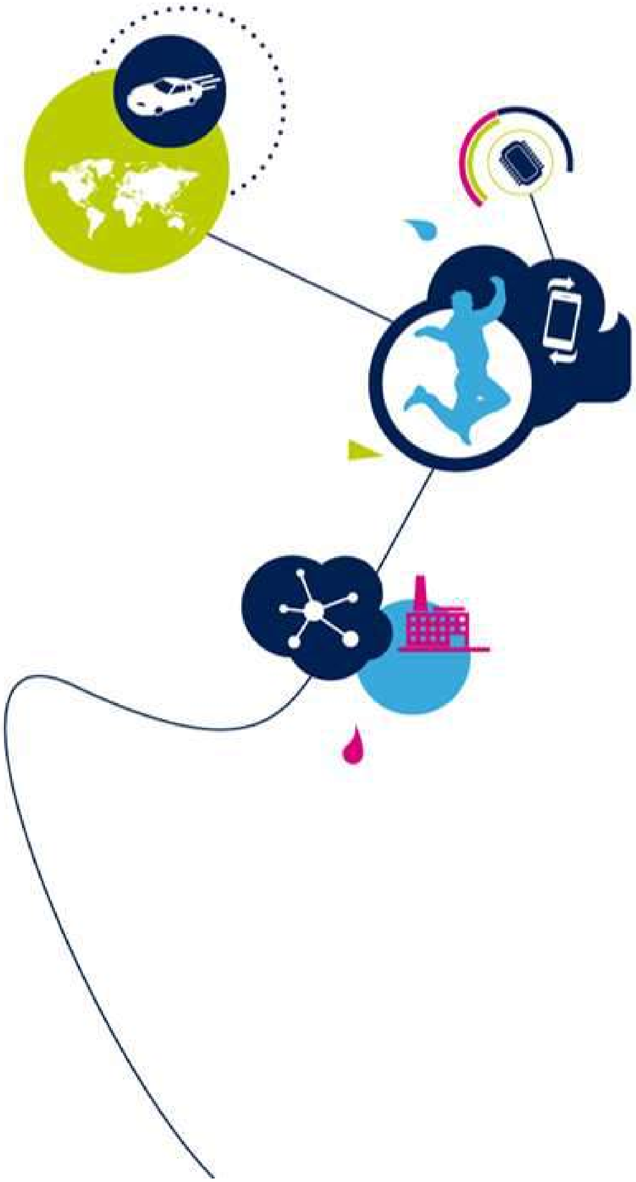
STMicroelectronics

Capital Markets Day 2018

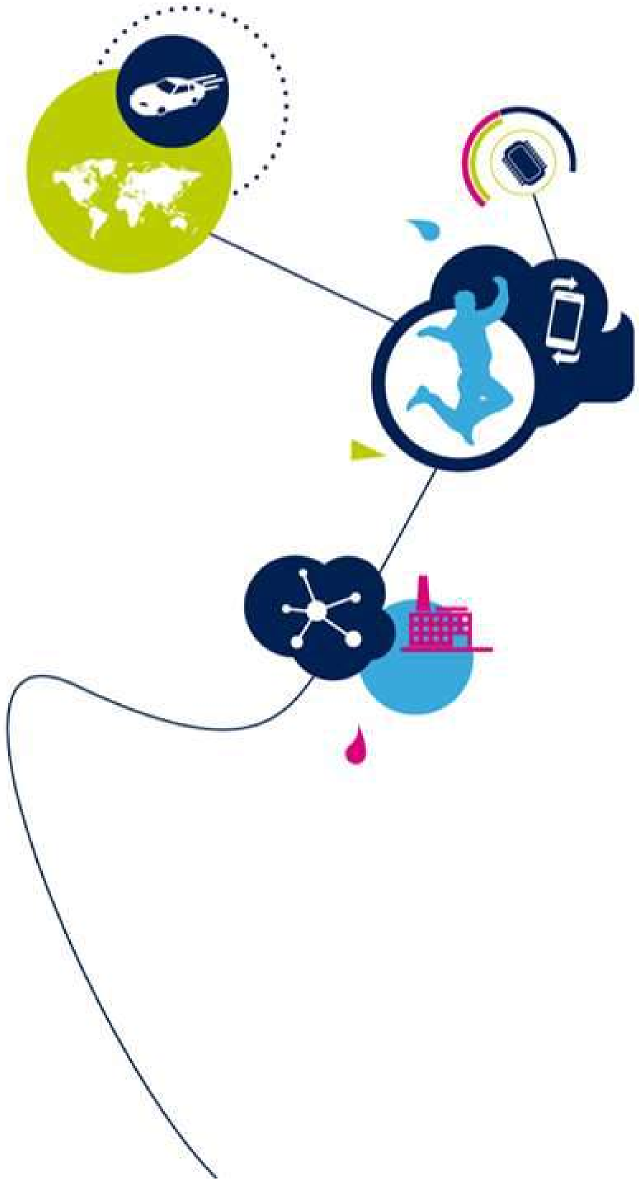


life.augmented

Introduction

Tait Sorensen

Group Vice President, Investor Relations



life.augmented

Agenda

Time	Presentation	Speakers
9:00 a.m.	**Introduction**	**Tait Sorensen**, Group Vice President, Investor Relations
	Welcome	**Carlo Bozotti**, President & CEO
	Introductory Remarks	**Jean-Marc Chery**, Designated President & CEO
	Business & Financials Results	**Carlo Ferro**, President, Finance, Legal, Infrastructure and Services, Chief Financial Officer
	2018 Financial Priorities	**Lorenzo Grandi**, Designated President, Finance, Infrastructure and Services and Chief Financial Officer
	Global Sales & Marketing	**Marco Cassis**, Designated President, Sales, Marketing, Communications and Strategy Development
	Automotive and Discrete Group	**Marco Monti**, President, Automotive and Discrete Group
10:45 a.m.	**Break – Demos**	
11:00 a.m.	**Microcontrollers and Digital ICs Group**	**Claude Dardanne**, President, Microcontrollers and Digital ICs Group
	Analog, MEMS and Sensors Group	**Benedetto Vigna**, President, Analog, MEMS and Sensors Group
12:40 p.m.	**Q&A Panel**	**Carlo Bozotti, Jean-Marc Chery, Carlo Ferro, Lorenzo Grandi, Marco Cassis**
1:15 p.m.	**Lunch – Demos**	

Forward Looking Statements

Some of the statements contained in this release that are not historical facts are statements of future expectations and other forward-looking statements (within the meaning of Section 27A of the Securities Act of 1933 or Section 21E of the Securities Exchange Act of 1934, each as amended) that are based on management's current views and assumptions, and are conditioned upon and also involve known and unknown risks and uncertainties that could cause actual results, performance, or events to differ materially from those anticipated by such statements, due to, among other factors:

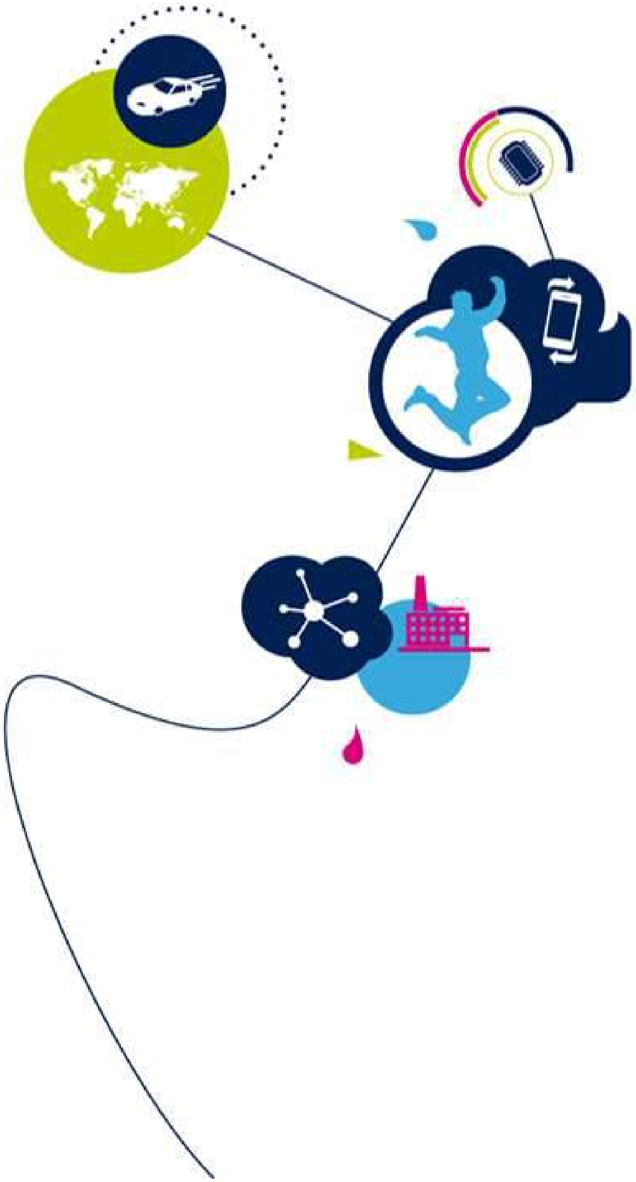
- *Uncertain macro-economic and industry trends, which may impact end-market demand for our products;*
- *Customer demand that differs from projections;*
- *The ability to design, manufacture and sell innovative products in a rapidly changing technological environment;*
- *Unanticipated events or circumstances, which may impact our ability to execute the planned reductions in our net operating expenses and / or meet the objectives of our R&D Programs, which benefit from public funding;*
- *Changes in economic, social, labor, political, or infrastructure conditions in the locations where we, our customers, or our suppliers operate, including as a result of macro-economic or regional events, military conflicts, social unrest, labor actions, or terrorist activities;*
- *The Brexit vote and the perceptions as to the impact of the withdrawal of the U.K. may adversely affect business activity, political stability and economic conditions in the U.K., the Eurozone, the EU and elsewhere. While we do not have material operations in the U.K. and have not experienced any material impact from Brexit on our underlying business to date, we cannot predict its future implications;*
- *Financial difficulties with any of our major distributors or significant curtailment of purchases by key customers;*
- *The loading, product mix, and manufacturing performance of our production facilities;*
- *The functionalities and performance of our IT systems, which support our critical operational activities including manufacturing, finance and sales, and any breaches of our IT systems or those of our customers or suppliers;*
- *Variations in the foreign exchange markets and, more particularly, the U.S. dollar exchange rate as compared to the Euro and the other major currencies we use for our operations;*
- *The impact of intellectual property ("IP") claims by our competitors or other third parties, and our ability to obtain required licenses on reasonable terms and conditions;*
- *The ability to successfully restructure underperforming business lines and associated restructuring charges and cost savings that differ in amount or timing from our estimates;*
- *Changes in our overall tax position as a result of changes in tax rules, new or revised legislation, the outcome of tax audits or changes in international tax treaties which may impact our results of operations as well as our ability to accurately estimate tax credits, benefits, deductions and provisions and to realize deferred tax assets;*
- *The outcome of ongoing litigation as well as the impact of any new litigation to which we may become a defendant;*
- *Product liability or warranty claims, claims based on epidemic or delivery failure, or other claims relating to our products, or recalls by our customers for products containing our parts;*
- *Natural events such as severe weather, earthquakes, tsunamis, volcano eruptions or other acts of nature, health risks and epidemics in locations where we, our customers or our suppliers operate;*
- *Availability and costs of raw materials, utilities, third-party manufacturing services and technology, or other supplies required by our operations;*
- *Industry changes resulting from vertical and horizontal consolidation among our suppliers, competitors, and customers;*
- *The ability to successfully ramp up new programs that could be impacted by factors beyond our control, including the availability of critical third party components and performance of subcontractors in line with our expectations; and*
- *Theft, loss, or misuse of personal data about our employees, customers, or other third parties, and breaches of global privacy legislation, including the EU's General Data Protection Regulation ("GDPR").*

Such forward-looking statements are subject to various risks and uncertainties, which may cause actual results and performance of our business to differ materially and adversely from the forward-looking statements. Certain forward-looking statements can be identified by the use of forward looking terminology, such as "believes," "expects," "may," "are expected to," "should," "would be," "seeks" or "anticipates" or similar expressions or the negative thereof or other variations thereof or comparable terminology, or by discussions of strategy, plans or intentions.

Some of these risk factors are set forth and are discussed in more detail in "Item 3. Key Information — Risk Factors" included in our Annual Report on Form 20-F for the year ended December 31, 2016, as filed with the SEC on March 3, 2017. Should one or more of these risks or uncertainties materialize, or should underlying assumptions prove incorrect, actual results may vary materially from those described in this release as anticipated, believed, or expected. We do not intend, and do not assume any obligation, to update any industry information or forward-looking statements set forth in this release to reflect subsequent events or circumstances.

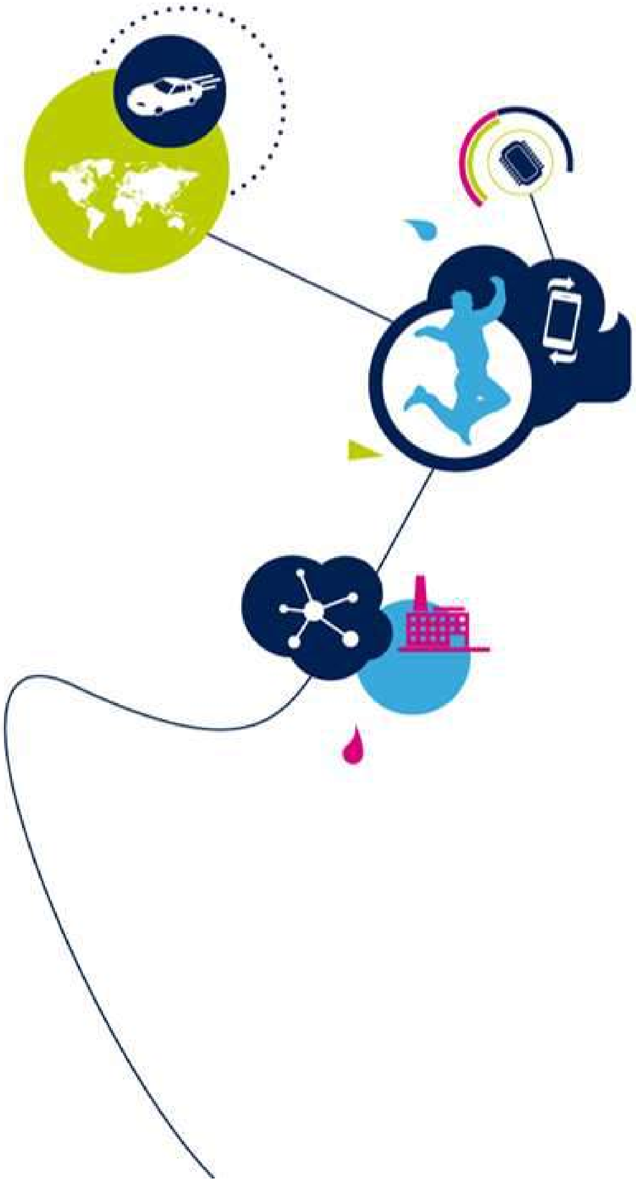
STMicroelectronics

Capital Markets Day 2018



life.augmented

Introductory Remarks



Jean-Marc Chery

Designated President and Chief Executive Officer

life.augmented

life.augmented

Business & Financial Performance


STM32
SUMMIT
2018
25-26 APRIL
SHENZHEN
life.augmented
2018年STM32中国峰会
SECURITY & INDUSTRY

MEMS
For Sensors & Microactuators

FD-SOI CMOS
FinFET through Foundry

Analog & RF CMOS

eNVM CMOS

Smart Power: BCD
(Bipolar - CMOS - Power DMOS)

Discrete, Passive Integration, Power MOSFET, IGBT
Silicon Carbide, Gallium Nitride

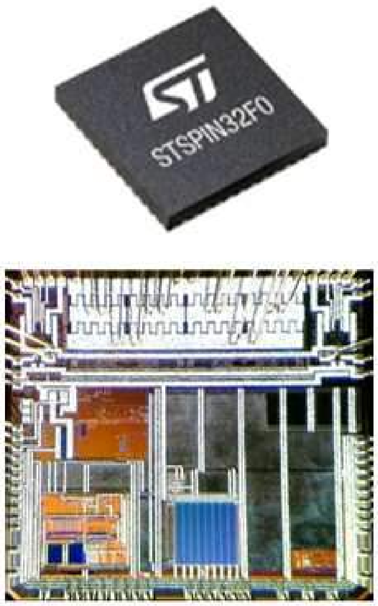
Vertical Intelligent Power

Specialized Imaging Sensors

Packaging technologies
Leadframe – Laminate – Sensor module – Wafer level

life.augmented

BCD



Specialized Imaging

Silicon Carbide


APPLIED MATERIALS
MENDC05
APPLIED MATERIALS
APPLIED MATERIALS
APPLIED MATERIALS
HBOUT07

Analog, Industrial & Power Conversion ICs

MEMS & Specialized Imaging Sensors

Dedicated Automotive ICs

Discrete & Power Transistors

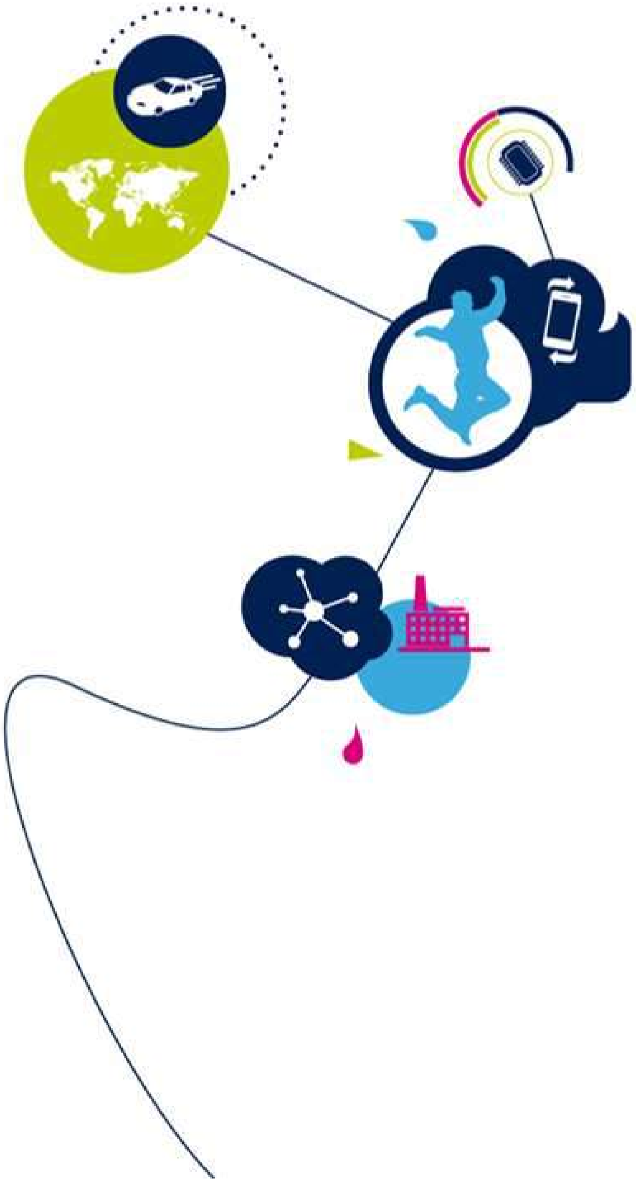
General Purpose & Secure MCUs EEPROM

Digital ASICs

life.augmented

STMicroelectronics

Capital Markets Day 2018

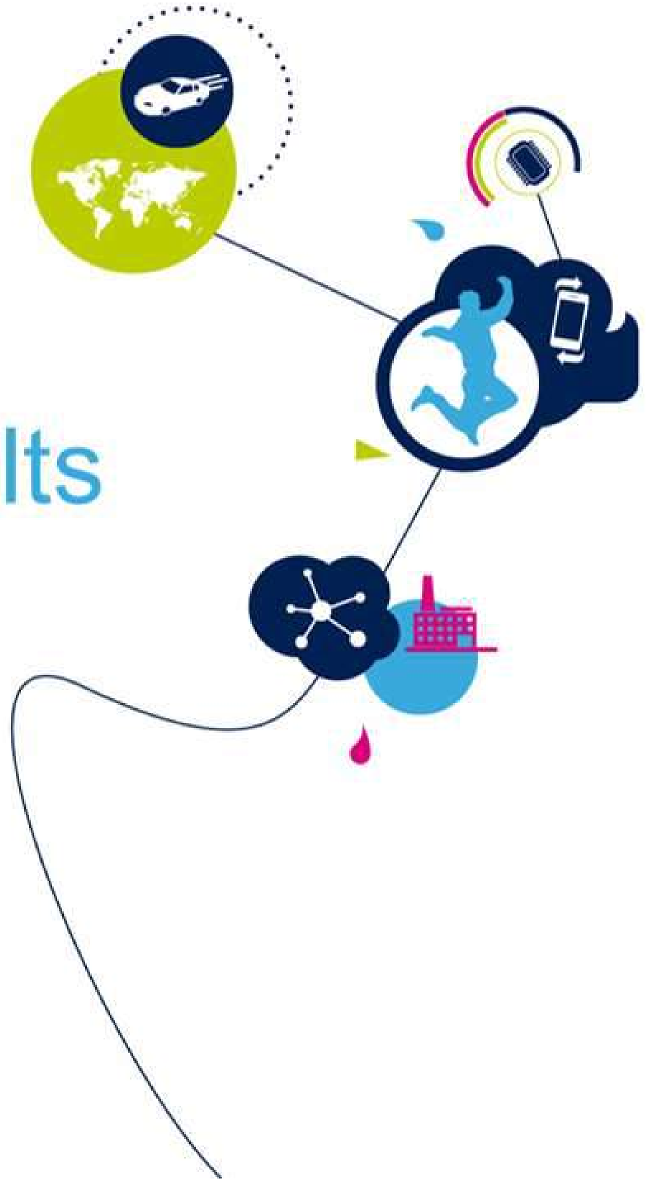


life.augmented

Business & Financial Results

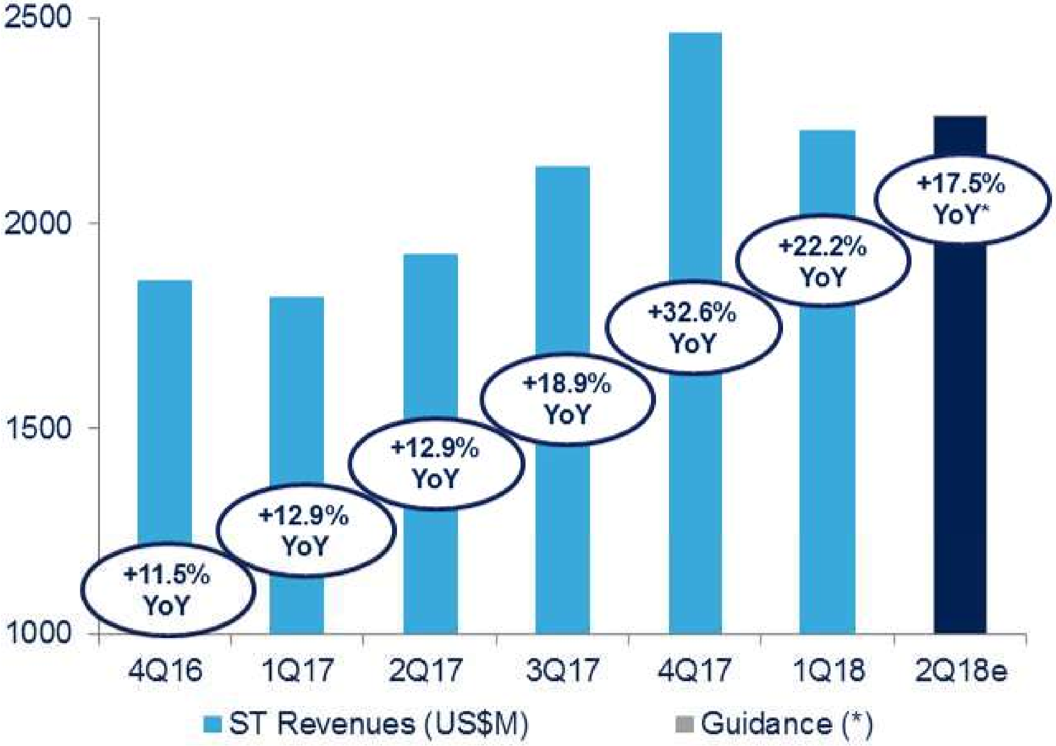
Carlo Ferro

Chief Financial Officer
President, Finance, Legal Infrastructure and Services



life.augmented

Solid Revenue Growth



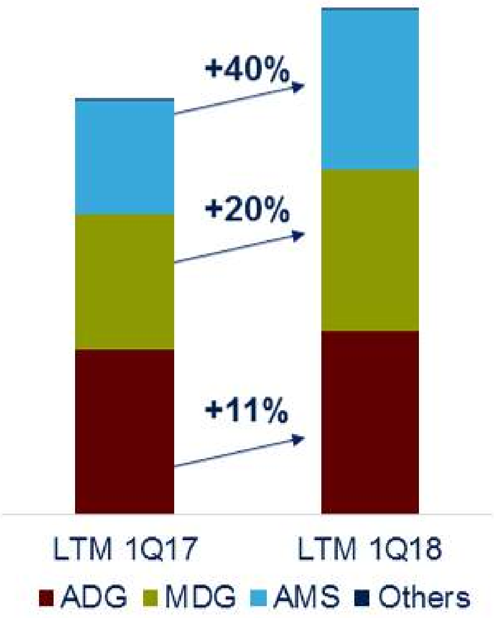
- Strategic focus on industry megatrends

- Innovative and broad product portfolio
- Successfully ramped key programs in 2017
- 6 consecutive quarters of double-digit y-o-y growth
- 2017 revenues of $8.35B, up 19.7% y-o-y
- 1H18 revenues (*) up 19.8% y-o-y
- Outperformed the Serviceable Available Market ("SAM") by about 7 points

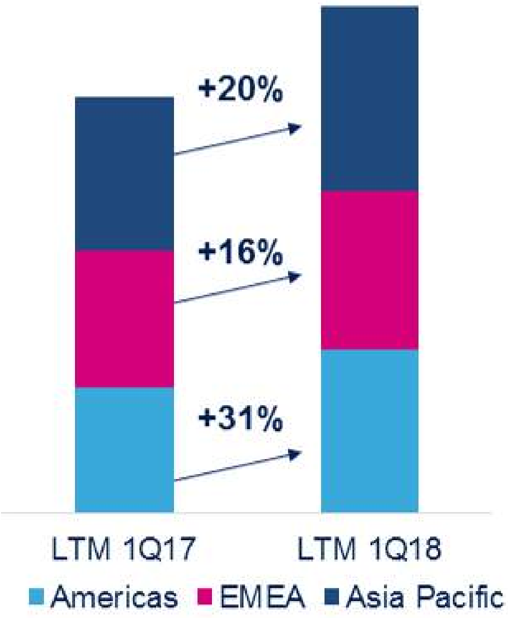
(*) At midpoint of guidance +/- 350 basis points

Synchronized Revenue Growth

Product Group



Region of Origin



Customer Type

ST Revenues by End Market

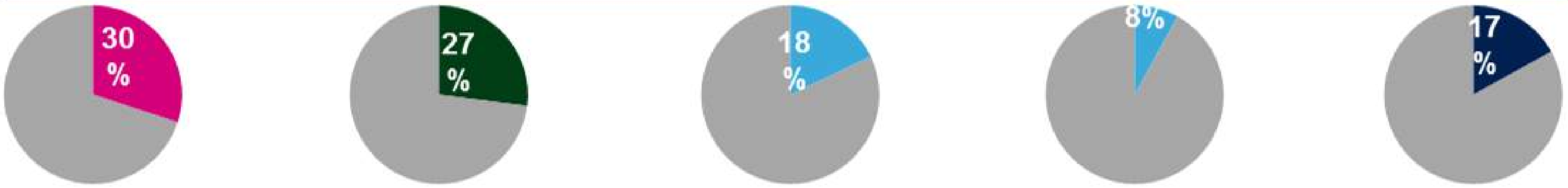
Automotive

Industrial

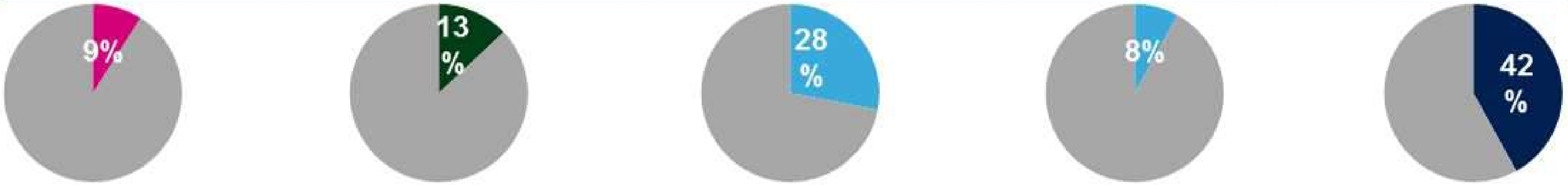
Personal Electronics
- Smartphones
- Other Personal Electronics

Communications Equipment, Computers & Peripherals

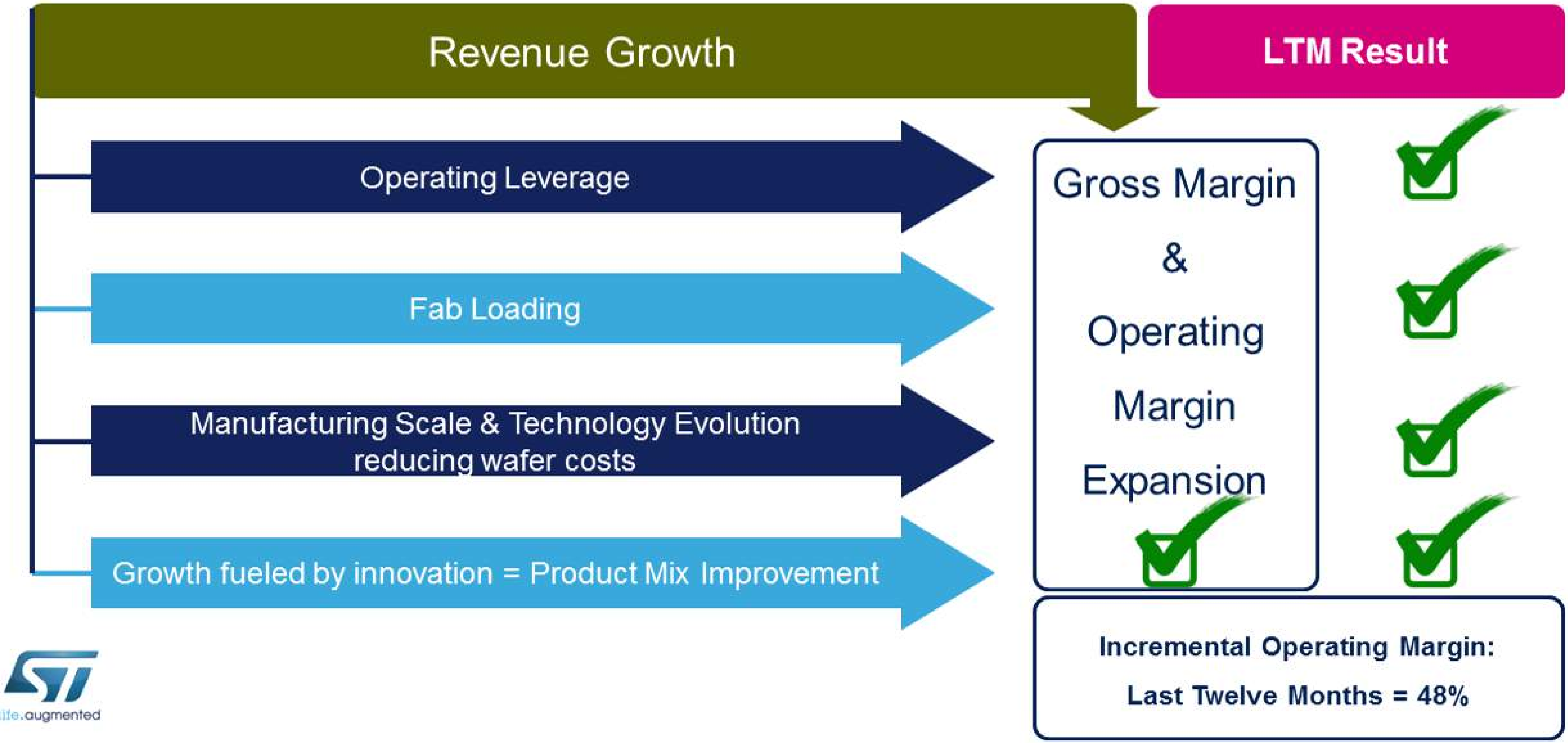
% of ST 2017 Total Revenues



% of ST 2017 Total Available Market (TAM)



Drivers to Improve Operating Margin



Revenue Growth

LTM Result

Operating Leverage ✓

Fab Loading ✓

Manufacturing Scale & Technology Evolution reducing wafer costs ✓

Growth fueled by innovation = Product Mix Improvement ✓

Gross Margin & Operating Margin Expansion ✓

Incremental Operating Margin:

Last Twelve Months = 48%

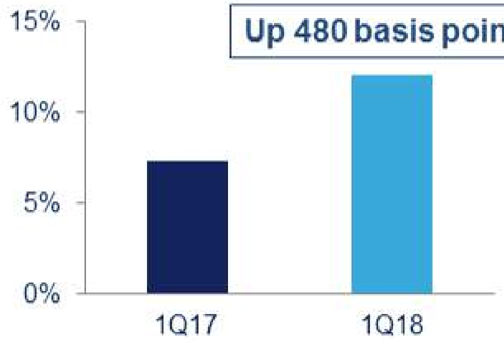
life.augmented

1Q18 Financial Highlights

Revenues = $2.23B


Up 22.2%

Operating Margin = 12.1%


Up 480 basis points

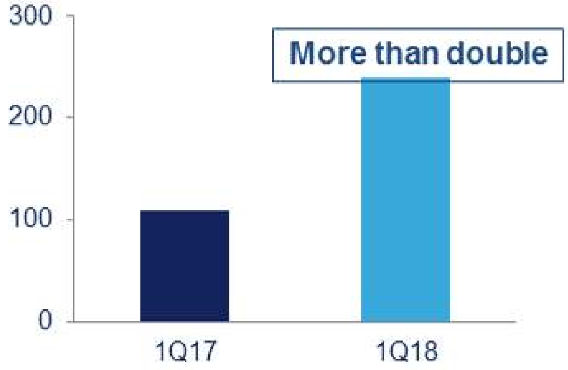
Capex= $351M


FY17: $1.3B; 1Q18: $351M

Gross Margin = 39.9%


Up 220 basis points

Net Income = $239M


More than double

Free Cash Flow* = $95M


LTM: $372M

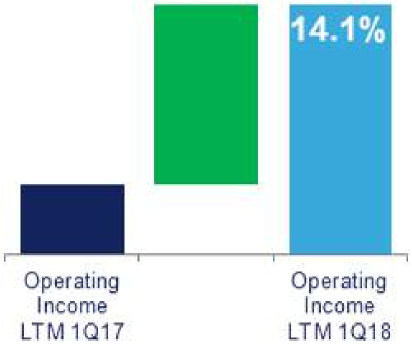
*Non-U.S. GAAP measure. See Appendix for additional information explaining why the Company believes these measures are important.

Operating Income Improvement

Last Twelve Months

ADG (US$M)

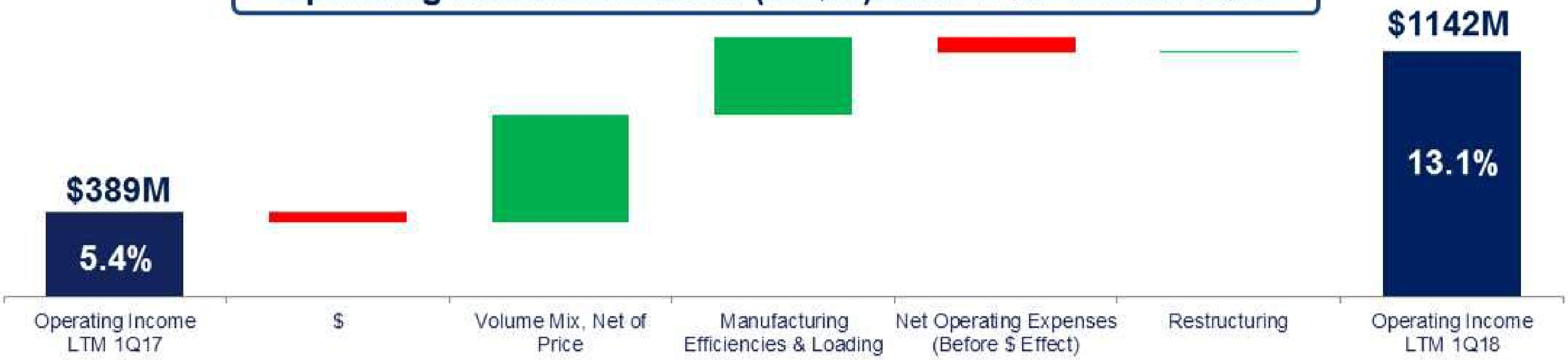
AMS (US$M)



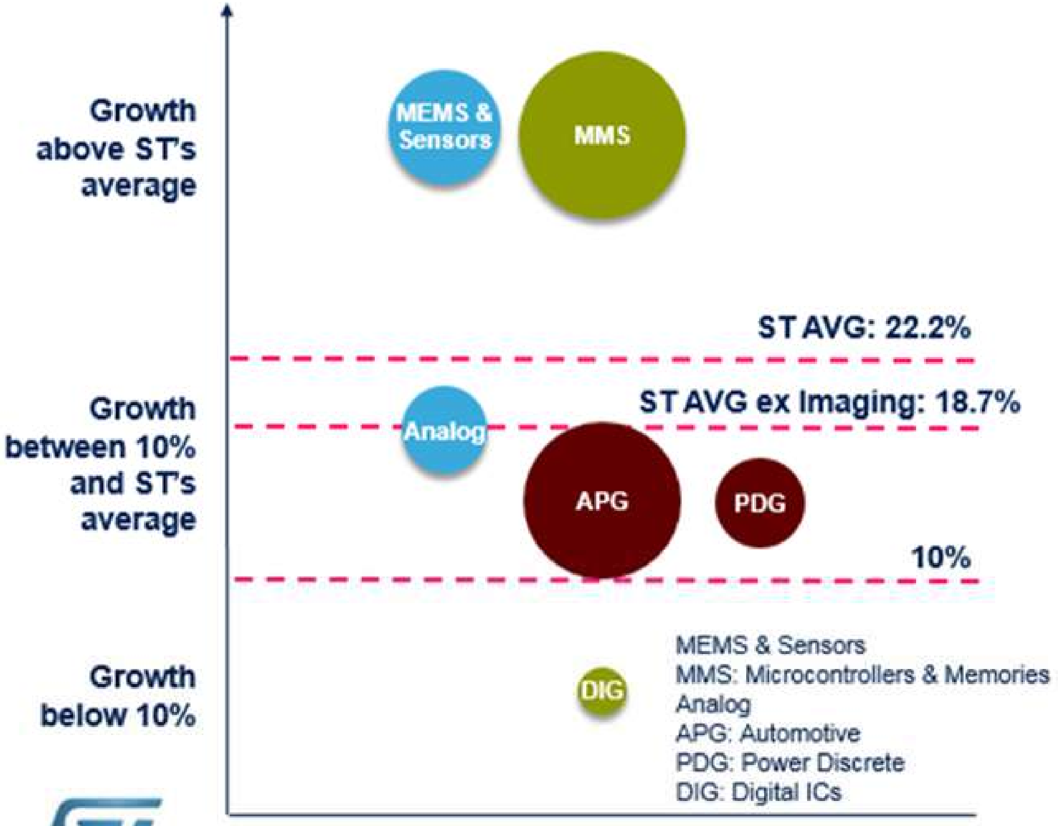
MDG (US$M)

Others (US$M)

Operating Income Evolution (US$M): LTM 1Q17 to LTM 1Q18



Strong Performance Across the Portfolio...



1Q18/1Q17 Revenue Growth

Note: Size of bubble is proportional to ST's 2017 revenue.

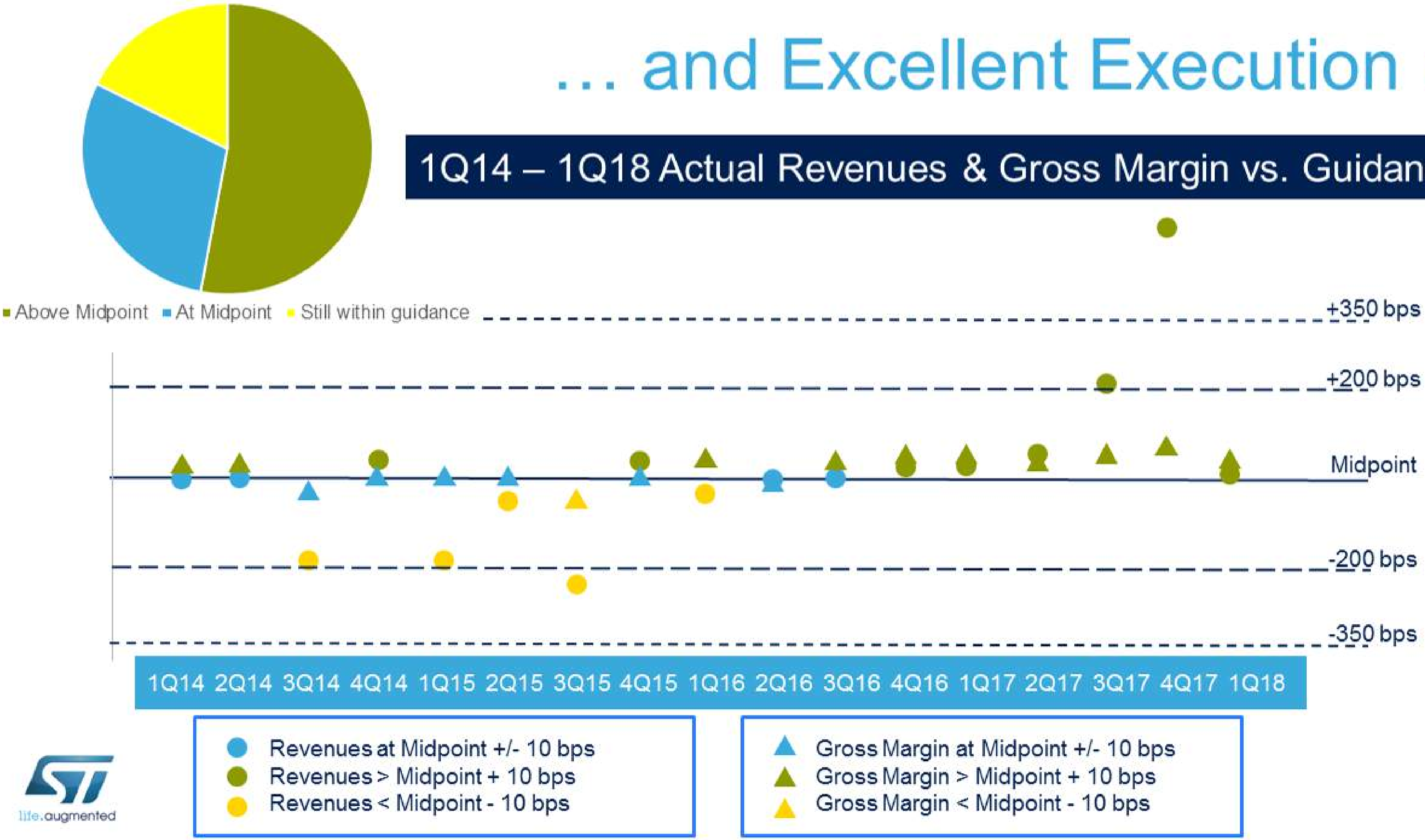
1Q18/1Q17 Operating Margin Expansion

Note: Size of bubble is proportional to ST's 1Q17 and 1Q18 revenue.

life.augmented

… and Excellent Execution

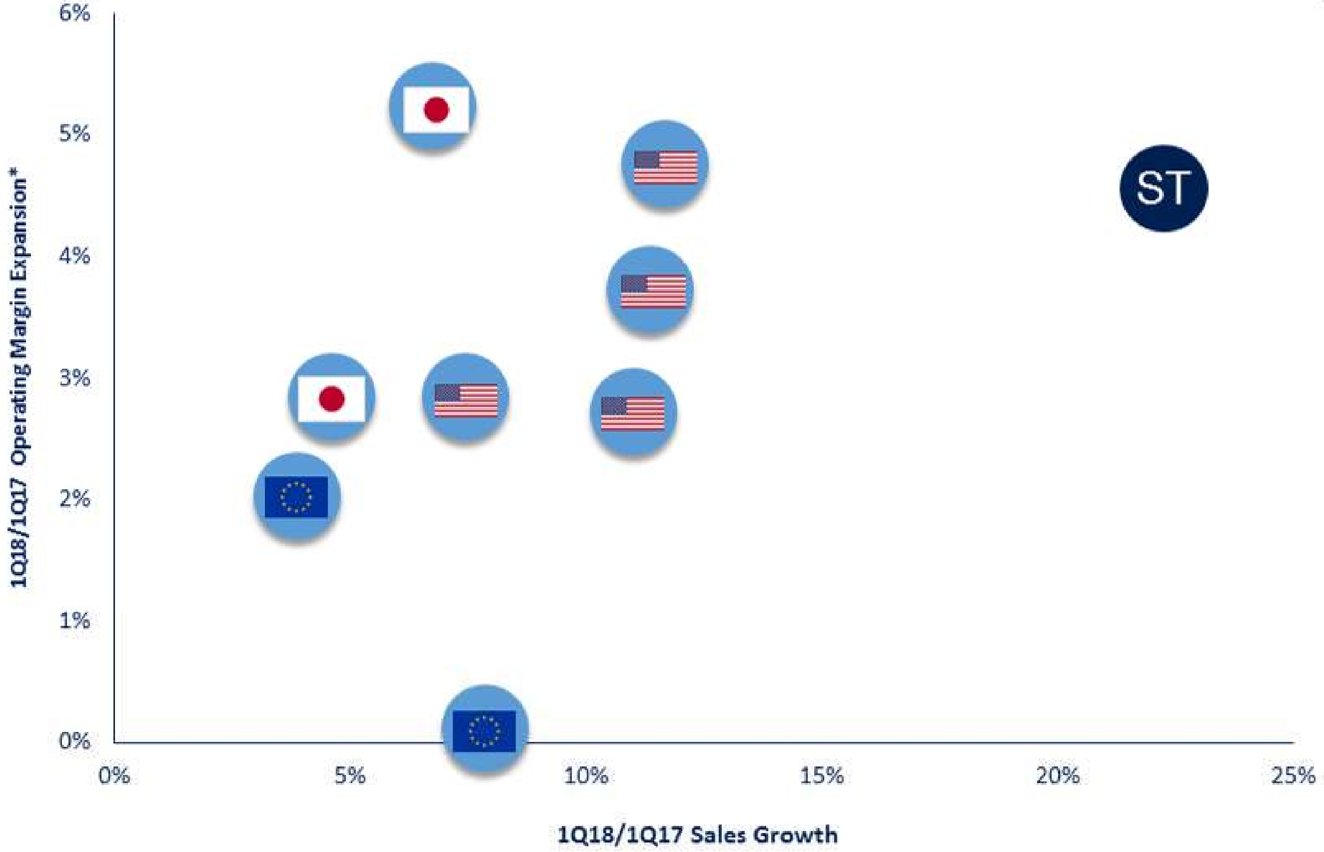
1Q14 – 1Q18 Actual Revenues & Gross Margin vs. Guidance



life.augmented

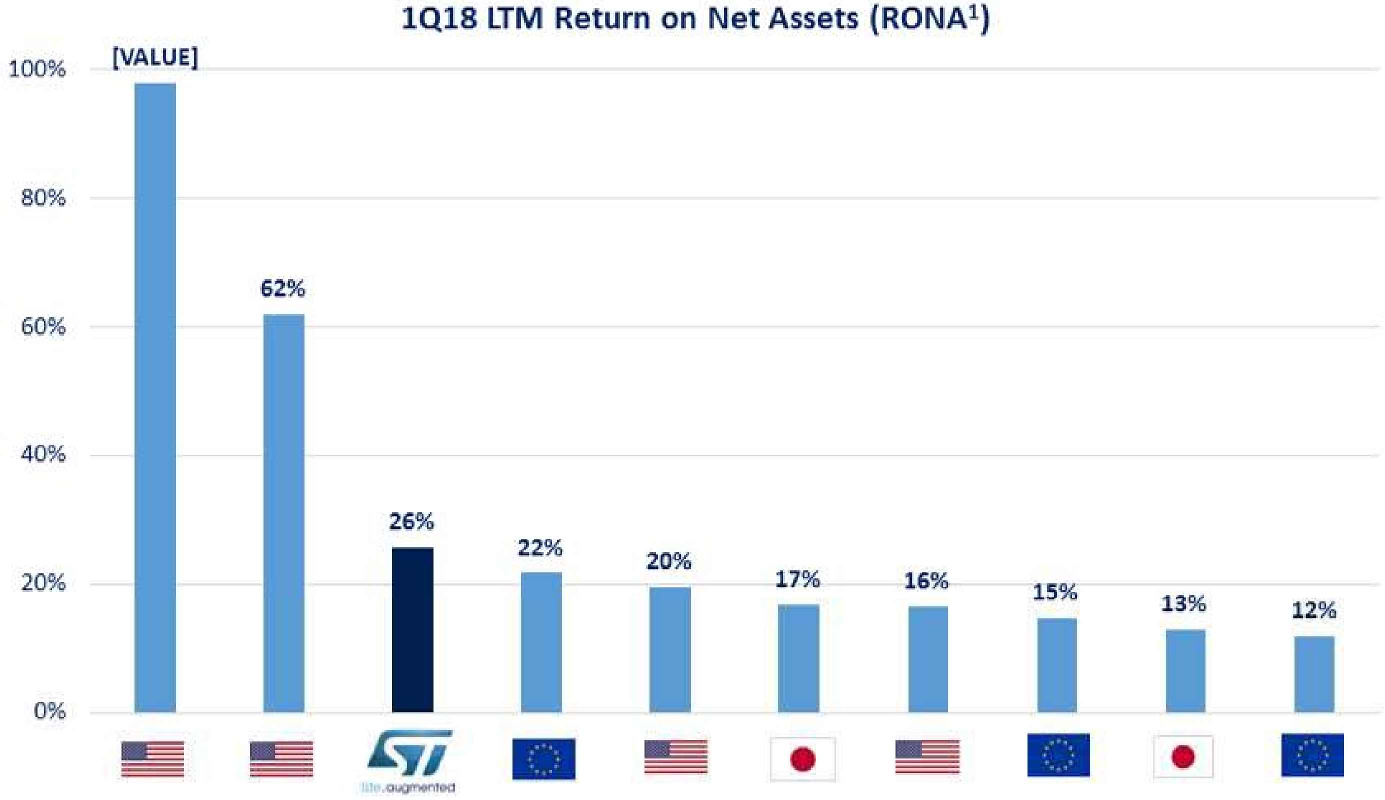
…Growing and Improving Margin

Faster Than the Competition



(*) Based on reported Operating Profit excluding Exceptionals

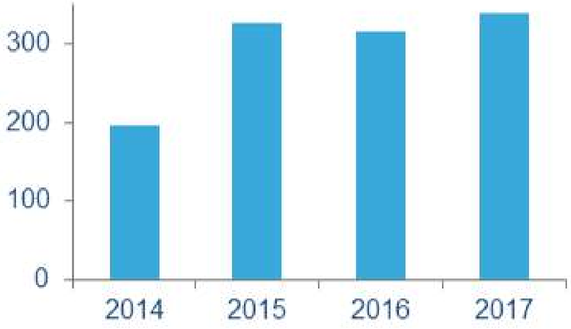
Turning Capital into Profits



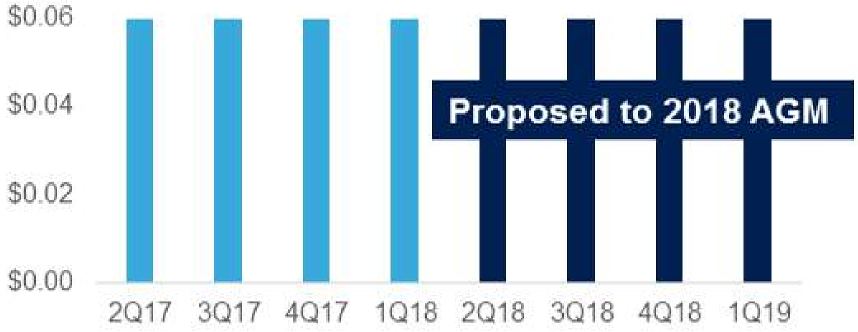
(1) RONA: Operating Profit pre-exceptionals / Average Net Assets (Assets – Cash/ST Investments – Non-financial Liabilities) from 1Q17 to 1Q18
Peers include – based on available reporting: AMS, Infineon, Maxim, Microchip, NXP, On Semi, Renesas, Rohm, TI

Keeping a Solid Capital Structure

FY17 Free Cash Flow* = $338M



Cash Dividend: proposal to shareholders at 2018 AGM is stable at $0.24 per share



1Q18 Net Financial Position* = $522M

End of period (US$M)	March 31 2018	December 31 2017	April 1 2017
Total Liquidity	2,234	2,190	1,976
Total Financial Debt	(1,712)	(1,701)	(1,458)
Net Financial Position*	**522**	**489**	**518**

*__Non-U.S. GAAP measure__. See Appendix for additional information explaining why the Company believes these measures are important.

A Sustainable and Profitable Growth Story

Sustainable growth

Margin expansion

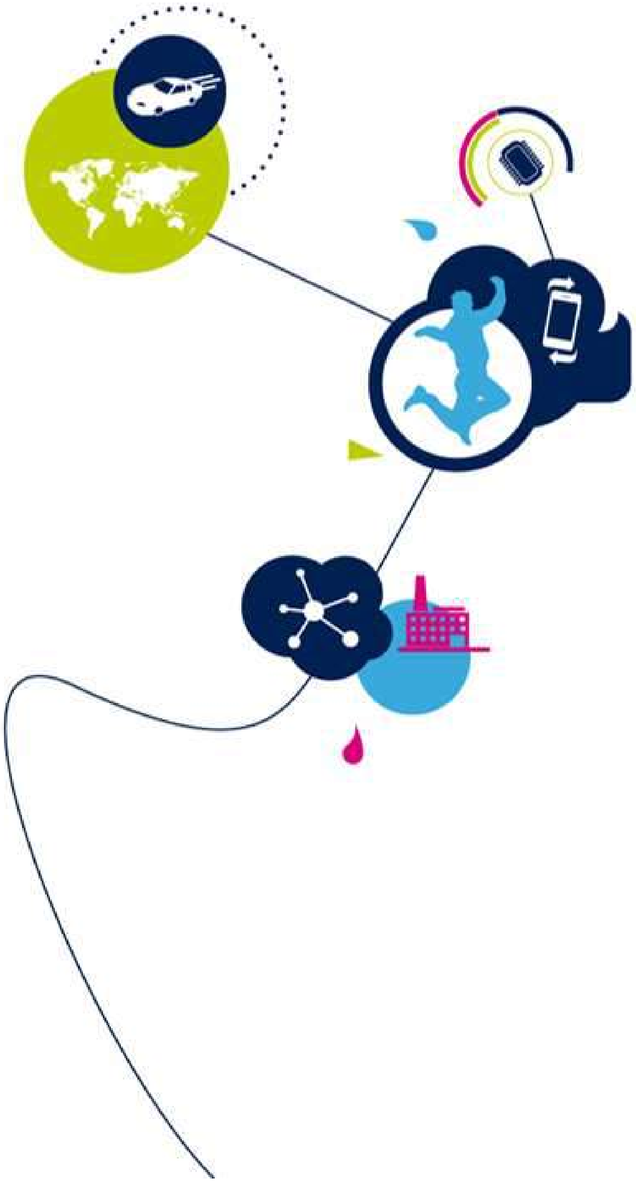
Shareholder value

life.augmented

STMicroelectronics

Capital Markets Day

2018

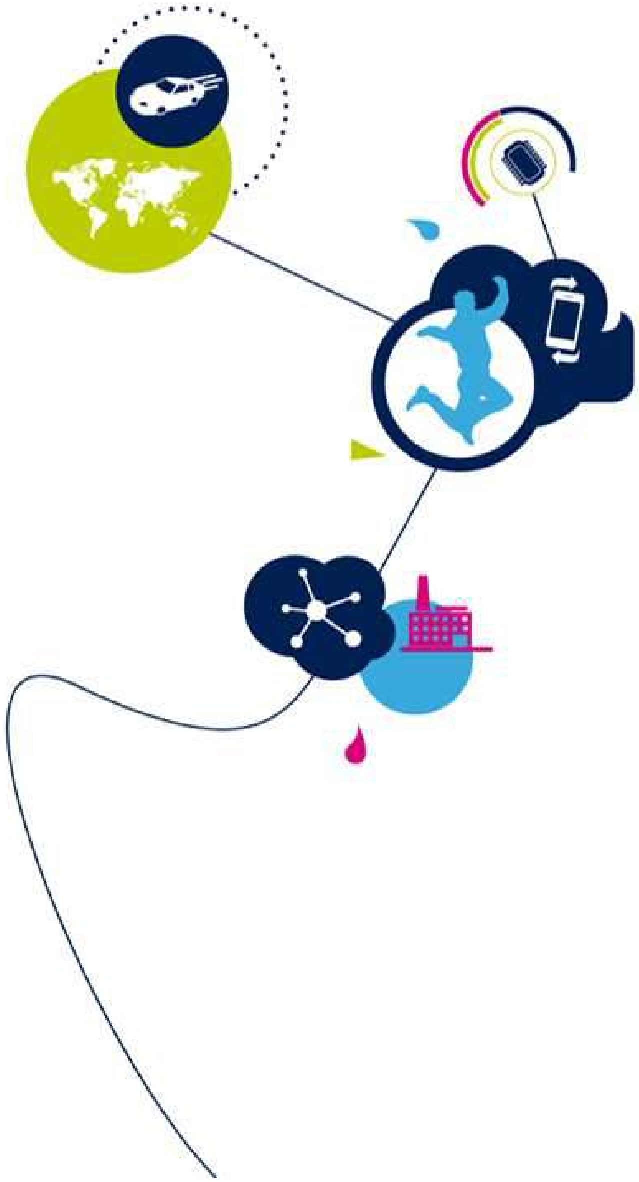


life.augmented

2018 Business Priorities

Lorenzo Grandi

Designated President, Finance, Infrastructure and Services
and Chief Financial Officer



life.augmented

ST Revenues

1Q18 Revenues = $2.23B

1Q18 revenues up 22.2% year-over-year

- Double-digit growth
  - MDG up 26.6%
  - AMS up 26.5%
  - ADG up 15.4%

1Q18 revenues down 9.8% sequentially

- Better than seasonal performance in Automotive and Industrial, unfavorable seasonal dynamics for Smartphone applications
- 20 bps above midpoint of the guidance

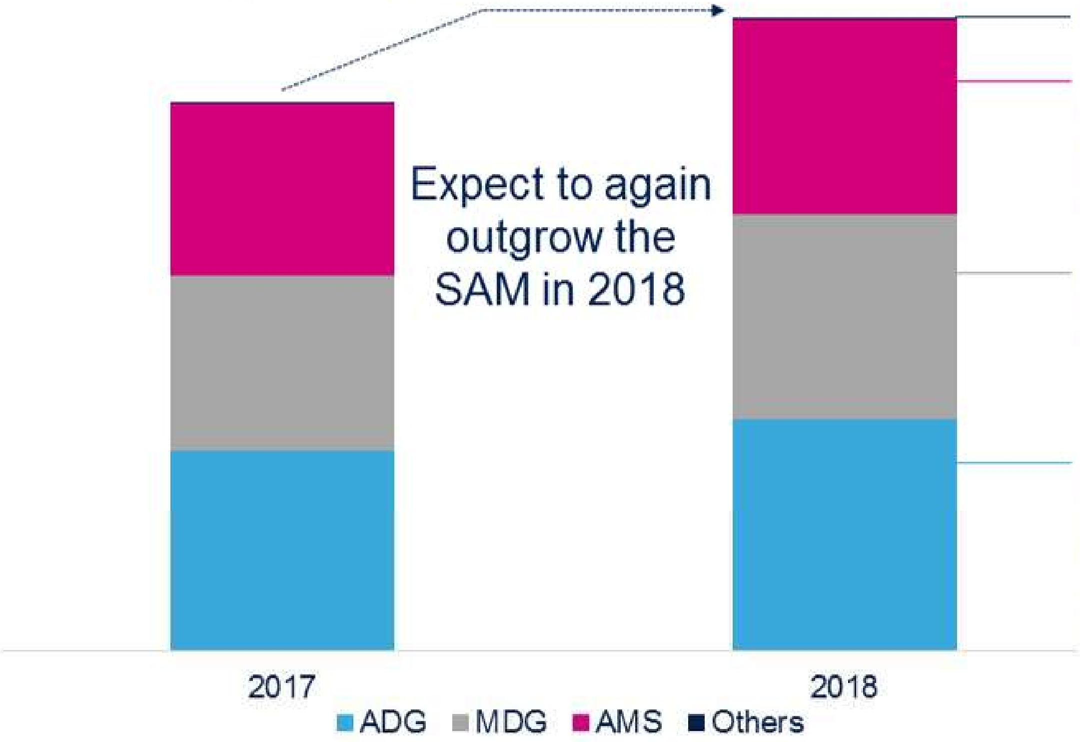
Revenue Outlook at midpoint of guidance

2Q18 up sequentially by about 1.5% (+/- 3.5% points)
2Q18 up year-over-year by about 17.5%
1H18 vs 1H17 up by about 19.8%

Profitable Growth in 2018

Growth Drivers

YoY revenue growth expected between about 14% and 17%*



Expect to again outgrow the SAM in 2018

Others

Analog, MEMS & Sensors (AMS)

- Analog ASSP
- General Purpose Analog & RF
- MEMS Sensors
- Time-of-Flight / Specialized Imaging Sensors

Microcontrollers & Digital ICs (MDG)

- General Purpose 32-bit MCU
- Secure MCU
- Digital ASICs

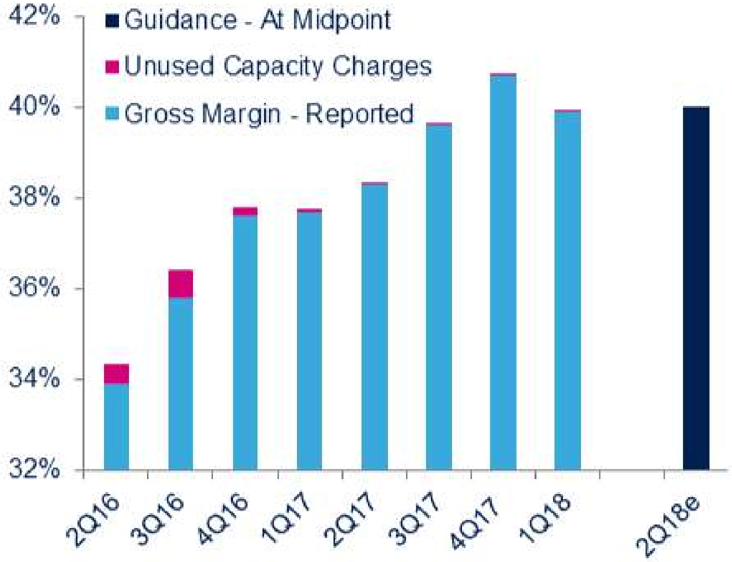
Automotive & Discrete (ADG)

- ADAS (Vision and Radar)
- 32-bit MCU
- Electrification products (including SiC)
- High Voltage PMOS in Industrial
- Smart Power (BCD and VIP)

* See Forward Looking Statement for full disclosure. Such statements are subject to various risks and uncertainties, which may cause actual results and performance of our business to differ materially and adversely from the forward-looking statements.

Gross Margin

1Q18 Gross Margin = 39.9%



2Q18 Gross Margin Outlook

About 40.0% (+/-2.0%)

1Q18 Gross Margin

- 40 bps above the midpoint of the guidance
- Up 220 bps year-over-year on improved manufacturing efficiency and better product mix, partially offset mainly by normal price pressure and negative currency effect, net of hedging
- Down 80 bps sequentially including specific one time negative impact

2H18 Gross Margin Drivers

⬆ Revenue Growth

↗ New Products

↗ Manufacturing Efficiency (excluding material price)

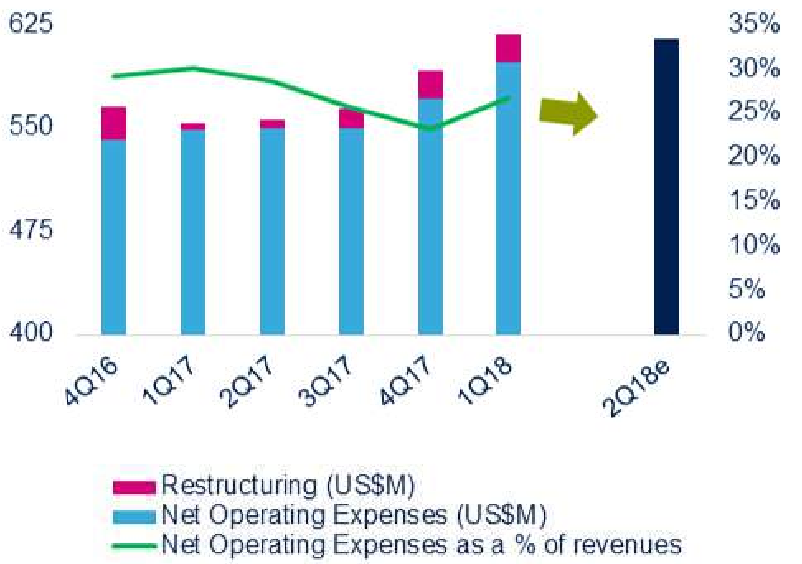
↙ Material Price

↙ € / $ Rate

⬇ Product Group Mix

Operating Expenses

1Q18 Net Operating Expenses : $598M



* Net Operating Expenses: R&D + SG&A – Other Income & Expense

1Q18 Combined SG&A and R&D at $614M

- Down 350 basis points to 27.6% of revenues y-o-y
- Up $48M or 8.4% y-o-y
- $598M net of Other Income & Expense

2H18 Operating Expense Drivers

- ↓ Negligible restructuring costs
- → Discipline in General & Administrative expenses
- ↗ Intensified R&D and S&M efforts in selected areas
- ↗ Inflation
- ↗ € / $ Rate

Discipline on OPEX Driving Leverage

Product Group Results

Automotive & Discrete

Last Twelve Months
Revenues = $3,168M
Operating Margin = 10.8%

Analog, MEMS & Sensors

Last Twelve Months
Revenues = $2,768M
Operating Margin = 14.1%

Microcontrollers & Digital ICs

Last Twelve Months
Revenues = $2,803M
Operating Margin = 17.5%

ADG Contribution

Leverage technology leadership

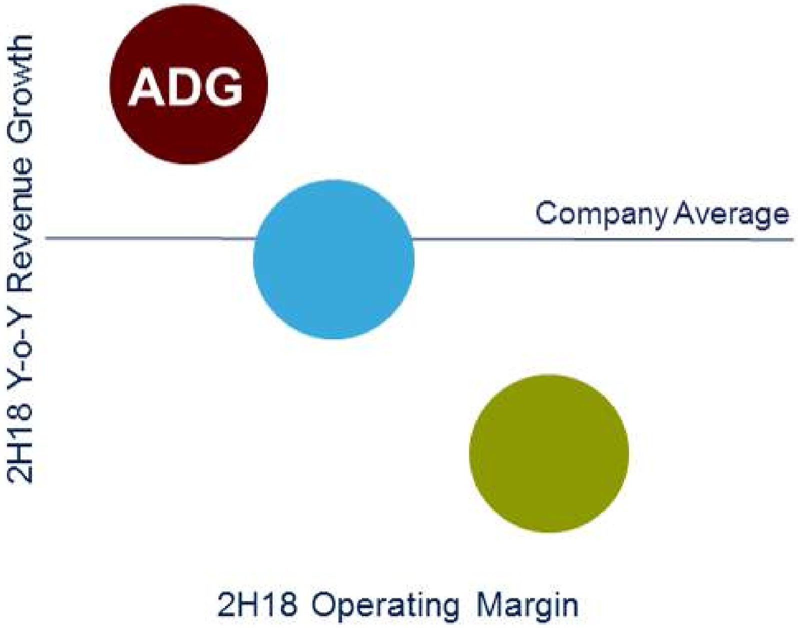
- BCD9 (110nm), BCD10 (90nm), eNVM, RF, FD-SOI, SiC & GaN

Revenue drivers

- ADAS (Vision & Radar)
- Automotive-grade 32-bit MCU
- Infotainment & Connectivity (Radio, Satellite, Terrestrial)
- Smart Power (Braking, Chassis, Powertrain)
- Power MOS & Silicon Carbide for Automotive & Industrial
- IPAD (Integrated Passive & Active Devices)
- Distribution

Margin expansion drivers

- Leverage revenue growth
- Improved mix in ADAS, Infotainment, Power Modules & growth in distribution
- Manufacturing: 150mm to 200mm conversion, expansion in Singapore 200mm for Power and Smart Power, wafer cost in Crolles 300mm, yield and productivity in testing



Operating Margin Target in 2H18 :
Low Teens

AMS Contribution

Leverage technology leadership

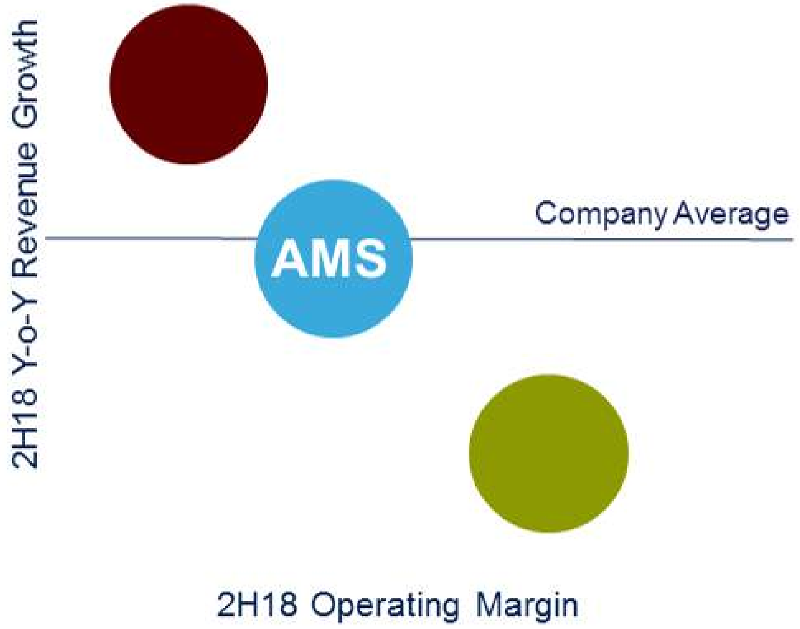
- Smart Power, Mixed Signal Analog, MEMS, Imaging Sensors

Revenue drivers

- Analog & MEMS for industrial & automotive
- Power management combo for hard disk drives
- Analog ASSP & motion MEMS for Personal Electronics
- General purpose analog & motion control ICs through Distribution
- Time-of-Flight / Specialized Imaging Sensors

Margin expansion drivers

- Leverage on revenue growth
- Better Analog and MEMS mix: both new product & extended applications
- Manufacturing: efficiency in 200mm mixed signal, full loading across all facilities, successful ramp up of new products



Operating Margin Target in 2H18 :
Mid Teens

MDG Contribution

Leverage technology leadership

- eNVM and differentiated digital processes (FD-SOI, BiCMOS…)

Revenue drivers

- General Purpose STM32 MCU
- Secure Microcontrollers for smartphones
- NFC portfolio
- RF EEPROM
- Mixed Process / Digital ASICs
- Mass market expansion

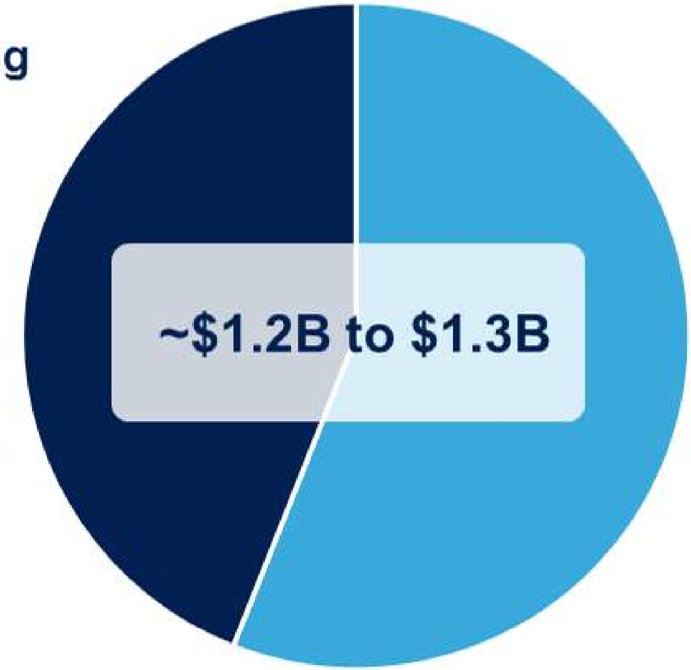
Margin expansion drivers

- Leverage on revenue growth
- Wafer cost in Crolles 300mm and 200mm; Assembly cost
- Improved product mix in Digital ICs
- Progressive wind-down of Set-Top Box Business

Operating Margin Target in 2H18 :
About 20%

life.augmented

FY18 Capital Spending



Probing, Assembly & Testing

- Assembly and Test capacity expansion to support revenue growth and new products particularly for Automotive MCU and advanced BCD
- Investment in Assembly and Test for Silicon Carbide
- Increasing the pace of equipment modernization

Front-End Manufacturing/R&D

- Increased flexibility and new technologies in Crolles 300mm within the current footprint
- Continued mix evolution to advanced BCD and preparing for 300mm pilot line in Agrate
- 200mm advanced BCD capacity growth and 150mm SiC capacity expansion in Catania
- Continued 200mm capacity expansion in Singapore for Power Discrete and BCD, widening technology capability

2018 Capex investment plan increased to support higher demand in 2H18 and beyond

Capex/Sales ratio model: ≤10% through a cycle

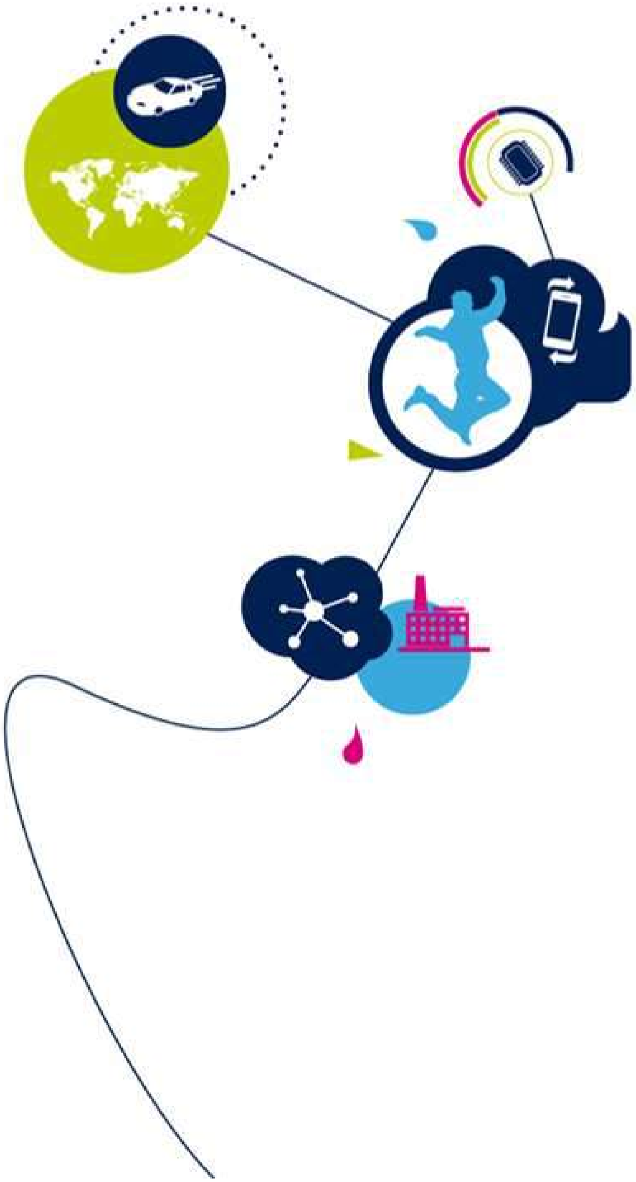
Takeaways

- Innovative and broad product portfolio, healthy demand and strong backlog for the second half of 2018 boosting growth across all our product groups, end markets - including smartphones, and regions. Revenue growth for FY18 now expected between about 14% to 17%
- Strategic focus on industry megatrends and new programs enabling growth faster than our Served Available Market (SAM)
- Operating margin expansion driven by expenses operating leverage despite Product Group revenues mix evolution that will substantially maintain our gross margin at current levels
- FY18 capex spending now expected between about $1.2 to $1.3 billion
- Solid Capital Structure and Operating Cash Flow generation allowing investment to support growth, to reward shareholders and maintain flexibility
- Shareholder Value creation

STMicroelectronics

Capital Markets Day

2018



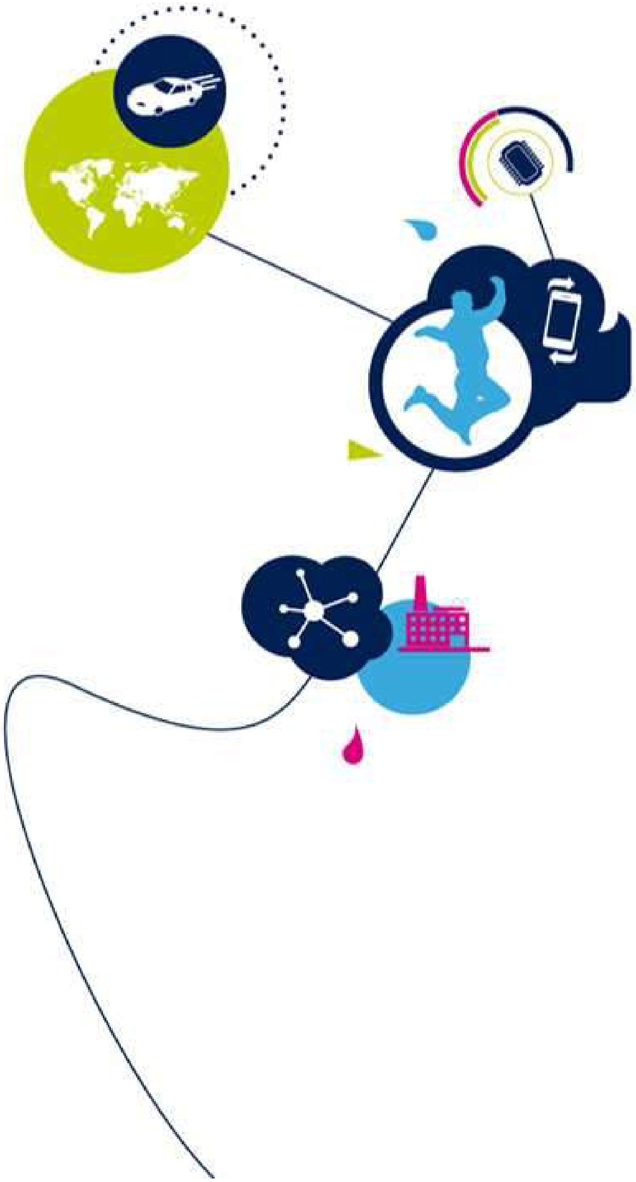
life.augmented

Sustainable Profitable Growth

Balanced and Broad

Marco Cassis

Designated President
Sales, Marketing, Communications and Strategy Development



life.augmented

Addressing Four End Markets…

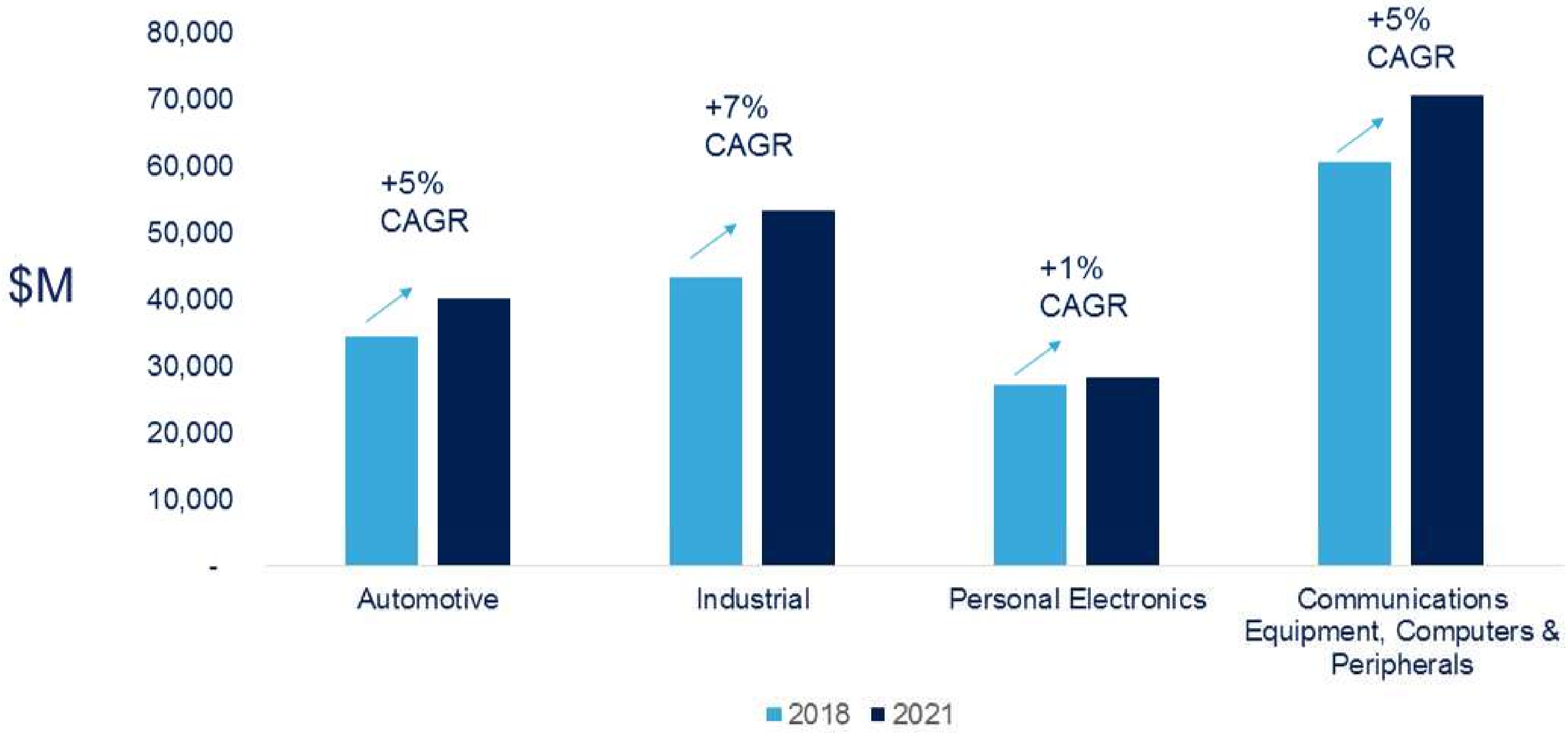
Automotive

Industrial

Personal Electronics

Communications
Equipment,
Computers & Peripherals

ST SAM by End Market



Source: IHS Markit, Strategy Analytics

…with a Strong Application Approach

Smart Driving

Internet of Things

Smart Driving

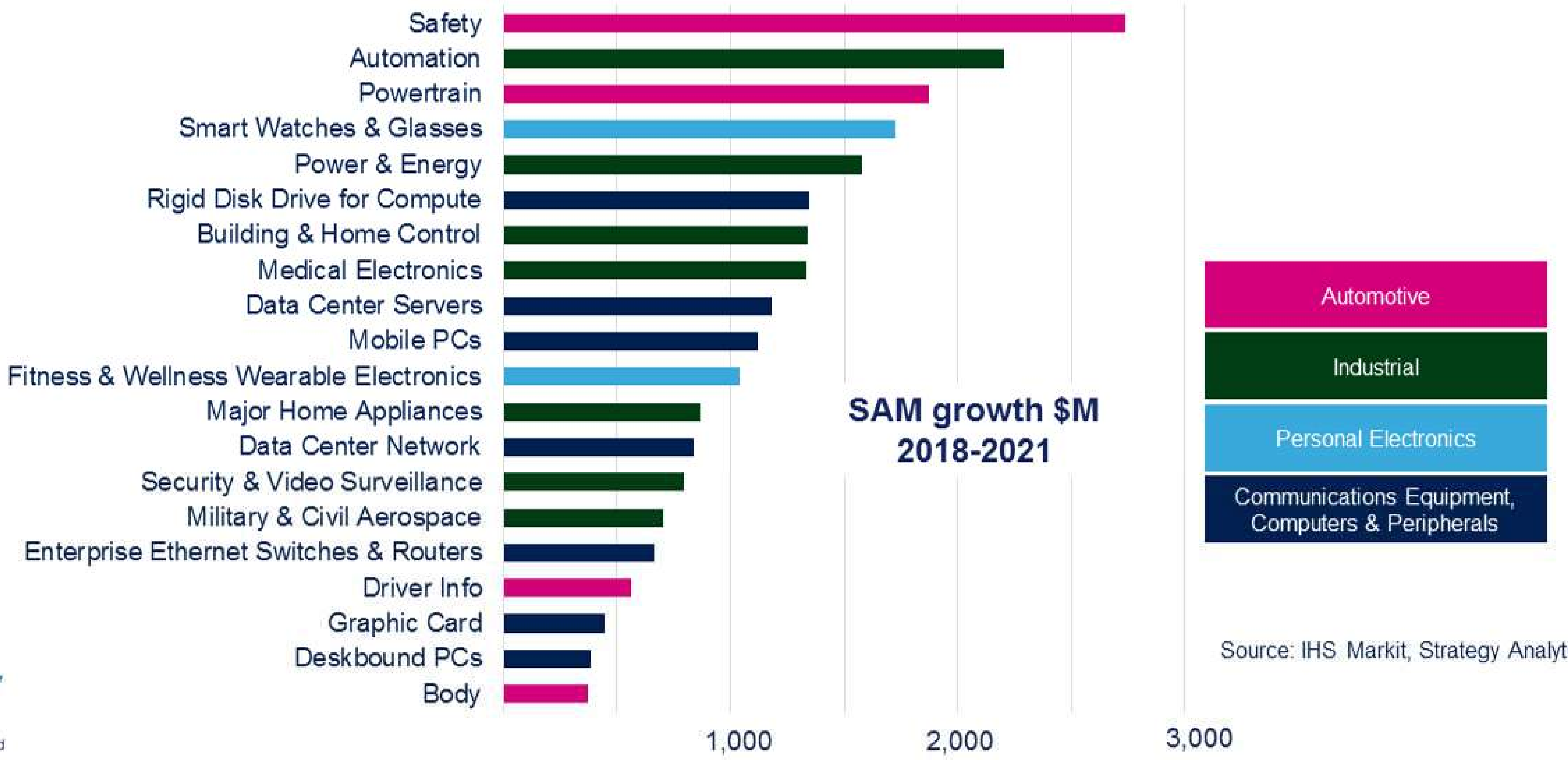
Smart Industry

Smart Home & City

Smart Things

Focus Applications Growth in our SAM

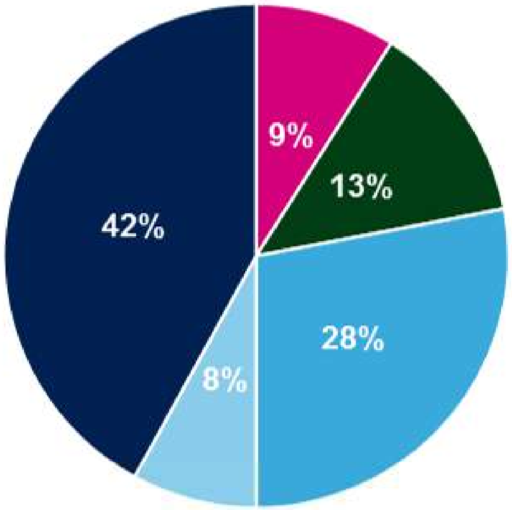
Top 20 SAM Growth Applications 2018-2021



Source: IHS Markit, Strategy Analytics

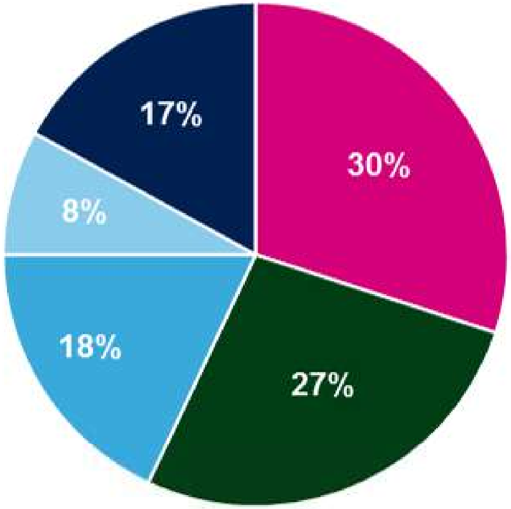
Balanced Sales
in Our Markets

TAM
2017



Source: IHS Markit, Strategy Analytics

ST Sales
2017



- Automotive
- Industrial
- Personal Electronics
  - Smartphones & other mobile
  - Other Personal Electronics
- Communications Equipment, Computers & Peripherals

Automotive End Market

ST Applications Priorities

- Chassis & Safety
- ADAS
- Powertrain for ICE
- Electromobility
- Body & Convenience
- In-vehicle Infotainment
- Telematics & Networking
- Mobility Services

Market Requirements

- Application-dedicated products
- Automotive quality
- Product longevity guarantee
- Supply chain security

ST Position

- More than 30 years experience
- Long-term relationships
- Complete portfolio addressing all areas of automotive electronics
- ST owned manufacturing

Leading Market Positions

- 33% share in Engine Control
- 30% share in RF and Vision for ADAS
- 45% share in Car Lighting
- 40% share in Audio Amplifiers
- First high-volume SiC for Automotive

life.augmented

Industrial End Market

ST Applications Priorities

- Factory Automation
- Motor Control
- Industrial Drives
- Industrial Power & Tools
- Energy Generation & Distribution
- Metering
- LED, General Lighting
- Home, Building & City Automation
- Appliances
- Power Supplies and Converters
- Point of Sales & Retail Logistics
- Medical & Healthcare
- Space, Avionics & Defense
- Smart Farming

Market Requirements

- Application-dedicated products
- General purpose products fitting many applications
- Industrial quality & robustness
- Product longevity guarantee

ST Position

- More than 30 years of experience in industrial applications
- Complete portfolio addressing hundreds of industrial applications
- IP building blocks, technologies and solutions for Smart Industry

Leading Market Positions

- Leading 32-bit GP MCU supplier
- 1 out of 2 Programmable logic controllers use ST smart power
- 1 out of 3 Motion control solutions use ST power management devices
- > 100 million meters with ST solutions

life.augmented

Industrial End Market

ST Applications Priorities

- Factory Automation
- Motor Control
- Industrial Drives
- Industrial Power & Tools
- Energy Generation & Distribution
- Metering
- LED, General Lighting
- Home, Building & City Automation
- Appliances
- Power Supplies and Converters
- Point of Sales & Retail Logistics
- Medical & Healthcare
- Space, Avionics & Defense
- Smart Farming

Programmable Logic Controllers (PLC)	PLC Control Unit Safety PLC Digital I/O Modules IO-Link Modules Human Machine Interface Fieldbus and Industrial Ethernet
Industrial Sensors	Current Motion & Vibration Environment Proximity Image Condition Monitoring / Predictive Maintenance
Industrial Communication	IO-Link Fieldbus and Industrial Ethernet Wireless Communication Contactless Communication (RFID / NFC)
Industrial Robots	Servo Drive / Inverter Sensing Module Communication Module Power Management
Tracking	Pallets and Container tracking Goods Guarantee

Personal Electronics End Market

ST Applications Priorities

- Smartphones
- Tablets & eReaders
- Wearables
- Personal Care & Hygiene
- Gaming
- Drones
- Audio & Video
- Virtual/Augmented Reality

Market Requirements

- Advanced technology and products, optimized for mobile applications
- Best performance on power consumption & accuracy
- High volume with fast ramp-up

ST Position

- Major supplier to flagship smartphone and personal device makers
- Enabling next generation devices with image and MEMS sensing, power & security solutions

Leading Market Positions

- > 600 millions components shipped for Time-of-Flight & 3D Sensing applications
- Serving the top 10 smartphone makers
- Supplier of choice for the majority of Android motion sensors

life.augmented

Personal Electronics End Market

ST Applications Priorities

- Smartphones
- Tablets & eReaders
- Wearables
- Personal Care & Hygiene
- Gaming
- Drones
- Audio & Video
- Virtual/Augmented Reality

Market Requirements

- Advanced technology and products, optimized for mobile applications
- Best performance on power consumption & accuracy
- High volume with fast ramp-up

ST Position

- Major supplier to flagship smartphone and personal device makers
- Enabling next generation devices with image and MEMS sensing, power & security solutions

Leading Market Positions

- > 600 millions components shipped for Time-of-Flight & 3D Sensing applications
- Serving the top 10 smartphone makers
- Supplier of choice for the majority of Android motion sensors

Communications Equipment, Computers & Peripherals

ST Applications Priorities

- Telecom Infrastructure
- Data Centers
- Enterprise Switching
- SOHO Servers
- Computers & Peripherals
- ASIC Services & IP Libraries

Market Requirements

- Dedicated, complex ASICs for specific applications
- Leading-edge technology

ST Position

- Long-stand relationships with key networking & computer peripheral makers
- Expertise in high complexity digital ASICs for networking & data centers

Leading Market Positions

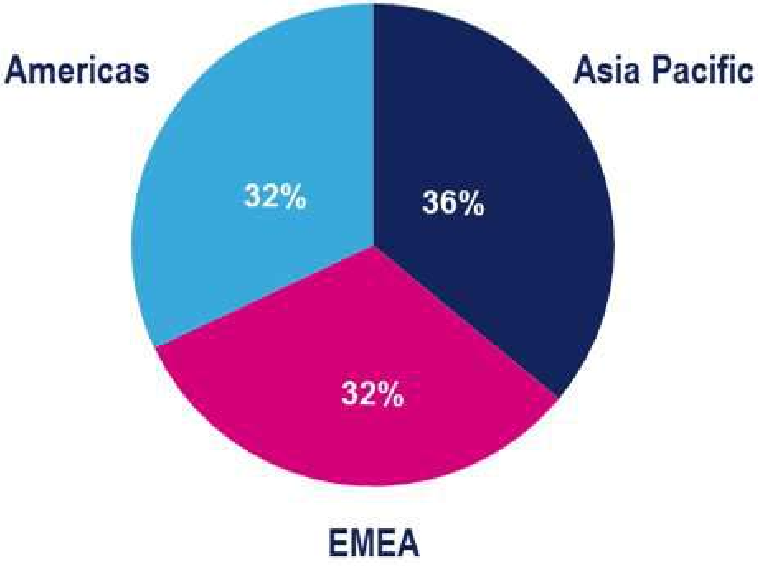
- Leading in power combo ICs for Hard Disks and Printers
- Leading supplier of fluidic MEMS for printers
- Pioneer in new server power architectures

life.augmented

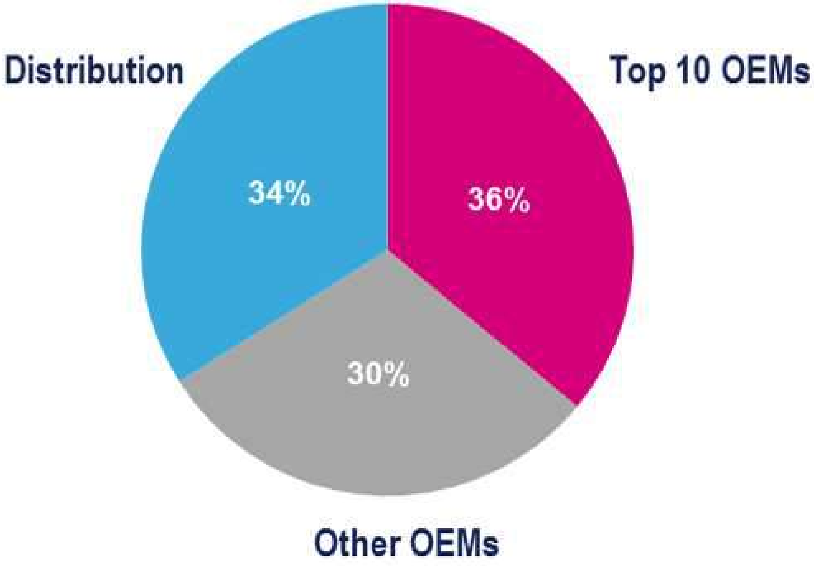
Balanced Sales

Geographically and by Customer Type

Sales by region of origin
2017



Sales by customer type
2017



life.augmented

Sales & Marketing

Sustainable Growth

- OEM Accounts (incl. Top 10 Customers)

Unified worldwide account management tailored to each account to provide global coverage and service

- Distribution Accounts
- Online Accounts

Differentiated approach by customer type with adapted tools and service levels

Top 10 Customers* 2017

Apple
Bosch
Cisco
Conti
HP
Huawei
Nintendo
Samsung
Seagate
Western Digital

*In alphabetical order

3 Regions, Central System Lab
30% of S&M are Application Engineers

Serving more than 100K customers and growing fast

Distribution is Key
to ST's Go-to-Market Strategy

Top 10 Distributors 2017

ARROW

AVNET
Reach Further

EDOM
TECHNOLOGY CO., LTD.

FUTURE
ELECTRONICS

Hakuto

NEXTY Electronics
A Toyota Tsusho group company

WILLAS-ARRAY™

WT MICROELECTRONICS
文曄科技

YOSUN
A Member of WPG Holdings
YOSUN Group

Distribution complements ST's direct approach

- Extended reach
- Local market sales expertize
- Understanding of local market needs
- Jointly benefiting from acquired market knowledge
- Innovation in business models
- Early entry point
- Local support for customers

life.augmented

Distribution Approach

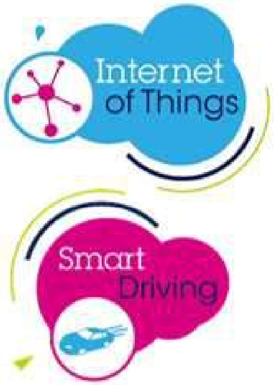
Products
&
Application Solutions

ST Sales & Marketing Presence
&
Partner Ecosystem

Training, Support
&
Tools

Online
&
Digital Marketing Initiatives

Aligned Go-To-Market
&
Joint Business Creation




Community

Home Forums Communities Browse Actions About this comm

Welcome to the ST Community

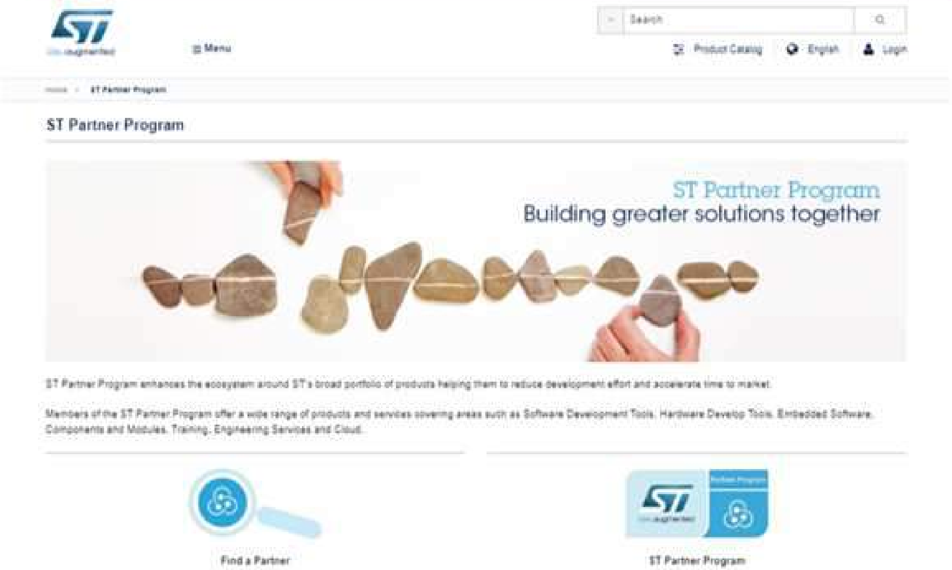
NEW HERE? GET STARTED

Help the Community

Partner Ecosystem & Tools

ST Partner Program

~150 Partners and growing



ST Partner Program

ST Partner Program enhances the ecosystem around ST's broad portfolio of products helping them to reduce development effort and accelerate time to market.

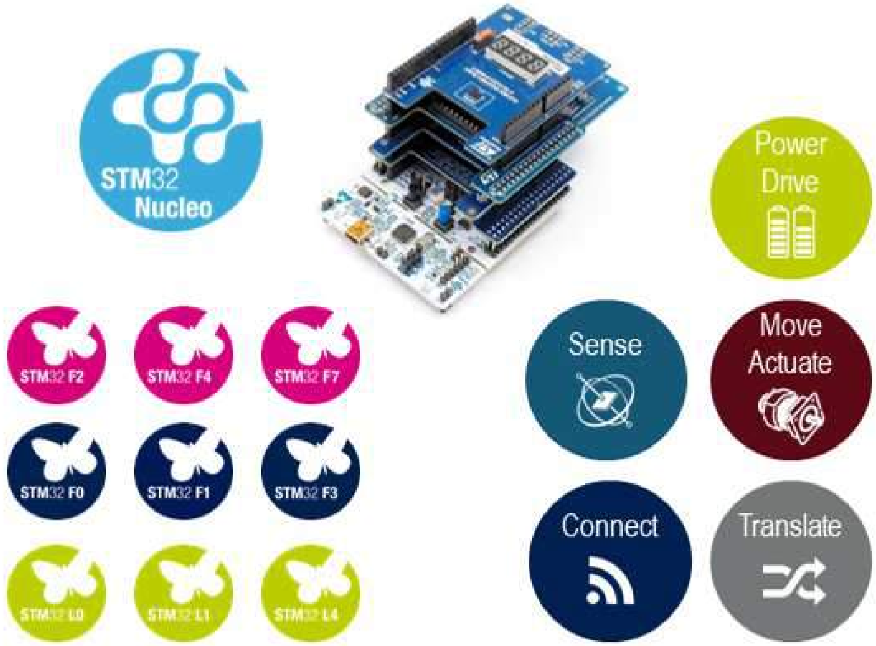
Members of the ST Partner Program offer a wide range of products and services covering areas such as Software Development Tools, Hardware Develop Tools, Embedded Software, Components and Modules, Training, Engineering Services and Cloud.

ST Development Tools

>520K MCU boards – **42** types

180K expansion boards – **48** types

(Since 2015)



Digital Marketing Initiatives

Web visits +15%
Page views +30%

Community website visits
+30%

Online contacts +20%
“opt in” contacts +50%


My Preferences

My Subscriptions

To remove an item, uncheck the box and click on the Confirm button below.

Aerospace newsletter (bi-yearly)	English
Automotive newsletter (quarterly)	English
IoT newsletter (quarterly)	中文 English
MEMS and Sensors newsletter (quarterly)	中文 English

YoY growth for March 2018

Aligned Market Approach

with Distribution Partners

New Customer Identification Program

1000+ new customers in 3 years

$80M in additional revenues in 2017

Additional Design-in Sockets Program

1500+ new sockets in 2017

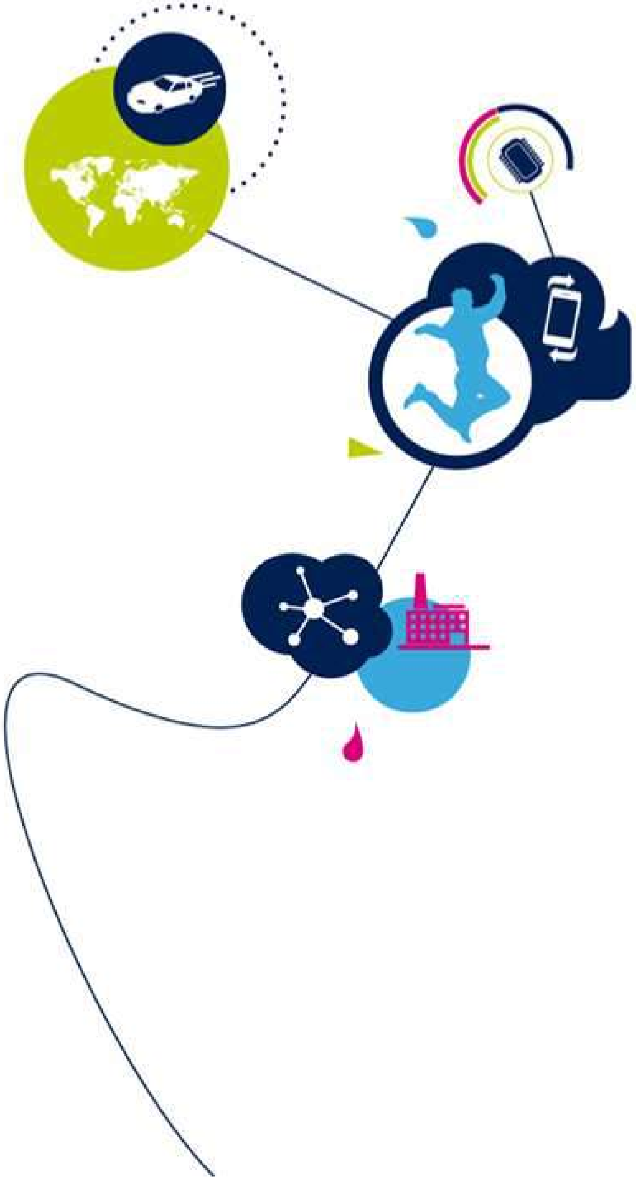
$140M additional revenues in 2017

Takeaways

- Focused on the fastest growing markets and applications in our SAM
- Balanced sales by end-market, customer type and geography
- Differentiated approach by customer type with adapted tools and service levels
- Strong partnerships with distribution supporting growth
- The most complete product portfolio to address the evolving needs of our customers

STMicroelectronics

Capital Markets Day 2018



life.augmented

Automotive & Discrete Group

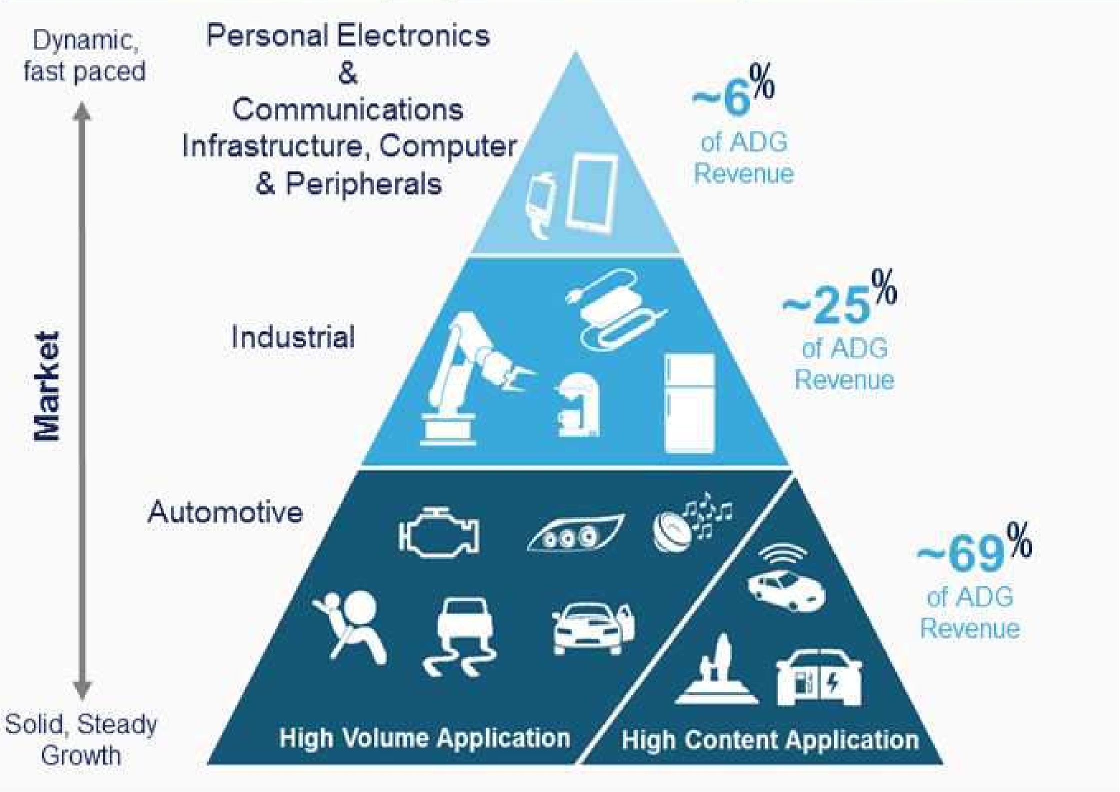
Marco Monti

President
Automotive and Discrete Group

life.augmented

ADG: Group Overview

Product Group Application Domain by End-Market



Customer Base

BOSCH
LEAR CORPORATION
Clarion
BOSE
KOSTAL
HARMAN
Continental
TESLA
MOBILEYE
Autoliv
JVCKENWOOD
Valeo
Pioneer
MAGNETI MARELLI
SiriusXM SATELLITE RADIO
HUAWEI
ERICSSON
ARTESYN EMBEDDED TECHNOLOGIES
Google
DELTA
NOKIA
EMERSON
Skyworth
GREE
Midea air conditioner
Electrolux
Haier

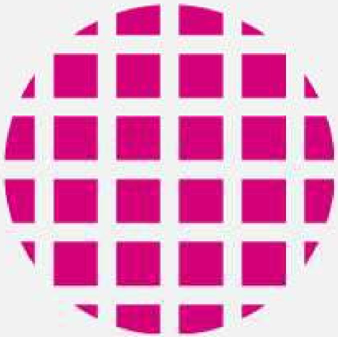
APG Technology and Manufacturing Overview

Smart Power
- BCD9 (110nm), BCD10 (90nm)
- VIP (Vertical integrated technology)

Embedded Non-Volatile-Memory
- M40 (40nm, Tunnel oxide Flash)
- M28 (28nm FD-SOI + Phase Change Memory)

CMOS
- 28nm FD-SOI
- 7nm FinFET

RF
- BiCMOS
- 28nm FD-SOI RF



Crolles R&D	CMOS FD-SOI logic eFlash ePCM
Catania & Agrate R&D	VIPower Advanced BCD
Singapore	VIPower Power MOSFET BCD Advanced BCD*
Foundry	7nm FinFET 90/40nm eFlash 2nd source

PDG Technology and Manufacturing Overview

PMOS

- HV-MOS Trench (400V ~ 1700V)
- LV-MOS Trench (40V~130V)

SiC

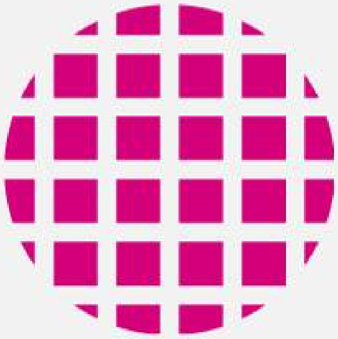
- 2nd Generation Planar (600V~1200V)
- 3rd Generation Trench (600V~1200V)
- SiC Diodes

GaN

- RF-Power GaN on Silicon
- Power GaN Transistor
- GaN Diodes

Discrete

- Passive & Active



Catania R&D	SiC Trench GaN-RF Power MOSFET
Tours R&D	Discrete Passive Integration GaN (Transistor & Diode)
Singapore	Power MOSFET

life.augmented

Automotive Product Sub-Group

Leveraging ST Automotive Leadership

Combustion Engine

33% Market Share

ASIC & ASSP solutions for **Engine** Control

Body & Convenience

45% Market Share

#1 Supplier in Car **Lighting**

Infotainment

40% Market Share

Conventional and Digital **Audio** Amplifiers

ADAS Safety

30% Market Share

Leading **RF and Vision** systems

Automotive Product group

63% Of ADG Revenues

Steady growth in 2017 with a broad range and innovative portfolio

>15% YoY Growth

- Car Radio Processors
- Electric Power Steering
- Smart Power ASSP
- VIP (Vertical Smart Power) drivers

>30% YoY Growth

- ADAS Imaging Processors
- Automotive Microcontrollers
- RADAR
- Premium Audio
- Transmission IC's

life.augmented

Source: Strategy Analytics, ST internal

Power Discrete Sub-Group

Wide Presence in Industrial, Automotive and Personal Electronics

HV - MOSFETS

28% Market Share

650 ~1200V

Leader in Lighting,
& Power Conversion

New Material: SiC-GaN

SiC

>50% Market Share

SiC Diodes & MOSFET
In Automotive

Automotive Inverters & Charging, Industrial
Automation, 4G/5G Communications Infrastructure

AC Switches

29% Market Share

Thyristors &
Triacs

Hi-End Power Conversion
Home Appliances, Motor Control

Protection & Diodes

12% Market Share

Schottky &
Ultra-fast Diodes

Server, Mobile & Personal Electronics,
Storage & Renewable Energy

Power Discrete Group

37%

of ADG
Revenues

Double digit growth in 2017 driven by innovative technologies

>10%

YoY Growth

- HV PMOS
- Automotive PMOS
- Power Schottky Diodes
- Protections

>30%

YoY Growth

- IGBT & Power Modules
- Ultra-Fast diodes
- SiC Diodes
- SiC MOSFETs
- RF Antenna Filters

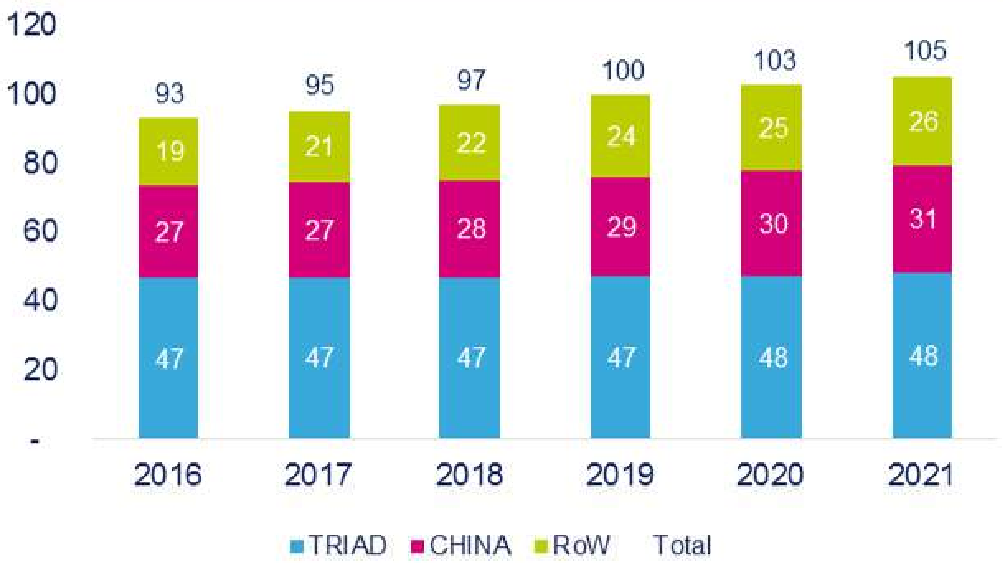
life.augmented

Source: IHS Markit; ST internal

Automotive Market: a Good Place to be

Silicon Content Growth Outpacing Vehicle Unit Growth

Vehicle Production Mu



CAGR 2016-2021: **+2.5%**

Silicon Content $

CAGR 2016-2021: **+3.6%**

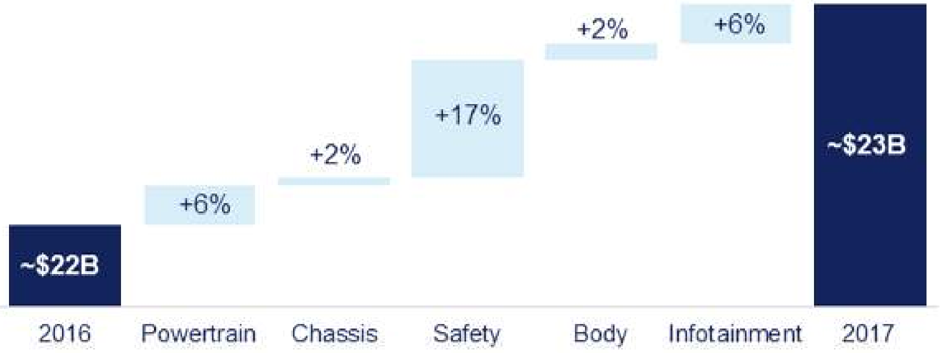
TRIAD : Europe-US-Japan, Source: Strategy Analytics

ADG Automotive: Outperforming the Market

Increased Penetration in all Automotive Domains

ADG SAM by Application Domain [B$]

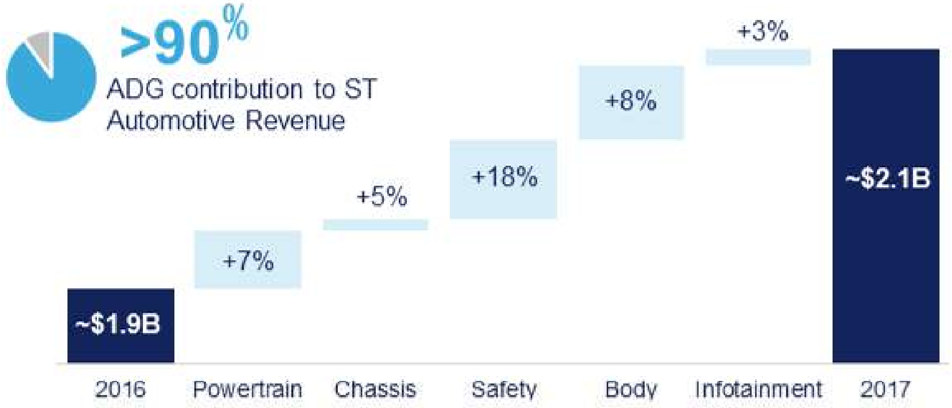
2017 vs. 2016 Growth



Market 2017 Growth on ADG SAM(*): **+6.5%**

ADG Automotive by Application Domain [B$]

2017 vs. 2016 ADG in Automotive Growth



>90%
ADG contribution to ST Automotive Revenue

ADG in Automotive 2017 Growth: **~10%**

(*) Excluding Sensors, Memory and 8-bit MCU

Source: Strategy Analytics

Automotive in ADG
a Business With Solid Foundations

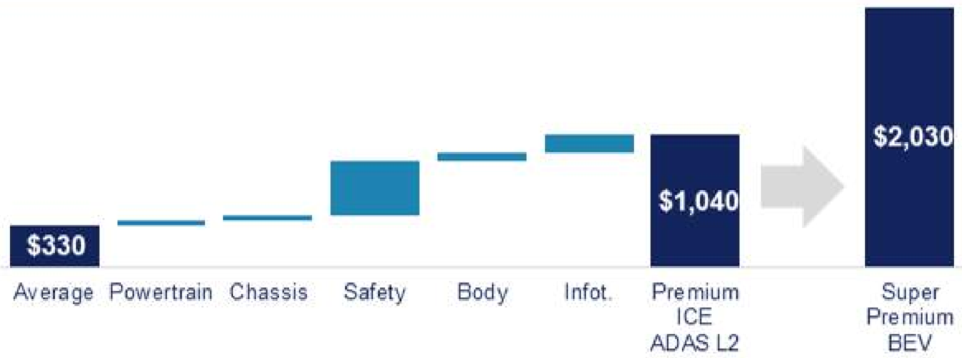
Share	Tier	Applications and Trends			Core Technologies
~27% of ST Auto Revenue	**Radical Innovation** anticipating market needs	**Autonomous Driving**	**V2X Communication**	**Integration & Miniaturization**	SiC (Silicon Carbide) GaN (Gallium Nitride) FD-SOI PCM (28nm FD-SOI + PCM)
	Enabling Transformation emerging trends	**Active Safety**	**Greener**	**Connectivity**	BCD10 (90nm) 40nm eFlash FD-SOI (28nm) RF-CMOS BiCMOS
~73% of ST Auto Revenue	**High Volume Applications** gaining market share	**ICE Power Train:** 33% Share Market Leader ASIC/ASSP **Passive Safety:** 17% Share Integrated solutions for Airbag and Braking	**Car Audio:** 40% Share #1 in Amplifiers, strong in Premium Audio, DAB, Tuners **Body:** 45% Share Market Leader in Door Control, Lighting		BCD9 (110nm) 90nm eFlash VIPower LV-PMOS

life.augmented

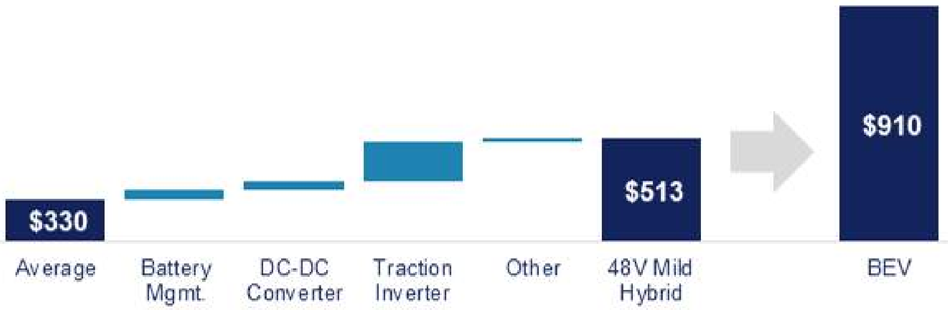
Transformational Trends: an Opportunity

Silicon Content

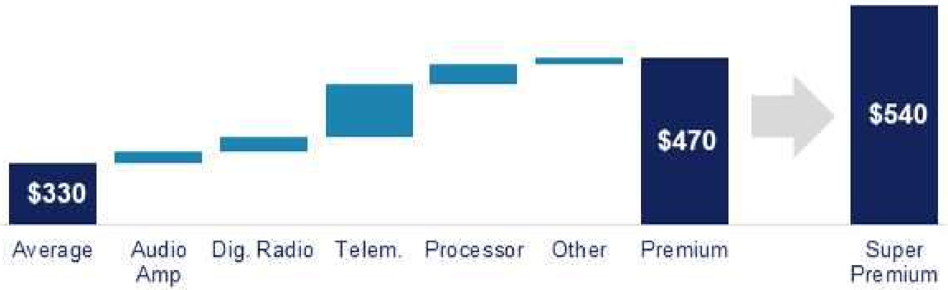
Premium vs. Average Vehicle



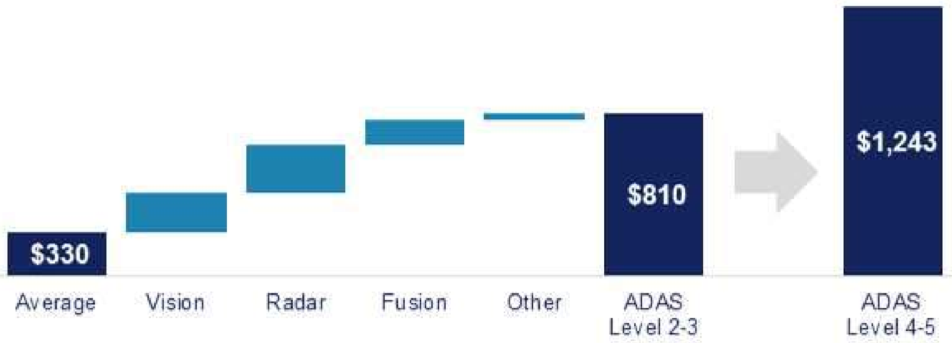
Electrification



Infotainment & Telematics



Autonomous Driving



BEV: Battery Electric Vehicle

Source: Strategy Analytics and ST

Environmental Impact

ST Addresses all Segments with a Complete Range of Solutions

Internal Combustion Engine

Reducing Emissions

Silicon content growth driven by regulation
Higher value silicon content

$2.6B 2017 ICE Semi market value

Euro4 vs. Euro6
$23 → $34
Semiconductor Content

Mild Hybrid 48V

Low-end entry level electrification

Affordable solution for entry level electrification
Added electronic content compared to ICE

Battery Electric Vehicle

High-end battery-based full electric car

Disruptive market change vehicle boosting
electronic content per vehicle

~65% less NOx(*)

~15% less CO_2

Zero CO_2 Emissions

Lower Emissions and Increasing Semiconductor Content

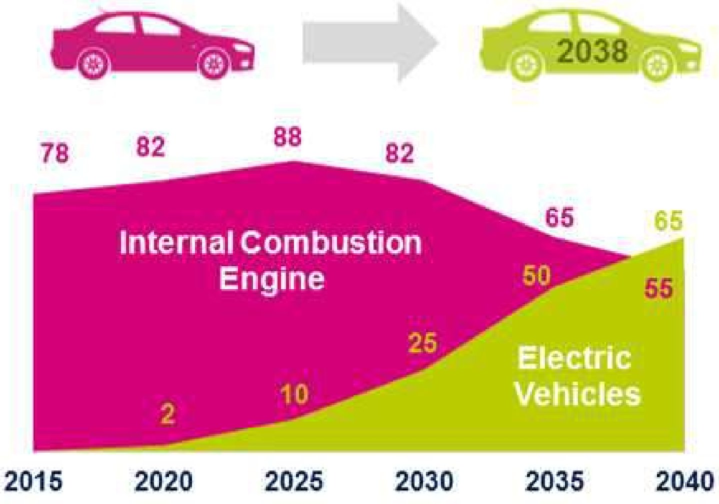
Euro4, Euro6 : European Emission standards for passenger cars and light commercial vehicles

(*) European emission standards referred to diesel passenger car (Euro4 vs. Euro6)

Improving the Internal Combustion Engine

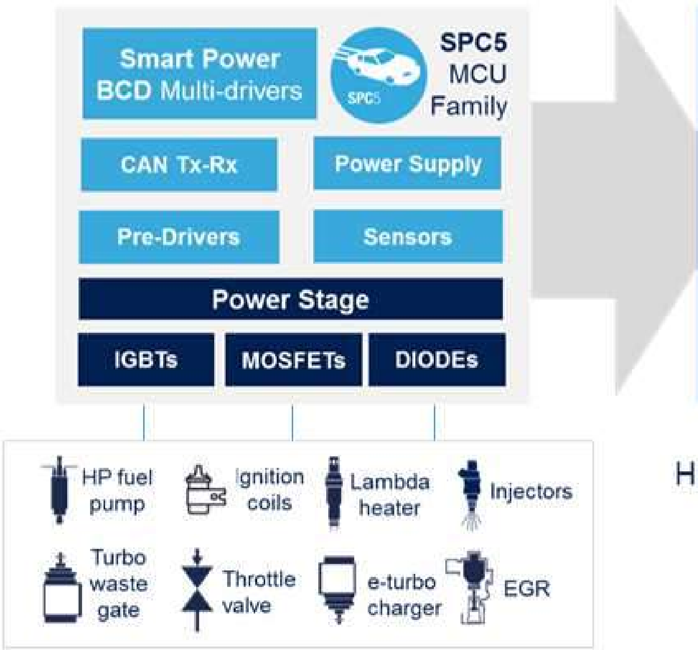
Emission Regulation Boosting Silicon Content And Value

ICE still strong in the years to come…



Electric vs. ICE Vehicle Sales M units

2018 Complete System Solution



Smart Power BCD Multi-drivers

SPC5 MCU Family

CAN Tx-Rx

Power Supply

Pre-Drivers

Sensors

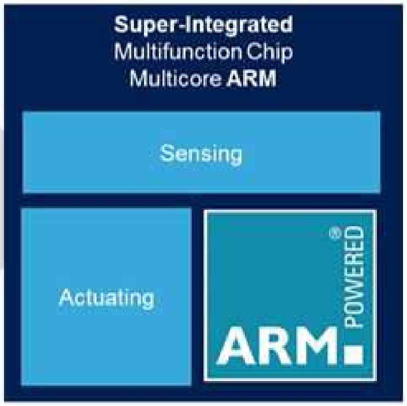
Power Stage

IGBTs

MOSFETs

DIODEs

Leading Edge Innovation



Super-Integrated Multifunction Chip Multicore **ARM**

Sensing

Actuating

Highly Integrated Engine Management System in BCD9 with embedded Processing Power

Next Gen 2022:
BCD10 for an enhanced system integration with **NVM**

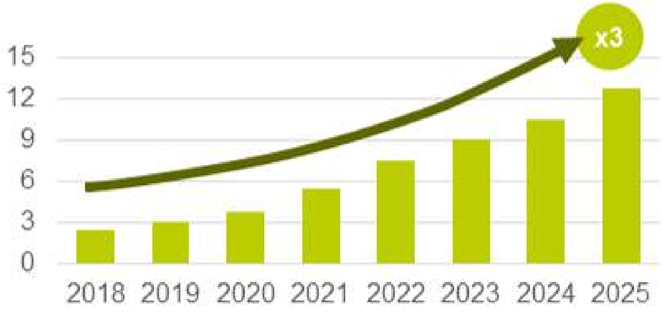
Source: Bloomberg NEF

life.augmented

Mild Hybrids

Affordable Solutions for Entry Level Electrification

Mild Hybrid Vehicles Mu*



~13M

Vehicles

in 2025

48V Mild Hybrid Benefits

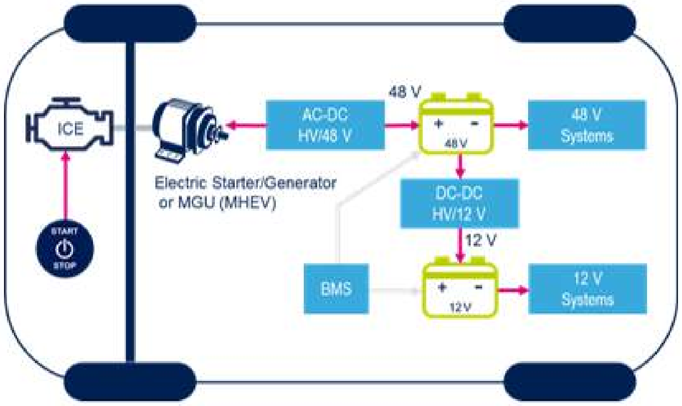
CO_2 reduction due to lower power losses (start-stop) and energy recuperation — -15% CO_2

Affordable Access to Electrification with significant benefits — $$$ 48 V

Enabling quicker engine start, sharper acceleration, and higher performance in-car applications

START STOP ENGINE

ST Solutions for Mild Hybrid Vehicles



- Low Voltage Power **MOSFET** technologies
- **VIPower** intelligent power switches for 48 V power distribution
- **BCD** pre-drivers and **VIPower** integrated drivers for multi-phase motor control
- Low-power 32-bit automotive microcontrollers
- Large variety of protection, filter and companion chips

life.augmented

*Source: Average of estimations of IHS, Continental, IDTechEx, Bloomberg

Battery Electric Vehicles
Disrupting the Market

Battery Electric Vehicles

ST working closely with OEMs

Engaged with key players in **Car Electrification**

Supporting Car Makers
with power modules
on a worldwide basis

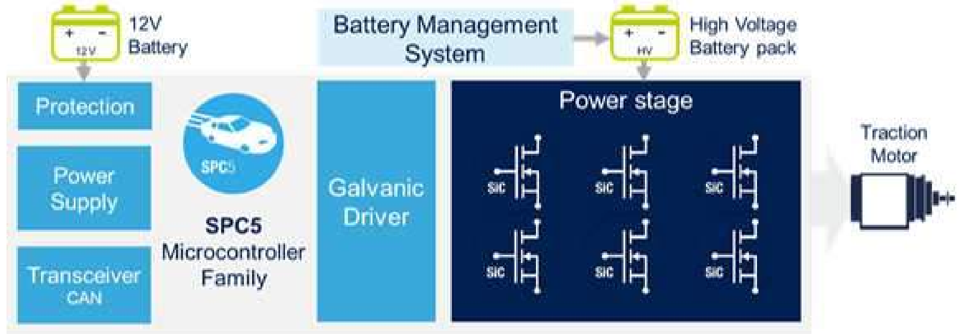
7x in **Europe**
4x in **America**
8x in **China**
3x in **Japan**
2x in **Korea**

~85%

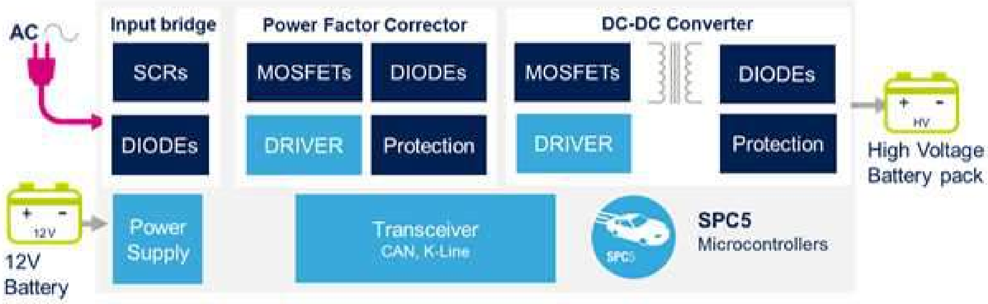
of the projects include **SiC** products

life.augmented

Focus on Traction Inverter, Charging & BMS



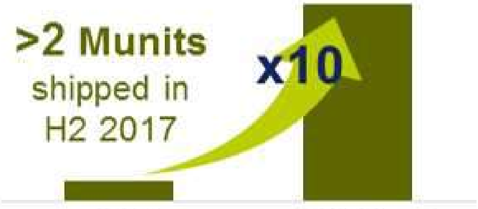
12V Battery
Battery Management System
High Voltage Battery pack
Protection
Power Supply
Transceiver CAN
SPC5
SPC5 Microcontroller Family
Galvanic Driver
Power stage
SiC
Traction Motor



AC
Input bridge
SCRs
DIODEs
Power Factor Corrector
MOSFETs
DIODEs
DRIVER
Protection
DC-DC Converter
MOSFETs
DIODEs
DRIVER
Protection
High Voltage Battery pack
12V Battery
Power Supply
Transceiver CAN, K-Line
SPC5
SPC5 Microcontrollers

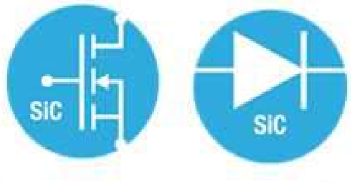
Innovation in Silicon Carbide for Automotive

SiC adoption faster than expected



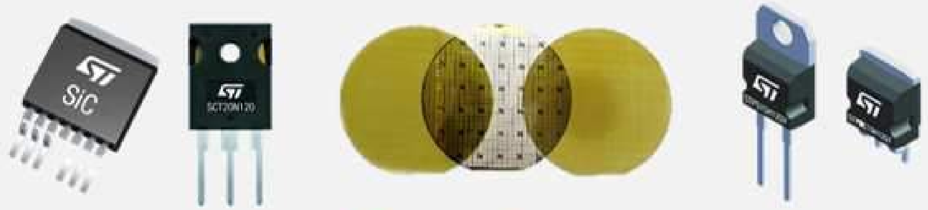
>2 Munits
shipped in
H2 2017

2017 **2018 F'cast**
Units shipped per year



650V to **1200V**
MOSFETs and DIODEs

Package offer - Discrete – Mini-module – Modules



Discrete Packaging

Front-end Evolution

Planar

x2 shrink

Planar

In Production

x4 shrink

Trench

Sampling 2018
Production 2019

Continuous Shrinkage
[R_{on} x cm2]

Power Modules

In Production

Customer dedicated module

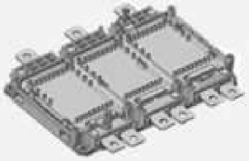
ACEPACK1

ACEPACK2

Production 2019

SMITpak

Production 2020



ACEPACK DRIVE

Increased Data Flows

Require Greater Security, Processing Power and Connection Speeds

Security

MCUs & Processors with Embedded Security

- Specific Microcontrollers dedicated to automotive, to secure all applications:
  - Power Train
  - Braking
  - Steering
  - Gateway & Connectivity
  - ADAS & V2X
  - Infotainment
- Embedded Hardware Security Module
- Security Level (EAL3/4)
- High data-rate encryption/decryption to manage data streams

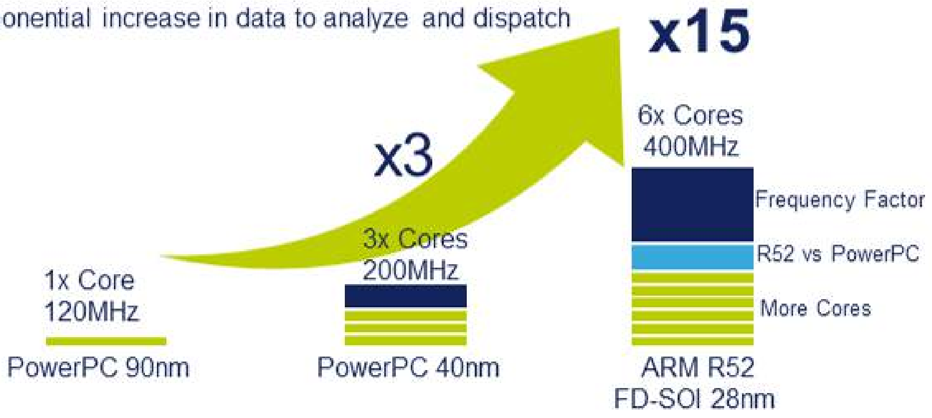
SPC58

TELEMACO 3P

ECU Processing Capability

Increase required in many automotive domains

Exponential increase in data to analyze and dispatch



ST's New high-end 32-bit Automotive MCU Family will provide the power

- ARM Cortex R52, 6x Cores, 400MHz
- 16/32 Mbyte 28nm FD-SOI with embedded PCM Flash memory
- Sampling 2018

life.augmented

Assisted and Autonomous Driving Solutions

Active Safety differentiated offer

2017/18

- Mobileye 4th Gen
- 2nd Gen 24 GHz
- 1st Gen 77 GHz
- Auto Parking MCU
- Surround View Video Processor & Camera (open market)

2019/20 → 202X

- Mobileye 5th Gen (7nm FinFET) ⟶ 6th Gen (7nm FinFET)
- Radar 28nm FD-SOI
- V2X (Wi-Fi 11p)
- Teseo Precise GNNS (<30cm)
- 360° ASIC Vision Processor

ADAS solutions through Distribution and IDH in China

New

10+ Projects engaged in China/Taiwan
Lead projects already in production


Processor


Sensor


Packaged in a small module

Rear View Camera


Overhead View


Basic Lane Detection


Obstacle Detection


life.augmented

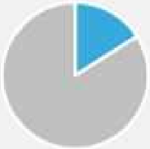
PDG: A Solid Market Presence

Product Sub-Group Portfolio

Industrial

56%
of PDG Revenues

Automotive(*)



16%
of PDG Revenues

Personal Electronics

16%
of PDG Revenues

Telecom Infrastructure

12%
of PDG Revenues

Differentiated product offer in power discrete products to maintain double-digit growth in 2018 across multiple application domains

- Maintain and reinforce market leadership in **High Voltage Power** applications (600V ~1200V)
- Complement Front-End innovation in trench technologies with a solid **Power Module** offer for Automotive and Industrial domains
- Product focus on **new materials** leveraging our market leadership in SiC for Automotive and Industrial Factory Automation applications and extending our portfolio to GaN on Silicon for Telecom Infrastructures
- Maintain focus on **Low Voltage MOSFETs** for Automotive, Industrial and Personal Electronics markets
- Extend our leadership in **Discrete Products** leveraging our innovative technology for protection and filtering products for a wide range of applications

(*) including Automotive SiC and Automotive PMOS drivers previously described

Leadership in Power Management

ADG Present in Multiple Markets

Keep Expanding ADG Presence in Power Conversion

Historical Leadership

In a ~$1B TAM market

ST HV MOSFET

+12%

2017 vs 2016

…Continuing 2018 Double-Digit Growth

Our key ingredients

- High voltage MOSFET technology leadership (MDmesh™)
- Dedicated solutions, tailored to specific market needs, to optimize system energy efficiency

TO-LL

PowerFLAT 5x6
dual-side cooling

DPAK

(*) SMPS: Switching Mode Power Supply HV: High Voltage

HV Leading position in main application domains

Server Farms - UPS

Telecom, ICT & Industrial Domain

High Power
500W - 3.5KW

60 M$
Market TAM

35%
Market Share

Portable Applications

Tools, Mobile Phones, Gaming, Tablets & Laptops

Low Power
5W - 120W

235 M$
Market TAM

30%
Market Share

LED Lighting

Ambient, Infrastructure and Green Houses

Indoor & Outdoor
15W – 1.2KW

330 M$
Market TAM

20%
Market Share

Source: IHS Markit + ST Estimation * High Voltage power MOSFET only

Energy Efficiency for Smart Industry

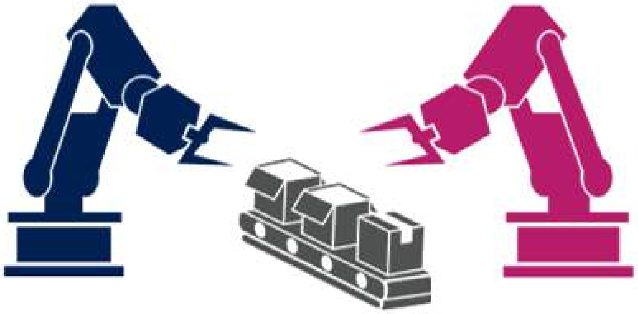
SiC Discrete and Modules for Factory Automation

From Silicon to SiC: Increasing efficiency in Factory Automation

Industrial Robots

Power Conversion

High Power Inverters



SiC expanding in Industrial Domain

Industrial SiC Market Value

2017 ~250M$

>700M$ 2024

Full SiC Module Growth

+31% 2017-2024 CAGR

ADG targeting >20% share by 2020

ST SiC Technology Key Performance

- Energy saving up to ~150 times cost of investment over product lifetime(1)
- Power board shrinkage up to 70% vs. Conventional IGBT solution
- Reducing size and cost of passive components elements

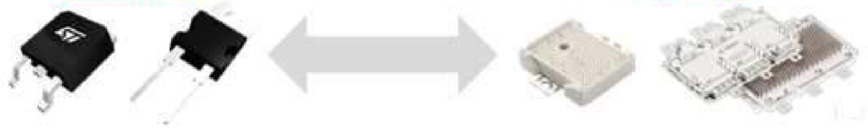
ST Dedicated Solutions

From 650V up to 1200V single and dual diodes

From 650V up to 1700V MOSFETS

DISCRETE

MODULE



life.augmented

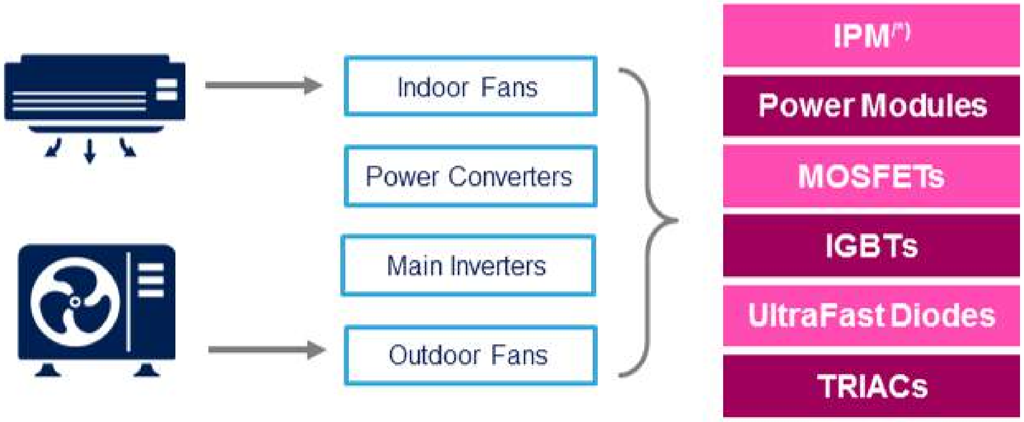
---

(1) 20 years life time and 50% usage factor considering just 1.5% higher average efficiency at half-load

(*) IHS Markit_SiC and GaN Power Semiconductors Report

Air Conditioning Systems
Power Discrete in Industrial

Full Application Coverage



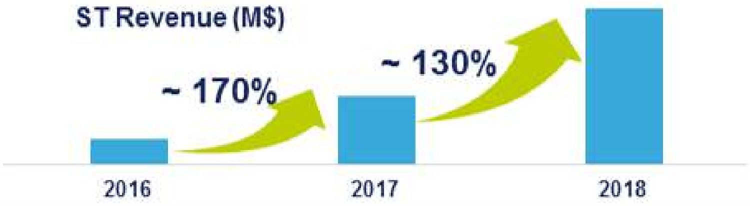
Indoor Fans
Power Converters
Main Inverters
Outdoor Fans

IPM(*)
Power Modules
MOSFETs
IGBTs
UltraFast Diodes
TRIACs

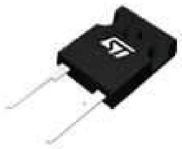
Strong Growth in a large Market

130Mu
2018 Market Volume

~11%
2018-2022 CAGR
Air-Conditioning Inverters



Best-in-class Ultrafast Power Factor Corrector (PFC) Diodes with enhanced EMI & ESD performances(**)



Turbo-Switch™ Diode

33%
2017 Growth

Intelligent Power Module: Power & gate driver in single package

SLLIMM™

32 x 12 mm

38 x 24 mm

Up to **3kW**
Air Conditioning inverter in less than 9cm²

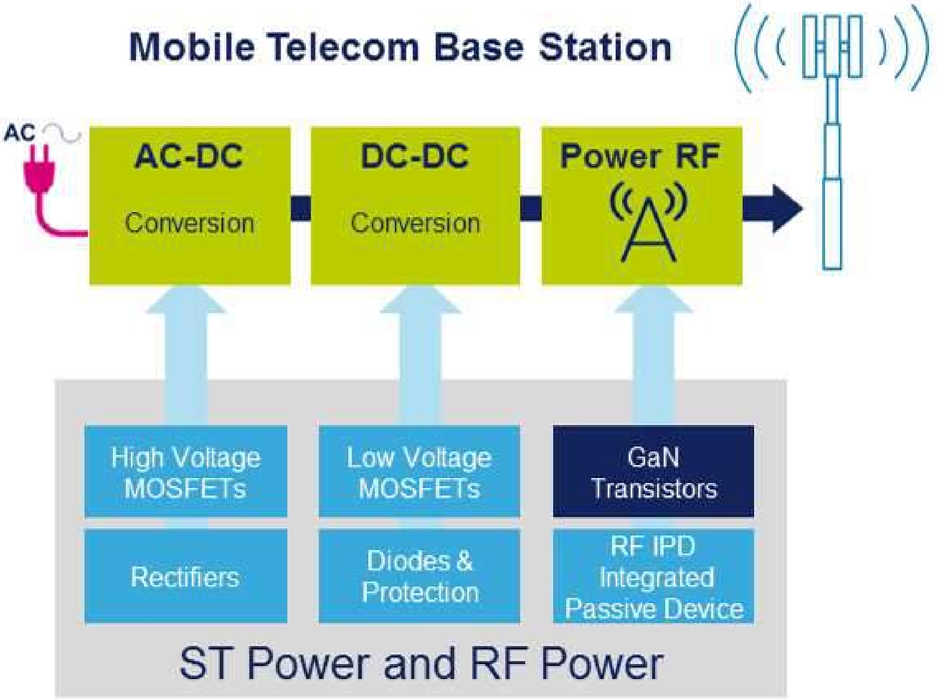
(*) Intelligent Power Module
(**) For AC line rectification as for IEEE std 519-1992 regulation

Source: Major Home Appliance Market Report 2017- Global Major Home Appliance Market

4G & 5G Basestations

ADG presence in Communications Infrastructure

Strengthening ST Position in Telecommunications



Mobile Telecom Base Station

AC-DC
Conversion

DC-DC
Conversion

Power RF

High Voltage MOSFETs

Rectifiers

Low Voltage MOSFETs

Diodes & Protection

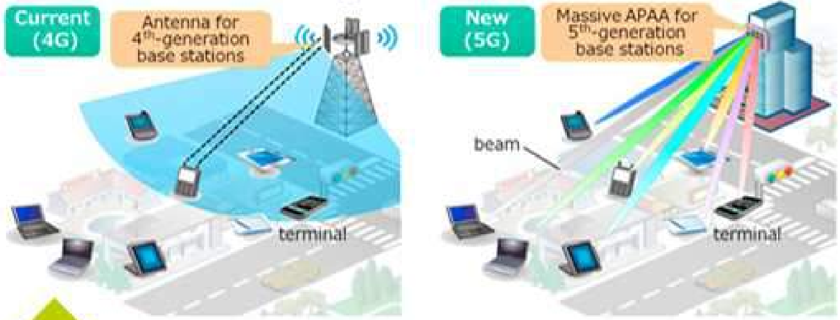
GaN Transistors

RF IPD Integrated Passive Device

ST Power and RF Power

Proliferation of RF Power amplifiers (*)

5G Standard: Boosting Semiconductor Pervasiveness



x10 Antenna elements 5G vs. 4G

+20 B$ **GaN in RF Market** in 2019-2023 timeframe

Strategic Partnership for GaN on Silicon

GaN-on-Silicon joint development for RF power products for Telecom infrastructure market

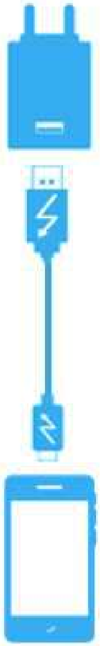
MACOM IP – ST Engineering and Manufacturing Samples 2018

(*) courtesy of Macom

Smartphones & Mobile Devices

ADG Presence in Personal Electronics

Portable Devices: Covering the Full Chain



Power Adapters

- Diodes for reverse battery protection
- Rectifiers
- Protections (TVS)
- High Voltage MOSFETs
- Low Voltage MOSFETs

Data Cables & Connectors

- Protection (EOS, ESD)
- Filtering for EMI

HDMI

USB Type-C, Power Delivery

Thunderbolt

Smartphones

- Protection (EOS, ESD)
- Integrated Active & Passive Components for RF
- Tuned Capacitors for Antennas
- Passive smart integration

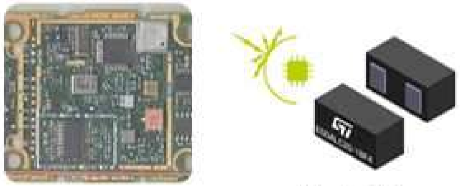
Innovation Factors

Integrated Approach

Several Passive Components in one IC


Integration for Miniaturization

Miniaturization


Body Size 0.2mm X 0.3mm

Advantages of Application Specific Integrated Solutions

Reduced Cost of Ownership

Up to 85% Miniaturization

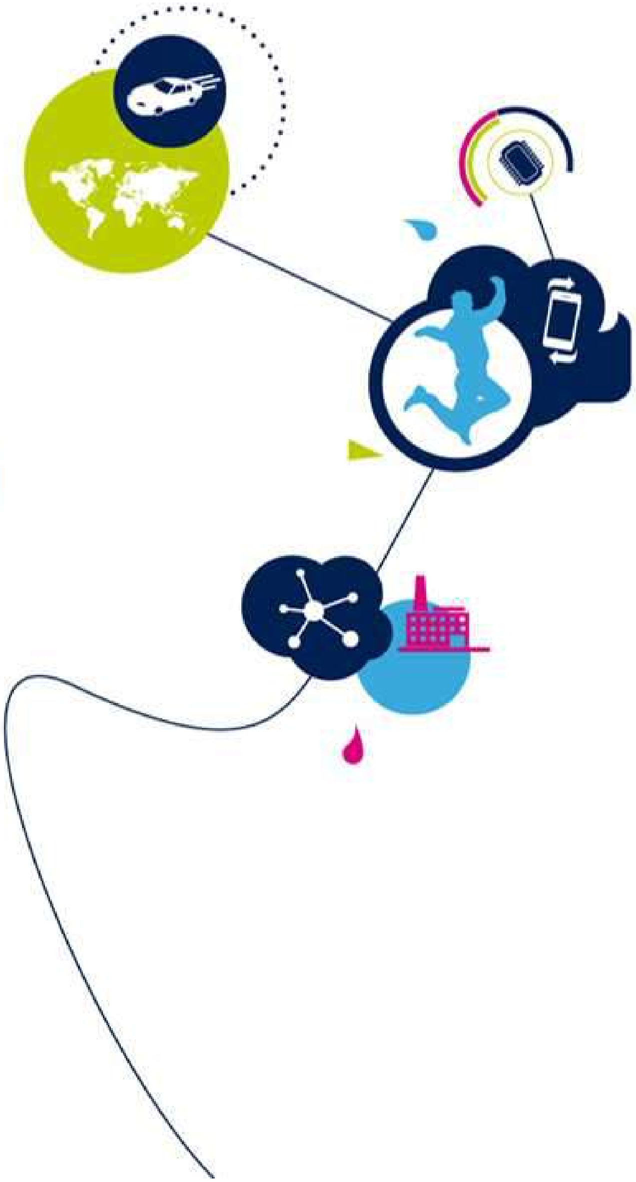
Faster Time to Market

Takeaways

- ADG represents an important part of ST, contributing to the stability and predictability or our business
- The Automotive business of ADG is built on solid foundations able to support the traditional automotive domains, the transformational trends and the radical innovation drivers
  - ST is taking advantage of the market opportunities that are resulting in increased silicon content in vehicles
  - ST has all the technologies, the IP portfolio and the partner networks to lead the transformation trends of the automotive industry
  - ST is disrupting the automotive industry and enabling the acceleration of EVs with its innovative Silicon Carbide Technology
- ADG has a wide and diversified product offer in the Industrial and IoT application domains with a well defined product strategy to keep growing
  - Leveraging the increased semiconductor pervasion in multiple application domains
  - Extending the product offer in new market segments like Smart Industry and 5G

Automotive & Discrete Group

Q & A

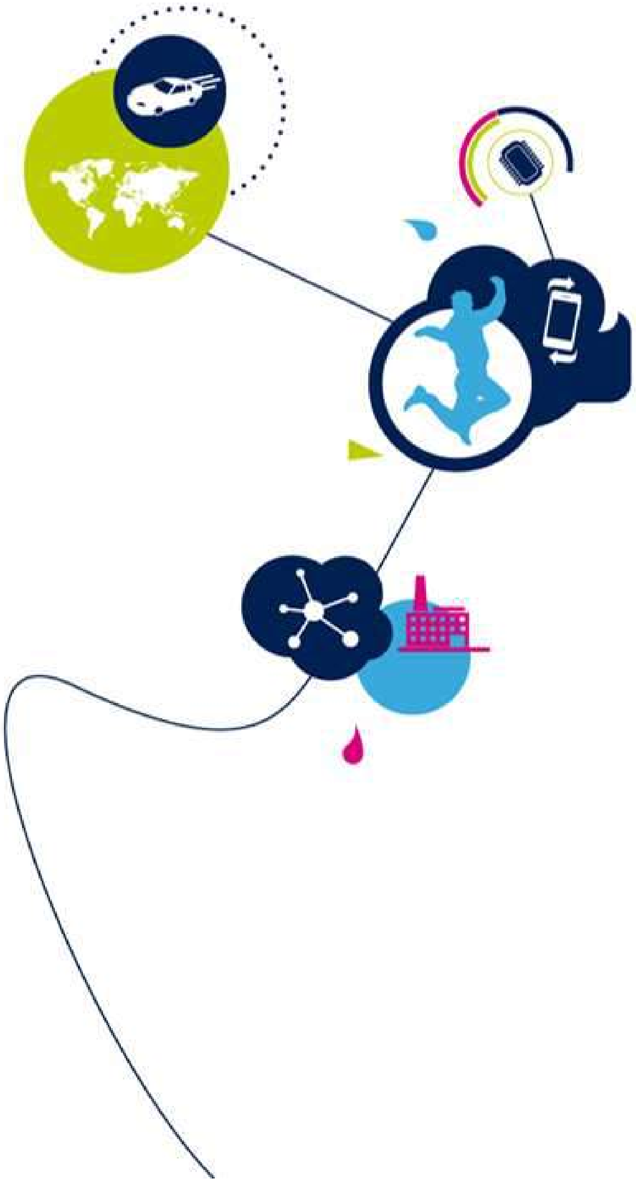


life.augmented

STMicroelectronics

Capital Markets Day

2018



life.augmented

Break

Smart Driving

Visit our demos

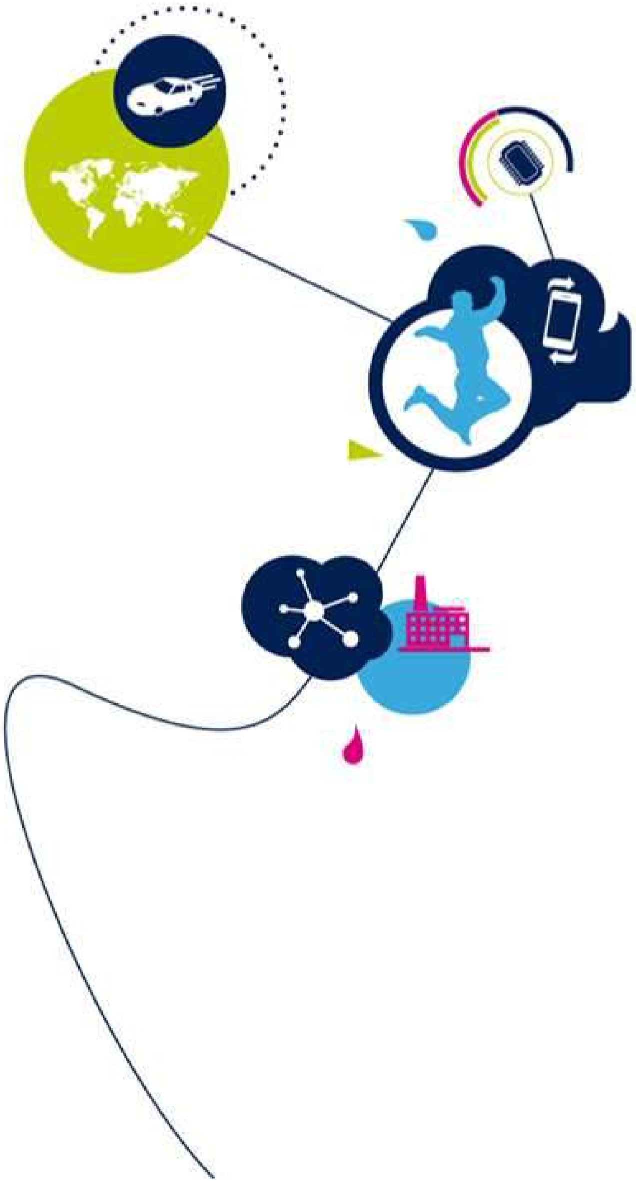
Next session at 11:00 a.m.

Internet of Things

life.augmented

STMicroelectronics

Capital Markets Day 2018



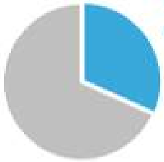
life.augmented

Microcontrollers & Digital ICs Group

Claude Dardanne

President
Microcontrollers and Digital ICs Group

life.augmented



MDG: Group at a Glance

Key Financial Data by Sub-Group

Group 2017 Revenue

$2.65B

Microcontrollers & Digital ICs Group

$2.06B

Microcontrollers & Memories

$0.59B

Digital ICs & ADL

FY17 vs FY16 Growth

MDG

+16%

Microcontrollers & Memories +25%

Digital ICs & ADL -7%

1Q18 vs Q117 Growth

MDG

+26%

Microcontrollers & Memories +34%

Digital ICs & ADL +3%

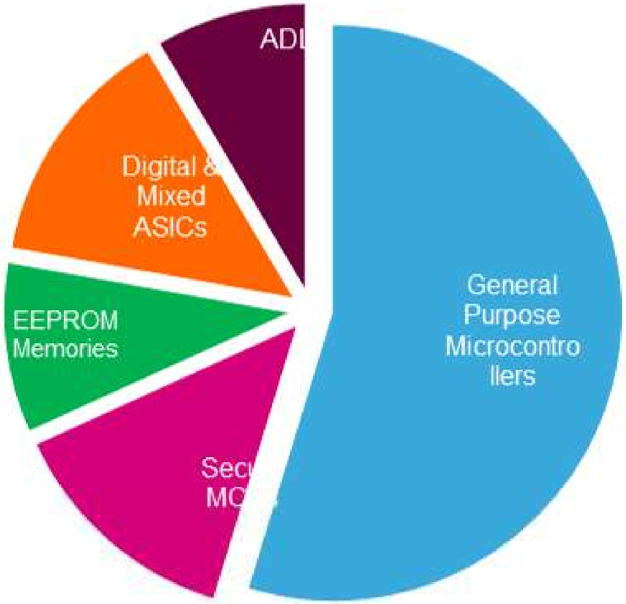
life.augmented

ADL= Aerospace & Defense, Legacy

Microcontrollers & Digital Group

2017 Business by Product Category

- Target global leadership on Microcontrollers* & EEPROM Memories
- Profitable participation on Digital products targeting specific markets
- Revenue Split
  - 68% Microcontrollers including General Purpose* & Secure MCUs.
  - 10% EEPROM memories.
  - 22% Digital including digital & mixed ASICs, Aerospace and Defense products
- Ranking
  - #2 Consolidated Microcontrollers* (#1 in 32-bit segment)
  - #3 General Purpose Microcontrollers*
  - #3 Secure Microcontrollers
  - #1 EEPROM Memories



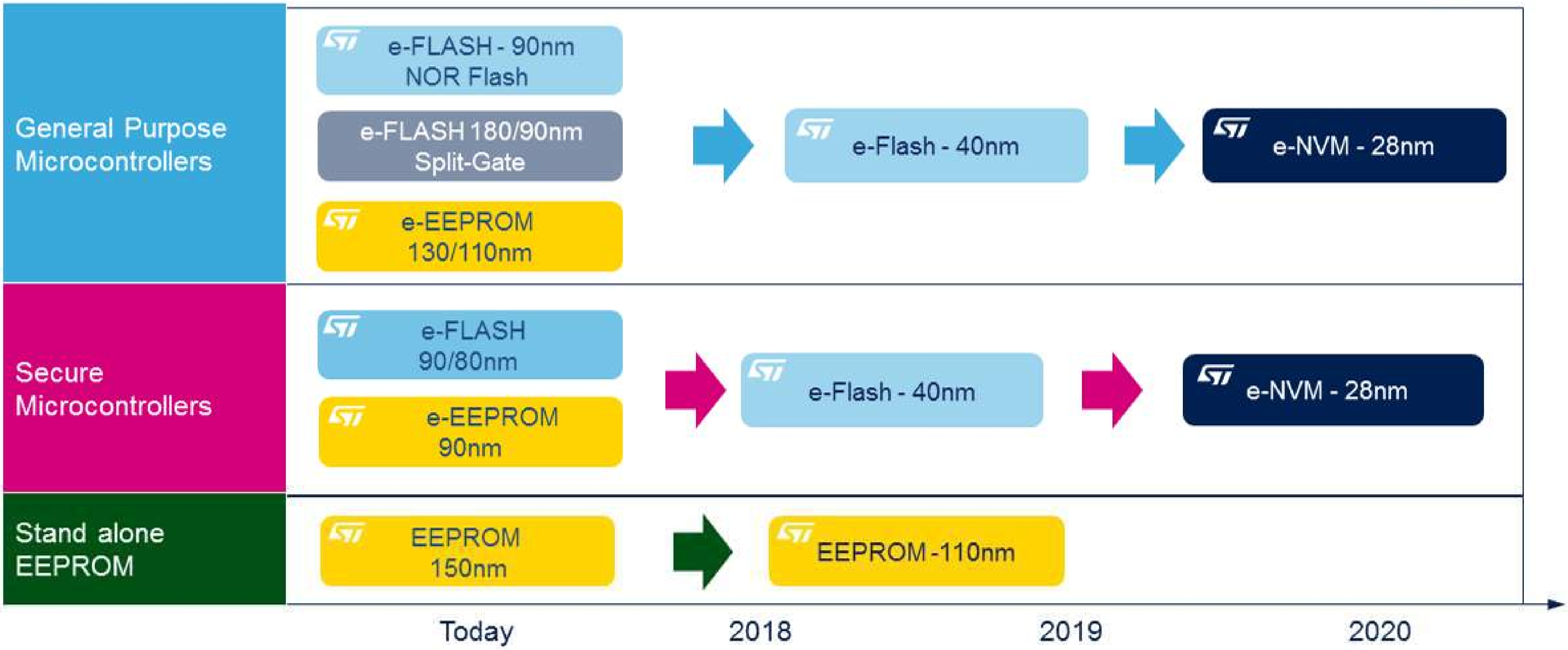
life.augmented

* General Purpose & Secure MCUs excluding automotive MCUs

ADL= Aerospace & Defense, Legacy

Advanced Technology Roadmap

Non-Volatile Memory



General Purpose Microcontrollers

e-FLASH - 90nm NOR Flash

e-FLASH 180/90nm Split-Gate

e-EEPROM 130/110nm

e-Flash - 40nm

e-NVM - 28nm

Secure Microcontrollers

e-FLASH 90/80nm

e-EEPROM 90nm

e-Flash - 40nm

e-NVM - 28nm

Stand alone EEPROM

EEPROM 150nm

EEPROM -110nm

Today

2018

2019

2020

life.augmented

EEPROM

NOR Flash

Advanced Technology Roadmap

Digital

Digital & Mixed

TSMC 16nm FF → TSMC 7nm FF

28 FD-SOI 28nm → GF 22 FD-SOI 22nm

C40/C65 28nm

BiCMOS

B55 55nm → B55 evolution 55nm

B9MW 130nm

Photonics

PIC25G P1 100G PSM4 → PIC50G 200G-400G

RF SOI

H9-SOI-FEM 130nm → 65-SOI-FEM 65nm

MDG Manufacturing Strategy

Technology			Products	First Source	Second Source
Non-Volatile Memory	CMOS eNVM Split Gate	≥ 90nm	STM32	Foundry	
	CMOS eNVM	≥ 90nm	MCUs & EEPROM	Rousset 200	AMK fab13
		≤ 90nm	GP & Secure MCUs	Crolles 300	Foundry
Digital	CMOS Bulk	≥ 40nm	Legacy	Crolles 300	Foundry
		≤ 40nm	ASICs	Foundry	Crolles 300
	CMOS FD-SOI	28nm	MPU RF mmW & ASICs	Crolles 300	Foundry
		22nm		Foundry	
	FinFET	16nm & 7nm	ASICs	Foundry	
	BiCMOS	≥ 90nm	RF mmW & ASICs	Crolles 200	
		< 90nm	Mixed ASICs, Optical ICs	Crolles 300	
	Silicon Photonics		Networking ASSP & ASICs	Crolles 300	
	HCMOS9A	130nm & 65nm	RF SOI	Crolles 200	Crolles 300

ST 200mm
ST 300mm
Foundry

Consolidated Microcontrollers*

Ranking Trend

General Purpose MCUs* + Secure MCUs Ranking (IHS Markit March 2018)

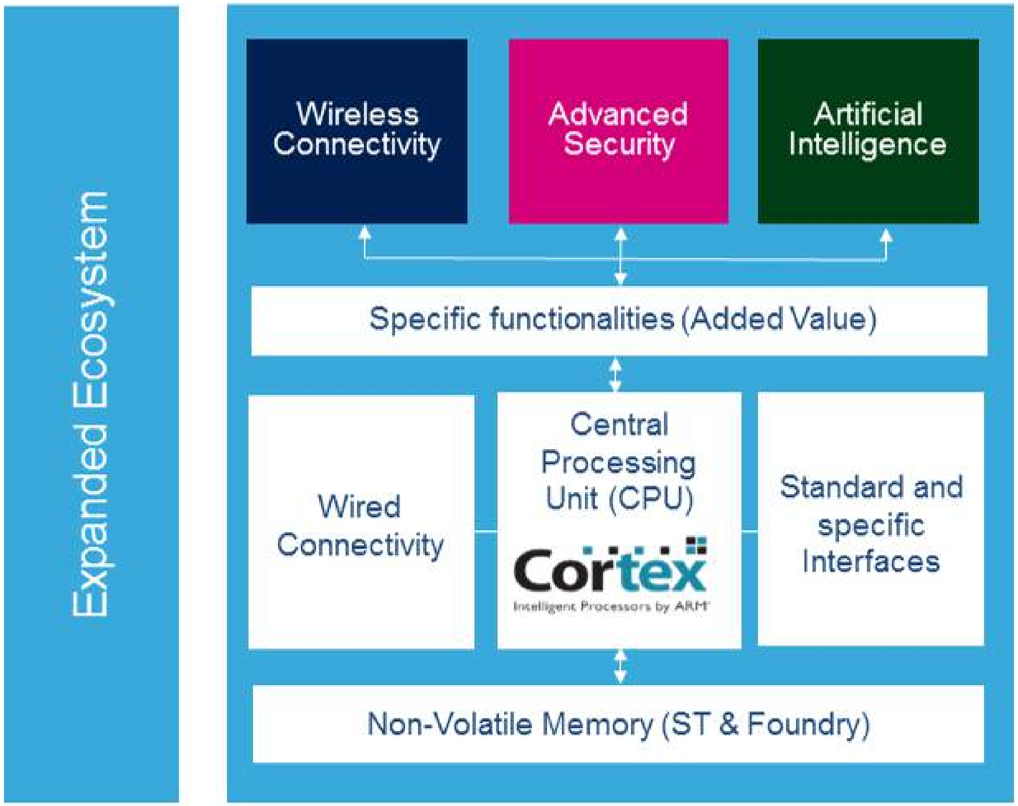
Rank	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	**Renesas**	**Renesas**	**Renesas**	**Renesas**	**Renesas**	**Renesas**	**Renesas**	**Renesas**	**NXP**	**NXP**	**Microchip**
2	Panasonic	Panasonic	Panasonic	Samsung	Atmel	Atmel	ST	ST	Renesas	Microchip	ST
3	Microchip	Infineon	Samsung	Atmel	Infineon	Microchip	Microchip	NXP	ST	ST	NXP
4	Toshiba	NEC	Microchip	Microchip	Microchip	ST	NXP	Microchip	Microchip	Renesas	Renesas
5	NEC	Microchip	Atmel	ST	Samsung	Infineon	Atmel	Atmel	Infineon	Infineon	Infineon
6	Freescale	Samsung	Infineon	Infineon	ST	Samsung	Infineon	Infineon	Atmel	TI	TI
7	Atmel	Atmel	NEC	Toshiba	TI	NXP	TI	TI	TI	Cypress	Cypress
8	Infineon	Toshiba	ST	TI	NXP	TI	Samsung	Freescale	Cypress	Samsung	Samsung
9	Samsung	Freescale	Toshiba	Fujitsu	Toshiba	Fujitsu	Freescale	Samsung	Samsung	Silicon Lab	Silicon Lab
10	NXP	ST	Fujitsu	Freescale	Freescale	Freescale	Cypress	Spansion	Huada	Huada	Nuvoton
11	Fujitsu	Fujitsu	Freescale	NXP	Fujitsu	Toshiba	Spansion	Cypress	Silicon Lab	Toshiba	Toshiba
12	ST	NXP	TI	Panasonic	Cypress	Cypress	Toshiba	Huada	Toshiba	Nuvoton	Huada
13	TI	TI	NXP	Cypress	Panasonic	Sharp	Huada	Toshiba	Datang	Datang	Cobham
14	Sharp	Sharp	Cypress	Nuvoton	Sharp	Huada	Silicon Lab	Silicon Lab	Nuvoton	Cobham	Datang
15	Cypress	Cypress	Sharp	Sharp	Nuvoton	Melfas	Sharp	Panasonic	Panasonic	Intel	Maxim

life.augmented

STM32

* MMS sub-group perimeter excluding automotive MCUs

General Purpose Microcontrollers



Expanded Ecosystem

Wireless Connectivity

Advanced Security

Artificial Intelligence

Specific functionalities (Added Value)

Wired Connectivity

Central Processing Unit (CPU)

Cortex

Intelligent Processors by ARM

Standard and specific Interfaces

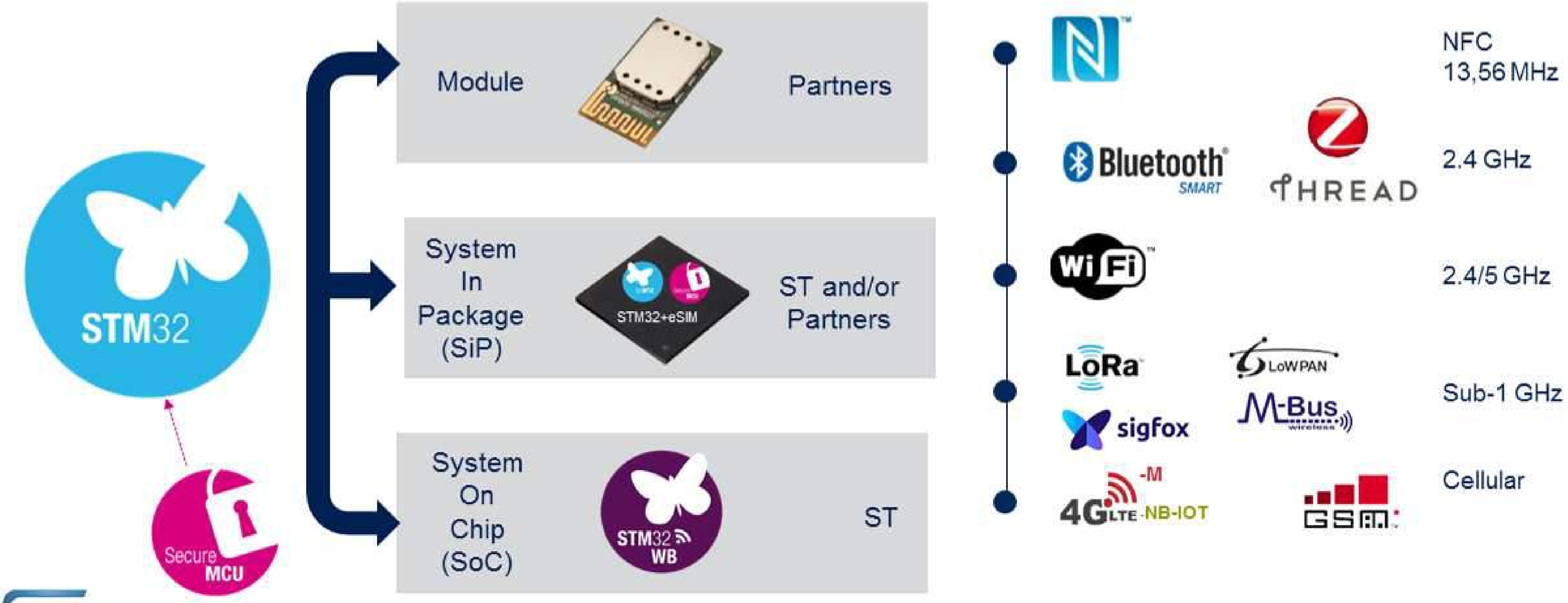
Non-Volatile Memory (ST & Foundry)

2017

- ~30% revenue growth
- #3 supplier
- ~19% market share
- > 2 Billion MCUs shipped
- > 1 Billion STM32 shipped
- > 800 STM32 part numbers
- Strong mass market presence
- > 50,000 customers
- > 50% revenue from Industrial market

Connectivity Powered by the STM32

from Module to Integrated Solutions



Module — Partners

System In Package (SiP) — ST and/or Partners

System On Chip (SoC) — ST

NFC 13,56 MHz

2.4 GHz

2.4/5 GHz

Sub-1 GHz

Cellular

life.augmented

Artificial Intelligence with STM32

STM32CubeMX.AI

STM32CubeMX.AI SW tool allows our customers to innovate…

Off-the-shelf tools

Lasagne
TensorFlow
theano
Microsoft CNTK
Caffe
Keras

Pre-trained Neural Network Model from major framework

ST SW tools

STM32 CubeMX.AI

Optimized Neural Network code automatically generated for STM32

ST AI solution

STM32 + Deep Learning Software

… bringing AI into the STM32 Portfolio

AI Application Processing Requirements

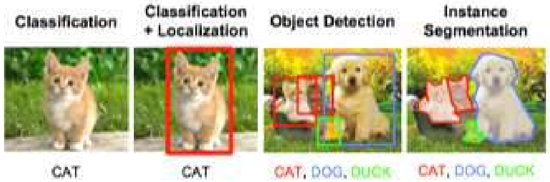
Low

- Sensor analysis
- Activity Recognition (motion sensors)
- Stress Analysis or Attention Analysis

Medium

- Audio & sound
- Speech Recognition
- Object Detection

High



- Computer Vision
- Multiple Objects Detection/Classification/Tracking
- Speech Synthesis

STM32 → From IP embedded in MCU/MPU to dedicated SoC

STM32 CubeMX.AI

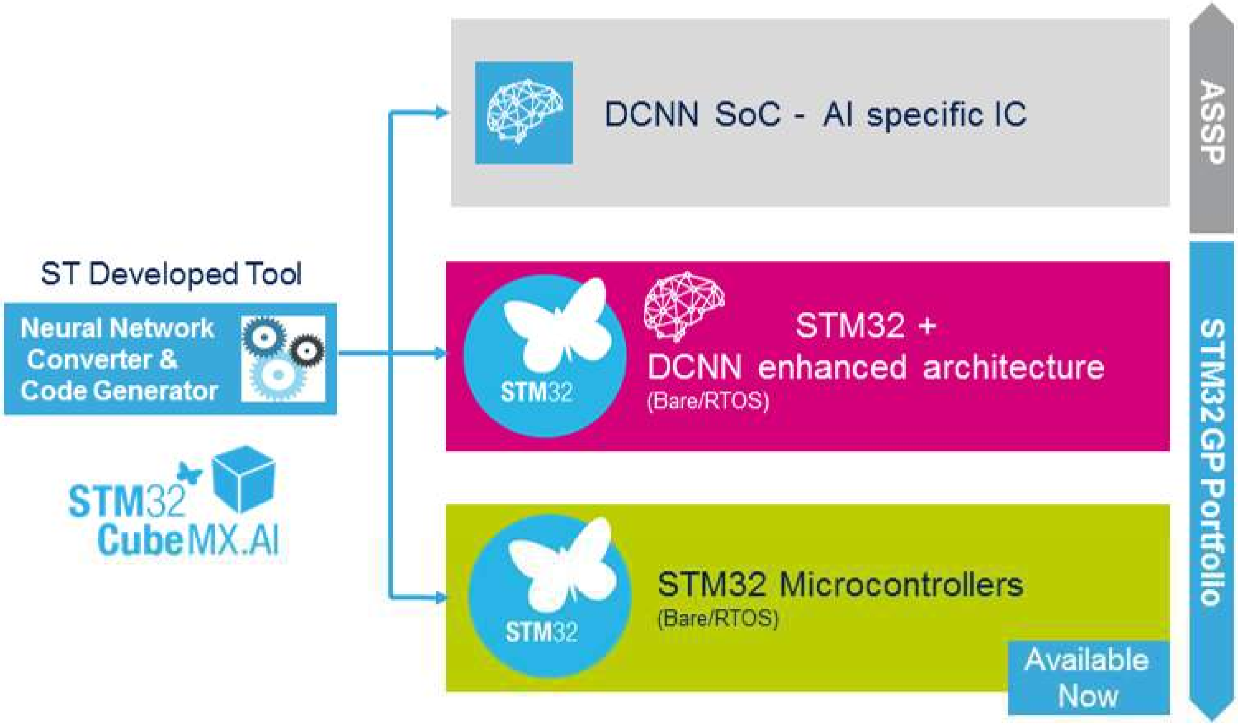
- Audio use cases with individual commands
- Classic motion sensor use cases

- Mandatory to support complex Audio and Video use cases.

life.augmented

Artificial Intelligence

ST Solutions



- Complements STM32 General Purpose portfolio with computer vision capable devices
- Addition of Neural Network co-processors to speed up operations in NN Layers Library in STM32CubeMX.AI tool
- Neural Networks ported to existing STM32 portfolio thanks to STM32CubeMx.AI tool
- Alpha customers engaged since 2017

Computing Power

DCNN = Deep Convolutional Neural Network

STM32
a Scalable Security Offer

- Secure storage
- Security Services
- Monitoring
- Cryptography
- Isolation

Certified

ST3x / ST5x

STM32 eSE

STM32 MCU ↔ STSAFE

STM32 MCU

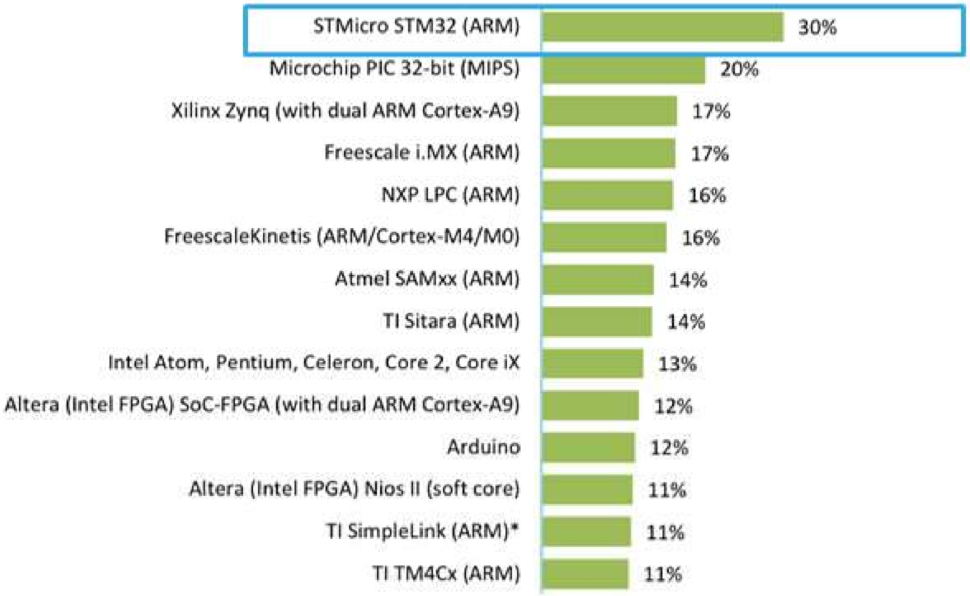
STM32 MCU

life.augmented

STM32
the Leading Choice for Developers

ASPENCORE

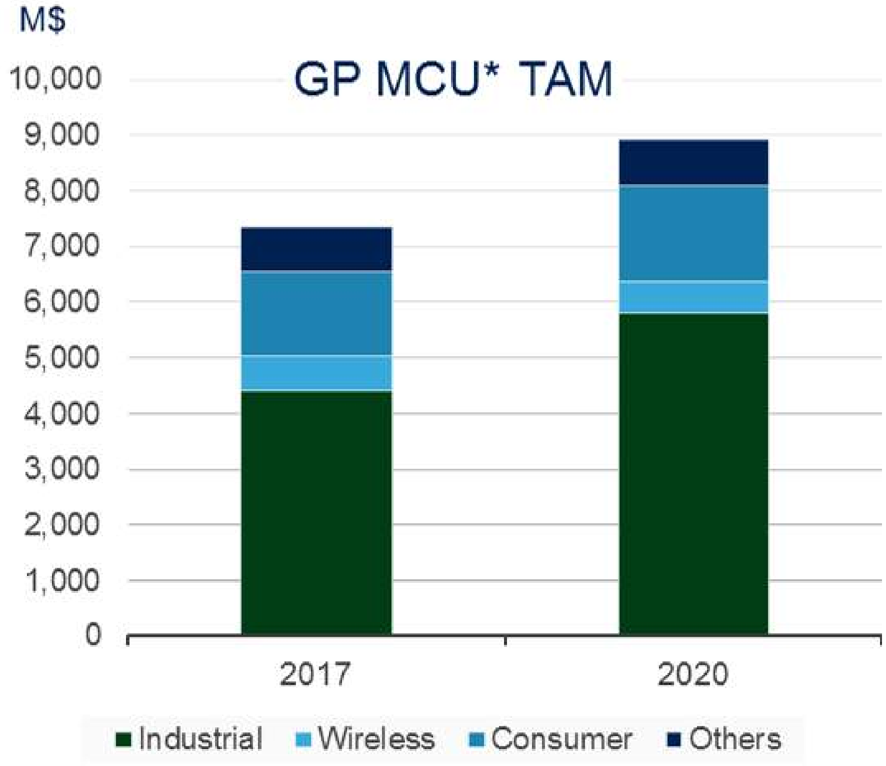
Which of the following 32-bit chip families would you consider for your next embedded project?



Aspencore 2017 Embedded Markets Study
m.eet.com/media/1246048/2017-embedded-market-study.pdf

General Purpose Microcontrollers

End Market Focus



* Excluding Automotive MCU
Source: WSTS, 2018 and ST estimates

Market Dynamics
CAGR 2017-20: **+7%**

Industrial

- Smart industry factory automation , medical, security & video surveillance, building & home control, power & energy, aerospace

CAGR 2017-20: +10%

Smartphones

- Smartphones
- Other mobile phones

CAGR 2017-20: -3%

Other Personal Electronics

- Gaming, wearable
- TV, audio, video, camera ..

CAGR 2017-20: +4%

Comms Equipment, Computer & Peripherals

- Computer and peripherals, POS
- Wired communication

CAGR 2017-20: +1%

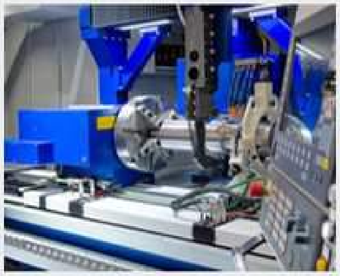
life.augmented

STM32
the Brain of Many Industrial Applications

Appliances

Metering

Robotics & Automation



Healthcare

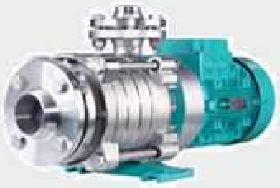
Power Tools

Secure Locks

Surveillance

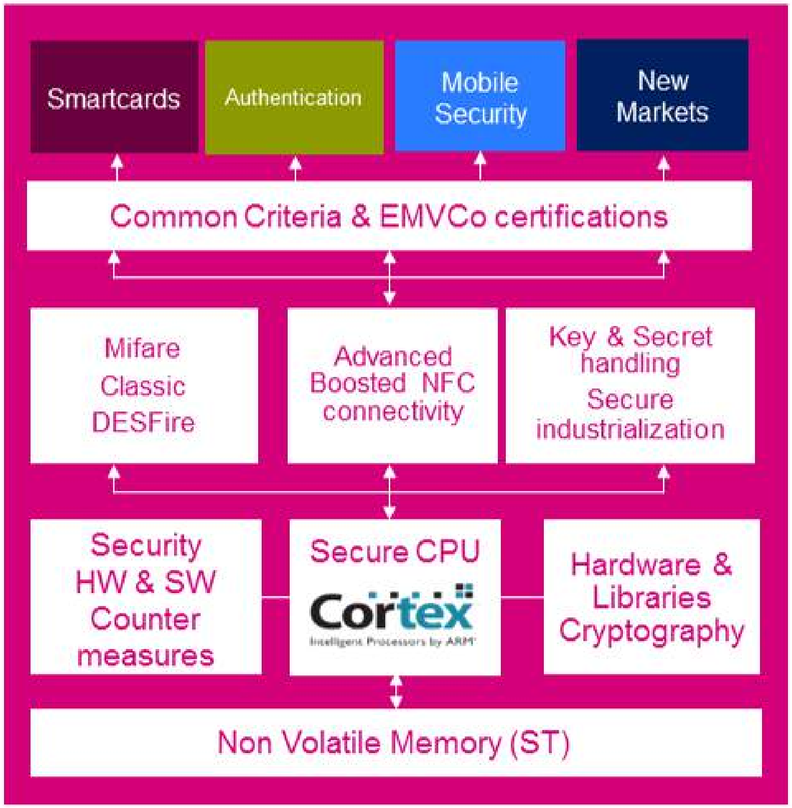
Smart Homes & Buildings

Drives, Pumps, Compressors



Lighting

Secure Microcontrollers



Smartcards

Authentication

Mobile Security

New Markets

Common Criteria & EMVCo certifications

Mifare Classic DESFire

Advanced Boosted NFC connectivity

Key & Secret handling

Secure industrialization

Security HW & SW Counter measures

Secure CPU

Cortex

Intelligent Processors by ARM

Hardware & Libraries Cryptography

Non Volatile Memory (ST)

2017

- > 15% revenue growth in a declining market
- #3 supplier
- ~15% market share
- > 1 Billion Secure MCUs shipped
- Strong contribution to the emerging Industrial market (M2M …)
- > 250 Million units shipped for Mobile Security

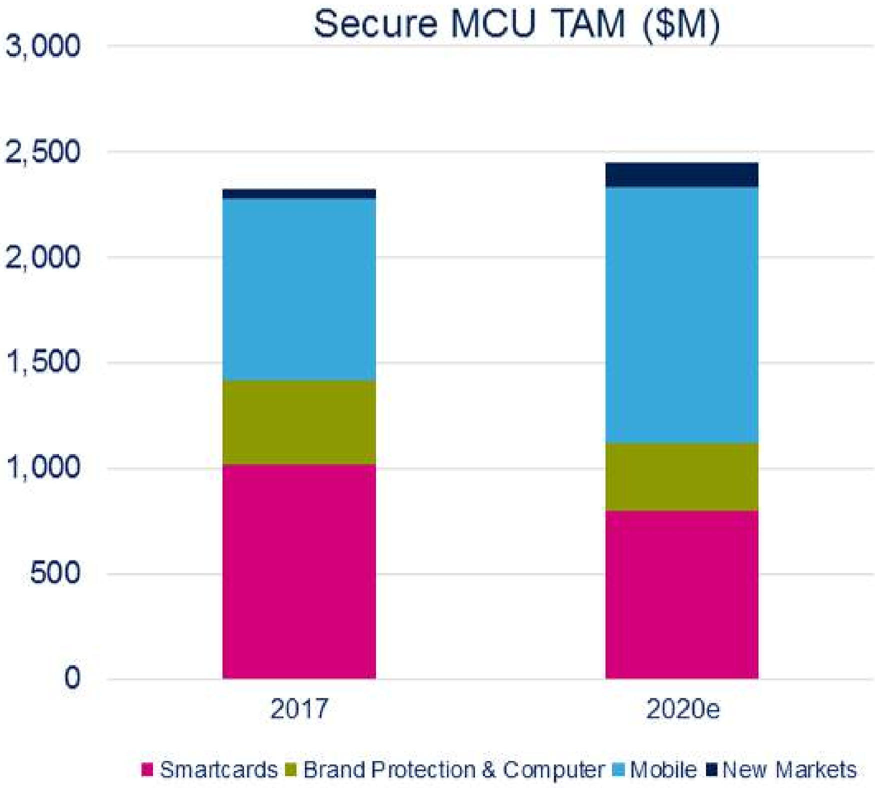
Secure MCUs

Market Coverage

	Smartcards	Mobile Security	Authentication
Target Markets	New Markets & New OEMS		
Target Customers	OS vendors & Local Card vendors	OS Vendors & OEMs	OEMs & Distribution
Personalization	Customers	Customers or ST (on behalf of customers)	Turnkey solution
Software	Application OS Partners or ST	Application OS Partners NFC OS & Middleware	
Hardware	Hardware	Hardware	
CPU	ARM SC000 / SC300		ARM SC300 & ST Core
Security	Advanced security features - Certified		
Technology	Advanced eNVM (eSTM 40nm)		

Secure Microcontrollers

End Market Focus



Source: WSTS, 2018 and ST estimates

Market Dynamics
CAGR 2017-20: **+2% (WSTS)**

Smartcards

- Banking & ID
- SIM classic
- Transport & Pay TV

CAGR 2017-20: -8%

Mobile Secure Transactions

- Secure Element & NFC controller
- embedded SIM
- Secure Wearable

CAGR 2017-20: +12%

Authentication

- Brand Protection
- TPM for Computer

CAGR 2017-20: -7%

New Markets

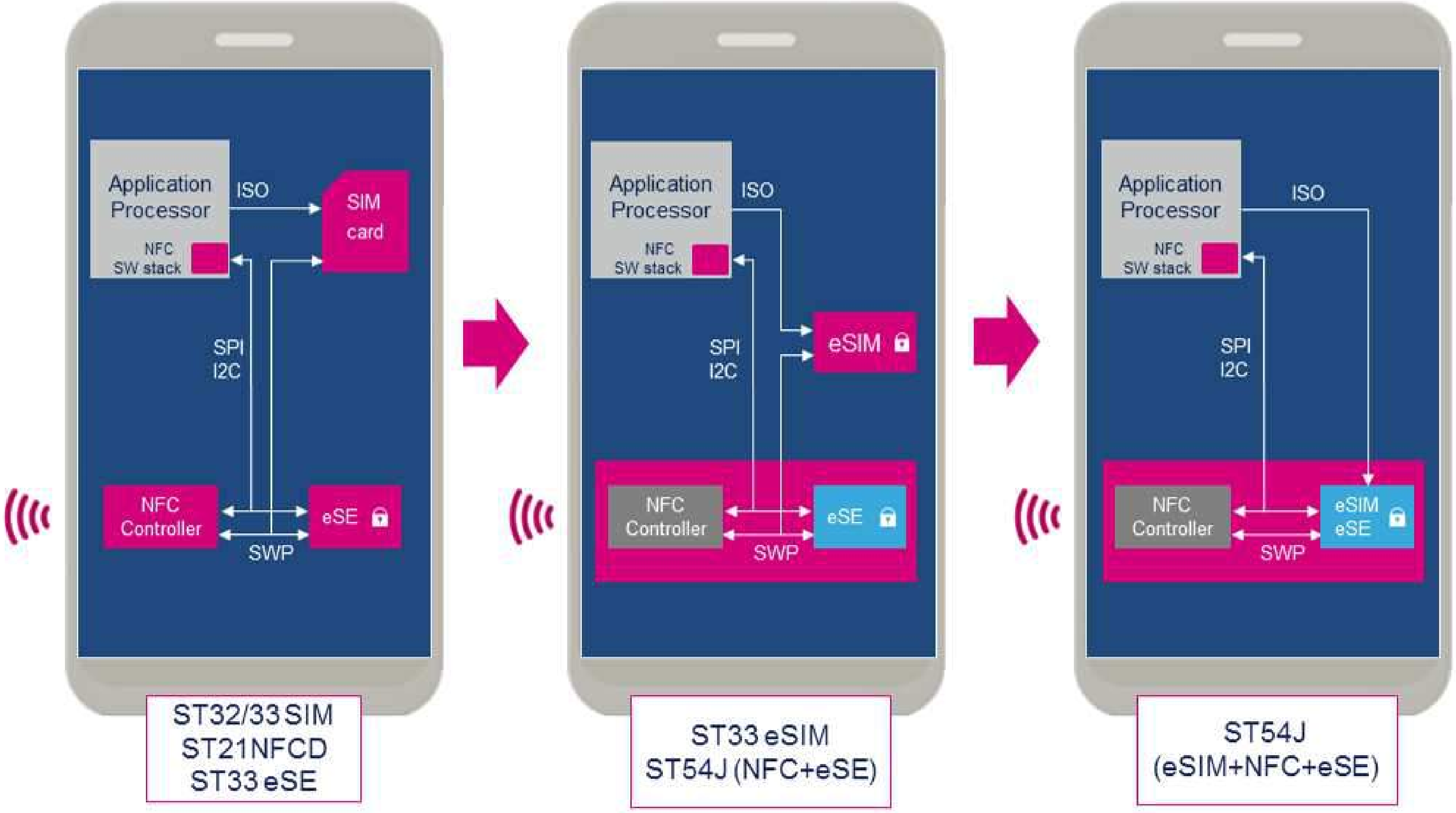
- Machine-to-Machine solution
- Automotive
- Secure IoT solution

CAGR 2017-20: +33%

life.augmented

Secure MCUs

Mobile Security



ST32/33 SIM
ST21NFCD
ST33 eSE

ST33 eSIM
ST54J (NFC+eSE)

ST54J
(eSIM+NFC+eSE)

Secure MCUs

New Markets

Machine to Machine

SIM-M2M card

eSIM

ST32-M
ST33-M
SIM / eSIM M2M

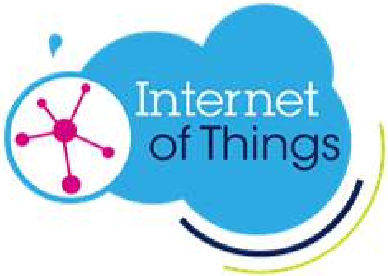
Automotive

Telematics MCU → eSE eSIM

Gateway MCU → eSE

ST33-A eSIM
ST33-A eSE
in TCU*, Gateway or ECU

Internet of Things



STM32 → STSAFE

STM32, STSAFE

* TCU: Telematics Control Unit

Secure MCUs

Pervasion in Industrial Applications

IoT Nodes

(sensors, lighting, alarm, devices connectivity)

LoRaWAN

sigfox

Utilities

Factory Automation

Networking Equipment & Servers

Smart Home & Building Gateways

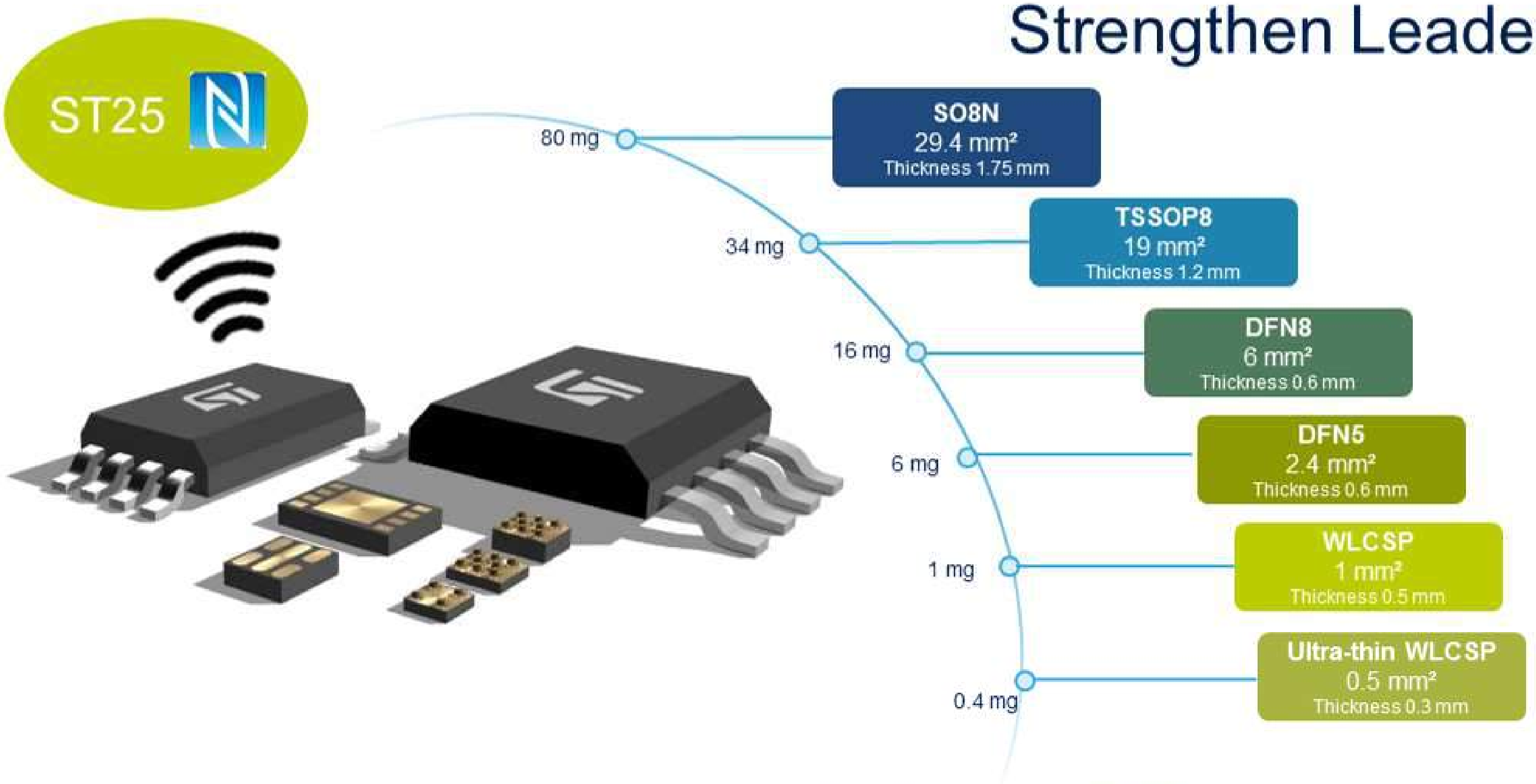
Robotics & Motor Control

Secure Locks

Asset Tracking

EEPROM Memory

Strengthen Leadership



80 mg

SO8N
29.4 mm^2
Thickness 1.75 mm

34 mg

TSSOP8
19 mm^2
Thickness 1.2 mm

16 mg

DFN8
6 mm^2
Thickness 0.6 mm

6 mg

DFN5
2.4 mm^2
Thickness 0.6 mm

1 mg

WLCSP
1 mm^2
Thickness 0.5 mm

0.4 mg

Ultra-thin WLCSP
0.5 mm^2
Thickness 0.3 mm

Leveraging packaging, reliability, and RFID connectivity
to create the most competitive solutions

Digital Activity Redeployment

	Aerospace & Defense	RF & mmW				Digital & Mixed Signal
Markets	Aerospace & Defense	60 GHz short range Connectivity	5G Infrastructure	Satellite Communications		Networking & Data centers
Business Models	COT / ASIC	ASSP (SPARCLink)	ASIC / ASSP		ASIC / ASSP	ASIC
ST added value	Independent Manufacturing Crolles & Rennes	In-house mmW RF expertise (10 years experience) Wide range of mmW IP & Technologies			Leverage Broadcast STB expertise for Broadband SatCom	Ability for complex integrations
Key IP	Rad-hard & Hi-Rel IP A/D converters	Transceivers, Beamformers, Optimized RF Front-ends A/D converters, Rad-hard			DVB-S2X Wide band A/D	High Speed Links, A/D converters, Optical connectivity
Technologies	28FD-SOI-Space C65-Space	BiCMOS & RF SOI 28-22 FD-SOI & CMOS 65			28-22 FD-SOI CMOS 40	Silicon Photonics, BiCMOS, FD-SOI, FinFET

life.augmented

RF & mmW
ST Strengths

- In-house mmW RF expertise
- Wide range of RF Technologies & IP
- Developing mmW RF solutions for 10+ years

Technologies
- BiCMOS
- RF SOI
- CMOS
- 28-22nm FD-SOI

IP portfolio
- LNA, PA, RF switch
- A/D Converters, SerDes
- Beamformers
- Transceivers

Expertise
- Modeling
- Design &Testing
- Packaging
- Industrialization

mmW RF Solutions
- Transceivers up to 60 GHz
- RF Front-ends
- Ka & Ku-bands SatCom

life.augmented

SPARCLink 60 GHz RF Transceiver

RF MmW Short Range Connectivity

High-speed, low-power wireless link for close proximity data transmission

Instantaneous Data Transfer

Seamless Docking

Flex cable replacement

SPARCLink A2

6 Gbps - SLVS

SPARCLink A3

Standard Interfaces (USB, DisplayPort)

SPARCLink A4

10 Gbps

- From 1 Mbps up to **6 Gbps**
- Very low power solution with a power budget of just **40 mW**
- Miniature form factor with **optimized BoM**

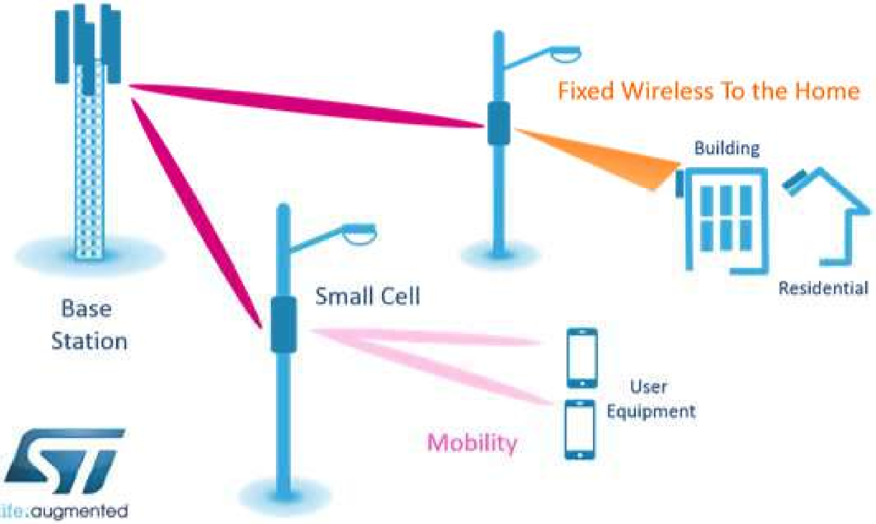
life.augmented

5G Network Infrastructure

ST Well Positioned to Differentiate

Flexible engagement model to meet customer needs and speed up time to market

- New Radio (NR) mmW for more spectrum
- Phase Array Antenna
- Beamforming



Strengths

- BiCMOS / RF SOI for cost-effective GaAs replacement
- FD-SOI for integrated mixed signal SoC
- Advanced mmW expertise & IP
- Analog & Digital beamforming solutions
- mmW over-the-air testing & industrialization capabilities

life.augmented

Takeaways

- Positive outlook for General Purpose & Secure MCU, fueled by:
    - STM32 MCU proliferation addressing a very large number of applications
    - Deployment of STM32 embedding connectivity, security features and Artificial Intelligence on high performance and ultra-low power platforms
    - Strong activity to enlarge ecosystems to reinforce broad market adoption
    - State-of-the-art NFC offer for mobile and IoT security thanks to very high performance ST21 NFC controller, ST33 and STSAFE secure element.
- Deployment of Advanced Digital & RF mmW solutions
    - Short range very low power & high speed connectivity
    - 5G infrastructure
    - Satellite communications

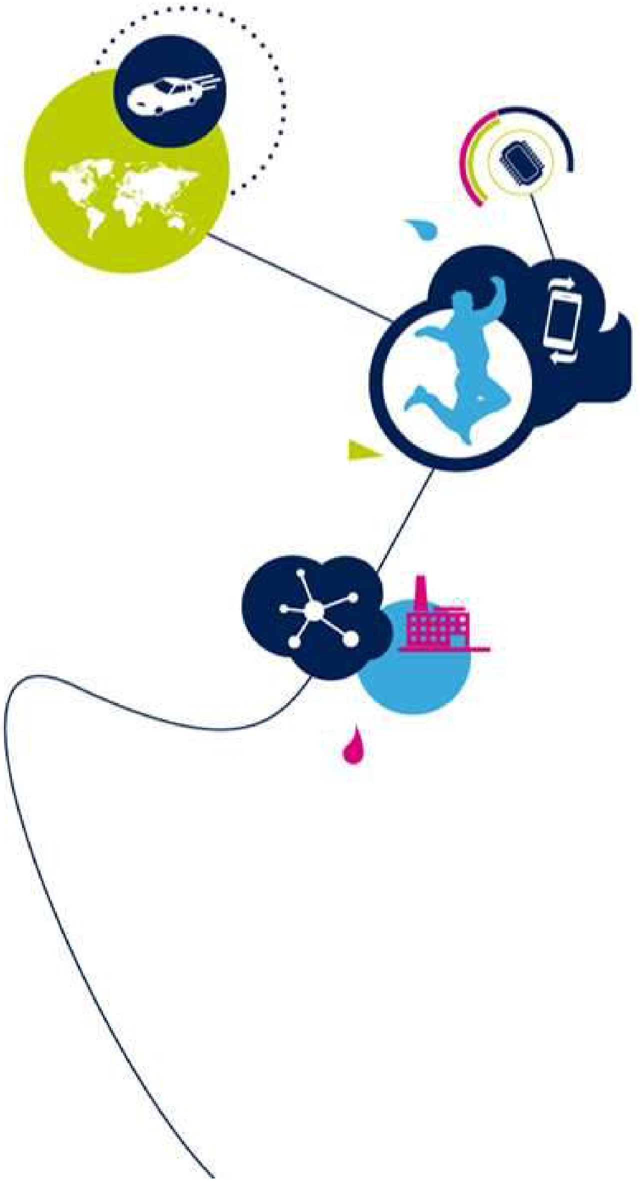
Microcontrollers & Digital ICs Group

Q & A

life.augmented

STMicroelectronics

Capital Markets Day 2018



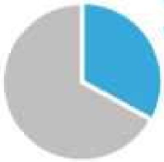
life.augmented

Analog, MEMS & Sensors Group

Benedetto Vigna

President
Analog, MEMS and Sensors Group

life.augmented



31%
of ST 2017
revenues

AMS: Group at a Glance

Key Financial Data by Sub-Group

Group 2017 Revenue

$2.63B

Analog MEMS & Sensors Group

$1.22B
Analog

$1.41B
MEMS & Sensors

More than
5,200
available products

Serving more than
65,000
Customers

FY17 vs FY16 Growth

AMS
+41%

Analog **+23%**

MEMS & Sensors **+64%**

1Q18 vs 1Q17 Growth

AMS
+27%

Analog **+19%**

MEMS & Sensors **+35%**

AMS Product Portfolio

Sensors	Motion MEMS	Environmental Sensors	Acoustic	ToF Proximity & Ranging	3D Sensing	Sensing
Analog	Operational Amplifiers & Comparators	Voltage References	Rad Hard Analog	Standard Interfaces	Touch Analog Front End	Conditioning
	Power Line Communication	Power over Ethernet	IO-Link	Bluetooth	Sub-1 GHz	Connectivity
	Motor Drivers & Gate Drivers	Industrial ASICs	Galvanic Isolated ICs	Intelligent Power switches	Microactuators	Actuation
	AC-DC & DC-DC Regulators	Wireless & Wired Chargers	LED Drivers	Power Management for Portable	AMOLED Display Power	Power & Energy Management
	Digital Power	Linear Regulators & LDOs	Battery Management	PMIC for Data Storage	Custom Analog	

life.augmented

AMS Technology Focus

BCD for Analog

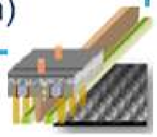
Increased Digital processing capability

Advanced BCD

BCD8 (160nm) with higher density non-volatile memory

BCD9s (110nm) 1.8V / 8V-60V (with ePCM option)

BCD10 (90nm) 1.2V / 8V-60V (with ePCM option)

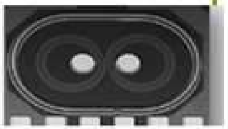


Power & High Voltage Evolution

High Voltage BCD

BCD OFFLINE Up to 1200V

BCD with galvanic isolation up to 6kV



Process customization by application

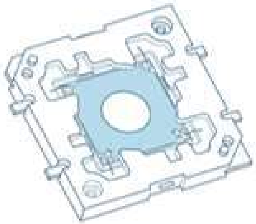
System-on-Chip Solutions for Actuation, Power & Energy Management

life.augmented

ST MEMS shipped
14
BILLION

AMS Technology Focus

MEMS Sensors & Microactuators



Thin Film Piezoelectric PεTRA*

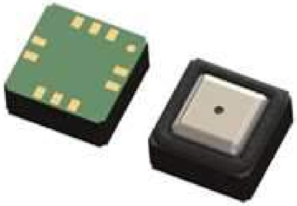
- Innovative piezoelectric materials
- Higher efficiency
- Lower cost

PZT Microactuators
for InkJet printing, Camera Autofocus,
MEMS Speakers &
MEMS Infrared Scanners

Next Generation ThELMA*

- Higher accuracy and sensitivity
- Higher performance and lower power
- Higher reliability

Motion MEMS for
Personal Electronics, Automotive
& Industrial



Next Generation BASTILLE*

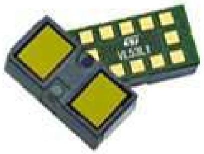
- Higher accuracy
- Size reduction
- Waterproofing

Environmental MEMS for Personal
Electronics & Industrial

*ST proprietary MEMS technologies.

AMS Technology Focus

Imaging Solutions



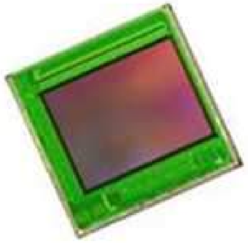
Time of Flight

- High accuracy
- 40 nm SPAD
- Multi-zone & multi-object capability

Proximity and ranging Sensors
for Personal Electronics and Industrial

Time of Flight

- Direct & indirect
- Increasing resolution
- All-in-one & low power
- 3D-BSI 40 nm



Structured Light

- Low pitch Global Shutter
- High Quantum Efficiency
- 3D-BSI

3D Sensing
for smartphones (Front Facing and
Rear Facing) and Smart Driving
(LiDAR)

AMS Manufacturing Strategy

ToF, Specialized Imagers, Analog CMOS	**Crolles**
Advanced BCD **MEMS**	**Agrate**
Advanced BCD	**Catania**
BCD	**Singapore**
• Advanced BCD • 130 nm analog CMOS for sensor interfaces	Foundry partners

AMS Balanced Market & Customer Strategy

Driven by Application & End Market Focus

Customer Base

Distribution Channel

- Broad base of > 65,000 customers
- Industrial-centric applications
- Proven technologies & market-accepted solutions

↔

Key Accounts

- Global industry leaders
- Long-term relationships
- Leading-edge technologies & dedicated solutions

Balancing stability and growth opportunities

AMS for Industrial Applications

Key Applications

- Factory Automation
- Motor Control
- Industrial Drives
- Industrial Power & Tools
- Energy Generation & Distribution
- Metering
- LED, General Lighting
- Home, Building & City Automation
- Appliances
- Power Supplies and Converters
- Point of Sales & Retail Logistics
- Medical & Healthcare
- Space, Avionics and Defense
- Smart Farming

AMS offering

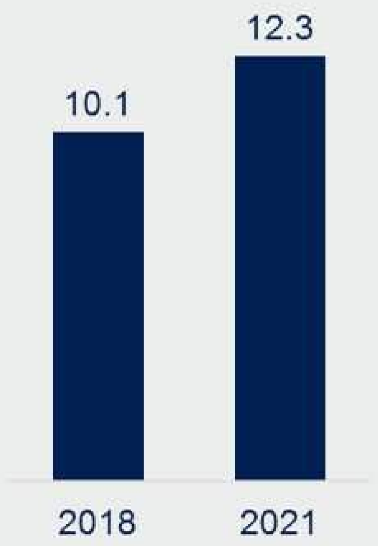
Sensing	Conditioning	Connectivity	Actuation	Power & Energy Management

- Over **30 years** of continuous investment and experience
- Product portfolio enabling solutions for customer applications
- Long-lasting relationships with global technology leaders in industrial
- IP building blocks, technologies and solutions enabling Smart Industry
- Meeting the levels of **quality, longevity & robustness** required for industrial
- Pervasive **marketing and application presence** in the field

life.augmented

Analog for Factory Automation

Automation
SAM B$



Main building blocks

Connectivity

- IO-Link
- Isolated Interfaces
- Power line modem
- Sub-1 GHz Bluetooth

Signal Conditioning & Protections

Power & Energy Management

Motion Control

- Motor Drivers
- Motor Drivers SiP with MCU
- Motor Drivers SiP with Power Stage
- High-Density Power Drivers
- Gate Drivers
- Galvanic Isolated ICs
- Intelligent Power switches
- Safety Integrity Level ICs
- ASICs with Embedded Diagnostics

IO-Link transceiver

Galvanic isolated gate driver

System-in-Package gate drivers power MOSFET

System-in-Package motor controller with MCU

High voltage op amp

Stepdown switching regulator

Source: IHS Markit

Stepper motor drivers

Brushed DC motor drivers

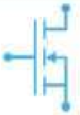
Brushless DC motor drivers

Analog for Motor Control

Flexible Solutions for all Types of Motors

Complete ecosystem with a range of evaluation boards, reference designs, firmware and development tools to simplify and accelerate design

Multi Chip



Power Transistors

STSPIN

Motor Control

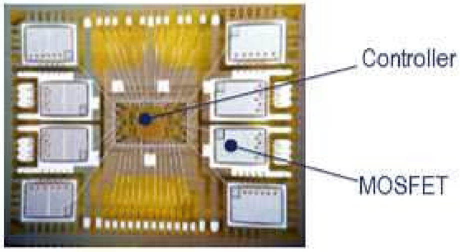
STM32

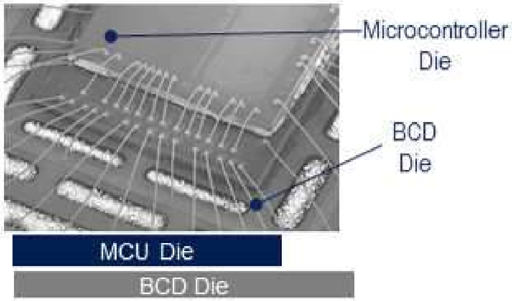
Microcontroller

STSPIN

Motor Control

System In Package

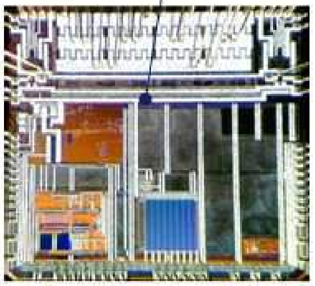




BCD Low Voltage & Microcontroller

System on Chip

Motion Control with embedded Microcontroller, Memory & Power device



BCD with embedded non-Volatile Memory

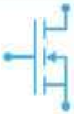
life.augmented

Analog for Motor Control

Flexible Solutions for all Types of Motors

Complete ecosystem with a range of evaluation boards, reference designs, firmware and development tools to simplify and accelerate design

Multi Chip



Power Transistors

STSPIN

Motor Control

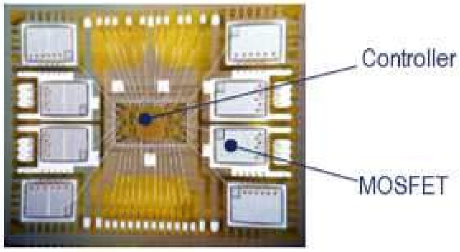
STM32

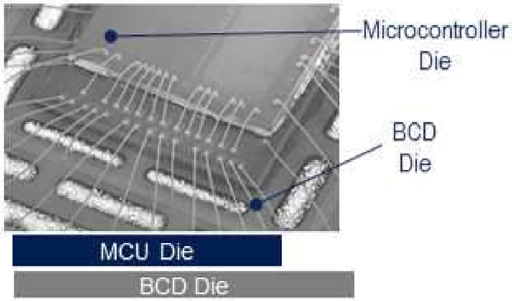
Microcontroller

STSPIN

Motor Control

System In Package

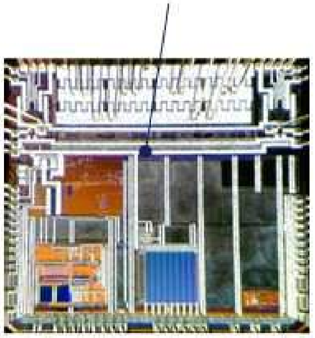




BCD Low Voltage & Microcontroller

System on Chip

Motion Control with embedded Microcontroller, Memory & Power device



BCD with embedded non-Volatile Memory

life.augmented

Analog for Galvanic Isolation

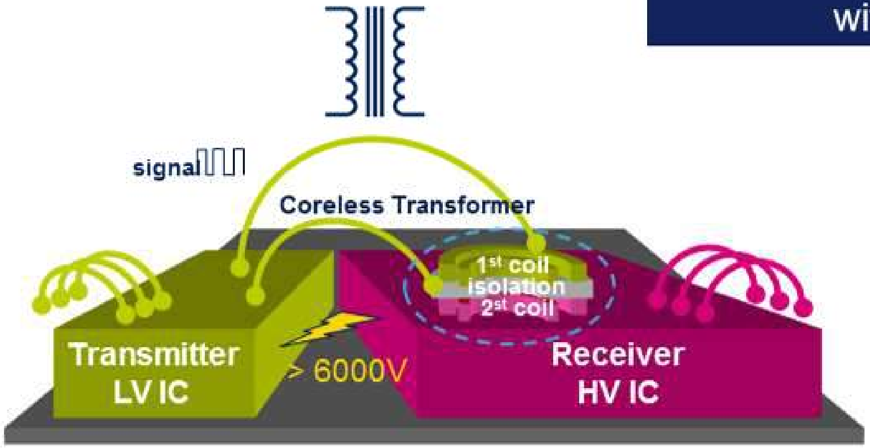
Key Applications
- Motor control
- Factory automation
- Industrial drives and fans
- DC-DC converters
- Welding

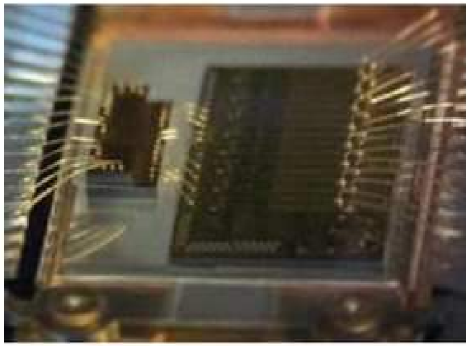
Rugged enough to operate in harsh industrial environments

Ability to withstand voltages as high as **1700 V**

Maintaining high noise immunity and low switching losses

Suitable for high capacity switches, with a current capability up to **4 A**





Sensors for Industrial

Motion, Vibration, Angle Measurement → **MEMS motion sensors**
Accelerometers, gyroscopes, 6-axis IMUs, magnetometers

Environmental Sensors

Temperature Monitoring & Calibration → **Temperature sensors**

Pressure Monitoring → **Pressure sensors**

Humidity Monitoring → **Humidity sensors**

Acoustic Monitoring → **MEMS microphones**
Analog, digital, top and bottom port solutions

Proximity, Position, Presence Detection → **Time-of-Flight sensors**
Ranging, multi-zone, multi-object detection

ISM330DLC
6x IMU – Ultra-low power consumption, wide bandwidth

IIS2DH
Accelerometer - Wide Bandwidth, Ultra-low-power

ISM303DAC
High performance Integrated Compass

IIS2MDC
Magnetometer Low-Noise, Low Power

IIS3DHHC
Accurate, low-noise inclinometer

ST Solutions for Factory Automation

Condition Monitoring & Predictive Maintenance

Mechanical vibration

- Displacement
- Speed
- Acceleration
- Acoustic noise
- Angular speed
- Torque

Acoustic signals

- Noise
- Ultra sound

Functional needs	Capture vibrations	Signal conditioning	Processing	Power Management	Connectivity	Secure Connections
ST solutions	MEMS Sensors	Op Amps Comparators	MCU	Power ICs & Power Discrete	Bluetooth Wi-Fi Sub-1 GHz IO-Link	Secure MCU

life.augmented

Powering Leading Industrial Products

SIEMENS

Industrial Inverters, Factory Automation, Power Supplies

ST Solutions

- Application Specific ICs
- Power Conversion
- Power Discrete
- Microcontroller

Nidec All for dreams **SECOP**

Compressors

ST Solutions

- Motor Control with embedded MCU
- Power Conversion
- Power Discrete

Analog for Smart Metering

Main building blocks

Smart Sensing
- Anti-tamper & Environmental sensors

Processing
- Microcontrollers

Actuators
- Relay Drivers
- Motor Drivers

Connectivity
- WAN/NAN Power Line Communication, Radio Frequency

Power Management
- Power Conversion
- Metrology ICs

Signal Conditioning
- Operational Amplifiers

Multi-standard programmable PLC solutions

Low data rate, low power Sub-1 GHz transceiver

- Field-proven technology with over **100** million meters with ST inside
- Power Line Communication technology leadership
- System know-how and partnership with key players
- Delivering integrated, secure and flexible solutions
- Possibility for intelligent loads management

life.augmented

Solutions for Home & Building Automation

KNX

Tiny Transceiver, KNX Certified
Complete Network-Node Solution

light+building
Frankfurt am Main
18. – 23.3.2018

Early adopter Vimar for future-focused product line


Building & Home Control
SAM $B

KNX bus nodes in home and building control applications

- Lighting, shutter control, HVAC
- Security systems, monitoring and alarms
- Energy management, smart metering
- Household appliance control

Source: IHS Markit

life.augmented

Ultra-Low Power Sigfox IoT Module

with Dual RF Connectivity

Key Features

- Programmable ARM Cortex-M0
- Excellent receiver sensitivity
- Wide range of I/O peripherals
- Configurable RF output power
- Ready-to-use with full-featured SDK
- Enforced end-to-end security

Powering Connected Devices for Industrial

kamstrup

Smart
Water
Meter

sigfox

ST Solutions

- Sub-1 GHz Transceiver
- Microcontroller

life.augmented

sensolus

Asset
tracking

ST Solutions

- Sub-1 GHz Transceiver
- Bluetooth Processor

sigfox

Bluetooth™

Solutions for Digital Power

Analog

- Consolidated technology
- Real time control and continuous processing
- Modular architecture
- Cost-effective

DSP

- Improved flexibility
- Adaptive control
- Programmable operation limits and fault handling
- Diagnostics and remote control

ST Digital Power

- Monolithic and SiP approach for different markets
- High power-density, high-end performance with flexibility and communication
- Easy design and configurable through graphical user interface (GUI)

Power & Energy
SAM $B

Key Applications in Power supply

- Industrial and Medical Equipment
- LED Lighting
- High-end Computer and Server
- Telecom Infrastructure

Source: IHS Markit

Powering Leading Industrial Products

TCL

Midea®

Home
Appliances

ST Solutions

- Analog Signal Conditioning
- Gate Driver
- Power Module / Discrete
- Microcontroller / EEPROM

EMERSON

Industrial Inverters,
Power Supply,
Motor Control

ST Solutions

- Analog Signal Conditioning
- Galvanic Isolation
- Power Module / Discrete
- Microcontroller

life.augmented

AMS for Personal Electronics

Key Applications

- Smartphones
- Tablets & eReaders
- Wearables
- Personal Care & Hygiene
- Gaming
- Drones
- Audio & Video
- Virtual/Augmented/Mixed Reality

AMS offering

Sensing	Conditioning	Connectivity	Actuation	Power & Energy Management

- **Leadership** Position in:
  - MEMS Sensors
  - PZT Microactuators
  - Time-of-Flight and 3D Sensing solutions
- Long-lasting relationships with key players and fast growing relationships with new customers
- **Largest sensor portfolio** with lowest power consumption and highest accuracy
- Leading solutions for wired & wireless **charging applications** and battery management

Targeted Smartphone Opportunities

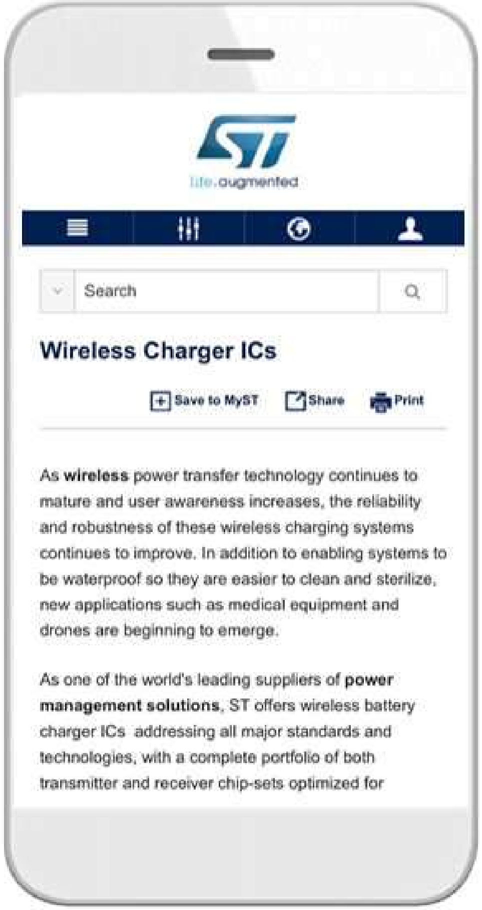
Analog

Wired & Wireless Charging

Wireless charging ICs, USB-C

Display Controllers & Display Power Management

Touchscreen controller, AMOLED PMIC



Wireless Charger ICs

As **wireless** power transfer technology continues to mature and user awareness increases, the reliability and robustness of these wireless charging systems continues to improve. In addition to enabling systems to be waterproof so they are easier to clean and sterilize, new applications such as medical equipment and drones are beginning to emerge.

As one of the world's leading suppliers of **power management solutions**, ST offers wireless battery charger ICs addressing all major standards and technologies, with a complete portfolio of both transmitter and receiver chip-sets optimized for

Sensors & Actuators

3,6-axis, OIS gyro, pressure, temperature

Specialized Imaging Solutions

Depth/3D sensing (ToF, Sensors)

MEMS & Sensors

OIS = Optical Image Stabilization

life.augmented

Broad Offer for Depth/3D Sensing

ST pioneering 3D & Depth sensing with more than 600M units cumulative components delivered

Proximity & Ranging sensors

Time of flight

- Multi-zone & multi-objects capability for spatial discrimination of scenes
- Lower power and all-in-one solutions
- Small resolutions

Depth/3D sensing solutions

Front facing (face detect)

Structured light

- Global shutter small pitch
- High quantum efficiency
- High accuracy

Time of Flight

- Medium distance
- High resolution
- Cost & integration

World facing (AR/VR/MR)

Time of Flight

- Higher distance
- High ambient immunity
- Scalable resolution

life.augmented

Powering Leading Personal Devices

Sensing

Connectivity

Conditioning

Power

AMS for Automotive

Key Applications

- ADAS
- Body & Convenience
- Chassis & Safety
- Electromobility
- In-vehicle Infotainment
- Powertrain for ICE
- Telematics & Networking
- Mobility Services

AMS offering

Sensing	Conditioning	Connectivity	Actuation	Power & Energy Management

- Growing presence with **Automotive Grade General Purpose Analog** Products
- Benefitting from **ST's long-last relationships** in the automotive industry
- Leadership position in Motion MEMS for **Telematics**
- Developing Motion MEMS for Active Safety Applications
- Developing Motion MEMS and **SPAD-based LiDAR** sensors for autonomous cars
- Offering High Dynamic Range & Flicker Free CMOS image sensors

AMS Sensors for Smart Driving

Navigation & Telematics

Medium-g accelerometer
for telematics boxes

6-axis inertial module
for navigation assistance

Safety & Convenience

Hi-g accelerometers
for airbag applications

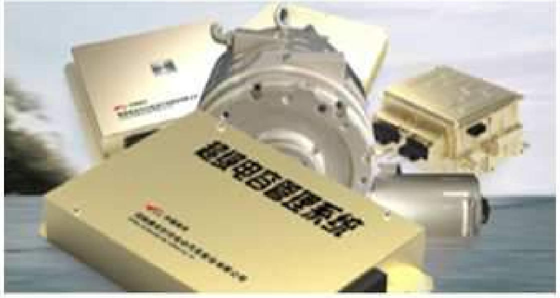
Gyroscopes
for vehicle dynamics applications

LiDAR
Autonomous Driving
through Sensor Fusion

life.augmented

Analog Powering Automotive

Electric vehicles



CRRC

ST Solutions

- High end operational amplifiers
- Power Management

life.augmented

Communications Equipment, Computers & Peripherals End Market

Key Applications

- Telecom Infrastructure
- Data Centers
- Enterprise Switching
- SOHO Servers
- Computers & Peripherals
- ASIC Services & IP Libraries

AMS offering

Sensing	Conditioning	Connectivity	Actuation	Power & Energy Management

- Leading Power management solutions for **storage devices**
- Long-standing relationships with disk drive makers
- Power management solutions addressing **servers, gateways and data centers** from 15W to over 1 kW
- **Unique system know-how** enabling innovative architecture with high power density and efficiency and minimum external component count
- Power solutions for Intel-based CPU platforms

Power Management Solutions
for Telecom and Infrastructure

Focus on lowest power consumption and highest power density

Data Center Servers
ST SAM $B

Multi-Application ICs

- Switched-Mode Power Solutions from Watt to KWatts
- Power Factor Corrector (PFC) ICs
- efuse/power limiters
- DC-DC Converters
- High voltage auxiliary converters

Application Specific ICs

- High Performance Power Management ICs for HDD
- Multi channel Power management IC for SSD
- Digital Controller ICs for Computing applications
- 48 V Digital Direct Conversion
- High-Power Supply Modulator ASIC for 5G Antenna Arrays

Source: IHS Markit

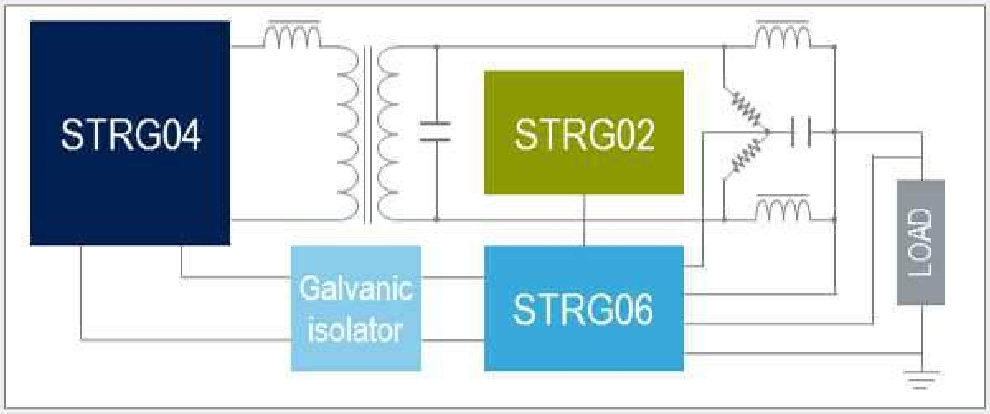
Driving the Evolution of Power

in Server & Communications Infrastructure

Highest power-conversion efficiency for 48V datacenter

- Full compliance with the CPU, GPU & DDR
- Fully-isolated resonator 48 V direct conversion
- Superior efficiency performance
- Auto-tuning & telemetry

Meeting Google Architecture Requirements



STRG04	70V full-bridge driver with programmable predictive control for zero voltage operations in constant phase
STRG02	Single wire controlled synchronous rectifier supporting zero voltage and zero current working
STRG06	Multiphase resonant constant on-time digital controller supporting up to 6 interleaved converters

life.augmented

General Purpose Analog & Low Power RF

for Distribution

Broad footprint with distribution leveraging a wide product offer

- Over 3,000 commercial products
- More than 60 new product families released in the past 2 years
- + 17% YoY growth in distribution in 2017
- More than 4.2 Billion units shipped in 2017

STMicroelectronics has introduced a battery-charger chip which integrates all important energy-management functions without compromising performance and power consumption.

Op Amps and DC-DC converters

+19% YoY growth

High precision, high voltage, low power operational amplifiers

High efficiency DC-DC switching converters

Standard ICs

+12% YoY growth

Ultra low noise and high precision LDO voltage regulators

Low Power RF

+200% YoY growth

life.augmented

Takeaways

- Strategic focus on Analog for Industrial applications
- Broadest Sensor portfolio in the industry expanding in Automotive and Industrial markets
- Robust, organic, double-digit revenue growth in Analog, MEMS and Sensors driven by technology leadership and system know-how

Well positioned for balanced growth in both Distribution and Key Account channels

life.augmented

Analog, MEMS & Sensors Group

Q & A

life.augmented

Broad Offer for Depth/3D Sensing

ST pioneering 3D & Depth sensing with more than 600M units cumulative components delivered

Proximity & Ranging sensors

Time of flight

- Multi-zone & multi-objects capability for spatial discrimination of scenes
- Lower power and all-in-one solutions
- Small resolutions

Depth/3D sensing solutions

Front facing (face detect)

Structured light

- Global shutter small pitch
- High quantum efficiency
- High accuracy

Time of Flight

- Medium distance
- High resolution
- Cost & integration

World facing (AR/VR/MR)

Time of Flight

- Higher distance
- High ambient immunity
- Scalable resolution

life.augmented

Analog, MEMS & Sensors Group

Q & A

life.augmented


Stepper motor drivers


Brushed DC motor drivers

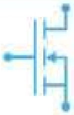

Brushless DC motor drivers

Analog for Motor Control

Flexible Solutions for all Types of Motors

Complete ecosystem with a range of evaluation boards, reference designs, firmware and development tools to simplify and accelerate design

Multi Chip


Power Transistors

STSPIN

Motor Control

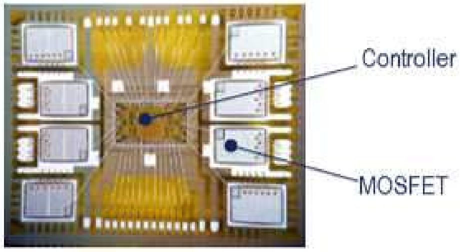
STM32

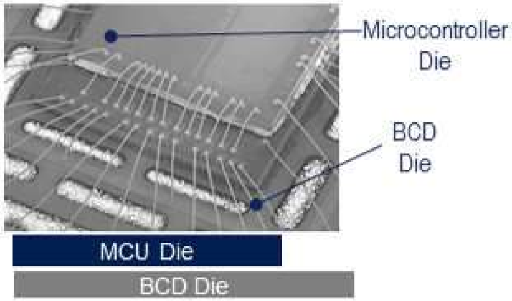
Microcontroller

STSPIN

Motor Control

System In Package

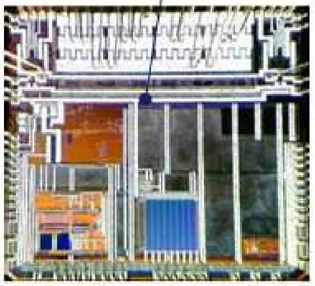




BCD Low Voltage & Microcontroller

System on Chip

Motion Control with embedded Microcontroller, Memory & Power device

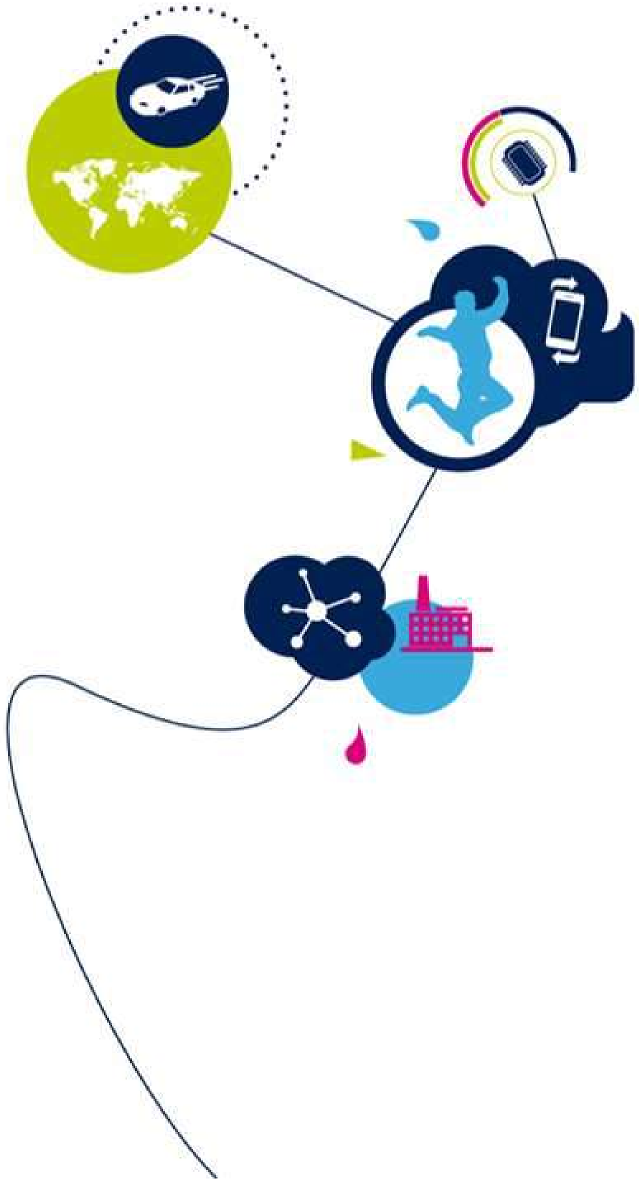


BCD with embedded non-Volatile Memory

life.augmented

STMicroelectronics

Capital Markets Day 2018



life.augmented