconductors. Conversely, Harris represents MHS exclusively for sales in North America.

Today, Matra-Harris remains the only independent French semiconductor operation not absorbed into the Thomson Group.

The Company's ASIC capability includes a range of matrices with from 250 to 7,500-gates, using CMOS technology and integrated design tools

based on the VAX or IBM PCs. Libraries are available on Daisy, Mentor, and Valid systems.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

Chairman  
Guy Dumas

Strategist  
Jean-Claude Rentlet

Commercial Dir  
Michael Thouvenan

## FINANCING

1979  
\$40.0M  
Matra S.A. and Harris Corp.

## RECENT HIGHLIGHTS

December 1986  
MHS unveiled eight new products at Wescon/86, including the HM65787, a 64Kx1 SRAM that is the first application of the 0.8-micron process licensed from Cypress Semiconductor.

June 1987  
Intel and Matra-Harris dissolved their joint venture design facility, CIMATEL G.I.E. CIMATEL was formed in 1982 as an equal partnership to design standard VLSI devices for the telecommunications and computer graphics

# Matra-Harris Semiconducteur

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markets. It was jointly owned by Intel and MHS S.A. The dissolution of CIMATEL is due to a reassessment by Intel of its long-range marketing plans. CIMATEL had been responsible for the design of the 82716 video controller, as well as the announced ISDN chip set, the 29C48 combo, and the 29C53 S-transceiver. CIMATEL was located in Paris, France, and employed 26 persons. MHS made employment offers to many CIMATEL employees.

## ALLIANCES

### Intel

March 1981

MHS and Intel signed an agreement covering NMOS circuits and establishing a joint design facility in Nantes called CIMATEL.

June 1987

Intel and MHS dissolved CIMATEL due to a change in Intel's long-range plans. CIMATEL employed 26 persons, many of whom were offered employment at MHS.

### Cypress Semiconductor

October 1985

Cypress transferred masks for its 25ns 4K and 16K SRAMs and provided its 1.2-micron CMOS technology to Matra-Harris. Cypress will receive 2 percent of Matra-Harris stock for an undisclosed amount of cash. A similar deal for the Cypress 0.8-micron process and 64K SRAM is planned.

### Weitek

March 1986

MHS and Weitek signed a technology exchange and foundry agreement. MHS was granted

Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process in exchange for manufacturing a variety of Weitek's products. The companies will also codevelop complex, high-speed logic devices for DSP, telecommunications, and military markets.

### Silicon Compilers

June 1986

MHS and Silicon Compilers Inc. (SCI) will integrate SCI's Genesil silicon design system with MHS' advanced 2-micron, dual-level, metal CMOS process. MHS will also offer prototyping services, volume production, and design services for Genesil users.

### Cypress. Aspen

April 1988

MHS entered into an R&D agreement with Cypress Semiconductor and Aspen Semiconductor. MHS will provide \$4.57 million in contract funding for the development of ultrahigh-speed ECL circuits to be developed by Aspen.

## MANUFACTURING

### Technology

2.5-, 2.0-, 1.2-, and 0.8-micron CMOS  
1- and 2-layer metal  
5-inch wafers

### Facilities

Nantes, France

72,000 sq. ft.

Design, manufacturing in Class 10 clean room, assembly, and test

## PRODUCTS

### CMOS SRAMs

MHS markets 4K, 16K, 64K, and 256K SRAMs in a wide range of configurations, available in I/O multiplexed or separated form.

### Dual-Port SRAMs

CMOS 2Kx8 Synchronous

CMOS 2Kx8

CMOS Dual-Port RAM Controller

## CMOS Linear Arrays

Available in 3-micron, 1-layer metal with 228-1139 gates or in 2-micron, 2-layer metal with 810 to 11,250 gates

## Microcomponents

### MPUs

HMOS 16-Bit MPU; 5, 8 MHz  
CMOS 16-Bit MPU; 5, 8 MHz  
HMOS 8-, 16-Bit MPU; 5, 8 MHz  
CMOS 8-, 16-Bit MPU; 5, 8 MHz

### MCUs

HMOS 8-Bit MCU with 4K ROM  
CMOS 8-Bit MCU with 4K ROM  
HMOS 8-Bit MCU with 8K ROM  
CMOS 8-Bit MCU with 8K ROM  
80C52 8-Bit with 16K ROM

### MPRs

Video Storage Display Device  
Interface

## Telecommunications Circuits

Serial PCM Codec-Filter Family  
CMOS Combo  
CMOS Digital Loop Controller  
X.21 Protocol Controller  
Monolithic CMOS Codec-Filter Serial Interface  
300-Baud Modem

## DSP

16x16 Parallel Multiplier/Accumulator 45ns  
16x16 Parallel Multiplier 45ns

## OTHER INFORMATION

Matra-Harris does not employ a PR firm.



# Maxim Integrated Products, Inc.

120 San Gabriel Drive  
Sunnyvale, CA 94086  
408/737-7600

ESTABLISHED: May 1983

NO. OF EMPLOYEES: 172

## BACKGROUND

Maxim Integrated Products, Inc., designs, manufactures, and markets a broad range of linear and mixed-signal ICs for the analog market. The Company's objective is to develop and market both industry-standard and proprietary linear ICs using a diversity of process technologies.

Currently, the Company offers 200 products that are available in a number of packaging options including surface-mounted package technology. Products are designed for computer and peripherals, instrumentation, process control, communications, military, factory automation, and medical applications.

The Company sees its primary competitors as Analog Devices and Intersil. The competition with Intersil is intense and is expected to intensify further as the result of a second-source agreement giving Intersil the right to select and license up to 10 circuits designed by the Company.

Maxim was founded by John F. Gifford, Frederick Beck, Dr. Steven Combs, and David J. Fullagar, all former employees of Intersil's Analog IC Product Division. Maxim purchased a 30,000-square-foot facility in Sunnyvale, California, from Si-Fab. In February 1988, the Company completed the sale of 2.3 million shares of common stock. Maxim is using the proceeds to prepay \$3 million in long-term debt incurred when it purchased a new facility in October 1987. The remaining amount will be applied to equipment and other expenses for the new facility. The facility houses the Company's executive offices, engineering, and all services connected with its manufacturing.

The Company's products are sold worldwide through 63 sales representative organizations and electronics distributors. Domestic distributors are Anthem Electronics, Bell Industries, Hall-Mark Electronics, and Pioneer Electronics. In fiscal

1987, approximately 38 percent of sales were from the United States, 37 percent from Europe, 17 percent from Japan, and 8 percent from ROW. Among the Company OEM users are AT&T, Brown Boveri, GEC Card Technology (an affiliate of General Electric Company Plc), Hewlett-Packard, IBM, McDonnell Douglas, NEC, Siemens, and Tokyo Electric Co., Ltd.

## BOARD

(Name and Affiliation)

John F. Gifford

Maxim Integrated Products, Inc., President

Paul Bancroft

Bessemer Venture Partners L.P., Limited Partner

B. Kipling Hagopian

Brentwood Associates, General Partner

Stephen L. Merrill

Merrill, Pickard, Anderson & Eyre, General Partner

James R. Bergman

DSV Associates

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*John F. Gifford

Intersil, President/CEO

### VP Mktg/Sales

\*Frederick Beck

Intersil, SR VP WW Sales/Mktg

### VP Operations

\*Dr. Steven Combs

GE, Mng Dir Process Tech

### VP R&D

\*David J. Fullagar

Intersil, VP Engineering

### VP Finance/Admin

John H. Troilman

DEST Corp., VP Finance

\*Founder

# Maxim Integrated Products, Inc.

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## FINANCING

1983

Round 1

\$4.9M

Bessemer Venture Partners; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Venad; overseas venture capital

February 1985

Round 2

\$5.5M

Adler & Co.; Bessemer Venture Partners; Brown Boveri; Brentwood Associates; DSV Partners; De Monet Industries; Merrill, Pickard, Anderson & Eyre

Lease

\$5.3M

Bank of America; Bank of the West

September 1985

Round 3

\$6.4M

Bessemer Venture Partners; BNP Ventures; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Rothschild, Inc.

March 1986

R&D

\$1.2M

Venture Technology Funding

February 1988

IPO

\$7.0M

Initial public offering

## RECENT HIGHLIGHTS

January 1987

Maxim offered a family of RS-232 components designed for specific uses such as digital PBX or modem interfaces. The devices are as follows:

- MAX230 and MAX231 digital PBX interfaces
- MAX232/233/235/236 general-purpose interfaces
- MAX234/237/239 modem interfaces

July 1987

Maxim offered an MPU supervisory circuit that tracks power levels to reset processor functions and switch over to battery backup. The device is designed for laptops and industrial control.

July 1987

Maxim offered the MAX452 family of CMOS video multiplexers/amplifiers.

February 1988

Maxim offered 1.7 million shares of common stock in an initial public offering. Maxim is using the proceeds to prepay \$3 million in long-term debt incurred in the acquisition of its new facility, with the remaining amount going toward equipment and other expenses for the new facility.

## ALLIANCES

Intersil

1984

Maxim and Intersil entered into an agreement that resolved legal proceedings between them. Under the agreement, Maxim granted Intersil the right to select, by July 1989, up to 10 circuits designed by Maxim for manufacture and sale on a royalty basis. Intersil granted Maxim certain rights to Intersil products, trade secrets, and patent rights. Intersil has selected three of Maxim's proprietary products.

April 1986

Maxim and Intersil signed a second-source agreement.

Brown Boveri

February 1985

Maxim agreed to design and manufacture devices for Brown Boveri.

Supertex

April 1988

Maxim and Supertex signed an agreement to jointly market the 690 family of MPU supervisory circuits.

## MANUFACTURING

Technology

Metal-gate CMOS for 1.5 to 18.0V operation  
Metal-gate CMOS for 5 to 40V operation

Silicon-gate CMOS-DMOS for up to 150V operation  
High-density/low-noise, analog silicon-gate CMOS  
Low-noise, precision linear bipolar for up to 44V operation

**Facilities**  
Sunnyvale, CA  
62,000 sq. ft.  
Design and test

## **PRODUCTS**

### **Multiplexers**

RF-Video, Fault-Protected, Differential, and CMOS Analog Multiplexer

### **CMOS Analog Switches**

Quad-SPST, Quad-DPST, Dual-DPST, Dual-SPST, Low-Power, Low-Charge, RF-Video, and TTL-Compatible Switches

### **A/D Converters**

3.5- and 4.5-Digit Converters, High-Speed, Low-Power or Low-Noise Converters, Available with LED or LCD Drivers, 12-Bit Converter with Three-State Binary Output

### **Op AMPs/Buffers**

Low-Power Single, Dual, Triple, and Quad OP Amps, Power Op Amp, Precision Op Amp, Fast and Very Fast Buffer Amp, High-Accuracy Fast Buffer, Superlow-Offset Op Amp, Chopper-Stabilized Op Amps

### **Display Drivers/Counters**

4-, 5-, 8-, 10-Digit LCD Decoder/Drivers, 4.5-Digit LCD, High-Speed Counters/Decoders/Drivers

### **Interface**

+5V Powered, Dual-RS-232 Transmitter and Receiver

### **Switched Capacitor Filter**

Dual, Second-Order, Universal Switch Capacitor Filter

### **Timers/Counters**

Programmable or fixed RC Timer/Counter, Low-Power, General-Purpose Timer or Dual Timer

### **Power Supply Circuits**

AC/DC Regulators, Fixed/Adjustable Output, Step-Up Switching Regulator, Inverting Switching Regulator, Step-Down Switching Regulator, Positive or Negative Voltage Regulator, Voltage Converter, Under-/Overvoltage Detector MPU Watchdog Battery, Switchover/Reset Generators

### **Voltage References**

+10.0V and -10.0V Precision Reference, 1.2V Voltage Reference, +10.0V Voltage Reference, +5.0V Precision Voltage Reference

## **OTHER INFORMATION**

Maxim does not employ a PR firm.

# MemTech Technology Corporation

3000 Oakmead Village Court

Santa Clara, CA 95051

408/970-8900

Fax: 408/986-0656

ESTABLISHED: December 1986

NO. OF EMPLOYEES: 75

## BACKGROUND

MemTech Technology Corporation is dedicated to the manufacture of bubble memory devices and related products. The Company was formed to acquire the business, principal assets, technology, and R&D capability of Intel Corporation's Magnetic Operation. The Company's leveraged buyout was initiated by the two founders, Richard H. Loeffler and William H. Almond, as well as an additional equity partner, Golodetz Corporation.

The Company is concentrating primarily on military and industrial applications of bubble memory technology. Recently, MemTech won a contract from the Wright-Patterson Air Force Base Avionics Laboratory to conduct work on advanced bubble memory devices. MemTech also works closely with General Electric on the Milstar Satellite program.

MemTech is headquartered in Folsom, California. The Company occupies more than 65,000 square feet of manufacturing space for device manufacture and assembly in Folsom, Santa Clara, and Santa Rosa, California. In addition, MemTech has a network of sales and customer service support operations located throughout the world.

In April 1987, MemTech purchased the Crystal Division of Materials Progress Corporation, the only remaining U.S. supplier of gadolinium gallium garnet (GGG) substrates. GGG are the base materials essential for the manufacture of bubble memory devices.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### Chairman/CEO

\*Richard H. Loeffler  
Helix Systems, Chairman/CEO

### President/COO

\*William H. Almond  
Eaton, GM Microlithography Division

### VP Sales/Mktg

Joseph J. Rutherford  
Materials Progress, VP Mktg/Sales

### VP Technology

Dr. Peter Silverman  
Intel, FAB Manager

\*Founder

## FINANCING

Not available

## ALLIANCES

Not available

## Facilities

Santa Clara, CA  
20,000 sq. ft.

Engineering, assembly, test, marketing, sales,  
component fabrication

Santa Rosa, CA  
13,000 sq. ft.

Crystal products division Tenth-Wave Division

# MemTech Technology Corporation

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## PRODUCTS

### 1Mb Device and Board-Level Products

Device	Description
BPK70AZ	1Mb (128KB), Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
BPK72AZ	1Mb Bubble Memory Prototype Kit
SBX251	Bubble Memory Board (128KB) Bubble Memory
SBC254	Bubble Memory Board (128KB to 512KB capacity)
BCK10	1Mb Bubble Cassette System with interchangeable 128KB Bubble Cassette Cartridges

### 4Mb Device and Board-Level Products

BPK74	4Mb Bubble Memory Subsystem (512KB) Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
SBX261	4Mb Bubble Memory Board SBX Bus Compatible (512KB Capacity)
SBC264	Bubble Memory Board (512KB to 2MB capacity)
PCB75/76	Bubble Memory Card (512KB to 1MB capacity), IBM PC, ST, AT Compatible, and other compatible systems
PCB74	Bubble Memory Expandable Memory Card (512KB to 4MB) IBM, PC, XT, AT Compatible or other compatible systems
BVME164/174	VMEbus Compatible Bubble Memory Boards. Expandible at system level up to 15MB
BCS74	1MB Bubble Memory Cassette System with Multiple Interfaces available, PC, SBX, SCSI, and STD (512KB to 1MB capacity)

## OTHER INFORMATION

MemTech's PR firm is Matthews and Clark.

# Micro Linear Corporation

2092 Concourse Drive

San Jose, CA 95131

408/433-5200

Fax: 408/432-0295

Telex: 275906

ESTABLISHED: October 1983

NO. OF EMPLOYEES: 144

## BACKGROUND

Micro Linear Corporation designs, manufactures, and markets linear and mixed linear/digital ICs, including both proprietary and enhanced second-source products as well as ASICs.

Micro Linear offers standard and semicustom ASICs that use a bipolar process. In addition, Micro Linear offers standard products using a CMOS process. Products are designed primarily for computer peripherals, telecommunications, power supply controls, industrial, and military applications.

Micro Linear also offers a number of computer-aided design (CAD) tools and a portfolio of linear semicustom design methodologies—including mask-programmable analog arrays and standard cells—that simplify the development of both standard and ASIC products containing analog functions.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Art Stabenow

National, Sr VP/Analog Div

### VP Marketing

Charles Gopen

Daisy Systems, GM IC Layout Div

### VP Sales

Tim D. Cox

National, Dir Dist Sales

### VP Engineering

\*Dr. Jim McCreary

Intel, Program Mgr

### VP Finance/Admin

\*Al Castleman, Jr.

MCI/Quantel, VP Finance

### VP Materials/Quality Ops

\*Abe Korgav

SEEQ, Dir Test/Assembly

### VP Mfg Operations

Micheal Morrione

National, Product Line Mgr-Linear Op

\*Founder

## FINANCING

### October 1983

Round 1

\$4.0M

Fairfield Ventures; Founders, Adler & Co.;  
Oak Investment Partners; Richard Reardon

Lease

\$3.5M

California First Bank; Western Technology  
Investors

### November 1985

Round 2

\$12.0M

Round 1 investors, Accel Partners, Grace  
Ventures, Greenwood Funds, Harvest Ventures,  
Institutional Venture Partners, International  
Industrial Interests, Investors in Industry,  
Kyocera International, Montgomery Bridge  
Funds, Grine Ventures, International Tadiran,  
Xerox Venture Capital

Lease

\$3.0M

Burnham Leasing Corp.; California First Bank

# Micro Linear Corporation

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## February 1986

### Round 3

\$15.0M

Round 1 and 2 investors, Aeneas Venture Corp., First Analysis Corp., GE Pension Fund, Kuwait & Middle East Financial Services, Northern Telecom, Schroeder Ventures, United Eastern Investments, U.S. Venture Partners

### Lease

\$3.2M

Burnham Leasing, Westinghouse Credit, Phoenix Leasing

## August 1988

### Round 4

\$10.0M

Round 1, 2, and 3 investors, Concord Partners, Merrill Lynch Venture Capital, Sigma Partners

### Lease

\$2.6M

Pitney Bowes Credit, GATX Leasing, Phoenix Leasing

## ALLIANCES

### IMP

June 1984

IMP and Micro Linear codeveloped a 10V CMOS process; IMP provides foundry services for Micro Linear.

### Rockwell

1985

Rockwell invested in Micro Linear (\$1.8M cumulatively) and purchases products from Micro Linear.

### Tadiran

1985

Tadiran invested in Micro Linear (\$1.6M cumulatively) and purchases products from Micro Linear.

### Kyocera

1985

Kyocera invested in Micro Linear (\$1.5M

cumulatively) and purchases products from Micro Linear.

### Toko

October 1985

Toko began making bipolar devices for Micro Linear at its Saitama, Japan, plant.

### Northern Telecom

1986

Northern Telecom invested in Micro Linear (\$2.0M cumulatively) and purchases products from Micro Linear.

### Analog Design Tools

July 1986

Micro Linear integrated both its micro- and macrocell libraries into Analog Design Tools' workbench CAE system.

### Daisy Systems

August 1986

Daisy Systems agreed to port Micro Linear's FB300 and FB900 cell libraries to Daisy's workstations.

### IMP/MBB

August 1986

IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

## MANUFACTURING

### Technology

#### Bipolar

20V, 300-MHz, single-layer metal  
12V, 900-MHz, dual-layer metal  
36V, 300-MHz, dual-layer metal  
12V, 3-GHz, dual-layer metal (1989)  
10V, 3.0-micron, dual-layer polysilicon CMOS  
8V, 1.2-micron, dual-poly/dual-metal (1989)

### Facilities

San Jose, CA

48,000 sq. ft.

Design, manufacturing, and test

# Micro Linear Corporation

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## PRODUCTS

### Bipolar Analog Arrays

Family	Linewidth (Microns)	Interconnect
FB900	10.0	Single-Layer Metal
FB300	8.0	Dual-Layer Metal
FB3400	8.0	Dual-Layer Metal
FB3600	7.0	Dual-Layer Metal

### Standard Linear Products

Device	Description
Disk Drives	Bipolar Standard and Semicustom ICs for Read/Write, Data Recovery, and Servo Actuator Control
Telecommunications	CMOS Products for Conditioning Analog Phone Lines; Programmable Attenuators, Equalizer, Loopback, and Tone Signaling
Data Converters	12-Bit and 8-Bit ADC with Serial and Parallel Interfaces

### CAD

Micro Linear provides Libraries of Devices and Macro Models for its bipolar ASIC products. The Libraries run on industry-standard platforms such as ViewLogic, Analog Design Tools, and Daisy Workstations.

## OTHER INFORMATION

Micro Linear Corporation's PR firm is Rigoli, Panthalon, Demeter.



# Microwave Monolithics

465 East Easy Street  
Simi Valley, CA 93065  
805/584-6642

ESTABLISHED: April 1982

NO. OF EMPLOYEES: 17

## BACKGROUND

Microwave Monolithics specializes in GaAs monolithic microwave ICs (MMICs) for Department of Defense (DOD) microwave specialty circuits as well as custom GaAs circuits.

The Company is privately held by five partners and completed first-round financing in 1983 through private sources.

Microwave Monolithics did custom GaAs circuit design research and development work for government agencies and OEMs until financing was secured. The Company began producing GaAs MMICs by year-end 1984.

## BOARD

Not available

## PRODUCTS

MMICs

## OTHER INFORMATION

Microwave Monolithics does not employ a PR firm.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Daniel Ch'en  
Rockwell, Mgr M/W Rsch

\*Founder

## ALLIANCES

Not available

## MANUFACTURING

### Technology

0.5-micron GaAs fine-line capability

### Facilities

Simi Valley, CA  
8,000 sq. ft.  
Two Class 100 clean rooms

# Microwave Technology, Inc.

4268 Solar Way  
Fremont, CA 94538  
415/651-6700  
Fax: 415/651-2208

ESTABLISHED: May 1982

NO. OF EMPLOYEES: 160

## BACKGROUND

Microwave Technology, Inc., (MwT) is a vertically integrated manufacturer of GaAs-based microwave components and subassemblies.

MwT designs, manufactures, and markets GaAs epitaxial materials, GaAs FET devices, MMICs, hybrid MICs, and microwave components and subassemblies. The Company's products are designed for defense-related applications.

MwT produces both ultralow-noise and medium-power GaAs FETs and AlGaAs HEMT devices for applications ranging from 0.5 GHz to 40.0 GHz. The devices are produced with gate lengths from 0.1 to 0.25 micron. The Company is developing a family of high-performance MMIC products and has completed a series of 2- to 6-GHz MMIC amplifiers. Products in the 2- to 18-GHz and 6- to 16-GHz ranges are in development.

The Company also offers GaAs FET amplifiers from 0.5 to 26.5 GHz that use MMIC and hybrid MIC modules.

In 1987, MwT acquired Monolithic Microsystems, Inc. of Santa Cruz, California. Monolithic Microsystems makes detector log video amplifiers (DLVAs), log video amplifiers (LVAs), and threshold detectors based on proprietary monolithic LVA ICs. Products are used in various EW systems and other defense electronic applications. Monolithic Microsystems will operate as a wholly owned subsidiary of MwT and will continue manufacturing in its 8,200-square-foot Santa Cruz facility.

## BOARD

(Name and Affiliation)

Thomas R. Baruch  
Microwave Technology, Inc., Chairman

Dr. M. Omori

Microwave Technology, Inc., VP of Engineering

C.C. Bond

New Enterprises Associates

Irwin Federman

Advanced Micro Devices

Dr. P. Kaminski

Hambrecht & Quist

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Joseph Lee

Litton, President

### VP Finance/CFO

J. Geyton

Avantek, Div Controller

### VP Materials

A. Herbig

Avantek, Tech Staff

### VP Engineering/R&D

Dr. Masa Omori

Avantek, Eng Mgr

### VP Mktg/Sales

David Gray

EM Systems, Sales Mgr

### VP Ops

John Sorci

Watkins-Johnson, Subsystems Div Mgr

## FINANCING

August 1983

Round 1

\$4.8M

Not available

Round 2

\$4.3M

# Microwave Technology, Inc.

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June 1985

Round 3

\$1.0M

Investors were the Allstate Insurance Company, Concord Partners, New Enterprise Associates, T. Rowe Price, Sequoia Capital, and U.S. Venture Partners.

## ALLIANCES

Not available

## MANUFACTURING

### Technology

GaAs

### Facilities

Fremont, CA

50,000 sq. ft.

Design, manufacturing

6,000 sq. ft.

Class 1,000 clean room

## PRODUCTS

GaAs Epitaxial Materials

GaAs FET Amplifiers, 0.5 to 26.5 GHz

GaAs MMIC Amplifiers, 2 to 6 GHz

GaAs MIC Microwave Products

Thin-Film Hybrids

Log Amplifiers

Detector Log Video Amplifiers

## OTHER INFORMATION

Microwave Technology, Inc. does not employ a PR firm.

**Mietec N.V.**  
Westerring 15  
9700 Oudenaarde, Belgium  
055-33-2211  
Fax: 055-318-112  
Telex: 85739 MIETEC

**ESTABLISHED: March 1983**

**NO. OF EMPLOYEES: 280**

## **BACKGROUND**

Mietec N.V. designs mixed analog and digital ASICs, using a cell-based library of digital and analog cells. The Company's ASIC products are split into two categories: user-specific ICs (USICs) and application-specific standard products (ASSPs) for dedicated uses.

The Company is capable of designing devices using CMOS (for low-power, high-density applications), BiMOS (for high-voltage applications, 70V), and SBiMOS (a multipurpose technology) processes. A proprietary development software support tool called Mietec Analog/Digital Engineering (MADE) allows the development and simulation of digital and analog functions simultaneously.

Mietec is a joint venture, 49.8 percent of which is owned by Alcatel Bell Telephone Company; 49.2 percent is owned by GIMV, a Flanders regional investment company; and 1.0 percent is owned by a private investment bank. Mietec is a major supplier of the ASIC products for the Alcatel System 12 and is working on the next generation of Alcatel exchanges based on ISDN.

## **BOARD**

Jo Cornu, Chairman

## **COMPANY EXECUTIVES**

(Position, Name, and Prior Company)

### **General Manager/CEO**

Jean-Pierre Liebaut  
Matra-Harris

### **Business Development Manager**

Eric Schutz  
Motorola

## **Director, Marketing & Sales**

Alain Gilot  
Mostek

## **FINANCING**

Investment in the Company totaled \$48.2 million.

## **ALLIANCES**

### **Sprague**

1983

Mietec entered a cross-licensing agreement with Sprague for a BiMOS process.

### **STM**

1987

Mietec, SGS-Thomson, and Alcatel agreed to the transfer of a 1.2-micron CMOS process.

## **MANUFACTURING**

### **Technology**

5.0-, 3.0-, and to 2.4-micron NMOS

3.0- and 2.4-micron CMOS

VMOS

BiCMOS

Single and double-layer metal

### **Facilities**

#### **Oudenaarde, Belgium**

The manufacturing center is situated on a 40,000-square-meter site with 10,000 square meters of floor space. A wafer fab is equipped with more than 2,000 square meters of clean rooms, of which 400 square meters are Class 10. Potential capacity is 150,000 wafers per year. The fab is suitable for technologies of 1 micron or lower.

## **Mietec N.V.**

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### **Brussels, Belgium**

The customer design center includes VAX 8500, VAX 750, MICROVAX, Tektronix, GPX2, and Daisy equipment, in addition to VALID workstations.

### **OTHER INFORMATION**

Mietec does not employ a PR firm.

# Modular Semiconductor, Inc.

138 Kifer Court  
Sunnyvale, CA 94086  
408/733-5000  
Fax: 408/733-0224

ESTABLISHED: September 1983

NO. OF EMPLOYEES: 12

## BACKGROUND

Modular Semiconductor, Inc., was founded by individuals from Hewlett-Packard, Signetics, and Synertek to design, develop, manufacture, and market VLSI ICs using a 1.0-micron CMOS process technology.

The Company is focusing on data communications chips, memories, semicustom and custom designs, VMEbus chip sets, and telecommunications products. Modular Semiconductor began manufacturing with a 2-micron CMOS process and is now offering 1.5-micron technology, with plans to use a 1.0-micron process in the near future.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Arockiyaswami Venkidu  
Faraday Electronics, Dir Engr

### Dir Mfg

\*Dr. Lenin Anne  
Hewlett-Packard, Sr Engr

\*Founder

## PRODUCTS

### CMOS SRAM

Device	Description	Access Time (ns)
MS6168	4K x 4	55ns
MS616	16K x 1	55ns

## FINANCING

Not available

## ALLIANCES

### Panatech/Ricoh

November 1984

Modular Semiconductor made a five-year, three-way agreement with Panatech and Ricoh of Japan. Modular provided Ricoh with its CMOS designs and process technology for 16K SRAMs and 256K DRAMs. Ricoh manufactured these devices in Japan and had the rights to market them in Japan. Panatech had the rights to market 16K memories only in North America. (expired)

## MANUFACTURING

### Technology

1.5-micron CMOS  
2.0-micron CMOS

### Facilities

Sunnyvale, CA  
7,000 sq. ft.  
Design

## Modular Semiconductor, Inc.

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### Data Communication

Device	Description
MS16C450/82C50A	PC UART
MS16C451	PC UART with parallel port
MS16C452	PC DUAL UART with parallel port
MS16C453	PC DUAL UART
MS16C454	PC QUAD UART
MS16C550A	PS/2 FIFO UART
MS16C551	PS/2 FIFO UART with parallel port
MS16C552	PS/2 FIFO DUAL UART with parallel port
MS16C553	PS/2 FIFO UART
MS16C554	PS/2 FIFO QUAD UART
MS68/88C681	DUART
MS82C684	QUART

### Bus Interface

MS68C153	VMEbus Interrupter Module
MS68C154	VMEbus Controller
MS68C155	VME Interrupt Generator

### OTHER INFORMATION

Modular Semiconductor does not employ a PR firm.

# Molecular Electronics Corporation

4030 Spencer Street MS108

Torrance, CA 90503-2417

213/214-1485

Fax: 213/542-1270

ESTABLISHED: 1984

NO. OF EMPLOYEES: 12

## BACKGROUND

Molecular Electronics Corporation (MEC) is developing technology for the formation, deposition, and commercial application of biomolecular membranes, or biomembranes, in the fields of electronics, optics, and biomedicine.

A biomembrane is a structural analog of the membrane that surrounds every living cell. MEC's proprietary technology enables the formation and deposition of highly ordered, perfectly uniform organic films onto a variety of substrate surfaces, with thickness control down to 10 angstroms. The Company's technology and know-how include a patented biomembrane production technology called MonoFab, and the molecular engineering and synthesis of biomembrane materials with the desired physical, electronic, optical, and biological properties.

MEC has developed several potential commercial applications of the core biomolecular membrane technology (BMT). The first is an ultrathin, uniform, high-resolution e-beam resist (MonoResist) that has a demonstrated resolution down to 1.0 micron. The second is an ultrathin anti-corrosive lubricant (MonoGuard) for rigid disk magnetic media. The third is a perfectly uniform antireflection coating (MonoArc) for pellicles.

The Company also has demonstrated a 20-angstrom biomembrane dielectric on GaAs devices. Outside of semiconductor applications, the Company has demonstrated unique biocompatible properties of biomembranes as coatings for medical implants, including intra-ocular lenses, and is developing drug delivery and surface-active (binding) sites applications (e.g., biosensors).

The MEC business plan calls for partnerships with corporations on both the electronic and medical applications of its technology. The Company believes that its technology will lead to new classes of organic/inorganic hybrid semiconductors and dielectric spacers for quantum devices in electronics and, ultimately, will represent the key enabling technology for bioelectronics including the biochip.

## BOARD

\*George Reynolds, Chairman  
Dr. Vladimir Rodov  
Dr. Paul Kaminski  
Parker Dale  
Roman Kupchynsky

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President, CEO

\*Dr. Vladimir Rodov  
TRW, N/A

### VP Dir Medical Bus

David Gibson  
Chiron Ophthalmics, Founder/Dir R&D

\*Founder

## FINANCING

Molecular Electronics has raised more than \$5 million in three rounds of financing.

## ALLIANCES

Alliances exist but information is not available.



# **Molecular Electronics Corporation**

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## **MANUFACTURING**

Currently on a pilot scale

### **Facilities**

Torrance, CA

7,500 sq. ft.

Headquarters, R&D lab (including Class 10 clean room, surface analytic, electronics, and chemistry sections)

## **OTHER INFORMATION**

Molecular Electronics Corp. does not employ a PR firm.

# MOS Electronics Corporation

914 West Maud Avenue  
Sunnyvale, CA 94086  
408/733-4556  
Fax: 408/773-8415

ESTABLISHED: September 1983

NO. OF EMPLOYEES: 64

## BACKGROUND

MOS Electronics Corporation (MOSel) designs, manufactures, and markets CMOS SRAMs and a family of specialty memory products for the dual-port cache control and telecommunications markets. The Company is using its SRAMs to build a base that will enable it to design specialty memories including cache tag RAMs; video RAMs; and radiation-hardened, 6-transistor RAMs.

MOSel does front-end R&D and marketing at its headquarters in Sunnyvale, California. Hyundai, Sharp, Taiwan Semiconductor, and UMC Manufacturing Corporation provide foundry services. Assembly and test are also subcontracted.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Peter Chen

Fairchild, Semi Tech Mgr.

### VP Technology

Nasa Tsai

Fairchild, Sr MTF

### Dir Eng Design

Y.T. Loh

Saratoga Semiconductor, VP Technology

### VP Sales/Mktg

Bruce Campbell

Intel, Mktg Mgr

### VP Finance

George Sun

Delta 79, VP Finance

### Dir of Sales

Eric Nagel

Intel, Dist Sales Mgr

### Dir of Bus Dev

Jim Summers

AT&T, Dir of Product Planning

## FINANCING

### 1983

Seed

\$1.0M

Founders

### 1984

Round 1

\$2.0M

Pacific Electric Wire & Cable (Taiwan)

### 1988

Round 2

\$3.0M

Walson Lihwa Corp (Taiwan)

## RECENT HIGHLIGHTS

### January 1987

MOSel offered the MS6130, a 1Kx8 dual-port RAM for use in 32-bit parallel computer applications, offering a 55ns address access time and a 30ns output enable time for no-wait operation with 25-MHz MPUs.

### March 1987

MOSel offered the MS7201 CMOS FIFO with access times of 50ns, 65ns, and 120ns.

# MOS Electronics Corporation

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## January 1989

MOSel introduced a cache memory chip jointly developed with Chips & Technologies for 25-MHz 80386 cache memory applications.

## ALLIANCES

### Fuji Electric

September 1985

Fuji Electric and MOSel signed an agreement whereby Fuji Electric will supply 4-inch and 6-inch wafers using MOSel 1.5 and 2.0-micron process technology. The companies will jointly develop CMOS 16K and 64K SRAMs for MOSel under an OEM contract.

### UMC

October 1985

MOSel licensed a 32Kx8 EPROM, a 16K SRAM, and a 1.2-micron process to UMC in Taiwan in exchange for fab capacity.

November 1985

Agreement extended to include 1.2-micron technology and 256K SRAM.

### Hyundai

February 1986

MOSel provided 8Kx8 and 32Kx8 SRAMs and 1.2- and 1.5-micron CMOS process technologies to Hyundai in exchange for foundry capacity under a discounted OEM contract.

March 1988

Agreement extended to include 1MB SCRAM and submicron technology.

## Sharp

June 1986

MOSel provided a 256K SRAM design based on a 1.2-micron CMOS process. Sharp provides foundry service under a favorable OEM contract.

## MANUFACTURING

### Technology

MOSel offers five high-performance CMOS (H-BiCMOS) processes and one BiCMOS process with minimum dimensions as follows:

Drawn (Microns)	Effective (Microns)
2.0	1.5
1.5	1.1
1.2	0.8
1.2 BiCMOS*	0.8
1.0*	0.8
0.8*	0.7

\*Under development

### Facilities

Sunnyvale, CA

10,000 sq. ft.

Design and test

Hsin-Chu, Taiwan

6,000 sq. ft.

Design

## PRODUCTS

### Bytewide SRAMs

Device	Description	Access Time (ns)
MS6516	2Kx8	45-100
MS6264	8Kx8	35-120
MS62256	32Kx8	25-85
MS88128	128Kx8	45-150*
MS88512	512Kx8	70-100*

\*Under development

# MOS Electronics Corporation

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## Specialty Memories

Device	Description	Access Time (ns)
MS7201	512Kx9 FIFO	50-120
MS6130	1Kx8 Dual Port	55-120
MS6132	2Kx8 Dual Port	55-120
MS82C308	Cache Memory	25 MHz
MS176	Video Color Palette	35, 50 MHz
MSVR35	Voice ROM	3 sec.
MSVR205	Voice ROM	20 sec.

## OTHER INFORMATION

MOSel does not employ a PR firm.

## MOSPEC Semiconductor Corp.

76 Chung Shan Rd, Hsin Shin

Tainan Taiwan R.O.C.

Taipei (2)755-6664

U.S. 213/802-7662

Fax: Taipei (2)755-6460

U.S. 213/802-7662

ESTABLISHED: April 1987

NO. OF EMPLOYEES: 300

### BACKGROUND

MOSPEC Semiconductor Corporation is a subsidiary of President Enterprises Corporation, one of the largest companies (No. 7 in total sales) in Taiwan. The Company previously was a fully owned unit of President under the name PECOR. As a result of a joint venture with U.S. company MOSPOWER Technology, Inc., MOSPEC was formed in April 1987.

MOSPEC is the only manufacturer of power devices in Taiwan. Its product lines include bipolar power transistors, Darlingtons, power MOSFETs, Schottky rectifiers, and ultrafast and fast-recovery rectifiers. The Company currently is shipping all of these products. MOSPEC also provides wafer fab and assembly services to other manufacturers on a contract basis. MOSPEC offers 3-micron bipolar and MOSFET process technologies.

The Company's production facilities include an 80,000 square feet plant that houses headquarters, wafer fab, assembly, design, test, and R&D operations.

### BOARD

(Name and Affiliation)

Dr. C.Y. Kao  
President Enterprises Corporation

Dr. M.L. Tarng  
MOSPEC Semiconductor Corporation, president

C.S. Ling  
President Enterprises Corporation

Ming-Yuen Tang  
Kao Chao Brokerage

### COMPANY EXECUTIVES

(Position and Name)

President  
M.L. Tarng

VP, Mktg.  
Ming-Yuen Tang

VP, Finance  
C.T. Chen

R&D Mgr  
W.C. Hsu

P/MC Mgr  
W.N. Teng

### FINANCING

Round 1  
\$7.8M  
Private Placement

Round 2  
\$4.0M  
Private Placement and employees

### ALLIANCES

Not available

### SERVICES

Wafer fab, assembly

# **MOSPEC Semiconductor Corp.**

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## **MANUFACTURING**

### **Technology**

3.0-micron bipolar and MOSFET technologies

### **Facilities**

Tainan, Taiwan

80,000 sq. ft. R&D, manufacturing, assembly,  
marketing, finance, test

## **PRODUCTS**

Bipolar Power Transistors

Power MOSFETs

Schottky, Ultrafast and Fast Recovery Rectifiers

Wafer Foundry

OEM Assembly

## **OTHER INFORMATION**

MOSPEC does not employ a PR firm.

# Multichip Technology Inc.

58 Daggett Drive  
San Jose, CA 95134  
408/432-7000  
Fax: 408/432-7049

ESTABLISHED: February 1988

NO. OF EMPLOYEES: 40

## BACKGROUND

Multichip Technology Inc. was formed in February 1988 to design, develop, and market multichip memory modules for Cypress Semiconductor. Financing was provided by Cypress, which owns 100 percent of the capital stock.

Multichip operates as a wholly owned subsidiary of Cypress Semiconductor Corporation and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Multichip-developed devices are fabricated by Cypress and sold through Cypress' sales organization.

Multichip Technology is engaging in a new approach to system design through multichip modules. Packing multiple chips into a single component reduces board space significantly. Modules create space by allowing chips to be stacked vertically or horizontally and in multiple layers, thus improving system density. By moving devices closer together, modules reduce interconnect capacitance, thus decreasing signal delays.

The Company offers high-performance SRAM modules, which began shipment in June 1988. Offerings include standard and custom products for both military and commercial applications. Multichip currently is developing products for RISC systems based on the SPARC microprocessor. Future multichip modules may integrate other Cypress advanced products such as PLDs, fast SRAMs, PROMs, FIFOs, and dual ports. The Company plans to offer denser and faster memory modules in the future, as well as application-specific modules (i.e., DSP, cache) and standard and custom products implemented using advanced packaging techniques.

## BOARD

(Name and Affiliation)

T.J. Rodgers, Chairman  
President, Cypress Semiconductor

Andy Paul  
President

Lowell Turriff  
VP, Mktg & Sales, Cypress Semiconductor

Roger Ross  
President, Ross Technologies

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
Andy Paul  
IDT, Mktg Mgr

VP, R&D  
Marcelo Martinez  
IDT, Eng Dir

VP, Mktg  
Tom Kadlec  
IDT, Mktg Mgr

VP, Finance  
John Green  
AMD, Asst Controller

VP, Mfg  
Jeff Michols  
MET, VP Mfg

## FINANCING

Round 1  
February 1988  
Cypress Semiconductor

## **Multichip Technology Inc.**

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### **ALLIANCES**

Multichip is a wholly owned subsidiary of Cypress Semiconductor Corporation.

### **MANUFACTURING**

#### **Technology**

Surface-mount components of ceramic and/or epoxy laminate substrates.

### **Facilities**

San Jose, CA  
18,000 sq. ft.  
Design, marketing

### **PRODUCTS**

High-performance SRAM modules (standard products and custom products; military and commercial)

### **OTHER INFORMATION**

Multichip does not employ a PR firm.



**nCHIP, Inc.**  
1971 North Capitol Avenue  
San Jose, CA 95132  
408/945-9991  
Fax: 408/945-0151

**ESTABLISHED: December 1987**

**NO. OF EMPLOYEES: 20**

## **BACKGROUND**

nCHIP was founded in December 1987 to address the performance bottleneck that is building up at the package level. The solution provided by nCHIP is multichip modules. The Company will design and/or manufacture silicon circuit boards, complete multichip modules, and module carriers for high-performance, high-density, and cost-sensitive applications.

nCHIP designs and manufactures custom high-performance, high-density silicon circuit boards (SiCBs) to be used for multichip modules, allowing faster, lighter, more compact, and more reliable systems to be built. Die are mounted directly on the SiCB, eliminating much of the typical package-related capacitances. nCHIP design rules enable dense placement of the ICs, approaching wafer-scale density in memory applications.

In addition to designing the silicon circuit board, nCHIP also provides complete multichip module design, fabrication, and assembly services to assist the systems designer in achieving the benefits of these technologies. The Company provides the module carrier, addresses power dissipation issues using proprietary technologies, and manufactures and delivers a complete, tested application-specific integrated module (ASIM) that is ready for system assembly.

The technology base was developed by nCHIP's founders at Lawrence Livermore National Laboratory (LLNL). While at LLNL, the founders produced functional models for use in a 1989 space mission. More than \$25 million was invested in the development program since 1983.

In 1989, nCHIP selected strategic customers, completed the design of its initial products, and set up a 5-inch wafer production line. In 1990, nCHIP will begin volume production and increase

its customer base. In late 1991, production capacity will be increased with the addition of an 8-inch manufacturing line.

## **BOARD**

(Name and Affiliation)

**Philip Dauber, CEO**  
nCHIP, Chairman/CEO

**William Davidow**  
Mohr, Davidow Ventures, Partner

**Bruce McWilliams**  
nCHIP, President/COO

**F. Gibson Myers**  
Mayfield Fund

**Richard Newton**  
University of California, Berkeley

**Martin Titland**  
Fairchild Space Company

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**Chairman/CEO**  
**Philip Dauber**  
Key Computer, President

**President/COO**  
**Bruce McWilliams**  
LLNL, Program Leader

**VP Operations**  
**Luc Bauer**  
IDT, VP and General Manager

**VP Technology**  
**David Tuckerman**  
LLNL, Project Leader

**VP Engineering**  
**Kamran Malik**  
Key Computer, Dir. of Engineering

## **nCHIP, Inc.**

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### **VP Finance**

**Kirk Flatow**

**Bain & Co., Senior Consultant**

### **FINANCING**

**October 1987**

**Seed**

**Private investors**

**April 1989**

**Seed**

**Private investors**

**August 1989**

**Round 1**

**\$4.2M**

**Mayfield Fund; Kleiner, Perkins, Caufield &  
Byers; Mohr, Davidow Ventures**

### **PRODUCTS**

**Circuit Boards**

**Multichip Modules**

### **OTHER INFORMATION**

**nCHIP does not employ a PR firm.**

### **SERVICES**

**Design**

**Fabrication**

**Assembly**

### **MANUFACTURING**

#### **Technology**

**CMOS**

**5-inch wafers**

**8-inch wafers in 1991**

# NMB Semiconductor Co. Ltd.

9730 Independence Avenue

Chatsworth, CA 91311

818/341-3355

Fax: 818/341-8207

ESTABLISHED: April 1984

NO. OF EMPLOYEES: 75

## BACKGROUND

NMB Semiconductor designs, manufactures, and markets 256K and 1Mb DRAMs and also offers foundry services. The Company was Japan's first start-up to build a VLSI facility capable of fabricating products with submicron geometries. Designs and technology were acquired initially through licensing agreements and technology exchanges with Inmos and other U.S. companies to bring existing processes on-line quickly.

NMB Semiconductor is a Division of NMB Technologies, which is, in turn, a subsidiary of the multinational Minebea Co. Ltd. of Tokyo, Japan. NMB Technologies was formed in early 1988 and consolidates Minebea's U.S. activities, which consist of NMB Semiconductor, Hi-Tek Corp., IMC Components Corp., and NMB Audio Research Corp. NMB Technologies is organized into a Memory Division (NMB Semiconductor), a Keyboard Division (Hi-Tek), an axial fan division (IMC Components), and an Audio Research Division (NMB Audio Research). NMB Technologies conducts the marketing for all products manufactured by the subsidiaries including DRAMs, hybrid ICs, switching power supplies, keyboards, inductors, DC servo and step motors, and AC and DC tube axial cooling fans.

All manufacturing for NMB Semiconductor's DRAMs is conducted by Minebea in a \$250 million, fully automated facility in Tateyama, Japan.

## BOARD

(Name and Affiliation)

Takumi Tamura  
NMB Semiconductor

Masatomo Yuki  
Minebea

Takami Takahashi  
Minebea

Iwao Ishizuka  
Minebea

Goro Ogino  
Minebea

Hidisato Ishikawa  
Minebea

Sadahiko Oki  
Minebea

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Hidisato Ishikawa  
Minebea, Sr Mng Dir

### Executive VP

William C. Connell  
NMB (USA), Vice President

### Dir Mfg & R&D

Shosuke Shinoda  
Matsushita, Dir MOS Process

## FINANCING

### 1984

#### Start-up

\$11.11M

Bank of Tokyo, Ltd.; Fuji Bank; Japan Associated Finance Co., Ltd.; K.K. Keiaisha; Kyowa Bank; Long Term Credit Bank of Japan; Minebea Co; Nippon Enterprises Development Corp.; Nippon Investment & Finance Co., Ltd.; Sumitomo Trust & Banking; Takami Takahashi; Takumi Tamura; Tokai Bank

### 1989

#### IPO

\$460.0M

Initial public offering

# NMB Semiconductor Co. Ltd.

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## RECENT HIGHLIGHTS

### March 1989

NMB acquired the Composite Recording Head Division of Seagate Technology.

## ALLIANCES

### Minebea Co.

1984

NMB is the subsidiary of and is financed by Minebea Co. Ltd. of Tokyo.

### Inmos

June 1984

NMB obtained a five-year license to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the 256K DRAM output. The companies also planned to codevelop the technology for Inmos' 64K and 1Mb DRAMs.

### Vitellic

November 1985

Vitellic granted a license to NMB Semiconductor for its 1Mb CMOS DRAM in exchange for one-third of NMB Semiconductor's plant capacity.

### National

September 1986

National contracted NMB to manufacture fast

SRAMs at the Tateyama fab. This agreement was canceled.

### TI

November 1987

NMB agreed to supply Texas Instruments (TI) with TI-designed, 1Mb field RAMs. Initially, NMB shipped 100,000 units a month.

### Alliance Semiconductor

December 1987

Alliance Semiconductor signed a five-year agreement with NMB Semiconductor, covering 256K and 1Mb DRAMs. NMB will manufacture and sell the devices worldwide.

## SERVICES

Silicon Foundry

## MANUFACTURING

### Technology

1.0- to 2.0-micron CMOS  
5-inch wafers

### Facilities

Tateyama, Japan  
200,000 sq. ft.  
Total space  
43,000 sq. ft.  
Class 1 clean room

## PRODUCTS

### DRAMs

Device	Description	Speed
AAA2800	256Kx1 Static Column Mode	60 to 80ns
AAA2801	256Kx1 Page Mode	60 to 80ns
1M100	1Mb x 1 Fast Page Mode	100 to 200ns
1M101	1Mb x 1 Nibble Mode	100 to 200ns
1M102	1Mb x 1 Static Column Mode	100 to 200ns
1M104	256Kx4 Fast Page Mode	100 to 200ns
1M105	256Kx4 Static Column Mode	100 to 200ns
1M200	1Mb x 1 Fast Page Mode	60 to 80ns
1M201	1Mb x 1 Nibble Mode	60 to 80ns
1M202	1Mb x 1 Static Column Mode	60 to 80ns
1M204	256Kx4 Fast Page Mode	60 to 80ns
1M205	256Kx4 Static Column Mode	60 to 80ns

## OTHER INFORMATION

NMB's PR firm is Capital Relations.

**NovaSensor**  
1055 Mission Court  
Fremont, CA 94539  
415/490-9100  
Fax: 415/770-0645  
Telex: 990010

**ESTABLISHED: October 1985**

**NO. OF EMPLOYEES: 105**

## **BACKGROUND**

NovaSensor was formed to develop, manufacture, and market the next generation of solid-state sensors and unique silicon-based mechanical microstructures. In the sensor field, the Company is focusing its design and development efforts on the physical parameters of pressure, acceleration, flow, and force. In the area of silicon-based mechanical microstructures, NovaSensor is focusing its efforts on the development of flow restrictors, programmable microvalves, micro-switches, nozzles, fluidics components, and micropositioners.

The Company was formed by Janusz Bryzek, Joseph R. Mallon, and Kurt Peterson. The team was joined by Phil Barth, a sensor technologist from Stanford University.

The Company is housed in a 32,000-square-foot facility that became operational in the summer of 1987 and includes a 4-inch wafer-processing line, assembly, and test.

First packaged devices were the TO-5 and TO-8 piezoresistive pressure sensors compensated over the range of 0° to 70° centigrade.

In September 1987, IC Sensors filed a suit against NovaSensor, claiming that the firm misappropriated information and trade secrets. The suit also names Mr. Bryzek, NovaSensor's president and CEO, and the former vice president and director at IC Sensors.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **Copresident/CEO**

\*Janusz Bryzek  
IC Sensors, Founder/President

### **Copresident/COO**

\*Joseph R. Mallon  
Kulite Semiconductor, VP Engineering

### **Exec VP Tech**

\*Kurt Peterson  
Transensory Devices, Founder/VP Tech

### **Dir Adv Sensor Dev**

Phil Barth  
Stanford University, Sr Rsch Assoc

### **Mgr of App Engr**

Dilip Vyas  
Sensym, Mgr QA

\*Founder

## **FINANCING**

NovaSensor was funded by Solarton Electronics Inc., a division of Schlumberger, for an undisclosed amount.

## **ALLIANCES**

Not available

## **MANUFACTURING**

Full-capability wafer fabrication for solid-state sensors, silicon microstructures, and transducer lines on 4-inch wafers. The facility is capable of producing more than 30 million sensors per year.

# **NovaSensor**

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## **Facilities**

Fremont, CA

22,000 sq. ft.

Manufacturing

3,500 sq. ft.

Class 1,000 clean room

## **PRODUCTS**

Low-Pressure Sensors (10 inches of water pressure) with High Output and Low Linearity

High-Pressure Sensors (up to 10,000 psi)

Acceleration Sensors

Isolated Metal Diaphragm Transducers

On-Chip Laser-Trimable Pressure Transducers

Low-Cost Mini-DIP Plastic Package Differential Pressure Sensor

## **OTHER INFORMATION**

NovaSensor's PR firm is Roger Grace, Inc.

## Novix Inc.

19925 Stevens Creek Blvd., Suite 280  
Cupertino, CA 95015  
408/255-2750

ESTABLISHED: March 1984

NO. OF EMPLOYEES: 20

### BACKGROUND

Novix develops and markets MPUs and development tools that implement a FORTH-in-silicon architecture. In 1986, Novix introduced the NC Series of 16-bit MPUs, which are high-level language, direct-execution (no microcode) MPUs. The MPUs are manufactured using 1.25-micron HCMOS and typically perform in excess of 20 mips. Other products include CPU boards, the ND4000 development system, a C compiler, and a FORTH operating environment. The Company states that the approach can be implemented in HCMOS, ECL, and GaAs. A 3-micron CMOS gate array was designed using Novix-developed technology.

Novix designs products for the artificial intelligence, embedded controller, cryptographics, robotics, and machine vision markets. Future plans also include implementing gallium arsenide in its product lines. The Company subcontracts all production and assembly.

Novix founders included Charles Moore, who invented the FORTH language in 1969; John Peers; John Golden; and Robert Murphy. The Company, originally named Technology Industries, was formed when Sysorex Information System, Inc., offered approximately \$1 million to develop devices based on the FORTH "language slice" computing. The combined Sysorex-Technology Industries R&D partnership was renamed Novix Inc.

In October 1986, Novix established an office in Belgium and signed nine European distributors.

In January 1987, John Golden and Robert Murphy formed a new company, named QSD, which applies the FORTH-in-silicon architecture to the military market.

### BOARD

(Name and Affiliation)

John Peers  
Novix Inc.

Ed Mack  
Consultant  
Ron Osborne  
Faultless Starch  
Peter Johnson  
Not Available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
John Peers  
Technology Industries Inc., President

### FINANCING

March 1984  
Round 1  
\$1.0M  
Sysorex International Inc.; Technology Industries Inc.

### RECENT HIGHLIGHTS

February 1987  
Novix put its 16-bit NC4016 MPU on an STD bus card measuring 4.5 x 6.5 inches. The NB4300 card supports 20-bit addressing and can be used as master or slave bus control.

April 1987  
Novix introduced the NS4100, a high-speed coprocessor/real-time controller board for IBM PCs or compatibles. The board is built with the Company's NC4016 MPU.

### ALLIANCES

Sysorex  
March 1984  
Sysorex International participated in first-round financing.

# Novix Inc.

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## Harris

July 1986

Harris added the Novix FORTH language MPU to its ASIC library as part of a licensing agreement covering MPU and MCU products based on the FORTH engine.

## Facilities

Cupertino, CA  
6,000 sq. ft.

Design, test

## MANUFACTURING

### Technology

3- and 1.25-micron CMOS

## PRODUCTS

### Microprocessors

Device	Description	Features
NC4016	16-Bit	64K Words Direct and 128-Gigaword On-Chip Memory Addressing, 10 to 12 mips
NC5116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, 20 to 25 mips
NC6116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, plus UARTS, FIFO, CTC, SCSI, On-Chip Stacks, 20 to 25 mips

### CPU Boards

Device	Description
NB4000	Novix Beta Board with 28K-word RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4100	IBM PC Add-In Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4200	Turbo Frame 4000 with 8K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4300	Novix STD Bus CPU Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH

### Development Tools

Device	Description
ND4000	Standalone System with Disk Controller, 10MB Hard Disk, Power Supply/Case, 360KB Floppy Disk, and Breadboard Development Area
Novix Empress	Comprehensive Superset FORTH-83 Operating Environment
Novix C	Full K and R and ANSI

## OTHER INFORMATION

Novix does not employ a PR firm.



**NSI Logic, Inc.**  
Cedar Hill Business Park  
257-B Cedar Hill Road  
Marlboro, MA 01762

**ESTABLISHED: November 1984**

**NO. OF EMPLOYEES: N/A**

### **BACKGROUND**

NSI Logic Incorporated designs, develops, and markets ASICs and video add-on boards that enhance graphics performance of new and existing IBM PC, PS/2, and compatible computer systems. The Company was founded in 1984 by Nandu Marketkar. Prior to founding NSI, Mr. Marketkar operated Custom Computer Systems.

NSI offers ASICs for the graphics and raster controller segments of the industry and will continue to develop turnkey solutions using state-of-the-art technology in related areas. The Company uses CMOS, MOS, and BiCMOS technologies in its ASIC development, which allows NSI to provide a platform for a broad line of high-performance products for applications in graphics and raster controllers. The Company's ASIC products are marketed to OEMs that build systems and video add-on boards. Primary markets for the Company's board products are owners and buyers of computer systems and value-added resellers (VARs).

### **BOARD**

(Name and Affiliation)

\*Nandu J. Marketkar, Chairman  
NSI Logic, CEO

Jeff Schiebe  
NSI Logic, President

### **PRODUCTS**

<b>VLSI</b>	<b>Controllers</b>
EVC215	EPIC EGA
EVC315	Smart EGA
EVC315CR	Smart EGA PLUS
EVC415A	Smart VGA/8
PS00004	VGA/8 and VGA/16

### **OTHER INFORMATION**

NSI Logic does not employ a PR firm.

Stephen A. Stecyk  
Not Available

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**Chairman & CEO**  
\*Nandu J. Marketkar  
Custom Computer Systems, President

**President & COO**  
Jeff Schiebe  
Masscomp

\*Founder

### **FINANCING**

Not available

### **ALLIANCES**

Not available

### **MANUFACTURING**

#### **Technology**

Not Available

#### **Facilities**

Marlboro, MA  
R&D, marketing

# Oak Technology, Inc.

139 Kifer Court  
Sunnyvale, CA 94086  
408/737-0888  
Fax: 408/737-3838

ESTABLISHED: July 1987

NO. OF EMPLOYEES: 35

## BACKGROUND

Oak Technology, Inc., was founded in 1987 to provide system-level solutions in chip form to the personal computer market. The Company was founded by David Tsang, a founder and president of Data Technology Corporation from 1979 to 1987. Oak Technology provides total silicon solutions to specific application areas by designing, marketing, and supporting OEM customers in their efforts to design and manufacture high-performance systems. By focusing on key growth areas of the personal computer chip market, Oak seeks to become a dominant player in those market segments. In particular, the targeted segments are battery-powered laptops, high-performance 286/386SX desktops, and graphics controller chips.

By focusing exclusively on those areas that present potential for a high growth rate, Oak hopes to avoid direct head-to-head battles with the numerous other chip set companies. While it cannot compete with larger competitors in the breadth of its product offerings, the objective is to aim at one specific piece of the total market and achieve superiority by designing its products to fit that specific need. Oak believes that it can become a performance leader in the laptop market and the specialized desktop market.

Initially, Oak supplied a PS/2 Model 30-compatible chip set and a VGA/Super VGA graphics controller. In the fall of 1989, Oak began to focus on the introduction of a laptop PC chip set, the OakHorizon. A second area of concentration is the VGA graphics controller market. Future products will target high-performance PCs.

Oak's strongest area of expertise is in the design and marketing of its products. For this reason, it focuses its resources in these areas and uses external fabrication facilities both in the United States and in the Pacific Rim to provide high-

volume manufacturing. In this way, Oak is able to take advantage of state-of-the-art manufacturing facilities without massive investment in manpower and capital.

## BOARD

(Name and Affiliation)

\*David Tsang  
Oak Technology, Inc., President  
Richard King  
KBA Venture Partners, Partner  
Wen Ko  
Hewlett-Packard Taiwan, President

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President  
\*David Tsang  
Qume, Vice Chairman  
VP, Mktg  
Sukkin Fong  
Harmony Inc., President  
Dir VLSI Design  
Dr. Mou Yang  
VLSI Technology, not available  
Dir Sys Des  
Lloyd Ebisu  
Data Technology, Dir Eng  
Dir Oak-Taiwan  
Abel Lo  
Convergent Technologies, not available  
Dir Ops  
James Ou  
Data Tech Corp., Ops Res Mgr  
\*Founder

# Oak Technology, Inc.

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## FINANCING

July 1987

Round 1

\$1.5M

KBA Venture Partners, Eastpac, private

November 1988

Round 2

\$4.5M

KBA Venture Partners, private

## RECENT HIGHLIGHTS

September 1988

Oak announced a family of CMOS chips for the IBM PS-2 Model 30 that uses high-density VLSI devices for systems logic, data separation, and peripherals. The chip family includes the OTI-031 system controller, the OTI-032 I/O

controller, the OTI-033 floppy disk controller, and the OTI-036 and OTI-037 graphics controllers.

## ALLIANCES

Kanematsu Semiconductor—Oak's Japanese representative

## MANUFACTURING

### Technology

Proprietary Megacell Technology, CMOS

### Facilities

Sunnyvale, CA

Design, marketing, test

## PRODUCTS

OTI-030 Core Logic for 8088/8086

OTI-037 Super VGA Controller

OTI-050 OakHorizon for 286/386-SX

## OTHER INFORMATION

Bailey Associates is Oak Technology's PR firm.

**Opto Diode Corp.**  
750 Mitchell Road  
Newbury Park, CA 91320  
805/499-0335  
Fax: 805/499-8108

**ESTABLISHED: 1981**

**NO. OF EMPLOYEES: 13**

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## **BACKGROUND**

Opto Diode Corp. (ODC) was formed in 1981 by James Kim, formerly with Rockwell's Collins division in Dallas, Texas. ODC offers semicustom high-reliability devices made to customer specifications. The Company is occupying a 10,000-square-foot facility in Newbury Park, California.

ODC had \$1 million in sales in 1985 from GaAs infrared LEDs for solid-state relay and optoelectronics markets. Future plans are to penetrate the U.S. military market and European market.

## **BOARD**

Not available

## **PRODUCTS**

Gallium Aluminum Infrared LEDs

## **OTHER INFORMATION**

Opto Diode does not employ a PR firm.

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

\*James Kim  
Rockwell, Sr Research Engr

\*Founder

## **FINANCING**

Not available

## **ALLIANCES**

Not available

**Opto Tech Corp.**  
32 Industrial East 4th Road  
Science-Based Industrial Park  
Hsinchu, Taiwan  
ROC  
(035) 777-481/3  
Telex: 31592 OPTO TECH

**ESTABLISHED: December 1983**

**NO. OF EMPLOYEES: 100**

## **BACKGROUND**

Opto Tech is offering GaAs-based products, silicon wafers, and photoresistor and photodiode semiconductors. The Company plans to offer small-signal and transmitting transistors, junction FETs, microwave transistors, and fast-recovery and Schottky-barrier diodes. Production began in July 1984.

The Company spun off from Fine Microelectronics and is owned by local investors and the Bank of Communications.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

James Chiu

Petrochemical Industry, President

## **PRODUCTS**

### **LED**

Transistors

Photodiodes

Phototransistors

Infrared Devices

## **OTHER INFORMATION**

Opto Tech does not employ a PR firm.

## **Business Liaison**

S. Shyu

Not available

## **FINANCING**

\$2.5M

Bank of Communications, Fortune Plastic Manufacturing Co., Opto Tech Corp.

## **ALLIANCES**

None

## **MANUFACTURING**

### **Technology**

GaAs

Silicon

### **Facilities**

Hsinchu, Taiwan

9,175 sq. ft.

## Orbit Semiconductor, Inc.

1230 Bordeaux Drive  
Sunnyvale, CA 94086  
408/744-1800  
Fax: 408/747-1263

ESTABLISHED: November 1985

NO. OF EMPLOYEES: 115

### BACKGROUND

Orbit Semiconductor, Inc., specializes in quick-turn, high-reliability foundry work with emphasis on 1.5-micron CMOS including either a double-poly or double-metal process. Other processes include 2.0- to 5.0-micron CMOS, HMOS, single- or double-poly, single- or double-metal, double-poly/double-metal, and multiple-layer poly.

Orbit guarantees single-poly and single-metal CMOS or HMOS in 10 working days or fewer and double-poly or double-metal CMOS in 15 working days or less.

The Company also offers computer-aided design services, which include layout from customer-provided logic drawings, design rule checking, data sizing, and conversion and Versatec plots. Orbit also acts as a prime contractor for providing photoplates.

In late 1979, Comdial Corporation, an Oregon firm that made subsystems for telephone dialing, started the firm as its engineering subsidiary. Comdial acquired an existing facility in 1979 and developed industry-compatible silicon-gate NMOS and CMOS processes. The Company, operating under the name Comdial Semiconductor, began offering foundry services in January 1980 and became the only guaranteed quick-turn fab in the business. One-half of the Company's resources were dedicated to quick-turn services and guaranteed parts within as few as 5 days for NMOS and 10 days for CMOS.

In November 1985, 80 percent of Comdial Semiconductor was acquired by Orbit Instruments, Inc., a supplier to Hughes and other military contractor companies. The management of Comdial Semiconductor retained 20 percent of the Company. In addition to continuing the previous services, Orbit is positioning itself to be

a stronger supplier to high-reliability commercial and military-oriented users. In 1987, Orbit added specialized processing such as p-well radiation-hardened CMOS and CCD manufacturing. The 2-micron radiation-hardened CMOS offers a total dose of radiation up to 1 megarad.

Orbit's North American customers include Amber Engineering, Cardiac Pacemakers, Crystal Semiconductor, Dallas Semiconductor, General Electric, General Motors, Honeywell, Hughes, Intermedics, ITT, Johns Hopkins University, Lotus Designs, Macronix, Martin Marietta, Motorola, RCA, Rockwell, Silicon General, and VLSI Design Associates. The Company's overseas customers include British Petroleum, Tadiran, and Thomson CSF.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Gary Kennedy  
Comdial Semiconductor, VP/GM

#### VP Finance

Joseph Wai  
Comdial Semiconductor, Controller

#### VP Technology

\*Steve Kam  
Comdial Semiconductor, Dir Technology

#### VP Wafer Fab

Al Bettencourt  
Comdial Semiconductor, Process Mgr

\*Founder

## **Orbit Semiconductor, Inc.**

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### **FINANCING**

Not available

### **RECENT HIGHLIGHTS**

#### **March 1988**

Orbit ordered \$1.4 million of 1:1 model 1100 lithography systems from General Signal's Ultratech Stepper unit. The order marks the first purchase of steppers by Orbit.

### **ALLIANCES**

Not available

### **SERVICES**

CAD

Foundry: HMOS, CMOS, Charge-Coupled Device Processing

### **OTHER INFORMATION**

Orbit does not employ a PR firm.

Prototype Manufacturing  
Volume Manufacturing  
Assembly  
Packaging  
Test

### **MANUFACTURING**

#### **Technology**

1.5-micron silicon-gate, double-poly, double-metal CMOS and HMOS  
2.0- to 5.0-micron CMOS single- or double-poly, single- or double-metal  
2.0- to 5.0-micron HMOS single- or double-poly, single- or double-metal  
4-inch wafers

#### **Facilities**

Sunnyvale, CA  
28,000 sq. ft.  
Manufacturing

## Oxford Computer, Inc.

39 Old Good Hill Road

Oxford, CT 06483

203/881-0891

Fax: 203/888-1146

**ESTABLISHED: March 1987**

**NO. OF EMPLOYEES: 3**

### BACKGROUND

Oxford Computer was founded to solve extremely demanding problems in pattern recognition. The initial technical approach was to build massive parallel analog chips that were inspired by neural networks. This approach proved infeasible, but basic lessons about placing processors within specially configured memory chips were learned. Oxford Computer's goal is to reduce the cost dramatically and expand the use of image processing, pattern recognition, and 3-D graphics devices.

A marketing communications campaign was launched in April 1988 that resulted in more than 50 newspaper and magazine articles about Oxford Computer and its technology during the 18 months following its start. As a result of many customer contracts, a family of application-specific, memory-plus-processor chips was defined and shown to be desired. Basic functions include matrix multiplication, convolution, and interpolation. Oxford calls these novel chips Intelligent Memory Chips.

Unlike ordinary memory chips that are limited to information storage, Oxford Computer's Intelligent Memory Chips both store and process information. In addition to their primary function as memory, Intelligent Memory Chips have multiple simple partial processors embedded within. Furthermore, unlike ordinary memory chips that handle only one or a few bits of information at a time, each Intelligent Memory Chip handles strings of hundreds of bits at a time. Although the idea of placing processors within memory chips is an old one, Oxford has devined a family of Intelligent Memory Chips with specific applications in digital signal processing, pattern recognition, and 3-D graphics.

Currently, two products are in development at Oxford Computer. The first is the Intelligent Pattern Recognition Memory Chip. The second product is the Intelligent Convolution Memory Chip, with samples due in spring 1990. Oxford subcontracts all manufacturing and assembly operations and most of its testing.

### BOARD

(Name and Affiliation)

Michael Mulshine  
Osprey Partners

Steven G. Morton  
Oxford Computer

Jack Harding  
Zycad Corporation

Howard Morgan  
ARCA Group, Inc.

Earl Rogers  
Formerly CEO of Precision Monolithics

### COMPANY EXECUTIVES

(Position and Name)

President & Chief Technical Officer  
Steven G. Morton

Corporate Secretary & Treasurer  
Jack Harding

Assistant Secretary  
Frank Marco

### FINANCING

Seed stage from the founder and a private placement.

Start-up financing initiated in the fall of 1989.



## **Oxford Computer, Inc.**

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### **ALLIANCES**

Not available

### **OTHER INFORMATION**

Oxford Computer does not employ a PR firm.

## Pacific Monolithics, Inc.

245 Santa Ana Court  
Sunnyvale, CA 94086  
408/732-8000  
Fax: 408/732-3413

ESTABLISHED: March 1984

NO. OF EMPLOYEES: 120

### BACKGROUND

Pacific Monolithics, Inc., designs and manufactures monolithic ICs (MMICs) based on GaAs, as well as microwave subsystems based on its GaAs MMICs. The Company offers more than 200 microwave macrocells (PM Cells) for semi-custom IC design for consumer, communications, and defense applications. Company strengths include yield-tolerant design techniques, advanced packaging technology, a proprietary CAD/CAE system, and foundry services.

The Company participated as a team member on several contracts for the Department of Defense, including Phase 0 and Phase 1 of the Microwave/Millimeter-Wave IC (MIMIC) program. The contracts were in the areas of communication, radar, electronic warfare, and smart weapons for the army, navy, and air force.

Pacific Monolithics has developed a set of monolithic GaAs subsystem building blocks for microwave signal processing. The Company's ASIC cell library includes amplifiers, mixers, oscillators, couplers, combiners, switches, attenuators, phase shifters, modulators, and demodulators.

In April 1986, Pacific Monolithics introduced three MMIC devices that were offered in 5V, commercial grade, 8-lead, surface-mount packages. The devices were an 0.8- to 3.0-GHz converter, a 3.0- to 6.0-GHz converter, and a 5.0- to 6.0-GHz converter.

In March 1986, the Company relocated from a 10,000-square-foot facility to a 22,000-square-foot facility that can be expanded by an additional 13,000 square feet. Presently, Pacific Monolithics uses several foundry services, including TriQuint and COMSAT.

### BOARD

(Name and Affiliation)

\*Allen Podell, Chairman of the Board

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

Donald A. Bond  
Sanders, VP/GM Microwave

#### SR VP & Director

Allen Podell  
A.F. Podell Assoc., President of Technology

#### VP Bus Dev

Frank Russell  
Avantek, Sales Mgr

#### VP Engr

Pang Ho  
Geotech, President

#### Dir Sys & Plan

\*Doug Lockie  
Strategic Technology, Consultant

\*Founder

### FINANCING

#### August 1985

Round 1

\$5.0M

IAI Venture Partners, Sand Hill Financial Corp., Shaw Ventures, Vanguard Associates

#### September 1986

Round 2

\$3.5M

Institutional Investment Partners, Oak Investment Partners

# **Pacific Monolithics, Inc.**

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## **RECENT HIGHLIGHTS**

### **November 1987**

Pacific Monolithics and TriQuint became team members, with Ford as primary contractor, for contracts that cover smart weapons, radar, and electronic warfare.

### **November 1987**

Pacific Monolithics and TriQuint became team members, with Allied Bendix as prime contractor, for two contracts that cover communications and radar.

## **ALLIANCES**

Not available

## **PRODUCTS**

Channelized Up/Down Converters  
Converters  
Amplifiers  
Oscillators  
Attenuators  
Active Isolators  
Phase Shifters  
Switches  
Synthesizers  
TR Modules  
Single-Chip Radars  
Microwave Sensors  
Expendable Countermeasure Subassemblies

## **OTHER INFORMATION**

Pacific Monolithics does not employ a PR firm.

## **MANUFACTURING**

### **Technology**

GaAs

### **Facilities**

Sunnyvale, CA

35,000 sq. ft.

Lab, manufacturing, administration

6,000 sq. ft.

Class 100 clean room

# Paradigm Technology, Inc.

(Formerly GL Micro Devices)

71 Vista Montana

San Jose, CA 95134

408/954-0500

**ESTABLISHED: February 1987**

**NO. OF EMPLOYEES: 35**

## BACKGROUND

Paradigm Technology, Inc., was formed to develop high-performance advanced CMOS products and is in an R&D mode. Norman Godinho and Frank Lee, founders of Paradigm Technology, Inc., also are founders of Integrated Device Technology (IDT). Mr. Godinho served as vice president and general manager of IDT's digital signal processing (DSP) division, and Mr. Lee was codirector of IDT's corporate research and development group.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Terry Holdt  
Linear Corp., Pres.

### VP Technology

\*Norman Godinho  
IDT, VP/GM DSP Div

### VP Prod Dev

\*Frank Lee  
IDT, Codirector Corp R&D

### VP Mktg/Sales

Steve Taylor  
IDT, NE Regional Mgr

### VP Operations

James Doran  
Intel, Plant Manager

### VP Finance/CFO

Richard Henander  
Sigma Circuits, VP Finance

\*Founder

## FINANCING

### February 1987

Round 1

\$2.4M

El Dorado Ventures, Glenwood Management

### May 1989

Round 2

\$9.6M

First-round investors, TA Associates,  
Chesapeake Ventures, Gateway Partners,  
Centennial Funds

## RECENT HIGHLIGHTS

### May 1989

Paradigm relocated from temporary facilities in Santa Clara, California, to its new 62,000-square-foot facility in San Jose. The new facility includes a wafer-fabrication facility dedicated to implementing Paradigm's proprietary design and process technology.

## MANUFACTURING

### Technology

CMOS

### Facilities

San Jose, CA

62,000 sq. ft.

R&D, manufacturing, administration

## **Paradigm Technology, Inc.**

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### **PRODUCTS**

A complete family of high-speed 256Kb SRAM chips, with 1Mb SRAMs expected in early 1990

### **OTHER INFORMATION**

Paradigm's PR firm is Ulevich and Orrange, Inc.

# Performance Semiconductor Corporation

610 East Weddell Drive

Sunnyvale, CA 94089

408/734-8200

Fax: 408/724-0258

ESTABLISHED: 1984

NO. OF EMPLOYEES: 330

## BACKGROUND

Performance Semiconductor Corporation designs, develops, manufactures, and markets high-speed SRAMs, MPUs, and logic devices for military, industrial, and telecommunications applications. The Company was founded by Dr. Thomas A. Longo, David Maxwell, and Gerald Herzog.

Performance Semiconductor is using an advanced single-CMOS process known as performance advanced CMOS engineered (PACE) technology. PACE uses 0.8-micron and 0.7-micron effective channel lengths to give 500ps loaded internal gate delays. PACE also includes two-level metal and epitaxial substrates.

The Company's products include CMOS SRAMs at levels of complexity of 1K to 64K; a 40-MHz, 16-bit MPU that executes the 1750A instruction set; and two support functions, the processor interface circuit (PIC) and MMU combination. In 1987, Performance offered an 8ns 1K SRAM organized as 256x4 and a new series of TTL I/O 16K SRAMs featuring an address access time of between 12ns and 15ns. In 1987, the Company also signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals.

In March 1985, Performance leased a 26,000-square-foot facility where it conducts research and development and all manufacturing. The Company has developed it into a Class 1 facility that uses 6-inch wafers. In 1987, Performance achieved military 883C compliance and shipped both 64K SRAMs and the 1750A processor compliant with the 883C.

In January 1988, Performance announced that it had signed a nationwide franchising agreement with Schweber Electronics, putting in place its North American distributor network. A nation-

wide franchise was previously signed with Zeus Components in July 1987.

## BOARD

(Name and Affiliation)

\*Dr. Thomas A. Longo, Chairman  
Performance Semiconductor Corporation

Robert Zicarelli  
Northwest Venture Partners

B. Kipling Hagopian  
Brentwood Associates

William Bowes  
U.S. Venture Partners

Dr. James Meindl  
Rensselaer Polytechnic Institute

T.J. Connors  
T.J. Connors Company

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*Dr. Thomas A. Longo  
Schlumberger

### VP Ops

Gene Blanchette  
Raytheon

### VP Sales/Mktg

Les Welborne  
Fairchild

### VP Finance

George Wikle  
Memorex

### VP Human Resources

William Strickland  
Fairchild

### VP Product Development

Dr. Vir Dhaka  
Xerox

# Performance Semiconductor Corporation

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**VP Product Development**  
Dr. John E. Iwersen  
Bell Labs

**VP Reliability & QA**  
Rudy Konegan  
U.S. Air Force

\*Founder

## FINANCING

**October 1984**

Round 1

\$11.3M

Advanced Technology Ventures, Albion Ventures, Arbeit & Co., Asset Mgmt., Brentwood Assoc., DSV Partners, IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital Mgmt., Rotan MOSel Technology Partners, Taylor & Turner, U.S. Venture Partners, Venwest Partners (Westinghouse Electric Corp.), Seymour Cray, Thomas Longo

Lease

\$6.6M

Westinghouse Electric Corp.

**November 1986**

Round 2

\$10.0M

Advanced Technology Ventures, Albion Ventures, Asset Mgmt., Brentwood Assoc., DSV Partners, Harvard Mgmt., IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital, Reynolds Creek Ltd. Partnership, L.F. Rothschild, Taylor & Turner, Unterberg Towbin, U.S. Venture Partners, Venwest Partners, Thomas Longo

**August 1988**

Round 3

\$5.0M

Berkeley International, Brentwood Associates, Cowen and Co., and several officers of Performance Semiconductor Corporation

## RECENT HIGHLIGHTS

**September 1987**

Performance offered the VSI chip, which incorporates bus interface features for intelligent controller applications. The device provides

32-bit VMEbus address decoding as well as interrupt and mailbox facilities.

**November 1987**

Performance presented information on its 40-MHz VHSIC-level PACE 1750A system at the GOMAC conference. The system is a CMOS three-chip set consisting of a CPU, a processor interface chip, and an MMU/combi-nation support chip. The set is said to provide system performance greater than 2 mips.

**March 1989**

Performance introduced two static RAMs—the P3C3147 and the P3C3148—that use 3.3V rather than 5.0V.

## ALLIANCES

**Westinghouse**

August 1986

Performance fabricated a VHSIC Phase-I, 11,000-gate array designed by the Westinghouse Defense and Electronics Center for the U.S. Air Force Wright Aeronautical Laboratories.

**MIPS Computer Systems**

November 1987

Performance signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals. Performance will also sell the MIPS software environment with the chips.

## MANUFACTURING

**Technology**

1.25-micron CMOS PACE I (0.8-micron effective channel lengths)

1.00-micron CMOS PACE II (0.7-micron effective channel lengths); all wafers produced have been 6-inch double-metal, epi substrates since 1985.

**Facilities**

Sunnyvale, CA

44,000 sq. ft.

Manufacturing

8,000 sq. ft.

Class 1 clean room

# Performance Semiconductor Corporation

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## PRODUCTS

### CMOS SRAMs

Device	Density	Organization	Speed (ns)	Features
P4C422	1K	256x4	8	
P4C147	4K	4Kx1	10	
P4C148	4K	1Kx4	10	
P4C149	4K	1Kx4	10	Fast CS
P4C150	4K	1Kx4	10	Separate I/O, Reset
P4C151	4K	1Kx4	10	Comparator
P4C116	16K	2Kx8	15	300-Mil Package
P4C168	16K	4Kx4	12	
P4C169	16K	4Kx	12	Fast CS
P4C170	16K	4Kx4	12	Output Enable
P4C1682/1681	16K	4Kx4	15	Separate I/O
P4C164	64K	8Kx8	20	300-Mil Package
P4C187	64K	64Kx1	12	
P4C188	64K	16Kx4	20	
P4C198	64K	16Kx4	20	Output Enable
P4C1982/1981	64K	16Kx4	20	Separate I/O
P4C163	72K	8Kx9	20	300-Mil Package
P4C1257	256K	256Kx1	20	

### Pace Logic CMOS Family

- 74PCT273/374 250-MHz Toggle Rates
- 74PCT373/533 Gated Latches
- 74PCT241/244 Bus Drivers
- 74PCT245/545/640/643/645 Transceivers
- 74PCT29818/29521 plus "A" versions of all logic parts

### Microcomponents

- |   |  |   |
|---|--|---|
| <ul style="list-style-type: none"> <li>PACE 1750A Family</li> <li>PACEMIPS</li> </ul> | <ul style="list-style-type: none"> <li>16-Bit MPUs</li> <li>R2000A CPU (16-MHz)</li> <li>R2010 FPA (16-MHz)</li> <li>R3000 CPU (25-MHz)</li> <li>R3010 FPA (25-MHz)</li> </ul> | <ul style="list-style-type: none"> <li>20-, 30-, and 40-MHz; Includes 32-Bit and 48-Bit Floating-Point Arithmetic Processing</li> </ul> |
|---|--|---|

## OTHER INFORMATION

Performance Semiconductor does not employ a PR firm.



# Photonic Integration Research, Inc.

1357 Perry Street  
Columbus, OH 43201  
614/424-3313  
Fax: 614/424-3320

ESTABLISHED: July 1987

NO. OF EMPLOYEES: 6

## BACKGROUND

Photonic Integration Research, Inc., (PIRI) was formed to develop basic optical IC technology for commercial applications. The Company is the result of a joint venture between Nippon Telegraph and Telecommunications (NTT), Mitsubishi Electric Corporation of Japan, and the Batelle Memorial Institute. NTT owns 49 percent of the Company; Mitsubishi owns 41 percent; and Batelle owns 10 percent.

PIRI president, Dr. Tadashi Miyashita, was formerly head of the Optoelectronic Materials Section of the Electronics Materials Department at NTT's Ibaraki Electrical Communications Laboratories. Shigeki Sakaguchi and Shin Sumida also were previously at NTT's Ibaraki Telecommunications Laboratories, where the optical IC technology was invented.

In addition to developing commercial applications for optical waveguide technology, PIRI will also develop applied components that will be made available to equipment manufacturers for use in such end products as optical communications equipment, optical measuring equipment, automobiles, and airplanes. The Company expects advancement in the technology to lead to greater miniaturization and increased utilization of fiber optics.

## PRODUCTS

Optoelectronic Devices  
Custom-Design Optical Devices

## OTHER INFORMATION

PIRI does not employ a PR firm.

PIRI is located in the Batelle Memorial Institute's Columbus, Ohio, facilities.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

Dr. Tadashi Miyashita  
NTT

### General Manager

Shigeki Sakaguchi  
NTT

### Chief Supervisor

Shin Sumida  
NTT

## FINANCING

July 1987

Round 1

\$10.0M

Batelle Research Institute, Mitsubishi Electric Corporation, Nippon Telephone & Telegraph

## Plus Logic

1255 Parkmoor Avenue

San Jose, CA 95126

408/293-7587

Fax: 408/298-7587

ESTABLISHED: 1988

NO. OF EMPLOYEES: 27

### BACKGROUND

Plus Logic was incorporated in October 1987. The founding team, which consists of former National Semiconductor founder Roger Smullen and semiconductor industry executives Clayton Marr and Cecil Kaplinsky, was established in January 1988. Plus Logic was formed to solve the system performance, cost, and time-to-market limitations of existing "glue logic" devices. The Company's goal is to become a major player in the ASIC market, targeting the multibillion-dollar field-programmable gate array (FPGA) market with a range of innovative and easy-to-use products and software design tools.

Plus Logic's answer to the problems associated with conventional glue logic lies within its family of FPGAs based on Plus Logic's proprietary PLUS ARRAY architecture. The PLUS ARRAY family of FPGAs combines the flexibility and faster time to market of user configurability, along with the cost and performance required to implement high-speed glue logic.

The PLUS ARRAY architecture provides the high-performance system designer with a way of implementing glue logic that is high in performance (40-MHz system clock rate), integrated (1,000 to 6,000 gates per chip), fast and easy to design (uses standard design tools), predictable in timing (does not require multiple design iterations), and low in cost.

Plus Logic's first family of products is the FPGA2000 family. Three family member parts will be introduced by the end of 1990. Based on a CMOS EPROM technology, the devices are capable of implementing functions of up to 2,000 gates and will support a system clock rate of up to 40 MHz. Plus Logic subcontracts

foundry and assembly services. In addition, the Company conducts in-house testing but also subcontracts a portion of this work.

### BOARD

(Name and Affiliation)

Roger Smullen, Chairman  
Plus Logic, President/CEO

Gordon Russel  
Sequoia Capital, Partner

Jeff Pickard  
Merrill, Pickard, Anderson & Eyre, Partner

Bernard J. Lacroute  
Formerly with Sun Microsystems

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

\*Roger Smullen  
AMCC, CEO/Chairman

#### VP R&D

\*Cecil Kaplinsky  
Katus Technologies, Partner

#### VP Mktg

\*Clayton Marr  
Katus Technologies, Partner

#### VP Finance

Howard Bailey  
MVI, Inc., Founder

#### VP Technology

George Simmons  
Phillips/Signetics, CMOS Tec Dev Mgr

\*Founder

# Plus Logic

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## FINANCING

October 1988

Seed

Not available

Chips & Technologies, Inc.; private investors

January 1989

Round 1

\$5.0M

Sequoia Capital; Merrill, Pickard, Anderson & Eyre; Asset Mgmt Co.; Brentwood Associates; Hook Partners

## MANUFACTURING

### Technology

1.2-micron CMOS

### Facilities:

San Jose, CA

28,000 sq. ft.

Engineering, development, test, marketing, administration

## ALLIANCES

Foundry agreements are in place and will be announced at a later date.

## PRODUCTS

### Silicon Device

#### FPGA 200 Family

2010	4 FBs
2020	8 FBs
2040	16 FBs

### Field-Programmable Subsystem Logic Family

5110	4 FBs and dual-port memory
5210	4 FBs and finite state machine

## OTHER INFORMATION

Plus Logic's PR firm is Maxtec.

# PLX Technology Corporation

625 Clyde Avenue  
Mountain View, CA 94043  
415/960-0448  
Fax: 415/960-0479

ESTABLISHED: May 1986

NO. OF EMPLOYEES: N/A

## BACKGROUND

PLX Technology Corporation was formed to offer CMOS programmable interface devices for MPU-based systems. The Company's first product, introduced in May 1987, was the PLX 448—an erasable programmable logic device (EPLD). The device has electrical and architectural features that are geared specifically for bus interface applications. The PLX 448 includes four 48mA drivers and four 24mA drivers that can drive VMEbus, Nubus, Micro Channel bus, proprietary buses, and memory buses directly. PLX is the only supplier that offers the high-drive capability. The device is fabricated using a 1.5-micron CMOS EPROM process and offers a propagation delay from input to high-drive-current output as low as 25ns.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Michael Salameh  
Hewlett-Packard, Mktg Manager

### VP R&D

Wei-Ti Liu  
AMD, R&D

### VP Prod Plan

D. James Guzy, Jr.  
AMD, R&D

### VP Sales

Don Etzbach  
Virtual Micro-System, Mktg/Sales

### Mgr Systems Eng

Arthur Chang  
Wyse Technology, Hardware Eng Mgr

### VP Marketing

Gaylord Galiher  
Hewlett-Packard, Marketing Mgr

## FINANCING

### May 1986

Round 1

N/A

Arbor Financial Group; Draper Associates; and others

### March 1988

Round 2

N/A

Initial investors; and others

### August 1989

Round 3

\$1.9M

Arbor Financial Group; Associated Venture Investors; Draper Associates

## ALLIANCES

None

## MANUFACTURING

### Technology

1.5-micron CMOS

1.2-micron CMOS

# PLX Technology Corporation

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## PRODUCTS

Device	Description
PLX 464	PLD with 64mA High-Drive Current
PLX 448	PLD with 24mA and 48mA High-Drive Current
VSB 1200	Master Module Interface Device with Single-Level Arbiter, Bus Requester, Bus Controller
VME 1200/1210/1220	VMEbus Master Controllers with Single-Level System Arbiter, Bus Requester, Driver
VME 2000	VMEbus Slave Module Interface Device
MCA 1200	Micro Channel Bus Controller and Local Arbiter
VSB 2000	VSB Slave Module Interface Device
VME 3000/3010	Interrupt Generators
VME 4000	Interrupt Handler
USB 1400	Multi-Master Bus Controller
<b>Multibus I</b>	
MBI 8289A/8289B	MBI APX 86/88/186 Bus Arbiter iAPX
<b>Multibus II</b>	
PSB 2000/2100	Reply agent controller and reply agent error generator
LBX 2000/2100	Reply agent controller/reply agent

## OTHER INFORMATION

PLX's FR firm is Robin Eschler Associates.

# Power Integrations Incorporated

411 Clyde Avenue  
Mountain View, CA 94043  
415/960-3572  
Fax: 415/940-1226

ESTABLISHED: May 1988

NO. OF EMPLOYEES: N/A

## BACKGROUND

Power Integrations Incorporated was founded in May 1988 by Dr. Klas Eklund, Arthur Fury, and Steve Sharp to develop, manufacture, and market high-voltage power semiconductors. Using proprietary technology, Power Integrations developed a line of power ICs that integrate low 5-volt circuits with circuits that handle 200 to 400 volts. The Company's products bridge the gap between low-voltage control circuitry and high-voltage peripheral devices.

Power Integrations introduced its first products in June 1989. One is a universal power driver used to control high-voltage peripherals such as relays, solenoids, lamps, and motors from low-voltage control circuitry including CMOS and TTL digital logic and analog signals. The Company also introduced a high-voltage interface and a high-voltage n-channel array. Each of these devices is available with voltage rating of 200 or 300 volts. The n-channel array and the universal power driver are also available with a 400-volt handling capacity. Future products will have high voltage and current ratings.

All of Power Integrations' products are based on CMOS technology. Power Integrations conducts all testing in-house, but wafer fab and assembly operations are conducted by external sources.

## BOARD

(Name and Affiliation)

Dr. William Davidow  
Mohr, Davidow Ventures

Irwin Federman  
Concord Partners

Floyd Kvamme  
Kleiner, Perkins, Caufield & Byers

\*Stephen Sharp  
Not available

Dr. Ed Ross  
Power Integrations

\*Dr. Klas Eklund  
Power Integrations

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Dr. Ed Ross  
Signetics, Sr VP Prod Div Grp

### VP R&D

\*Dr. Klas Eklund  
Data General, Product Manager

### VP Mktg

\*Art Fury  
Micro Linear, VP Mktg & Sales

### VP Mfg

Russ Anderson  
Signetics, VP/Gen Cus Spec Prod Div

\*Founder

## FINANCING

May 1988

Round 1

\$3.1M

Concord Partners; Data General Corporation;  
Kleiner, Perkins, Caufield & Byers; Mohr,  
Davidow Ventures

August 1989

Round 2

\$7.5M

Original investors; Hillman Ventures; Merrill,  
Pickard, Anderson & Eyre

# Power Integrations Incorporated

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## RECENT HIGHLIGHTS

### June 1989

Power Integrations, Inc., introduced its first family of products for the high-voltage power IC market. The products include the PWR-DRV1 universal power driver, the PWR-DRV451 through 4 high-voltage interface series, and the PWR-NCH801 high-voltage n-channel array.

## ALLIANCES

None

## PRODUCTS

Universal Power Driver  
High-Voltage Interface  
High-Voltage N-Channel Array

## OTHER INFORMATION

Power Integration's PR firm is Rigoli, Pamphilon, Demeter.

## MANUFACTURING

### Technology

CMOS

### Facilities

Mountain View, CA  
10,400 sq. ft.  
Design, test, marketing

**Powerex, Inc.**  
Hillis Street  
Youngwood, PA 15697  
412/925-7272  
Fax: 412/925-4393

**ESTABLISHED: January 1986**

**NO. OF EMPLOYEES: 500**

## **BACKGROUND**

Powerex, Inc., manufactures and markets thyristors and rectifiers rated greater than 50 amperes. The Company also offers power transistors, Darlington, FETMOD, and MOSBIP modules. Powerex is a service-oriented company, providing just-in-time delivery, and has developed business partnership arrangements with many key customers. The Company has more than 100 accounts, including electric companies, railroads, and government agencies.

Powerex is the result of a joint venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corporation. The purpose of the joint venture was to form a company that would be a leading supplier of power semiconductors in the United States. To create the new entity, Westinghouse combined its semiconductor division with General Electric's high-power rectifier and thyristor business. Mitsubishi contributed working capital and technology for a 10 percent ownership.

The Company is developing high-power semiconductor devices and plans to supply intelligent-power hybrid circuits that combine a power element (e.g., power transistor) with a logic/control element.

## **BOARD**

Not available

## **COMPANY EXECUTIVES**

Position, Name, and Prior Company)

**President/CEO**  
Ronald Whigham  
Westinghouse Electric Corporation

## **VP Commercial Op**

Stanley R. Hunt  
Westinghouse Electric Corporation

## **CFO**

J.A. Sibenac  
Westinghouse Electric Corporation

## **VP Operations**

Dave Gillott  
Westinghouse Electric Corporation

## **FINANCING**

Powerex received initial funding from Westinghouse Electric Corporation (45 percent), General Electric Company (45 percent), and Mitsubishi Electric America (10 percent) for an undisclosed amount.

## **1988**

Financing changed to one-third ownership by previously mentioned companies

## **RECENT HIGHLIGHTS**

### **January 1986**

Powerex received licenses and technological know-how for Darlington transistor modules and GTOs from Mitsubishi; it received all thyristor and rectifier technology from Westinghouse, General Electric, and Mitsubishi.

### **August 1986**

Powerex assumed exclusive sales responsibilities for Mitsubishi Darlington transistor modules in North America.

### **August 1986**

Powerex reached an agreement with Mitsubishi to build a world-class automated assembly facility in France for isolated modules.



# Powerex, Inc.

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## September 1987

Powerex purchased GE/RCA's low-power thyristor product line. The Company also signed a technology-licensing agreement with GE/RCA for MOSFET, IGBT, and MCT products and received exclusive sales rights for all MCTs rated greater than 100 amperes.

## December 1987

Powerex started up a new wafer fab in Youngwood. The new fab is capable of producing complex geometry devices. Powerex also produced its first isolated modules for quality conformance testing in France.

## MANUFACTURING

### Technology

R&D  
Design

Assembly  
Test  
Manufacturing

### Facilities

Youngwood, PA  
225,000 sq. ft.  
Wafer fab

Auburn, NY  
Wafer fab

Massey, France  
Wafer fab, assembly

Puerto Rico  
Assembly

Singapore  
Assembly

## PRODUCTS

Standard Rectifiers—High Power  
Fast Recovery Rectifiers  
Phase-Control Thyristors  
Thyristors for Pulse Applications  
Inverter-Grade SCRs  
Reverse Conducting Thyristors  
Gate Turn-Off (GTO) Thyristors  
Triacs  
Thyristor and Diode Modules  
Power Transistor Modules  
Darlington Modules  
FETMOD Isolated MOSFET Modules  
MOSBIP Hybrid Isolated Modules  
IGBT Modules  
Low-Power Product Line

## OTHER INFORMATION

Powerex does not employ a PR firm.

# PromTech

1885 Lundy Avenue, Suite 202  
San Jose, CA 95131  
408/434-9550  
Fax: 408/434-7045

ESTABLISHED: 1984

NO. OF EMPLOYEES: 7

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## BACKGROUND

PromTech was formed to combine the high-speed EPROM expertise of the founding members with custom and semicustom design. The Company has been working on contracts to design custom memory devices. PromTech also has developed a 1Mb and 4Mb EPROM in the 70ns access range.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Dr. Paul Ouyang  
Universal Semi, Exec VP

\*Founder

## FINANCING

1984  
Seed  
\$0.2M  
Private

## PRODUCTS

To be announced

## OTHER INFORMATION

PromTech does not employ a PR firm.

## ALLIANCES

### 1984

PromTech licensed technology to an unnamed Japanese company.

### 1987

PromTech licensed its EPROM technology to Yamaha Corp. Yamaha will develop a new ASIC standard chip that combines the EPROM technology with its own voice- and image-processing capabilities.

## MANUFACTURING

### Technology

1.2-, 1.5-, and 2.0-micron single-metal,  
double-poly CMOS

### Facilities

San Jose, CA  
2,000 sq. ft.  
Administration, design, R&D

**RAMAX Limited**  
Monash Business Park  
Level 1, Building 11  
Business Park Drive  
Notting Hill VIC 3168  
Australia  
(03) 558 9900  
Fax: (03) 558 9123

**ESTABLISHED: 1987**

**NO. OF EMPLOYEES: N/A**

## **BACKGROUND**

RAMAX Limited was formed in 1987 to commercialize and produce integrated circuits for global markets based on new nonvolatile memory (NVM) technology. Funding for the Company was provided solely by the Victoria State Government in the form of equity subscription. This funding has allowed RAMAX to acquire rights to this new technology and commence the pursuit of the business opportunities it has identified.

The Company recognizes that the demand for integrated circuits with higher density and higher speed is driving the semiconductor industry toward the use of optical techniques. These techniques are based primarily on active thin-film technologies, and RAMAX has chosen to specialize in this rapidly growing market area.

To realize its market opportunity, RAMAX will develop and commercialize a range of differentiated products based on active thin-film technologies; these products are thin-film ferroelectrics and compound semiconductor epi layers. RAMAX's long-term emphasis will be on compound semiconductor-based (specifically GaAs) integrated circuits—electronic and optoelectronic—that combine the advantages of both the GaAs and thin-film ferroelectric materials. However, market opportunities in silicon NVMs also will be pursued, particularly the replacement of current EEPROMs with ferroelectric versions that offer superior performance characteristics.

The Company formed a joint venture with Epi Materials Ltd. (EML) of the United Kingdom to

enter the epi-treated wafer market in Asia. The product initially will be sourced from EML and primarily will be GaAs-based epi layers that use an enhanced, high-quality, high-yield metalorganic chemical vapor deposition (MOCVD) process developed by EML. Once sufficient sales volume has been generated, the product will be manufactured in Australia.

The silicon NVM market will be approached in two phases. In the first, RAMAX proposes to market the product from an existing European or North American manufacturer into Asia to build marketing capability and understand customer needs before entering the market with its own products. The second phase will be the launch of a new NVM product that offers significantly improved user benefits utilizing thin-film ferroelectrics. A foundry manufacturing strategy will be employed for production.

Initial entry to the GaAs market will be via an agency for products from an existing manufacturer. As with silicon NVMs, this method of entry will allow a marketing capability to be established and the building of customer relationships. The Company then proposes to establish a design facility for standard GaAs products and ultimately design GaAs NVM products utilizing the thin-film ferroelectric technology.

The Company's long-term entry to the optoelectronic IC market will result from the integration of the active thin-film technologies that will allow a new generation of OEICs to be developed.

# RAMAX Limited

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## BOARD

(Name and Affiliation)

Vincent N. Schutze, Chairman  
Dr. David G. Beanland, Director  
Allan G. Tapley, Managing Director

## COMPANY EXECUTIVES

(Position and Name)

Chief Executive Officer  
Allan G. Tapley

Admin. Manager & Company Secretary  
William D. Gleeson

Technology Manager  
R. Bruce Godfrey

## FINANCING

June 1987

Round 1

\$8.0M

State Government of Victoria

## PRODUCTS

MOCVD epi-treated wafers

Silicon- and GaAs-based NVM and standard products to be announced

## OTHER INFORMATION

RAMAX does not employ a PR firm.

## ALLIANCES

Ramtron Corp.

June 1987

RAMAX licensed Ramtron's thin-film ferro-electric NVM technology. RAMAX has world-wide nonexclusive rights with sublicensing on silicon and worldwide exclusive rights with sublicensing on GaAs.

Epi Materials Ltd.

October 1989

An Australian joint venture was formed to market EML's epi-treated wafers into Asia and ultimately to manufacture epi-treated wafers in Australia.

## SERVICES

Marketing

Manufacturing

**Ramtron Corporation**  
1873 Austin Bluffs Parkway  
Colorado Springs, CO 80918  
719/594-4455  
Fax: 719/594-4939

ESTABLISHED: May 1984

NO. OF EMPLOYEES: 53

## BACKGROUND

Ramtron Corporation is a technology research, development, and marketing organization founded in 1984 to develop a solution to the inherent problem of volatility in microelectronic circuits.

Ramtron's solution is ferroelectronics. Ferroelectronics merge the ferroelectric effect, known for its nonvolatile storage characteristics, with conventional integrated circuitry. Ferroelectronics produces the world's first true nonvolatile microelectronic memory. In 1987, Ramtron successfully integrated its proprietary lead zirconate titanate (PZT) with a conventional CMOS fabrication process and introduced the world's first ferroelectric random access memory (FRAM). The FRAM combines the benefits of existing memories in a single device: the speed and ease of use of SRAM, the high density and potential low cost of DRAM, and a nonvolatility that equals or exceeds that of EEPROM. FRAMs provide a common memory element that can be used throughout a system, replacing the diverse memory types currently required.

The Company licensed potassium nitrate technology from George Rohrer whose company, Technovation Corporation, owns a minority interest in Ramtron. Newtech Development Corporation of Australia negotiated an agreement with Mr. Rohrer for the patent and formed Ramtron to conduct R&D programs at the University of Colorado in a \$5 million research lab.

Ramtron is actively pursuing strategic partnerships and agreements to accelerate ferroelectronic technology insertion in a broad range of applications. Initial markets for the FRAMs include industrial, military, and aerospace applications where nonvolatility is essential. These markets traditionally have used EEPROMs, ROMs, and memories with battery backup. The Company is developing

several applications for its FRAMs, including smart sensors, smartcards, smart tags, smart watches, and smart toys.

## BOARD

(Name and Affiliation)

Ross M. Lyndon-James, Chairman  
Ramtron Australia Ltd., Deputy Chairman  
Brian L. Harcourt, Exec Director  
Ramtron Australia Ltd., Managing Director  
Richard L. Horton, Exec Director  
Ramtron Corp., President  
Hilton J. Nicholas, Director  
Ramtron Australia Ltd., Chairman  
A. Geoffrey Lee, Director  
Ramtron Australia Ltd., Director  
Glen R. Madland  
Integrated Circuit Engineering, Chairman  
Dr. Steward S. Flaschen, Director  
Flaschen & Davies, Consultant  
Charles W. Missler, Director  
Resdel Industries, Inc., Chairman & CEO  
Sam Freeman, Director  
Rio Grand Industries, Consultant  
Jack F. Moore, Director  
International Brotherhood of Electrical  
Workers, International Secretary

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Richard L. Horton  
Honeywell, Dir of Bus Dev

### Exec VP/COO

\*Dr. Fred Gnadinger  
INMOS, VP of R&D & Founder

### VP Finance/Admin

Jerald Bollinger  
Elxsi, CFO

# Ramtron Corporation

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## VP of Research & Development

S. Sheffield Eaton

INMOS, Project Leader & Founder

\*Founder

## FINANCING

May 1984

Round 1

\$5M

Ramtron Australia Limited

May 1986

Round 2

\$10M

Ramtron Australia Limited

March 1989

Round 3

\$19.5M

National Electrical Contractors Association

## ALLIANCES

**RAMAX Limited**

June 1987

RAMAX Limited, an Australian technology company, licensed Ramtron's FRAM technology.

**ITT Semiconductor**

June 1988

ITT and Ramtron have a codevelopment and licensing program to develop an advanced submicron ferroelectric manufacturing process.

**NMB Semiconductor**

October 1988

NMB and Ramtron have a codevelopment and licensing program to develop a 4Mb DRAM

process technology and products utilizing high dielectric materials.

**TRW**

November 1988

TRW and Ramtron have a codevelopment program to develop radiation-hardened nonvolatile memory for aerospace and defense applications.

**Seiko-Epson Corp.**

April 1989

Ramtron entered a strategic technology codevelopment alliance with Seiko-Epson. Seiko-Epson will provide Ramtron with manufacturing capacity for FRAM products and will receive sales and distribution rights for FRAM products in Japan and Southeast Asia.

**Alcan Aluminum**

June 1989

Ramtron and Alcan signed joint development and stock purchase agreements. The agreements include a 6.5 percent equity investment in Ramtron by Alcan and initiate a joint program focused on the development of advanced ferroelectric materials.

## MANUFACTURING

### Technology

3.0-micron CMOS

1.5-micron CMOS

1.2-micron CMOS (in development)

0.8-micron CMOS (in development)

### Facilities

A 69,000-square-foot facility currently under construction in Colorado Springs, Colorado, will house the headquarters and R&D facility, including wafer fab. It is scheduled for completion in June 1990.

**PRODUCTS**

FM1008	128x8	Available
FM1108	256x8	Available
FM1208	512x8	Available
FM1408	2Kx8 FRAM	Q4 1989
FM1608	8Kx8 FRAM	Future Product
FM1808	32Kx8	Future Product
FM2008	128Kx8	Future Product

**OTHER INFORMATION**

Ramtron does not employ a PR firm.

# S3, Incorporated

2933 Bunker Hill Lane, Suite 100

Santa Clara, CA 95054

408/986-8144

Fax: 408/986-1457

ESTABLISHED: January 1989

NO. OF EMPLOYEES: 33

## BACKGROUND

S3, Incorporated, was founded in January 1989 by Diosdado Banatao and Ron Yara, two Chips & Technologies veterans. The Company plans to bring a workstation level of performance to PC compatibles by developing advanced silicon subsystems. S3 is currently in its design phase and is expected to introduce its first products in 1990.

In recent years, Dataquest has identified an industry-wide trend toward the "system on a chip." Of course, the ultimate expression of this trend would be a monolithic system chip that integrates logic and memory into the microprocessor. Although the industry has yet to reach this level of integration, the ASIC revolution allowed for the consolidation of logic through gate arrays and similar devices. More recently, many companies have chosen to optimize system performance by developing specialized logic chip sets. Companies that pursue this approach to increasing system performance have found value in design engineers who possess both IC logic and systems expertise.

S3's design methodology is an example of the application of systems expertise to silicon-based subsystem design. In developing its subsystems, S3 simulates system level operation and then partitions its design into chip-level subsystems. This approach to subsystem design allows high-performance integration while maintaining degrees of flexibility at multiple levels for the end-system designer.

The Company has adopted a strategy of using outside companies for its wafer fabrication needs. This strategy allows S3 the flexibility to choose the most economical process for each chip

design. Without owning its own fab, S3 is not bound to one process technology and therefore can shop around for the best foundry to fit its needs.

## BOARD

(Name and Affiliation)

\*Diosdado P. Banatao

President & CEO, S3, Incorporated

Andrew S. Rachleff

Merrill, Pickard, Anderson & Eyre

L. John Doerr

Kleiner, Perkins, Caufield & Byers

Andrew R. Heller

Kleiner, Perkins, Caufield & Byers

William H. Davidow

Mohr, Davidow Ventures

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Diosdado P. Banatao

Chips & Technologies, VP/GM

### VP, Mktg

\*Ronald T. Yara

Chips & Technologies, VP

### Dir, Finance

David K. Hanabusa

Ashtech, CFO

### Dir, Eng

Robert C. Schopmeyer

Not available

\*Founder



## **S3, Incorporated**

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### **FINANCING**

**April 1989**

**Round 1**

**\$6.0M**

**Merrill, Pickard, Anderson & Eyre; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow; Sequoia Capital; Mayfield Fund; AVI Management Partners**

### **MANUFACTURING**

#### **Technology**

**1.5-micron CMOS**

**1.0-micron CMOS**

**S3 will use foundries for manufacturing.**

### **ALLIANCES**

**The Company has strategic alliances, but it is not yet in a position to identify them.**

### **PRODUCTS**

**Silicon Subsystems**

### **OTHER INFORMATION**

**S3 does not employ a PR firm.**

# Samsung Semiconductor, Inc.

3725 North First Street

San Jose, CA 95134

408/980-1630

ESTABLISHED: 1983

NO. OF EMPLOYEES: 250

## BACKGROUND

Samsung Semiconductor, Inc., (formerly Tristar Semiconductor) designs, manufactures, and markets a broad range of products including NMOS and CMOS memories, logic devices, microprocessors and peripherals, and power MOSFETs. The Company began its operations as a DRAM supplier and, through strategic alliances, has licensed designs to expand its product portfolio quickly.

Building on its base of CMOS DRAM technology with the addition of a new 80,000-square-foot R&D facility in San Jose, California, Samsung is amassing a portfolio of proprietary products. In 1988, the Company introduced a 1Mb DRAM; 64K and 256K SRAMs with 70ns, 80ns, and 100ns access times; fast CMOS logic; and PLDs with speeds of 25ns and 35ns, followed later by a 15ns model. Later that year, Samsung introduced 64K EEPROMs and fast SRAMs with access times down to 20ns and densities of up to 256K, microperipherals running at 10 MHz, a DRAM controller, and AC/ACT CMOS standard logic. These products were developed at two Korean R&D facilities, as well as in Samsung's new San Jose R&D center. In addition, the Company will be producing PLD and DRAM controllers in the San Jose facility.

Samsung Semiconductor is a wholly owned subsidiary of Samsung Electronics Co. (SEC), of the Samsung Group, a Korean conglomerate. SST's investment in Samsung totals \$550 million.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

S. Joon Lee

Honeywell, Manager

### VP R&D

Ibok Lee

NSC, Div Mgr

### VP Mktg/Sales

C.H. Oh

SST, Sr VP

### VP Finance

Won Yang

SST, GM

### Dir Mktg

Oriando Gallegos

Zytrex, VP Mktg/Sales

### Dir Sales

Mike Barthmen

Hitachi, Natl Sales Mgr

## FINANCING

### 1983

Start-up

\$6.0M

Samsung Semiconductor and Telecommunications Ltd. (SST)

### 1983

Lease

\$7.0M

SST

## RECENT HIGHLIGHTS

### February 1987

Samsung formally opened its \$36 million national headquarters in San Jose, California. The facility, which Samsung purchased for \$5 million, houses administration, R&D operations, and a research fab. Included in the 80,000-square-foot facility is a 12,000-square-foot Class 1 fab with 6-inch wafer processing equipment. Currently, 50 percent of the Company's capacity of 10,000 wafer starts per month is devoted to R&D.

## Samsung Semiconductor, Inc.

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**June 1987**

Samsung Semiconductor, GoldStar Semiconductor Inc., and Hyundai Electrical Engineering Co. announced that they are preparing to launch full-scale production of a 1Mb DRAM chip jointly developed by the three South Korean firms in 1986.

**June 1987**

Samsung Semiconductor agreed to supply Intel with 64K, 256K, and 1Mb DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea will begin in July.

### ALLIANCES

**SST**

**1983**

Samsung Semiconductor was set up as a U.S. subsidiary of Samsung Co. Ltd., of Korea.

**Exel**

**1983**

Exel granted Samsung a license to second-source its 16K EEPROMs.

**May 1985**

The agreement was extended to include 64K EEPROMs.

**Micron Technology**

**June 1983**

Samsung obtained a license to manufacture and market Micron's 64K DRAM design in exchange for cash. The agreement was later extended to include Micron's 256K DRAM.

**Micron Technology**

**July 1986**

Samsung acquired a 2.7 percent interest in Micron for \$5 million as part of an out-of-court settlement of a suit brought against Samsung. Micron claimed that Samsung failed to pay for materials and provide certain technology according to a 64K DRAM exchange pact. Micron obtained rights to the Samsung SRAM and EEPROM technologies for a 1 percent royalty, if sales exceeded 1 million units. The prior agreement was terminated.

**Intel**

**January 1985**

Intel granted Samsung a license to second-source certain microcomponents.

**June 1987**

Samsung agreed to supply Intel with 64K and 256K DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea began in July.

**Zytrex**

**June 1985**

Zytrex and Samsung signed a three-year technology/fab agreement. Samsung second-sourced Zytrex's LSI logic devices; Zytrex provided its proprietary ICE-MOS process. Zytrex is no longer in business.

**Mostek**

**1986**

Mostek and Samsung signed an agreement covering Mostek's 256K DRAM technology.

**IXYS**

**January 1986**

IXYS and Samsung signed an agreement allowing Samsung to receive IXYS' power MOS technology in exchange for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas.

**GoldStar/Hyundai**

**1986**

GoldStar, Samsung, and Hyundai agreed to cooperate on a 1Mb DRAM.

**NCR**

**January 1989**

Samsung and NCR's Microelectronics Division signed a broad technology exchange and license agreement that gives Samsung ASIC capability and gives NCR SRAM capability.

**Quadtree Software Corp.**

**February 1989**

Samsung and Quadtree announced a contract and licensing agreement under which Quadtree is developing full-function software models of Samsung's high-performance DRAM controllers.

**Zilog**  
June 1989

Samsung and Zilog signed two licensing agreements that permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 microcontrollers and the Z85C30 Serial Communications Controller.

**MANUFACTURING**

**Technology**

1.0- and 1.5-micron CMOS, NMOS, bipolar  
4-, 5-, and 6-inch wafers

**Facilities**

San Jose, CA  
80,000 sq. ft.  
Administration, R&D, manufacturing

12,000 sq. ft.  
Class 1 clean room

The facility has a capacity of 10,000 wafer starts per month.

**PRODUCTS**

Linear	Device	Description
Op Amps	LM324	Quad Op Amp
	LM358/1458/4558	Dual Op Amp
	LM741	Single Op Amp
	LM386	Low-Voltage Power Amp
Timers	NE555	Single Timer
	NE556	Dual Timer
	KS555	Single Timer
	KS555H	High-Speed Timer
	KS556	Dual Timer
Voltage Regulators	KA33	Precision Voltage Regulator
	LM72	Adjustable Precision
	MC78	Positive Voltage Regulator
	MC79	Negative Voltage Regulator
	KA78S40	Switching Regulator
	KA431	Programmable Precision
Reference		
Comparators	LM311	Single Comparator
	LM339	Quad Comparator
	LM393	Dual Comparator
Data Converters	KS5C02/25C03	8-Bit Successive Aprox Register
	KS25C04	12-Bit Successive Aprox Register
	KSV3100	8-Bit and 10-Bit Flash Converter
	KSV3310	8-, 9-, and 10-Bit DACs
Interface	MC1488/1489	Quad Line RS-232 Receiver
Other	KA2181/2182/2183	Remote Control Preamp
	KA2580/2588	8CH Source Driver
	KA2803	Ground Default Detector
	KA2804	Zero-Voltage Switch

# Samsung Semiconductor, Inc.

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Linear	Device	Description
Telecommunications	LM567	Tone Decoder
	KA2410/2411	Tone Ringer
	KA2412	Subset Amplifier
	KA2413/5805	DTMF
	MC3361	FM IF Amplifier
	KS5804/5805	Pulse Dialer
	KT3170	DTMF Receiver
	KS5820	Tone/Pulse Dialer w/Redial
	KS5822/5823	Repertory Dialers
Transistors	Power MOSFET	
	General-Purpose Transistors	
	Low-Noise Amplifier Transistors	
	High-Voltage Transistors	
	Darlington Transistors	
Logic	KS54/74AHCT Family of Advanced High-Speed CMOS	
	KS54/74HCTLS Family of High-Speed CMOS	
Memory	64K, 128K, 256K, and 1Mb DRAMs	
	16K, 64K, and 256K SRAMs	
	16K and 64K EEPROMs	
	4K and 8K FIFO dual-port buffer memories	

## OTHER INFORMATION

Samsung's PR firm is Roy Twitty & Co.

# Seattle Silicon Corporation

3075 112th Avenue NE

Bellevue, WA 98004

206/828-4422

Fax: 206/827-4224

ESTABLISHED: 1983

NO. OF EMPLOYEES: 90

## BACKGROUND

Seattle Silicon Technology, Inc., was founded during the heyday of ASIC start-ups in 1983. Its initial business strategy has three important points aimed at establishing a unique position in the market. One is to supply silicon compiler software to systems designers with little or no actual experience with integrated circuit design. A second cornerstone of the firm's strategy is to provide process-independent designs, thus making it one of the first ASIC suppliers to base its business on providing tools and support services rather than wafer processing from a captive manufacturing facility. This key point in the strategy allows its customers to establish second sources easily and migrate its designs to newer fabrication processes as they become available. The third point of the Company's strategy is to integrate its software compilers into the familiar design environments of the leading third-party CAE workstations such as those from Digital Equipment Corporation, Tektronix, and Valid.

With its early software product, called Concorde, Seattle Silicon was successful in establishing strategic partnerships with Fortune 100 companies such as Burroughs (now Unysis), General Dynamics, and General Motors. Concorde offered customers an integrated software compiler that allowed input in the form of high-level functional specifications such as block diagrams or Boolean expressions. Process and foundry independence are achieved by referencing a table of process parameters for each foundry. Seattle Silicon claims that its products give customers access to more fabrication processes than any other ASIC supplier.

As the worldwide ASIC business evolved, it fragmented into gate arrays, standard cells, and silicon compilation. The major market acceptance was primarily on gate arrays, with standard cells and silicon compilers well behind. In 1987,

recognizing a need to broaden its business base, Seattle Silicon began adapting its strategy to the evolving ASIC market by building upon early successes. The company now targets selected high-end application segments of the electronics market such as military, high-performance ASICs and mixed analog/digital circuits. The Company learned that many potential customers were not willing to take full responsibility for a chip's performance, so it introduced its "First Silicon" service, where Seattle Silicon guarantees working ASICs from a variety of manufacturing processes.

The Company continues to add processing options to its software and now allows designers to take advantage of the most advanced CMOS, VHSIC, SOS, and GaAs processes. Seattle Silicon believes that in the future of the ASIC industry, companies without a dedicated fab will be the norm rather than the exception; it is among the vanguard in this trend.

## BOARD

(Name and Affiliation)

Stewart Carrell

Diasonics, Inc., Chairman/CEO

Bill Hambrecht

Hambrecht & Quist, General Partner

Amaury Piedra

Seattle Silicon, President/CEO

Paul Kirby

Hill, Kirby, Washing & Carman, General Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President

Amaury Piedra

Fairchild, VP Strategic Alliances

# Seattle Silicon Corporation

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## VP Marketing

Ed Fernandez  
National Semiconductor, Fairchild Analog  
Division

## VP Sales

Dick Braydon  
Fairchild, Technology Marketing Manager

## VP Finance

John Celms  
Amary International, CFO

## VP Design Tools Development Engineering

Robert V. Alessi  
Eastman Kodak, Manager IC Design

## VP First ASIC Operations

Fred Tsang  
Supertex, VP/COO

## VP Software Operations

Bill Moore  
Silvar-Lisco Inc., Dir. R&D

## FINANCING

### February 1985

Round 1  
\$6.2M  
Hill, Kirby & Washing; Canadian Enterprise  
Development Corp.; Hambrecht & Quist;  
Norwest Venture Capital Management; Paragon  
Partners; Olympic Venture Partners; TWB  
Investment Partnership; Rainier Venture  
Partners

### November 1985

Round 2  
\$0.5M  
Previous investors

### Early 1986

R&D Financing  
\$5.0M  
General Motors

### August 1986

R&D Financing  
\$7.0M  
Pru-Tech

### August 1987

Round 3  
\$5.0M  
Hill, Kirby & Washing; Hambrecht & Quist;  
Rainier Venture Partners; Norwest Venture  
Capital Management; Paragon Partners

### August 1988

Round 4  
\$5.1M  
Hill, Kirby & Washing; Hambrecht & Quist;  
Norwest Venture Capital Management

## RECENT HIGHLIGHTS

### February 1988

Seattle Silicon introduced ChipCrafter®, a software design tool that will provide fully automatic physical design for high-functionality ASICs and maintain manufacturing process independence.

### August 1988

Seattle Silicon announced the first production shipments of ChipCrafter.

### August 1988

Using Seattle Silicon's compiler-based ASIC design software, two University of Michigan engineering students won first prize in the industry-sponsored sixth annual Student VLSI Design contest. Four out of the top six designs were completed using Seattle Silicon's Concorde compiler tool.

## ALLIANCES

### Gould AMI Semiconductors

September 1986  
Seattle Silicon and Gould AMI signed an agreement that provides systems manufacturers with a simplified means of designing ASICs and transferring final design data to Gould AMI for fabrication. By the agreement, Gould AMI provided Seattle Silicon with its proprietary geometric design rules and performance characteristics of selected fabrication processes.

### Burroughs Corp.

August 1986  
Seattle Silicon and Burroughs signed an agreement to jointly develop a "new-generation design system" for integrated circuits.

## **United Technologies Microelectronics Center (UTMC)**

June 1987

Seattle Silicon and UTMC announced their intention to jointly design and fabricate ASICs used in tactical and strategic radiation environments.

## **National Semiconductor**

October 1987

Seattle Silicon and National signed a foundry agreement to qualify National's 1.25- and 1.20-micron VHSIC CMOS processes for design with Concorde, Seattle Silicon's compiler for top-end ASIC designs.

## **Oki Electric**

August 1988

Seattle Silicon and Oki announced an agreement to develop a compiler for a process-

independent, five-port, high-speed (15ns) static RAM module.

## **GigaBit Logic**

June 1989

Seattle Silicon and GigaBit Logic announced the formation of an alliance to develop the design automation industry's first comprehensive set of software tools specifically created for GaAs ASICs.

## **SERVICES**

"First Silicon" production management

## **MANUFACTURING**

### **Technology**

1.2-micron CMOS

## **PRODUCTS**

ChipCrafter design software tool  
ChipCrafter ASIC Expert  
ChipCrafter IC Expert  
Concorde ASIC compiler tool  
User-configured ASICs

## **OTHER INFORMATION**

Seattle Silicon's PR firm is Franson & Associates, Inc.



# SEEQ Technology, Inc.

1849 Fortune Drive  
San Jose, CA 95131  
408/432-7400  
Fax: 408/432-1550

ESTABLISHED: January 1981

NO. OF EMPLOYEES: 530

## BACKGROUND

SEEQ Technology, Inc., designs, manufactures, and markets nonvolatile semiconductor memory devices used in defense electronics, industrial, and data processing applications. SEEQ specializes in EEPROM processes for applications that require both nonvolatility and in-circuit programmability.

SEEQ products are grouped strategically into three classifications: EEPROM products that support nonvolatile memory needs, EEPROM microprocessors, and telecommunication circuits. SEEQ's EEPROMs range in density from 4K to 256K and offer benefits such as page-mode writes, 1M cycle endurance, silicon signature, and DiTrace as standard features. The Company's flash EEPROMs combine in-circuit programmability and the density of UV EPROMs. The Company's 8-bit, single-chip MCUs feature on-board EEPROMs for applications that allow on-chip reprogramming of code and data. SEEQ also offers enhanced Ethernet data link controllers and CMOS Manchester coder/decoder circuits.

SEEQ Technology was founded by Gordon Campbell, Dr. Philip J. Salsbury, Larry T. Jordan, Maria Ligeti, and George Perlegos, all formerly employed by Intel Corporation, and Dan Barbato, who was previously employed by Synertek.

Four domestic and two international sales offices manage a network of sales representatives in the United States, Canada, Europe, and Japan. Three national and three regional distributors serve the United States and Canada.

## BOARD

(Name and Affiliation)

J. Daniel McCranie, Chairman  
SEEQ Technology, Inc.

E. Floyd Kvamme  
Kleiner, Perkins, Caufield & Byers  
John W. Larson  
Brobeck, Phleger & Harrison  
Philip Paul  
Hillman Ventures  
\*Dr. Philip J. Salsbury  
SEEQ Technology, Inc.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**Chairman/CEO**  
J. Daniel McCranie  
Harris, Grp VP Sales

**VP Finance/CFO**  
Patrick Brennan  
NSC, VP/Treasurer

**VP Manufacturing**  
Michael Van Hoy  
SGS-Thomson, VP Operations

**VP/CTO**  
\*Dr. Philip J. Salsbury  
Intel, Div Dir EEPROMs

**VP Strat Accounts**  
Tom Endicott  
Signetics, Mgr Rel & QA

**VP Worldwide Sales**  
Philip Ortiz  
CDI, Dir Mktg/Sales

**VP/GM Flash Div**  
Michael Villot  
Motorola, Dir Mktg MPUs

**VP/Business Development**  
Ralph Harms  
Signetics, Controller

\*Founder

# SEEQ Technology, Inc.

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## FINANCING

**March 1981**

Initial

\$15.0M

Kleiner, Perkins, Caufield & Byers; Hillman Ventures

**September 1983**

Initial public offering

\$20.0M

**March 1985**

Private placement

\$14.0M

**October 1986**

Private placement

\$6.0M

Bridge Capital; GE Venture Capital; Hillman Ventures; John Hancock; Kleiner, Perkins, Caufield & Byers

**November 1988**

Private placement

\$4.0M

Monolithic Memories

**April 1988**

Public offering

\$19.5M

## RECENT HIGHLIGHTS

**February 1987**

SEEQ reincorporated in Delaware.

**April 1987**

SEEQ announced the addition of its 27C256 EPROM to military drawing 86063. It was the first time SEEQ ever had parts listed for a military drawing, and it followed the 27C256's compliancy with MIL-STD-883 Rev C, Class B.

**April 1987**

SEEQ announced its successful demonstration to the Defense Electronics Supply Center (DESC) of SEEQ's compliance with the requirements of MIL-M-38510 and MIL-STD-976. DESC recognized SEEQ as

having reached a level of manufacturing competence in which all phases of design, processing, and testing meet or exceed established standards by DESC.

**April 1988**

SEEQ introduced the 512K flash EEPROM, first of the generation of high-density flash-type electrically erasable programmable memories.

**February 1989**

SEEQ announced the industry's first 1Mb flash EEPROM at the 36th ISSCC in New York. The part offers twice the density of other currently available flash EEPROM devices. The 48F010 is available in commercial and military versions.

## ALLIANCES

**Amkor**

1981

SEEQ signed Amkor to assemble its IC products.

**Rockwell**

July 1982

SEEQ signed an exclusive licensing agreement to provide its 16K EEPROM and 16K UV EPROM technology to Rockwell. In exchange, Rockwell paid SEEQ \$5.0 million, leased \$5.5 million of SEEQ's equipment, and agreed to pay a 3 percent royalty on sales of these products.

**Texas Instruments**

August 1982

SEEQ licensed its EEPROM technology to Texas Instruments in exchange for its TMS7000 8-bit MCU.

**Silicon Compilers**

1983

SEEQ announced that it would manufacture the Silicon Compiler, Inc., (SCI) Ethernet data link controller.

**July 1985**

SEEQ provided all of its EEPROM designs for integration into SCI's Genasil system. SEEQ will manufacture the EEPROM logic circuits using its 2-micron CMOS process.

## Monolithic Memories

November 1986

Monolithic Memories Inc. (MMI) purchased a 16 percent equity in SEEQ for \$4 million. The two firms also agreed to a joint product and technology program to codevelop four CMOS EEPROM-based PLDs.

## Motorola

December 1986

SEEQ and Motorola signed an engineering development agreement to develop a high-performance EEPROM microcomputer.

## National Semiconductor

October 1987

SEEQ and National Semiconductor signed a four-year exclusive technology licensing and manufacturing agreement. Under the agreement, the two companies share technology and marketing rights to SEEQ's 512K and 1Mb and to National's 256K flash EEPROMs. The agreement was extended October 1988.

June 1989

SEEQ and National scaled back their 1987 agreement to cover only current Flash

technology. SEEQ will continue to develop the next generation of 0.8 $\mu$  Flash chips alone.

## Hamilton-Standard

October 1987

SEEQ signed a \$1.4 million contract to supply CMOS 256K EEPROMs to Hamilton-Standard, a division of UTC. The EEPROMs, configured as 32Kx8, will be used in military flight tape recorders.

## MANUFACTURING

### Technology

2.0-micron, double-poly, floating-gate CMOS  
1.25-micron, double-poly, floating-gate CMOS  
5-inch wafers

### Facilities

San Jose, CA

120,000 sq. ft.

Administration, design, manufacturing (The SEEQ fab has DESC certification to allow individual parts to achieve JAN qualifications.)

## PRODUCTS

### EEPROMs

16K Latched; 4K, 16K, and 64K Latched and Timed; 64K and 256K Page Mode; High-Speed CMOS 64K and 256K EEPROMs; Timer EEPROM

### Flash

512K and 1024K CMOS Flash EPROMs, 512K and 1024K CMOS Flash EEPROMs

### EPROMs

64K, 128K, 256K CMOS

### Data Communications

Ethernet Data Link Controller, Manchester Code Converters, Advanced Ethernet Data Link Controller

### EEPLD

Registered Asynchronous CMOS EEPLD, Versatile 28-pin CMOS EEPLD

## MILITARY PRODUCTS

### EEPROMs

16K and 64K Latched; 16K and 64K Latched and Timed; 64K and 256K Page Mode, Latched & Timed; High-Speed CMOS Bipolar PROM Replacement; High-Speed CMOS; High-Speed CMOS Bipolar PROM; 1,024K EEPROM

## **SEEQ Technology, Inc.**

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### **EPROMs**

64K, 128K, and 256K EPROMs; 256K CMOS EPROM; DESC SMD-Compliant 64K, 128K, and 256K CMOS UV EPROMs

### **FLASH**

512K and 1,024K CMOS Flash EEPROMs, 512K and 1,024K CMOS Flash EPROMs

### **OTHER INFORMATION**

SEEQ Technology does not employ a PR firm.

**Sensym, Inc.**  
1255 Reamwood Avenue  
Sunnyvale, CA 94089  
408/744-1500  
Fax: 408/734-0407  
Telex: 176376

**ESTABLISHED: October 1982**

**NO. OF EMPLOYEES: 120**

## **BACKGROUND**

Sensym, Inc., designs, manufactures, and markets a complete line of IC accelerometers and IC pressure sensors and transducers including absolute, differential, and gauge types ranging from 0 to 1 psi to 0 to 5,000 psi. The Company provides devices with a variety of coatings, isolators, and special packages made specifically to handle various media, from dry air to hostile environments such as steam, water, freon, and high humidity. Products are used in many applications including energy management, avionics, medical diagnostics, agrionics, and industrial controls.

Sensym was founded when the principal management of National Semiconductor's transducer group initiated a leveraged buyout from the parent company, with the assistance of venture capital funding. The Company set up its operation in Sunnyvale, California, to provide only United States-built products and offers the National Semiconductor transducer product line as well as numerous product additions. Round two of financing, completed in 1984, assisted in the expansion of Sensym's manufacturing capacity.

In April 1989, Sensym was acquired by FASCO Sensors and Controls Group, a division of FASCO Industries. Sensym became the tenth member of the Sensors and Controls Group, a consortium of FASCO companies that provides temperature, pressure, and position-sensing technology as well as aerospace controls and subsystems.

## **BOARD**

(Name and Affiliation)

Dennis Dauenhauer  
Sensym, Inc.

Roger J. Barry  
Crosspoint Venture Partners, Partner

Robert L. Cummings  
Robertson, Colman & Stephens, Partner

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**President/CEO/COO**  
Dennis Dauenhauer  
National, Grp Dir Transducers

**VP Mktg/Sales**  
W. Frederick Jones  
Varian Associates, Div Mgr

**VP Hybrid & Semi**  
Fred Adamic  
National, Linear Prod Line Mgr Ops

## **FINANCING**

**October 1982**  
Round 1  
\$ 1.0M  
Crosspoint Venture Partners; Robertson,  
Colman & Stephens

**Round 2**  
\$ 1.5M  
Crosspoint Venture Partners; Med-Tec  
Ventures; National Semiconductor; Robertson,  
Colman & Stephens

**August 1986**  
Round 3  
\$ 1.5M  
Becton & Dickinson

**August 1989**  
Acquisition  
\$250.0M  
Sensym acquired by FASCO Sensors and  
Controls Group

# Sensym, Inc.

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## RECENT HIGHLIGHTS

### August 1987

Sensym leased 20,405 square feet of research and development space at 1244 Reamwood Avenue, Sunnyvale. The additional space will be used for the development and manufacture of digital electronic tire gauges.

### April 1989

Sensym was acquired by FASCO Sensors and Controls Group.

## ALLIANCES

### Michelin

Sensym has a technology agreement with Michelin of France.

## PRODUCTS AND SERVICES

- Custom Pressure Sensors
- Disposable Blood Pressure Sensors
- Tape Tension Pressure Sensors
- Energy Management Pressure Sensors
- Medical Instrumentation Pressure Sensors
- Barometric Pressure Sensors
- Engine Diagnostic System Sensors
- Accelerometers
- Digital Tire Gauges
- Digital Pressure Gauges
- Sensor-Based Subsystems
- Proprietary and Custom Solid State Sensors for Pressure and Acceleration

## OTHER INFORMATION

Sensym does not employ a PR firm.

## MANUFACTURING

### Technology

- CMOS capabilities
- Bipolar
- 4-inch wafers
- Solid-state sensors
- Sensor-based systems

### Facilities

- Sunnyvale, CA
- 65,000 sq. ft.  
Manufacturing, engineering, administration
- 20,405 sq. ft.  
Corporate offices, R&D, marketing and sales
- 1,500 sq. ft.  
Class 100 clean room

# SID Microelectronics S.A.

Av. Brig. Faria Lima  
1476 - 7. andar 01452  
Sao Paulo, Brazil  
011/210-4033

ESTABLISHED: April 1984

NO. OF EMPLOYEES: 850

## BACKGROUND

SID Microelectronics S.A. designs, manufactures, and markets small and medium transistors and linear devices. The Company plans to introduce hybrid circuits, surface-mounted device technology, metallic-can transistors, ceramic and metal (cermet) ICs, and digital IC assembly. Additional product plans include MOS logic, custom/semicustom ICs, memories, microprocessors, TTL, LIC, and LSI devices. The Company plans to continue support of its design and research and development activities in CMOS.

SID succeeds the RCA-Ford semiconductor manufacturing joint venture in Brazil that closed in 1983. In 1984, SID purchased the IC fab from RCA to produce ICs for the merchant market. SID is the only South American semiconductor manufacturing company with all the manufacturing steps, including wafer production.

## BOARD

(Name and Affiliation)

Matias Machline

Sharp S.A. Equipamentos Electronics

Jose B. Amorim

SID S.A. Servicos Tecnicos

Yuichi Tsukamoto

SHARP S.A. Equipamentos Electronics

Jose Papa, Jr.

FIESP

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President

Matias Machline

Not available

## VP R&D

Adalberto Machado  
Ford-Brazil

## VP Finance

Luis Paulo Rosenberg  
Not available

## Mng Director

Victor Blatt  
CPQD-Telebras

## Indus Director

Wilson L.M. Leal  
Siemens

## Planning Mgr

Luiz Mauge  
Sharp

## Mktg Mgr

Inacio Hatanaka  
RCA

## FINANCING

1984

Initial

\$14.2M

Private investors

## MANUFACTURING

Technology

3.0-micron bipolar

## **SID Microelectronics S.A.**

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### **PRODUCTS**

Small-Signal Transistors  
Medium-Power Transistors  
Linear ICs

### **OTHER INFORMATION**

SID Microelectronics does not employ a PR firm.



# Sierra Semiconductor Corporation

2075 North Capitol Avenue

San Jose, CA 95132

408/263-9300

Fax: 408/263-3337

Telex: 384467

ESTABLISHED: November 1983

NO. OF EMPLOYEES: 350

## BACKGROUND

Sierra Semiconductor Corporation is a service-oriented supplier of CMOS ASICs with a complementary portfolio of standard products that include memory and linear digital ICs. The Company specializes in designs that combine analog, digital, and/or EEPROM memory technology on one chip. Products target telecommunications, data communications, computers and peripherals, and selected industrial applications.

The Company's proprietary Triple Technology makes the integration of analog, digital, and EEPROM memory on a single IC possible. Sierra's products are fabricated on 5-inch wafers using 1.5-, 2.0-, and 3.0-micron CMOS process technology. Currently, Sierra conducts its own manufacturing and test but occasionally also uses foundries to augment internal capability. A recent joint venture company established in Singapore ensures adequate manufacturing and test resources for the foreseeable future.

Sierra is considered to be strong in circuits combining analog and digital technology and is also considered to have a strong cell library. The Company has an EE cell library—only two other suppliers (NCR and National Semiconductor) have such a library. Sierra's initial strategy was to develop a portfolio of CMOS standard products that demonstrated Sierra's Triple Technology. Sierra's long-term strategy is to expand its custom and cell-based products to 70 percent of sales and identify new markets and applications that benefit from the combination of digital, analog, and EE nonvolatile memory. At the end of 1987, Sierra's sales were about evenly split between standard and custom products.

Sierra has established two joint ventures in the last few years. In June 1986, Sierra formed a corporation in the Netherlands, named Sierra

Semiconductor B.V. The \$9 million in equity funding for the venture came from the Netherlands-based MIP Equity Fund. The headquarters, which opened in October 1986, houses a design center, technical support and services, and marketing and sales for Sierra's standard and cell-based ICs. In January 1987, Dr. Stephen Forte was appointed president of the operation.

In November 1987, Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore named Chartered Semiconductor Pte. Ltd. The company is located at a 170,000-square-foot site in the Singapore Science Park. Initial capacity will be 5,000 6-inch wafers per month. This firm fabricates and tests CMOS wafers and ASIC devices primarily for Sierra and National.

Singapore Technology holds 74 percent of the joint venture company; Sierra holds 17 percent, and National holds the remaining 9 percent. Sierra will contribute its Triple Technology CMOS process and technical management, while National will provide CMOS process technology and technical support to construct the clean room facility. Singapore Technology Corporation also participated in Sierra's third round of financing.

Sierra sells its products through manufacturers' representatives and distributors in North America and Asia. In Europe, the Company sells its products through Sierra Semiconductor B.V., headquartered in the Netherlands, and also through manufacturers' representatives.

## BOARD

(Name and Affiliation)

Donald T. Valentine, chairman  
Sequoia Capital

# Sierra Semiconductor Corporation

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Charlie C. Bass  
Ungermann-Bass

James V. Diller  
Sierra Semiconductor Corporation

Kheng-Nam Lee  
Singapore Technology Corporation, Inc.

Robert J. Schreiner  
Borg-Warner Electronics

Hans Severiens  
MIP Equity Fund

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

James V. Diller  
National, VP MOS Mem Ops

### Pres/Sierra B.V.

Dr. Stephen Forte  
AMI, VP WW Mktg/Sales

### VP Mktg/Sales

John T. Reynolds  
National, Group Mktg Dir

### VP Design

Andrew G. Varadi  
National, VP Technology

### VP Opns

Edward Boleky  
Intel, Mgr Mem Prod

### VP Finance

C. Stephen Cordial  
TI, Div Controller

### Mng Dir Chartered Semi

John Hambridge  
Fairchild, VP Logic Division

## FINANCING

January 1984

Round 1

\$ 7.7M

Arscott, Norton & Assoc.; Asset Mgmt.;  
Associated Venture Investors; Bay Partners;

Borg-Warner Electronics; Investors in Industry;  
Mohr, Davidow Ventures; Sequoia Capital;  
Sutter Hill Ventures; Technology Venture  
Investors; Venrock Associates

April 1985

Round 2

\$15.0M

Initial investors; Bryan and Edwards; Burr,  
Egan, Deleage & Co.; Litton Industries; Suez  
Technology Fund; Tellabs, Inc.

October 1986

Round 3

\$18.4M

Asset Mgmt.; Associated Venture Investors;  
Bay Partners; Berkeley International; Borg-  
Warner Electronics; Churchill International;  
Hambrecht & Quist; Litton Fund; MIP Equity  
Fund; Mohr, Davidow Ventures; Sequoia  
Capital; Singapore Technology Corporation;  
Suez Technology Fund; Sutter Hill Ventures;  
Technology Venture Investors; Venrock  
Associates

September 1987

Round 4

\$10.0M

Convertible debentures, Berkeley International

## RECENT HIGHLIGHTS

June 1986

MIP Equity Fund invested \$9 million in Sierra  
and Sierra Semiconductor B.V. The latter oper-  
ates as a design and service center. Additional  
funding through government grants was assured.  
In January 1987, Dr. Forte joined Sierra as  
president of the subsidiary.

October 1986

Sierra completed third-round financing for  
\$18.4 million. In addition to discussing an  
investment, Singapore Technology Corp. and  
Sierra discussed establishing a joint venture in  
Singapore for a design center and semicon-  
ductor manufacturing facility.

December 1986

Sierra introduced the SC11270 and SC11289  
DTMF receivers.

## December 1986

Sierra introduced the SC11401/11402/11403/11404 8-bit video DACs, which are compatible with RS-170 and RS-323 specifications.

## December 1986

Sierra announced that its cell library is now supported on Mentor Graphics workstations.

## January 1987

Sierra and National Semiconductor announced a jointly developed family of 8-bit CMOS MCUs. The first members in the family of flexible controllers are called SC44820, SC44821, and SC44822 by Sierra and COP820C, COP821C, and COP822C by National Semiconductor.

## May 1987

Sierra sampled a CMOS 2,400-bps modem chip set based on its initial 1,200-bps modem chip set, which is second-sourced by VLSI Technology. The SC11006 is the 2,400-bps modem, and the SC11009 and SC11011 are companion controllers. The SC11009 is for parallel bus applications such as the PC XT, AT, or compatibles; and the SC11011 supports RS-232 applications.

## September 1987

Sierra ported the MIXsim behavioral modeling tools to the Mentor Graphics Idea workstation.

## November 1987

Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore and named it Chartered Semiconductor Pte. Ltd.

## ALLIANCES

### National Semiconductor

#### July 1984

Sierra and National signed a technology exchange agreement that covers selected advanced CMOS products and processes. Sierra leased a facility from National to develop its process and manufacture products using its own equipment and employees.

## November 1987

Sierra, National, and Singapore Technology Corporation formed a joint venture company named Chartered Semiconductor Pte. Ltd. The new firm, located in the Singapore Science Park, will fabricate and test CMOS wafers and ASIC devices primarily for Sierra and National. Initial capacity will be 5,000 6-inch wafers per month. Sierra and National are providing process technology and technical assistance.

## VLSI Technology

### January 1985

Sierra and VLSI have an agreement that provides for the exchange of technical information and the mutual sharing of developments in ASIC software, design expertise, and products. VLSI is also a second source for Sierra's custom and analog standard products.

## Mentor Graphics

### December 1986

Sierra announced that its cell library is now supported on Mentor Graphics workstations.

### September 1987

Sierra's MIXsim behavioral modeling tools are available on Mentor Graphics' Idea workstation.

## MANUFACTURING

### Technology

2.0-micron single- and double-poly, double-metal CMOS  
3.0-micron single- and double-poly CMOS  
1.5-micron  
5-inch wafers  
6-inch wafers available in third quarter 1989

### Facilities

#### San Jose, CA

71,000 sq. ft.

Headquarters, administration, marketing, design, and test

#### Santa Clara, CA

16,000 sq. ft.

Engineering, wafer fabrication

# Sierra Semiconductor Corporation

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## PRODUCTS

### CMOS Cell Library

Process	Linewidth	Cells
Si-Gate CMOS	2.0-micron	280 Digital Cells, 50 Analog Cells, 25 EEPROM Cells, RAM, ROM, PLA, 2901, Multiplier
Si-Gate CMOS	1.5-micron	250 Digital Cells, 25 Analog Cells, 70-MHz PLL, Video DACs, 9 EEPROM Cells, RAM, ROM, PLA, Data Path, Multiplier

### EEPROMs

Device	Description
SC22001/22002	CMOS 256-Bit Serial EEPROM
SC22011/22012	CMOS 1,024-Bit Serial EEPROM
SC22101	CMOS 128x8 Multiplexed EEPROM
SC22102	CMOS 256x8 Multiplexed EEPROM
SC22104	CMOS 512x8 Multiplexed EEPROM

### Microcomponents

SC44820/44821/44822	8-Bit CMOS MCUs
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### Linear

#### Data Communication

SC11000/11001/11005	CMOS 1,200-Baud Modem Filters
SC11002/SC22003	CMOS 300-Baud Modem
SC11004/SC11014	CMOS 1,200-Baud Modem
SC11006	CMOS 2,400-Baud Modem
SC11007/SC11008	CMOS Modem Controller
SC11009	SC11006 Companion Controller for Parallel Bus
SC11011	SC11006 Companion Controller for RS-232
SC11015	CMOS 1,200-Baud Modem with Programmable Receiver Gain Amplifier

#### Telecommunications

SC11202/11203/11204/11270	DTMF Receiver
SC11270/11289	DTMF Receiver
SC11280/11289/11290	DTMF Transceiver
SC11301/11302	Codec Filter Combo

#### Computer/Peripheral

SC11401/11402/11403/11404	8-Bit Video DACs
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### Developmental Tools

MONTAGE - Systems Integration Software	Design system that permits schematic capture and simulation of mixed signal ASICs by the system's designer
SCDS	Custom Design System
MIXsim	Behavioral Modeling Tools

## OTHER INFORMATION

Sierra Semiconductor does not employ a PR firm.

**Si-Fab Corporation**  
27 Janis Way  
Scotts Valley, CA 95066  
408/438-6800  
Fax: 408/438-6800, Ext. 107

**ESTABLISHED: 1980**

**NO. OF EMPLOYEES: 15**

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**BACKGROUND**

Si-Fab Corporation provides process design and engineering services as well as quick-turn CMOS foundry services. The Company filed for Chapter 11 protection during the economic downturn in the semiconductor industry and reorganized its management and systems. Consequently, Si-Fab's business outlook and sales have increased substantially.

**BOARD**

Not available

**COMPANY EXECUTIVE**

(Position and Name)

**President**

Leon B. Pearce

**FINANCING**

Private

**PRODUCTS**

Aftermarket Technology  
Proprietary Products  
High-Speed SRAM 44-64U

**OTHER INFORMATION**

Si-Fab does not employ a PR firm.

**ALLIANCES**

Not available

**SERVICES**

Custom IC design  
Thin-film coating services  
Metal gate and Si-gate CMOS foundry  
P-channel and n-channel foundry

**MANUFACTURING**

**Technology**

1.0- to 1.25-micron SOS, CMOS, NMOS,  
and PMOS  
4-inch and 5-inch wafers

**Facilities**

Scotts Valley, CA  
12,000 sq. ft.  
Plant  
5,000 sq. ft.  
Clean rooms

## **SIMTEK Corporation**

1465 Kelly Johnson Boulevard, Suite 301  
Colorado Springs, CO 80902  
719/531-9444  
Fax: 719/531-9481

**ESTABLISHED: May 1987**

**NO. OF EMPLOYEES: 30**

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### **BACKGROUND**

SIMTEK Corporation designs, manufactures, and markets advanced nonvolatile memory products. SIMTEK is using proprietary nonvolatile integrated circuit technology, and its first two products are a 256K EPROM and a 64K NVSCRAM. SIMTEK began production of these products in early 1989 and expected its first revenue from them late in 1989.

SIMTEK is using advanced CMOS processes coupled with silicon nitride oxide semiconductor (SNOS) technology. This technology provides high-density, high-performance, reliable, and full-function nonvolatile products.

Initial capitalization was provided by Nippon Steel Corporation of Japan, which owns about 20 percent of the Company and has a seat on the board. Other financing was provided by the founders.

Dr. Richard Petritz, a founder of Mostek and Inmos, serves as chairman and CEO of the Company.

### **OTHER INFORMATION**

SIMTEK does not employ a PR firm.

### **BOARD**

Dr. Richard Petritz  
Dr. Gary Derbenwick  
Mr. Kazuo Takanashi

### **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

**Chairman/CEO**  
Dr. Richard Petritz  
Inmos, Founder

**COO**  
Dr. Gary Derbenwick  
Inmos, Mgr Technology

**VP Operations**  
Dr. Dennis Ryden  
Inmos, Process Mgr

**VP Engineering**  
Dr. Ralph Sokel  
Inmos, CAD Development

**VP Finance**  
William G. Skolout  
RAMTRON, CFO

# Solid State Optronics Inc.

442 Queens Lane  
San Jose, CA 95112  
408/436-1390  
Fax: 408/436-1392

ESTABLISHED: June 1982

NO. OF EMPLOYEES: 5

## BACKGROUND

Solid State Optronics, Inc., designs and manufactures solid-state relays, photoresistors, and thyristors. The Company was founded by Zag Kadah in 1982. Prior to founding the Company, Mr. Kadah was employed at Electro-Trol, Inc., as vice president in charge of the optoelectronics division. In 1979, Mr. Kadah founded Power Interface, a company that pioneered the development of an IC to drive back SCRs in solid-state relays.

The Company subcontracts manufacturing to a company in Asia; assembly is done in the Philippines.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*Zag Kadah  
Elec-Trol, Inc.

## PRODUCTS

- Input/Output Modules
- Interrupters
- Photodiodes
- Photo Arrays
- Silicon Photo Detectors
- Solid-State Relays
- Hybrid Optoelectronic Modules

## OTHER INFORMATION

Solid State Optronics' PR firm is QMI.

## Marketing

Sid Kadah  
UC Berkeley

## Financial Officer

Fay Kadah  
Magnex

\*Founder

## FINANCING

Zag Kadah holds 100 percent of the Company.

## ALLIANCES

Not available

## MANUFACTURING

### Technology

- Bipolar
- Dielectric isolation
- DMOS
- GaAs and GaAlAs

### Facilities

San Jose, CA  
1,200 sq. ft.  
R&D, design, engineering, and assembly

## Spectrum Microdevices

5330A Spectrum Drive

Frederick, MD 21701

301/695-0868

Fax: 301/831-4032

ESTABLISHED: 1980

NO. OF EMPLOYEES: 21

### BACKGROUND

Spectrum Microdevices is a part of Fairchild Communications & Electronics Company, which, in turn, is part of Fairchild Industries. In 1983, Fairchild acquired a 51 percent share of Insouth, a company that makes large-scale ICs, hybrids, and gate arrays. Fairchild has since increased its holdings to 100 percent.

In 1986, Spectrum Microdevices, then known as Insouth Microsystems, moved from Auburn, Alabama, to Frederick, Maryland. Some members of the management and design group, including General Manager Marvin L. Harding, were transferred to coordinate component manufacturing more closely with Fairchild Communications & Electronics Company in Germantown, Maryland. Fairchild Communications & Electronics Company, Spectrum Microdevices' major customer, manufactures avionics and telecommunications equipment. The move was completed in September 1986, and the Company's name was changed in early 1987.

### PRODUCTS

Military Hybrids/Custom Monolithic Assembly and Test  
Surface Mount for Military

### OTHER INFORMATION

Spectrum Microdevices does not employ a PR firm.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position and Name)

Director Operations

William K. Bowers

### FINANCING

Not available

### MANUFACTURING

#### Technology

2.0-micron CMOS

#### Facilities

Frederick, MD

2,500 sq. ft.

Administration

12,500 sq. ft.

Manufacturing, assembly, test



**Synaptics, Inc.**  
2860 Zanker Road, Suite 105  
San Jose, CA 95134  
408/434-0110  
Fax: 408/434-9819

**ESTABLISHED: 1986**

**NO. OF EMPLOYEES: 7**

## **BACKGROUND**

Synaptics, Inc., was formed to develop a family of neural network interpret circuits for use in intelligent sensors and pattern recognition applications. The Company is in a research stage and does not expect to introduce products for some time.

The Company hopes to develop a device with the ability to sense and process real-world signals in real time and to learn without prior knowledge embedded in its program.

The basic research is guided by a scientific advisory committee chaired by Carver Mead of California Institute of Technology. Professor Mead, a leading force in the development of silicon computer design methodology for VLSI, has been modeling neural networks with analog VLSI systems.

## **BOARD**

Not available

## **OTHER INFORMATION**

Synaptics does not employ a PR firm.

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President**

\*Federico Faggin  
Cygnnet Communication, Founder

### **Chairman**

Carver Mead  
California Institute of Technology, Computer  
Science Professor

\*Founder

## **FINANCING**

### **May 1986**

#### **Seed**

\$0.6M

Avalon Ventures, Sprout Group, Technology  
Venture Investors

### **June 1987**

#### **Round 1**

\$1.5M

Kleiner, Perkins, Caufield & Byers; Sprout  
Group; Technology Venture Investors

# Synergy Semiconductor Corporation

3450 Central Expressway  
Santa Clara, CA 95051  
408/730-1313  
Fax: 408/737-0831

ESTABLISHED: 1987

NO. OF EMPLOYEES: 48

## BACKGROUND

Synergy Semiconductor Corporation was formed to offer ultrahigh-performance bipolar ECL memory and logic products for the commercial and military markets. The Company is in its product development stage and plans to begin offering ECL bipolar products that will serve the needs of the high-performance computer and ATE markets in the second half of 1988. Its first product will be a 4K memory chip with an access time of less than 5ns.

Synergy was cofounded by Ralph O. Cognac, Larry J. Pollock, George W. Brown, Thomas S. Wong, and E. Marshall Wilder. All of the founders worked together at Advanced Micro Devices, where they developed the advanced bipolar technology called IMOX. Mr. Cognac and Mr. Pollock also played key roles at Integrated Device Technology, a leading supplier of high-speed CMOS memory and logic products.

Kenneth G. Wolf joined the Company as president and CEO in July 1987. Mr. Wolf was previously employed at Motorola for 22 years in management positions. At various times, he was responsible for the bipolar memory, bipolar logic, and ASIC divisions.

In January 1988, Synergy Semiconductor purchased Zoran Corporation's Santa Clara, California, wafer fabrication clean room and a portion of the 50,000-square-foot manufacturing and office facility.

## BOARD

(Name and Affiliation)

Sven E. Simonson, chairman  
Sequoia Capital

\*Ralph O. Cognac  
Synergy Semiconductor Corporation

William J. Harding

J.H. Whitney & Company

Glenn M. Mueller

Mayfield Fund

Kenneth G. Wolf

Synergy Semiconductor Corporation

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Kenneth G. Wolf

Motorola, VP/GM ASIC Div

### VP Prod Ops

\*George W. Brown

AMD, Prod Mgr Bipolar RAMs

### VP Mktg/Sales

\*Ralph O. Cognac

IDT, VP Mktg

### VP Technology

\*Larry J. Pollock

IDT, VP Corp Engr

### VP Prod Dev

\*Thomas S. Wong

AMD, Dsn Mgr Bip RAMs

### VP Mfr Ops

\*E. Marshall Wilder

AMD, Mgr Dir MOS RAMs

\*Founder

## FINANCING

July 1987

Round 1

\$3.9M

Mayfield Fund, Sequoia Capital, Suez  
Technology Fund

# Synergy Semiconductor Corporation

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**February 1988**

Round 2

\$ 9.0M

Broventure Capital Mgmt.; Matrix Partners;  
Mayfield Fund; Menlo Ventures; Merrill,  
Pickard, Anderson & Eyre; Oak Investment  
Partners; Stanford University Engineering;  
Sequoia Capital; J.H. Whitney

**January 1989**

\$8.5M

Revolving Lease Line

## ALLIANCES

Major strategic alliances are as yet unnamed.

## MANUFACTURING

### Technology

1.5-micron bipolar ECL  
4-inch wafers

### Facilities

Santa Clara, CA  
30,000 sq. ft.  
Administration and manufacturing  
7,000 sq. ft.  
Class 10 clean room

## PRODUCTS

Synergy's first product is the industry's fastest 1Kx4 bipolar ECL RAM 3ns SY100474 and SY10474 offering 100K and 10K compatible logic levels. These parts feature balanced read/write, elimination of the traditional write recovery glitch, and standard or fast edge rates. They are designed for alpha particle immunity and are available in industry-standard DIP and Flatpack packages.

Synergy plans to offer a complete family of the industry's fastest 1K, 4K, and 16K ECL RAMs as well as several specialized ASM (application-specific RAMs) memories.

Synergy also plans a series of ultrafast logic products in the future.

## OTHER INFORMATION

Synergy Semiconductor does not employ a PR firm.

# Taiwan Semiconductor Manufacturing Company, Limited

1F No. 9, Industriale E. 4th Road  
Science-Based Industrial Park  
Hsinchu, Taiwan  
(035) 961240  
Fax: (035) 942616

North American Office  
3150 Almaden Expressway, Suite 111  
San Jose, CA 95118  
408/978-1322  
Fax: 408/978-1365

ESTABLISHED: 1986

NO. OF EMPLOYEES: 300

## BACKGROUND

Taiwan Semiconductor Manufacturing Company, Limited, (TSMC) was formed to provide one-stop semiconductor manufacturing services including wafer fabrication, probing test, packaging, final test, and burn-in for a wide variety of ICs.

Taiwan's Executive Yuan, or legislature, earmarked funds from its development fund for a 48.0 percent stake in the Company. N.V. Philips has a 27.5 percent share in the \$150 million investment in TSMC and an option to purchase controlling interest in the Company. The remainder is held by other Taiwanese firms.

In 1987, Dr. Morris Chang, former president and chief executive officer of General Instrument Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan, was made chairman of TSMC. Dr. Chang is also chairman of United Microelectronics Corporation. Also in 1987, Jim Dykes joined TSMC as president and chief executive officer. Mr. Dykes had set up General Electric Company's Semiconductor Division. Stephen L. Fletcher, who had been vice president of sales and marketing for GE Semiconductor, was named director of a new North American and European marketing and sales operation of TSMC.

In early 1987, TSMC made its first wafer shipment from its facility, which is capable of producing 10,000 6-inch wafers per month. It is equipped to produce chips, using 1.5-, 2.0-,

and 3.0-micron CMOS and NMOS processes. TSMC began volume production in early 1988.

In December 1987, TSMC received approval to build a second manufacturing facility in Taipei, Taiwan. The new facility, which is scheduled for completion by year-end 1989, will cost about \$220 million and will nearly quadruple the Company's capacity. The planned 65,000-square-foot fab facility will have a production capacity of 30,000 6-inch wafers per month. It is designed for submicron processes; however, initial production will be done via a 1.2-micron process. In the future, TSMC plans to convert a portion of the capacity to 8-inch wafers and also to shrink its processes to the submicron level by 1990.

When the Company begins volume production, it expects approximately 25 percent of its production to be for Philips, 25 percent for Taiwanese firms, and the remainder for U.S. manufacturers.

## BOARD

Dr. Morris Chang, Chairman

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President/CEO  
Klaus Wiemer  
Texas Instruments

# Taiwan Semiconductor Manufacturing Company, Limited

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## VP Operations

F.C. Tseng  
ERSO

## VP Marketing

John Luke  
Monsanto Silicon, VP Sales

## VP Finance

Mient Vinenga  
Philips

## VP Admin

Eddie Mou  
Texas Instruments, Pacific Rim Sales

## FINANCING

1986

Round 1  
\$48.0M

Executive Yuan Development Fund (48.3 percent), N.V. Philips (27.5 percent), China American Petrochemical, Formosa Chemicals & Fiber, Formosa Plastics, Nan Ya Plastics, Central Investment Holding Co., Asia Polymer Corp., China General Plastics, Mabuchi Taiwan, USI Far East Corp., Yao Hua Glass, ADI Corp., Tai Yuen Textile, Union Petrochemical

1988

Round 2  
\$29.0M  
Original investors

1988

Round 3  
\$205.0M  
Original investors

## OTHER INFORMATION

Taiwan Semiconductor's PR firm is Masto Dagastine.

## ALLIANCES

### Philips

1986

N.V. Philips has a 27.5 percent share in the \$150 million investment in TSMC, with the remainder held by the government and Taiwanese firms. Philips has an option to purchase controlling interest in the Company.

## SERVICES

Foundry  
Assembly  
Packaging  
Test  
Burn-in

## MANUFACTURING

### Technology

3.0-micron silicon-gate NMOS and CMOS  
p-well  
2.0-, 1.5-, and 1.25-micron silicon-gate CMOS  
n-well  
6-inch wafers  
Submicron processes and 8-inch wafer compatibility planned by 1990

### Facilities

Taiwan  
21,000 sq. ft.  
Manufacturing, Class 1 and Class 10 clean rooms

A second \$220 million 65,000-square-foot facility is planned for completion in late 1989. The facility will have a production capacity of 36,000 6-inch wafers per month.

# Telcom Devices Corporation

914 Tourmaline Drive  
Newbury Park, CA 91320  
805/499-0335  
Fax: 805/499-8018

**ESTABLISHED: 1986**

**NO. OF EMPLOYEES: 6**

## BACKGROUND

Telcom Devices Corporation was formed in early 1986 to offer indium gallium arsenide (InGaAs) photodiodes and indium gallium phosphide (InGaP) light-emitting diodes.

Founders James Kim, Ock-Ky Kim, and Larry Perillo are former Rockwell engineers. Telcom Devices is a subsidiary of Opto Diode Corp. (ODC) and is operating from ODC's facilities in Newbury Park, California. Both companies share clean room and manufacturing space.

Telcom Devices began volume production of its first products in May 1986. The products were InGaAs PIN photodiodes for fiber-optic applications and included the Planar 13PD100 and Planar 15PD100.

## BOARD

Five members (James Kim is Chairman.)

## PRODUCTS

InGaAs Photodiodes and Long-Wavelength LEDs

## OTHER INFORMATION

Telcom Devices Corp. does not employ a PR firm.

## COMPANY EXECUTIVES

(Position, Name, and Prior Company)

### President

\*James Kim  
Rockwell

### VP Engr

\*Ock-Ky Kim  
Rockwell

### Dir Opto Mtls

\*Larry Perillo  
Rockwell

\*Founder

## FINANCING

Not available

## MANUFACTURING

### Facilities

Newbury Park, CA  
10,000 sq. ft.  
Administration, manufacturing

## Three-Five Systems, Inc.

10230 S. 50th Place

Phoenix, AZ 85044

602/496-0035

Fax: 602/496-0168

**ESTABLISHED: April 1985**

**NO. OF EMPLOYEES: 235**

### BACKGROUND

Historically, Three-Five Systems, Inc., produced and marketed custom and semicustom products that combine silicon and GaAs technologies for the consumer, industrial, telecommunications, and computer markets. The Company's main product thrust now is custom user interface modules utilizing LED, LCD, and keyboard components.

The Company is headquartered in a 40,000-square-foot facility in Phoenix, Arizona. The facility houses all corporate functions as well as a quick-turn prototype manufacturing area. In 1987, Three-Five consolidated its domestic operations in Phoenix, Arizona, and eliminated a facility in Troy, New York.

The Company was formed via a leveraged buyout of National Semiconductor's Optoelectronics business unit and was named Three-Five Semiconductor. The Company's founders are Frank Shroff, John Gragg, Dennis Riccio, Joe Riccio, and Brent Fox. Three-Five received acquisition funding, which was completed in December 1985, from Continental Illinois Venture Corporation (Chicago, Illinois) and OptoVen of Phoenix, an investment company formed specifically to invest in Three-Five.

In 1987, the Company changed its name from Three-Five Semiconductor Corporation to Three-Five Systems to reflect a shift from a front-end semiconductor emphasis to a broader systems approach. The Company has reorganized into two groups. The optoelectronics group supplies all existing and future standard products, and the display group is responsible for Application-Specific Integrated Displays (ASIDs) as well as other technologies that may be added. In September 1987, Three-Five raised \$5.5 million in second-round financing, which was used to expand its technical staff and facilities to support

the Company's thrust into new opto product areas. In March 1988, Three-Five initiated a further round of financing to support the Company's thrust into LCDs.

Currently, 400 products that were developed by the Company while it was a division of National are offered by Three-Five and include infrared and custom devices. New products include custom LCDs. In the long term, the Company will focus on PLCDs and GaAs-based products, optoelectronics (standard and custom), and integrated optoelectronic ICs. The Company will also focus on display systems, such as LED and LCD, with a higher degree of electronic control.

### BOARD

(Name and Affiliation)

David R. Buchanan  
Chairman

Kenneth M. Julien  
Vice President, Chief Financial Officer

Burt McGillivray  
Vice President, Continental Illinois Venture Corporation

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President/CEO

David R. Buchanan  
Talos Systems (now Calcomp Digitizer Division), Founder/Chairman/CEO

#### VP Finance/CFO

Kenneth M. Julien  
CerProbe, VP/CFO

#### VP Quality

\*Joseph Riccio  
Motorola, Area Sales Mgr

# Three-Five Systems, Inc.

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## Dir Mktg/Sales

Norman E. Clarke

MCI Telecommunications, National Account  
Manager

## Dir European Ops

Martin Woolfenden

National Semiconductor, Marketing Manager

## Dir Manufacturing

Dr. Carl Derrington

Motorola, Prod Mgr, Sensors

## Dir Materials and Process Technology

Dr. Joseph Morrissy

Alcatel Information Systems, Manufacturing  
Manager

## Dir Engineering

Mike Petera

Alphasil, Elec Design Mgr

\*Founder

March 1988

Round 3

Sears Pension Trust

## MANUFACTURING

### Technology

Liquid Crystal  
GaAs

### Facilities

Phoenix, AZ

40,000 sq. ft.

Prototype laboratories, corporate headquarters

Manila, Philippines

Manufacturing, inventory

Swindon, United Kingdom

European headquarters

## FINANCING

September 1987

Round 2

\$5.5M

Continental Illinois Venture Corporation,  
National Semiconductor Corp., OptoVen  
Partners

## PRODUCTS

Application-Specific Integrated Displays(ASIDs)  
Custom User Interface Modules (Displays and Keyboards)  
LCD Modules—Standard and Custom  
Integrated Displays  
Integrated LED Bar Graphs  
Infrared  
LED Dot Matrix Displays  
Visible Lamps and LED Digits  
Multidigit LED Displays  
Keyboards

## OTHER INFORMATION

Three-Five Systems does not employ a PR firm.



## Togai InfraLogic, Inc.

30 Corporate Park, Suite 107

Irvine, CA 92714

714/975-8522

Fax: 714/975-8524

ESTABLISHED: August 1987

NO. OF EMPLOYEES: 14

### BACKGROUND

Togai InfraLogic, Inc., was founded in August 1987 for the sole purpose of developing fuzzy logic tools and applications. The Company was founded by Dr. Masaki Togai, Carl Perkins, and Rodney J. Corder. The Company is actively developing and marketing fuzzy logic development tools for the commercial market in Japan, North America, and Europe.

Fuzzy logic is a form of multivalued logic that makes it possible for computer-controlled products to make "shades of gray" decisions the way humans do, as opposed to the limited yes-or-no approach dictated by conventional computer logic. In August 1989, Togai InfraLogic introduced the FC110 Digital Fuzzy Processor, the world's first embedded AI processor. The FC110 is a flexible 10-mips RISC processor with a specialized instruction set for fuzzy logic processing targeted at real-time embedded applications such as color copiers and engine controllers. In September 1989, the Company introduced its AT Accelerator board for PC AT based on the FC110. The Company also offers two products designed to facilitate fuzzy logic expert system development—the Fuzzy-C Compiler and the TIL Shell. The latter is a graphical CASE tool for expert system development.

Togai's first major commercial project is a joint development program with Japan's Mitsubishi Heavy Industries to create the world's first fuzzy logic-controlled air conditioning system. The system is designed to outperform the existing PID control for heating/cooling time and overall stability. Designers also anticipate a significant savings in power use resulting from implementation of this system.

### BOARD

(Name and Affiliation)

Professor Lotfi Zaheh  
University of California, Berkeley

Frank Lundberg  
Rockwell—retired

### COMPANY EXECUTIVES

(Position, Name, and Prior Company)

#### President

\*Masaki Togai, PhD  
Rockwell

#### VP, R&D

\*Rodney J. Corder  
Rockwell

#### VP, Mktg

\*Carl Perkins  
Rockwell

#### Dir, Software Dev

Jon Terchrow  
N/A

\*Founder

### FINANCING

1987

Round 1

Less than \$1M

Corporations and private individuals

### RECENT HIGHLIGHTS

#### December 1988

Togai introduced its first fuzzy logic development product—the Fuzzy-C Compiler, a textual tool for developing fuzzy logic expert systems in portable C source code.

# **Togai InfraLogic, Inc.**

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## **May 1989**

Togai's first VLSI processor, rated at 160 million 16-bit operations per second, was released for image classification and sorting, the output of which is managed by fuzzy logic knowledge bases.

## **August 1989**

Togai introduced the FC110 Digital Fuzzy Processor, a 10-mips RISC processor with a specialized instruction set for fuzzy logic processing.

## **September 1989**

Togai introduced its AT accelerator board and its graphical CASE tool for fuzzy logic expert system development.

## **PRODUCTS**

Fuzzy-C Development System  
TIL Shell Graphical Expert System  
Fuzzy Logic AT Accelerator Board (based on its VLSI fuzzy processor)

## **OTHER INFORMATION**

Togai InfraLogic's PR firm is Bond Communications.

## **ALLIANCES**

### **Mitsubishi Heavy Industries**

September 1989

Togai and Mitsubishi Heavy Industries announced the joint development of an air conditioning system based on a fuzzy logic controller.

## **MANUFACTURING**

### **Technology**

Fuzzy logic; 1.5- and 1.0-micron CMOS

### **Facilities**

Irvine, CA  
5,000 sq. ft.  
Design, marketing

# Topaz Semiconductor Inc.

1971 North Capitol Avenue

San Jose, CA 95132-3799

408/942-9100

Fax: 408/942-1174

ESTABLISHED: March 1985

NO. OF EMPLOYEES: 37

## BACKGROUND

Topaz Semiconductor designs and manufactures advanced field-effect transistors (FETs) and CMOS/DMOS ICs. Topaz, a company representing a partial buyout of Semi-Processes, Inc. (SPI), was formed by Thomas Cauge and Bruce Watson. The purchase included DMOS transistor and certain IC designs, and wafer fabrication, test, and finishing equipment. Topaz later acquired the SPI facilities as the result of an agreement to be acquired by Hytek Microsystems, Inc., of Los Gatos, California.

Topaz Semiconductor operates as a wholly owned subsidiary of Hytek Microsystems. Hytek designs and manufactures thick-film hybrid microcircuits. In July 1985, Hytek purchased all the DMOS-related assets of SPI. Hytek's integration of the SPI assets with those of Topaz Semiconductor insures a continued source of SPI products, as well as contribution to the faster expansion of Topaz Semiconductor.

With the financial backing of Hytek, a significant number of new Topaz products has been added. These products include medium-power lateral DMOS discretes (high-voltage and ultralow-leakage n- and p-channel); vertical DMOS discrete products with 20-micron hex-to-hex spacing; and new CMOS/DMOS IC analog switch products for video switching applications. Topaz will focus on high-speed digital and precision analog switching applications for its lateral DMOS devices and on low- to medium-current relay-replacement applications for its vertical DMOS line. Topaz initially has integrated DMOS and CMOS on a single chip. Plans include integrating logic with both lateral and vertical DMOS to allow more user flexibility. Topaz also supplies standard and special high-reliability products that are tested to military requirements.

Topaz subcontracts assembly operations to companies in Thailand, Malaysia, and Taiwan.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Thomas Cauge  
Semi-Processes Inc., VP Opns

### Dir Marketing

\*Bruce Watson  
Semi-Processes Inc., Prod Mktg Mgr

### Dir Engineering

Paul Denham  
Semi-Processes Inc., Engr Mgr

### Dir Sales

Robert Vosburgh  
Marconi Instruments, Sales Mgr

\*Founder

## FINANCING

1985

Seed

\$1.5M

Private

## RECENT HIGHLIGHTS

### March 1987

Topaz offered the CDG2214N, an analog switch with a CMOS-compatible control input. The device combines CMOS and DMOS processes and switches analog signals of  $\pm 10V$  with CMOS logic levels.

# Topaz Semiconductor Inc.

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## April 1987

Topaz offered the CDG201B, a low-insertion-loss quad analog switch that is TTL-compatible and pin- and function-compatible with standard CMOS devices.

## April 1987

Topaz offered the CDG211CJ, a quad single-pole, single-throw analog switch with TTL-compatible control input.

## June 1987

Topaz offered the SD5400 series of DMOS analog switches in 14-lead, small-outline packages. Power dissipation is 546 milliwatts and the series operates from 0 to 70° centigrade.

## June 1987

Topaz offered the SD1202, a 200V, n-channel enhancement-mode vertical D-MOSFET with a high gate standoff of 100V.

## June 1987

Topaz offered the SD1500BD, a 600V enhancement-mode vertical D-MOSFET.

## January 1988

Topaz offered the CDG4460J, a 6-bit digital-controlled attenuator for video frequencies of 10.7 to 30.0 MHz, with attenuation of 0.25dB per step.

## February 1988

Topaz offered the SD220/SD221 series of 60V, 9-ohm/100V, 12-ohm n-channel enhancement-mode lateral D-MOSFETs for ultrahigh-speed display driver applications.

## ALLIANCES

### Hytek Microsystems

#### July 1985

Topaz was acquired by Hytek Microsystems and operates as a wholly owned subsidiary. Hytek and Topaz cooperate on development of precision, standard hybrid circuits.

## MANUFACTURING

### Technology

3.0-micron and 20.0-micron hex-to-hex spacing silicon-gate Vertical DMOS

5-inch wafers

Lateral DMOS (3-inch wafers)

3.0-micron CMOS

### Facilities

San Jose, CA

30,000 sq. ft. total

20,000 sq. ft.

Design, wafer fab, and test

8,000 sq. ft.

Class 10 clean room (underhood)

## PRODUCTS

Lateral DMOS FETs

DMOS Power FETs

DMOS FET Ultralow Leakage

High-Voltage DMOS Power FETs

Vertical DMOS FETs

Dual-Gate DMOS FETs

DMOS FET Switches

Ultrahigh-Speed, Low-Cost Switches

Quad Monolithic SPST CMOS/DMOS Analog Switches

Dual Monolithic SPST CMOS/DMOS T-Configuration Analog Switch

DMOS FETs 8-Channel Arrays  
Quad DMOS Power FET Arrays  
Quad DMOS FET Driver Arrays  
Quad DMOS FET Analog Switch Arrays  
FET Ultrahigh-Speed Dual Drivers  
4:1 Monolithic CMOS/DMOS Analog Multiplexers

**OTHER INFORMATION**

Topaz does not employ a PR firm.

# TranSwitch Corporation

8 Progress Drive  
Shelton, CT 06484  
203/929-8810  
Fax: 203/926-9453

ESTABLISHED: April 1988

NO. OF EMPLOYEES: 16

## BACKGROUND

TranSwitch was founded in April 1988 to develop telecommunication ICs. The Company will offer chip sets that facilitate synchronous optical network (SONET) multiplexing.

Multiplexing is a foundation of telecommunications data transmission. The purpose of multiplexing is to combine a number of signals into one higher-level signal to accelerate transmission speeds. For example, a T-1 line is the result of the combination of 24 voice channels. Twenty-eight T-1 signals may then be combined to form a T-3 line. Similarly, 24 voice channels are combined to form a DS-1 signal. Next, 28 DS-1 signals can be combined to form a DS-3 line. SONET uses DS-3 lines to build higher-level signals for transmission.

The Company is scheduled to introduce DS-3 VLSI devices in January 1990, followed by the introduction of SONET VLSI devices in April 1990. TranSwitch contracts outside firms for wafer fab and assembly operations. Devices are manufactured using a 1.5-micron CMOS process. TranSwitch has raised more than \$3 million in venture capital financing through two rounds. During the next three years, the Company plans to acquire \$4 million worth of capital equipment and expand its facilities to 20,000 square feet.

## BOARD

(Name and Affiliation)

Dr. S. Flashen  
Independent Consultant

Dr. S. Das  
President, TranSwitch Corporation

Dr. A. Paladino  
Partner, Advanced Tech. Ventures

Dr. C. Lee  
Partner, ABACUS Ventures

I. Wolff  
Partner, Rothschild Ventures

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Dr. S. Das  
Spectrum Digital, President

**Dir, R&D**  
D. Upp  
ITT, Dir, Exploration Sys

**VP, Mktg**  
J. Lane  
Telco Systems, VP, Engineering

**Dir, Finance**  
M. McCoy  
ITT, Controller, ITT-ATC

**Mgr, Ops**  
E. Linke  
Black & Decker, Manager

## FINANCING

**December 1988**  
Round 1  
\$1.7M  
Advanced Technology Ventures, Abacus Ventures, Transtech Ventures, Rothschild Ventures, Merrill Lynch Management Fund

**July 1989**  
Round 2  
\$2.5M  
Initial investors, Connecticut Seed Ventures

## ALLIANCES

None

# **TranSwitch Corporation**

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## **MANUFACTURING**

### **Technology**

1.5-micron CMOS, BiCMOS

### **Facilities**

Shelton, CT

6,500 sq. ft.

Design, test, marketing

## **PRODUCTS**

DS-3 VLSI Devices

SONET VLSI Devices

## **OTHER INFORMATION**

TranSwitch Corporation, does not employ a PR firm.

# Triad Semiconductors International

5575 Tech Center Drive  
Colorado Springs, CO 80919  
1-800/228-1874  
Fax: 719/528-8875

ESTABLISHED: September 1988

NO. OF EMPLOYEES: 25

## BACKGROUND

Triad Semiconductors International (Triad) designs, develops, and markets specialty memory ICs for use in high-performance data and algorithmic processors, digital telecommunications and video applications, image/voice synthesis and recognition and other artificial intelligence applications, and advanced industrial instrumentation and control systems. Triad's high-performance specialty memories are based on CMOS technology, but the Company plans to use other technologies if and when appropriate.

The Company has defined 24 products. Initial products include a monolithic 256-color graphics palette chip with RAM and DAC on-chip and a 2Kx9 and 4Kx9 FIFO, 64Kx4 Fast Industry Standard (FIS) latched and registered version. Future product introductions will include a writable control store chip, 1Kx48 CAM, 128Kx8 cached DRAM, and a second-generation monolithic color graphics chip.

The parent company of Triad is registered in the Netherlands. The Company conducts back-end services, such as testing in the Netherlands, and plans to add design activities to serve the EEC market. The Company has a joint venture with Rood Testhouse in Europe to guarantee engineering and test capacity in exchange for business committed by Triad. Operations are centralized in the United States and headquartered in Colorado Springs, Colorado.

Triad has adopted a strategy of developing a worldwide network of corporate alliances with industrial partners to obtain core product designs and then applying its expertise to add value-enhancing features. In October 1987, Triad negotiated an alliance with a Japanese semiconductor manufacturer, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D. Triad

also has foundry alliances with AT&T and Seiko and plans additional alliances with a U.S. and a European company. Assembly is conducted by Lingsen in Taiwan and Swire in Hong Kong.

Applied Marketing Technology, based in the United Kingdom, has been signed as the Company's representatives in the EEC. Other representatives are being set up in the Far East and the United States.

## BOARD

(Name and Affiliation)

Pieter Niessen, Chairman  
Raymond Bullens  
Henk Van der Kwast

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Michael Burton  
Inmos, Mgr Commercial Ops

### Sr VP Sales/Mktg

Bruce Threewitt  
AMD, Dir Prod Dev

### CFO

Jop Van der Wiel  
Not available

\*Founder

## FINANCING

1985  
Initial  
\$8.0M

AMRO Bank, founders, The Limburg Investment Bank, private placement, grants and subsidies from the Dutch government



# Triad Semiconductors International

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1986

Round 2

N/A

LIOS

1987

Round 3

N/A

Kempen Co.

**Seiko**

Triad signed a foundry alliance with Seiko, which is manufacturing the monolithic color palette.

**Rood Testhouse**

Triad signed an agreement with Rood Testhouse in Europe, guaranteeing engineering and test capacity in exchange for business committed by Triad.

## ALLIANCES

### Japanese Company

Triad negotiated an agreement with a Japanese semiconductor company, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D.

### AT&T

Triad signed a foundry alliance with AT&T, which is manufacturing the fast latched/registered pipelined memories.

## MANUFACTURING

### Technology

1.2- and 1.5-micron CMOS  
Double-metal, double-poly process  
Double-metal, single-poly process

### Facilities

Colorado Springs, CO

15,000 sq. ft.

Corporate headquarters, design

The Netherlands

25,000 sq. ft.

European headquarters

## PRODUCTS

Product	Availability
256-Color Graphics Palette Chip	Q2 1988
16Kx4 Fast Industry Standard (FIS)	Q2 1989
64Kx4 FIS	Q3 1988
64Kx4 Latched and Registered Memory	Q4 1989
Writable Control Store	Q1 1989
1Kx48 LAN CAM	Q2 1990

## OTHER INFORMATION

Triad's PR firm is Ad-Infinitum.

# TriQuint Semiconductor, Inc.

Group 700  
P.O. Box 4935  
Beaverton, OR 97076  
503/644-3535  
Fax: 503/644-3198

ESTABLISHED: January 1984

NO. OF EMPLOYEES: 135

## BACKGROUND

TriQuint designs, develops, manufactures, and markets microwave, linear, and GHz digital GaAs IC components. TriQuint also offers a broad range of foundry services. The Company's products are used in high-performance applications such as fiber-optic telephone communication, high-speed computer interfaces, instruments, and military systems.

The Company evolved from research on GaAs ICs that began in Tektronix Laboratories in 1978. Several of TriQuint's founders were leaders on the Tektronix research team. In 1984, TriQuint was formally established as a majority-owned subsidiary with the entrepreneurial freedom to establish a broad portfolio of long-term manufacturing contracts.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

Alan D. Patz  
Tektronix, GM GaAs ICs

### Dir Mktg/Sales

Dennis C. Powers  
Not available

### Mgr QA

Richard Allen  
Tektronix, Div Mfg Mgr

### VP R&D

Dr. Richard Koyama  
Tektronix, Technical Manager

### Dir Finance/Admin

Richard Sasaki  
Tektronix, Financial Mgr

### VP Mfg

Dr. Gordon Roper  
Tektronix, Principal Engr

### VP Digital & Linear Products

Dr. Ajit Rode  
Tektronix, IC Process Engr

### VP Microwave Prod

Philips Snow  
Not available

## RECENT HIGHLIGHTS

### November 1987

TriQuint offered the TQ3000, a 3,000-gate array that features 1,020 cells and 64 I/Os. The TQ3000, which can perform at up to 1 GHz, is produced with a 1-micron GaAs E- and D-MESFET process. The new array is supported by Daisy, Mentor, and Tek/CAE workstations.

### October 1987

TriQuint introduced the TQ6330, an ultrafast pin driver, and the TQ6331 line receiver pair.

### February 1988

TriQuint announced a radio-frequency/large-scale integration (RF/LSI) GaAs IC foundry service named the QED/A process.

### March 1988

TriQuint introduced the QLSI cell-based library, a GHz LSI cell-based library that supports LSI applications of up to 6,000 equivalent gates and toggle rates of up to 2 GHz.

# TriQuint Semiconductor, Inc.

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## May 1988

TriQuint is the first GaAs foundry to manufacture microwave and digital ICs on 4-inch wafers.

## May 1988

TriQuint announced an optimized 0.5-micron microwave foundry process.

## July 1989

TriQuint announced the shipment of wafers and die screened to U.S. Department of Defense Class 5 requirements, the first commercial IC manufacturer to announce availability of this level of screening—permitting satellite systems applications.

## ALLIANCES

### Tektronix

January 1984

Tektronix spun off TriQuint, remaining the parent company and completing a sales agreement with the new subsidiary.

### EEsof

May 1986

EEsof and TriQuint teamed up to incorporate TriQuint's GaAs custom MMIC foundry models into Touchstone, EEsof's minicomputer- and workstation-based MMIC CAD program. Jointly, they developed a GaAs MMIC element library that allows users to simulate microwave ICs, using MMIC components that model components available from TriQuint's custom MMIC foundry facility.

### TRW

June 1987

TRW Components and TriQuint agreed jointly to develop and supply class-S level GaAs devices for space applications. TriQuint will

provide microwave and digital GaAs technology in addition to foundry services.

### MSC

March 1988

Microwave Semiconductor Corporation and TriQuint agreed to provide customers with GDS-II tape interchangeability and equivalent performance for GaAs analog and digital ICs and MMICs.

### Hewlett-Packard

May 1988

TriQuint's MMIC Library of foundry design models are incorporated into Hewlett-Packard Company's microwave CAE design system.

### Gazelle Microcircuits

May 1988

Gazelle Microcircuits signed foundry contract with TriQuint for 4-inch digital wafer production.

## MANUFACTURING

### Technology

1.0- and 0.5-micron gate length depletion mode MESFET processes capable of fabricating  
D-MESFETs VIAs  
1.0- and 0.5-micron gate length enhancement/  
depletion mode MESFET processes capable of  
fabricating E- and D-MESFETs  
3-inch wafers  
4-inch wafers

### Facilities

Beaverton, OR

35,000 sq. ft.

Administration, engineering, manufacturing

15,000 sq. ft.

Class 100 clean room

## PRODUCTS

### Foundry

1A/1D Process

1.0-Micron Gate Length Depletion Mode MESFET for D-MESFET, Schottky Diodes, Implanted Resistors, MIM Capacitors, and Airbridge Inductors

HA Process

0.5-Micron Gate Length Depletion Mode MESFET Process for Both 0.5- and 1.0-Micron D-MESFETs, Schottky Diodes, Implanted Resistors, Precision Nichrome Resistors, MIM Capacitors, and Airbridge Inductors

## TriQuint Semiconductor, Inc.

**QED Process** 1.0-Micron Gate Length Enhancement/Depletion Mode MESFET for E- and D-MESFETs, Schottky Diodes, Implanted Resistors, and Airbridge Inductors

**QED/A Process** An Enhanced Version of the QED Process that Allows the Mixing of Low-Power Digital LSI Circuits and Precision Analog Circuits on a Single Die

**3A Process** Optimized 0.5-micron microwave process

### Gate Arrays

Family	Linewidth	Delay	Gates
QLSI	1.0	0.15	2,000; 3,000; 4,000

### Cell-Based Library

Family	Cells
Q-Logic	1,000 Gates, Data Encoders/Decoders, MUX/DEMUX, Counters, Dividers, Prescalers
QLSI	8,000 Gates, ZFL Cells, SCFL Cell Family

### MMICs (Die and Components)

TQ9111	1- to 8-GHz Amplifier
TQ9141	1- to 10-GHz Power Divider
TQ9152	1- to 10-GHz SPDT Switch
TQ9161	1- to 10-GHz Variable Attenuator
TQ9121	0.5 to 20.0-GHz 10w Noise Amplifier
TQ9131	0.5 to 20.0 GHz Active Combiner

### Digital Products

TQ1131	Pgm 8:1, 16:1 MUX
TQ1132	Pgm 1:8, 1:16 DEMUX
TQ1133	4:1 MUX
TQ1134	1:4 DEMUX
TQ1135	12:1 MUX
TQ1136	12:1 DEMUX

### Linear ICs

TQ6330	Pin Driver
TQ6331	Line Receiver
TQ6111-D	8-Bit DAC, 600 Ms/S, Die Form
TQ6111-M	8-Bit DAC, 600 Ms/S, Ceramic Package
TQ6111-BI	8-Bit DAC, 600 Ms/S, Board Module, Instrumentation Version
TQ6111-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
TQ6112-D	8-Bit DAC, 1,000 Ms/S, Die Form
TQ6112-M	8-Bit DAC, 1,000 Ms/S, Ceramic Package
TQ6112-BI	8-Bit DAC, 1,000 Ms/S, Board Module, Instrumentation Version
TQ6112-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
EK-TQ6101	GIGADAC Evaluation Kit

### OTHER INFORMATION

TriQuint's PR firm is Hastings and Humble Public Relations.

# United Microelectronics Corp.

#3 Industrial Road  
Hsinchu City  
Taipei, Taiwan  
(035) 773131  
Telex: 31476 UMCHSC  
Fax: 035 774 767

ESTABLISHED: September 1979

NO. OF EMPLOYEES: 950

## BACKGROUND

United Microelectronics Corp. (UMC) offers gate array and standard cell design services in addition to consumer, telecommunications, memory, and microprocessor ICs. The Company was formed to commercialize ERSO's IC technology and is Taiwan's largest wafer foundry. UMC provides foundry services to major U.S. and domestic IC design companies.

In 1983, UMC funded Unicorn Microelectronics, a design center, in San Jose, California. National Microelectronic Corporation is the U.S. sales and distribution arm for UMC's foundry services and products.

In December 1987, UMC started construction of a \$170 million VLSI plant, with a planned capacity of 30,000 units of 6-inch wafers per month.

In 1987, UMC elected Dr. Morris Chang chairman. Dr. Chang is also the chairman of Taiwan Semiconductor Manufacturing Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan. Dr. Chang was a vice president at Texas Instruments and chief executive officer at General Instrument Corporation.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

Robert H.C. Tsao  
ERSO, VP Operations

### VP Operations

Alex I.D. Liu  
ERSO, Production Manager

### VP Marketing

John Hsuan  
ERSO, Marketing Manager

### R&D Director

M.K. Tsai  
ERSO, Design Manager

### Plant Director

Hyley Huang  
ERSO, Process Manager

## FINANCING

### 1979

#### Round 1

\$12.5M

Bank of Communications, China Development Corp., Kuang Hua Investment Co., Ministry of Economic Affairs, Orient Semiconductor, Sampo, Teco, Walsin-Lihwa Electric Wire & Cable, Yao Hua Glass Co.

### July 1985

#### Round 2

\$7.5M

Initial public offering

## RECENT HIGHLIGHTS

### November 1986

National Semiconductor filed a suit against UMC charging theft of trade secrets, fraud, breach of contract and fiduciary obligations, unfair competition, conversion, interference, and conspiracy. The suit concerns the marketing by UMC of a real-time clock part and

## United Microelectronics Corp.

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a UART, which National claims was based on designs received from National under a fab agreement. National is seeking \$10 million in damages. UMC filed a countersuit against National in the United States, alleging that National has made false statements in an effort to interfere with UMC's economic relationships.

### December 1987

UMC started construction of its \$170 million VLSI plant II, with a planned capacity of 30,000 units of 6-inch wafers per month.

### January 1988

UMC reported fiscal 1987 sales of \$90 million.

## ALLIANCES

### ERSO

1979

ERSO granted UMC a license for design and process technology for 4-inch silicon wafers.

### AMI

April 1983

Dialer ICs were produced in cooperation with AMI. UMC is also a second source for AMI's products and 5-micron silicon-gate CMOS in Asia.

### Unicorn

January 1985

UMC funded Unicorn for \$2.5 million.

June 1985

UMC and Unicorn agreed to jointly develop a standard cell library and to design cells for data path, memory, I/O, random logic, and complex logic.

### Honeywell/Synertek

July 1985

UMC gained nonexclusive product licenses for 18 ICs formerly produced by Synertek and purchased some Synertek production equipment and inventory from Honeywell. Products covered in this agreement included 4K and 16K SRAMs and 8K, 16K, and 32K ROMs.

Honeywell received \$3 million plus royalties of 3 to 5 percent over the next three years.

### MOSel

October 1985

MOSel transferred rights to a high-speed 2Kx8 SRAM and EEPROM to UMC, additionally providing 1.5- and 2.0-micron processes that were used to bring up the 2-micron CMOS process at UMC.

### TRW

April 1986

UMC successfully developed 1.25-micron VLSI products with TRW.

### SMC

June 1986

UMC signed a contract with SMC to cooperate on a computer IC.

## SERVICES

Design—Gate arrays, standard cell, full custom  
Foundry—CMOS  
Prototype Manufacturing  
Production Manufacturing

## MANUFACTURING

### Technology

5.0- and 2.0-micron silicon-gate NMOS  
3.0- to 1.2-micron single/double metal/poly  
CMOS  
5.0-micron silicon-/metal-gate CMOS  
18V high-voltage CMOS  
10V poly capacitor analog CMOS  
2.0-micron CMOS EPROM  
4-inch wafers

### Facilities

Taiwan  
92,000 sq. ft.  
Total space  
17,000 sq. ft.  
Wafer fab

## **PRODUCTS**

### **Memory**

512x9 and 1,024x9 Parallel FIFOs, ROMs in 4Kx8, 8Kx8, 16Kx8, and 32Kx8 configurations, High-Speed SRAMs in 1Kx4, 2Kx8, 16Kx1, and 4Kx4 configurations, and a 1Kx4 SRAM

### **Consumer ICs**

Melody Generators, CMOS Calculator, Timer, Clock, and Watch Chips, Voice Control IC, Speech Synthesizer, Encoder/Decoder, Dimmer

### **Microcomponents**

8-Bit Single-Chip MCUs, 8-Bit MPU, CRT Controller, Video Attributes Controller, Disk Controller, Double-Row Buffer, Floppy Disk Separator, Bus Controllers, RTC, ACIA, VIA, PIA, RAM I/O Timer Array, DUART, EPCI IC, Programmable Interval Timer, Programmable Interrupt Controller, Programmable Peripheral Interface, Clock Generator and Driver, Capacitance Keyboard Encoder

### **New Microcomponent Products**

System, I/O and FDC Support Chips for PS/2 Model 30, Single-Chip MCGA, Single-Chip FDC for PS/2 Model 30, Two Serial Ports and One Parallel Port, Advanced ACE, CMOS ACE, COS ACE, Single-Chip Monochrome Graphics Adapter, Single-Chip MGA and CGA, Micro Channel Interface Chip, SCSI Bus Controller

### **Data Converter ICs**

3.5-Digit A/D Converter, Digit A/D Converter, CMOS DAC

### **Telecommunications**

Simple Pulse Dialer, Repertory Pulse Dialer, Simple Tone Dialer, Tone/Pulse Dialer, T/P Redialer, Repertory T/P Dialer, Slave T/P Dialer, Direct Access Adapter, Crosspoint, DTMF Receiver

### **ASICs**

Mask Programmable Logic Arrays

### **Gate Arrays**

3-microns, 300 to 920 gates; 2-microns, 1,200 to 3,000 gates

### **Cell-Based Libraries**

3.0-Micron, 1 Layer Poly, 1 Layer Metal  
2.0-Micron, 1 Layer Poly, 1 Layer Metal  
1.5-Micron Series, 1 Layer Poly, 2 Layers Metal

### **Silicon Compilers**

Data Path Module, PLA Module, PAD Module, FIFO Module, RAM Module, ROM Module, Random Logic Module, and User-Specific Module

## **OTHER INFORMATION**

UMC does not employ a PR firm.

# United Silicon Structures

1971 Concourse Drive

San Jose, CA 95131

408/435-1366

Fax: 408/435-0504

**ESTABLISHED: September 1987**

**NO. OF EMPLOYEES: 25**

## BACKGROUND

United Silicon Structures (US2) was founded in September 1987 by European Silicon Structures (ES2) to serve the U.S. ASIC market by delivering quick-turn, low-cost prototypes and low-volume production runs. US2 perceives the ASIC market as developing to the point where many customers require many different designs with low-volume requirements of each part type. The Company believes that market opportunity is being created for a new type of service-oriented company dedicated to manufacturing prototypes and small production series.

US2 utilizes an e-beam process for direct write production. Fabrication currently is conducted by US2's sister company, ES2, which operates two e-beam systems in a 100,000-square-foot plant in Rousset, France. The technology employed by US2 is compatible with the most popular CAE and CAD platforms, such as those of Mentor Graphics, Cadence Design Systems, and Silicon Compiler Systems. When volume production is required, the company makes use of its foundry contracts with Philips, Signetics, and TSMC.

First-round funding was provided by Advent International; Concord Partners; and Mohr, Davidow Ventures in the amount of \$4.52 million. This venture capital investment represents a 30 percent equity investment in the Company. In addition, ES2 holds 40 percent of the equity stake, while the remaining 30 percent is reserved for US2's key employees.

Within the next three years, US2 will install a North American fab facility. The fab is designed to service the prototyping and low-volume marketplace. US2's new fab facility will also employ an e-beam write-on process.

## BOARD

(Name and Affiliation)

Henri Jarrat

United Silicon Structures, President/CEO

William Davidow

Mohr, Davidow Ventures, General Partner

Irwin Federman

Dillon, Reed & Company, Managing Director

David Brown

Advent International, Senior Vice President

Jean-Luc Grand-Clement

European Silicon Structures, Chairman

Werner Koepf

European Silicon Structures, President/CEO

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO/Chairman

Henri Jarrat

VTI, President

### Executive VP

Jim Ellick

CAECO, President

### VP Customer Eng

Ian Mackintosh

VTI, Dir West Coast Tech Centers

### VP Mktg

Jacques Castaillac

European Silicon, VP Sales & Mktg Structures

### Dir Customer Eng

Timothy O'Donnell

National Semiconductor, ASIC App Mgr

### Dir R&D

Robert Heaton

European Silicon, Design Ctr Mgr Structures



# United Silicon Structures

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## FINANCING

March 1989

Initial

\$4.5M

Advent International; Concord Partners; Mohr,  
Davidow Ventures

## ALLIANCES

### European Silicon Structures

European Silicon Structures is a sister company with which United Silicon Structures shares technology. Partnership agreements are with large volume silicon manufacturers such as National Semiconductor, Philips, Signetics, and TSMC.

## PRODUCTS

Silicon Prototype Services  
Low-Volume Silicon Production  
Entry Level Design Software

## OTHER INFORMATION

US2's PR firm is Miller Communications.

## SERVICES

ASIC prototypes

Low-volume ASIC production

## MANUFACTURING

### Technology

CMOS, n-well, single poly, double metal

2.0 micron

1.5 micron

1.2 micron

1.0 micron (available in 1990)

### Facilities

Rousset, France

100,000 sq. ft.

Manufacturing, test, assembly

## Vadem

1885 Lundy Avenue, Suite 201

San Jose, CA 95131

408/943-9301

Fax: 408/943-9735

ESTABLISHED: 1983

NO. OF EMPLOYEES: 17

### BACKGROUND

Vadem, founded in 1983 by Chikok Shing and Henry Fung, designs, develops, and markets integrated circuits used in DOS-compatible systems. Vadem provides logic chip sets that offer PC XT compatibility, as well as application support chips that add to the core logic and enhance the use of the PC architecture in embedded control applications. Vadem targets the large class of products that incorporate a PC-compatible architecture in the control of computer-based equipment.

Vadem core logic chip sets focus on integrated processors from Intel and NEC, which typically serve the embedded control marketplace. Vadem offers a core logic chip set for the 80186/80C186 processor, which offers performance ranging from 8 to 16 MHz. Vadem's core logic chip sets for the NEC V-40 provide a very low cost PC XT solution at clock speeds of up to 10 MHz.

Vadem's application support chips focus on providing high levels of integration, which lower component count and reduce power consumption for products that use the PC architecture for embedded computer control. Applications that can make excellent use of the PC architecture for embedded controllers include portable or hand-held terminals; market-specific terminals such as point-of-sale terminals, ATMs, and ticket and vending machines; PC-compatible intelligent terminals or network workstations; industrial and machine control systems; telecommunications; and home electronics.

Vadem also is involved in many design projects for major corporations. In 1984, Vadem designed the first battery-operated PC-DOS system for Morrow Designs. A modification of this design was licensed to Zenith and became the Z-171 laptop computer. Vadem has established design relationships with Sharp Electronics and Zenith Corporation in the PC area. Vadem currently is

working on additional design projects that will result in new products such as a complete PC engine on a single chip.

### BOARD

(Name and Affiliation)

- \*Chikok Shing  
Vadem, Chairman/CEO
- \*Henry Fung  
Vadem, Vice President of Engineering
- Bob Dilworth  
Metrocom, Inc., CEO
- Samuel Fang  
General Electronics, Inc., Hong Kong,  
Managing Director
- JJ Guo  
SIS, Taiwan, President

### COMPANY EXECUTIVES

(Position, Name, and Prior Company)

#### Chairman, CEO

- \*Chikok Shing  
Osborne Computer Corp.

#### VP Eng

- \*Henry Fung  
Intel Corporation

#### Dir Mktg

- Barney Ichikawa  
David Systems

#### Dir ASIC Dev

- Siu Tsang  
Intel Corporation

#### Dir Software Eng

- Rich Peters  
Seitor Corporation

#### NA Sales Manager

- Howard James  
Prolog Corporation

\*Founder

# Vadem

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## FINANCING

Vadem is privately held and was funded initially by its founders; the founders and other employees own more than 80 percent of Vadem stock.

## ALLIANCES

### Intel

March 1988

Vadem and Intel signed an agreement in which Intel made a small up-front investment in an IBM Model 30 and PC XT-compatible chip set that Vadem is developing.

### Intel

September 1988

Vadem and Intel signed a second strategic

alliance focused on Vadem's Model 30 and PC XT-compatible chip set. Under the terms of the five-year agreement, Intel's sales force will refer customers to Vadem for the chip set. Vadem, meanwhile, will market the chip set independently.

## MANUFACTURING

### Technology

CMOS

### Facilities

San Jose, CA

6,000 sq. ft.

R&D, test, marketing

## PRODUCTS

Intel 80C186 Support Products

NEC V-40 Support Products

Application Support Chips

## OTHER INFORMATION

Vadem does not employ a PR firm.

# VIA Technologies, Inc.

(Formerly LOGICSTAR)

4160 B Technology Drive

Fremont, CA 94538

415/651-2796

Fax: 415/659-9057

ESTABLISHED: 1987

NO. OF EMPLOYEES: 20

## BACKGROUND

VIA Technologies, Inc., was formed to design, manufacture, and market high-performance VLSI graphics and local area network (LAN) chips. The Company is addressing the PC AT market and is using a VLSI design methodology to bring products to market quickly.

The Company's initial products are a five-chip PC AT chip set that is pin-for-pin compatible with Chips & Technologies' chip set, a monographics controller, a memory mapper, a dual-channel NRZI encoder/decoder, and a Starlan interface chip. In April 1988, VIA Technologies, Inc., began volume shipments of its chip sets. Future products will include a VGA chip, 386 chip sets, additional disk communications chips, and disk controllers.

The Company has set up joint ventures for design with companies in Japan, Korea, and Taiwan. These agreements may be extended to include manufacturing and marketing at a future time. Foundry services are being provided by companies in the United States, Europe, and Japan.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### Chairman, CEO

Don Brooks

Fairchild, President

### VP Oper/CFO

Mark Kaleem

OSM Computer, President

### VP Engr

Idris Kothari

VLSI, N/A

### VP Sales/Mktg

Peyton Cole

Fairchild, N/A

## FINANCING

### March 1989

Financing was provided by Fujitsu as part of the strategic alliance covering chip sets for Sun-compatible workstations.

## ALLIANCES

### Fujitsu

March 1989

VIA Technologies announced a strategic partnership with Fujitsu Microelectronics to codevelop peripheral chip sets for Sun-compatible workstations.

## MANUFACTURING

### Technology

1.3-micron, double-metal CMOS

### Facilities

Fremont, CA

5,000 sq. ft.

Administration, design

# VIA Technologies, Inc.

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## PRODUCTS

### Current Products

Device	Description
SL2002	Dual-Channel NRZI Encoder/Decoder
SL600X	80286-Based PC AT Chip Set
SL6001	PC AT System Controller
SL6002	PC AT Memory Decode
SL6003	PC AT System Buffer-1
SL6004	PC AT System Buffer-2
SL6005	PC AT System Buffer-3
SL6003C	PC AT System Buffer-1
SL6004C	PC AT System Buffer-2
SL6005C	PC AT System Buffer-3
SL6002A	PC AT Advanced Memory Controller
SL6012	PC AT Memory Mapper
SL5001	Parallel Printer Port
SL5002	Parallel Printer Port with Crystal Oscillator
SL7001	Monographic Controller
SL4000	Starlan Interface

### New Products

SL9090	Universal AT Clock Chip
SL9091	Video Clock Chip
SL90XX	FlexSet, PC AT Core Logic (80286/80386SX/80386)
SL9010	System Controller
SL9020	Data Controller
SL9025	Address Controller
SL9030	Universal Peripheral Controller
SL9X5X	PC AT Memory Controllers
SL9150	80286-Based Page Mode
SL9155	80286-Based Cache-Based
SL9250	80386SX-Based Page Mode
SL9255	80386SX-Based Cache-Based
SL9350	80386-Based Page Mode
SL9355	80386-Based Cache-Based

## OTHER INFORMATION

VIA Technologies does not employ a PR firm.

**Vitellic Corporation**  
3910 North First Street  
San Jose, CA 95134-1501  
408/433-6000  
Fax: 408/433-0331

**ESTABLISHED: December 1983**

**NO. OF EMPLOYEES: 180**

## **BACKGROUND**

Vitellic designs, develops, manufactures, and markets high-performance specialty memory devices based on 1.2-micron CMOS manufacturing technology. The Company specializes in application- and customer-specific memory devices. Vitelic was founded by Alex Au, former director of VLSI research at Fairchild Camera and Instrument Corporation.

In 1987, Vitelic established a customer-specific memory business to serve the needs of board-level and system designers. The focus of this department is on supermini, supermicro, and high-performance workstations, as well as graphics and image-processing products.

Vitellic contracts all manufacturing to several Asian manufacturers through various licensing agreements.

## **BOARD**

(Name and Affiliation)

**Alex Au**  
Vitellic Corporation, President/CEO

**Teruaki Aoki**  
Sony Corporation, Deputy Senior General Manager

**Neill Brownstein**  
Bessemer Venture Partners, L.P., General Partner

**Kazuo Inamori**  
Kyocera Corporation, Chairman

**Harry Marshall**  
J.H. Whitney & Company, General Partner

**David Wang**  
Syntek Design Tech Ltd., General Manager

**Kunnan Lo**  
Kunnan Enterprises Ltd., Founder

## **COMPANY EXECUTIVES**

(Position, Name, Prior Company, and Prior Position)

### **President/CEO**

\*Alex Au  
Fairchild, Dir Research

### **Exec VP**

Will Kauffman  
Intel, VP Quality & Rel

### **VP Sales/Mktg**

Gary Ater  
NMB, VP/GM US Ops

### **VP R&D**

Michael Barry  
Fairchild, Dir CMOS/VLSI Lab

### **SR VP Sourcing Relationships**

John Seto  
Hyundai, Dir Operations

### **SR VP/CFO**

Arthur Wang  
Raychem, GM Malaysia and Thailand

### **SR VP VTC**

Hsing Tuan  
Fairchild, N/A

### **SR VP/GM Taiwan Operations**

Chun Ho  
Exel, Dir Tech Development

### **SR VP Corp Mktg**

James Koo  
Synertech, Dir of Memory Products

### **VP Finance**

Henry Shaw  
Talen Group, Mktg/Sales Director

### **VP General Counsel. Asst. Secretary**

Martin Baker  
Wilson, Sonsini, Goodrich & Rosati, Counselor

### **VP GM SRAM Group**

Raymond Wang  
Victory Computer, President/CEO

# Vitellic Corporation

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## FINANCING

March 1984

Seed

\$7.0M

Bessemer Venture Partners, INCO Securities Corp., Kyocera International, Oak Investment Partners, Oxford Venture Fund, Waverley Vencap, J.H. Whitney

August 1985

Round 1

\$7.2M

Original investors, Pathfinders Chappell, Sony Corporation

August 1987

Round 2

\$2.0M

Bessemer Venture Partners, INCO Venture Capital Management, Kyocera, Oak Investment Partners, Oxford Venture Fund, Sony, Waverley, J.H. Whitney

January 1989

Round 3

\$39.0M

Western Digital Corp., Sigma Designs, Hambrecht & Quist Venture Partners, Genoa Systems Corp., Societe Nationale Elf Aquitaine, Mitsui & Co. Ltd., and others

## RECENT HIGHLIGHTS

April 1989

Vitellic signed both Schweber Electronics and Almac Electronics as authorized Vitelic distributors. Almac is the major distributor in the Northwest and Schweber is the number three distributor in the United States.

May 1989

Vitellic introduced the V63C64, a high-speed 8Kx8 SRAM device with access times of 25ns and an output enable time of 9ns. The full CMOS part is designed for use in cache memory applications in high-end 80386-based PCs and workstations.

July 1989

Vitellic introduced the V53C261, a high-performance 64Kx4 video RAM that clocks

256 four-bit words at a serial rate of 33 MHz and has an access time of 80ns.

August 1989

Vitellic introduced the V63C329, an 8Kx16 cache data RAM designed for use in large-capacity cache memory applications from 64 Kbytes to 256 Kbytes, for high-performance PCs and workstations.

## ALLIANCES

Kyocera

March 1984

Kyocera participated in the first-round financing of Vitelic.

ERSO

May 1984

ERSO and Vitelic agreed to codevelop EPROMs and 64K and 256K CMOS DRAMs.

Sony

June 1985

Vitellic and Sony signed an agreement giving Sony access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity.

NMB

July 1985

Vitellic granted a license for its 1Mb DRAM to NMB in exchange for one-third of NMB's plant capacity.

Hyundai

July 1985

Hyundai obtained a license to produce Vitelic memory products in exchange for manufacturing capacity. Vitelic memory products include 64K, 256K, and 1Mb CMOS DRAMs and 16K CMOS SRAMs.

Philips

March 1986

Philips and Vitelic agreed to a broad-ranging agreement that gave Vitelic access to Philips' process technology. In exchange, Vitelic would design a family of high-performance CMOS SRAMs for manufacture, use, license, and sale by both companies (expired).

## Sanyo

October 1986

Sanyo and Vitelic would jointly develop a high-speed 64K SRAM family. Sanyo would manufacture the SRAMs, using 1-micron process technology. The agreement includes the manufacture of the products that Vitelic designs for Philips, using Philips' process developed by Tokyo Sanyo.

## Facilities

San Jose, CA

33,000 sq. ft.

Headquarters and design

Taiwan

Under construction

Engineering and test

Japan

N/A

Sales location

## MANUFACTURING

### Technology

2.0- to 1.0-micron CMOS (n-well)  
VICMOS III

## PRODUCTS

	Device	Organization	Access Time
CMOS DRAM	V53C256/258	256Kx1	70-100ns
	V53C466/464	64Kx4	70-100ns
	V53C100/102	1Mbx1	80-100ns
	V53C104/105	256Kx4	80-100ns
CMOS SRAM	V63C64	8Kx8	25-45ns
	V61C16	2Kx8	35-70ns
	V61C68	4Kx4	35-55ns
	V61C6	16Kx1	35-55ns
Dual-Port RAM	V61C32	2Kx8	55-90ns
FIFO	V61C01	512x9	25-65ns
	V61C02/3	1Kx9	25-65ns
Video RAM	V53C261	64Kx4	80-100ns
Cache Data RAMs	V63C328	8Kx16	35ns
	V63C308	4Kx16	35ns

## OTHER INFORMATION

Vitellic's PR firm is Thomas Mahon and Associates.



# Vitesse Semiconductor Corporation

741 Calle Plano  
Camarillo, CA 93010  
805/388-3700  
Fax: 408/433-0331

ESTABLISHED: July 1984

NO. OF EMPLOYEES: 103

## BACKGROUND

Vitesse Semiconductor Corporation designs, manufactures, and markets cost-effective digital gallium arsenide (GaAs) large-scale ICs for the high-performance marketplace and offers foundry services on a contract basis. Products are manufactured using enhancement/depletion mode transistors and self-aligned gate technology according to silicon manufacturing techniques. The Company's first products were commercial versions of a family of GaAs ICs, including gate arrays, RAMs, and logic products.

Initially, the Company was organized into two divisions—the Integrated Circuits Division, which was responsible for GaAs IC designs, and the Digital Products Division, which was developing a minisupercomputer product. Early in 1987, the Integrated Circuits Division raised \$10 million, establishing an independent company, and was renamed Vitesse Semiconductor Corporation. Dr. Louis Tomasetta, formerly president of the IC Division, is president and CEO of the new company. Dr. Tomasetta was director and program manager of the \$40 million DARPA GaAs pilot program at Rockwell International.

Vitesse remains in the existing 45,000-square-foot facility and will use the additional funding raised in 1987 to develop additional products and expand into higher-volume production. The building is designed specifically for the production of LSI-level digital ICs in GaAs. Approximately 12,000 square feet have been designated as clean room area, and half of that area is a Class 10 clean room.

In March 1987, Pierre R. Lamond was elected chairman of the board. Mr. Lamond organized the \$10 million financing of Vitesse Semiconductor and also serves on the boards of Convex

Computer, Cypress Semiconductor, and several other private companies. In October 1987, Dr. T.J. Rodgers, president and CEO of Cypress Semiconductor Corporation, joined the board of Vitesse Semiconductor.

Vitesse has established a nationwide network of manufacturers' representatives to sell its foundry services and products. In June 1987, Vitesse signed Zeus as its first distributor to sell its 29G00 family of products.

## BOARD

(Name and Affiliation)

Pierre R. Lamond, Chairman  
Sequoia Capital, General Partner  
Dr. T.J. Rodgers  
Cypress Semiconductor Corp., President  
Jim Cole  
Spectra Enterprise Assoc., Partner

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Dr. Louis Tomasetta  
Rockwell, Dir R&D Center

### Executive VP

\*Patrick Hoffpauir  
VLSI Technology, GM ASIC Ops

### VP Marketing/Sales

David Mooring  
Intel, Mktg Mgr

### VP Sales

Neil Rappaport  
AMCC, Ntl Sales Mgr

### VP Engineering

\*Ira Deyhimy  
Rockwell, Mgr IC Engr

# Vitesse Semiconductor Corporation

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## VP Operations

James Mikkelson

Hewlett-Packard, Mgr Process Dev

## VP Finance/CFO

Michael A. Russell

Avicon Intl, VP Finance/CFO

\*Founder

## FINANCING

### February 1987

Round 1

\$10.0M

Bryan & Edwards; New Enterprises Assoc.;  
The Norton Company; Oxford Venture Corp.;  
Robertson, Colman & Stephens; Sequoia  
Capital; Spectra Enterprises; Walden Capital;  
J.H. Whitney

### January 1988

Round 2

\$8.1M

Previous investors; Hook Partners; Mohr,  
Davidow Ventures; Morgenthaler Ventures;  
Oak Investment Partners; Singapore  
Development Board

### April 1989

Round 3

\$7.3M

Previous investors, Aeneas Venture Corp.,  
Security Pacific Capital Corp., Hughes  
Investment Management Co., New Venture  
Partners

## RECENT HIGHLIGHTS

### June 1987

Vitesse offered GaAs versions of the 2900 family of slice processors, produced through a licensing agreement with Advanced Micro Devices.

### September 1987

Vitesse offered its first digital GaAs ICs fabricated with an E- and D-MESFET transistor process. They include a family of 1,500- and 4,500-gate arrays. The arrays are tailored for telecom fiber-optic MUX/DEMUX, computer,

backplane, tester, and instrumentation applications.

Vitesse also offered the VS12G22E, a 256x4 SRAM with an access time of 3ns. The device is ECL RAM compatible, has 1.5-watt power dissipation, and is radiation hardened.

### October 1987

Vitesse announced that Dr. T.J. Rodgers, President/CEO of Cypress Semiconductor, had joined the board of directors.

### January 1988

Vitesse introduced the VS8001, a 1.25-GHz 12-to-1 multiplexer, and the VS8002 1-to-12 demultiplexer with ECL-compatible parallel I/O. The devices offer 12-bit parallel-to-serial and serial-to-parallel data conversion for communications applications. A unique feature is a self-test path designed to allow the devices to test each other.

### March 1988

Vitesse announced that it has developed the VS8010, a MUX/DEMUX with control logic that meets the Synchronous Optical Network (SONET) standard at the 1.2-Gbit per second (Gbps) communications rate.

### November 1988

Vitesse announced the world's first GaAs VLSI product, a 10,000-gate array, the VSC 10000.

### January 1989

Vitesse announced a GaAs 22,000-gate array using standard cells.

### August 1989

Vitesse announced shipment of its VSC10K GaAs gate array to E-Systems for that company's high-performance digital signal processor series.

## ALLIANCES

### Norton

July 1984

The initial investment of \$30 million in Vitesse was provided by the Norton Company, a \$1.3 billion company of Worcester, Massachusetts.

# Vitesse Semiconductor Corporation

## Advanced Micro Devices

November 1985

Vitesse and Advanced Micro Devices (AMD) agreed to develop and manufacture AMD's AM2900 family of MPUs in gallium arsenide.

## TRW

December 1986

Vitesse signed a sales and marketing agreement with TRW Components International Inc. (TRWCI) covering logic, memory, and ASIC products. Vitesse will supply high-performance wafers, die, and packaged devices to TRWCI, which will assemble, test, qualify, and sell to the space-quality, Class-S level market. The companies will also cooperate to solve the radiation problems found in logic and memory products.

## E-Systems

August 1987

Vitesse signed an agreement allowing E-Systems to use Vitesse's proprietary GaAs technology in its current and future programs. E-Systems also has an option to purchase design, packaging, and test technologies. The agreement allows Vitesse to participate in the EW systems market through E-Systems' military programs.

## VLSI Technology

September 1987

Vitesse will develop a GaAs cell library for VLSI's design tools. VLSI will provide technical information and assist in the porting effort.

When the library is completed, both companies will market the tools, which Vitesse will use internally. VLSI will extend the tools to its silicon compiler library; Vitesse will own the library and provide fabrication.

## Ford Microelectronics

October 1987

Vitesse and Ford Microelectronics agreed to second-source each others' IC foundry services. The companies will develop common design rules.

## Fujitsu

November 1989

Vitesse and Fujitsu Ltd. announced an alternate-source agreement with regard to Vitesse's FURY GaAs VLSI gate array family.

## MANUFACTURING

### Technology

GaAs E/D MESFET

0.8-1.25 microns

3-inch wafers

### Facilities

Camarillo, CA

45,000 sq. ft.

Total space

10,000 sq. ft.

Class 10 clean room

## PRODUCTS

### Foundry

LSI Enhancement/Depletion Mode Process, 0.8-Micron Feature Size, Sub-100ps Gate Delays, 3-layer metal

	Device	Description
Gate Arrays	VSC1500	Structured Cell Array
	VSC4500	Gate Array
	VSC10K	Gate Array
	VSC15K	Gate Array
	VCB50K	Standard Cell
SRAMs	VS12G422E	256x4 SRAM, 3, 4, 5ns
	VS12G422T	256x4 SRAM, 4, 6, 8ns, TTL I/O
	VS126476	4Kx1 SRAM 2.5ns Self-Timed

# Vitesse Semiconductor Corporation

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	<b>Device</b>	<b>Description</b>
<b>Microcomponents</b>	<b>VS29G01</b>	<b>4-Bit Slice Processor</b>
	<b>VS29G02</b>	<b>Look-Ahead Carry Generator</b>
	<b>VS29G10</b>	<b>Microcontroller</b>
<b>Standard Products</b>	<b>VS8001</b>	<b>12:1 MUX at 1.2 GHz</b>
	<b>VS8002</b>	<b>1:12 DEMUX at 1.2 GHz</b>
	<b>VS8010</b>	<b>SONET MUX/DEMUX</b>
	<b>VS8004</b>	<b>4:1 MUX at 2.5 Gbps</b>
	<b>VS8005</b>	<b>1:4 DEMUX at 2.5 Gbps</b>

## **OTHER INFORMATION**

Vitesse's PR firm is Capitol Relations, Inc.

# VTC Incorporated

2401 East 86th Street  
Bloomington, MN 55425-2702  
612/851-5200  
Fax: 612/851-5199  
Telex: 857113

ESTABLISHED: May 1984

NO. OF EMPLOYEES: 460

## BACKGROUND

VTC Incorporated designs, manufactures, and markets a broad line of high-performance linear and digital ICs, using bipolar and CMOS process technologies. The Company also offers a wide range of semicustom and custom ASICs, as well as a portfolio of standard products for the aerospace, telecommunications, and computer markets.

In the linear area, products include linear signal-processing (LSP) devices and mass storage devices. The signal-processing devices include very fast operational amplifiers, buffers, comparators, transconductance amplifiers, and sample/hold and data converters. These products are the highest-performance products in their respective classes, rivaling expensive hybrid circuits. In the mass storage area, the Company offers a full line of preamplifiers, data separators, channel devices, voltage-controlled oscillators, and tape drive servo controllers. These devices have speeds and features available from only a few suppliers and are aimed at the high-performance end of the market.

VTC is perceived to have very good cell-based libraries in bipolar and CMOS technologies. Products manufactured using the libraries are often modified and turned into standard parts. VTC also provides a complete set of CAD tools supporting its libraries.

The Company is also perceived to have a leadership position in the following linear areas: pre-amplifiers for disk drives and ultrahigh-speed op amps. VTC is expected to have 1988 sales of about \$50 million and plans to be a \$100 million company by 1990.

In the first quarter of 1986, VTC occupied an additional 170,000-square-foot facility. The

facility includes a 30,000-square-foot Class 1/Class 10 clean room. The Company makes its own masks in a shop equipped with E-Beam technology. Its factories are designed for high-volume production with advanced manufacturing, in-house packaging, and test equipment.

In June 1987, VTC signed a merger agreement under which it became a wholly owned subsidiary of Control Data Corporation, its largest investor and major customer. Terms were not disclosed. Control Data has invested \$56 million in VTC since it was founded and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock.

## BOARD

(Name and Affiliation)

Larry Jodsaas  
VTC Incorporated, CEO  
Daniel Pennie  
Control Data Corporation  
Robert Lillestrand  
Control Data Corporation  
John Buckner, Chairman  
Control Data Corporation  
Donald Powers  
Control Data Corporation  
Allen Cuccio  
Control Data Corporation

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

CEO  
Larry Jodsaas  
Control Data, SR VP Quality

# VTC Incorporated

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## VP/CFO

J.R. Martin  
Fairchild, Div Controller

## VP Operations

E.M. Schnable  
National, Operations Mgr

## VP Engineering

D.A. Orton  
Fairchild, Engr Mgr

## VP Marketing

George Sanders  
Micro Powersystem, Marketing Mgr

## SR VP Sales

Daniel B. Griffith  
Control Data, VP/GM

## FINANCING

From 1984 through 1987, VTC financed its capital equipment and facility requirements with operating leases totaling about \$75 million. In July 1987, employees of VTC, who collectively owned 51 percent of the Company, sold their ownership interest to Control Data Corporation (CDC), giving CDC 100 percent of VTC's common stock.

## RECENT HIGHLIGHTS

### April 1987

VTC was awarded a \$7.5 million contract from the Control Data Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chip-types designed with VTC's 1-micron CMOS standard cell library.

### May 1987

VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by Silicon Compilers Systems Inc. (SCS). VTC will also develop a radiation-hardened cell and other macrocells for the system.

### May 1987

VTC offered the VL3000, a 6-GHz linear/digital bipolar cell library. It allows users to

mix linear and digital circuits on the same chip, without redesigning at the transistor level. The library contains more than 100 predefined linear, digital, and memory functions.

### June 1987

VTC became a wholly owned subsidiary of Control Data Corporation. Terms were not disclosed.

### September 1987

VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

## ALLIANCES

### CDC

#### October 1984

Control Data Corporation invested \$56 million in VTC and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock. The arrangement includes a fabrication technology license.

#### 1987

VTC was awarded a \$7.5 million contract from CDC's Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chips designed with VTC's 1-micron CMOS cell library.

### Silicon Compilers

#### May 1986

VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by SCI. VTC will also develop a radiation-hardened cell for Genesil and additional macrocells for SCI's silicon compiler system.

### IDT

#### January 1987

IDT agreed to allow VTC to second-source its FCT product line of TTL-compatible CMOS logic devices.

## TRW

March 1987

TRW Components International and VTC signed a three-year agreement to cross sample space-quality, Class-S devices. VTC will supply TRW with unpackaged ICs that meet Class-S specs; TRW will assemble, test, qualify, and market the devices. They include radiation-hardened CMOS SRAMs, comparators, amps, and transceivers.

## VME Technology Consortium

September 1987

VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

## MANUFACTURING

### Technology

3.0- and 2.0-micron bipolar linear  
2.0-micron bipolar digital  
1.2- and 1.0-micron two-layer metal CMOS

### Facilities

Bloomington, MN

140,000 sq. ft.

Headquarters, manufacturing

30,000 sq. ft.

Class 1 and Class 10 clean rooms

20,000 sq. ft.

Manufacturing

## PRODUCTS

### Gate Arrays

CMOS and Bipolar/Linear Arrays

### Cell Library

Bipolar cell libraries, 3.0-micron with 170 cells (100 digital, 70 analog), 2.0-micron with 88 cells; ECL or TTL I/O, 2.0-micron with 120 cells (90 digital, 30 analog)

### Silicon Compiler

1.0- and 1.6-micron CMOS Compilers; RAM, ROM, FIFO, and PLA cells

### Linear Signal Processing

Transconductance Amps and Dual-Transconductance Amps, each with or without buffer, 75-MHz Bandwidth

### Video Amplifiers

Low-Noise 733 or 592 Video Amp

### Op Amps

High-Speed, Dual High-Speed, and Quad High-Speed Precision and Fast-Setting Op Amps; Wideband High-Slew Rate, Dual High-Slew Rate, and Quad High-Slew Rate Op Amps; Sample and Hold Amp; Low-Voltage Amp

### Data Converters

8-Bit Video DAC, 200 to 300 MHz; 12-Bit DAC, 125ns Settling Time

### Comparators

Very Fast Comparator, Ultrafast Comparator, TTL Comparator, Ultrafast Dual Comparator, Dual TTL Comparator

### Line Drivers

NTDS Driver/Receiver, Video Line Driver

# VTC Incorporated

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## Mass Storage

Disk Drive Read/Write Preamps: Ferrite Heads, Center-Tapped Thin-Film Heads, Thin-Film Heads, Vertical Heads; Servo Preamps: Ferrite Head, Low-Noise Ferrite Head, Thin-Film Head; Data Separator, Disk Drive Read Channel/Enhanced: Disk Drive Read/Write Channel, Tape Drive Clock Synchronizer; Tape Write Driver; Encoder/Decoder; Write/Servo Phase-Locked Oscillator

## V54/74 FCT/ACT Interface Logic Family (Commercial & Mil Qualified)

Octal and 10-Bit Buffers and Line Drivers; Octal, 9-Bit, and 10-Bit Bus Transceivers; Octal, 9-Bit, and 10-Bit D-Type Transparent Latches; Octal, 9-Bit, and 10-Bit D-Type Edge-Triggered Flip-Flops; Dual 4-Bit D-Type Edge-Triggered Flip-Flops

## OTHER INFORMATION

VTC Incorporated does not employ a PR firm.



# WaferScale Integration, Inc.

47280 Kato Road  
Fremont, CA 94538  
415/656-5400  
Fax: 415/657-5916

ESTABLISHED: August 1983

NO. OF EMPLOYEES: 125

## BACKGROUND

WaferScale Integration, Inc., (WSI) founded by Eli Harari, Terry Leader, and Stephen Su, designs and manufactures high-performance CMOS reprogrammable ICs that incorporate advanced CMOS EPROM capability.

WSI offered an 8Kx8 R PROM (UV erasable reprogrammable PROM) in the first quarter of 1986. In mid-1987, WSI introduced two 256K CMOS EPROMs that use the Company's patented, self-aligned split-gate EPROM technology. The EPROMs feature an access time of 55ns and provide one- and two-chip program-store solutions for 16- and 32-bit MPU and DSP applications. WSI also supplies high-speed CMOS bit-slice processors and peripheral circuits.

In addition, the Company offers the capability to combine EPROM, SRAM, and complex system logic functions on a single IC in its CMOS macroblock cell library. The macroblock library provides VLSI EPROMs, SRAMs, and a family of high-performance bit-slice processor cells (from 4 bits to 32 bits). The library also contains bit-slice peripherals cells including microprogram controllers, variable pipelines, FIFOs, multipliers, bus registers, and register files.

WSI focuses on high-performance markets that include telecommunications, minicomputers, local area networking, digital signal processing, array processing, high-resolution color graphics, and military avionics and communication. WSI market involvement presently includes 55 percent office automation, 25 percent telecommunications, 15 percent military, and 5 percent other. The Company is directing efforts to balance office automation, telecommunications, and military to roughly 30 percent each by 1990.

WSI has leveraged its partnerships with Altera Corporation, GE Solid State, Intergraph Corpo-

ration, Kyocera Corporation, and Sharp Corporation to invest its capital into advancing its technology and realigning products to match market shifts.

Sharp and GE Solid State have invested in WSI through equity positions, and both companies hold WSI technology licenses. Altera and Intergraph are two additional strategic alliances involving either equity and/or technology. The Kyocera alliance involves equity and distribution of WSI products in Japan.

WSI's products are manufactured at Sharp Corporation's plant at Fukuyama, Japan. The facility produces 5-inch wafers with 1.2-micron CMOS VLSI circuits in a Class 1 clean room environment. In the United States, GE/RCA manufactures circuits for WSI in a Class 10 facility, using 1.0-micron CMOS on 5-inch wafers.

WSI's products are sold worldwide through a sales network that includes a combination of regional and direct sales managers, manufacturers' representative companies, and components distributors.

## BOARD

(Name and Affiliation)

Irwin Federman, Chairman  
WaferScale Integration, Inc., CEO

Harry Marshall  
J.H. Whitney

James Swartz  
Accel Partners

Donald K. Grierson  
General Electric Corporation

Richard Santilli  
RCA Corporation

Henry Kressel  
Warburg Pincus Capital Partners

# WaferScale Integration, Inc.

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### CEO/Acting

Irwin Federman

Concord Venture, Partner

### VP Finance

Robert J. Barker

MMT, Mgr Finance

### VP Systems Production

Zel A. Diel

GigaBit Logic, VP Prod Dev

### VP Process Technology

Yale Ma

STC Computer, Mgr Wafer Fab Ops

### VP Operations

Steve Sanghi

Intel, GM Prog Memory Ops

### VP Device

Boaz Eitan

Intel, Mgr Device Physics

### VP WW Sales

Thomas Branch

Micro Genesis, Principal

## FINANCING

February 1984

Round 1

\$16.1M

Accel Partners; Adler & Co.; Bessemer; Genevest (Switzerland); Intergraph; Oak Investment Partners; Robertson, Colman & Stephens; Smith Barney Venture Corp.; Tadiran (U.S.) Inc.; Venture Partners II; Warburg-Pincus; J.H. Whitney

Lease

Bank of America, Bateman Eichler Leasing Corp., Equitec

November 1984

Round 2

\$8.5M

Original investors, Baillie Gifford & Co. (Scotland), Continental Illinois Venture Corp.

April 1986

Round 3

\$13.0M

Original investors, Intergraph Corp., RCA Corporation, Sharp Corporation

July 1987

Round 4

\$8.0M

Accel Partners; Adler; Bessemer Venture Partners; GE/RCA; Intergraph Corp.; Kyocera; Robertson, Colman & Stephens; Warburg Pincus; J.H. Whitney

## RECENT HIGHLIGHTS

June 1987

WSI received a patent on its self-aligned, split-gate CMOS EPROM process.

July 1988

WSI introduced the WS57C51B, a 16Kx8-bit CMOS PROM, which is user-reprogrammable and consumes one-fourth the power of equivalent bipolar densities.

July 1988

WSI introduced its "L" series of low-power EPROMs, available in 128Kx8, 64Kx8, and 32Kx8 configurations.

July 1988

WSI introduced the MAP168 Mappable Memory Subsystem, which functionally integrates a memory subsystem into a single device.

October 1988

WSI announced the PAC1000, a high-performance, 16-bit microcontroller, the first of WSI's new class of user-configurable Programmable System Devices (PSD).

## ALLIANCES

Sharp

December 1984

WSI agreed to allow Sharp to use its technology and produce a 64K CMOS EPROM. WSI received manufacturing capacity and royalties. Development and production of 256K CMOS EPROMs were planned.

## October 1985

WSI and Sharp expanded the 1984 agreement to include WSI's 1.6-micron CMOS technology in exchange for royalties and foundry capacity.

## GE/RCA and Sharp

March 1986

GE/RCA and Sharp signed a five-year agreement with WSI to develop an advanced cell library. WSI's library of LSI macrocells will be combined with cell libraries from GE/RCA and Sharp. The companies also jointly developed 1.0-micron cell libraries, advanced tools, packaging techniques, high-speed EPROMS, and other high-performance standard products. The alliance gives WSI alternative sources of chips and a springboard into the market in Japan.

July 1987

WSI and GE/RCA expanded the terms of their previous EPROM agreement to include U.S. manufacturing. Under a long-term foundry agreement, WSI will be guaranteed volume capacity at GE/RCA's new 5-inch wafer fab module in Findley, Ohio. WSI will transfer its

1.2-micron fast CMOS EPROM process to Findley. GE/RCA will use the process to manufacture ASIC circuits and second-source some of WSI's EPROM memory products.

## Altera and Sharp

January 1987

Altera and WSI announced a five-year technology relationship to develop a new family of standalone microsequencer products with wafers manufactured by Sharp of Japan.

## MANUFACTURING

### Technology

SCMOS I: 2.0-micron, double-metal CMOS  
SCMOS II: 1.0-micron, double-metal CMOS  
4- and 5-inch wafers

### Facilities

Fremont, CA  
66,000 sq. ft.  
Design, test, marketing, sales, administration

## PRODUCTS

### Memory

Device	Organization	Access Time
WS57C191/291	2Kx8 R PROM	45ns
WS57C43	4Kx8 R PROM	35, 55ns
WS57C49	8Kx8 R PROM	35, 55ns
WS57C51	16Kx8 R PROM	40, 70ns
WS27C64	8Kx8 Byte-Wide EPROM	55, 90ns
WS57C128	16Kx8 Byte-Wide EPROM	55, 90ns
WS57C256	32Kx8 Byte-Wide EPROM	55, 90ns
WS57C65	4Kx16 Word-Wide EPROM	55ns
WS57C257	16Kx16 Word-Wide EPROM	55ns

### Microcomponents

WS5901	4-Bit Bit-Slice Processor	43 MHz
WS59016	16-Bit Bit-Slice Processor	432 MHz
WS59032	32-Bit Bit-Slice Processor	25 MHz
WS5910	Microprogram Controller	30 MHz
WS59520	Multilevel Pipeline Register	45 MHz
WS59510	16X16 Multiplier/Accumulator	30ns
WS59820	16-Bit Bidirectional Bus Interface Register	50 MHz

## **WaferScale Integration, Inc.**

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### **ASICs**

#### **Modular Cell Library**

**Combines EPROM and System Functions with 1.2-Micron Technology to Produce Devices with Sub-1.0ns Delay. Functions Include 4-Bit to 32-Bit Bit-Slice Processors, Microprogram Controllers, Variable Pipelines, FIFOs, Multipliers, Bus Registers, Register Files, ROM, RAM, PLD, 75 Gates, and 26 MSI.**

### **OTHER INFORMATION**

**WSI's PR firm is Capithorne and Bellows.**

# Weitek Corporation

1060 East Arques Avenue

Sunnyvale, CA 94086

408/738-8400

Fax: 408/739-4374

Telex: 910-339-9545

ESTABLISHED: 1981

NO. OF EMPLOYEES: 134

## BACKGROUND

Weitek designs, manufactures, and markets digital signal processing circuits for high-performance numerics-processing applications. The Company's goal is to make arithmetic-processing power available on a broad scale to systems developers. The Company's product strategy is to offer a complete range of products, including building blocks that achieve maximum system performance, attached processors for maximum price/performance, and coprocessors for the lowest system cost.

In March 1988, Weitek introduced three new products. The WTL2364 multiplier/WTL2365 ALU chip set is a double-precision vector floating-point processor chip set that implements the IBM 370 Basic Floating-Point Facility standard. It is capable of 32 million floating-point operations per second (mflops) for single-precision operations and up to 16 mflops for double-precision operations. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak rate of 20 mflops for the 100ns speed grade. The floating-point processors each integrate a 64-bit multiplier, a 64-bit ALU, a divide/square-root unit, a 32-word by 64-bit six-port register file, and status and control logic on one chip.

Currently, the Company purchases wafers in the foundry market from VLSI Technology Inc. Long-term wafer processing is guaranteed under agreements with Cypress Semiconductor, Hewlett-Packard Company (HP), and Intel Corporation. Processes available to Weitek are 2.0-micron NMOS and 1.5-micron double-metal CMOS from Intel, 1.2-micron CMOS from HP, 1.2-micron double-metal CMOS from Cypress, and 1.5-micron NMOS and CMOS from VLSI Technology.

Weitek was founded in 1981 by Godfrey Fong, Dr. Edmund Sun, and Dr. Chi-Shin Wang and operated initially as a custom design house specializing in ROMs. In 1985, the Company began offering advanced circuit design semiconductors that use advanced concepts in numerics processing.

## BOARD

(Name and Affiliation)

G. Leonard Baker  
Sutter Hill Ventures

Arthur J. Collmeyer  
Weitek Corporation

David House  
Intel Corporation

Gerald Lodge  
InnoVen Partners

Arthur Reidel  
Alex Brown

James Patterson  
Quantum Corporation

W. Frank King III  
Lotus Development Corp.

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

**President**  
Arthur Collmeyer  
Calma, VP/GM Microelec Div

**VP Sales**  
Robert T. Derby  
Intel, Dir WW Sales/Mktg

**VP Operations**  
Steven Farnow  
Visic, Dir Ops

# Weitek Corporation

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## VP Marketing

John F. Rizzo  
Apple, Mktg Mgr

## VP Finance

A. Brooke Seawell  
Southwall Tech, VP Finance/Admin

## VP Admin

John Steinhart  
Stanford Univ, Dir Sloan Program

## VP IC R&D

John J. Barnes  
SGS-Thomson, Dir Tech Dev

## FINANCING

### January 1981

Round 1  
\$1.0M  
InnoVen

### February 1982

Round 2  
\$1.3M  
InnoVen, Sutter Hill Ventures

### March 1983

Round 3  
\$2.2M  
InnoVen; Institutional Venture Partners;  
Merrill, Pickard, Anderson & Eyre; Sutter  
Hill Ventures

### January 1986

Round 4  
\$3.0M  
All of the above, Alex Brown, Glynn Capital

### September 1988

IPO  
\$8.4M  
Initial public offering

## RECENT HIGHLIGHTS

### March 1988

Weitek introduced three new products. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak

rate of 20 mflops for the 100ns speed grade. The WTL2364 multiplier and WTL2365 ALU chip set is a double-precision vector floating-point processor chip that implements the IBM 370 Basic Floating-Point Facility standard.

### April 1988

Weitek announced that the WTL1167 floating-point coprocessor is featured as an option in the new Sun 386 workstation family.

### March 1989

Weitek announced the XL-8832 floating-point RISC processor, developed for Digital Equipment Corporation to deliver 3-D graphics performance to Digital's VAXstation 3520 and VAXstation 3540 midrange graphics workstations.

### April 1989

Weitek announced the Abacus 3170 and Abacus 3171, the first single-chip floating-point coprocessors for the SPARC architecture, in speed grades ranging from 20 to 40 MHz.

### May 1989

Weitek introduced the Abacus 4167, a floating-point coprocessor for the Intel 80486 microprocessor that completes math operations five to six times faster than the 486's on-chip floating-point unit.

## ALLIANCES

### Cypress

#### October 1985

Weitek and Cypress made an agreement to jointly develop a series of high-performance VLSI logic circuits designed by Weitek and manufactured using Cypress' 1.2-micron CMOS process. The circuits are designed for telecommunications, graphics, instrumentation, military, and CAD/CAM applications.

### Intel

#### October 1985

Weitek agreed to develop an interface IC that Intel would second-source and for which Intel would provide foundry services on 6-inch NMOS and CMOS wafer-processing equipment.

## NSC

October 1985

National Semiconductor announced that it would design, manufacture, and market an interface chip.

## Step Engineering

March 1986

Step Engineering agreed to produce development tools for the debugging and microcoding of Weitek's floating-point integer processor designs.

## Quadtree

April 1986

Weitek announced that Quadtree Software would develop behavioral simulators for the WTL2264/2265 chip sets.

## Matra-Harris

May 1986

Weitek and MHS signed a technology exchange and foundry agreement. MHS was granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process.

## Hewlett-Packard

May 1987

Hewlett-Packard would incorporate the Weitek model 2264/2265 chip set for high-performance, floating-point computation in current and future HP Precision Architecture computers. HP would manufacture the chip, using a 1.2-micron CMOS process.

## Matsushita

November 1988

Weitek entered into a manufacturing agreement with Matsushita Electric Corporation, whereby Matsushita agreed to manufacture Weitek's higher volume processor and coprocessor products using its 1.2- and 1.5-micron CMOS process technologies. This agreement complements Weitek's existing manufacturing agreements, forged with Hewlett-Packard and VLSI Technology.

## Toshiba

November 1988

Weitek signed an agreement with Toshiba wherein the two companies will cooperate in the development of high-performance numeric semiconductors. As part of the agreement, Weitek will receive manufacturing services from Toshiba's 1.0-micron CMOS and 1.5-micron BiCMOS production processes. Weitek will provide floating-point unit technology to Toshiba for use in certain Toshiba products.

## MANUFACTURING

### Technology

2.0- and 1.5-micron NMOS  
1.2-micron, one-level metal CMOS  
1.5-, 1.2-, 1.0-, 0.8-micron, two-level CMOS

### Facilities

Sunnyvale, CA  
50,000 sq. ft.  
Administration, design, R&D

## PRODUCTS

### 16-Bit Integer Family

Device	Description	Speed
WTL2516	16x16 Parallel Multiplier	38ns
WTL2517	16x16 Parallel Multiplier	38ns
WTL2010	16x16 Multiplier/Accumulator	45ns
WTL2245	16x16 Multiplier/Accumulator	45ns

### 32-Bit Floating-Point Family

WTL1232/1233	Multiplier/Adder	10 mflops
WTL3132	Data Path Unit	20 mflops
WTL3332	Data Path Unit	20 mflops

# Weitek Corporation

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## 64-Bit Vector Floating-Point Family

Device	Description	Speed
WTL1264/1265	Multiplier/Adder	8 mflops
WTL2264/2265	Multiplier/ALU	20 mflops
WTL2364/2365	Multiplier/ALU, Double-Precision	32 mflops

## 64-Bit Floating-Point Coprocessor Family

WTL1167	80386 Coprocessor	3.5 mflops
WTL1164/1165	Multiplier/Adder/Divider	3.5 mflops
WTL3164	Data Path Unit	100ns, 20 mflops
WTL3364	Data Path Unit	100ns, 20 mflops
Abacus 3167	80386 Coprocessor	20, 25, 33 MHz
Abacus 3168	68020/030 Coprocessor	20, 25, 33 MHz
Abacus SPARC	SPARC Coprocessors	20, 25 MHz
Abacus 3171	SPARC Coprocessors	25, 33, 40 MHz

## XL-Series Family

XL-8000	32-Bit Integer Processor	8 mips
XL-8032	32-Bit Single-Precision Processor	8 mips, 20 mflops
XL-8064	64-Bit Double-Precision Processor	7 mips, 20 mflops
XL-8136	Program Sequencing Unit	
XL-8137	Integer-Processing Unit	
XL-8200	32-Bit Hyperscript Processor	1 mflop
XL-8232	32-Bit Hyperscript Processor	20 mflops
XL-8832	32-Bit Single Precision Processor	20 mflops

## Development Tools for the XL-Series Family

XL-Series C Compiler-Based Software Development Environment  
XL-Series FORTRAN-Based Software Development Environment

PS-8000	XL-Series Prototyping System for the XL-8000
PS-8032	XL-Series Prototyping System for the XL-8032
PS-8064	XL-Series Prototyping System for the XL-8064

Functional Simulators for All Weitek Components

## OTHER INFORMATION

Weitek's PR firm is Regis McKenna, Inc.



# Wolfson Microelectronics Limited

Lutton Court,  
20 Bernard Terrace  
Edinburgh, EH8 9NX Scotland  
031/667-9386  
Fax: 031/667-5176  
Telex: 727659

ESTABLISHED: January 1985

NO. OF EMPLOYEES: 28

## BACKGROUND

Wolfson Microelectronics Limited designs, manufactures, and markets ASICs and specializes in the development of complex mixed analog and digital circuits. The Company offers IC design using semicustom and full-custom approaches including gate arrays with up to 20,000 gates; cell-based libraries in 3.0-, 2.0-, 1.5-, and 1.2-micron CMOS technology; and full-custom design using a range of CMOS and bipolar technologies.

Wolfson Microelectronics Limited evolved from the Wolfson Microelectronics Institute at Edinburgh University. The Company, although completely autonomous, retains its technological links with the academic research activities of the university.

The Company has developed an extensive CAD capability based on a network of Sun workstations to provide an integrated design environment for semicustom and structured custom design. The emphasis of its work has been signal processing. The Company has developed a 2-micron digital library of macro cells with variable parameters for digital designs and an extensive analog library of linear and nonlinear functions.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position and Name)

**Managing Director**  
David Milne

**Technical Director**  
James Reid

**Finance Manager**  
Neil Hattersley

## FINANCING

Not available

## ALLIANCES

Wolfson has manufacturing arrangements with AMS, Fujitsu, Mietec, and SGS-Thomson dating from 1985.

## MANUFACTURING

### Technology

All processes are for second-sourcing capability.

- 1.2-, 1.5-, 2.0-, 3.0-Micron SPSM/SPDM CMOS Digital Process
- 2.0-Micron SPDM BiMOS Analog Process
- 2.0-Micron SPDM CMOS Analog Process
- 3.0-Micron DPDM/DPSM CMOS Analog Process
- 4.0-Micron DPSM CCD Analog Process
- 5.0-Micron DPSM CMOS Analog Process

# Wolfson Microelectronics Limited

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## PRODUCTS

### Current Products

Device	Description
WM 2020	Dual 15-Pt Tapped Delay Line
WM 2210	Dual 15-Pt Tapped Delay and Integrate
WM 2120	64-Pt Programmable Transversal Filter
WM 2130	256-Pt Programmable Transversal Filter
PWM 213	512-Pt Correlator Module
PWM 215	1,024-Pt VME Correlator Module

### Future Products

WM 3201	Fifth Order, Low-Pass Elliptical Continuous Time Filter; Cutoff 5 KHz to 50 KHz
WM 33XX	Semicustom Switched Capacitor Family
WM 5110	128-Pt Complex Digital Programmable Transversal Filter
WM 5120	Digital Programmable Transversal Filter Controller

## OTHER INFORMATION

Wolfson Microelectronics does not employ a PR firm.

# Xilinx Incorporated

2100 Logic Dr.  
San Jose, CA 95125  
408/559-7778  
Fax: 408/559-7114

ESTABLISHED: February 1984

NO. OF EMPLOYEES: 150

## BACKGROUND

Xilinx Incorporated is a leading supplier of user-programmable gate arrays for the ASIC market. The Xilinx Logic Cell Array (LCA) uses specially designed static memory cells to store logic and interconnection configuration information generated by Xilinx design software.

The Company was founded by James Barnett, Ross Freeman, and Bernard Vonderschmitt, all formerly with Zilog. Xilinx introduced its first logic cell array, which consists of 1,000 to 1,500 equivalent two-input NAND gates, in November 1985. Since then, products with complexities of up to 9,000 gates have been added and are the largest available today. Designs are performed on PC ATs, and Apollo, Digital, and Sun workstations.

The Company has set up several barriers to entry, including patents, extensive development system software, advanced CMOS process technology, and alternative sources. Advanced Micro Devices is a second source of the Company's logic cell arrays and development system. Xilinx has a foundry arrangement with Seiko Epson, which produces the devices in the Suwa, Japan, plant.

The Company's devices and associated development systems are sold by a sales force that includes five sales offices in North America and one each in the United Kingdom and in Japan; 12 field-application engineers; 60 manufacturer's representatives worldwide; 54 North American distributor branches, including Hamilton-Avnet, Marshall, Insight, and Western Microtechnology; and 15 international distributor locations.

## BOARD

Not available

## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President

\*Bernard Vonderschmitt  
Zilog, VP/GM IC Div

### VP Admin

\*James Barnett  
Zilog, Prod Line Dir

### VP Eng

\*Ross Freeman  
Zilog, Dir Eng

### VP Sales

R. Scott Brown  
Menlo Corp., VP Sales

### VP Ops

Frank Myers  
Exel, VP Ops

### VP Mktg

Wes Patterson  
VLSI, Dir Ops

### VP Finance/CFO

Gordon Steel  
Pyramid, VP Finance/Admin

\*Founder

## FINANCING

### March 1984

Round 1

\$2.8M

Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; J.H. Whitney & Co.

### December 1985

Round 2

\$8.3M

Round 1 investors, Berry Cash Southwest Partnership, InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners

# Xilinx Incorporated

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January 1987

Round 3

\$6.4M

Round 1 investors: Fleming Ventures Ltd., InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners, Security Pacific, Monolithic Memories Inc.

August 1988

Round 4

\$3.5M

Round 1 investors, others

## RECENT HIGHLIGHTS

January 1987

Xilinx raised \$3.4 million in third-round financing.

October 1987

Xilinx offered the XC3020, the first in a family of 1.2-micron, user-programmable gate arrays with 1,800 to 2,400 two-input NAND gates and a 40-MHz system clock rate.

November 1987

Xilinx introduced the XC3090, a 9,000-gate, user-programmable gate array.

November 1987

Xilinx's user-programmable gate arrays are available on Viewlogic Systems' Workview workstation. The support allows design and logic simulation on IBM PC ATs.

March 1989

Xilinx introduced the first user-programmable gate arrays to be fully compliant with MIL-STD 883, Class B.

## PRODUCTS

### Logic Cell Arrays (LCAs)

Device	Description
XC2064	1,200 gates
XC2018	1,800 gates
XC3020	2,000 gates
XC3030	3,000 gates
XC3042	4,200 gates
XC3064	6,400 gates
XC3090	9,000 gates

## ALLIANCES

Seiko-Epson

December 1985

Xilinx and Seiko-Epson agreed to codevelop LCAs and development systems. Seiko-Epson will manufacture the LCAs, using Xilinx's proprietary technology. The companies also agreed on the joint development of Seiko-Epson's CMOS process. Seiko Epson gained nonexclusive marketing rights to the LCA product in Japan.

MMI/AMD

June 1986

Xilinx and MMI signed a three-year agreement allowing MMI to manufacture and market Xilinx's LCAs and development system. The first product transferred was the XC2064, a 1,200-gate device. Xilinx will supply future members of the LCA family to MMI as they become available. Xilinx also has given rights to market the XACT development system and the Xactor in-circuit emulator. The two companies will cooperate in extending software support for LCA products.

## MANUFACTURING

### Technology

1.2-micron double-metal silicon-gate CMOS  
6-inch wafers

### Facilities

San Jose, CA

100,000 sq. ft.

R&D, design, marketing, and test

XACT Gate Array Development System with In-Circuit Emulation  
LCA Development System, Hardware and Software  
XC2064, UART Design with Encryption/Decryption  
Logic Synthesis Software

**OTHER INFORMATION**

Xilinx Inc.'s PR firm is Capithore and Bellows.

**XTAR Corporation**  
9915 Business Park Avenue, Suite C  
San Diego, CA 92131  
619/271-4440

**ESTABLISHED:** September 1982

**NO. OF EMPLOYEES:** 9

### BACKGROUND

XTAR electronics designs, develops, and manufactures graphics microprocessors, video shift registers, board-level products, and graphics systems. The Company concentrates on the design and development of new products.

XTAR funded the formation of the Company and development through its sales. It has developed a graphics microprocessor (GMP), a video shift register (VSR), and board-level products. Its GMP, a full-custom device, is designed to replace 400 devices with two chips. The VSR uses a standard-cell CMOS process technology. All of XTAR's products were sampled in September 1984, and production quantities were available in the fourth quarter of 1984. XTAR contracts wafer fabrication.

### BOARD

Not available

### COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

#### President

Anthony J. Miller  
Universal Research Labs, Dir Engineering

### PRODUCTS

Device	Description
X1001/1002	Graphics MPU Chip Set
X1003	Video Shift Register
PG-2000	PC AT Graphics Board - Real-Time 3D Animation
AP-2000	20 MFLOPS 32-Bit Array Processor
Falcon-PC	PC AT Based Real-Time Graphics System -1024 x 1024 or 1024 x 768 -256 Colors from Palette of 4096 or 16.7M -Displays 30,000 Flat-Shaded Polygons/SEC -Fills Polygons AT 160 Million Pixels/SEC

### OTHER INFORMATION

XTAR's PR firm is Nufter, Smith and Tucker.

#### VP Engr

Terrence Coleman  
Universal Research Labs, Chief Engineer

#### Dir Mktg/Sales

Richard K. Thistle  
Spectragraphics Corp, Product Mktg Manager

### ALLIANCES

#### Fairchild

September 1986 Fairchild and XTAR signed an alternate-source agreement for XTAR's X1000/X1002 Graphics MPU chip set, which Fairchild will redesign for manufacture using the FACT (Fairchild Advanced CMOS Technology) fabrication process.

### MANUFACTURING

#### Technology

3.0-micron CMOS and NMOS  
1.2-micron CMOS  
4-inch wafers

#### Facilities

San Diego, CA  
6,000 sq. ft.  
Design

## Zoran Corporation

3450 Central Expressway

Santa Clara, CA 94051

408/720-0444

Fax: 408/720-9875

ESTABLISHED: 1983

NO. OF EMPLOYEES: 70

### BACKGROUND

Zoran Corporation designs, manufactures, and markets proprietary systems processors and programmable peripherals devices for the digital signal-processing (DSP) market. The Company is focusing on a unique systems design approach and combines VLSI and DSP to integrate DSP functions on single chips.

In June 1986, the Company offered two digital-filter processors (DFPs) and a vector signal processor (VSP) in addition to hardware support tools for the VSP. During 1987, Zoran offered new VSP devices, including a VLSI product that implements the IEEE 32-bit FFT algorithm and two 25-MHz and 30-MHz products. In addition, Zoran offered an image compression processor (ICP), which is a scaled-down version of the VSP.

To accelerate the implementation of its processors in end-user products, the Company has embedded algorithms and high-level instructions in the hardware. Zoran's integration of software algorithms and optimized hardware in its systems processors provides ease of design, high reliability, high performance, and optimized architectures.

Zoran, a privately held company, was cofounded by Dr. Levy Gerzberg and Yuval Almog. Prior to founding Zoran, Dr. Gerzberg was associate director of and senior research associate at the Stanford University Electronics Laboratory.

Mr. Almog served in management positions at Raychem Corporation where he was responsible for military electronics marketing and resource planning. Zoran's systems approach to products is based on the research conducted by the cofounders.

In December 1987, Dale Williams joined Zoran as president and chief executive officer from Rockwell, replacing John Ekiss who resigned in

May. Mr. Williams was formerly vice president and general manager of Rockwell International's Far East Operations, divisional manager with Intel, and founder of Monolithic Memories. Mr. Williams will be expanding the Company's marketing effort, particularly in Japan, and directing the Company's move into telecommunications and instrumentation products.

In December 1987, Zoran sold its fabrication facility to Synergy Semiconductor for \$4 million in cash and notes. The Company stated that the fab, purchased at low cost from Storage Technology in late 1985, served its purpose of facilitating the rapid development of Zoran's first three product families to get to market quickly. In 1988, many of Zoran's customers entered production, a situation that outstripped the capacity of the R&D fab. The cost of expanding the fab's capacity and upgrading it to a more advanced process technology was not justified in light of the availability of existing foundries worldwide.

In April 1988, Zoran announced that it opened a Far Eastern headquarters facility in Tokyo, Japan. Heading the facility will be General Manager Noboru Iino, formerly Tokyo operational director at Rockwell Semiconductor. Under Mr. Iino's direction, the facility will provide local user-application engineering support, as well as marketing and sales direction. The Company hopes to capture a share of the DSP applications in the growing Japanese data compression market.

Zoran has a direct sales force with offices in Santa Clara and Los Angeles, California; Boston, Massachusetts; Chicago, Illinois; Tokyo, Japan; and Paris, France; and a worldwide network of manufacturers' sales representatives.

### BOARD

Not available

# Zoran Corporation

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## COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

### President/CEO

\*Dr. Levy Gerzberg  
Stanford Electronics Lab, Assoc Director

### GM Far East Ops

Noboru Iino  
Rockwell International, Tokyo Ops Dir

### GM/European Ops

Jean-Pierre Garnier  
Rockwell International, Euro Ops Dir

\*Founder

## FINANCING

### August 1983

Round 1  
\$3.5M  
Adler & Company; Elron Electronics Industries,  
Ltd., Israel

### 1984

Round 2  
\$1.5M  
Previous investors

### October 1985

Round 3  
\$22.0M  
Previous investors; Concord Partners; Grace  
Ventures Corp.; Investment Advisors, Inc.;  
Kleiner, Perkins, Caufield & Byers; Mitsui &  
Co. Inc. (USA); Montgomery Securities; Vista  
Ventures; Welsh, Carson, Anderson & Stowe

### April 1987

Round 4  
\$6.8M  
Adler & Company; Concord Partners Elron  
Electronics Industries, Ltd.; Grace Ventures  
Corp.; Kleiner, Perkins, Caufield & Byers;  
Mitsui & Co. Inc.; Montgomery Securities;  
Vista Ventures; Welsh, Carson, Anderson &  
Stowe

### May 1988

Harris Corporation bought 10 percent equity in  
Zoran Corporation.

## RECENT HIGHLIGHTS

### December 1986

Zoran offered a low-cost version of its VSP (VSP-10) and two personal computer development boards for the VSP. The VSP-10 is optimized for DSP applications and operates at 10 MHz versus 20 MHz for the VSP-20. The VSP-10 is aimed at instrumentation, medical imaging, and telecommunications applications.

To support the VSP chips, Zoran also introduced two development boards, the VSPX and VSPE, for use with an IBM PC XT or PC AT.

### March 1987

Zoran introduced Support Tool Environment (STE), a development tool kit that addresses VSP and DFP. Zoran embedded the basic algorithms required in fixed, on-chip logic.

### June 1987

Zoran offered an ICP, which is a scaled-down version of the VSP. The device is pin-compatible with the VSP-161, with its instruction set reduced for image applications. The device, which the Company says is the first in the marketplace, targets electronic publishing, satellite, electronic camera, picture data base, and broadcasting applications.

### November 1987

Zoran offered the ZR33891-25, a 25-MHz digital filter processor; and ZR33891-30, a 30-MHz digital filter processor. The devices are upgraded digital filter processors designed for imaging, HDTV, and digital radio applications.

### December 1987

Zoran sold its 50,000-square-foot fabrication facility for \$4 million in cash and notes.

### December 1987

Zoran offered the ZR34161 VSP in a 52-pin, ceramic J-leaded package. The device is available in 15-, 20-, and 25-MHz speeds.

### April 1988

Zoran announced that it has opened a Far Eastern headquarters facility in Tokyo, Japan.



**ALLIANCES**

**IMP**

June 1983

IMP and Zoran codeveloped a CMOS PROM technology.

**Toshiba**

January 1988

Zoran and Toshiba agreed to a technology and manufacturing alliance.

**SGS-Thomson**

March 1988

Zoran and SGS-Thomson agreed to a technology and manufacturing alliance.

**MANUFACTURING**

**Technology**

1.0- to 2.0-micron, two-level metal CMOS  
4-inch, 5-inch, and 6-inch wafers

**Facilities**

Santa Clara, CA

Headquarters, design

Haifa, Israel

Design center

Tokyo, Japan

Marketing/Sales

Paris, France

Marketing/Sales

**PRODUCTS**

**Digital Filter Products**

**Device**

**Description**

ZR33491	Four Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33881	Eight Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33891	Eight Cells; 9x9-Bit Arithmetic; 15, 20, 25, 30 MHz
ZR37381	16 Beat ALU Compatible with the LDI ALU
ZR33771	2D Converter 3x3 Symmetrical 40 MHz to 7x7 10 MHz Video rate

**Vector Signal Processors**

ZR34161	16-Bit Block Floating-Point DSP; 20, 25 MHz
ZR34325	32-Bit IEEE Floating-Point DSP; 25 MHz
ZR34322	32-Bit Block Floating-Point DSP; 20, 25, 30 MHz

**Image Compression Processor**

ZR36010	Discrete Cosine Transform Processor; 20, 25, 30 MHz
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**Development Tool Hardware**

VSPX	ZR34161 Array Processor Board for IBM AT, 16K RAM, 10 MHz
VSPA	ZR34161 Array Processor Board for IBM XT, 16K RAM, 20 MHz
VSPD	ZR34161 Array Processor Board for IBM AT, 64K RAM, 20 MHz, I/O
DFPB	ZR39481/881 Digital Filter Board for IBM AT; 15, 20 MHz
ZRPD	ZR34325 Development System for the ZR34325 Floating-Point Processor

**Development Tool Software**

VSPS	ZR34161 Simulator
VSPA	ZR34161 Assembler
DFPS	Digital Filter Design Software
ZSPS	ZR34325 Software Tool Package

# Zoran Corporation

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## Board/Subsystem

ZR73650      IEB (Image Engineering Board), AT-Compatible Board that supports  
development of imaging algorithms

## OTHER INFORMATION

Zoran Corp. does not employ a PR firm.

# Dataquest

**DB** a company of  
The Dun & Bradstreet Corporation

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