

Sun Ultra 24 Workstation Just the Facts

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Table of Contents - Ultra 24 Just The Facts

.....	3
.....	3

Introduction.....4.....

Target Workloads.....5.....

Software Development.....5.....

 Software Development.....5

 Development.....5

 Electronic Design Automation (EDA).....5

 Mechanical Computer Aided Design (MCAD).....5

Features.....6.....

Value Propositions.....7.....

System Architecture.....9.....

 Intel Core 2 Architecture.....11

 Intel X38 Express Chipset.....12

 PCI Express Gen 2.....12

 Expansion Slots.....13

Expansion Slots.....13.....

 Memory.....14

Memory.....14.....

Expansion Bays.....15.....

 Hard Disk Drives (HDD).....15

 Optical Disk Drives (ODD).....15

 Connectivity.....16

Graphics Accelerators.....17.....

 NVIDIA Quadro FX 5600 Graphics Accelerator Card.....18

 NVIDIA Quadro FX4600 Graphics Accelerator Card.....19

 NVIDIA Quadro FX 3700 Graphics Accelerator Card (Available Q4CY07 – INFORMATION IS CONFIDENTIAL).....20

 NVIDIA Quadro FX1700 Graphics Accelerator Card.....21

 NVIDIA Quadro FX1700 Graphics Accelerator Card.....21

 NVIDIA Quadro FX570 Graphics Accelerator Card.....22

 NVIDIA Quadro NVS 290 Graphics Card.....23

Displays.....24.....

Operating Systems.....25.....

Availability & Ordering.....26.....

 Assemble to Order (ATO).....27

 Standard Configuration.....28

 X-Options.....28

 Field Replacement Units (FRUs) and Customer Replacement Units (CRUs).....29

 Country Kits (Mouse, Keyboard, Power Cords).....30

Appendix.....31.....

 Comparison: Sun Ultra 24 Workstation versus Sun Ultra 25 Workstation.....32

Additional Sun Ultra 24 Workstation documentation.

Title	Sunwin Token # or URL
Sun Ultra 24 Workstation – Technical White Paper	508690
Sun Ultra 24 Workstation – Product Datasheet	508685
Sun Services Datasheet for x64 workstations	443663
Sun Services for Ultra 24 @ a Glance	509345
Sun Ultra 24 Photos	http://photos.sun.com/page/588
Sun Ultra 24 Workstation – Customer Presentation	508687
Sun Ultra 24 Workstation – Technical Presentation	508689
Sun Ultra 24 Workstation – Reviewer's Guide	509346
Sun Ultra 24 Workstation – Benchmark Results	http://www.sun.com/desktop/workstation/ultra24/benchmarks.jsp
Sun Ultra 24 Workstation – ISV Certification	http://www.sun.com/x64/mcad/
Sun Ultra 20 M2 Workstation – Just the Facts	447754
Sun Ultra 25 Workstation – Just the Facts	473547
Sun Ultra 40 M2 Workstation – Just the Facts	484050
Solutions Brief for EDA	429802
Solutions Brief for MCAE	429805
Solutions Brief for MCAD	450625
Success Stories	http://www.sun.com/x64/success-stories/
Sun Ultra 24 Workstation - Service Manual	http://sundev.central/docs/pending/products-n-solutions/hardware/docs/Workstation_Products/Workstations/ultra_24/index.html
Sun Ultra 24 Workstation – Installation Guide	
Sun Ultra 24 Workstation - Product Notes	
Sun Ultra 24 Workstation - OS Installation Guide	
Sun Ultra 24 Workstation – Safety and Compliance Guide	or http://docs.sun.com/app/docs?q=Sun+Ultra+24&s=t

Introduction

Professionals prefer to use the highest-quality, highest-performing tools. Such tools best enable the fullest talents of an engineer or a software developer, allowing them to express themselves, their vision, and their skills to the greatest effect. Organizations employing these tools get products to market more quickly, and with higher quality than organizations that employ lesser tools.



Figure 1 – Sun Ultra 24 Workstation

The Sun Ultra 24 Workstation, Sun's first Intel processor based workstation, demonstrates Sun's commitment to deliver the broadest range of technical workstation platforms in the industry. Based on the Intel® Core™2 Duo architecture and supporting both dual and quad core processors, Sun's Ultra 24 Workstation is one of most compelling workstations in the industry today. Targeted toward meeting the Intel workstation requirements of Fortune 1000 companies, the Sun Ultra 24 Workstation supports a wide range of operating systems including Solaris, Windows XP, Windows Vista, SUSE and RedHat all at a starting price under \$1,000. With a single architecture, the Sun Ultra 24 Workstation supports both 32-bit and 64-bit operating systems and applications, offering flexibility for customers who want to run existing 32-bit operating systems and applications and at the same time migrate to the next-generation 64-bit operating systems and applications. The Sun Ultra 24 Workstation has been designed to meet or exceed the buying criteria of the discerning workstation buyer, and at an aggressive price point.

Ranging from the Intel® Core™2 Dual core to the Intel® Core™2 Quad core, from simple 2D graphics to the highest performance NVIDIA Quadro® graphics, from Microsoft Windows XP to Solaris, the Sun Ultra 24 workstation delivers the best solutions for the widest range of technical computing requirements.

Target Workloads

Customer requirements for workstations vary by market segments. In market segments such as software development, programmers care about fast compilations and the tight integration of development tools on the workstation. In the EDA segment, ASIC or CPU designers run processor-intensive applications and usually evaluate a workstation based on its published SPEC CPU2000 benchmark results. In market segments such as MCAD, mechanical engineers run applications that require not only high processor performance but mid-range to high-end 3D graphics performance as well, and they therefore also evaluate a workstation based on its published SPECviewperf 9 benchmark results. Examples of primary needs for each market segment are explained in the next three paragraphs and also summarized later in Table 1.

Software Development

Software engineers value binary compatibility, reliability, scalability and convenience for their projects. Software engineers demand a workstation pre-installed with software development tools for them to start their project immediately. It is a powerful feature to have the ability to offer a cost-effective Solaris platform on which they can develop and test software applications that will eventually run on higher-end Solaris-based servers. Software engineers tend to develop code on standalone workstations with back-end servers for final compilation and integration.

Electronic Design Automation (EDA)

The most complex IC projects, including the Sun UltraSPARC T1 processor with 32 simultaneous processing threads, are completed on a Sun workstation. Sun workstations run applications from companies such as Mentor Graphics, Cadence Designs, and Synopsys, which are used to design, verify, and test complex IC products for the consumer and commercial market. Many companies have also developed in-house applications that run on Solaris and Linux. The complexity of IC devices is increasing dramatically and it is not uncommon to find devices with hundreds of millions of gates. Since the simulation run time of a device with 500M gates is much longer than a device with 50M gates, customers place a premium on high processor performance as it allows them to run more simulations in less time. EDA customers in general are extremely performance sensitive and require high-performance processors (measured by SPEC CPU2000 benchmark results), memory (determined by capacity, reliability, memory-CPU bandwidth and latency), and hard disks (determined by bandwidth, latency, and capacity). EDA customers generally do not need 3D graphics support but still require fast 2D graphics performance for routing and layout applications.

Mechanical Computer Aided Design (MCAD)

Sun has a significant presence in the high-end MCAD market. High-end MCAD customers run applications from Independent Software Vendors (ISVs) such as PTC, CATIA, I-DEAS, and Unigraphics which are used to design various products ranging from fan assemblies to complete automobiles. Customers in the MCAD market often integrate these software applications into their design and production processes and hence switching cost is high. Therefore, customers in this market, place a high premium on binary compatibility and the ability to run their applications on Solaris or Windows without having to port or retest them. These customers typically, but not always, purchase workstations with high-performance 3D graphics with emphasis on geometry performance.

Table 1 - Target Markets and Customers of the Sun Ultra 24 Workstation

Target Markets	Target Customers	Customer Needs
Software Development	Software developers who develop and test commercial applications and data sets	Flexible, low-cost development platform that supports 32-bit and 64-bit computing environments Support for multiple operating systems. Eliminate issues associated with transitioning software applications and datasets
Semiconductor manufacturers	Electronics engineers who design and verify complex ASICs and CPUs	High-performance processors Professional 2D or entry-level 3D graphics Large memory capacity
Automobile Aerospace Heavy machinery	Mechanical engineers who design automobiles and aircraft and simulate crash tests of automobiles and aircraft	Professional high-performance graphics Large amounts a memory Increased I/O bandwidth

To finish their projects on time, these users require professional graphics solutions, large memory capacity, high-performance disks, and a high degree of reliability. All of these applications demand the highest level of performance and support from a platform. Furthermore, users of these applications insist on a high level of support and expertise from their IT department, equipment suppliers, and application software vendors.

Features

Workstation technology is different than that of a PC. The unique technological features that a workstation utilizes, generally allow professionals to get more from their IT investments. A PC is a general-purpose, lower-cost machine designed for a variety of home and standard business tasks, such as running word processing, spreadsheets, etc, whereas a workstation has been designed to meet the requirements of a number of more specific and heavier workloads. How users employ their systems, i.e. "workload", directly influences the technology that manufacturers use as the basis for the product. Technology such as high-performance Intel, AMD and SPARC Processors, ECC memory, SAS hard disk drives, and ISV-certified graphics accelerator cards are all key characteristics of a workstation. Another aspect of all Sun Workstation is not what appears on screen, but what goes on behind the scenes, such as certification testing and driver optimization. Sun has earned a solid reputation in all of these areas.

The Sun Ultra 24 Workstation is targeted toward workstation customers across the spectrum of the technical workstation markets who demand the latest in workstation technology and performance. Featuring the Intel® Core™2 Duo and Intel® Core™2 Quad Processors, the Sun Ultra 24 Workstation has the feature set as described in Table 2.

Table 2 – Feature Summary of the Sun Ultra 24 Workstation

Features	Descriptions
Processor Type	Intel® Core™2 Duo Processors Intel® Core™2 Quad Processors Intel® Core™2 Extreme Processors
Number of Processors	One
Processor Models	E4400 Intel® Core™2 Duo 2.0Ghz, 800Mhz FSB E6750 Intel® Core™2 Duo 2.66Ghz, 1066Mhz FSB E6850 Intel® Core™2 Duo 3.0Ghz, 1333Mhz FSB Q6600 Intel® Core™2 Quad 2.4Ghz, 1066Mhz FSB Q6700 Intel® Core™2 Quad 2.66Ghz, 1066Mhz FSB QX6850 Intel® Core™2 Extreme Quad Core 3.0Ghz, 1333Mhz FSB
Memory	Unbuffered DIMMs, DDR2-667, 4 DIMM slots, 8GB maximum. Three DIMM sizes: 512MB (ECC) and 1GB (ECC), 2GB (ECC)
Graphics	One NVIDIA Quadro FX 5600 graphics accelerator card One NVIDIA Quadro FX 4600 graphics accelerator card Two NVIDIA Quadro FX 3700 graphics accelerator card (Available Q4CY07) Two NVIDIA Quadro FX 1700 graphics accelerator card Two NVIDIA Quadro FX 570 graphics accelerator card Two NVIDIA Quadro NVS 290 graphics accelerator card
Networking	Single Gigabit Ethernet integrated on motherboard One RJ-45 port (rear)
Optical Disk Drives	DVD-ROM or DVD-Dual
Hard Disk Drives	Up to four SATA drives, 3TB maximum: 250GB, 750GB (7,200 rpm) Up to four SAS drives (Through PCIe HBA), 1.2TB maximum: 146GB, 300GB (15,000 rpm)
RAID Levels	0 and 1 (Windows XP Professional and Vista, Linux, Solaris with Update 5)
FireWire Ports	Two (Front)
USB 2.0 Ports	Two (Front) Four (Back)
Audio	High Definition 7.1 Channel
Serial Ports	None
PCI Express Slots	Two full-length x16 Gen-2 slots One full-length x8 slot (Electrically x4) One full-length x1 slot
5V/32-bit/33-MHz PCI slots	Two full-length slots
Operating Environments Validated by Sun	Solaris 10 8/07 (Update 4) Windows Vista Ultimate (32-bit/64-bit) Windows XP Professional (32/64) Service Pack 2 and Later Windows Server 2003 R2 and SP2 (32-bit/64-bit) Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) and Later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) and later SuSE Linux Enterprise Server 9 (64-bit) Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit) Service Pack 1 and later
Pre-Installed Software	Solaris 10 8/07 (Update 4) Sun Studio 12 Sun Java Studio Creator 2 Sun Java Studio Enterprise 8 Net Beans 5.5 IDE
Height	433.6mm (17.07 in)
Width	199.6mm (7.86 in)
Depth	467.45mm (18.40 in)
Weight	15.4 kg (34 lbs)
Power Supply	530 Watt
(U.S) List Price Range	Starting under \$1000

Features	Descriptions
Warranty	One Year Next Business Day HW Coverage Hours: Business Hours HW Response Times: Next Business Day Delivery Method: Parts Exchange or Onsite

Value Propositions

The Sun Ultra 24 Workstation with Intel® Core™2 Duo and Intel® Core™2 Quad Processors combine for the Ideal single socket workstation. The Ultra 24 workstation provides cutting edge performance with the Intel processors, the latest workstation functionality with PCI-Express Gen 2 graphics and investment protection with a future upgrade path to next generation Intel cpus.

The Sun Ultra 24 featues performance and flexibility

- Dual PCI Express x16 Gen 2 graphics support for maximum performance and flexibility
- Intel Core 2 Extreme Edition Processor support for performance scaling with up to four cores
- A broad choice of operating environments including Solaris, Windows Vista and XP, RedHat and SUSE linux.

A lower power micro-architecture with Intel® Core™2 quad- and dual-core processors

- Continues to deliver better performance/watt than previous generation Intel platforms
- Improved workstation acoustics using Intel Quiet Systems Technology

The Intel architecture is optimized for entry-level Workstations

- The Intel X38 Express Chipset demonstrates Intel's proven ability in delivering stable, compatible workstation platforms

And lastly the Sun Ultra 24 with the Intel® Core™2 processors guarantee platform longevity

- Supports for key new technologies such as a 1333Mhz FSB and current-generation 65nm and next-generation 45nm dual- and quad-core processors to deliver increasing system performance and investment protection.

The Sun Ultra 24 Workstation and Sun's value-added activities, such as installed software, ISV certification, driver optimization, and support, have been focused, above all else to benefit the workstation buyers, i.e. software developers, mechanical engineers, ASIC/CPU designers, and the IT organizations that support them. Examples of value propositions for each market segment are described in the following paragraphs.

Develop Software in Less Time

Software developers can start developing Solaris applications and Java applications immediately after unpacking. Every Sun Ultra 24 Workstation comes with a pre-installed fully-licensed copy of Solaris 10. Additionally, a rich suite of Sun software development tools has been pre-installed on it. These intuitive, easy to use tools, coupled with the high-performance Intel® Core™2 Duo and Intel® Core™2 Quad Processors enable rapid development of Web services as well as traditional applications.

The Solaris 10 Operating Environment contains new features such as Dtrace, Predictive Self-Healing, Solaris Containers, and ZFS. Dtrace, a real-time application debugging and optimization tool, gives the programmer unprecedented observability into the system. Predictive Self-Healing, a feature to improve availability, supports automatic diagnosis and recovery from hardware and application faults to maximize system uptime. Solaris Containers, an industry-first utilization feature, helps consolidate, isolate, and manage many applications on a single workstation.

In addition to Solaris, every Sun Ultra 24 Workstation comes pre-installed with a rich suite of Sun software development tools, including Sun Studio 12 and Net Beans 5.5 IDE. Sun Studio 12 provides a comprehensive, integrated suite of tools for enterprise C, C++, and Fortran applications. Net Beans IDE 5.0 offers comprehensive support for building IDE plug-in modules and rich client applications on the Net Beans platform. These application development tools have been conveniently pre-installed on the Sun Ultra 24 Workstation to help developers to create a range of applications and services, in less time.

Accelerate Design Cycles

The Sun Ultra 24 Workstation features the Intel® Core™2 Duo and Intel® Core™2 Quad Processors, the best workstation processor in the industry. The Intel® Core™2 Architecture supports both dual and quad core chip sets and is optimized for the needs of technical professionals.

The Sun Ultra 24 Workstation has high-density, high-performance, and reliable internal storage. Utilizing Serial ATA for density, Sun Ultra 24 Workstation accommodates up to four internal 750GB drives for a maximum capacity of 3TB. Utilizing RAID 0 for high-performance (within the Microsoft Windows XP Professional and Vista, Linux and Solaris with update 5), Sun Ultra 24 Workstation delivers very high transfer rate to load quickly the largest engineering drawings. Utilizing RAID 1 for redundancy (Microsoft Windows XP Professional and Vista, Linux and Solaris with update 5), Sun Ultra 24 Workstation safeguards customer data for mission-critical application.

Sun Ultra 24 Workstation has a large, fast, and reliable memory footprint of up to 8GB. The memory subsystem on Sun Ultra 24 Workstation is fast. Based on DDR2-667, Sun Ultra 24 Workstation delivers a maximum memory bandwidth of 10.6 Gbps. Last, Sun Ultra 24 Workstation uses ECC memory exclusively to protect mission-critical data sets. ECC (Error Correction), a method of checking integrity of data in DRAM, detects multiple-bit errors and locates and corrects single-bit errors.

Visualize More Data Sets, Simultaneously

The Sun Ultra 24 Workstation can drive up to six displays, the most of any Sun Workstation.. The Sun Ultra 24 Workstation also supports two PCI Express x16 ("16 lane") Generation 2 expansion slots for latest graphics accelerators to drive up to four displays to help customers visualize more data sets simultaneously and make quicker decisions during design. The Sun Ultra 24 Workstation supports a wide variety of the latest workstation-class graphics accelerators from NVIDIA delivering Sun's customers the next level of creativity with OpenGL high-performance graphics and support for multiple displays and visualization software.

Sun maintains strategic partnerships with leading ISVs to certify the Sun Ultra 24 Workstation for compatibility with the most complex MCAD applications. Through rigorous validation, Sun helps ensure compatibility in the most complex and technically demanding computing environments. Additionally, the Sun Ultra 24 Workstation has been tuned for optimal performance with each application and deliver a best-in-class price-performance workstation. Table 3 list the dates of Sun Ultra 24 Workstation certification at leading engineering ISVs.

Table 3 – ISV Certification Plan for the Sun Ultra 24 Workstation

ISV	Application	Target Certification Date
PTC	Pro Engineer Wildfire 2.0 & 3.0	Q4CY2007
Dassault Systeme	CATIA v5 32-bit & 64-bit	Q4CY2007
Solidworks	Solidworks 2004, 2005, 2006	Q4CY2007
UGS	NX2, NX3, versions v5.0, v5.1. SolidEdge	Q4CY2007
Autodesk	Inventor 10	Q4CY2007
ICEM	Surf	Q4CY2007

Deploy With Confidence

Sun Ultra 24 Workstation has been designed to help IT organizations support their environment. The Sun Ultra 24 Workstation is compatible with many operating systems, factory lead-time is a week or less, pricing is competitive, investment in 32-bit software is protected, and service is backed by the Global Sun Services organization.

When an IT manager buys the Sun Ultra 24 Workstation, it can be deployed in more environments, because it has been certified to be compatible with more operating systems than any workstation in its class. The Sun Ultra 24 Workstation supports Solaris 10, Red Hat Enterprise Linux WS, SUSE Linux Enterprise Server, SuSE Linux Enterprise Desktop (SLED) 10, Microsoft Windows Vista and Microsoft Windows XP Professional. Customers can purchase either Solaris or Linux operating systems from Sun and obtain complete system support from Sun. For customers who deploy Windows Vista Client, Windows XP Professional or Windows XP Professional x64, note that the Sun Ultra 24 Workstation has been certified by Microsoft and support for those Windows operating systems can be purchased from Sun.

Factory lead time for standard configurations (pre-built in factory) of the Sun Ultra 24 Workstation is five days or less. Factory lead time for Assemble to Order (ATO) and X-Options of the Sun Ultra 24 Workstation is seven days or less. Factory lead time of Field Replacement Units (FRUs) is 13 days or less. For more details on factory lead-time, please see the chapter on Availability and Ordering.

With a starting NTE list price (U.S.) under \$1,000, the Sun Ultra 24 Workstation competes head-to-head with any workstation based on the Intel® Core™2 Duo and Intel® Core™2 Quad Processors.

By using the same architecture to run 32-bit and 64-bit operating systems and applications, Sun Ultra 24 Workstation helps customers protect their investments in 32-bit operating systems/applications, while giving them a simplified migration path to 64-bit operating systems/applications. With Sun Ultra 24 Workstation, customers can take advantage of today's improved 32-bit performance enhancements and protect their 32-bit investments while retaining the ability to upgrade to 64-bit operating systems and applications as needed.

Every Sun Ultra 24 Workstation is supported by the power of Sun Global Services organization. This organization provides a wide range of services to help customers migrate from legacy environments, reduce cost and complexity, accelerate network deployment, and deliver mobility with security—all from a single source. A one-year, next business day warranty is standard with every Sun Ultra 24 Workstation.

These user-driven features, engineered to accelerate design cycles and reduce errors in design, demonstrates Sun's commitment to deliver the most compelling x64-based workstation portfolio in the industry. Coupled with pre-installed Solaris 10, pre-installed Sun development tools, competitive pricing, a one-year warranty and next-business-day support, the Sun Ultra 24 Workstation offers an exceptional low total cost of ownership (TCO) among 1-socket x64 workstations.

System Architecture

The Sun Ultra 24 Workstation is targeted toward workstation customers who demand the best solution. Featuring the Intel® Core™2 Duo and Intel® Core™2 Quad Processors, Sun Ultra 24 Workstation is Sun's first workstation product to feature Intel processors and chipsets and the first Sun workstation to offer quad core on the desktop.

Figure 2 shows the internal view of the Sun Ultra 24 Workstation.

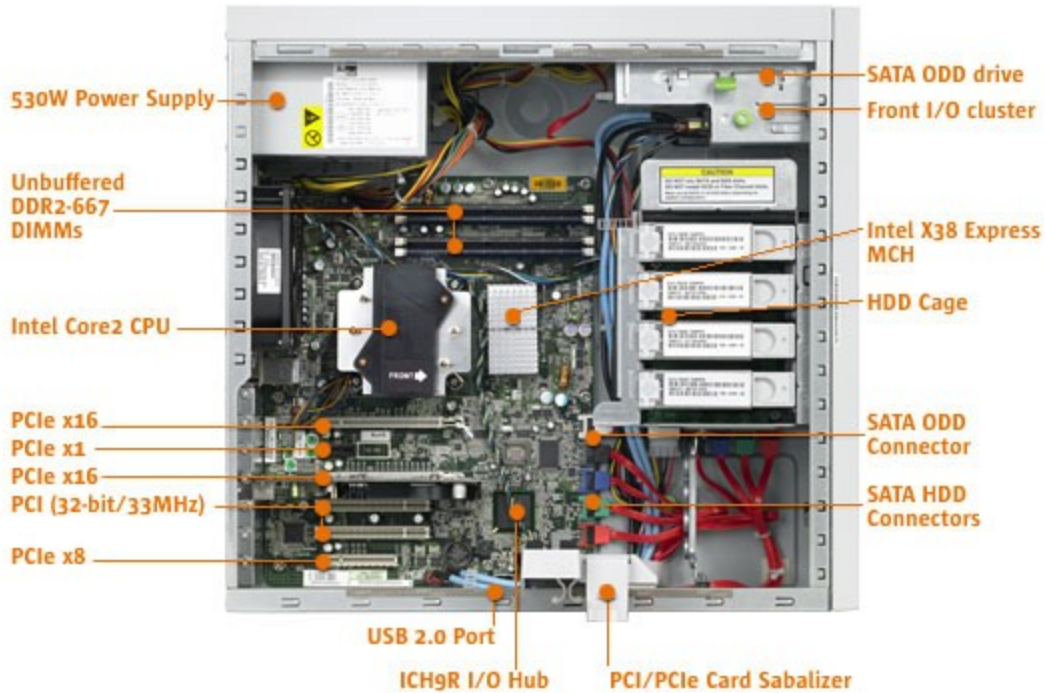


Figure 2 – Internal View of the Sun Ultra 24 Workstation

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Figure 3 shows the block diagram of the Sun Ultra 24 Workstation. The Intel® Core™2 Processors drives four DDR2 DIMMs. The Intel X38 Express chipset with Intel's ICH9R provide bridging interfaces, such as PCI Express, gigabit Ethernet, SATA, and USB 2.0, to the Intel Core2 Processor. These two key, highly integrated, components drive the system architecture of Sun Ultra 24 Workstation.

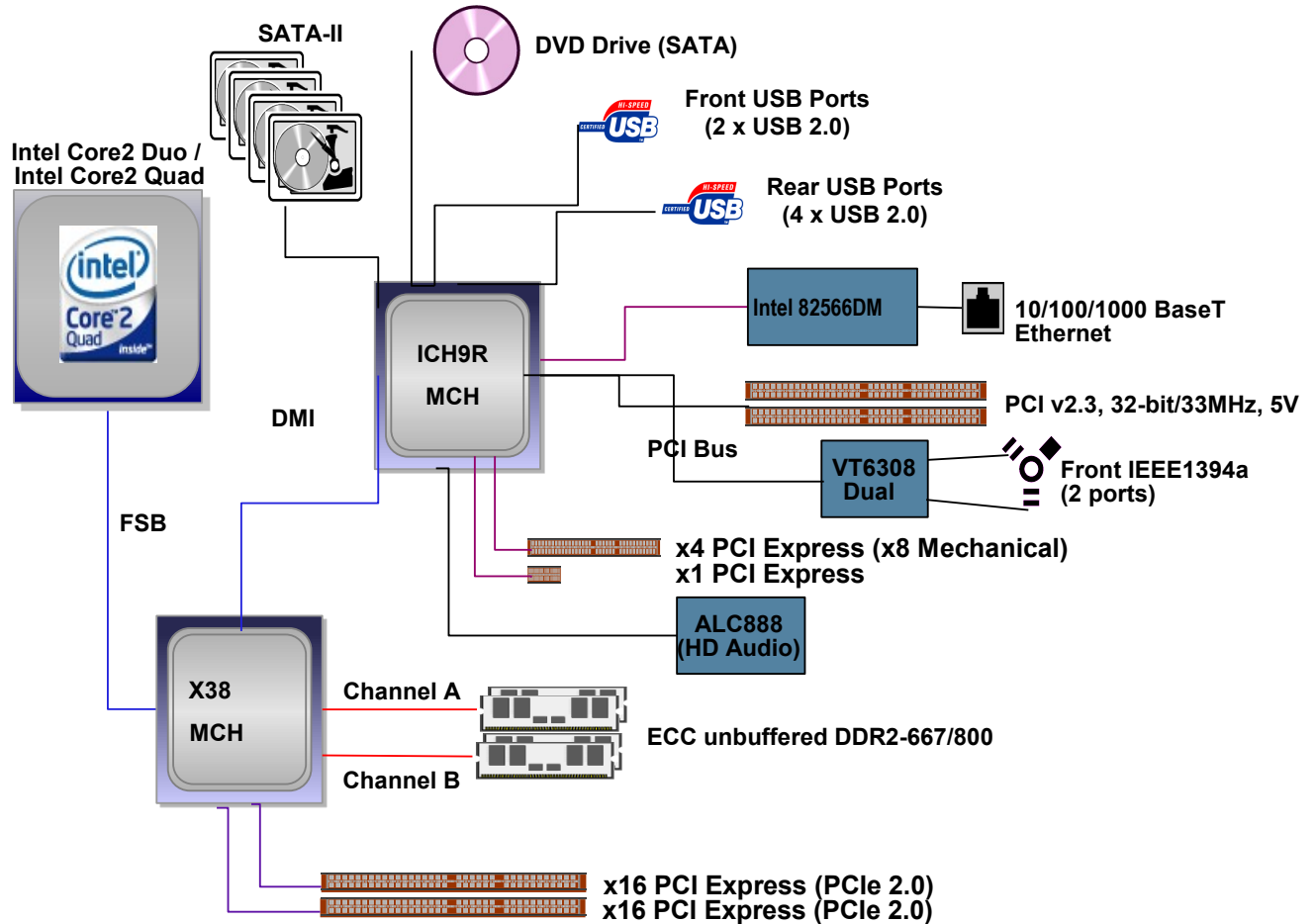


Figure 3 – Block Diagram of the Sun Ultra 24 Workstation

The Sun Ultra 24 Workstation supports a single or dual core Intel Core2 processor at speeds up to 3.0Ghz at announcement. The Sun Ultra 24 has been designed to incorporate Intels upcoming 45nm processors as they become available. A Frontside Bus (FSB) running at up to 1333Mhz connects to Intel's X38 Express MCH which provides an interface to DDR2 memory as well as connects to the Intel ICH9R southbridge which provides a wide variety of connectivity options including USB, SATA-II, PCI Express and PCI bus interfaces.

Intel Core 2 Architecture

The Sun Ultra 24 Workstation is powered by the dual-core and quad-core Intel® Core™2 Duo and Intel® Core™2 Quad Processors. These processors, enabling simultaneous 32- and 64-bit computing, are designed to run existing 32-bit applications with outstanding performance and offers customers a simplified migration path to 64-bit computing.

With Intel® Core™2 Duo processor, you'll experience revolutionary performance, unbelievable system responsiveness, and energy-efficiency second to none. And, you won't have to slow down for virus scan, multiple compute intensive programs, or multimedia downloads—these desktop processors are up to 40% percent faster with improved energy-efficiency.

With four execution cores, the Intel® Core™2 Quad processor blows through processor-intensive tasks in demanding multitasking environments and makes the most of highly threaded applications. Whether you're creating multimedia, annihilating your gaming enemies, or running multiple compute-intensive applications one at one time, the new quad-core processing will change the way you do everything. Pioneer the new world of quad-core and unleash the power of multithreading.

The Intel Core 2 Duo processor-based desktop PC was designed from the ground up for energy efficiency, letting you enjoy higher performing, ultra-quiet, sleek, and low power desktop PC design

Now you can do more at the same time, like playing your favorite music, running virus scan in the background, and all while you edit video or pictures. The powerful Intel Core 2 Duo desktop processor PCs provides you with the speed you need to perform any and all tasks imaginable.

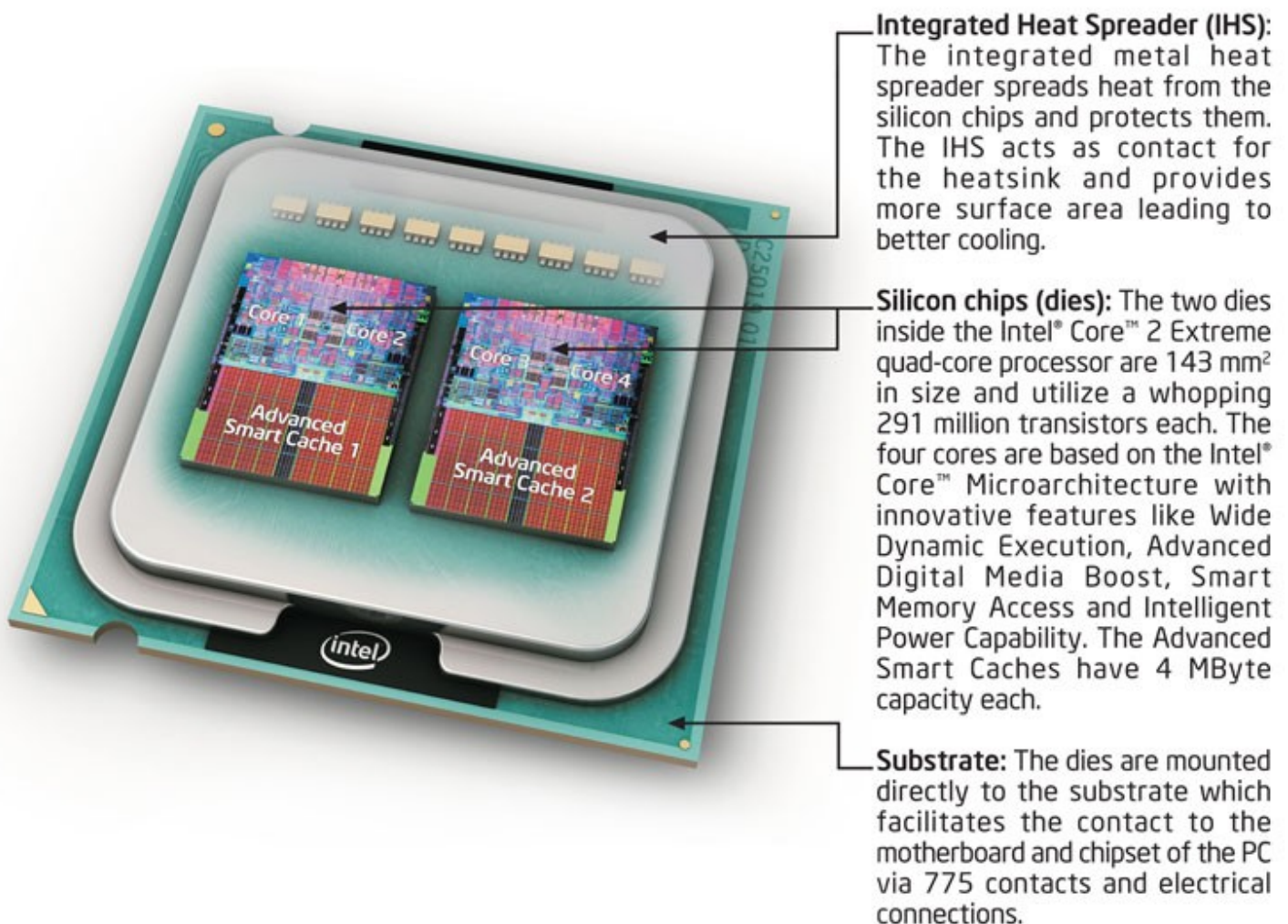


Figure 4 – The Intel® Core™2 Quad Processors,

Table 4 shows the key features and benefits of the Intel® Core™2 Duo architecture. For more details, including block diagrams and specifications, please visit www.intel.com.

Table 4 - Intel Core 2 Architecture – Features and Benefits

Feature	Benefit
Intel Wide Dynamic Execution	Enables delivery of more instructions per clock cycle to improve execution time and energy efficiency.
Intel Intelligent Power Capability	Designed to deliver more energy efficient performance.
Intel Smart Memory Access	Improving system performance by optimizing the use of the available data bandwidth
Intel Advance Smart Cache	Providing a higher-performance, more efficient cache subsystem. Optimized for multi-core and dual-core processors
Intel Advanced Digital Media Boost	Accelerating a broad range of applications, including video, speech and image, photo processing, encryption, financial, engineering and scientific applications

Intel X38 Express Chipset

The Sun Ultra 24 Workstation uses the high-performance Intel X38 Express and Intel ICH9R chipset to complement the Intel Core 2 Processors. Together the two chips provide a highly-integrated design for high performance and reliability. Additionally, it provides a comprehensive suite of connectivity and I/O suitable for workstations.

The Intel X38 Express MCH together with the ICH9R chipsets provide the following bridging interfaces and features:

- PCI Express interfaces to graphics accelerators and expansion boards including two PCI Express Gen 2 interfaces for graphics.
- DDR2 Memory Interfaces up to 1333Mhz (DDR2/667 supported on the Ultra 24)
- 10/100/1000BASE-T Ethernet interface
- Six channel SATA2 ports 3Gb/s with RAID 0, 1, 5 and 10 capable (Raid 0, 1 and 5 supported on Windows XP Professional and Vista. Linux and Solaris with Update 5 release)
- USB 2.0
- Legacy I/O: PCI 32-bit/33Mhz

Table 5 shows the key features and benefits of the Intel X38 Express MCH and ICH9R chipsets. For more details, including block diagrams and specifications, please visit www.intel.com

Table 5- Features and Benefits of the Intel X38 Express MCH and ICH9R chipset

Feature	Benefit
1333Mhz Frontside bus with DDR2 Memory support.	High performance memory interface for optimal performance. Up to 10.67GB/sec bandwidth.
PCI Express Gen2	Architected to support PCI Express and PCI Express Gen2. Multiple PCI-Express slots and the ability to support the latest and highest bandwidth graphics cards from NVIDIA.
Support for Legacy PCI devices	Leverage investment in existing PCI cards and simplify transition.

PCI Express Gen 2

A key feature of the X38 Express chipset is it's support of PCI Express Gen 2. The central feature of the base version of PCI Express 2.0 is a substantial speed boost achieved through faster signaling. PCI Express 2.0 doubles each serial line's data transfer rate from 2.5 gigabits per second to 5Gbps. This means that a x32 connector can transfer data at an effective rate of up to 16 GB/s in EACH direction. PCI Express Gen 2 remains compatible with PCI Express 1.1, so previous generation cards will still be usable on a PCI Express Gen 2 platforms.

The Sun Ultra 24 workstation implementation of PCI Express Gen 2 provides two PCI Express x16 Gen2 interfaces that deliver up to twice the bandwidth to graphics cards that support the Gen 2 interface. In this implementation, the Sun Ultra 24 workstations has doubled the data transfer rate with each graphics card from an aggregate bi-directional bandwidth of 8 GB/s to 16 GB/s across the PCI Express x16 interface.

Additional information on the PCI Express Gen 2 specifications can be found at the PCI SIG website:
http://www.pcisig.com/news_room/faqs/pcie2.0_faq/

Expansion Slots

Sun Ultra 24 Workstation has six (6) expansion slots:

- Two PCI Express x16 slot (Gen2)
- One PCI Express x8 (x4 electrically)
- One PCI Express x1 slot
- Two 5V, 32-bit/33-MHz PCI card slots

The PCI Express x16 slots are intended for graphics accelerators but can be used for any qualified PCI Express expansion cards with x16, x8, x4 or x1 connector. The remaining slots, one PCI-Express x8 slot, one PCI-Express x1 slot and two 32-bit/33-MHz PCI slots can be used for optional cards such as Gigabit NICs, SAS adapters, others. Table 6 explains the layout of the expansion slots.

Table 6 - Sun Ultra 24 Workstation Expansion Slot Layout

Slot #	Slot Type	Full Length?	Maximum Power	Description
1	PCI Express x16 (Gen 2)	Yes	180W with aux. power	Located nearest power supply. For graphics accelerator card or any PCI-Express cards up to 180W
2	PCI Express x1	Yes	25W	Not intended for graphics accelerator cards. Intended for PCI Express I/O cards (NICs, SAS)
3	PCI Express x16 (Gen 2)	Yes	180W with aux. power	For graphics accelerator card or any PCI-Express cards up to 80W
4	5V, 32-bit/33-MHz PCI	Yes (up to 13.4-inch)	25W	5V, 32-bit/33-MHz PCI cards only Do not install 64-bit PCI cards. Do not install PCI-X cards
5	5V, 32-bit/33-MHz PCI	Yes (up to 13.4-inch)	25W	Located farthest from power supply.. Can accept 5V 32-bit/33-MHz cards Can accept 64-bit PCI cards Do not install PCI-X cards
6	PCI Express x8 (x4 electrically)	Yes	25W	Intended for PCI Express I/O cards (NICs, SAS)

Sun Ultra 24 Workstation has six expansion slots, the same number as the Sun Ultra 20M2 Workstation. The Sun Ultra 24 Workstation features two Gen 2 PCI-Express x16 slots for the latest graphics capabilities. Table 7 compares the slot assignment of Sun Ultra 24 Workstation versus the Sun Ultra 20M2 Workstation and Sun Ultra 20 Workstation.

Table 7 – Slot Assignment Comparison of Sun Ultra 24 Workstation versus Sun Ultra 20 Workstation

Slot	Sun Ultra 24 Workstation	Sun Ultra 20 M2	Sun Ultra 20 Workstation
1	PCI Express x16 card slot (Gen2)	PCI Express x16 card slot	PCI Express x16 card slot
2	PCI Express x1 card slot	PCI Express x1 card slot	PCI Express x1 card slot
3	PCI Express x16 card slot (Gen2)	PCI Express x16 card slot wired as x8	PCI Express x1 card slot
4	5V, 32-bit/33-MHz PCI card slot	5V, 32-bit/33-MHz PCI card slot	5V, 32-bit/33-MHz PCI card slot
5	5V, 32-bit/33-MHz PCI card slot	5V, 32-bit/33-MHz PCI card slot	5V, 32-bit/33-MHz PCI card slot
6	PCI Express x8 card slot	5V, 32-bit/33-MHz PCI card slot	5V, 32-bit/33-MHz PCI card slot
7	Does not exist	Does not exist	5V, 32-bit/33-MHz PCI card slot

NOTE: Slot #1 and 3 are intended as the primary graphics interface slots. Due to total system power constraints Dual FX4600 or Dual FX5600 cannot be simultaneously supported in the Ultra 24. Lower power graphics cards (FX3700 and below) can be supported in dual card configs. Nvidia SLI is not supported on the Sun Ultra 24 due to limitations in the Intel ICH9R chipset.

Memory

Sun Ultra 24 Workstation's dual-channel integrated DDR2 memory controller is capable of yielding a memory bandwidth of 10.6GB/s and supports up to four unbuffered DDR2-667 DIMMs. The Sun Ultra 24 Workstation can reach up to a maximum of 8GB using its 4 DIMM slots and supports a 4GB Memory Kit (2x 2GB ECC DIMMs), a 2GB Memory Kit (2x 1GB ECC DIMMs), and a 1GB Memory Kit (2x 512MB ECC DIMMs). Each memory kit contains two identical DIMMs from the same supplier. Both DIMMs must be installed to ensure proper electrical matching and to deliver full dual-channel of memory bandwidth. DIMMs are not available for sale in a quantity of one. The entry configuration of Sun Ultra 24 Workstation makes an exception to this rule. This configuration has one 512MB DIMM and thus does not benefit from the full dual-channel memory bandwidth as other configurations. Table 8 explains the memory upgrade paths for the Sun Ultra 24 Workstation:

Table 8 – Memory Upgrade Paths for Sun Ultra 24 Workstation

From	To	Actions	Remaining DIMM Sockets
Sun Ultra 24 Workstation w/ 512MB (1x 512MB DIMM)	1GB	<ul style="list-style-type: none"> Remove existing single 512MB DIMM Install one 1GB (2x 512MB) Memory Kit 	<ul style="list-style-type: none"> Two
	2GB	<ul style="list-style-type: none"> Remove existing single 512MB DIMM Install one 2GB (2x 1GB) Memory Kit or install two 1GB (2x 512MB) Memory Kits 	<ul style="list-style-type: none"> Zero DIMM sockets remaining if installing two 1GB (2x 512MB) Memory Kits Two DIMM sockets remaining if installing one 2GB (2x 1GB) Memory Kits
	3GB	<ul style="list-style-type: none"> Remove existing single 512MB DIMM Install one 2GB (2x 1GB) Memory Kit Install one 1GB (2x 512MB) Memory Kit 	<ul style="list-style-type: none"> Zero
	4GB	<ul style="list-style-type: none"> Remove existing single 512MB DIMM Install two 2GB (2x 1GB) Memory Kits 	<ul style="list-style-type: none"> Zero
	5GB	<ul style="list-style-type: none"> Install one 4GB (2x 2GB) Memory Kit Install one 1GB (2x 512MB) Memory Kit 	<ul style="list-style-type: none"> Zero
	6GB	<ul style="list-style-type: none"> Install one 4GB (2x 2GB) Memory Kit Install one 2GB (2x 1GB) Memory Kit 	<ul style="list-style-type: none"> Zero
	8GB	<ul style="list-style-type: none"> Install two Sun 4GB (2x 2GB) Memory Kits 	<ul style="list-style-type: none"> Zero
Sun Ultra 24 Workstation w/ 1GB (2x 512MB DIMMs)	2GB	<ul style="list-style-type: none"> Leave in existing two 512MB DIMMs Install one Sun 1GB (2x 512MB) Memory Kit 	<ul style="list-style-type: none"> Zero
	3GB	<ul style="list-style-type: none"> Leave in existing two 512MB DIMMs Install one Sun 2GB (2x 1GB) Memory Kit 	<ul style="list-style-type: none"> Zero
	4GB	<ul style="list-style-type: none"> Remove existing two 512MB DIMMs Install one Sun 4GB (2x 2GB) Memory Kit or two Sun 2GB (2x 1GB) Memory Kits 	<ul style="list-style-type: none"> Zero DIMM sockets remaining if installing two Sun 2GB (2x 1GB) Memory Kits Two DIMM sockets remaining if installing one Sun 4GB (2x 2GB) Memory Kits
	5GB	<ul style="list-style-type: none"> Leave in existing two 512MB DIMMs Install one Sun 4GB (2x 2GB) Memory Kit 	<ul style="list-style-type: none"> Zero
	6GB	<ul style="list-style-type: none"> Remove existing two 512MB DIMMs Install one Sun 4GB (2x 2GB) Memory Kit Install one Sun 2GB (2x 1GB) Memory Kit 	<ul style="list-style-type: none"> Zero
	8GB	<ul style="list-style-type: none"> Remove existing two 512MB DIMMs Install two Sun 4GB (2x 2GB) Memory Kits 	<ul style="list-style-type: none"> Zero
Sun Ultra 24 Workstation w/ 2GB (2x 1GB DIMMs)	3GB	<ul style="list-style-type: none"> Leave in existing two 1GB DIMMs Install one Sun 1GB (2x 512MB) Memory Kit 	<ul style="list-style-type: none"> Zero
	4GB	<ul style="list-style-type: none"> Leave in existing two 1GB DIMMs Install one Sun 2GB (2x 1GB) Memory Kit 	<ul style="list-style-type: none"> Zero
	5GB	<ul style="list-style-type: none"> Not possible 	<ul style="list-style-type: none"> Not applicable
	6GB	<ul style="list-style-type: none"> Leave in existing two 1GB DIMMs Install one Sun 4GB (2x 2GB) Memory Kit 	<ul style="list-style-type: none"> Zero
	8GB	<ul style="list-style-type: none"> Remove existing two 512MB DIMMs Install two Sun 4GB (2x 2GB) Memory Kits 	<ul style="list-style-type: none"> Zero

Expansion Bays

The Sun Ultra 24 Workstation has one external drive bay and four internal drive bays (the Sun Ultra 20 Workstation has two). The external bay is occupied by either the DVD Dual drive or the DVD-ROM drive. There is also a No Optical Drive ATO option. The internal drive bays are reserved for hard disk drives only. Table 9 describes the different expansion bays.

Table 9 - Sun Ultra 24 Workstation Expansion Bays

Bay	Type	Size	Description
1	External	5.25-inch half-height	Occupied by DVD-Dual or DVD-ROM
2	Internal	3.5-inch half-height	Occupied by 250GB, or 750GB SATA hard disk drive or 146GB or 300GB SAS hard disk drive.
3	Internal	3.5-inch half-height	Occupied by 250GB, or 750GB SATA hard disk drive or 146GB or 300GB SAS hard disk drive.
4	Internal	3.5-inch half-height	Occupied by 250GB, or 750GB SATA hard disk drive or 146GB or 300GB SAS hard disk drive.
5	Internal	3.5-inch half-height	Occupied by 250GB, or 750GB SATA hard disk drive or 146GB or 300GB SAS hard disk drive.

Hard Disk Drives (HDD)

3.0GBps Serial ATA is the primary method of storage for the Sun Ultra 24 Workstation. The Sun Ultra 24 Workstation is available in standard configurations with one SATA drive and has the option to add up to three more SATA drive for a maximum of four drives. The Sun Ultra 24 Workstation will be available with SATA RAID 0 and RAID 1 at General Availability for Windows XP Professional, Vista and Linux. HW Raid support in Solaris will be available with update 5. Parallel SCSI hard disk drives are not available.

The Sun Ultra 24 Workstation will support Serial Attached SCSI (SAS) through the use of a host bus adapter. Customers may obtain SAS by ordering through either ATO or as X-Options, an internal SAS adapter (Part Number (x)4219A) and a SAS 146GB 15,000-rpm hard disk drive (Part Number (X)RA-SS1CA-14G15K). The Sun Ultra 24 Workstation supports up to two SAS 146GB 15,000-rpm hard disk drives.

Note that the Sun Ultra 24 Workstation is available for sale without HDD installed for diskless environments.

Optical Disk Drives (ODD)

The Sun Ultra 24 Workstation offers two types of optical drives, DVD-ROM (plays DVD/CD only, does not record) and the DVD-Dual (records DVD in +/- format, on both layers). Sun Ultra 24 Workstation does not support CD-ROM, CD-RW, or DVD-ROM/CD-RW drives. The Sun Ultra 24 Workstation employs the familiar tray-loading mechanism from the Sun Ultra 20 Workstation.

Table 10 – Specifications of Sun Ultra 24 Workstation's Optical Disk Drives

Format	DVD-Dual (records in +/- format, on both layers)	DVD-ROM (plays DVD only, does not record)
DVD-ROM Read	16x	16x
DVD+R Write	16x	Not available
DVD-R Write	16x	Not available
DVD-RW Write	6x	Not available
CD-R Write	48x	48x
CD-RW Write	24x	Not available

Connectivity

The Sun Ultra 24 Workstation uses a very similar chassis to the Sun Ultra 20 Workstation. Key I/O ports and visual indicators remain conveniently located in the front of the chassis. Figure 6 shows the front I/O ports of the Sun Ultra 24 Workstation. The tray-loading DVD-ROM or the DVD-Dual always occupies the external drive bay. The LED shows the activity of the system and blinks when the system is in sleep mode (it does not have any error indication capability). The LED in the front panel provides only limited information—PC Check diagnostic utility software (included with the Sun Ultra 24 Workstation) should be used to gain detailed information about the system. Rounding out the front panel, the Sun Ultra 24 Workstation provides convenient attachment to external portable hard drives or video cameras via two USB 2.0 connectors and two IEEE 1394a (FireWire) connector. Additionally, an input for a microphone (pink) and an output for headphone (green) are also included. The remaining complementary connectors are provided in the rear panel.



Figure 6. Back Side

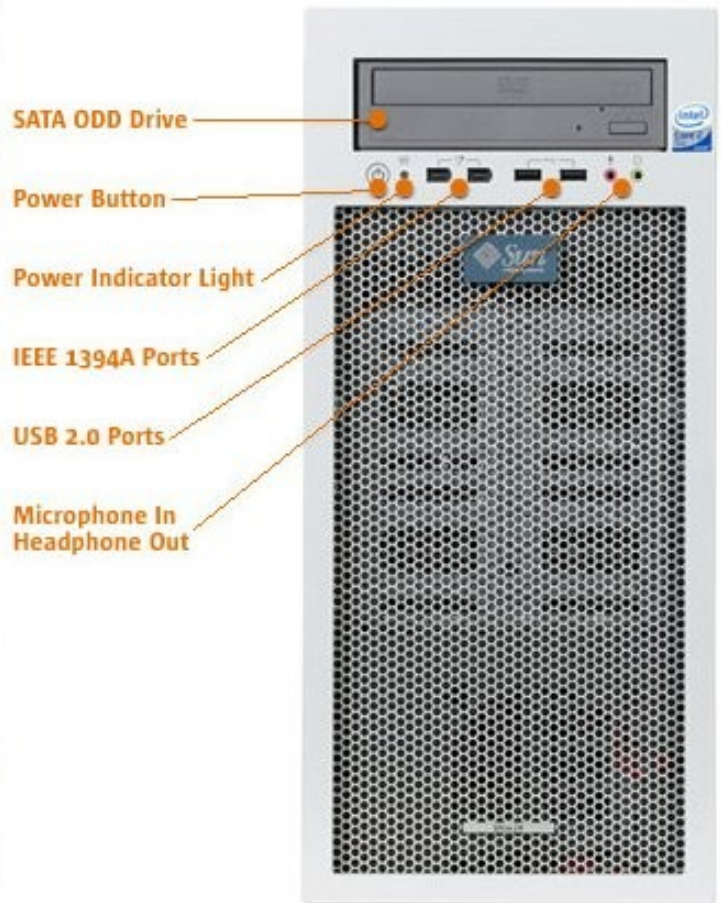


Figure 7. Front Side

Figure 7 shows the rear view of the Sun Ultra 24 Workstation. It contains the remaining USB ports and the audio ports introduced earlier. Starting from the top of the chassis, the Sun Ultra 24 Workstation provides the remaining audio connectors: line in (blue), line out (green), microphone in (pink). Next, two USB 2.0 ports and the RJ-45 port is stacked above the final two USB 2.0 ports. Table 11 summarizes the I/O port locations of the Sun Ultra 24 Workstation.

Table 11 – Summary of I/O Port Locations of Sun Ultra 24 Workstation

Port Type	Front	Back
USB 2.0	2	4
1394a	2	0
Gigabit Ethernet	0	1
Audio	2	6
Parallel	0	0
Serial	0	0

Graphics Accelerators

Customers of the Sun Ultra 24 Workstation gain a selection of six workstation-class graphics accelerator cards, ranging from professional 2D, suitable for SW Development or Education to high-end professional 3D, suitable for professional MCAD and Scientific Visualization applications. Table 12 shows the graphics options for the Sun Ultra 24 Workstation.

Table 12 – Graphics Options for Sun Ultra 24 Workstation

	NVIDIA Quadro FX 5600	NVIDIA Quadro FX 4600	NVIDIA Quadro FX 3700	NVIDIA Quadro FX 1700	NVIDIA Quadro FX 570	NVIDIA Quadro NVS 290
Availability	FY07	FY07	Q3FY07	(RR) October 2007	(RR) October 2007	(RR) October 2007
Form Factor	Card	Card	Card	Card	Card	Card
Memory	1.5GB	768MB	512MB	512MB	256MB	128MB
Bus Type	PCI Express x16	PCI Express x16	PCI Express x16 Gen 2 compatible	PCI Express x16 Gen 2 compatible	PCI Express x16 Gen 2 compatible	PCI Express x16
Geometry (Triangles per Second)*	300 Million	250 Million	TBA	191 Million	137 Million	NA
Texels per Second/Fill Rate*	19.2 Billion	12 Billion	TBA	7.36 Billion	3.68 Billion	NA
Display Connector(s)	Dual Link DVI-I Dual Link DVI-I 3-pin mini-DIN stereo-out connector	Dual Link DVI-I Dual Link DVI-I 3-pin mini-DIN stereo-out connector	Dual Link DVI-I Dual Link DVI-I 3-pin mini-DIN stereo-out connector	Dual Link DVI-I Dual Link DVI-I 7-pin mini-DIN HDTV-out connector	Dual Link DVI-I Dual Link DVI-I	59-pin DMS-59 connector & DMS-59 connector-to-DVI cable
Number of Cards per Sun Ultra 24 Workstation	One	One	Two	Two	Two	Two
Maximum Resolution (Digital)	3840 x 2400 at 24Hz	3840 x 2400 at 24Hz	2560 x 1600 @60Hz	2560 x 1600 @60Hz	2560 x 1600 @60Hz	2560 x 1600 @60Hz
Maximum Resolution (Analog)	2048 x 1536 at 75Hz	2048 x 1536 at 75Hz	2048 x 1536 at 85Hz	2048 x 1536 at 85Hz	2048 x 1536 at 85Hz	2048 x 1536 at 75Hz
Sun Display Support	24.1-inch LCD 20-inch LCD 19-inch LCD 17-inch LCD	24.1-inch LCD 20-inch LCD 19-inch LCD 17-inch LCD	24.1-inch LCD 20-inch LCD 19-inch LCD 17-inch LCD	24.1-inch LCD 20-inch LCD 19-inch LCD 17-inch LCD	24.1-inch LCD 20-inch LCD 19-inch LCD 17-inch LCD	24.1-inch LCD 20-inch LCD 19-inch LCD 17-inch LCD

* For comparison only. Numbers provided by Nvidia. Measured on unspecified platform.

The Sun Ultra 24 Workstation provides two PCI Express x16 Gen2 physical slots for higher performance graphics. Each slot can accept a PCI Express x16 card shown in Table 13. "Slot #1" and "Slot #3" (located nearest to the power supply) deliver full PCI Express x16 Gen2 bandwidth (up to 8GB/s), and thus can accept any graphics accelerators listed in Table 12.

NVIDIA Quadro FX 5600 Graphics Accelerator Card

The NVIDIA® Quadro® FX 5600 Graphics Accelerator card provides to customers the highest-performance workstation graphics solution in the high-end workstation segment for professional MCAD and Scientific Visualization applications. It contains performance features such as full 128-bit floating point pipeline, 8 pixel-per-clock rendering engine, hardware accelerated lines, planes, and lighting. It contains programmability features such as vertex processing, pixel shading, and full support for Microsoft Shader Model 3.0. It supports Microsoft DirectX 9.0c (and earlier) and OpenGL 1.5 (and earlier) to ensure full compatibility.

Figure 10– Board Layout of NVIDIA Quadro FX5600 Graphics Accelerator Carrd



Figure 9 – Connectors of NVIDIA Quadro FX 5600 Graphics Accelerator Card



Each NVIDIA Quadro FX 5600 Graphics Accelerator card can drive two LCDs in digital mode at resolution up to 3840 x 2400 at 24Hz, via its two DVI-I output connectors. Each NVIDIA Quadro FX 5600 Graphics Accelerator card also can drive two LCDs in analog mode or two CRTs, via the optional DVI-to-VGA adapter (Sun Part Number X8015A), at resolutions up to 2048 x 1536 at 75Hz. The NVIDIA Quadro FX 5600 Graphics Accelerator card supports stereoscopic video output through a 3-pin DIN connector to carry sync signal to stereo shutter glasses devices. Only one NVIDIA® Quadro" FX 5600 Graphics Accelerator card may be installed in Sun Ultra 24 Workstation and it must only be installed in Slot #1 (nearest power supply). Table 14 summarizes key specifications and features of the NVIDIA Quadro FX 5600 Graphics Accelerator card.

Table 14 – Summary of NVIDIA Quadro FX 5600 Graphics Accelerator Card Features and Specifications

Form Factor	PCI-Express x16 Full Height (7.8 inches x 4.376 inches)
Memory	1.5GB of GDDR3 SDRAM (384-bit interface)
Clock Rates	<ul style="list-style-type: none"> Memory Clock = 600MHz. Graphics Clock = 450MHz
Connectors	<ul style="list-style-type: none"> Dual Link DVI-I (digital) Dual Link DVI-I (digital) 3-pin mini-DIN stereo connector
Power Dissipation	171W with auxiliary power connected to card
Display Support	<ul style="list-style-type: none"> Dual Link DVI-I output: Drives a digital display at resolutions up to 3840 x 2400 at 24Hz Analog display output: Drives an analog display at resolutions up to 2048 x 1536 at 75Hz Dual internal 400MHz RAMDAC
Maximum Resolution	Sun 24-inch TFT LCD: 1920 x 1200 Sun 20-inch TFT LCD: 1600 x 1200 Sun 19-inch TFT LCD: 1280 x 1024 Sun 17-inch TFT LCD: 1280 x 1024
Max Display Per Board	Two
Max Boards Per Sun Ultra 24	Two
Standard Configuration	No
ATO / X-option	Yes / Yes
Available Drivers	Solaris 10 (Update 4) or later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) – and later Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) – and later SuSE Linux Enterprise Server 9 (64-bit only)– Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit only)– Service Pack 1 and later Windows XP Professional Service Pack 2 and later Windows XP Professional x64 Service Pack 2 and later
Notes	Install in Slot #1 or Slot #2. Can only support only one FX5600 in system

NVIDIA Quadro FX4600 Graphics Accelerator Card

The NVIDIA® Quadro™ FX 4600 Graphics Accelerator card provides to customers the highest-performance workstation graphics solution in the high-end workstation segment for professional MCAD and Scientific Visualization applications. It contains performance features such as full 128-bit floating point pipeline, 8 pixel-per-clock rendering engine, hardware accelerated lines, planes, and lighting. It contains programmability features such as vertex processing, pixel shading, and full support for Microsoft Shader Model 3.0. It supports Microsoft DirectX 9.0c (and earlier) and OpenGL 1.5 (and earlier) to ensure full compatibility.



Figure 9 – Connectors of NVIDIA Quadro FX 4600 Graphics Accelerator Card

Figure 10– Board Layout of NVIDIA Quadro FX4600 Graphics Accelerator Card



Each NVIDIA Quadro FX 4600 Graphics Accelerator card can drive two LCDs in digital mode at resolution up to 3840 x 2400 at 24Hz, via its two DVI-I output connectors. Each NVIDIA Quadro FX 4600 Graphics Accelerator card also can drive two LCDs in analog mode or two CRTs, via the optional DVI-to-VGA adapter (Sun Part Number X8015A), at resolutions up to 2048 x 1536 at 75Hz. The NVIDIA Quadro FX 4600 Graphics Accelerator card supports stereoscopic video output through a 3-pin DIN connector to carry sync signal to stereo shutter glasses devices. Only one NVIDIA® Quadro™ FX 4600 Graphics Accelerator card may be installed in Sun Ultra 24 Workstation and it must only be installed in Slot #1 (nearest power supply). Table 15 summarizes key specifications and features of the NVIDIA Quadro FX 4600 Graphics Accelerator card.

Table 15 – Summary of NVIDIA Quadro FX 4600 Graphics Accelerator Card Features and Specifications

Form Factor	PCI-Express x16 Full Height (7.8 inches x 4.376 inches)
Memory	768GB of GDDR3 SDRAM (256-bit interface)
Clock Rates	• Memory Clock = 600MHz. Graphics Clock = 450MHz
Connectors	<ul style="list-style-type: none"> • Dual Link DVI-I (digital) • Dual Link DVI-I (digital) • 3-pin mini-DIN stereo connector
Power Dissipation	108W with auxiliary power connected to card
Display Support	<ul style="list-style-type: none"> • Dual Link DVI-I output: Drives a digital display at resolutions up to 3840 x 2400 at 24Hz • Analog display output: Drives an analog display at resolutions up to 2048 x 1536 at 75Hz • Dual internal 400MHz RAMDAC
Maximum Resolution	Sun 24-inch TFT LCD: 1920 x 1200 Sun 20-inch TFT LCD: 1600 x 1200 Sun 19-inch TFT LCD: 1280 x 1024 Sun 17-inch TFT LCD: 1280 x 1024
Max Display Per Board	Two
Max Boards Per Sun Ultra 24	One
Standard Configuration	No
ATO / X-option	Yes / Yes
Available Drivers	Solaris 10 (Update 4) or later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) – and later Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) – and later SuSE Linux Enterprise Server 9 (64-bit only)– Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit only)– Service Pack 1 and later Windows XP Professional Service Pack 2 and later Windows XP Professional x64 Service Pack 2 and later
Notes	Install in Slot #1 or Slot #2. Can only support only one FX4600 in system

NVIDIA Quadro FX 3700 Graphics Accelerator Card (Available Q4CY07 – INFORMATION IS CONFIDENTIAL)

The NVIDIA® Quadro™ FX 3700 Graphics Accelerator card provides to customers the highest-performance workstation graphics solution in the high-end workstation segment for professional MCAD and Scientific Visualization applications. It contains performance features such as full 128-bit floating point pipeline, 8 pixel-per-clock rendering engine, hardware accelerated lines, planes, and lighting. It contains programmability features such as vertex processing, pixel shading, and full support for Microsoft Shader Model 3.0. It supports Microsoft DirectX 9.0c (and earlier) and OpenGL 1.5 (and earlier) to ensure full compatibility.



Figure 9 – Connectors of NVIDIA Quadro FX 3700 Graphics Accelerator Card



Figure 10– Board Layout of NVIDIA Quadro FX3700 Graphics Accelerator Card

Each NVIDIA Quadro FX 3700 Graphics Accelerator card can drive two LCDs in digital mode at resolution up to 3840 x 2400 at 24Hz, via its two DVI-I output connectors. Each NVIDIA Quadro FX 3700 Graphics Accelerator card also can drive two LCDs in analog mode or two CRTs, via the optional DVI-to-VGA adapter (Sun Part Number X8015A), at resolutions up to 2048 x 1536 at 75Hz. The NVIDIA Quadro FX 3700 Graphics Accelerator card supports stereoscopic video output through a 3-pin DIN connector to carry sync signal to stereo shutter glasses devices. Table 16 summarizes key specifications and features of the NVIDIA Quadro FX 3700 Graphics Accelerator card.

Table 16 – Summary of NVIDIA Quadro FX 3700 Graphics Accelerator Card Features and Specifications

Form Factor	PCI-Express x16 /Gen 2 Full Height (6.875 inches x 4.25 inches)
Memory	512MB of GDDR3 SDRAM (256-bit interface)
Clock Rates	• Memory Clock = 800MHz. Graphics Clock = 500MHz
Connectors	<ul style="list-style-type: none"> • Dual Link DVI-I (digital) • DP • 3-pin mini-DIN stereo connector
Power Dissipation	120W with auxiliary power connected to card
Display Support	<ul style="list-style-type: none"> • Dual Link DVI-I output: Drives a digital display at resolutions up to 3840 x 2400 at 24Hz • Analog display output: Drives an analog display at resolutions up to 2048 x 1536 at 75Hz • Dual internal 400MHz RAMDAC
Maximum Resolution	Sun 24-inch TFT LCD: 1920 x 1200 Sun 20-inch TFT LCD: 1600 x 1200 Sun 19-inch TFT LCD: 1280 x 1024 Sun 17-inch TFT LCD: 1280 x 1024
Max Display Per Board	Two
Max Boards Per Sun Ultra 24	Two
Standard Configuration	No
ATO / X-option	Yes / Yes
Available Drivers	Solaris 10 (Update 4) or later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) – and later Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) – and later SuSE Linux Enterprise Server 9 (64-bit only)– Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit only)– Service Pack 1 and later Windows XP Professional Service Pack 2 and later Windows XP Professional x64 Service Pack 2 and later
Notes	Install in Slot #1 or Slot #3. SLI is not supported.

NVIDIA Quadro FX1700 Graphics Accelerator Card

NVIDIA Quadro® FX 1700 Graphics Accelerator card delivers exceptional performance, quality, and price for professionals. Featuring a revolutionary unified architecture, Quadro FX 1700 dynamically allocates geometry, shading, pixel, and compute processing power to deliver optimized GPU performance while consuming significantly less power. With a C programming environment, Quadro FX 1700 is certified on all industry-leading CAD, DCC, and visualization applications. The FX 1700 contains performance feature such as full 128-bit floating point pipeline, 8 pixel-per-clock rendering engine, hardware accelerated lines, planes, and lighting. It contains programmability features such as vertex processing, pixel shading, and full support for Microsoft Shader Model 4.0. It supports Microsoft DirectX 10 (and earlier) and OpenGL 2.1 (and earlier) to ensure full compatibility.

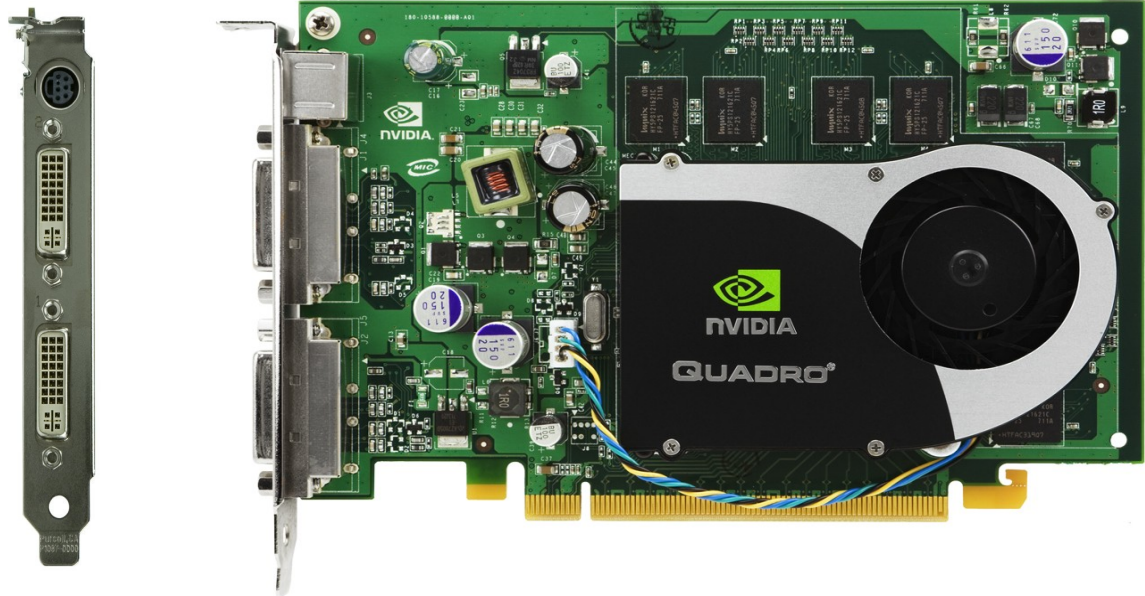


Figure 11 – NVIDIA Quadro FX 1700 Graphics Accelerator Card

Figure 12 – Board Layout of NVIDIA Quadro FX 1700 Graphics Accelerator Card

Each NVIDIA Quadro FX 1700 Graphics Accelerator card can drive two LCDs in digital mode at resolution up to 2560 x 1600 @60Hz, via its two DVI-I output connectors. Each NVIDIA Quadro FX1700 Graphics Accelerator card also can drive two LCDs in analog mode or two CRTs, via the optional DVI-to-VGA adapter (Sun Part Number X8015A), at resolutions up to 2048 x 1536 at 85Hz. The NVIDIA Quadro FX 1700 Graphics Accelerator card supports HDTV output through a 7-pin HDTV connector. Table 17 summarizes key specifications and features of the NVIDIA Quadro FX 1700 Graphics Accelerator card.

Table 17 – Summary of NVIDIA Quadro FX 1700 Graphics Accelerator Card Features and Specifications

Form Factor	PCI-Express x16 Full Height (6.60 inches x 4.376 inches)
Memory	512MB of GDDR3 SDRAM (128-bit interface, 12.8 GB/sec)
Clock Rates	• Memory Clock = 460MHz. Graphics Clock = 400MHz
Connectors	• Dual Link DVI-I (digital) • Dual Link DVI-I (digital) • HD Out
Power Dissipation	42W
Display Support	• Dual Link DVI-I output: Drives a digital display at resolutions up to 2560 x 1600 @60Hz • Analog display output: Drives an analog display at resolutions up to 2048 x 1536 at 85Hz • Dual internal 400MHz RAMDAC
Maximum Resolution	Sun 24-inch TFT LCD: 1920 x 1200 Sun 20-inch TFT LCD: 1600 x 1200 Sun 19-inch TFT LCD: 1280 x 1024 Sun 17-inch TFT LCD: 1280 x 1024
Max Display Per Board	Two
Max Boards Per Sun Ultra 24	Two
Standard Configuration	Yes
ATO / X-option	Yes / Yes
Available Drivers	Solaris 10 (Update 4) or later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) – and later Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) – and later SuSE Linux Enterprise Server 9 (64-bit only)– Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit only)– Service Pack 1 and later Windows XP Professional Service Pack 2 and later Windows XP Professional x64 Service Pack 2 and later
Notes	Install in Slot #1 or Slot #3

NVIDIA Quadro FX570 Graphics Accelerator Card

NVIDIA Quadro entry level graphics boards deliver unmatched value. Featuring a revolutionary unified architecture, Quadro dynamically allocates geometry, shading, and compute processing power to deliver optimized GPU performance. With 256 MB the frame buffer, Quadro entry-level solutions are Microsoft® Vista™ ready, and are certified on CAD, DCC, and video applications. The NVIDIA® Quadro™ FX 570 Graphics Accelerator card provides to customers an entry-level 3D workstation graphics solution for professional MCAD and EDA applications. Up to two NVIDIA® Quadro™ FX570 Graphics Accelerator cards can be installed in Sun Ultra 24 Workstation simultaneously (in Slot #1 and Slot #3), to drive a maximum of four displays. The FX 570 contains programmability features such as vertex processing, pixel shading, and full support for Microsoft Shader Model 4.0. It supports Microsoft DirectX 10 (and earlier) and OpenGL 2.1 (and earlier) to ensure full compatibility.



Figure 13 – Connector of the NVIDIA Quadro FX 570 Graphics Accelerator Card

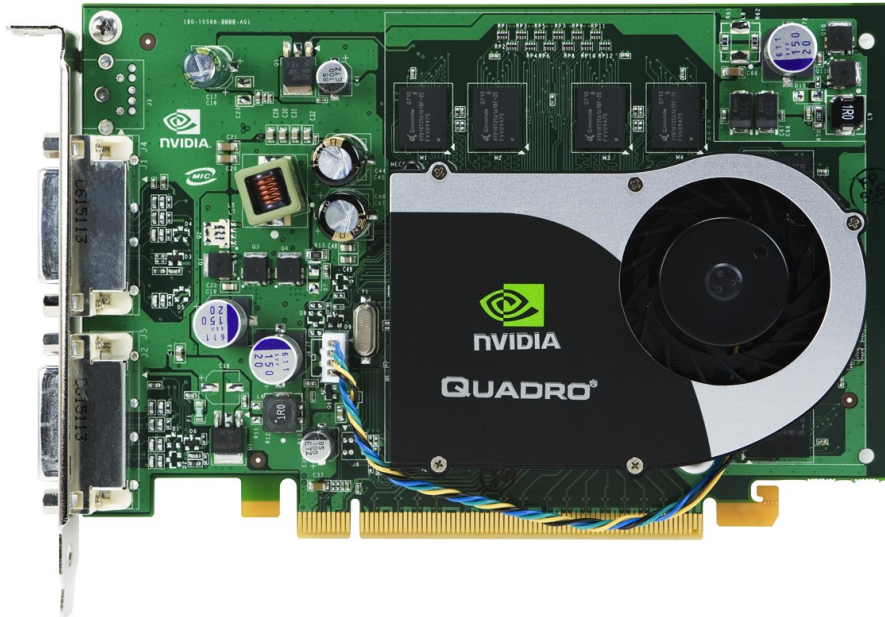


Figure 14 – Board Layout of the NVIDIA Quadro FX 570 Graphics Accelerator Card

Each NVIDIA Quadro FX 570 Graphics Accelerator can drive up to two LCDs, one at resolutions up to 2560 x 1600 at 60Hz and another at resolution up to 2048 x 1536 at 85Hz. Each NVIDIA Quadro FX 570 Graphics Accelerator card can also drive two LCDs, in analog mode, or two analog CRTs via an optional DVI-to-VGA adapter (Sun Part Number X8015A). Table 18 summarizes key specifications and features of the NVIDIA Quadro FX 570 Graphics Accelerator card.

Table 18 – Summary of NVIDIA Quadro FX 570 Graphics Accelerator Card Features and Specifications

Form Factor	PCI-Express x16 Full Height (4.376 inches x 6.6 inches)
Memory	256MB of DDR2 (128-bit interface, 12.8MB/sec)
Clock Rates	• Memory Clock = 450MHz. Graphics Clock = 400MHz
Connectors	• Dual Link DVI-I (digital) • Dual Link DVI-I (digital)
Power Dissipation	38W
Display Support	• Dual Link DVI-I output: Drives a digital display at resolutions up to 2560 x 1600 at 60Hz • Analog display output: Drives an analog display at resolutions up to 2048 x 1536 at 85Hz • Dual internal 400MHz RAMDAC
Maximum Resolution	Sun 24-inch TFT LCD: 1920 x 1200 Sun 20-inch TFT LCD: 1600 x 1200 Sun 19-inch TFT LCD: 1280 x 1024 Sun 17-inch TFT LCD: 1280 x 1024
Max Display Per Board	Two
Max Boards Per Sun Ultra 24	Two
Standard Configuration	No
ATO / X-option	Yes / Yes
Available Drivers	Solaris 10 (Update 4) or later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) – and later Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) – and later SuSE Linux Enterprise Server 9 (64-bit only)– Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit only)– Service Pack 1 and later Windows XP Professional Service Pack 2 and later Windows XP Professional x64 Service Pack 2 and later
Notes	Install in Slot #1 or Slot #3

NVIDIA Quadro NVS 290 Graphics Card

NVIDIA Quadro® NVS 290 graphics board brings a new level of performance, quality and stability for professional 2D multi-display environments. Ground-breaking NVIDIA® unified architecture dynamically allocates geometry, shader, and compute processing power to efficiently deliver optimized performance. Featuring 256MB frame buffer and two single-link DVI-I connectors, NVIDIA Quadro NVS 290 offers the industry’s best image quality at resolutions up to 2560 x 1600 @ 60Hz.

The NVIDIA® Quadro™ NVS 290 Graphics Accelerator card provides to customers the highest-quality professional 2D workstation graphics solution for SW Development or EDA applications. Up to two NVIDIA® Quadro NVS 290 Graphics accelerator cards can be installed in Sun Ultra 24 Workstation simultaneously (Slot #1 and Slot #3), to drive a maximum of four displays.

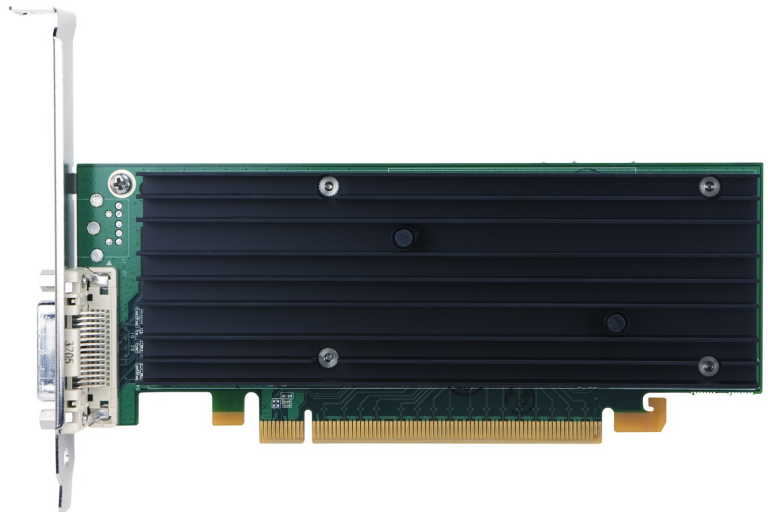


Figure 15 – DMS59-to-DVI Cable



Figure 16 – Connector of NVIDIA Quadro NVS 290 Graphics Accelerator Card

Figure 17 – Board Layout of NVIDIA Quadro NVS 290 Graphics Accelerator Card



The NVIDIA Quadro NVS 290 Graphics Accelerator Card can drive up to two Sun LCDs in digital mode at resolutions up to 1920 x 1200. Each NVIDIA Quadro NVS 290 Graphics Accelerator card also can drive up to two LCDs, in analog mode, or up to two CRTs via an optional DVI-to-VGA adapter (Sun Part Number X8015A). Table 19 summarizes key specifications and features of the NVIDIA Quadro NVS 290 Graphics Accelerator.

Table 19 – Summary of NVIDIA Quadro NVS290 Graphics Accelerator Card Features and Specifications





Form Factor	PCI-Express x1 Low profile with full height connector (2.731 inches x 6.6inches)
Memory	256MB of DDR2 (64-bit interface, 6.4MB/sec)
Clock Rates	<ul style="list-style-type: none"> Memory Clock = 400MHz. Graphics Clock = 350MHz
Connectors	<ul style="list-style-type: none"> DMS59 (DMS59 to DVI cable included)
Power Dissipation	20W
Display Support	<ul style="list-style-type: none"> Drives a digital display at resolutions up to 2560 x 1600 @ 60Hz Drives an analog display at resolutions up to 2048 x 1536 at 85Hz

Form Factor	PCI-Express x1 Low profile with full height connector (2.731 inches x 6.6inches)
Maximum Resolution	Sun 24-inch TFT LCD: 1920 x 1200 Sun 20-inch TFT LCD: 1600 x 1200 Sun 19-inch TFT LCD: 1280 x 1024 Sun 17-inch TFT LCD: 1280 x 1024
Max Display Per Board	Two
Max Boards Per Sun Ultra 24	Two
Standard Configuration	Yes
ATO / X-option	Yes / Yes
Available Drivers	Solaris 10 (Update 4) or later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) – and later Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) – and later SuSE Linux Enterprise Server 9 (64-bit only)– Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit only)– Service Pack 1 and later Windows XP Professional Service Pack 2 and later Windows XP Professional x64 Service Pack 2 and later
Notes	Install in Slot #1 or Slot #3

Displays

The Sun Ultra 24 Workstation and its graphics accelerators have been fully validated to support the following Sun displays:

Table 20 – Sun Displays Validated on Sun Ultra 24 Workstation

	Sun 24.1 inch LCD	Sun 20.1 inch LCD	Sun 19 inch LCD	Sun 17 inch LCD
				
Part Number	X7236A	X7200A	X7205A	X7204A
Resolution	1920x1200	1600x1200	1280x1024	1280x1024
Pixel Pitch	0.27mm	0.255m	0.294m	0.264m
Contrast Ratio	1000:1	700:1	350:1	500:01:00
Brightness	400 cd/m ² (typical)	400 cd/m ² (typical)	230 cd/m ² (typical)	300 cd/m ²
Response Time	16ms	16ms	Unknown	12ms
Viewing Angle	± 89 degrees	± 88 degrees	Unknown	± 70 degrees
Inputs	DVI-D (Digital) HD15 (Analog) YpbPr (component) S-Video C-Video	DVI-D (Digital) HD15 (Analog)	DVI-D (Digital) HD15 (Analog)	DVI-D (Digital) HD15 (Analog)
Cables (All cables detachable unless noted)	DVI-D to DVI-D (3-meter) 1.8-meter HD15 to HD15 Component video cable (YPbPr) S-Video cable C-Video cable USB 2.0 cable	DVI-D to DVI-D (1.8-meter) HD15 to HD15 (length unknown)	DVI-D to DVI-D (3-meter) and HD15 to HD15 (2-meter)	Non-detachable HD15 to HD15 (2-meter)
Power	90W	Unknown	46W	42W
W x H x D (mm)	564.6 x 408.3 x 277.1	442 x 408.5 x 120	412.5 x 406.5x 151	371.9 x375.0 x 213.7
Weight	9.4kg (20.72lbs)	8.4kg (18.5lbs)	8.75kg (19.3lb)	3.7 kg (8.157 lbs)
List Price (U.S)	\$795 (October '07)	\$495 (October '07)	\$299	\$225

Operating Systems

Interoperability in a heterogeneous environment is important to IT managers. The Sun Ultra 24 Workstation is a 64-bit workstation that offers the widest available range of operating systems support—more than other workstations offered by Sun's competitors. Sun Ultra 24 Workstation supports multiple 32-bit and 64-bit operating systems, including Linux and Solaris. Sun Ultra 24 Workstation will also be listed in the Windows Catalog as being fully certified for the Windows XP Professional and Windows XP Professional x64. Table 20 shows the operating systems supported on Sun Ultra 24 Workstation.

Table 21 - Supported Operating Systems on Sun Ultra 24 Workstation

Operating System	Version	When Supported on Sun Ultra 24 Workstation	Pre-installed Option at the Factory?	Sold by Sun?	Supported by Sun
Solaris 10	08/07 (Update 4) & later	Revenue Release	Yes	Yes	Yes
Linux					
Red Hat Enterprise Linux WS 4 (32-bit & 64-bit)	Update 5 & later	Revenue Release	No	Yes	Yes
Red Hat Enterprise Linux WS 5 (32-bit & 64-bit)	Update 0 & later	Revenue Release	No	Yes	Yes
SuSE Linux Enterprise Server 9 (64-bit)	Service Pack 3 & later	Revenue Release	No	Yes	Yes
SuSE Linux Enterprise Desktop 10 (64-bit)	Service Pack 1 & later	Revenue Release	No	Yes	Yes
Windows					
Windows Vista Ultimate (32/64 bit)		Revenue Release	No	No	Yes
Windows Server 2003 R2	Service Pack 2	Revenue Release	No	No	Yes
Windows XP Professional	Service Pack 2 & later	Revenue Release	No	No	Yes
Windows XP Professional x64	Service Pack 2 & later	Revenue Release	No	No	Yes

All Red Hat Enterprise Linux OS's, SuSE Linux Enterprise Server OS's, and Solaris 10 can be ordered from Sun. Support contracts are also available for these operating systems.

The Sun Ultra 24 Workstation will also be listed in the Windows Catalog as being fully certified for the Windows XP Professional, Windows XP Professional x64 and Windows Vista. It has earned the "Compatible with Windows" designation as a certified platform to run the Microsoft Windows XP Professional and Windows XP Professional x64 Operating system. Sun Ultra 24 Workstation will be listed on the Microsoft Hardware Compatibility List (HCL) which can be seen by visiting the Microsoft Windows Hardware and Driver Central (WHDC) at <http://www.microsoft.com/whdc/hcl/search.mspx>. While qualified to run the Microsoft Windows XP Professional operating systems, these operating systems cannot be procured from Sun. However, Sun does support the Windows XP Professional operating systems.

Availability & Ordering

PRESTO

The Sun Ultra 24 Workstation will be formally and fully disclosed, in the form of an "intro", to Sun Field Sales and Sun's Partners on October 23, 2007 the PRESTO date. PRESTO is a cross-Sun review prior to launch that is designed to ensure that Sun products are ready for sale: quotable, orderable, and shippable to Sun customers/partners worldwide, including through online vehicles such as the Sun Catalog, Sun Store and European Portals. The EZ Launch ID for the Sun Ultra 24 "intro" is EZLaunch ID 7733. Announcement ID is Q1FY2008-78.

Webdesk

Webdesk provides the capability to quote and order the Sun Ultra 24 Workstation. Inside Webdesk, the user can place an order for the Sun Ultra 24 Workstation in any configuration. Webdesk will be available on October 23, 2007.

Revenue Release

The Sun Ultra 24 Workstation will reach Revenue Release (RR) on September 28, 2007. RR is the term associated with the first product unit shipped for revenue. RR indicates that the Sun Ultra 24 Workstation meets all of its planned and approved functional feature and quality requirements)

General Availability

The Sun Ultra 24 Workstation will reach General Availability (GA) on October 23, 2007. GA refers to the dates when the Sun Ultra 24 Workstation is available in all planned languages and on all planned media types, with standard processes in place to order, build, deliver and bill for any of them on a worldwide basis. (All orders taken and still pending shipment when GA is declared are to be filled on a first priority basis using standard lead times).

End Of Life (EOL)

End of Life (EOL) is the date in which Sun announces the end-of-life schedule for a stated product. The Sun Ultra 24 Workstation will be EOL has not been determined as of this writing.

Factory Lead Time (FLT)

No amount of standard configurations (configurations pre-built in factory) can meet the various workloads and budget intended for customers of Sun Ultra 24 Workstation. Sun strongly advises resellers and direct customers to order via ATO (Assemble to Order) to get exactly what they want. Unlike previous experiences, there are nearly zero lead time penalties for ATO and nearly zero price premiums for ATO, when compared to standard configurations. Table 22 describes the factory lead time of Sun Ultra 24 Workstation.

Table 22 – Factory Lead Time of Sun Ultra 24 Workstation

	Factory Lead Time	Orders Received by Monday 8am PDT will direct ship to customers or arrive at Sun cross-dock by:
ATO Configurations US EMEA APAC	5 days 5 days 7 days	Friday Friday Following Monday
Standard Configurations US EMEA APAC	4 days 5 days 4 days	Thursday Friday Thursday
X-Options US EMEA APAC	4 days 5 days 4 days	Friday Friday Following Monday
Field Replacement Units	7 – 13 days	Following Monday to second Monday

Assemble to Order (ATO)

Table 23 shows the part numbers and descriptions for Sun Ultra 24 Workstation ATO. ATO provides the ultimate flexibility to Sun's customers, at nearly zero price premium and nearly zero added factory lead time. ATO is available via WebDesk and will soon be available via store.sun.com. An ATO Sun Ultra 24 Workstation order will be built in Sun's factory according to the content specified by the customer.

Table 23 - Sun Ultra 24 Workstation ATO Options

ATO Part Number	List Price	Discount Category	Description
B21-AA	\$495	F	ATO Base for Sun Ultra 24 Workstation (chassis , motherboard, accessory kit)
4117A-Z	\$1176	F	Intel Core2 Extreme Quad Core QX6850 (Kentsfield) 3.0Ghz, 1333Mhz FSB
4118A-Z	\$309	F	Intel Core2 Quad Q6600 (Kentsfield) 2.4Ghz, 1066Mhz FSB
4119A-Z	\$309	F	Intel Core 2 E6850 (Conroe XE) 3.0Ghz, 1333Mhz FSB
4125A-Z	\$133	F	Intel Core2 Duo E4400 (Conroe) 2.0Ghz, 800Mhz FSB
4126A-Z	\$613	F	Intel Core2 Quad Q6700 (Kentsfield) 2.66Ghz, 1066Mhz FSB
4122A-Z	\$218	F	Intel Core2 Duo E6750 (Conroe) 2.66Ghz, 1066Mhz FSB
5279A-Z	\$599	F	4GB Unbuffered ECC DDR2-667 Memory Kit (2x 2GB)
5278A-Z	\$279	F	2GB Unbuffered ECC DDR2-667 Memory Kit (2x 1GB)
5277A-Z	\$179	F	1GB Unbuffered ECC DDR2-667 Memory Kit (2x 512MB)
4084A-Z	\$2795	F	Nvidia Quadro FX 5600
4083A-Z	\$1795	F	Nvidia Quadro FX 4600
4128A-Z	\$965	F	Nvidia FX3700
4129A-Z	\$545	F	Nvidia FX1700
4130A-Z	\$245	F	Nvidia FX570
4131A-Z	\$145	F	Nvidia NVS290
SG-XPCIE4SAS-Z	\$199	F	LSI Logic 4-port SAS (Serial Attached SCSI) Internal Adapter (Available in Q1CY07)
RB-ST1CE-750G7K	\$649	F	3.5" 750GB SATA 3.0Gbps 7,200 RPM
RC-ST1CE-250G7K	\$229	F	3.5" 250GB SATA 3.0Gbps 7,200 RPM
RB-SS1CE-146G15KZ	\$459	F	3.5" 146GB SAS 15,000 RPM
RB-SS1CE-300G15K	\$999	F	3.5" 300GB SAS 15,000 RPM
4133A-Z	\$110	F	DVD-Dual (16X DVD+/-RW Drive supports read/write in dual +/- formats. Supports double-layer DVD to hold up to 8.5GB or single-layer DVD to hold up to 4.7GB)
4134A-Z	\$55	F	DVD-ROM (16X DVD-ROM drive reads CD/DVD only. Does not write)
8015A-Z	\$15	F	ATO Option DVI-to-VGA Adapter
8016A-Z	\$0	F	No HDD optio
4218A	\$70	F	Intel Pro/1000 PT Desktop Adapter (PCI-Express x1, 1-port desktop copper NIC – Intel P/N EXP19300PT)
7280A-2	\$269	F	Sun PCI-Express x4 Dual Gigabit Ethernet NIC (Copper)
7281A-2	\$889	F	Sun PCI-Express x4 Dual Gigabit Ethernet NIC (Fiber)
3319A-Z	\$0	F	Solaris 10 Update 4 Preinstall Image
4136A-Z	\$15	F	No Optical Drive Option - Blank face plane

Standard Configuration

Sun Ultra 24 Workstation has four standard configurations. Table 24 shows the part numbers and descriptions for each standard configuration of Sun Ultra 24 Workstation.

Table 24 - Sun Ultra 24 Workstation Standard Configurations

Part Number	U.S. List Price	Discount Category	Description
B21-TAZ1-AA-512DT	\$995	F	Sun Ultra 24 Workstation ROHS-6; 1 * Intel Core2 Duo E4400 2.0Ghz, 512MB Memory, 1 *250GB SATA HDD, Nvidia NVS290 Graphics, 1 * DVD-ROM, 1 * 10/100/1000 BaseT Ethernet port, 2 * 1394 Firewire, Audio, 6 * USB2.0 ports, 2 * full-length PCI slots, 4 * PCI-Express slots, Solaris license. Solaris 10 and Sun Development tools pre-installed.
B21-TNZ1-AA-1GDU	\$1445	F	Sun Ultra 24 Workstation ROHS-6; 1 * Intel Core2 Quad Q6600 2.4Ghz, 1GB Memory, 1 *250GB SATA HDD, Nvidia NVS290 Graphics, 1 * DVD-ROM, 1 * 10/100/1000 BaseT Ethernet port, 2 * 1394 Firewire, Audio, 6 * USB2.0 ports, 2 * full-length PCI slots, 4 * PCI-Express slots, Solaris license. Solaris 10 and Sun Development tools pre-installed.
B21-TGZ1-AC-1GDU	\$1835	F	Sun Ultra 24 Workstation ROHS-6; 1 * Intel Core2 Duo E6850 3.0Ghz, 1GB Memory, 1 *250GB SATA HDD, Nvidia FX 1700, 1 * DVD-Dual, 1 * 10/100/1000 BaseT Ethernet port, 2 * 1394 Firewire, Audio, 6 * USB2.0 ports, 2 * full-length PCI slots, 4 * PCI-Express slots, Solaris license. Solaris 10 and Sun Development tools pre-installed.
B21-TSZ1-AA-2GDU	\$2335	F	Sun Ultra 24 Workstation ROHS-6; 1 * Intel Core2 Quad Extreme QX6850 3.0Ghz, 2GB Memory, 1 *250GB SATA HDD, Nvidia NVS290 Graphics, 1 * DVD-Dual, 1 * 10/100/1000 BaseT Ethernet port, 2 * 1394 Firewire, Audio, 6 * USB2.0 ports, 2 * full-length PCI slots, 4 * PCI-Express slots, Solaris license. Solaris 10 and Sun Development tools pre-installed.

X-Options

Table 25 shows the part numbers and descriptions for Sun Ultra 24 Workstation X-options. X-Options are upgrade components such as graphics accelerators, hard disk drives, memory, and are deemed by Sun to be end-user installable. X-Options may be purchased directly at store.sun.com or Webdesk. X-Options comes in individual packaging and contain end-user friendly instructions to aid installation. Some items such as CPUs, are available via ATO only and not X-Options because these items must be installed in Sun Ultra 24 Workstation before shipped to customer.

Table 25 - Sun Ultra 24 Workstation X-Options

Part Number	List Price	Discount Category	Description
X5279A-Z	\$599	F	4GB Unbuffered ECC DDR2-667 Memory Kit (2x 2GB)
X5278A-Z	\$279	F	2GB Unbuffered ECC DDR2-667 Memory Kit (2x 1GB)
X5277A-Z	\$179	F	1GB Unbuffered ECC DDR2-667 Memory Kit (2x 512MB)
X4084A-Z	\$2795	F	Nvidia Quadro FX 5600
X4083A-Z	\$1795	F	Nvidia Quadro FX 4600
X4128A-Z	\$965	F	Nvidia FX3700
X4129A-Z	\$545	F	Nvidia FX1700
X4130A-Z	\$245	F	Nvidia FX570
X4131A-Z	\$145	F	Nvidia NVS290
SG-XPCIE4SAS-Z	\$199	F	LSI Logic 4-port SAS Internal Adapter
XRB-SS1CE-146G15KZ	\$459	F	146GB Internal SAS 15,000-RPM 3.5-inch HDD
XRB-SS1CE-300G15K	\$995	F	300GB Internal SAS 15,000-RPM 3.5-inch HDD
XRB-ST1CE-750G7K	\$649	F	750GB Internal SATA 3Gbps 7,200-RPM 3.5-inch HDD
XRC-ST1CE-250G7K	\$229	F	250GB Internal SATA 3Gbps 7,200 RPM 3.5-inch HDD
SG-XTAPDAT72-D2	\$995	F	Sun StorEdge DAT 72 (3MBps, 72GB per cartridge – available Q1CY07)
SG-XTAPSDLT600-D-Z	\$4,855	F	Sun StorEdge SDLT Drive 600 Table-Top Local Backup (36MBps, 300GB per cartridge – available Q1CY07)
SG-XTAPLTO2V-D	\$2195	F	Sun StorEdge "LTO 2V" Tape Drive (24MBps, 200GB per cartridge)
SG-XTAPLTO2-D-2	\$4855	F	Sun StorEdge "LTO " Tape Drive (30MBps, 200GB per cartridge)
SG-XTAPLTO3-D-2	\$5685	F	Sun StorEdge "LTO 3" Tape Drive (80MBps, 400GB per cartridge)
X4133A-Z	TBD	F	DVD-Dual (16X DVD+/-RW Drive supports read/write in dual +/- formats. Supports double-layer DVD to hold up to 8.5GB or single-layer DVD to hold up to 4.7GB)
X4134A-Z	TBD	F	DVD-ROM (16X DVD-ROM drive reads CD/DVD only. Does not write)
X8015A-Z	\$15	F	Option DVI-to-VGA Adapter
X4136A-Z		F	No Optical Drive Option - Blank face plane
X4218A	\$60	F	Intel Pro/1000 PT Desktop NIC (PCI Express x1, 1-port copper - EXP19300PT)
X7280A-2	\$269	F	Sun PCI Express x4 Dual Gigabit Ethernet NIC (Copper)
X7281A-2	\$889	F	Sun PCI Express x4 Dual Gigabit Ethernet NIC (Fiber)

Field Replacement Units (FRUs) and Customer Replacement Units (CRUs)

Table 26 shows the part numbers and descriptions for Sun Ultra 24 Workstation Field Replacement Units (FRUs) and Customer Replacement Units (CRUs). CRUs are components that can be replaced at the buyer's location without having to send the entire system to be repaired. FRUs are not deemed by Sun to be end-user installable due to their complexity (mechanical, electrical, others). Only processors and motherboard assembly of the Sun Ultra 24 are FRUs. FRUs and CRUs may be purchased from Sun via store.sun.com.

Table 26 - Sun Ultra 24 Workstation FRUs and CRUs

Part Number	FRU / CRU	Price	Description
#375-3540	FRU	\$594.99	Motherboard Assembly (Spec is 950-5453)
#310-0163	CRU	\$87.99	CPU Fan Heatsink – Active
#371-3617	FRU	\$3455.99	Intel Core2 Extreme Quad Core QX6850 (Kentsfield) 3.0Ghz, 1333Mhz FSB
#371-3618	FRU	\$922.99	Intel Core2 Quad Q6600 (Kentsfield) 2.4Ghz, 1066Mhz FSB
#371-3619	FRU	\$922.99	Intel Core2 Duo E6850 (Conroe XE) 3.0Ghz, 1333Mhz FSB
#371-3620	FRU	\$411.99	Intel Core2 Duo E4400 (Conroe) 2.0Ghz, 800Mhz FSB
#371-3621	FRU	\$1811.99	Intel Core2 Quad Q6700 (Kentsfield) 2.66Ghz, 1066Mhz FSB
#371-3622	FRU	\$658.99	Intel Core2 Duo E6750 (Conroe) 2.66Ghz, 1066Mhz FSB
#540-7238	CRU	\$885.99	3.5" 750GB SATA 3.0Gbps 7,200 RPM
#540-6485	CRU	\$245	3.5" 250GB SATA 3.0Gbps 7,200 RPM
#540-7088	CRU	\$933.99	3.5" 146GB SAS 15,000 RPM
#540-7155	CRU	\$1542.99	3.5" 300GB SAS 15,000 RPM
#300-2132	CRU	\$244.99	530W Power Supply Unit
#371-2108	CRU	\$52	System Fan Module – Single Unit (Munich's fan assy)
#540-7058	CRU	\$290	1GB Unregistered DDR2-667 DIMM Kit (2x512MB)
#540-7059	CRU	\$490	2GB Unregistered DDR2-667 DIMM Kit (2x1GB)
#540-7060	CRU	\$1490	4GB Unregistered DDR2-667 DIMM Kit (2x2GB)
#540-7509	CRU	\$152	DVD-Dual (Write/Read DVDs/CDs. DVDs in + formats, on both layers)
#540-7510	CRU	\$96.99	DVD-ROM (Reads DVDs/CDs only. Double Density, Not capable to write)
#371-2964	CRU	\$6574.99	Nvidia Quadro FX 5600
#371-2963	CRU	\$3365.99	Nvidia Quadro FX 4600
#371-3624	CRU	\$1989.99	Nvidia FX3700
#371-3625	CRU	\$1989.99	Nvidia FX1700
#371-3626	CRU	\$1087.99	Nvidia FX570
#371-3627	CRU	\$345.99	Nvidia NVS290
#530-3474	CRU	\$15	DVI-to-VGA Adapter
#371-3631	CRU	\$50.99	System Cable Kit (5), 1394, DVD, Front Control, HDD Bkpln, +1 more ?
#371-209	CRU	\$199	4-port internal-only SAS Adapter (LSI Logic 3041E)
#371-2131	CRU	\$55	I/O PCBA Assembly (Munich)
#371-3630	CRU	\$74.99	HDD Backplane Assembly (4 Drive)
#371-2210	CRU	\$40.00	Motherboard battery

Country Kits (Mouse, Keyboard, Power Cords)

Sun Ultra 24 Workstation has been fully validated with 27 different Sun Country Kits shown in Table 27. Country kits include the keyboard, mouse, and power cord compatible to a specific geography. Sun Ultra 24 Workstation has been validated with Type 7 keyboards and Type 7 mice only. Type 6 keyboards and Type 6 mice have been discontinued and have not been validated on Sun Ultra 24 Workstation.



<p>Sun Type 7 Keyboard</p> 	<p>Full size keyboard with Solaris short-cut keys</p> <ul style="list-style-type: none"> • Tilt legs for adjustable typing angles • 6.5 ft. (2 meter) Cable • UNIX and PC layouts available (UNIX layout uses different layout for non-standard keys, such as ESC, Backspace, Caps Lock and Control functions) • Multi-language support (support for 25 different languages) • Includes 2 USB hubs for plugging in other devices such as mouse and smart card reader • RoHS-6 (Lead Free) Compliant • Sleek new Sun industrial design • Fully tested for compatibility with Sun workstation and Sun Ray thin clients
<p>Sun Type 7 Mouse</p> 	<p>Three button with optical tracking and scroll wheel</p> <ul style="list-style-type: none"> • Optical sensor records motion more precisely than a traditional mouse • Ease-of-use and increased reliability because there are no moving parts to wear out or collect dust/dirt • No mouse pad needed for this device • Convenient, faster scrolling through documents without clicking on scroll bar • Ergonomic design • RoHS-6 (Lead Free) Compliant • Sleek, intuitive new Sun industrial design • Fully tested for compatibility with Sun workstations and Sun Ray thin clients

Table 27 - Sun Type 7 Country Kits

Country Kit	Part Number	Country Kit	Part Number
Type 7 Arabic	X3791A	Type 7 Norwegian	X3760A
Type 7 Australian	X3766A	Type 7 Portuguese	X3761A
Type 7 Belgian	X3790A	Type 7 Russian	X3785A
Type 7 Chinese	X3782A	Type 7 Spanish	X3762A
Type 7 Danish	X3763A	Type 7 Swedish	X3736A
Type 7 Dutch/Netherlands	X3765A	Type 7 Euro Universal	X3868A
Type 7 Euro Universal	X3868A	Type 7 Euro UNIX	X3759A
Type 7 Euro UNIX	X3759A	Type 7 Swiss-French	X3734A
Type 7 Finnish	X3767A	Type 7C Swiss-German	X3735A-COM
Type 7 French	X3732A	Type 7C Taiwanese	X3754A-COM
Type 7 German	X3733A	Type 7C Turkish-Q	X3787A-COM
Type 7 Italian	X3764A	Type 7C UK	X3737A-COM
Type 7 Japanese	X3756A	Type 7C US PC	X3731A-COM
Type 7 Korean	X3755A		

Table 28 - Sun Power Cords

Power Cord	Part Number
US/Asia	X311L
Continental Europe	X312L
Australia	X386L
UK	X317L
Switzerland	X314L
Italy	X384L
Denmark	X383L
Chinese	X312E
Argentina, AC	X312F
Korean. 250V	X312G

Appendix

Comparison: Sun Ultra 24 Workstation versus Sun Ultra 20 M2 Workstation

Sun Ultra 24 Workstation is intended to complement the Sun Ultra 20 M2 Workstation and provide customers and developers the choice between the two dominate x64 processor architectures – AMD Opteron and Intel's Core 2. The Sun Ultra 20 M2 Workstation, featuring the AMD Opteron 1000-series processor, represented a tremendous price-performance ratio at its introduction, with significantly better memory bandwidth than it's predecessor and dual core Opteron processors. Sun Ultra 24 Workstation, featuring the dual-core and quad-core Intel® Core™2 processor, improves upon this legacy. Sun Ultra 24 Workstation matches the memory bandwidth of the Ultra 20 M2 while doubling the number of processing cores to deliver higher system performance than the Sun Ultra 20 Workstation, while retaining the starting list price of under \$1,000 (U.S. List Price). Table 29 compares the differences of these two workstations.

Sun Ultra 24 Workstation will enable customers to:

- Deploy the latest Intel Processor technology.
- Visualize very large data sets (up to 8GB of main memory)
- See multiple data sets, simultaneously (up to four high performance displays)
- Use the the latest and fastest graphics technology FX5600 and Gen2 PCI-Express
- Be more productive by running multiple applications simultaneously, or for applications that can split a task across four processor cores
- Gain the highest overall performance found on a 1-socket workstation
- Wants the flexibility of using dual-core or quad-core processors

The Sun Ultra 20 Workstation is ideal for customers who:

- Visualize very large data sets (up to 8GB of main memory)
- See multiple data sets, simultaneously (up to four high performance displays)
- Reduce the cost of networking down time (integrated dual gigabit Ethernet ports)
- Wants the flexibility of using single-core or dual-core processors

Table 29 - Improvements of Sun Ultra 24 Workstation to the Sun Ultra 20 Workstation

Features	Sun Ultra 24 Workstation	Sun Ultra 20 M2 Workstation	Sun Ultra 24 Delta
Processor Type	Intel® Core™2 Duo Processors Intel® Core™2 Quad Processors	AMD Opteron 1200-series Processor Dual-core only	Quad Core Capable
Processor Models	E4400 Intel® Core™2 Duo 2.0Ghz, 800Mhz FSB E6750 Intel® Core™2 Duo 2.66Ghz, 1066Mhz FSB E6850 Intel® Core™2 Duo 3.0Ghz, 1333Mhz FSB Q6600 Intel® Core™2 Quad 2.4Ghz,1066Mhz FSB Q6700 Intel® Core™2 Quad 2.66Ghz, 1066Mhz FSB QX6850 Intel® Core™2 Extreme Quad Core 3.0Ghz, 1333Mhz FSB	1220SE (Dual Core 2.8GHz 125W) 1218 (Dual Core 2.6GHz 103W) 1214 (Dual Core 2.2GHz 103W) 1210 (Dual Core 1.8GHz 103W) 1222SE (Dual Core 3GHz 125W)	Dual and Quad core processors on the Ultra 24
Memory	Unbuffered DDR2-667, 8GB maximum 3 DIMM sizes (512B ECC, 1GB ECC, 2GB ECC)	Unbuffered DDR2-667, 8GB maximum 3 DIMM sizes (512B ECC, 1GB ECC, 2GB ECC)	
Graphics Accelerators	One Quadro FX 5600 One Quadro FX 4600 Two Quadro FX 3700 Two Quadro FX 1700 Two Quadro FX 570 Two Quadro NVS 290	One Quadro FX 3500 One Quadro FX 1500 One Quadro FX 560 One Quadro NVS 285 ATI ES1000 (on-board) Up to two FX560 or NVS 285	Wider range of graphics offers, PCIExpress Gen2 capable. Support for highend FX5600 and FX4600.
Internal Storage	Up to four SATA drives, 3TB maximum: 250, 750GB (7,200-rpm) Up to four SAS drives, 1.2TB maximum: 146GB, 300GB (15,000-rpm) SAS provided through PCIe HBA	Up to two SATA drives, 1TB maximum: 80, 250, 500GB (7,200-rpm) Up to two SAS drives, 292GB maximum: 146GB (15,000-rpm)	More drive expansion. Four drive bays vs two.
Optical Drives	Front-loading DVD-Dual (SATA)	Front-loading DVD-Dual (IDE)	
Networking	One Gigabit Ethernet port integrated on motherboard. Single RJ-45 ports (rear)	Two Gigabit Ethernet ports integrated on motherboard. Two RJ-45 ports (rear)	
Audio	High Definition 7.1 Channel	High Definition Channel	
PCI-Express slots	Two full-length @ x16 slot One full-length @ x8 slot <u>wired as x4</u> One full-length @ x1 slot	One full-length @ x16 slot One full-length @ x16 slot <u>wired as x8</u> One full-length @ x1 slot	Four vs Three PCIe slots. Support for Gen2. Additional PCIe x1 and PCIe x8 slots.
32-bit/33-MHz PCI Slots	Two full-length slots	Three full-length slots	

Features	Sun Ultra 24 Workstation	Sun Ultra 20 M2 Workstation	Sun Ultra 24 Delta
O/S Validated by Sun	Solaris 10 8/07 (Update 4) Windows Vista Ultimate (32-bit/64-bit) Windows XP Professional (32/64) Service Pack 2 and Later Windows Server 2003 R2 and SP2 (32-bit/64-bit) Red Hat Enterprise Linux Client 5 (32/64-bit) and Later Red Hat Enterprise Linux WS 4.5 (32/64-bit) and later SuSE Linux Enterprise Server 9 (64-bit) Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit) Service Pack 1 and later	Solaris 10 6/06 (Update 2) or later RHEL WS 3 Update 7 & later RHEL WS 4 Update 3 & later RHEL WS 5 Update 3 & later SLES 9 SP3 & later SLED 10 SP3 & later Windows XP Professional SP2 & later Windows XP Professional x64 SP0 & later Windows Vista Client (32./64)	Ultra 20M2 maintains legacy support for Windows and RHEL
Height	433.6mm (17.07 in)	433.6mm (17.07 in)	No change
Width	199.6mm (7.86 in)	199.6mm (7.86 in)	No change
Depth	467.45mm (18.40 in)	467.45mm (18.40 in)	No change
Power supply	530 Watt (80 Plus Efficiency Rating)	400 Watt	Higher Power, More efficient
Price Range		\$995 to \$2,795 (U.S. List)	

Comparison: Sun Ultra 24 Workstation versus Sun Ultra 25 Workstation

Sun Ultra 24 Workstation complements and broadens Sun's workstation portfolio. The Sun Ultra 25 Workstation, featuring the UltraSPARC III Processor, represents 24 years of Sun designing and delivering enterprise-class technical workstations. At the heart of the most complex and demanding projects, Sun has shipped more than 1M UltraSPARC-based workstations to date. Sun Ultra 24 Workstation, featuring the Intel® Core™2 Processors, represents the best performance for x64 applications and addresses customer needs for compatibility of x64 32-bit applications with the seamless ability to move into the future of 64-bit computing. Table 30 compares the differences of these two workstations.

The Sun Ultra 24 Workstation enables customers to:

- Run both 32-bit x64 and 64-bit x64 applications
- Get more performance / \$
- Run more applications on a wider range of operating systems (Solaris, Linux, and Windows)
- Acquire a 64-bit x64 workstation at a starting list price of about \$995 (USD)
- Get much higher memory bandwidth

The Sun Ultra 25 Workstation is ideal for customers who:

- Require binary compatibility with Sun SPARC processors
- Want to run applications available only on SPARC/Solaris
- Have modest graphics requirements

Table 30 - Comparison of the Sun Ultra 24 Workstation to the Sun Ultra 25 Workstation

Features	Sun Ultra 24 Workstation	Sun Ultra 25 Workstation	Advantages
Processor Type	Intel® Core™2 Duo Processors Intel® Core™2 Quad Processors	Sun UltraSPARC III Processor	Sun Ultra 24
Processor Models	E4400 Intel® Core™2 Duo 2.0Ghz, 800Mhz FSB E6750 Intel® Core™2 Duo 2.66Ghz, 1066Mhz FSB E6850 Intel® Core™2 Duo 3.0Ghz, 1333Mhz FSB Q6600 Intel® Core™2 Quad 2.4Ghz, 1066Mhz FSB Q6700 Intel® Core™2 Quad 2.66Ghz, 1066Mhz FSB QX6850 Intel® Core™2 Extreme Quad Core 3.0Ghz, 1333Mhz FSB	Single Core 1.6GHz	Sun Ultra 24
Memory	Unbuffered DDR2-667, 8GB maximum 3 DIMM sizes (512B ECC, 1GB ECC, 2GB ECC)	Unbuffered DDR-333 8GB maximum 3 DIMM sizes (512B ECC, 1GB ECC, 2GB ECC)	Sun Ultra 24
Graphics Accelerators	One Quadro FX 5600 One Quadro FX 4600 Two Quadro FX 3700 Two Quadro FX 1700 Two Quadro FX 570 Two Quadro NVS 290	Up to 2 Sun XVR-2500 Up to 2 Sun XVR-100	Sun Ultra 24
Optical Drives	Front-loading DVD-Dual	Slot-loading DVD-Dual	
Hard disk drives	Up to four SATA drives, 3TB maximum: 250, 750GB (7,200-rpm) Up to four SAS drives, 1.2TB maximum: 146GB, 300GB (15,000-rpm) SAS provided through PCIe HBA Gigabit Ethernet port	Up to four SATA drives, 1TB maximum: 160, 250 GB (7,200-rpm) Up to four SAS drives, 584GB maximum: 146GB (15,000-rpm)	Sun Ultra 24
RAID	Raid 0, 1 (Windows, Linux – Solaris in Update 5)	None	Sun Ultra 24

Features	Sun Ultra 24 Workstation	Sun Ultra 25 Workstation	Advantages
Audio	High Definition 7.1 ChannelTwo full-length @ x16 slot	AC '97	Sun Ultra 24
Serial Ports	None	Two (rear)	Sun Ultra 25
PCI-Express slots	Two full-length @ x16 slot (Gen2) One full-length @ x8 slot <u>wired as x4</u> One full-length @ x1 slot	One full-length x16 wired as x8 One full-length x16 wired as x4 One full-length x8 wired as x4	Sun Ultra 24
PCI-X slots (3.3V, 64-bit, up to 133MHz)	None	Two full-length slots	Sun Ultra 25
Conventional PCI slots (32-bit, 33MHz)	Two full-length slots	One full-length slot	Sun Ultra 24
O/S Validated by Sun	Solaris 10 8/07 (Update 4) Windows Vista Ultimate (32-bit/64-bit) Windows XP Professional (32/64) Service Pack 2 and Later Windows Server 2003 R2 and SP2 (32-bit/64-bit) Red Hat Enterprise Linux Client 5 (32-bit & 64-bit) and Later Red Hat Enterprise Linux WS 4.5 (32-bit & 64-bit) and later SuSE Linux Enterprise Server 9 (64-bit) Service Pack 3 and later SuSE Linux Enterprise Desktop 10 (64-bit) Service Pack 1 and later	Solaris 10	Sun Ultra 24
Height	433.6mm (17.07 in)	445mm (17.50 in)	Sun Ultra 24
Width	199.6mm (7.86 in)	205 mm (8.10 in.)	Sun Ultra 24
Depth	467.45mm (18.40 in)	569 mm (22.40 in.)	Sun Ultra 24
Weight	15.4 kg (34 lbs.)	26.31 kg (58 lbs)	Sun Ultra 24
Power supply	530 Watt (80 Plus Efficiency Rating)	1000 Watt	Sun Ultra 24
Price Range	Starting under \$1000	\$3,695 to \$4,095	Sun Ultra 24