# Introduction

**Tait Sorensen**

Group Vice President, Investor Relations

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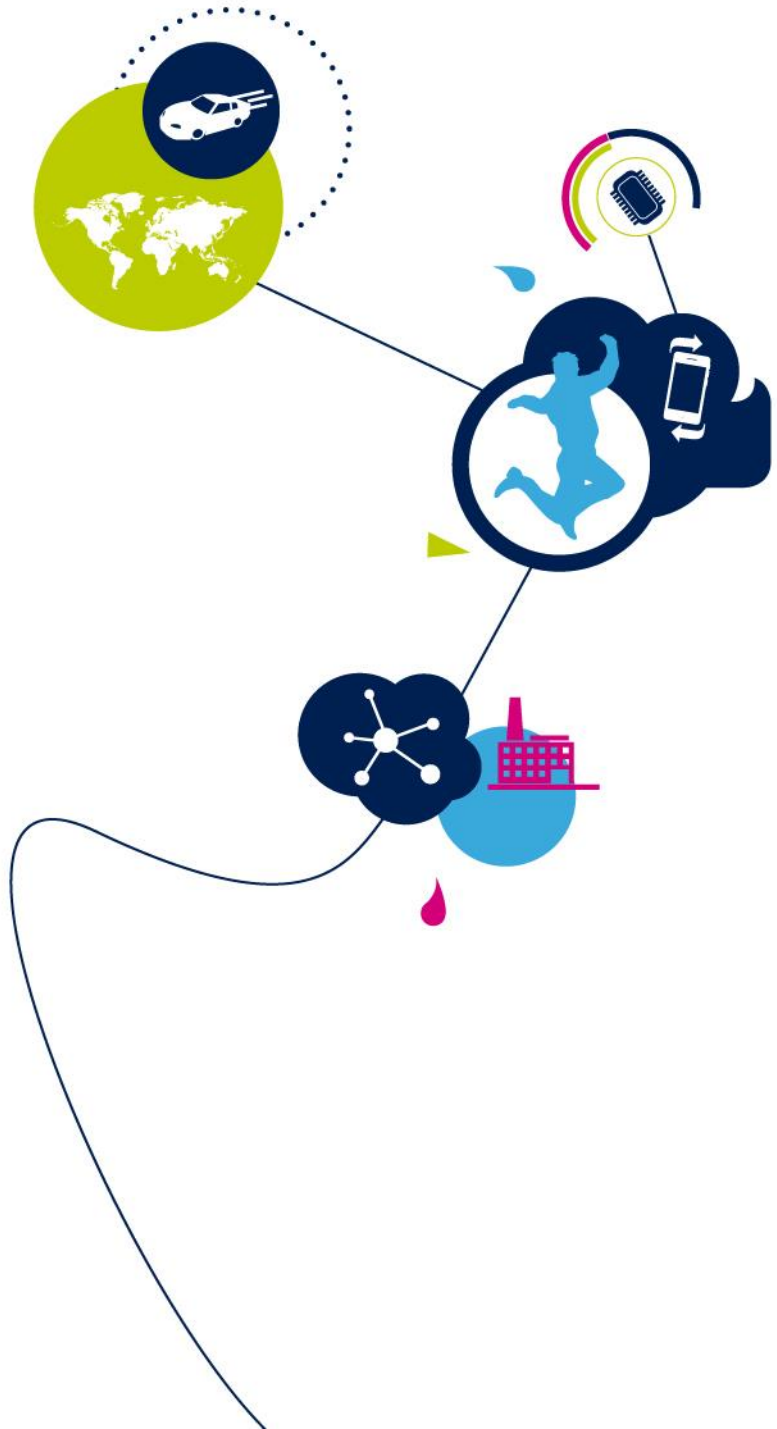


# Agenda



| 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").*

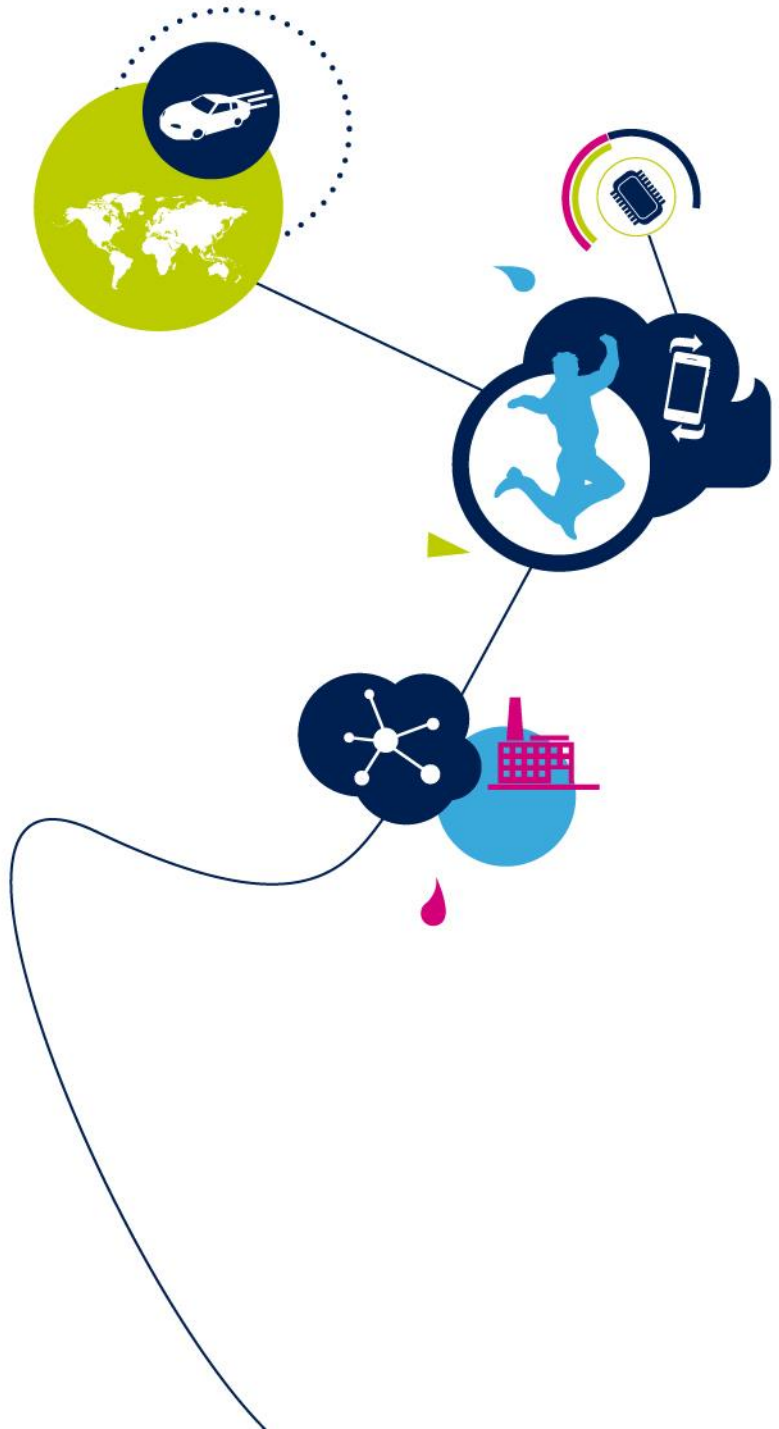
*Such forward-looking statements are subject to various risks and uncertainties, which may cause actual results and performance of our business to differ materially and adversely from the forward-looking statements. Certain forward-looking statements can be identified by the use of forward looking terminology, 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.*

# Introductory Remarks

**Jean-Marc Chery**

Designated President and Chief Executive Officer



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# Business & Financial Performance


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

MEMS
For Sensors & Microactuators

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

FD-SOI CMOS
FinFET through Foundry

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

Analog & RF CMOS

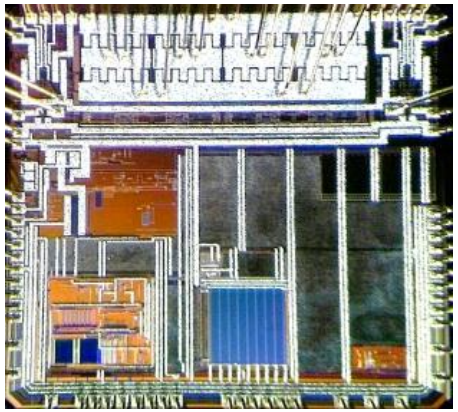
Vertical Intelligent Power

eNVM CMOS

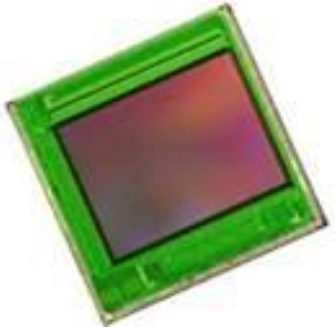
Specialized Imaging Sensors

Packaging technologies
Leadframe – Laminate – Sensor module – Wafer level

## BCD

## Specialized Imaging

## Silicon Carbide




APPLIED MATERIALS
MENDC05
APPLIED MATERIALS
MENDC05
FACTORY INTERFACE
APPLIED MATERIALS
MENDC04
HBOUT07

Analog, Industrial & Power Conversion ICs

MEMS & Specialized Imaging Sensors

Dedicated Automotive ICs

Discrete & Power Transistors

General Purpose & Secure MCUs EEPROM

Digital ASICs

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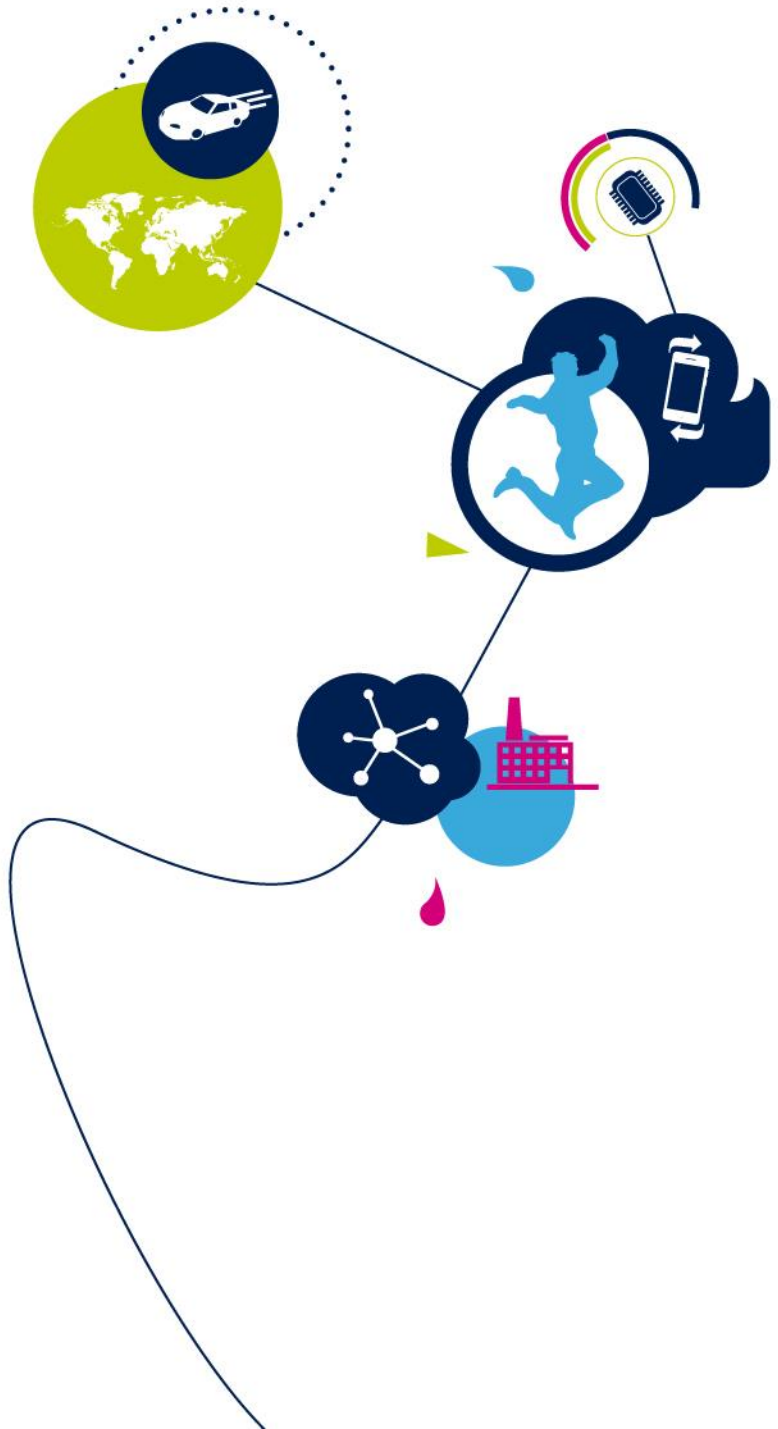
# Business & Financial Results

**Carlo Ferro**

Chief Financial Officer
President, Finance, Legal Infrastructure and Services



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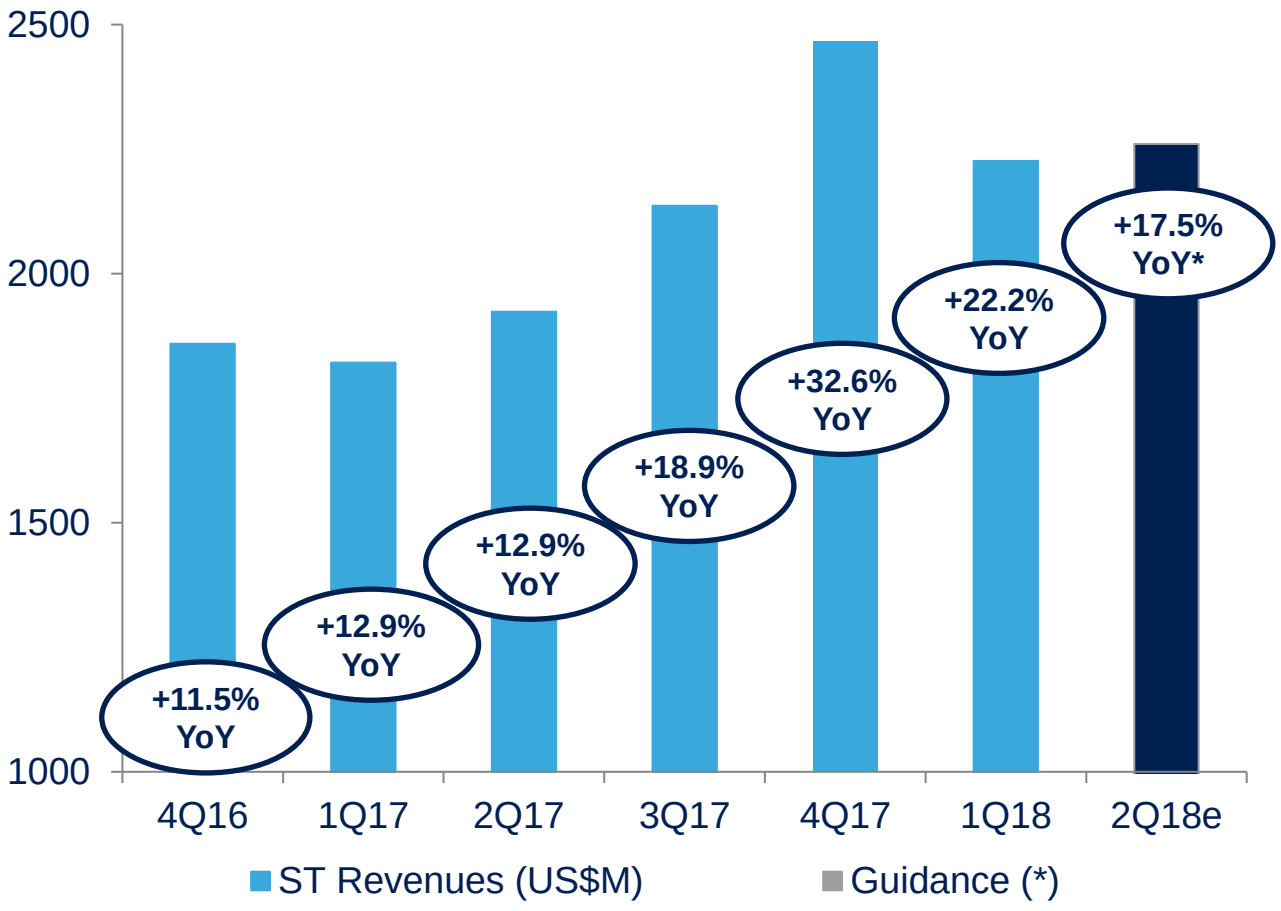
# Solid Revenue Growth






- Strategic focus on industry megatrends

Smart Driving

Internet of Things

- 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

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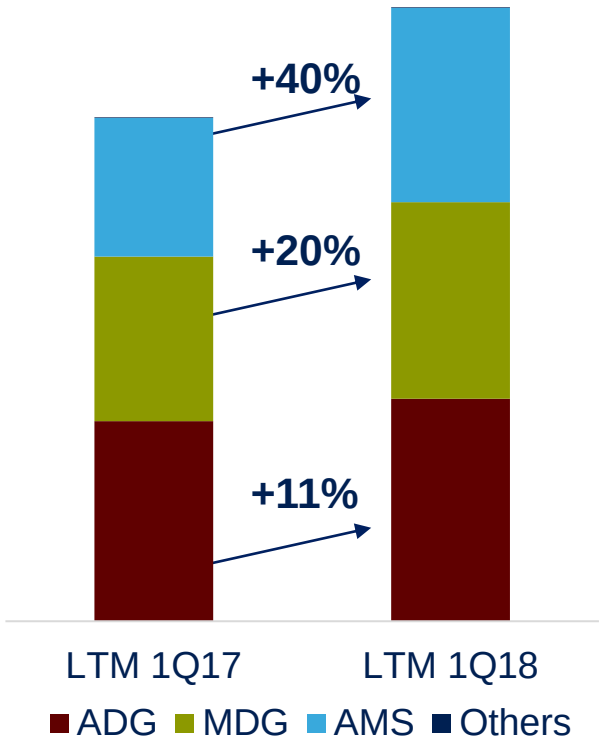
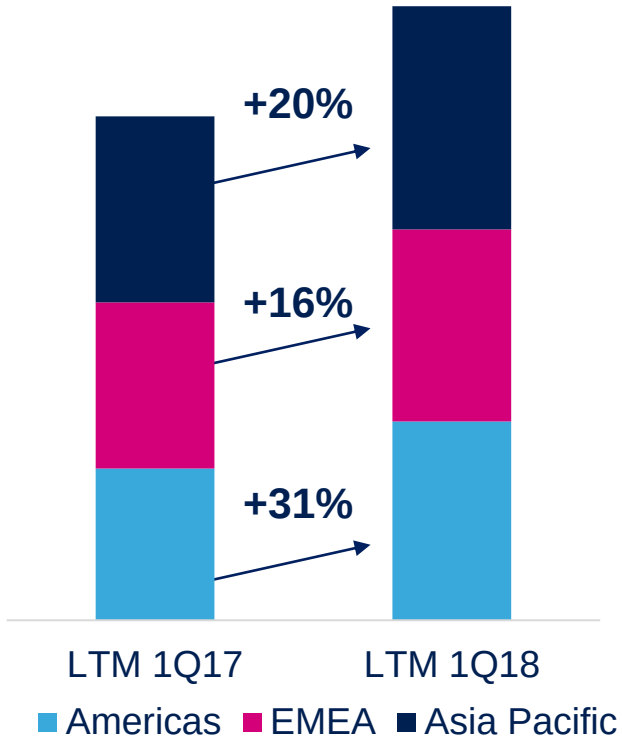
# Synchronized Revenue Growth



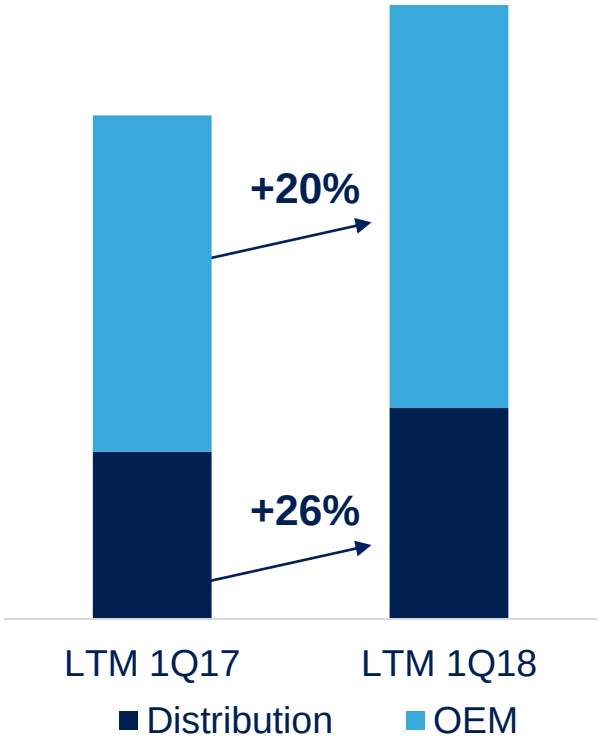
## Product Group




## Region of Origin




## Customer Type

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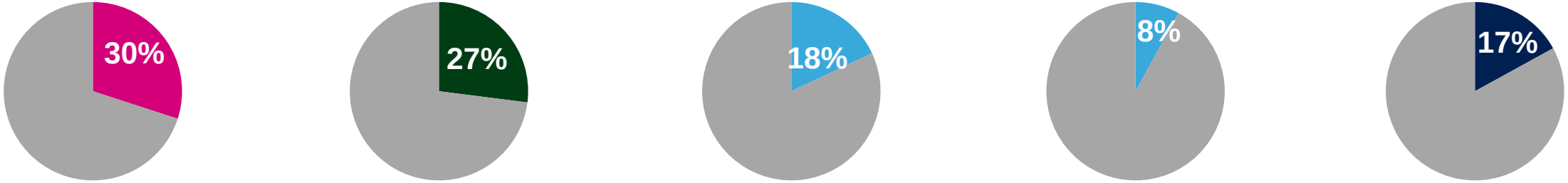
# ST Revenues by End Market

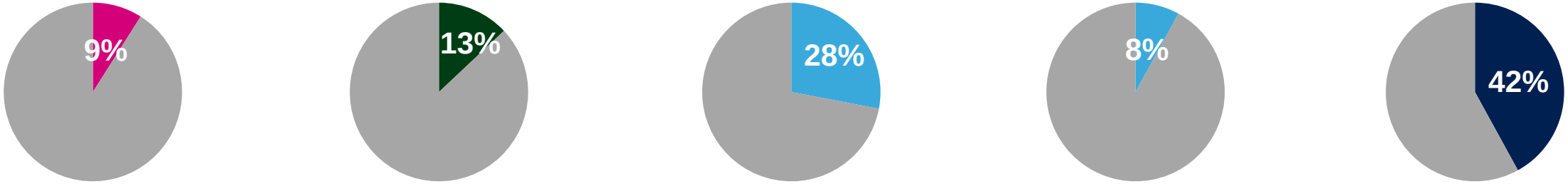


| Automotive | Industrial | Personal Electronics | | Communications Equipment, Computers & Peripherals |
|---|---|---|---|---|
| | | Smartphones | Other Personal Electronics | |

**% of ST 2017 Total Revenues**

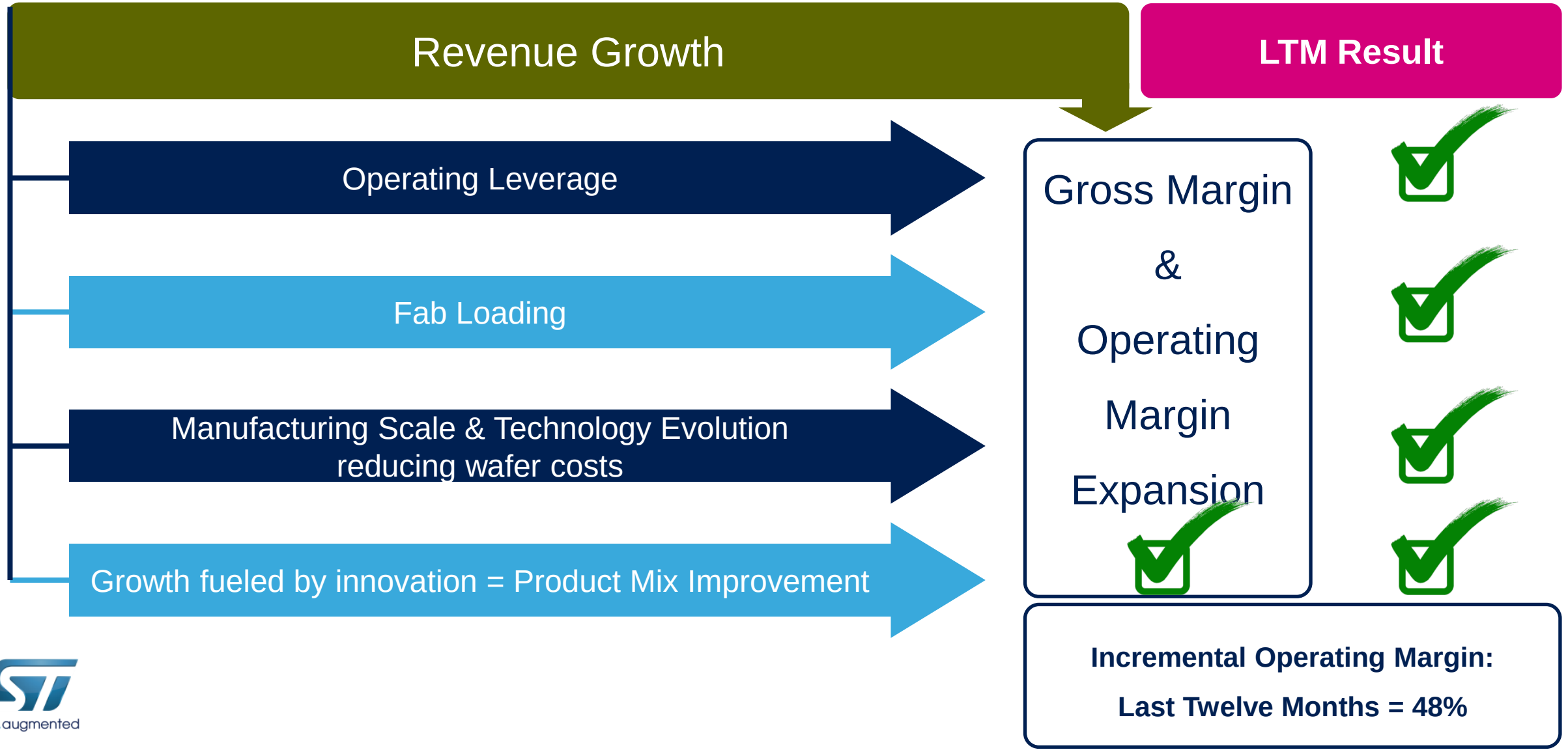



**% of ST 2017 Total Available Market (TAM)**



# Drivers to Improve Operating Margin



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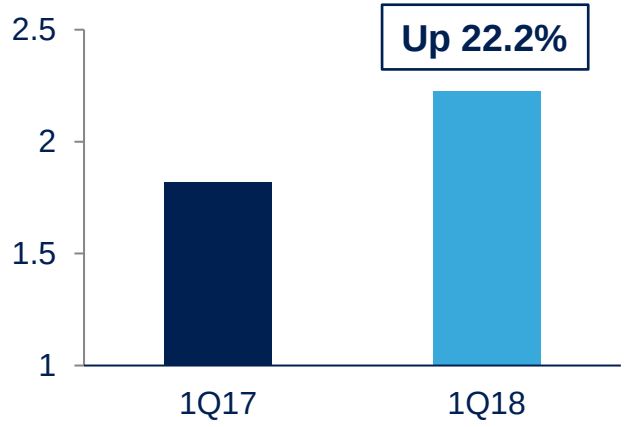
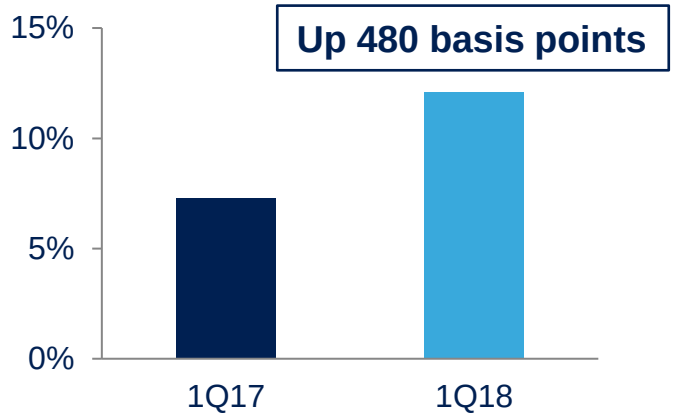
# 1Q18 Financial Highlights



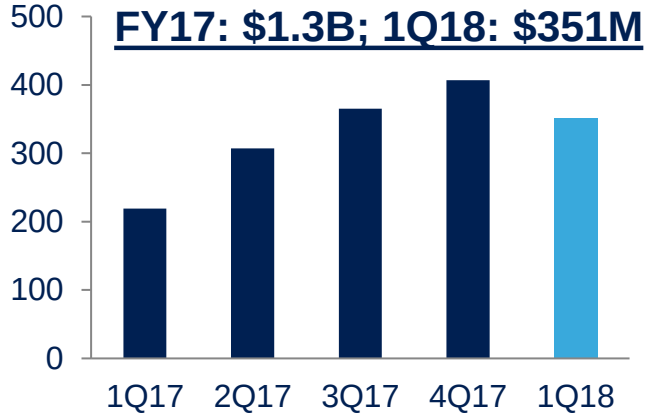
## Revenues = $2.23B



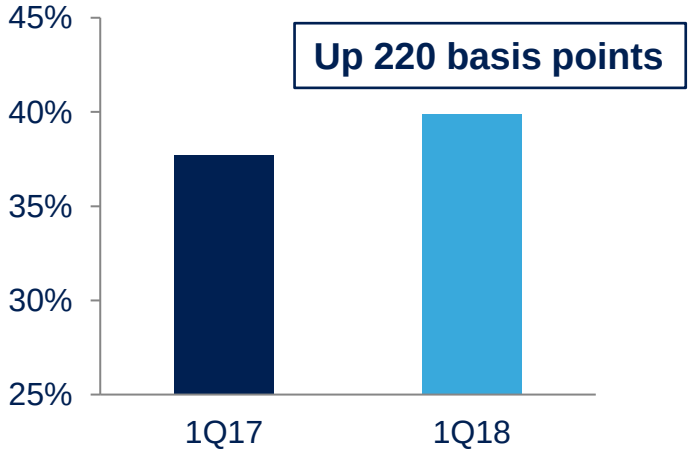

## Operating Margin = 12.1%



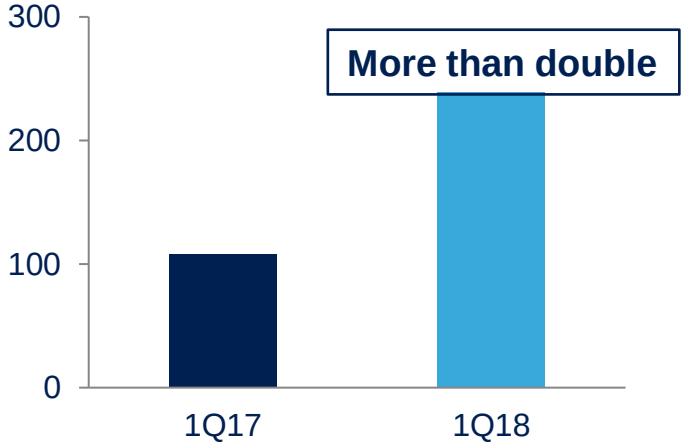

## Capex= $351M



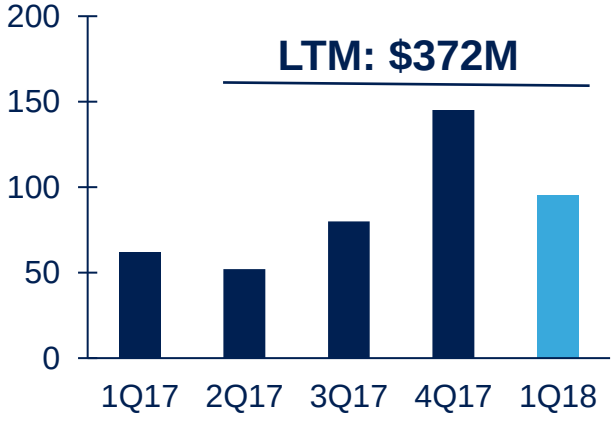

## Gross Margin = 39.9%




## Net Income = $239M




## Free Cash Flow* = $95M



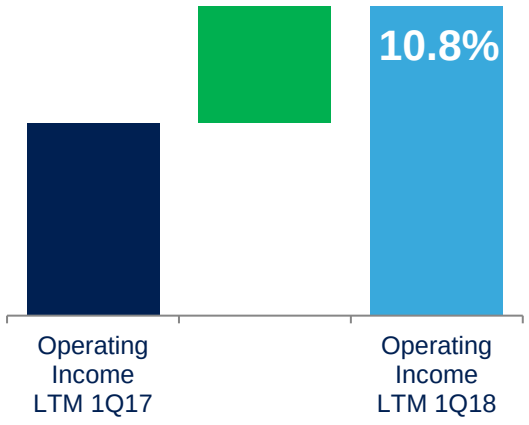

*__Non-U.S. GAAP measure__. See Appendix for additional information explaining why the Company believes these measures are important.

# Operating Income Improvement

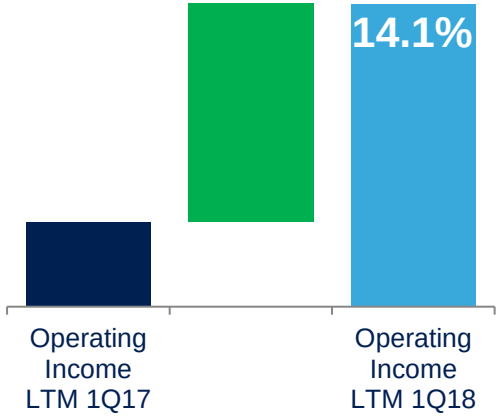


## Last Twelve Months

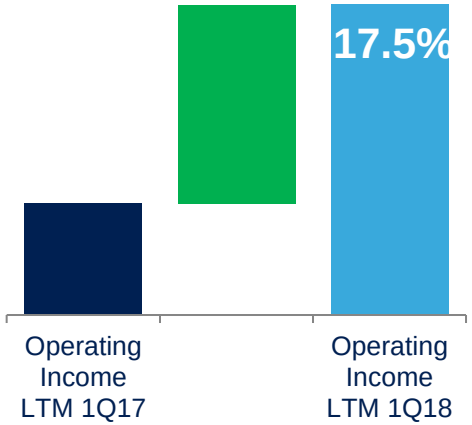
**ADG (US$M)**



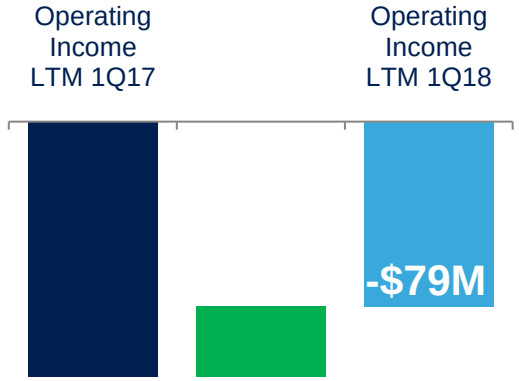

**AMS (US$M)**



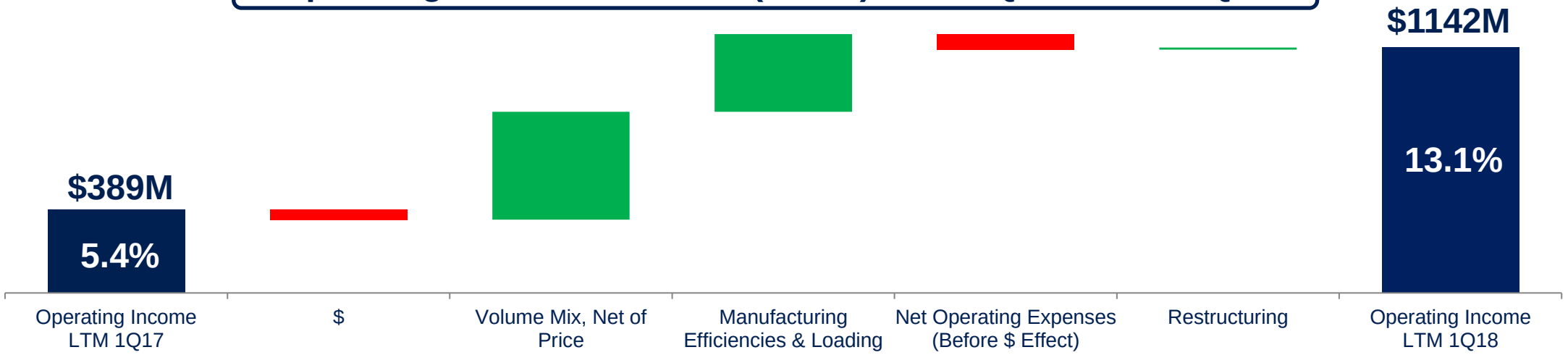

**MDG (US$M)**




**Others (US$M)**




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

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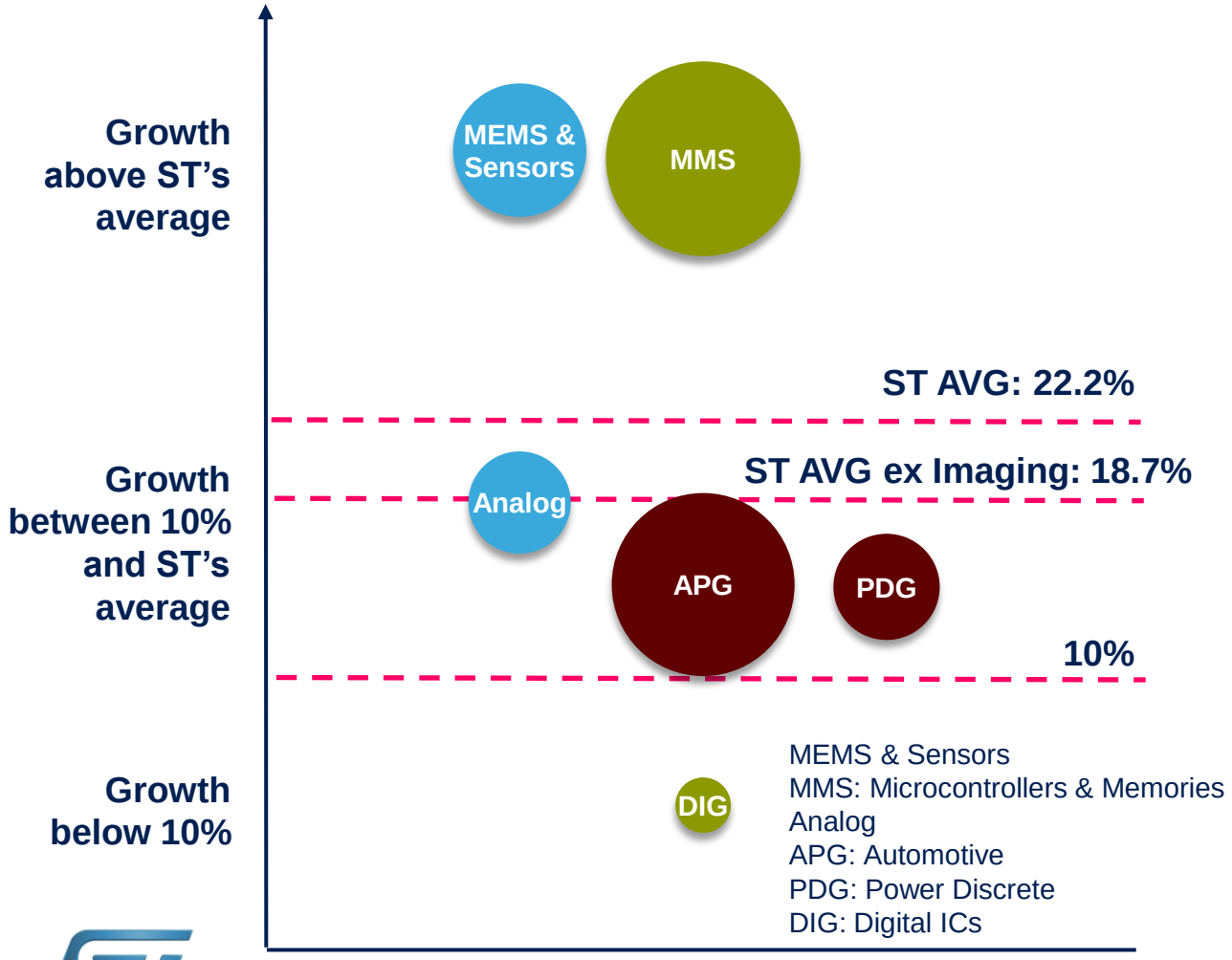
# Strong Performance Across the Portfolio…

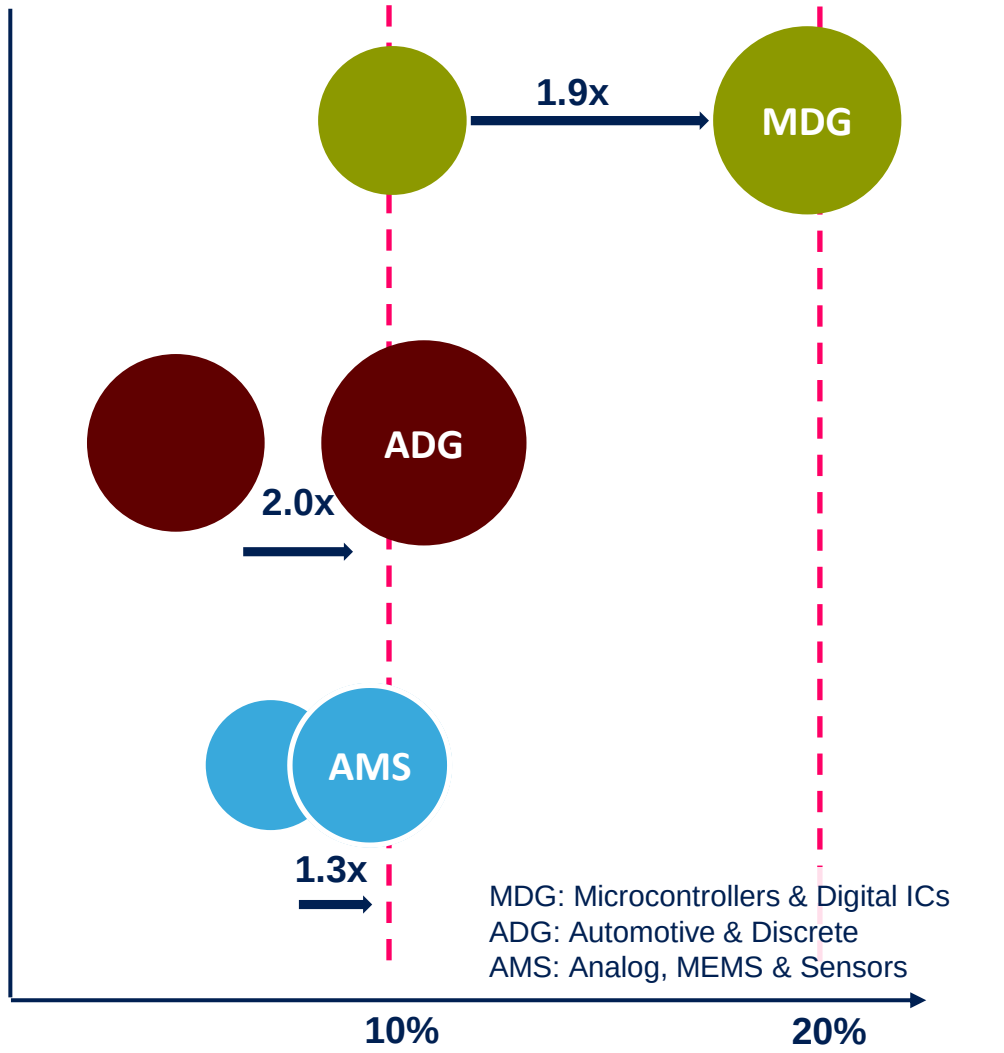


## 1Q18/1Q17 Revenue Growth




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.

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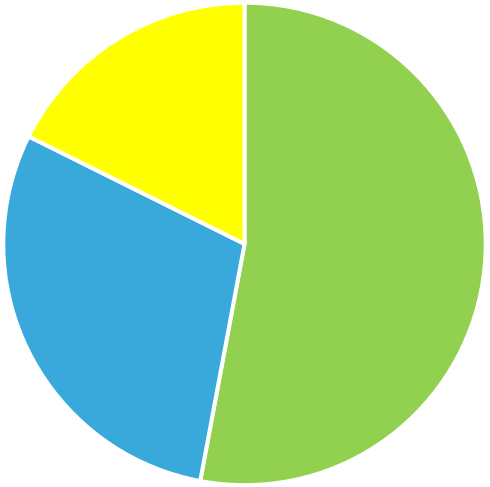
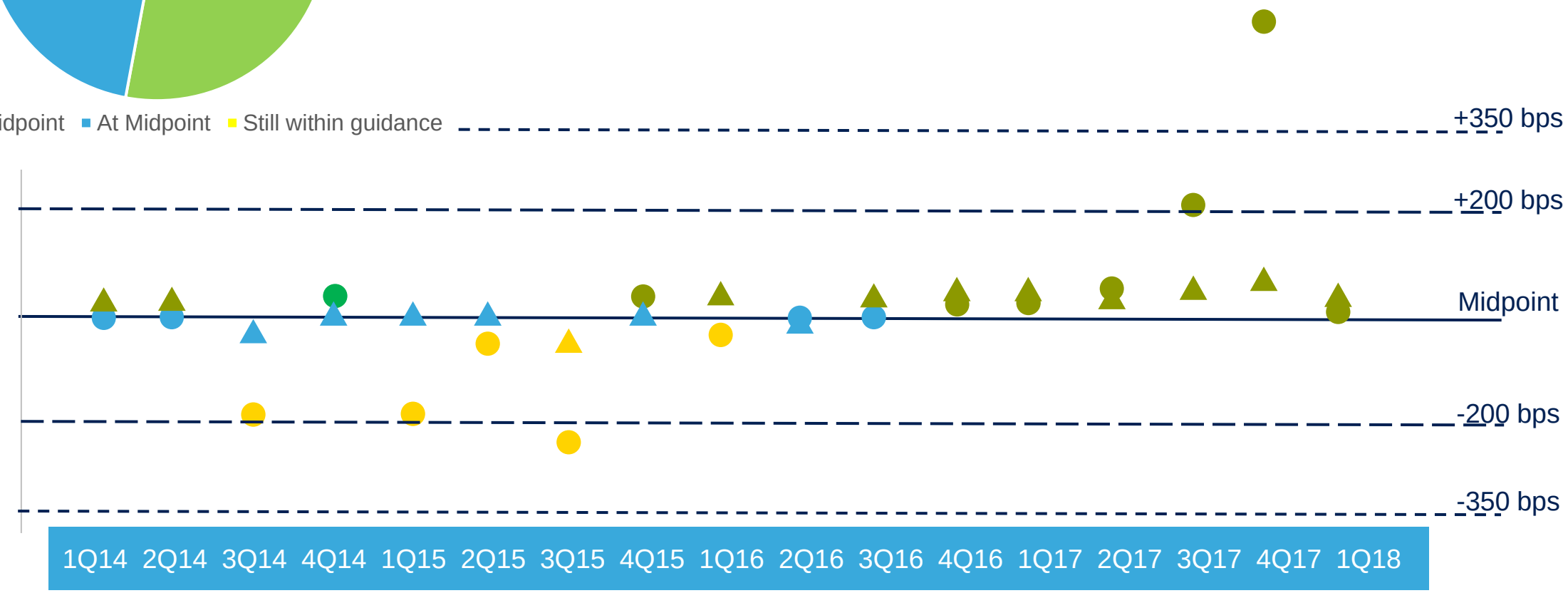
# … and Excellent Execution




## 1Q14 – 1Q18 Actual Revenues & Gross Margin Vs. Guidance




- Revenues at Midpoint +/- 10 bps
- Revenues > Midpoint + 10 bps
- Revenues < Midpoint - 10 bps

- Gross Margin at Midpoint +/- 10 bps
- Gross Margin > Midpoint + 10 bps
- Gross Margin < Midpoint - 10 bps

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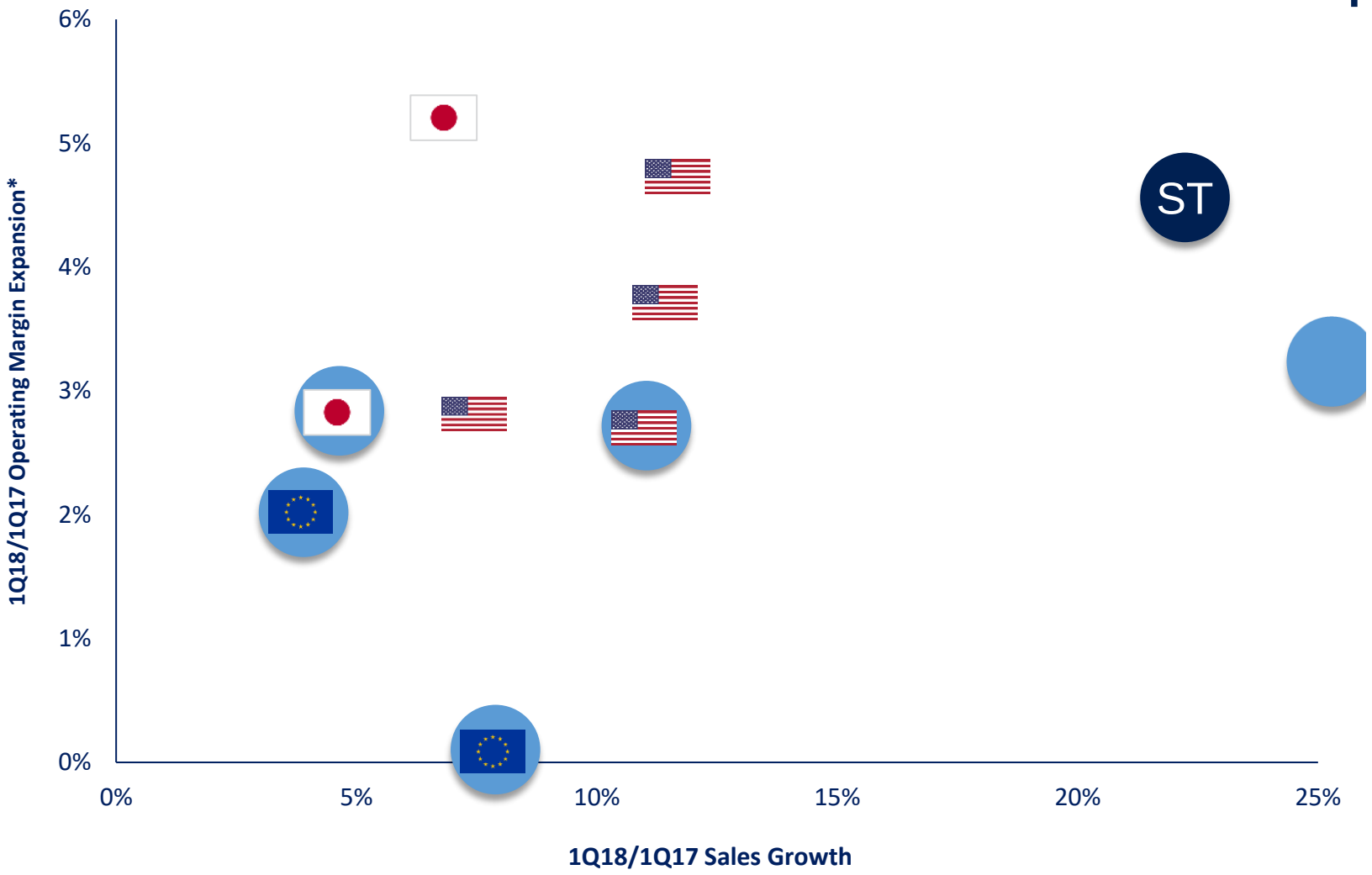
# …Growing and Improving Margin
## Faster Than the Competition






(*) Based on reported Operating Profit excluding Exceptionals

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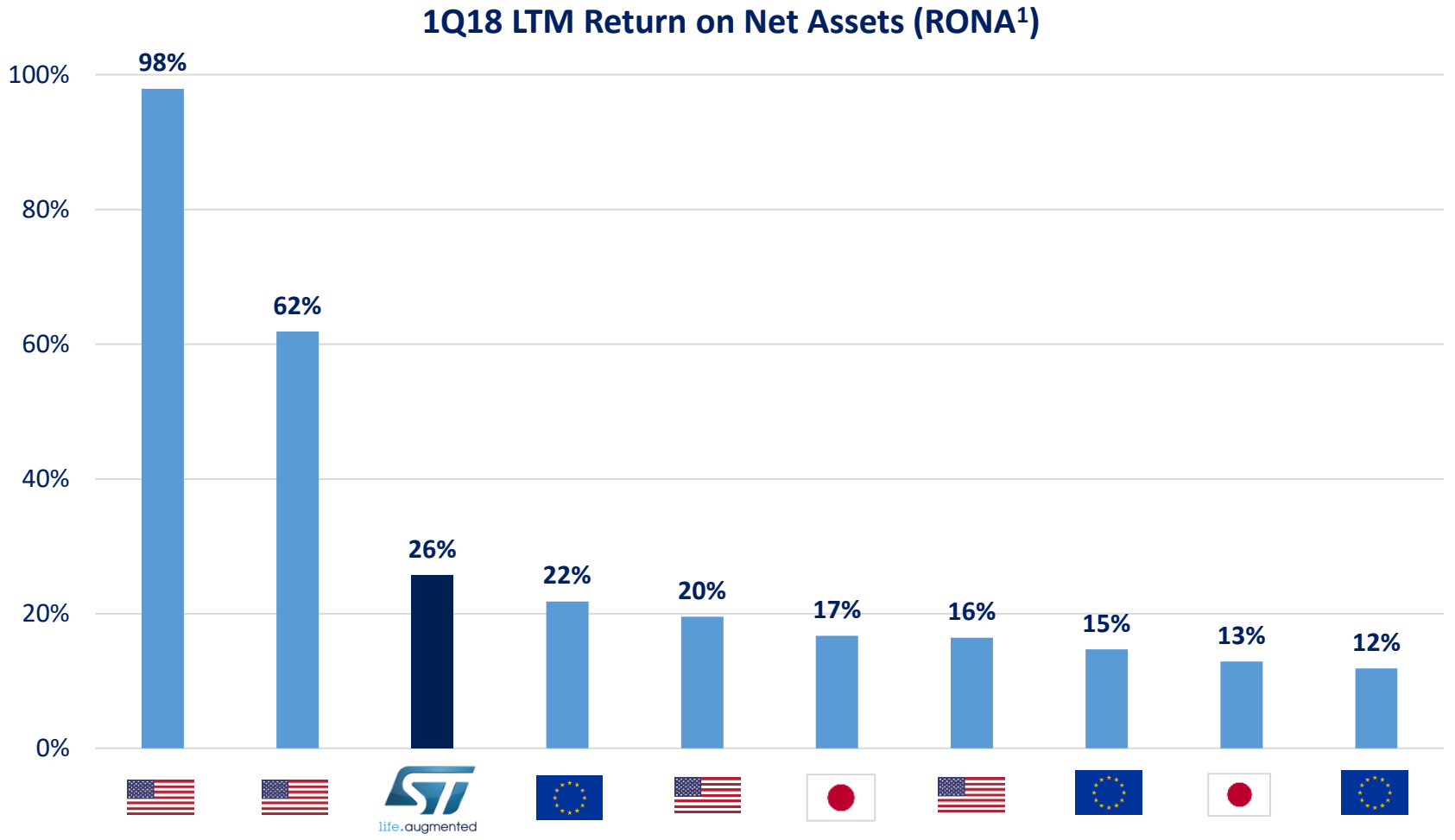
# Turning Capital into Profits






(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

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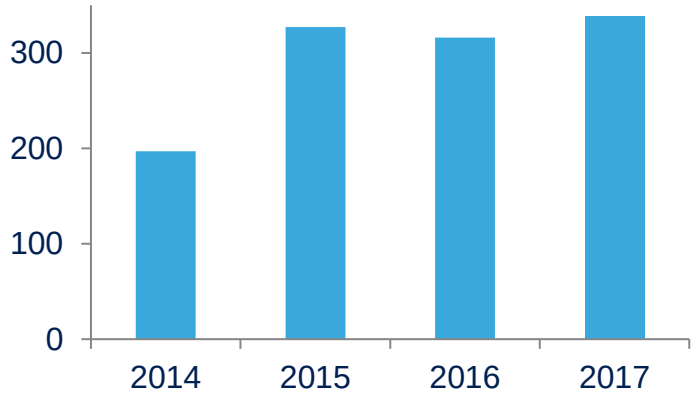
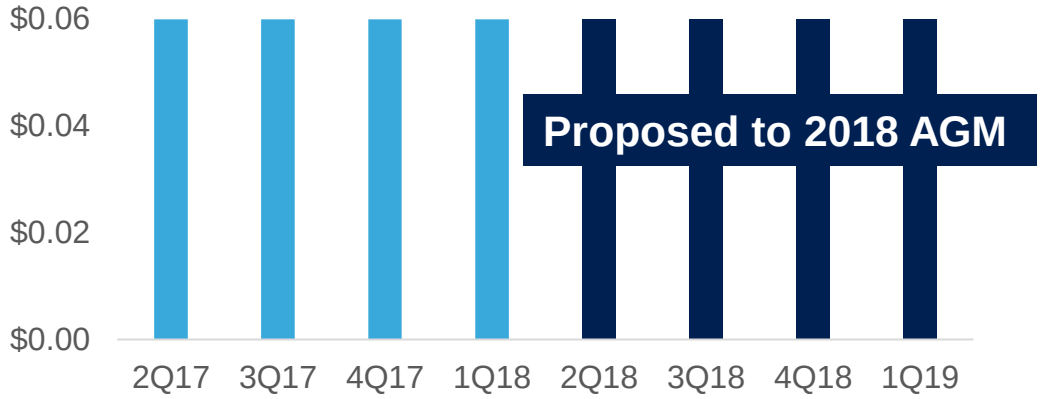
# Keeping a Solid Capital Structure



## 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

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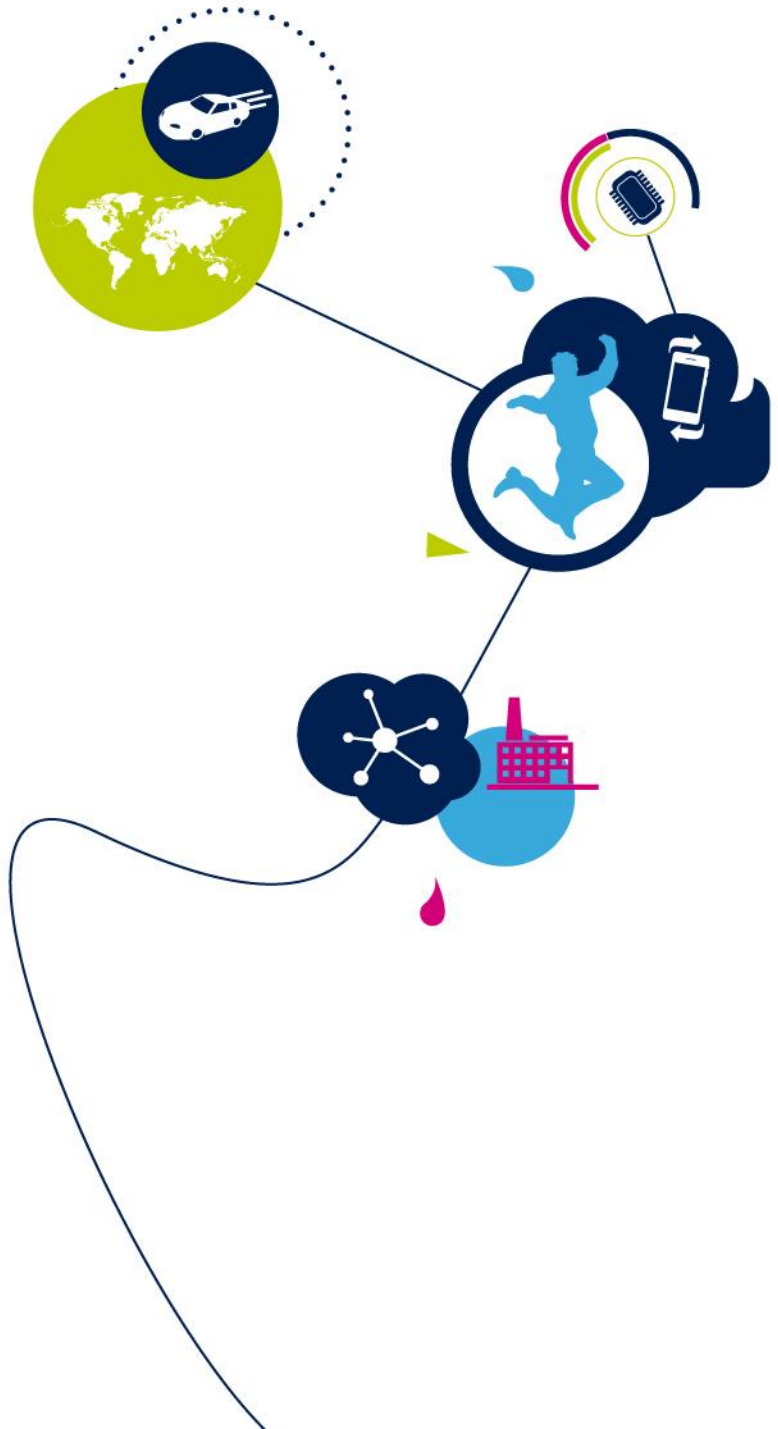
# 2018 Business Priorities

**Lorenzo Grandi**

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



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# ST Revenues



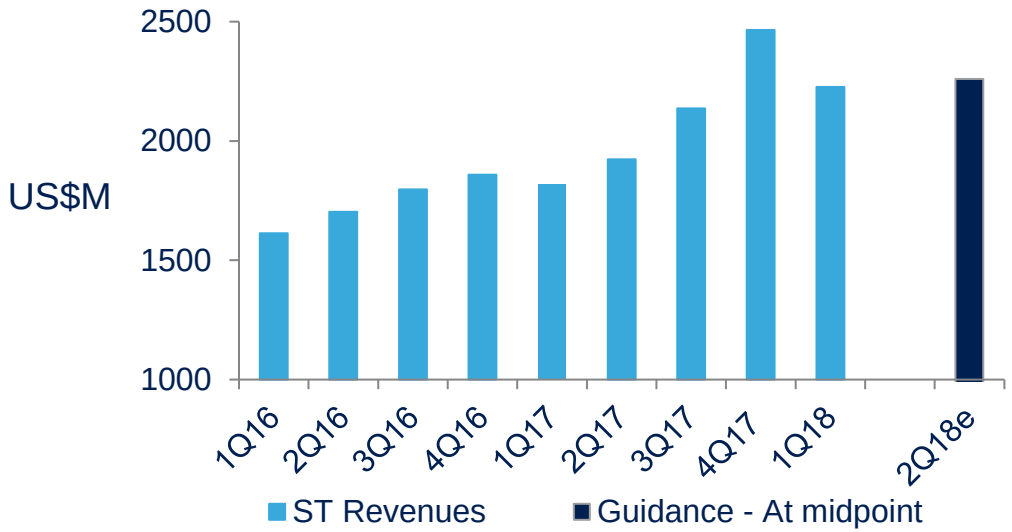
## 1Q18 Revenues = $2.23B

**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%

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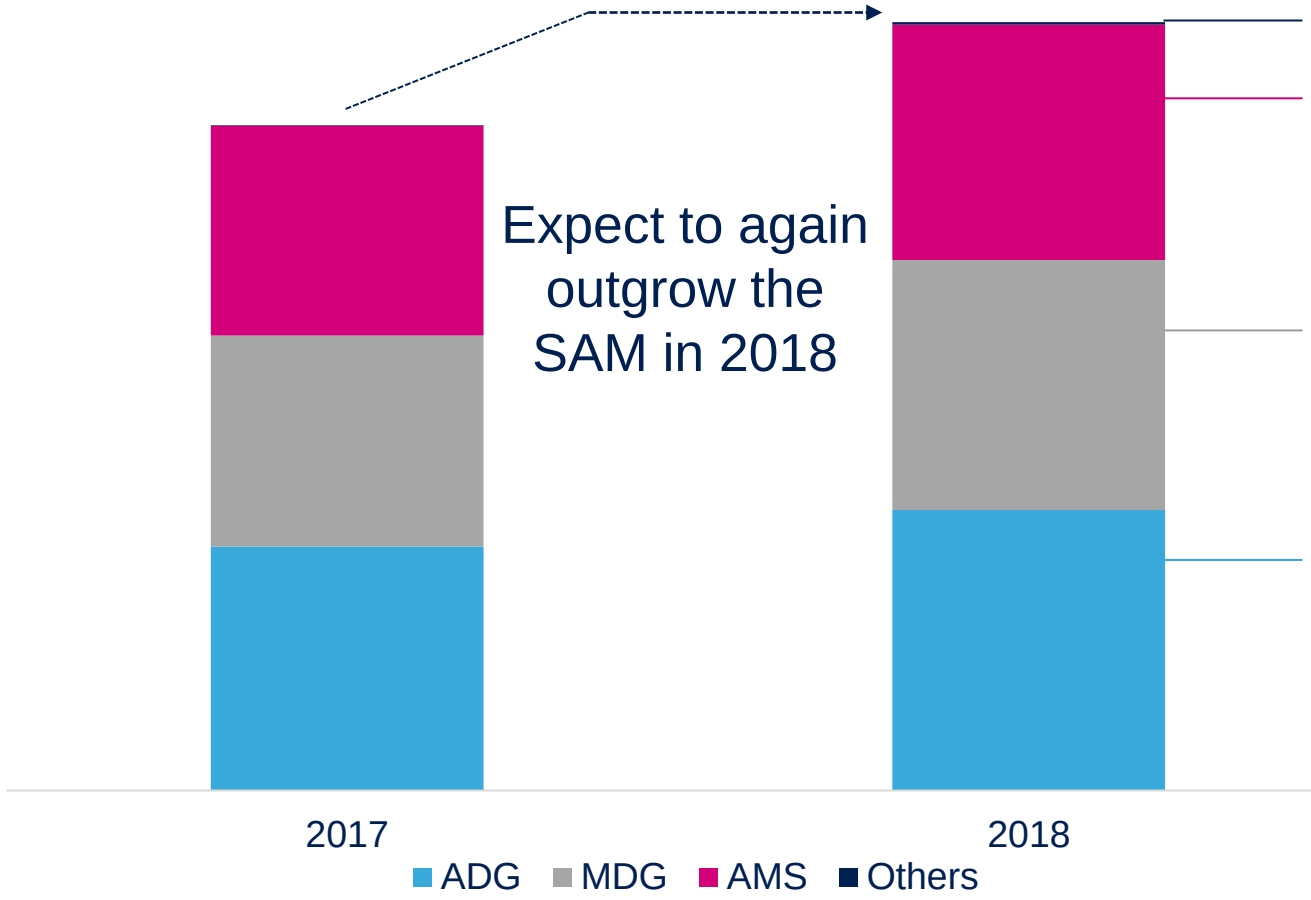
# Profitable Growth in 2018



## Growth Drivers

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




**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)

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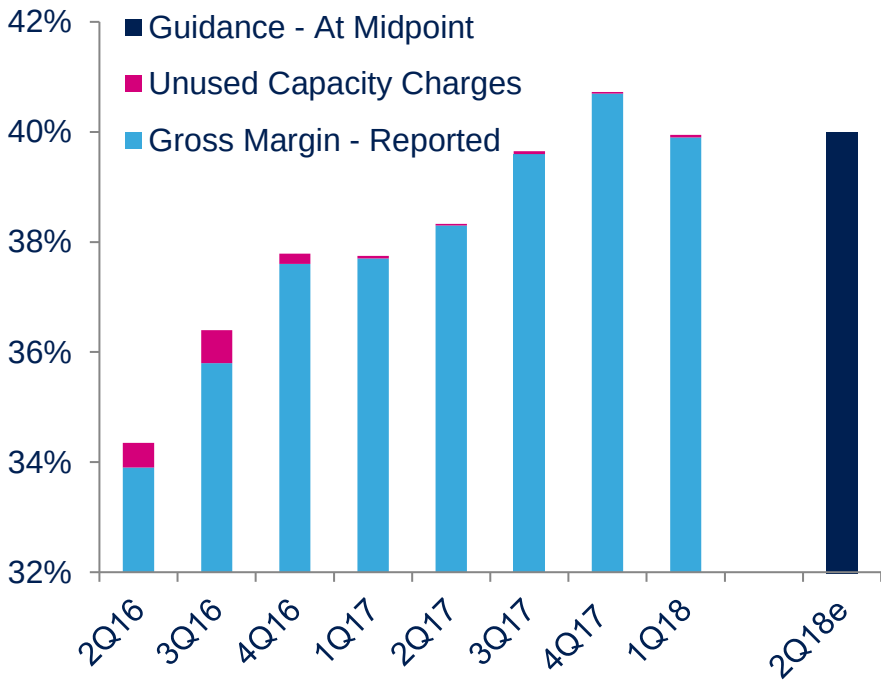
* See Forward Looking Statement for full disclosure. Such statements are subject to various risks and uncertainties, which may cause actual results and performance of our business to differ materially and adversely from the forward-looking statements.

# 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

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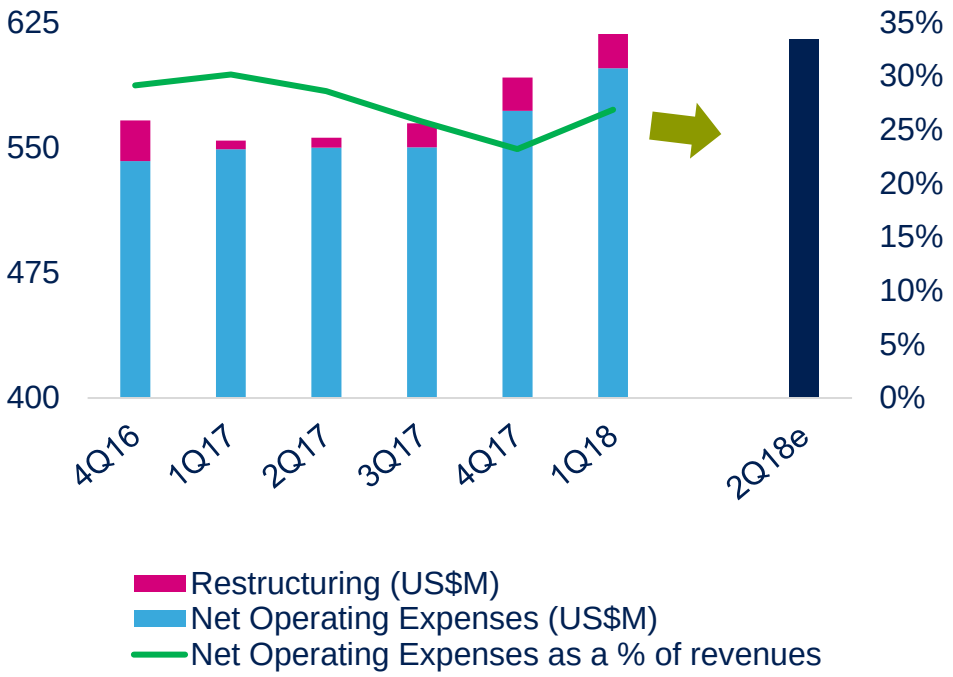
# Operating Expenses



## 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

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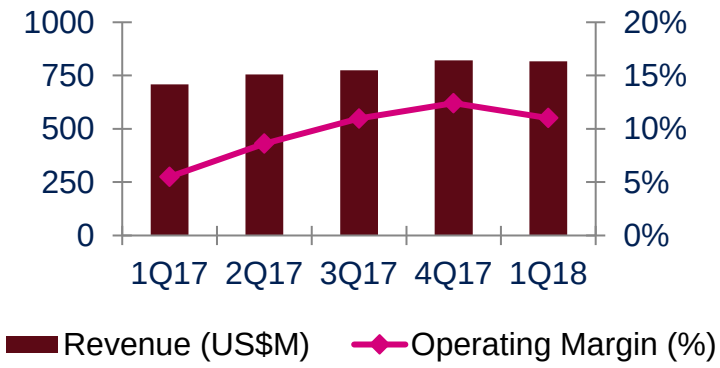
# Product Group Results



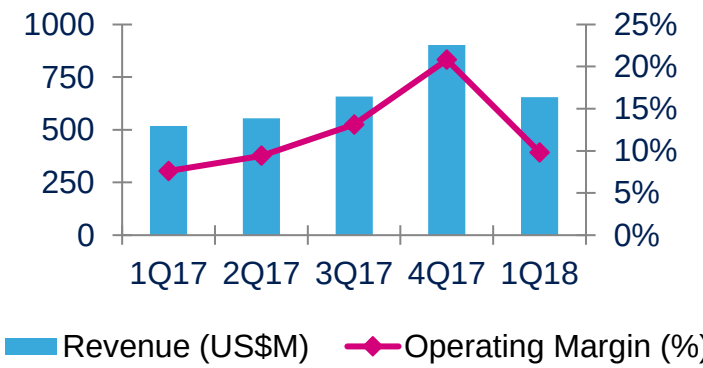
## Automotive & Discrete

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



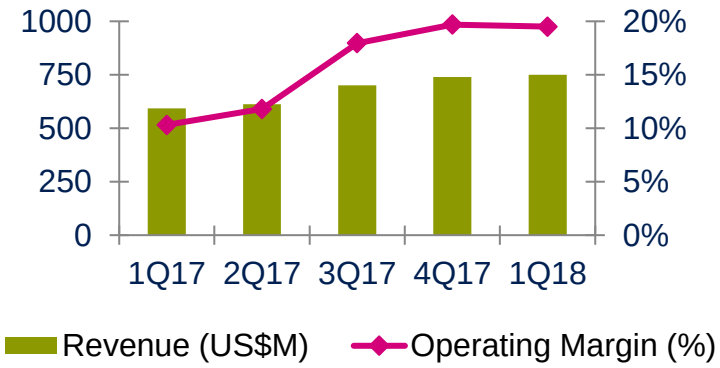

## Analog, MEMS & Sensors

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




## Microcontrollers & Digital ICs

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

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# ADG Contribution



## Leverage technology leadership

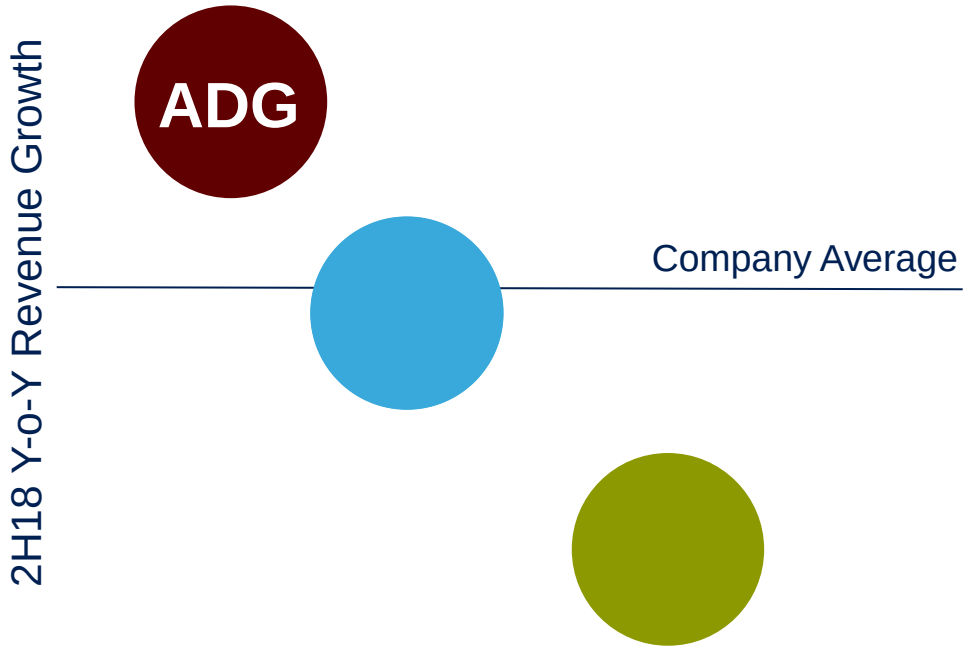
- BCD9 (110nm), BCD10 (90nm), eNVM, RF, FD-SOI, SiC & GaN

## 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

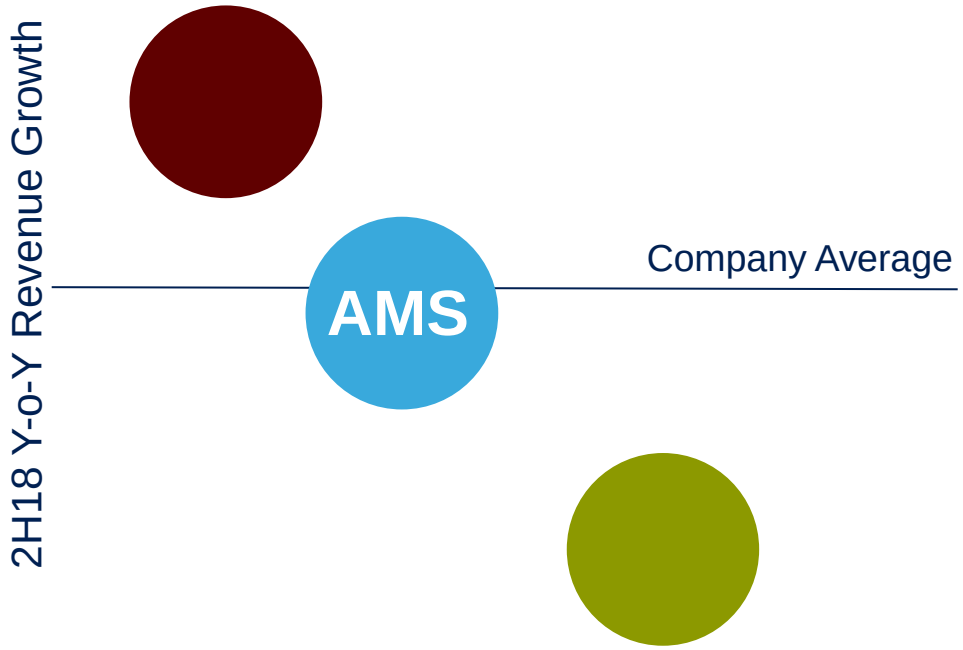
- Smart Power, Mixed Signal Analog, MEMS, Imaging Sensors

## 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

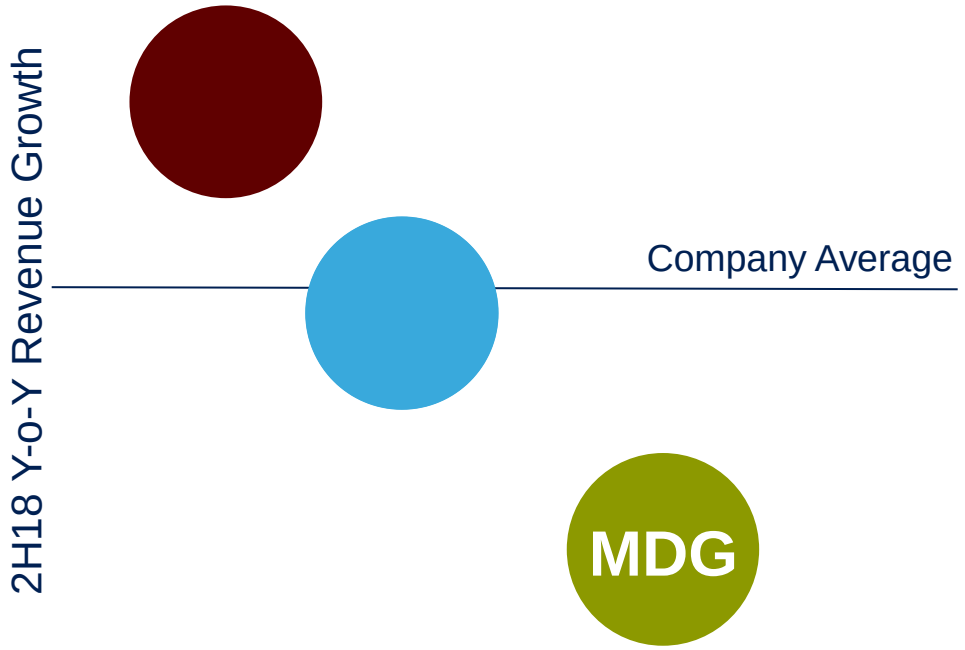
- eNVM and differentiated digital processes (FD-SOI, BiCMOS…)

## 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%**

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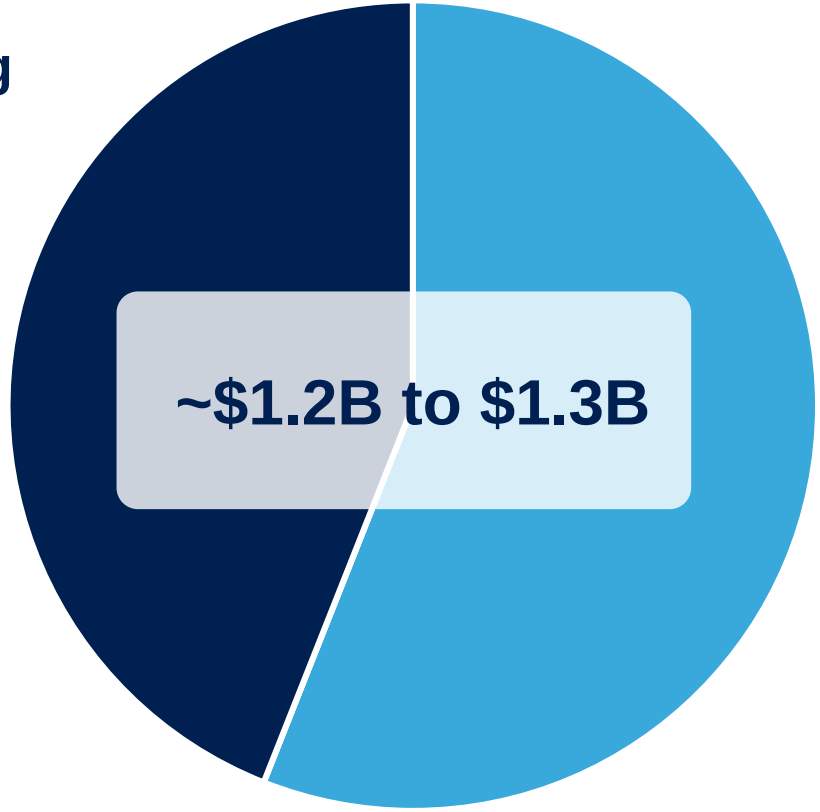
# FY18 Capital Spending



## 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**

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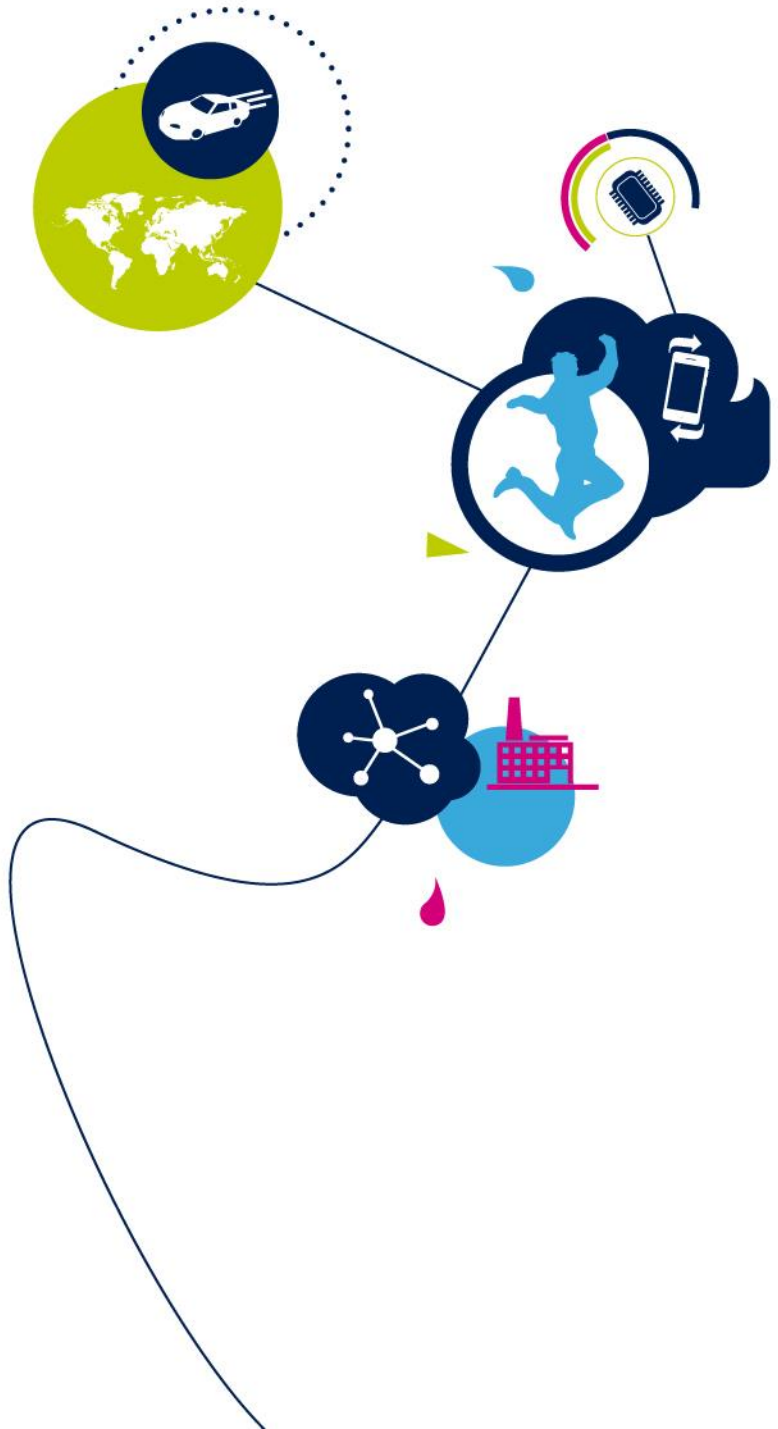
# Takeaways



- 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

# Appendix



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# Appendix



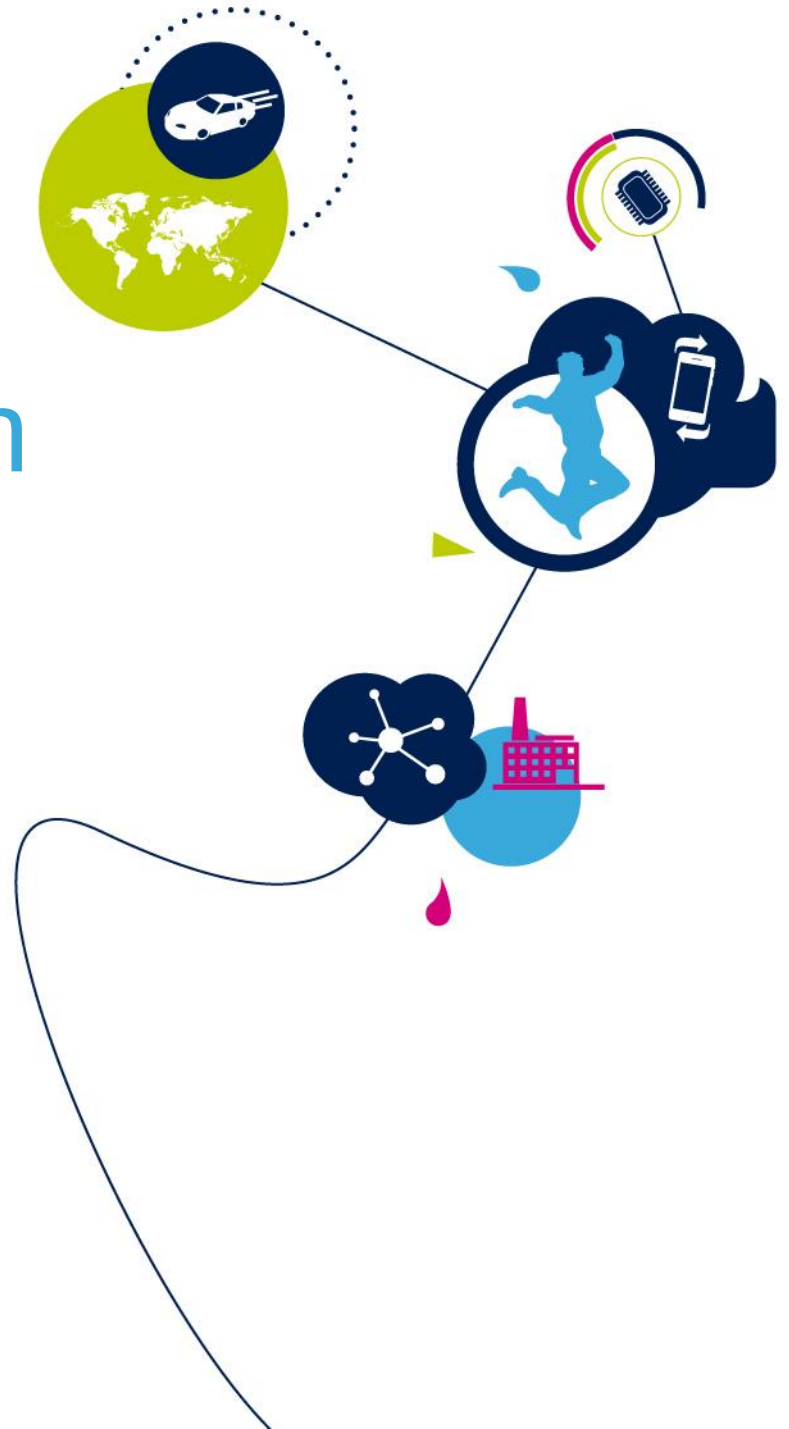
- **Free cash flow** is defined as net cash from operating activities minus net cash from (used in) investing activities, excluding payment for purchases (proceeds from the sale of) marketable securities and net cash variation for joint venture deconsolidation. We believe free cash flow provides useful information for investors and management because it measures our capacity to generate cash from our operating and investing activities to sustain our operating activities. Free cash flow is not a U.S. GAAP measure and does not represent total cash flow since it does not include the cash flows generated by or used in financing activities. In addition, our definition of free cash flow may differ from definitions used by other companies.
- **Net financial position** resources (debt) represents the balance between our total financial resources and our total financial debt. Our total financial resources include cash and cash equivalents, marketable securities, short-term deposits and restricted cash, and our total financial debt includes short term borrowings, current portion of long-term debt and long-term debt, all as reported in our consolidated balance sheet. We believe our net financial position provides useful information for investors because it gives evidence of our global position either in terms of net indebtedness or net cash position by measuring our capital resources based on cash, cash equivalents and marketable securities and the total level of our financial indebtedness. Net financial position is not a U.S. GAAP measure.
- **Adjusted net earnings and earnings per share (EPS)** are used by our management to help enhance an understanding of ongoing operations and to communicate the impact of the excluded items like impairment, restructuring charges and other related closure costs, net of the relevant tax impact.
- **Net revenues of "Others"** includes revenues from sales of assembly services and other revenue. **Operating income (loss) of Others** includes items such as unused capacity charges, impairment, restructuring charges and other related closure costs, phase out and start-up costs, and other unallocated expenses such as: strategic or special research and development programs, certain corporate-level operating expenses, patent claims and litigations, and other costs that are not allocated to product groups, as well as operating earnings of other products. Others includes:

| (US$ Million) | Q1 2018 | Q4 2017 | Q3 2017 | Q2 2017 | Q1 2017 |
|---|---|---|---|---|---|
| **Unused Capacity Charges** | 1 | 1 | 1 | 1 | **1** |
| **Impairment & Restructuring Charges** | **21** | **20** | **14** | **6** | **5** |

# Sustainable Profitable Growth
# Balanced and Broad

**Marco Cassis**

Designated President
Sales, Marketing, Communications and Strategy Development



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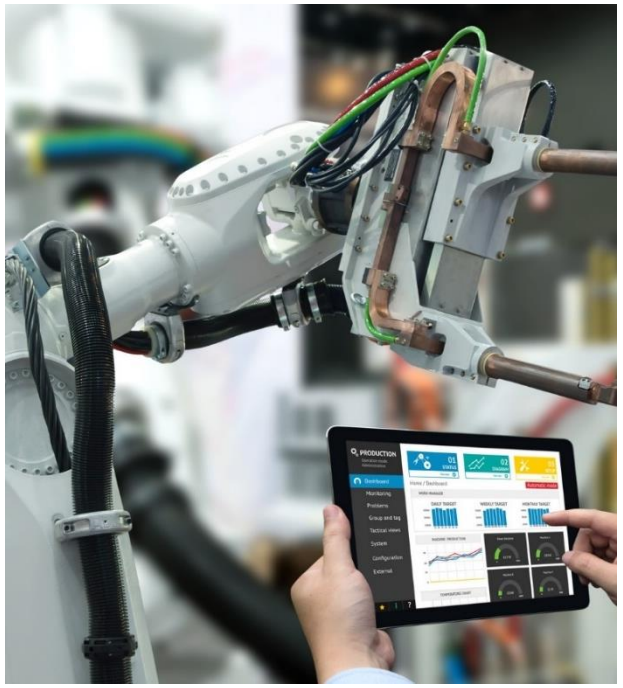
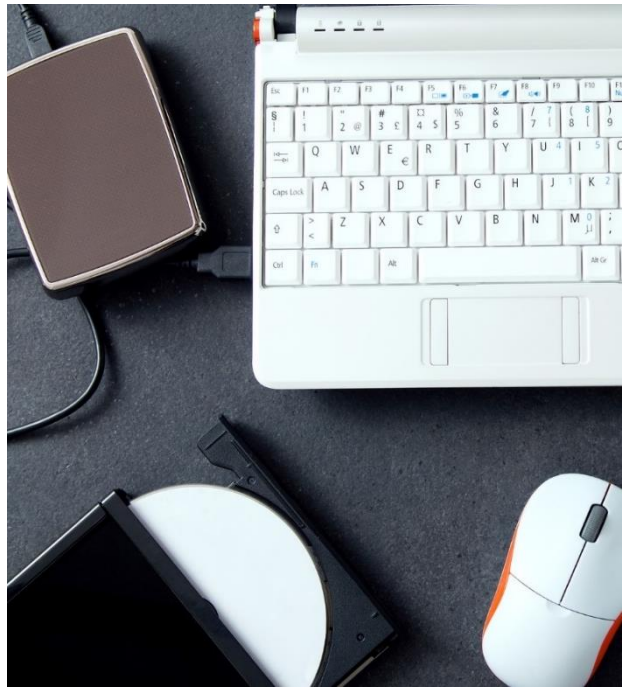
# Addressing Four End Markets…



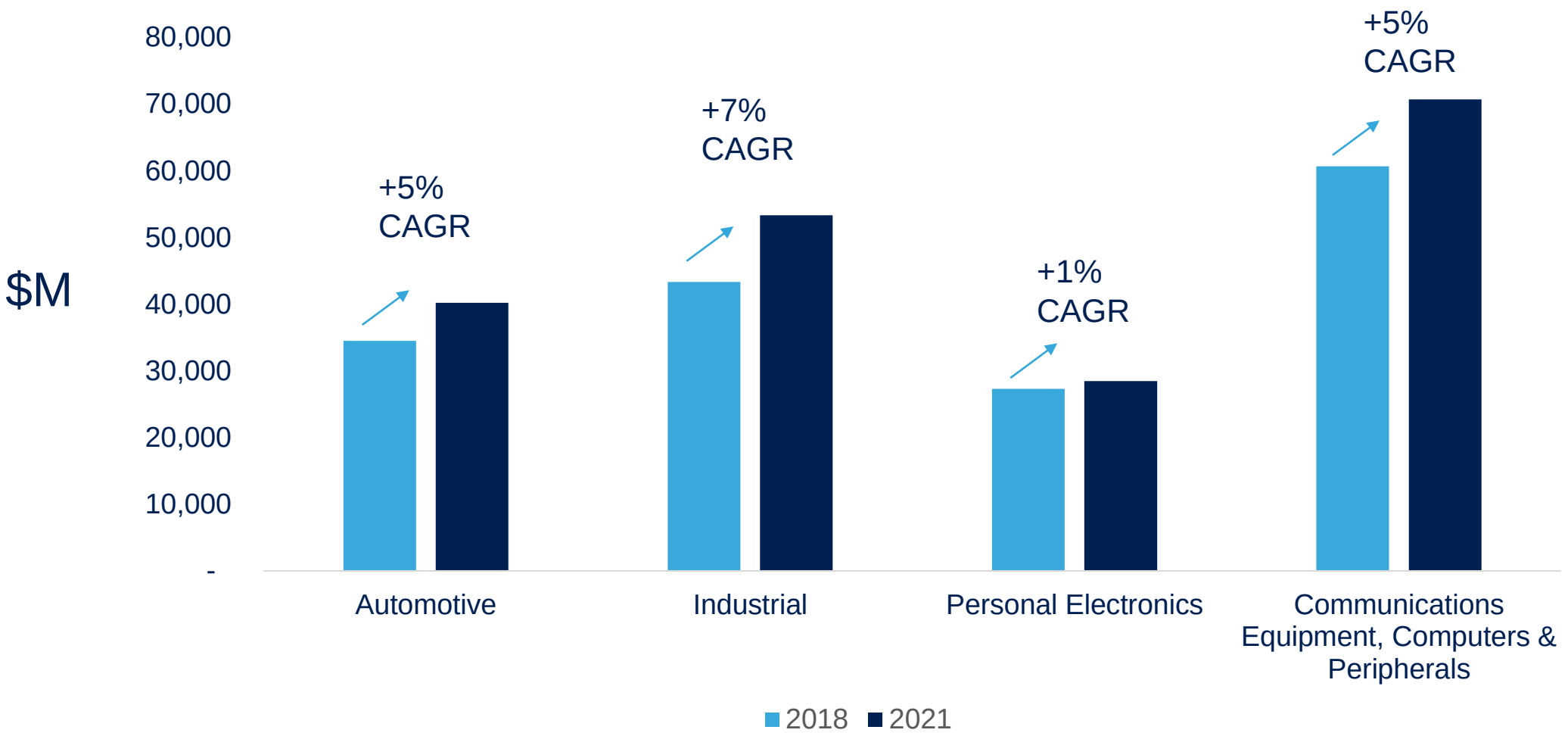
| Automotive | Industrial | Personal Electronics | Communications Equipment, Computers & Peripherals |
|---|---|---|---|



# ST SAM by End Market






Source: IHS Markit, Strategy Analytics

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# …with a Strong Application Approach



Smart Driving

Internet of Things

Smart Driving

Smart Industry

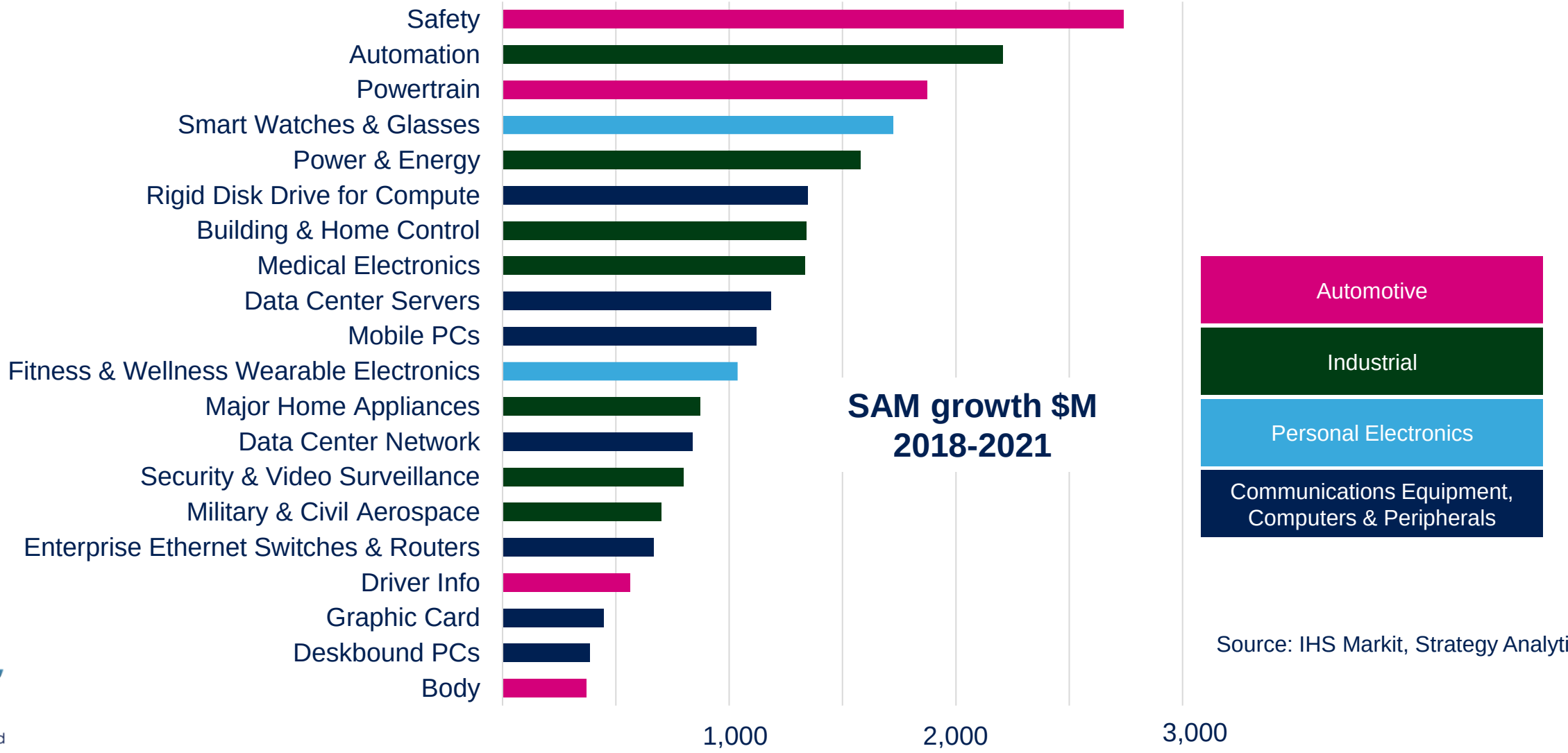
Smart Home & City

Smart Things

# Focus Applications Growth in our SAM



## Top 20 SAM Growth Applications 2018-2021




Source: IHS Markit, Strategy Analytics

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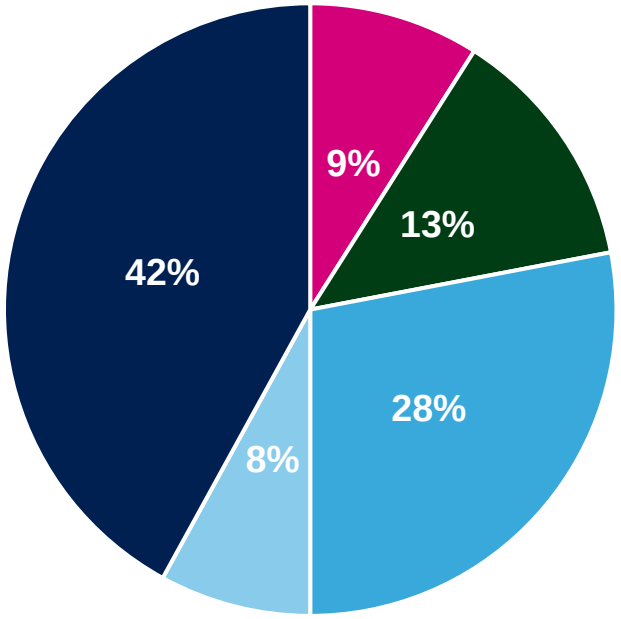
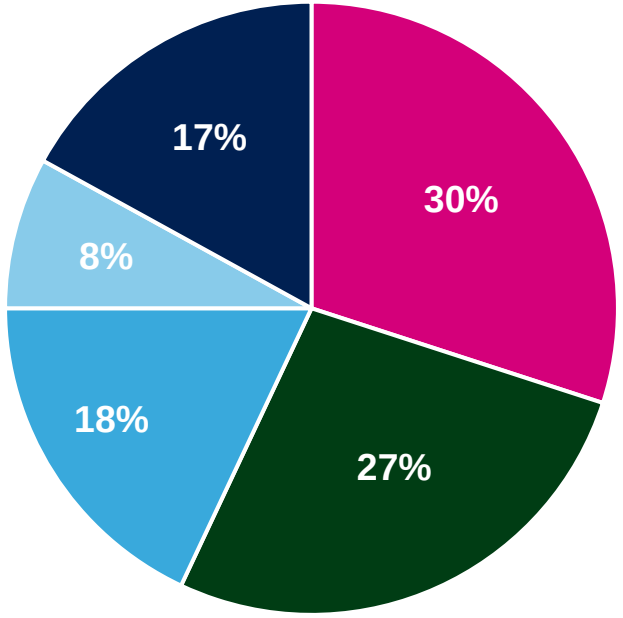
# Balanced Sales in Our Markets



## TAM
2017




## ST Sales
2017




Source: IHS Markit, Strategy Analytics

Automotive

Industrial

Personal Electronics
- Smartphones & other mobile
- Other Personal Electronics

Communications Equipment, Computers & Peripherals

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# 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

# 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

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

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# 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

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# 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

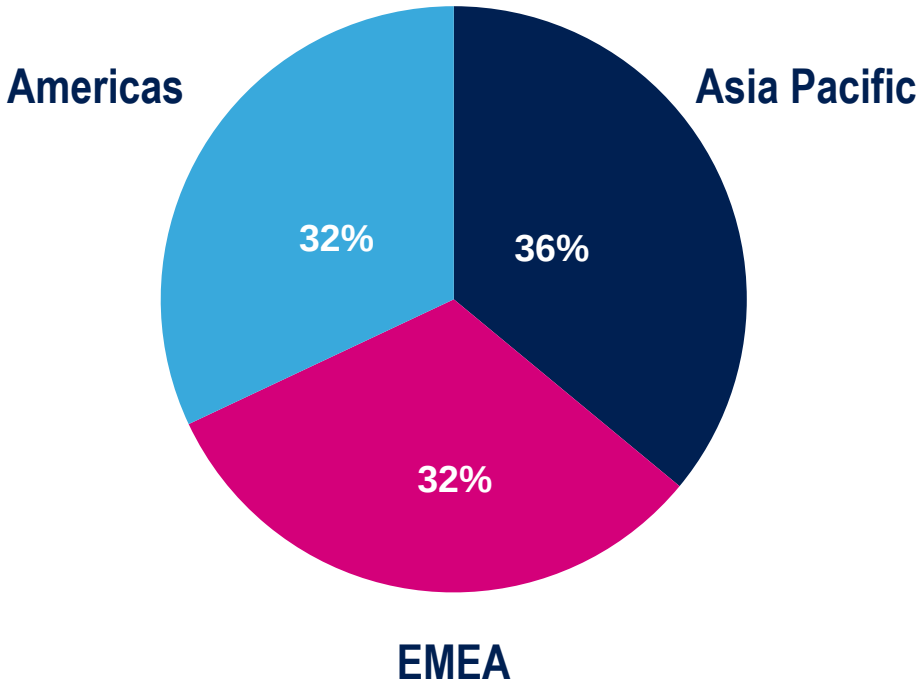
- Leading in power combo ICs for Hard Disks and Printers
- Leading supplier of fluidic MEMS for printers
- Pioneer in new server power architectures

# Balanced Sales

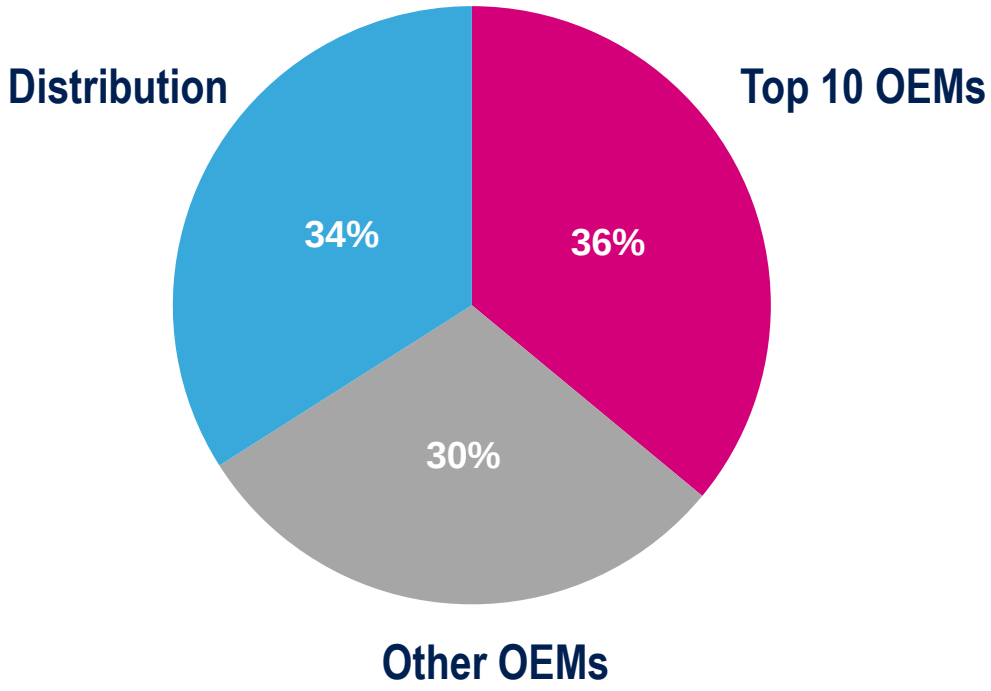


## Geographically and by Customer Type

**Sales by region of origin**
FY2017




**Sales by customer type**
FY2017

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# 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










**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

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# Distribution Approach



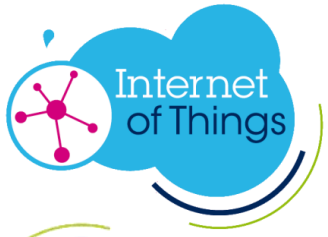
Products & Application Solutions

ST Sales & Marketing Presence & Partner Ecosystem

Training, Support & Tools

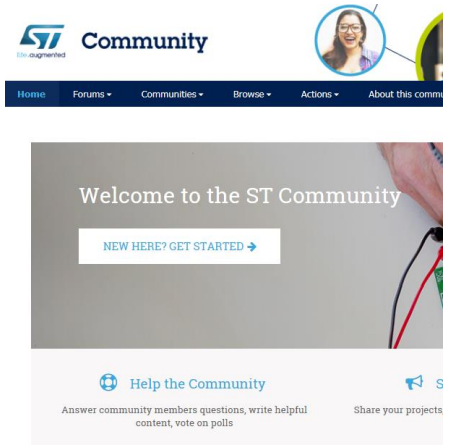
Online & Digital Marketing Initiatives

Aligned Go-To-Market & Joint Business Creation







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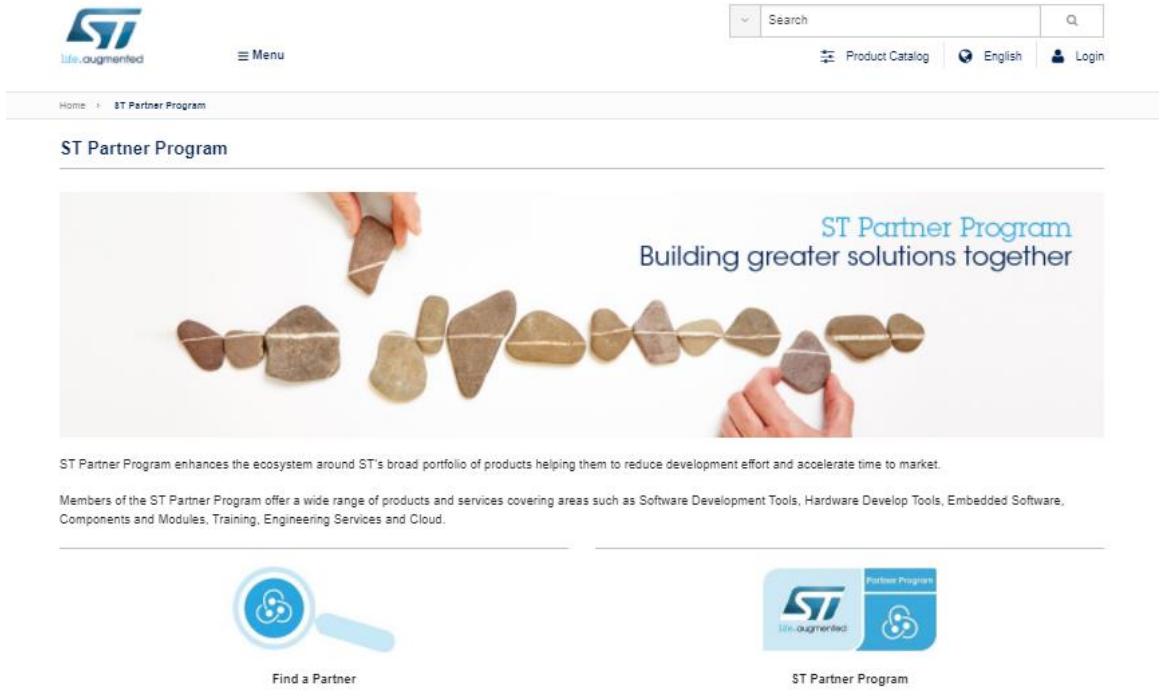
# Partner Ecosystem & Tools



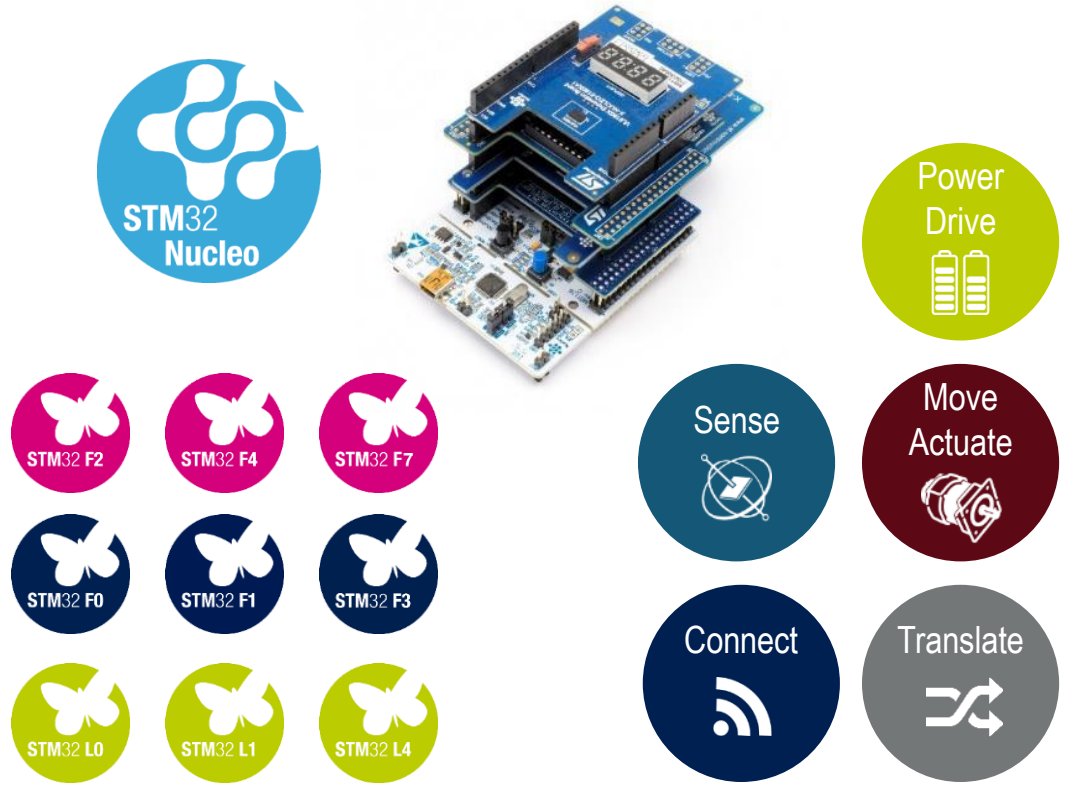
## ST Partner Program

~150 Partners and growing




## ST Development Tools

**>520K** MCU boards – **42** types
**180K** expansion boards – **48** types
(Since 2015)

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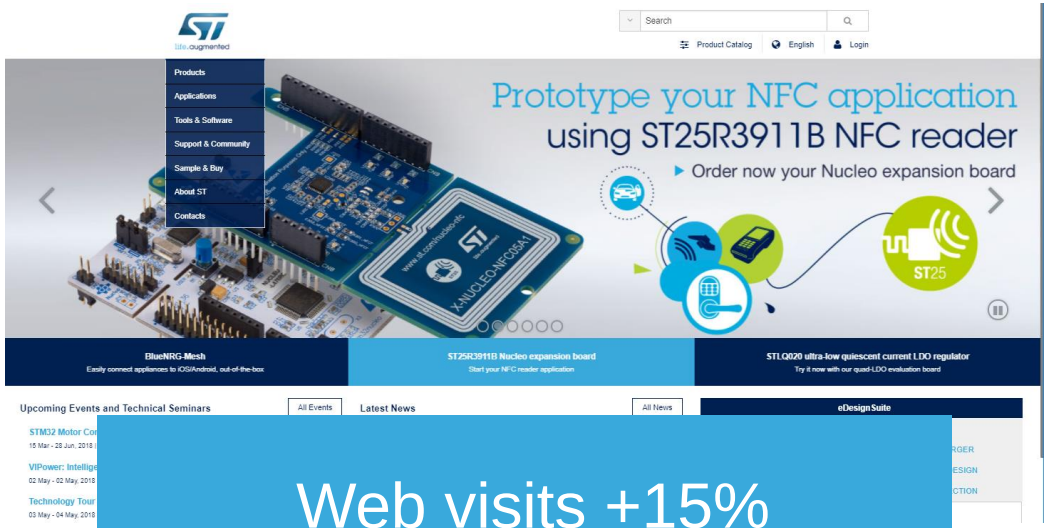
# Digital Marketing Initiatives

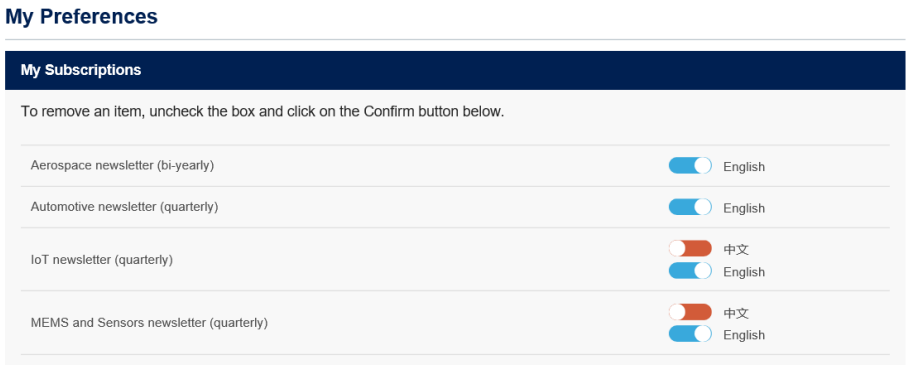





Web visits +15%
Page views +30%


Community website visits
+30%

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

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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

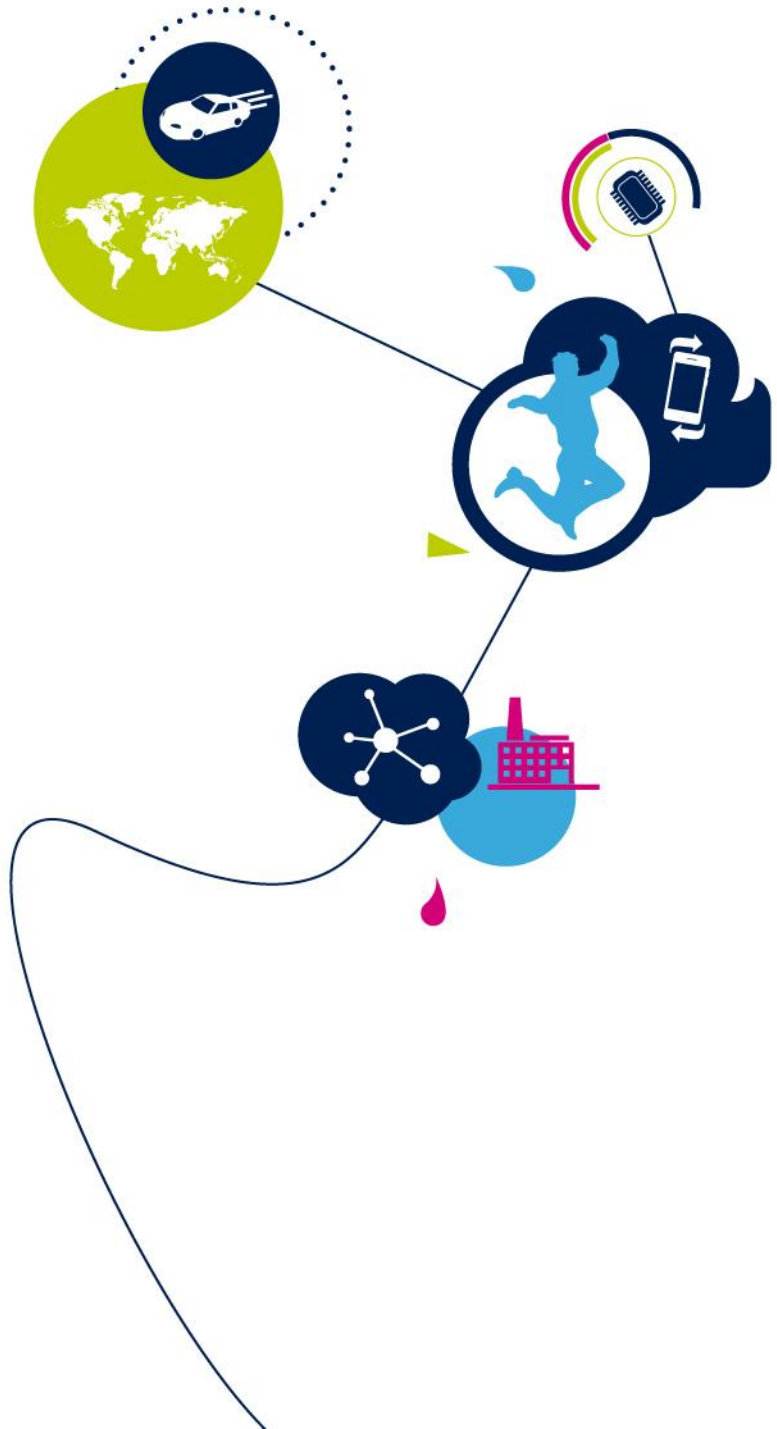


- Focused on the fastest growing markets and applications in our SAM
- Balanced sales by end-market, customer type and geography
- Differentiated approach by customer type with adapted tools and service levels
- Strong partnerships with distribution supporting growth
- The most complete product portfolio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

# Automotive & Discrete Group

**Marco Monti**

President
Automotive and Discrete Group



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**37%**
of ST 2017 revenues

# ADG: Group at a Glance

## Key Financial data by Sub-Group



### Group 2017 Revenue

**$3.06B**

**AUTOMOTIVE & DISCRETE GROUP**

**APG**
**Automotive Product Sub-Group**

**$1.93B**

**PDG**
**Power Discrete Sub-Group**

**$1.13B**

### Strong YoY Growth

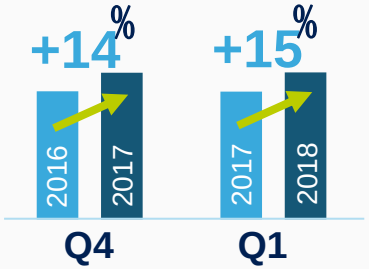
ADG **+9%**

Automotive Product Group **+6%**

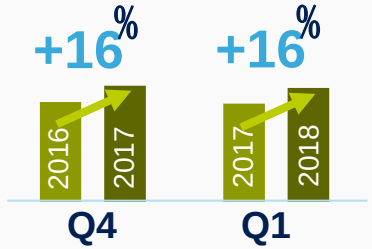
Power & Discrete Group **+13%**

### Balanced Double-Digit Q-to-Q Growth Rate

**APG** Sub-Group




**PDG** Sub-Group




**+25%**
**ADG Distribution Q1-o-Q1 Growth**

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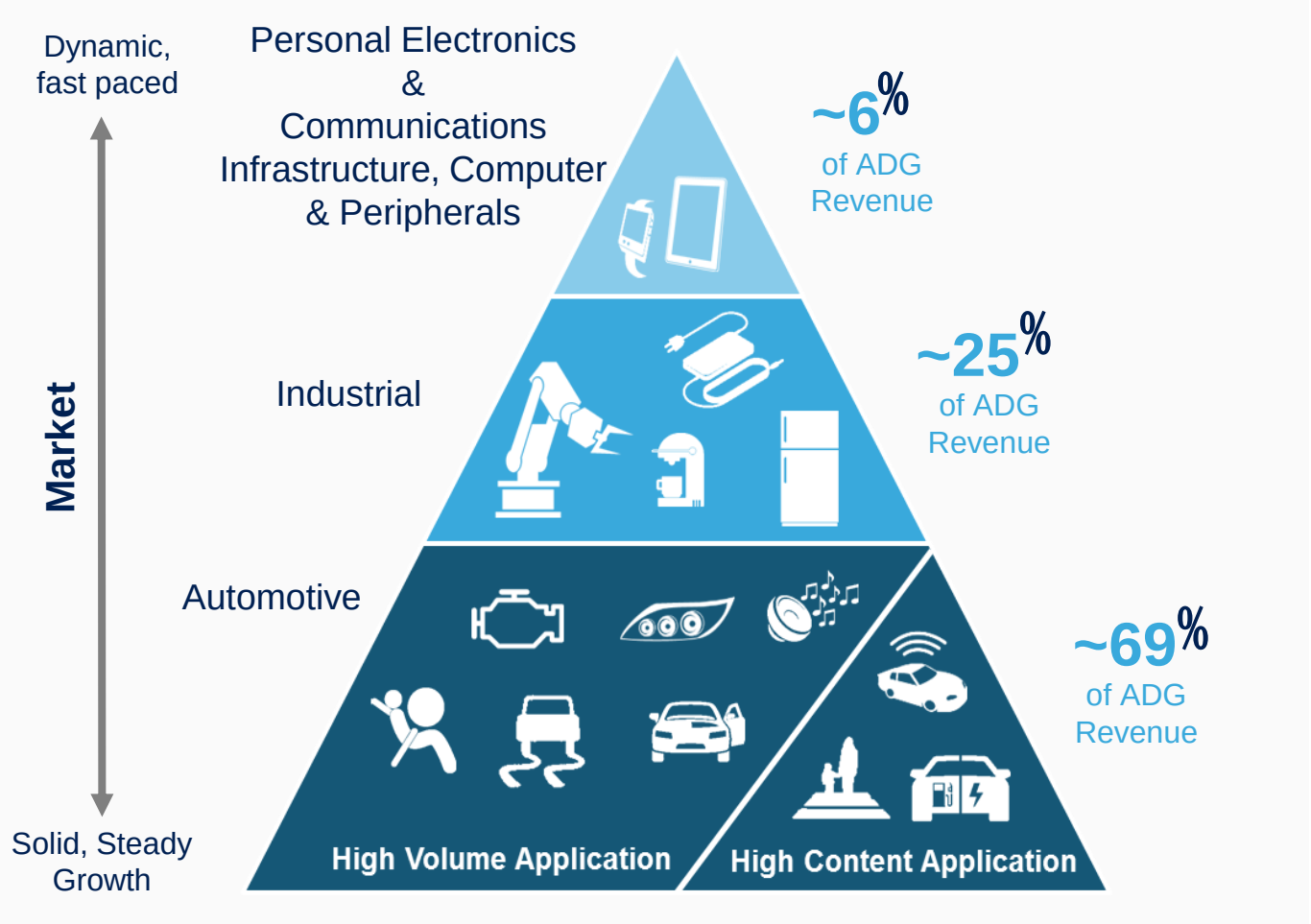
# ADG: Group Overview



## Product Group Application Domain by End-Market




## Customer Base

BOSCH, LEAR CORPORATION, Clarion, BOSE, KOSTAL, HARMAN, Continental, TESLA, MOBILEYE, Autoliv, JVC KENWOOD, 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<br>FD-SOI logic<br>eFlash<br>ePCM |
| **Catania & Agrate** R&D | VIPower<br>Advanced BCD |
| **Singapore** | VIPower<br>Power MOSFET<br>BCD<br>Advanced BCD* |
| **Foundry** | 7nm FinFET<br>90/40nm eFlash<br>2nd source |

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# 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<br>GaN-RF<br>Power MOSFET |
| **Tours** R&D | Discrete<br>Passive Integration<br>GaN (Transistor & Diode) |
| **Singapore** | Power MOSFET |

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# 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

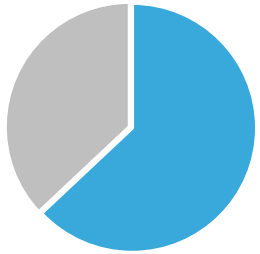
Conventional and Digital **Audio** Amplifiers

### 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

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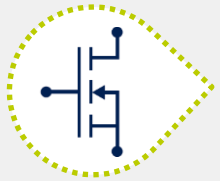
Source: Strategy Analytics Jan 2018, ST internal

# Power Discrete Sub-Group



## Wide Presence in Industrial, Automotive and Personal Electronics

### HV - MOSFETS



**28%** Market Share

650 ~1200V

Leader in Lighting,
& Power Conversion

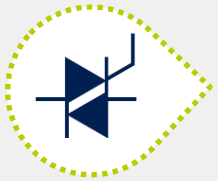
### New Material: SiC-GaN


**>50%** Market Share

SiC Diodes & MOSFET
In Automotive

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

### AC Switches

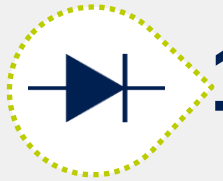


**29%** Market Share

Thyristors &
Triacs

Hi-End Power Conversion
Home Appliances, Motor Control

### Protection & Diodes

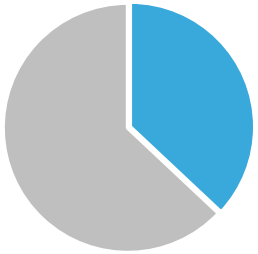


**12%** Market Share

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

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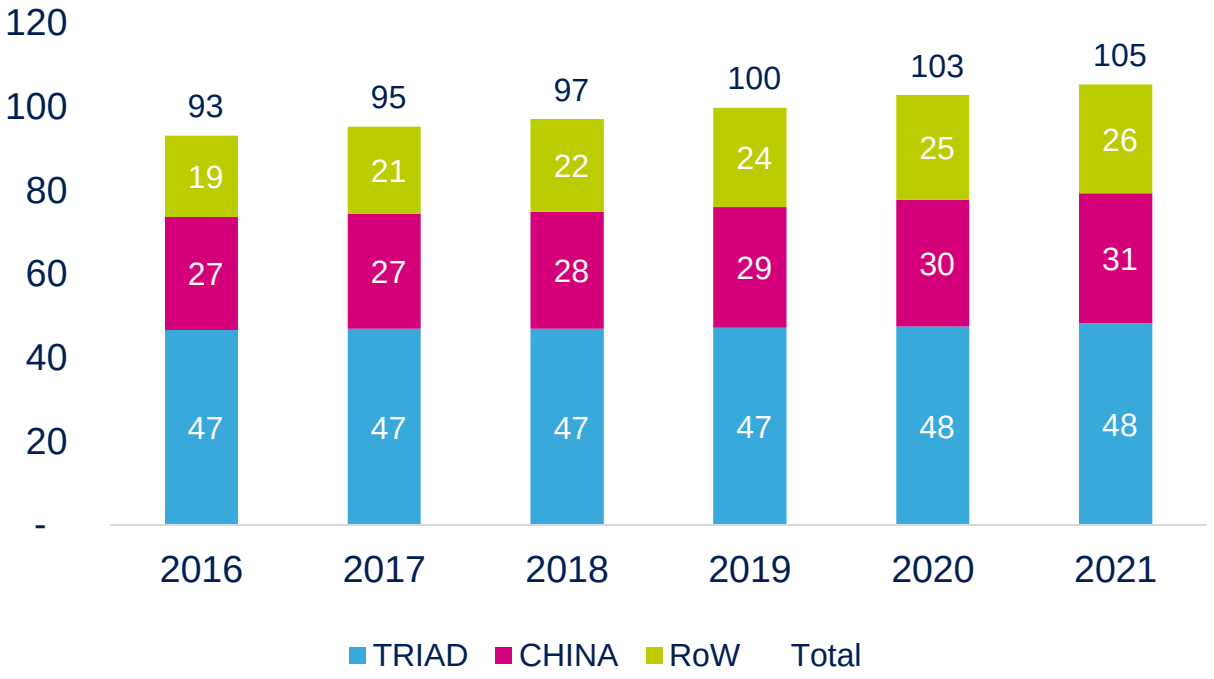
Source: IHS Markit; ST internal

# Automotive Market: a Good Place to be



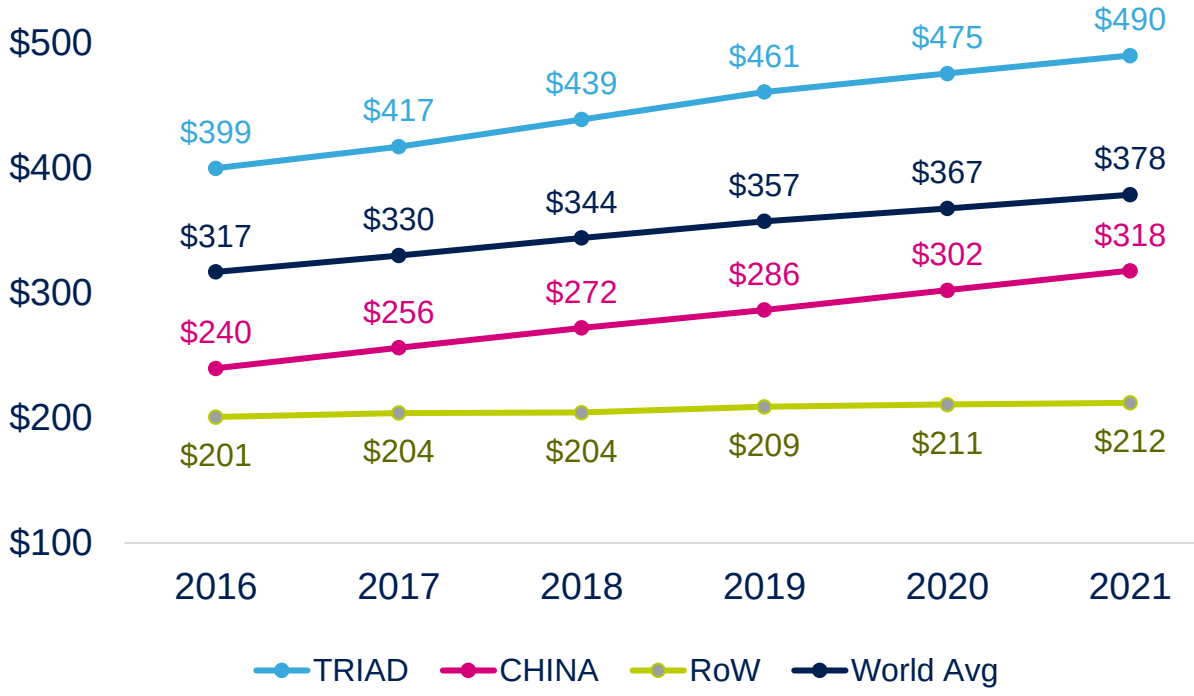
## Silicon Content Growth Outpacing Vehicle Unit Growth

### Vehicle Production Mu




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

### Silicon Content $




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

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

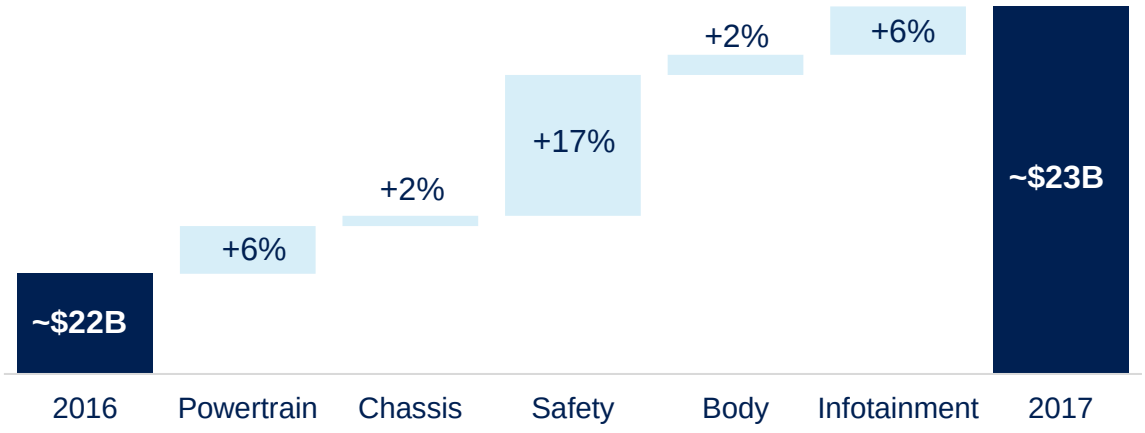
# ADG Automotive: Outperforming the Market



## Increased Penetration in all Automotive Domains

### ADG SAM by Application Domain [B$]

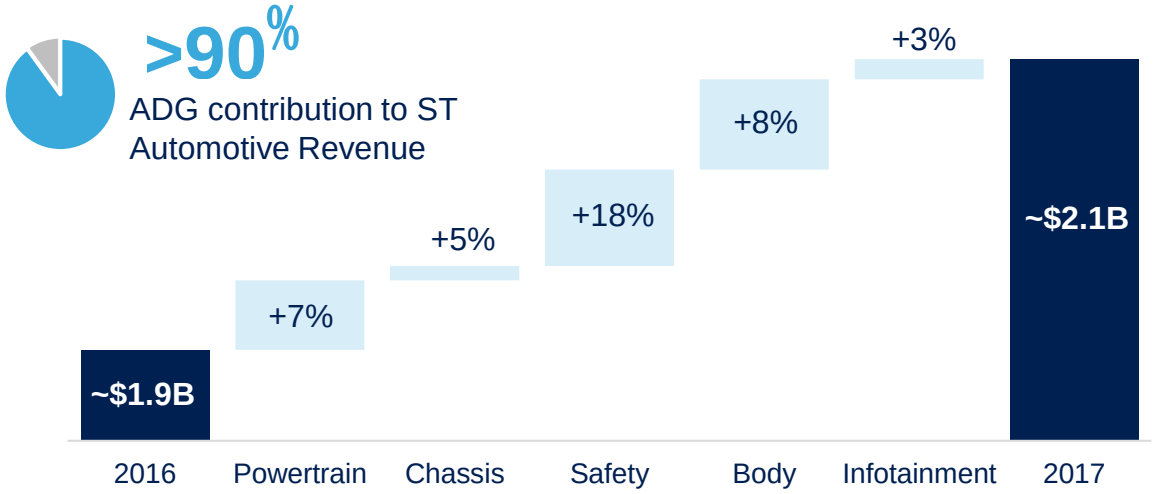
2017 vs. 2016 Growth




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

### ADG Automotive by Application Domain [B$]

2017 vs. 2016 ADG in Automotive Growth




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

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

Source: Strategy Analytics

# Automotive in ADG
## a Business With Solid Foundations



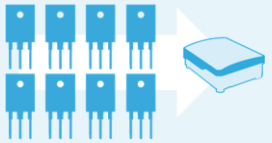
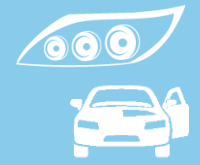
**Radical Innovation**
anticipating
market needs

**Enabling Transformation**
emerging trends

**High Volume Applications**
gaining market share

**~27%**
of ST Auto Revenue

**~73%**
of ST Auto Revenue

| Applications and Trends | Core Technologies |
|---|---|
| **Autonomous Driving**  **V2X Communication**  **Integration & Miniaturization**  | **SiC (Silicon Carbide)**<br>**GaN (Gallium Nitride)**<br>**FD-SOI PCM**<br>**(28nm FD-SOI + PCM)** |
| **Active Safety**  **Greener**  **Connectivity**  | **BCD10 (90nm)**<br>**40nm eFlash**<br>**FD-SOI (28nm)**<br>**RF-CMOS BiCMOS** |
| **ICE Power Train:** 33% Share<br>Market Leader ASIC/ASSP  <br>**Passive Safety:** 17% Share<br>Integrated solutions for<br>Airbag and Braking  <br>**Car Audio:** 40% Share<br>#1 in Amplifiers, strong in<br>Premium Audio, DAB, Tuners  <br>**Body:** 45% Share<br>Market Leader in<br>Door Control, Lighting  | **BCD9 (110nm)**<br>**90nm eFlash**<br>**VIPower**<br>**LV-PMOS** |

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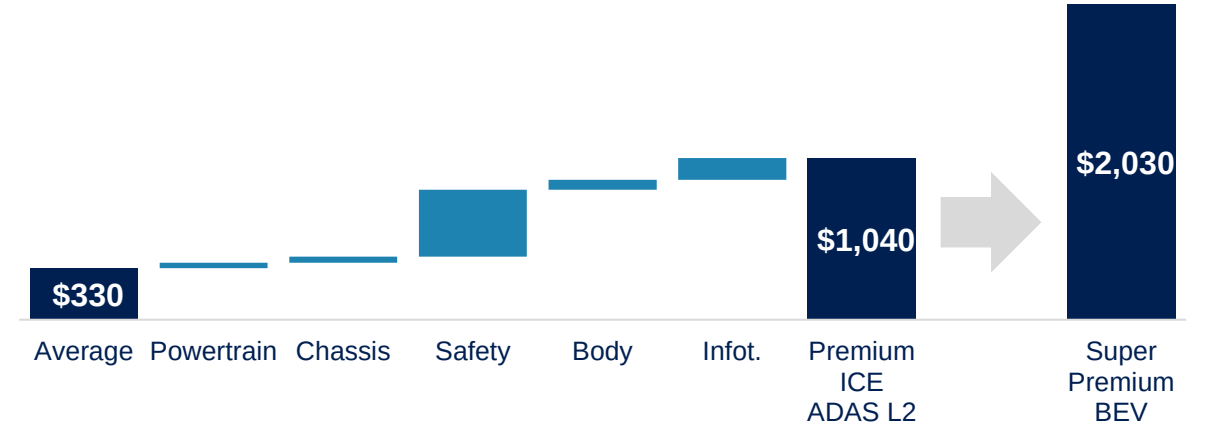
# Transformational Trends: an Opportunity

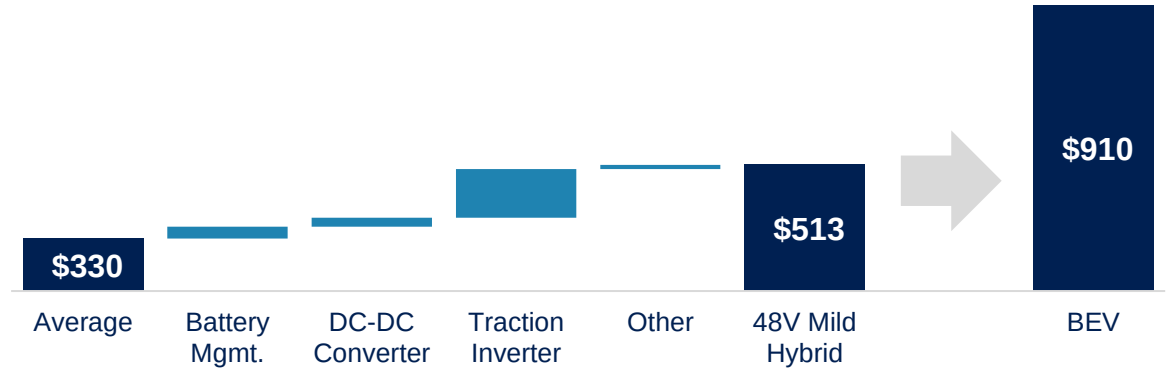


## Silicon Content

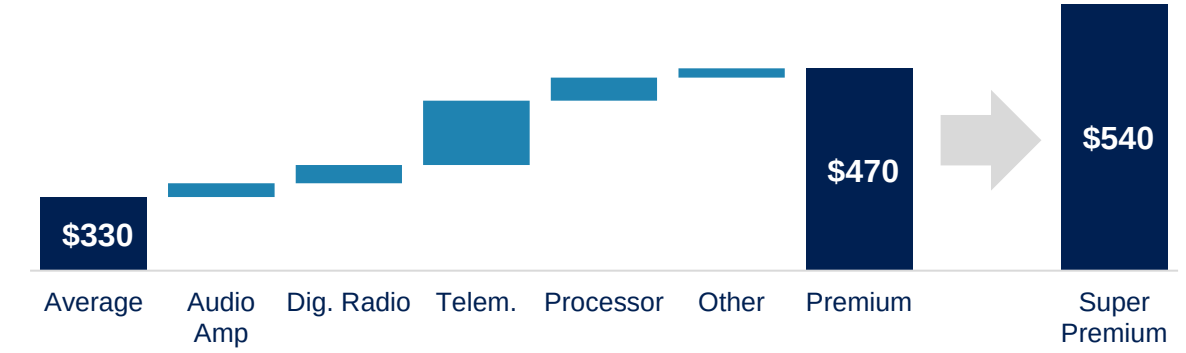
### Premium vs. Average Vehicle



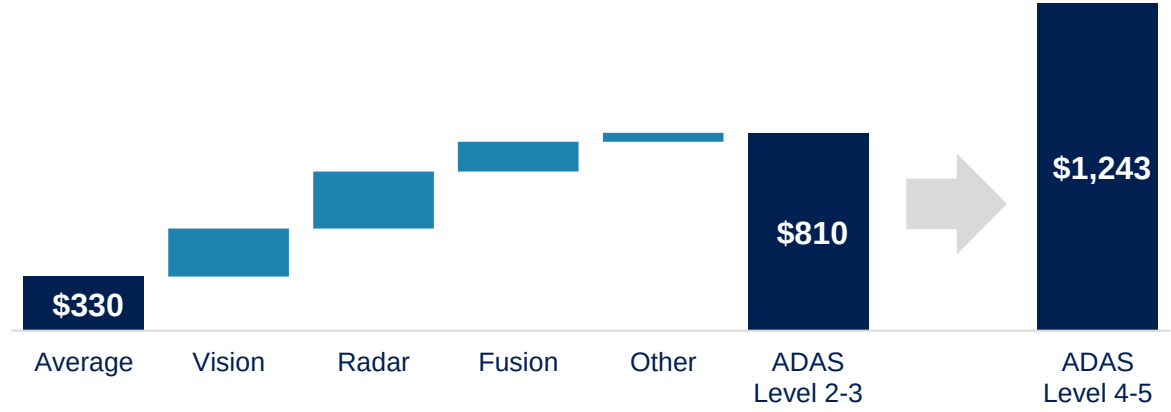

### Electrification




### 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

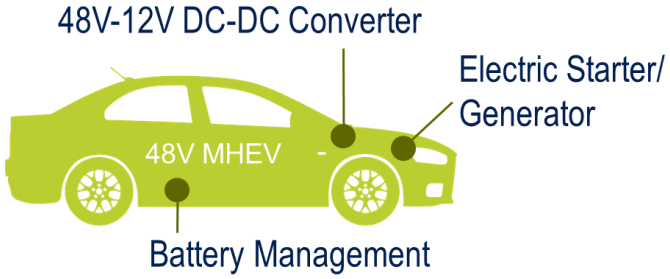
$2.6B 2017 ICE Semi market value

Euro4 vs. Euro6
**$23 ➔ $34**
Semiconductor Content

**~65% less NOx(*)**

### Mild Hybrid 48V
Low-end entry level electrification

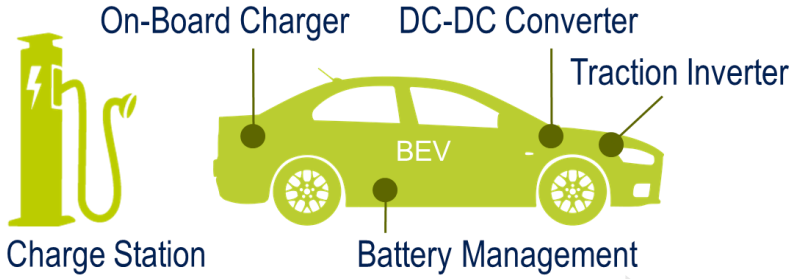
Affordable solution for entry level electrification
Added electronic content compared to ICE




**~15% less $CO_2$**

### Battery Electric Vehicle
High-end battery-based full electric car

Disruptive market change vehicle boosting
electronic content per vehicle




**Zero $CO_2$ Emissions**

Lower Emissions and Increasing Semiconductor Content

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

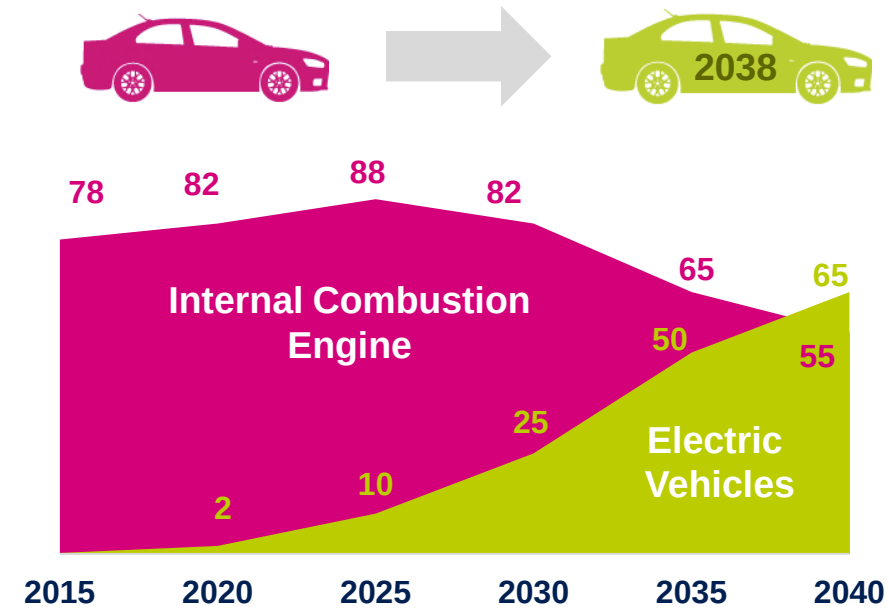
(*) European emission standards referred to diesel passenger car (Euro4 vs. Euro6)

# Improving the Internal Combustion Engine

## Emission Regulation Boosting Silicon Content And Value

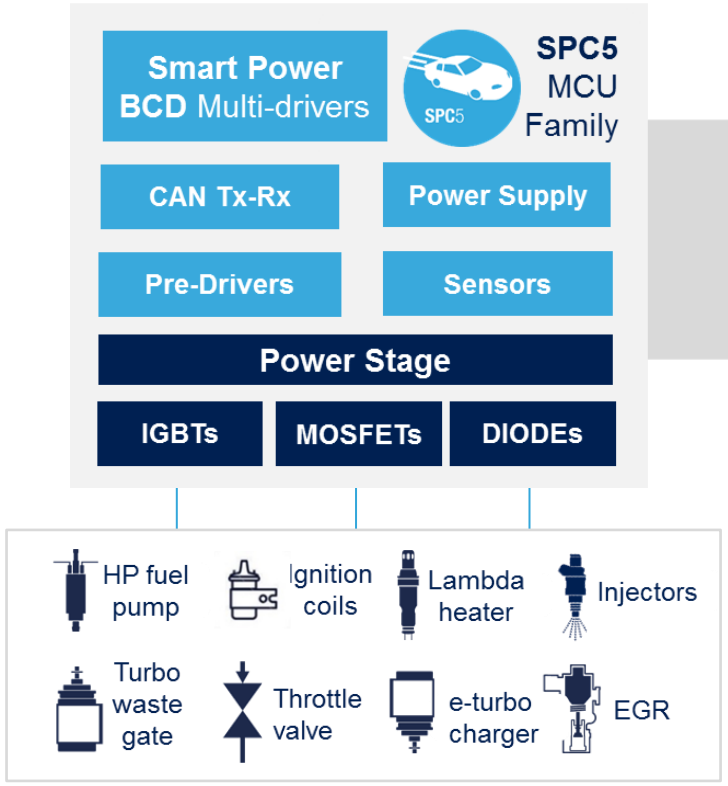


**ICE** still strong in the years to come…

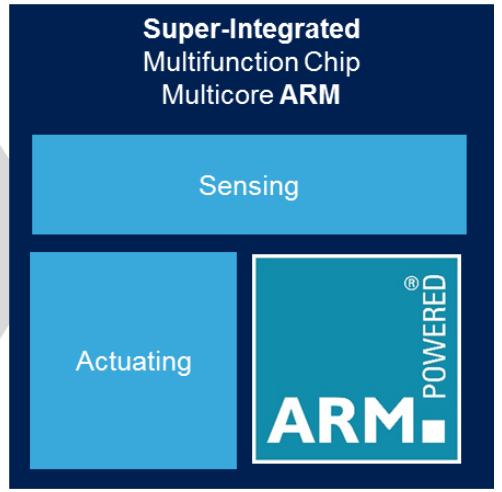



Electric vs. ICE Vehicle Sales Mu

**2018** Complete System Solution




Leading Edge Innovation




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

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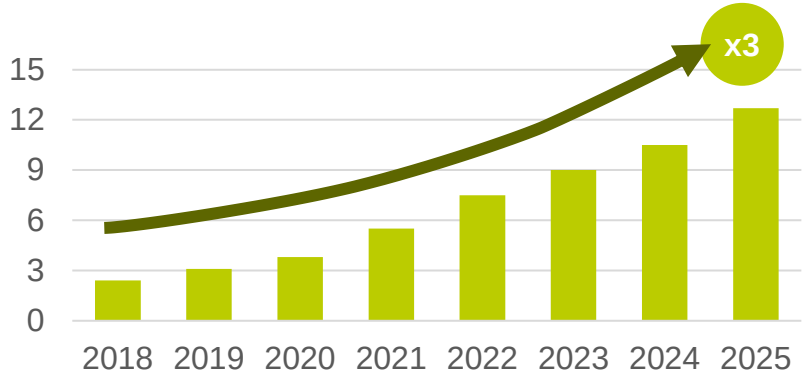
# Affordable Solutions for Entry Level Electrification

## Mild Hybrid Vehicles Mu*




**~13M Vehicles** in 2025

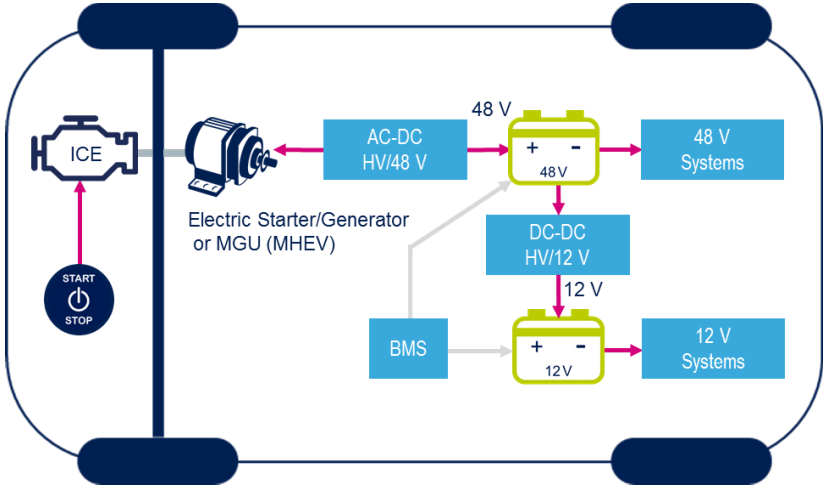
## 48V Mild Hybrid Benefits

$CO_2$ 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


## 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

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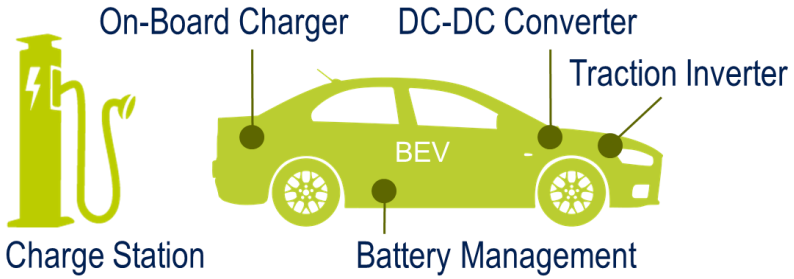
*Source: Average of estimations of IHS Markit, Continental, IDTechEx, Bloomberg

# Battery Electric Vehicles

## Disrupting the Market



## Battery Electric Vehicles




## ST working closely with OEMs

Engaged with key players in **Car Electrification**

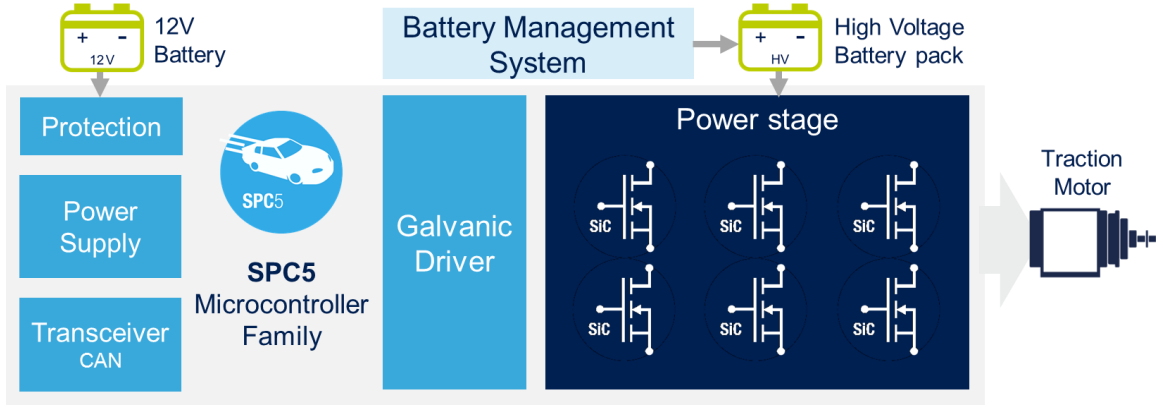
Supporting Car Makers with power modules on a worldwide basis

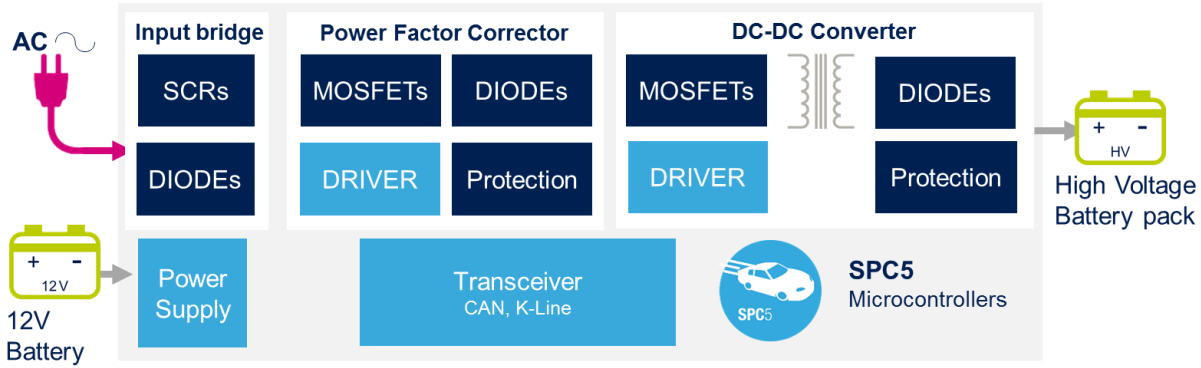


**7x** in **Europe**
**4x** in **America**
**8x** in **China**
**3x** in **Japan**
**2x** in **Korea**

**~85%** of the projects include **SiC** products

## Focus on Traction Inverter, Charging & BMS

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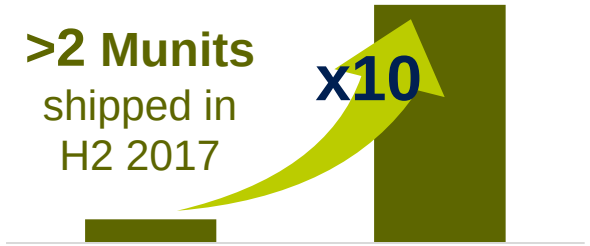
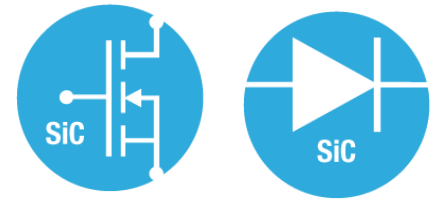
# Innovation in Silicon Carbide for Automotive

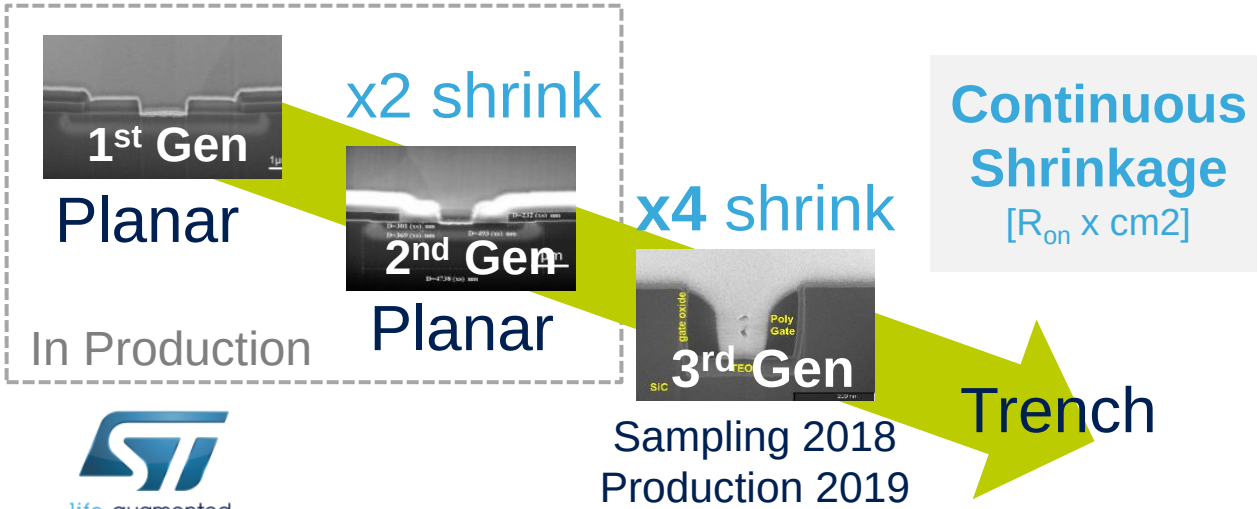


## SiC adoption faster than expected

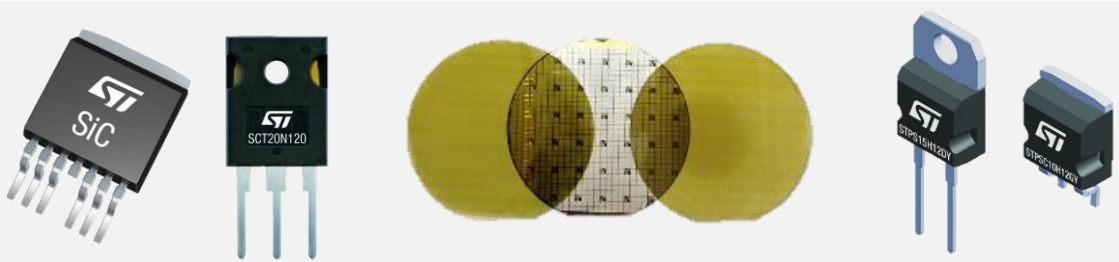



## Front-end Evolution




## Package offer - Discrete – Mini-module – Modules




## Power Modules

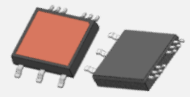
**In Production**


Customer dedicated module

ACEPACK 1

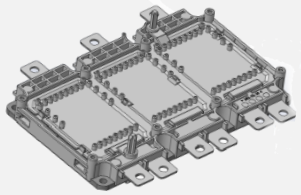
ACEPACK 2

**Production 2019**



SMITpak

**Production 2020**



ACEPACK DRIVE

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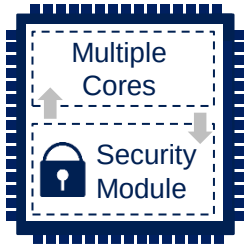
# Increased Data Flows



## Require Greater Security, Processing Power and Connection Speeds

### Security
MCUs & Processors with Embedded Security

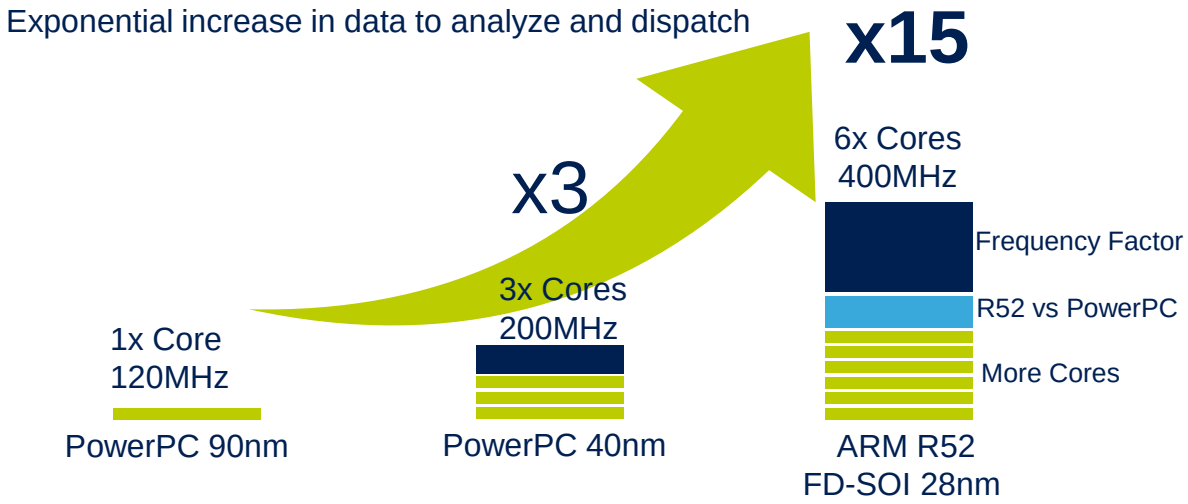



- Specific Microcontrollers dedicated to automotive, to secure all applications:
  - Power Train
  - Braking
  - Steering
  - Gateway & Connectivity
  - ADAS & V2X
  - Infotainment
- Embedded Hardware Security Module
- Security Level (EAL3/4)
- High data-rate encryption/decryption to manage data streams

SPC58

TELEMACO 3P

### ECU Processing Capability
Increase required in many automotive domains




### 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

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# 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

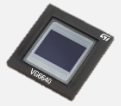
- Mobileye 5th Gen (7nm FinFET) → 6th Gen (7nm FinFET)
- Radar 28nm FD-SOI
- V2X (Wi-Fi 11p)
- Teseo Precise GNNS (<30cm)
- 360º ASIC Vision Processor

## ADAS solutions through Distribution and IDH in China

New

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


Processor



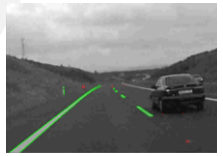
Sensor

Packaged in a small module

**Rear View Camera**

**Overhead View**

**Basic Lane Detection**



**Obstacle Detection**

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# PDG: A Solid Market Presence



## Product Sub-Group Portfolio

**Industrial**

**56%** of PDG Revenues

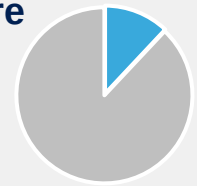
**Automotive(*)**

**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

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(*) 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

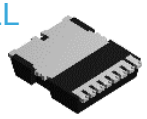
Historical Leadership
In a ~**$1B TAM market**

**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 

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

### HV Leading position in main application domains

**Server Farms - UPS**
Telecom, ICT & Industrial Domain

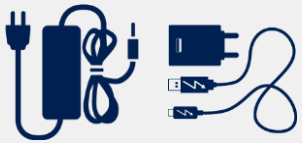
High Power
500W - 3.5KW

**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

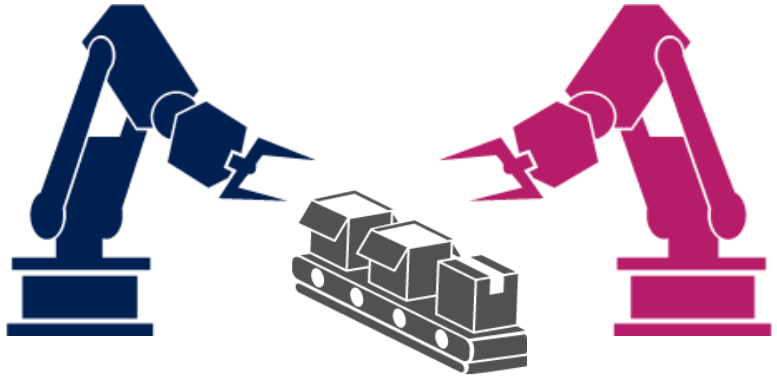
# Energy Efficiency for Smart Industry



## 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 ~**250** M$

2024 >**700** M$

**Full SiC Module Growth**

**+31**% 2017-2024 CAGR

ADG targeting **>20**% share by 2020

### ST SiC Technology Key Performance

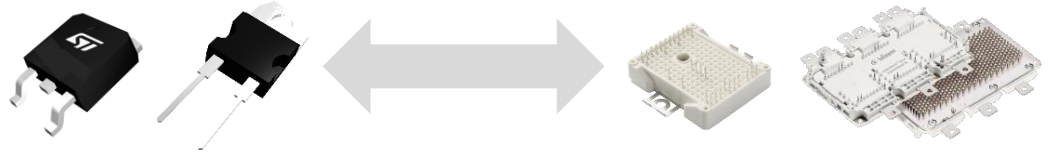
- Energy saving up to ~150 times cost of investment over product lifetime(1)
- Power board shrinkage up to 70% vs. Conventional IGBT solution
- Reducing size and cost of passive components elements

### ST Dedicated Solutions

SiC — **From 650V up to 1200V** single and dual diodes

SiC — **From 650V up to 1700V** MOSFETS

**DISCRETE** **MODULE**



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(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

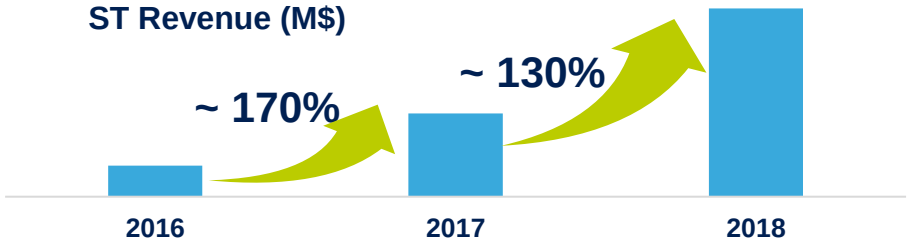
- Indoor Fans
- Power Converters
- Main Inverters
- Outdoor Fans

- **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



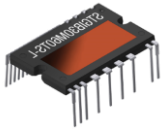

**Best-in-class Ultrafast Power Factor Corrector (PFC) Diodes with enhanced EMI & ESD performances (**)**

**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 9cm$^2$

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

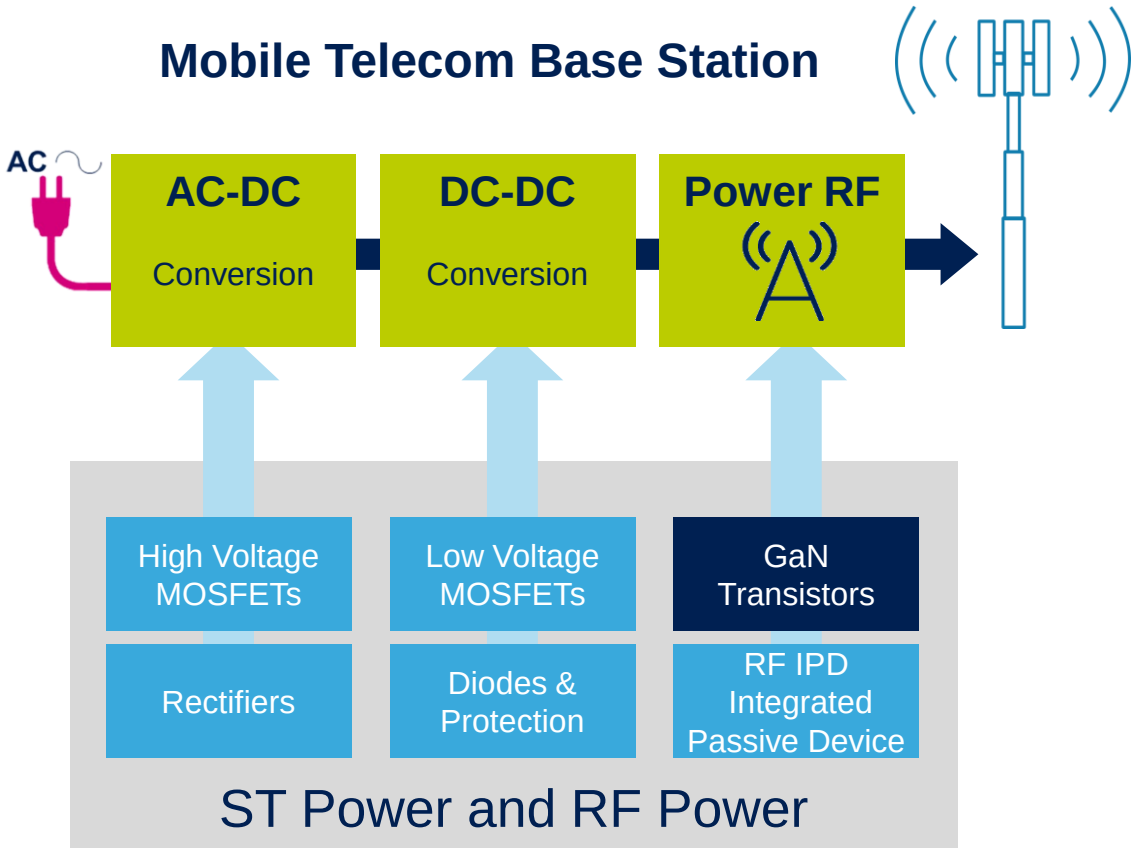
Source: Major Home Appliance Market Report 2017- Global Major Home Appliance Market

# 4G & 5G Basestations



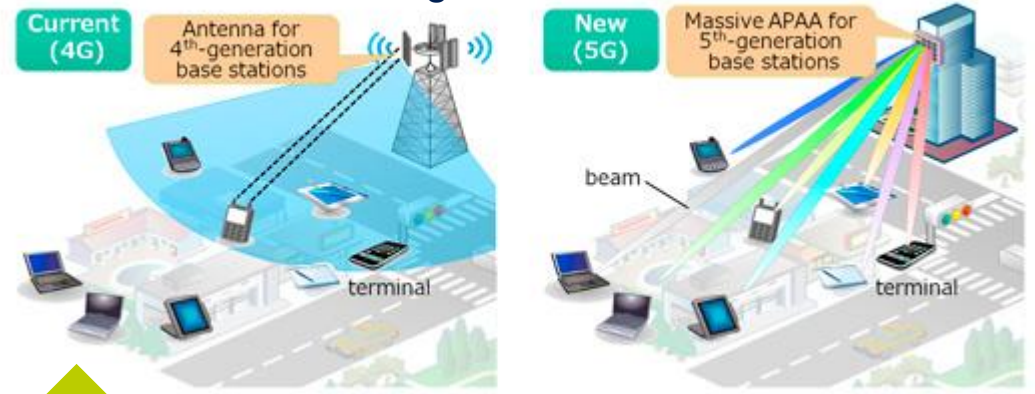
## ADG presence in Communications Infrastructure

### Strengthening ST Position in Telecommunications




### 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

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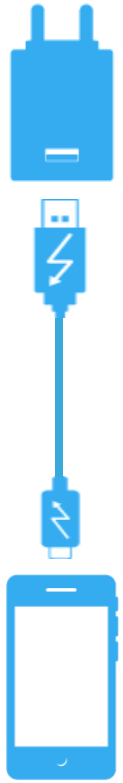
# Smartphones & Mobile Devices



## 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

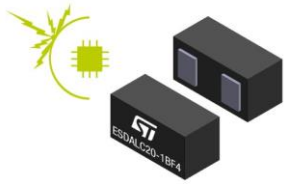
### Innovation Factors

**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**

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# 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

# Microcontrollers & Digital ICs Group

**Claude Dardanne**

President
Microcontrollers and Digital ICs Group

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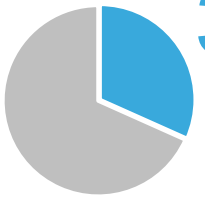

**32%**
of ST 2017 revenues

# 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 1Q17 Growth

MDG **+26%**

Microcontrollers & Memories **+34%**

Digital ICs & ADL **+3%**

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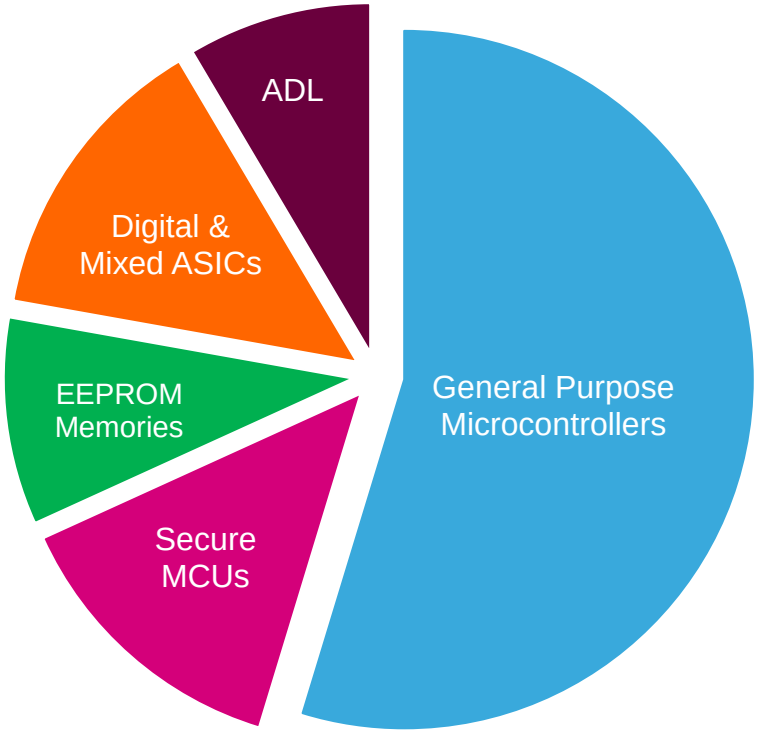
ADL= Aerospace & Defense, Legacy

# 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

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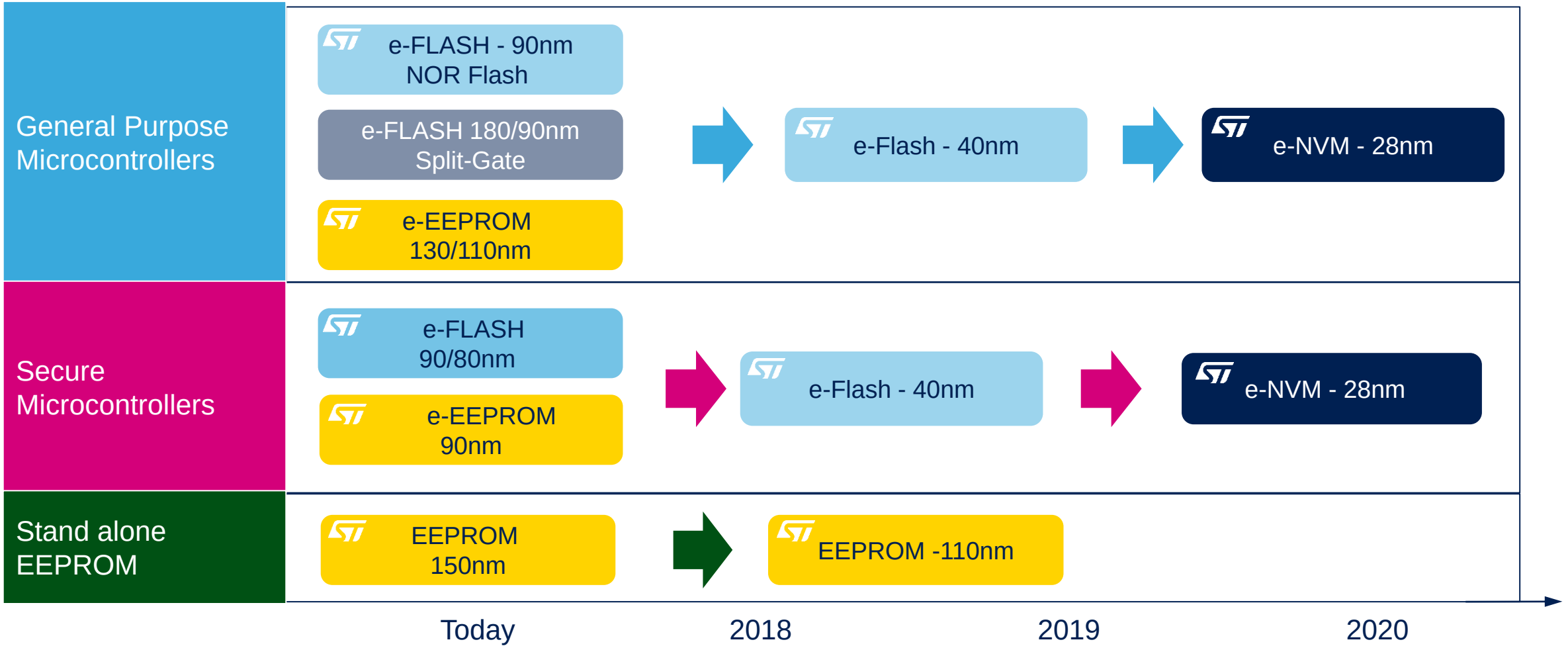
* General Purpose & Secure MCUs excluding automotive MCUs

ADL= Aerospace & Defense, Legacy

# Advanced Technology Roadmap



## Non-Volatile Memory

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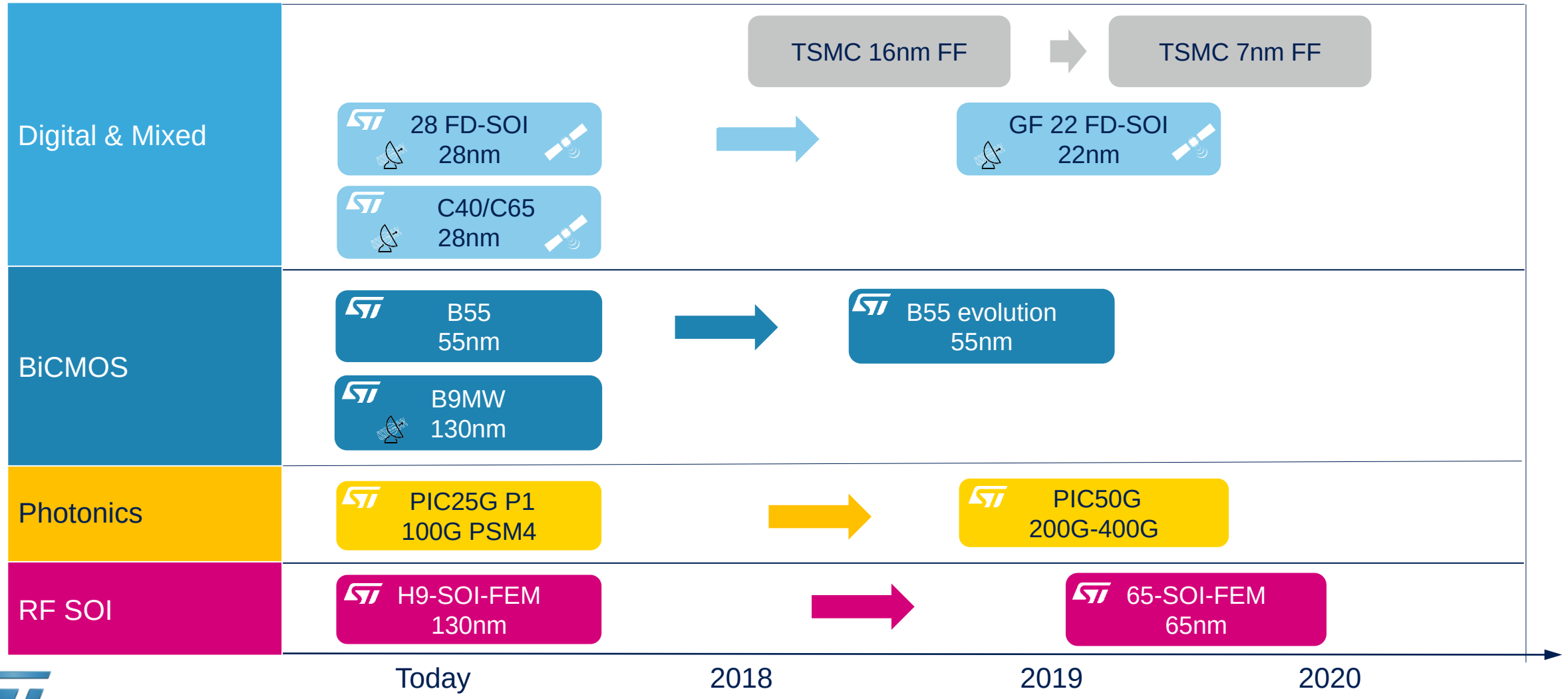
# Advanced Technology Roadmap



## Digital

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# 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 |

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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 |

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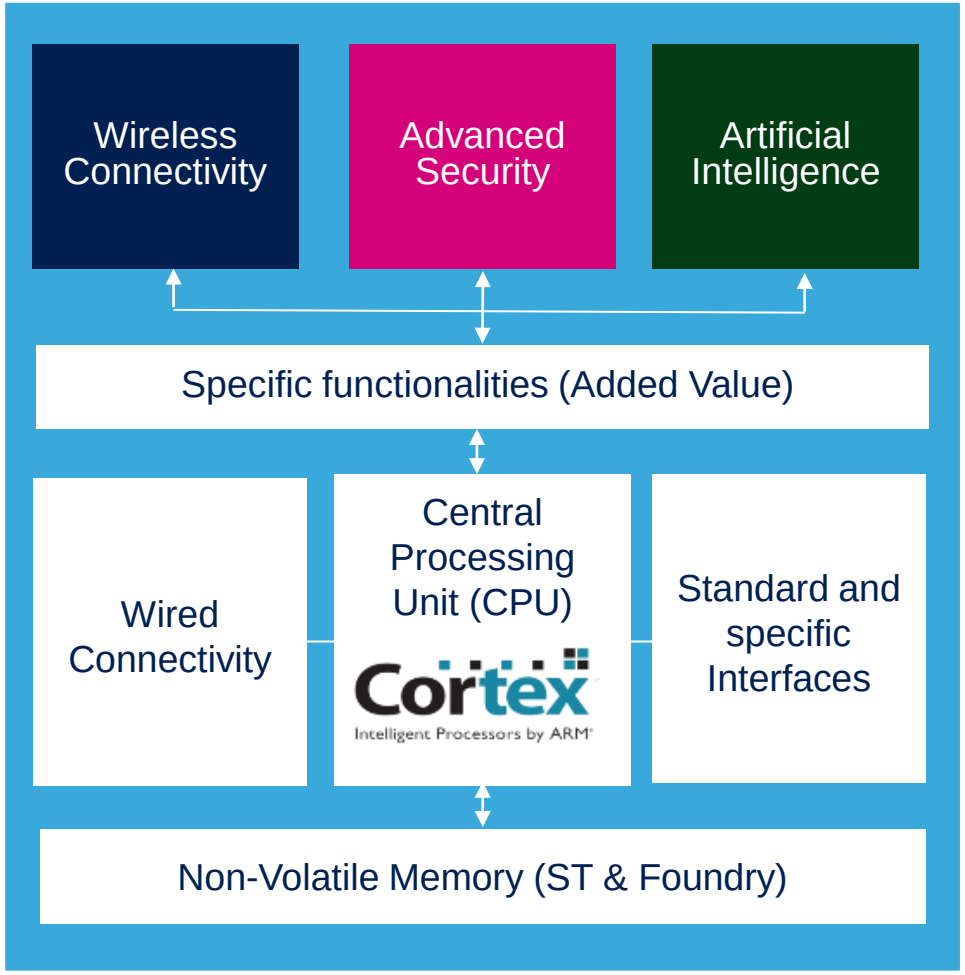
STM32

* MMS sub-group perimeter excluding automotive MCUs

# General Purpose Microcontrollers



Expanded Ecosystem




## 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

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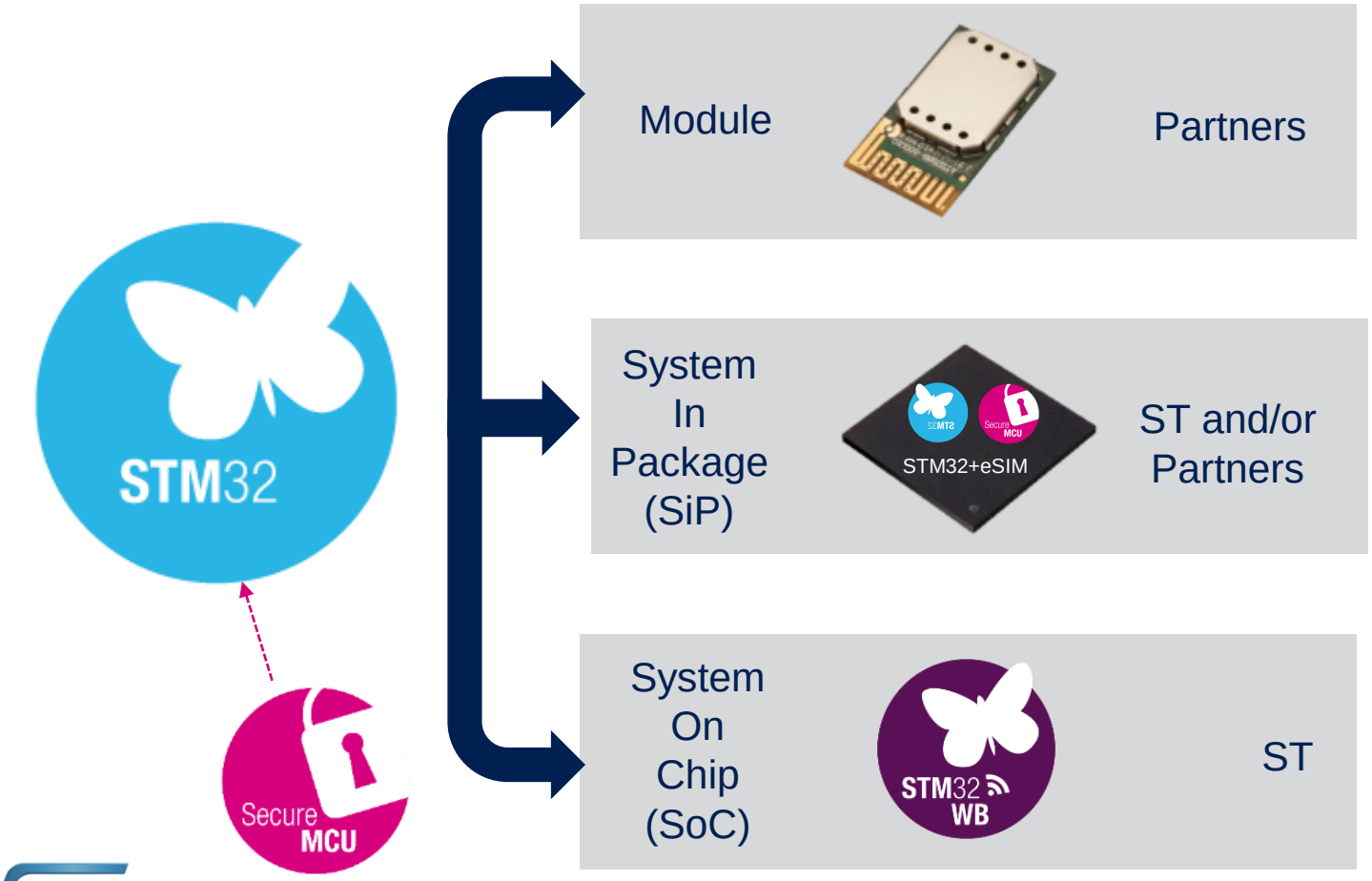
# Connectivity Powered by the STM32

## from Module to Integrated Solutions





# 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

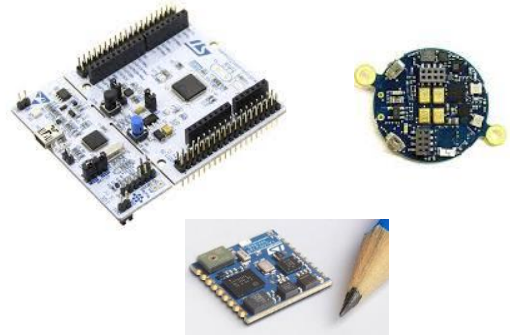
### ST SW tools

STM32 CubeMX.AI

Optimized Neural Network code automatically generated for STM32

### ST AI solution

STM32 + Deep Learning Software



**... bringing AI into the STM32 Portfolio**

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# AI Application Processing Requirements



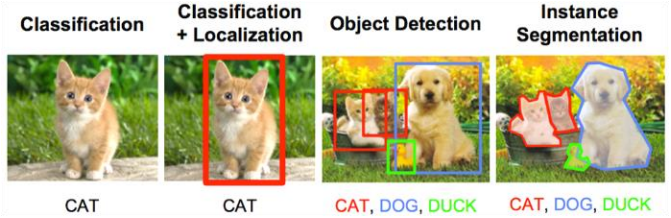
## Low


- 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.

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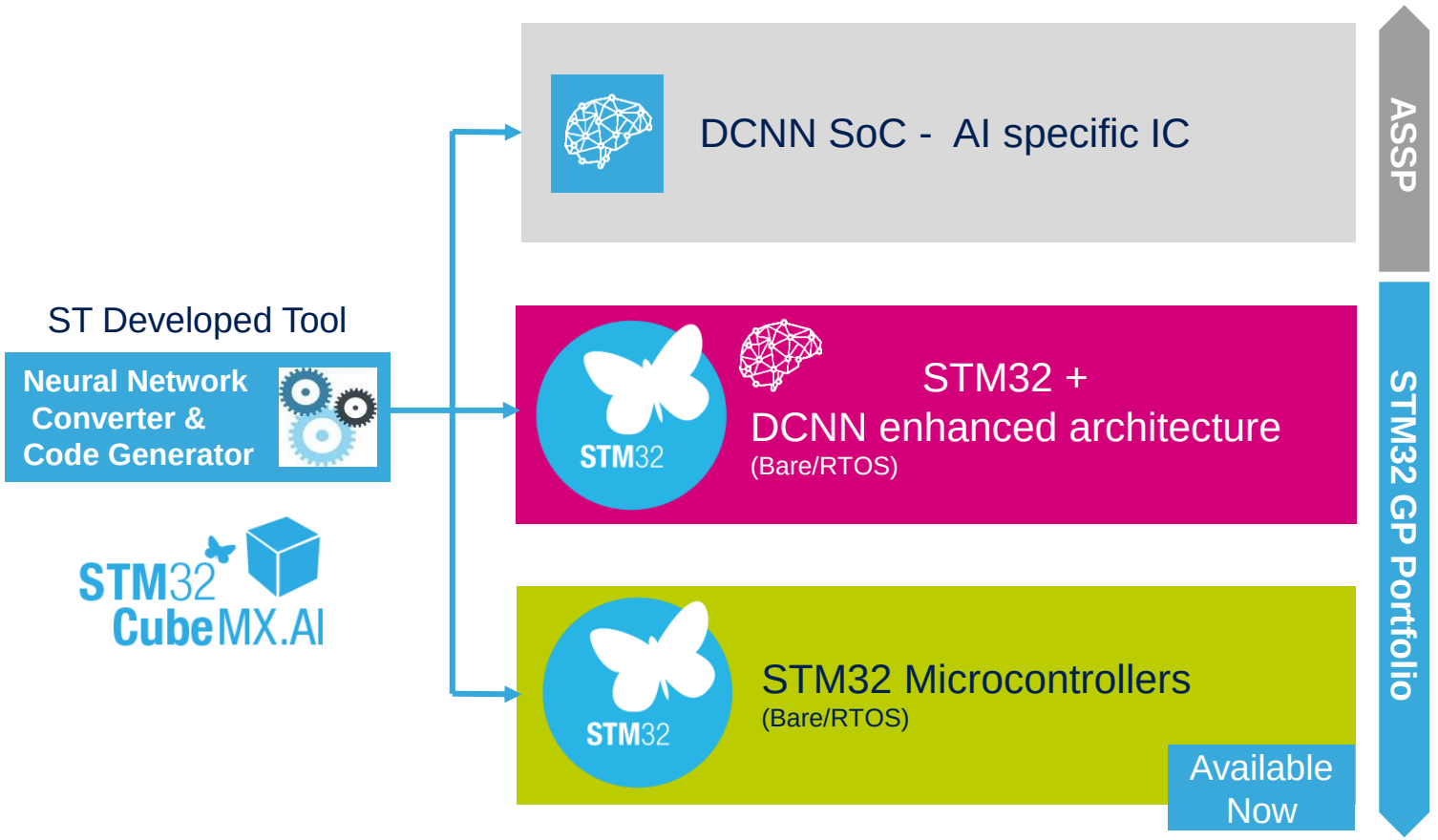
# Artificial Intelligence
## ST Solutions






- 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

DCNN = Deep Convolutional Neural Network

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# STM32
# a Scalable Security Offer


Certified

ST3x / ST5x


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

STM32 eSE

STM32 MCU ↔ STSAFE

STM32 MCU

STM32 MCU

Highest

Basic

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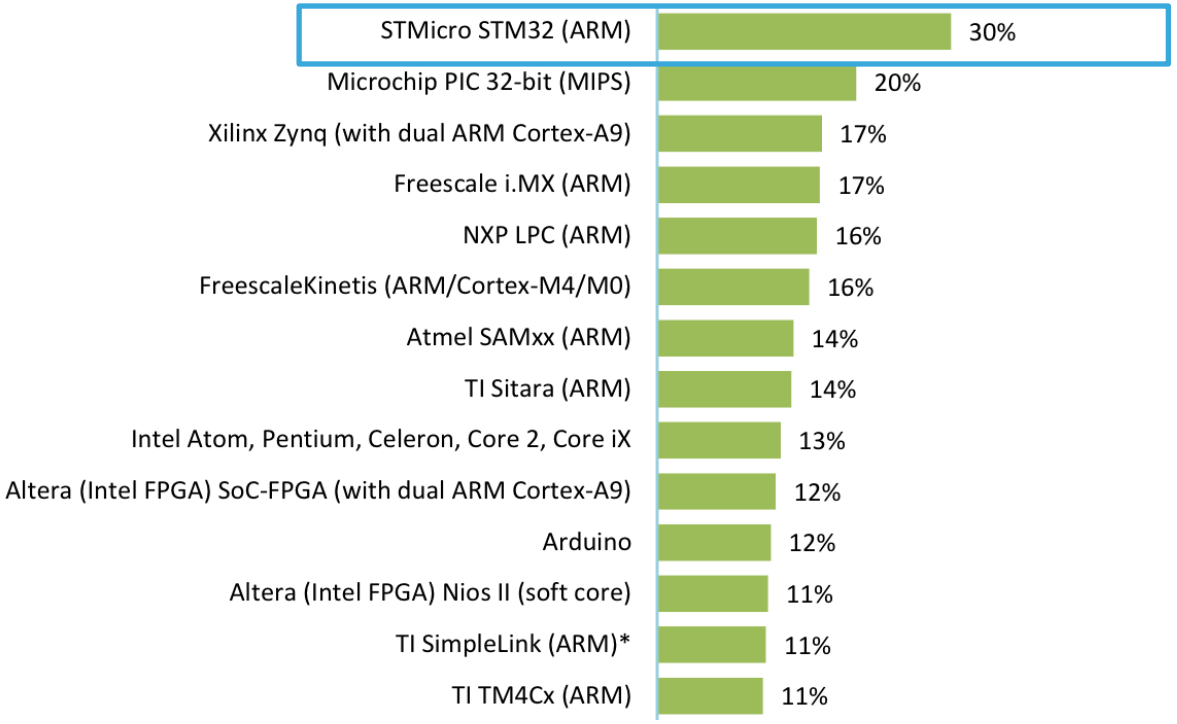
# STM32
# the Leading Choice for Developers

ASPENCORE

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



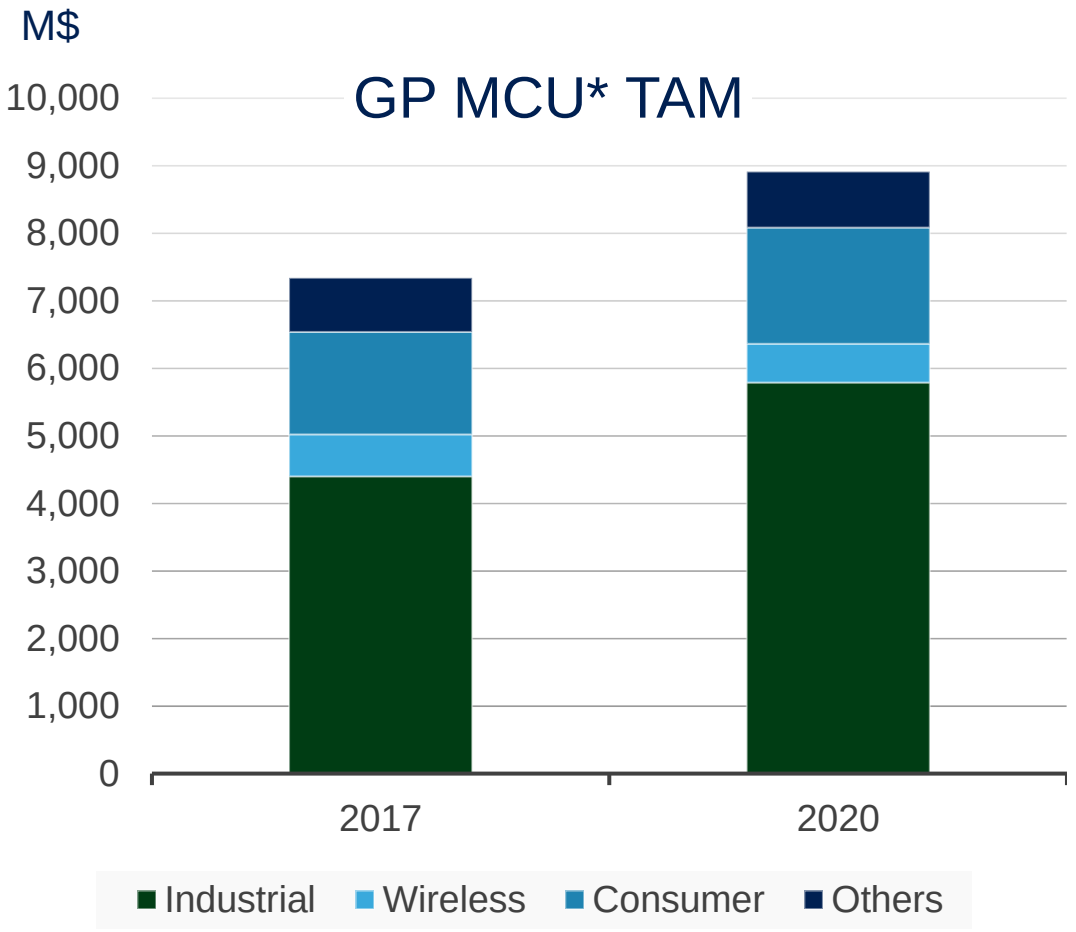

STM32

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%**

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# STM32 the Brain of Many Industrial Applications

## Appliances

## Metering

## Robotics & Automation

## Healthcare

## Power Tools

## Secure Locks

## Surveillance

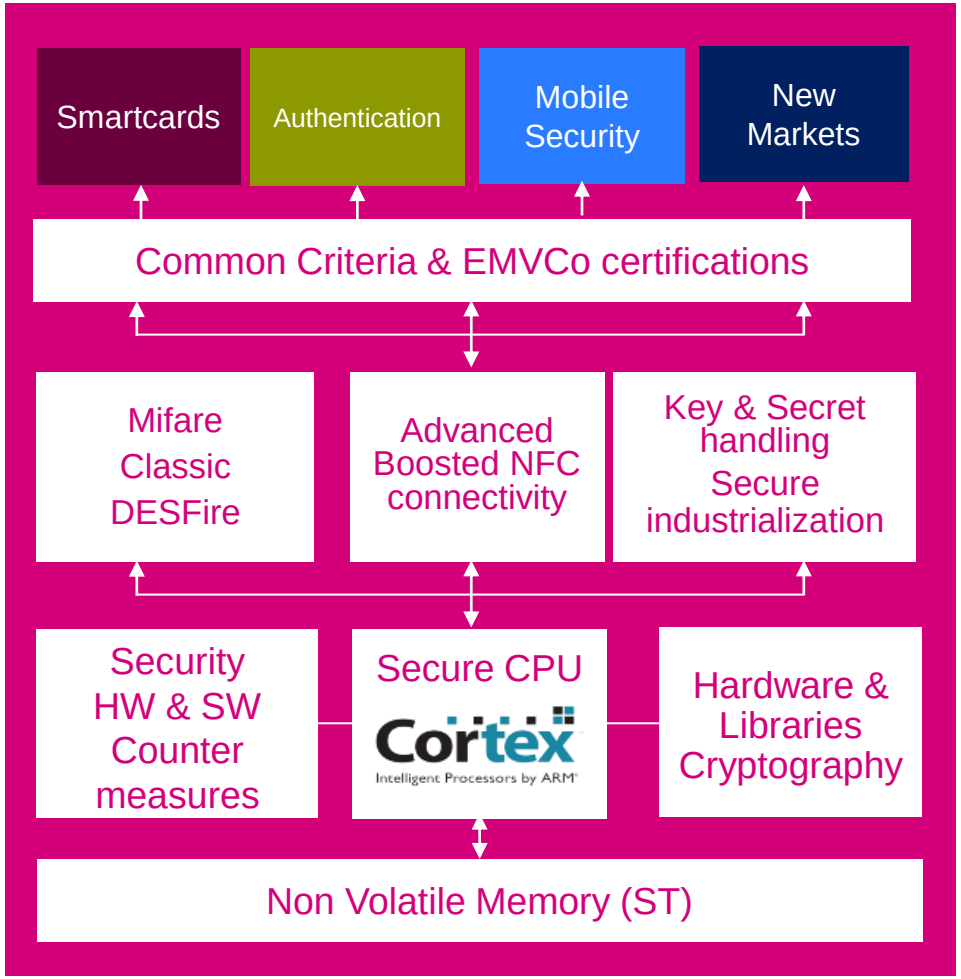
## Smart Homes & Buildings

## Drives, Pumps, Compressors

## Lighting

# Secure Microcontrollers



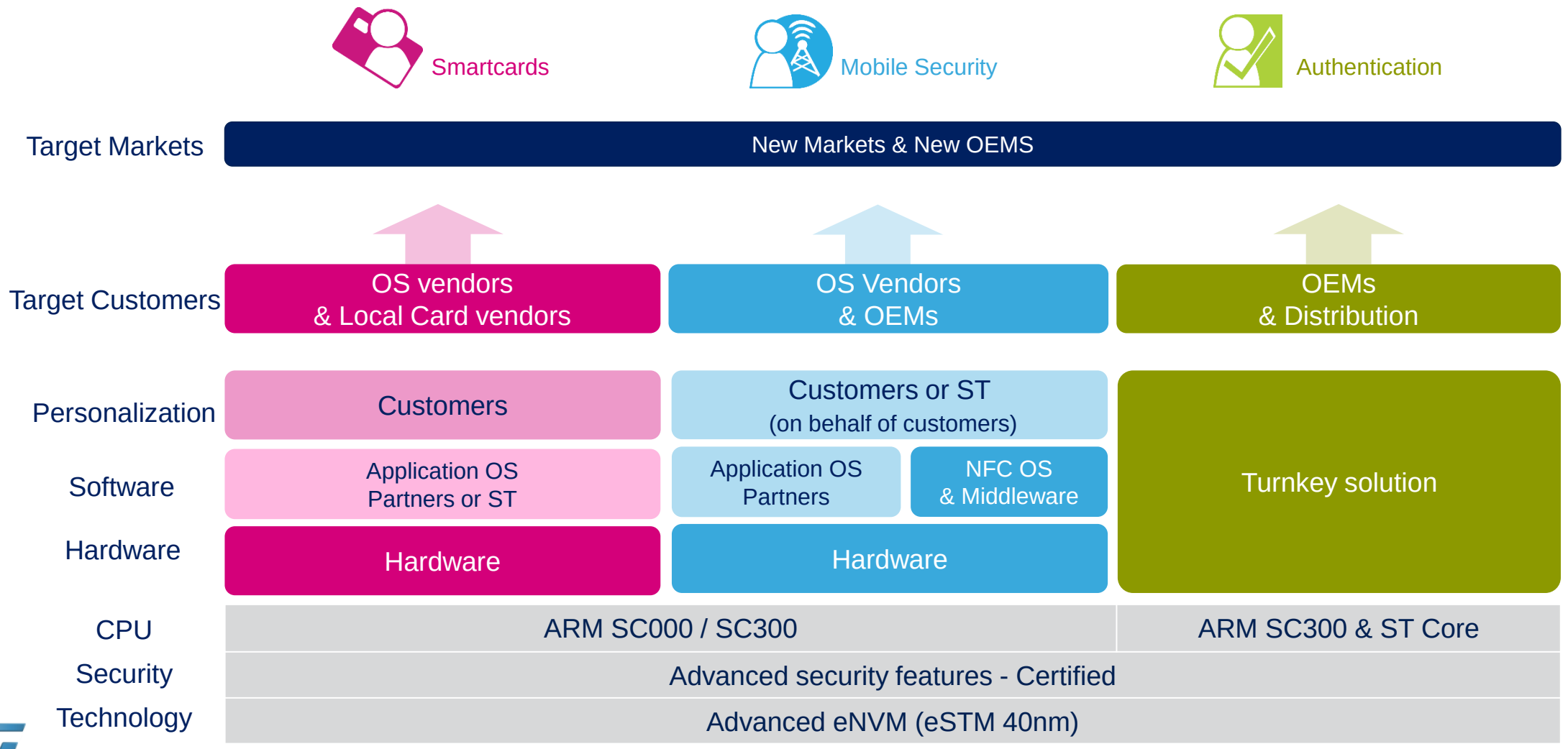



## 2017

- > 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



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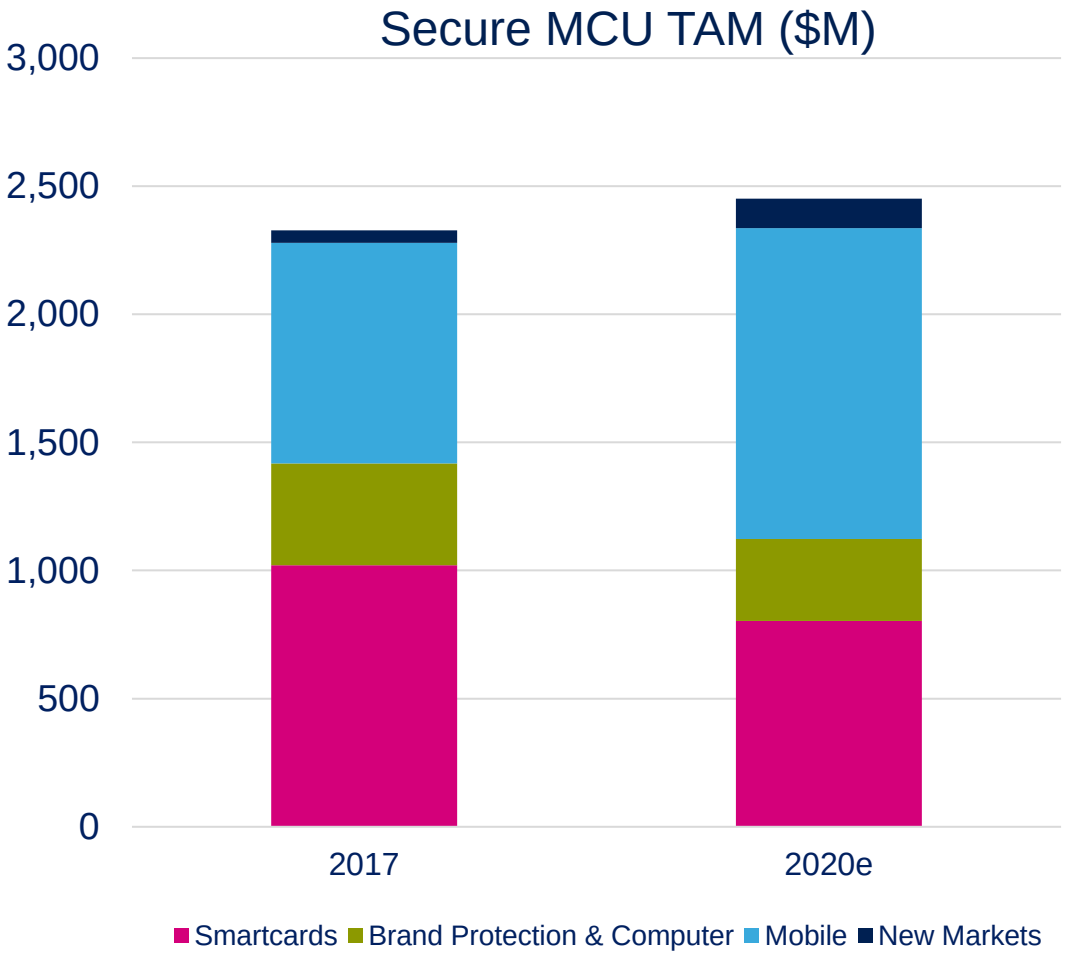
# Secure Microcontrollers



## End Market Focus




### 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%**

Source: WSTS, 2018 and ST estimates

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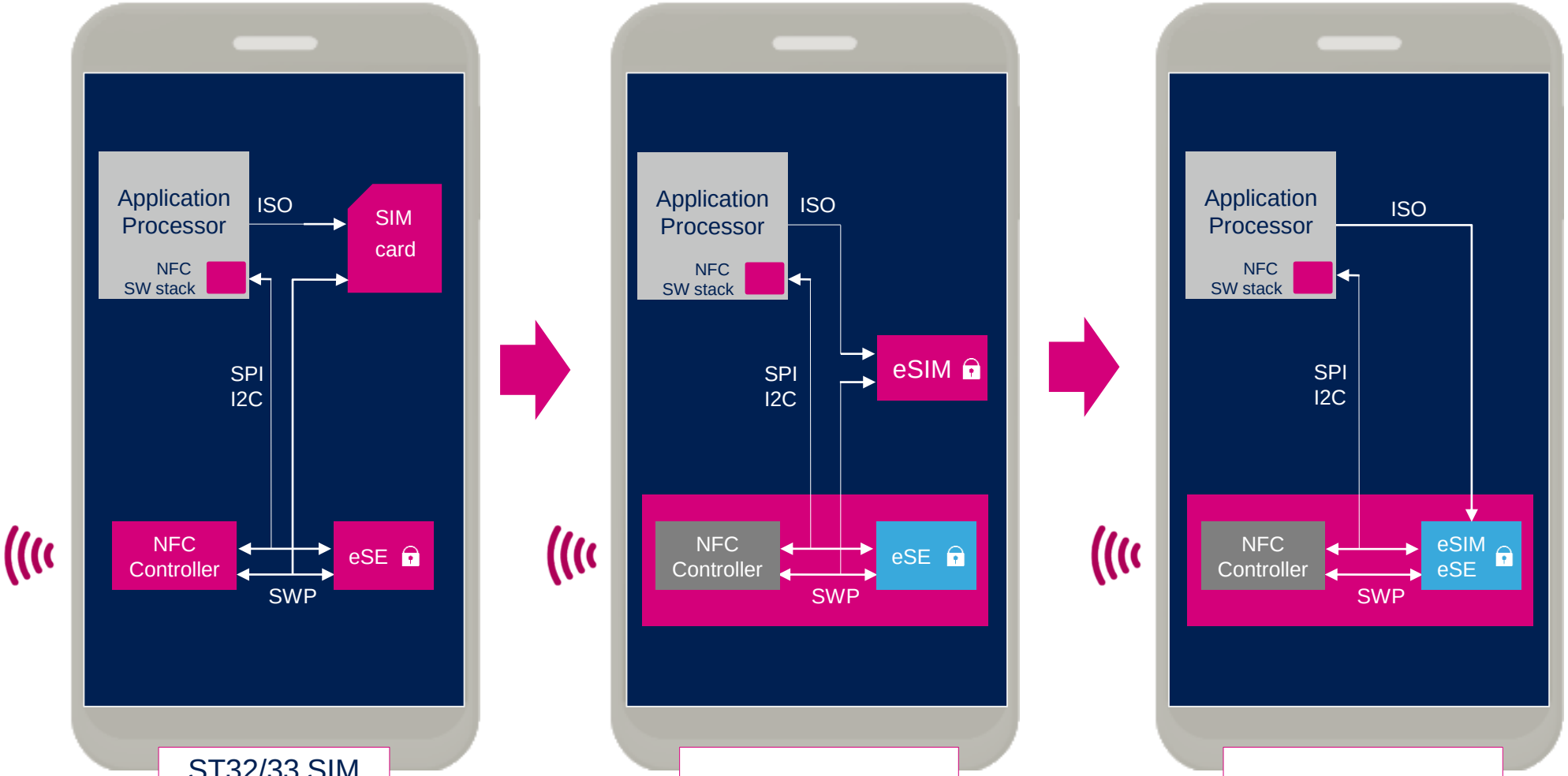
# Secure MCUs
## Mobile Security




ST32/33 SIM
ST21NFCD
ST33 eSE

ST33 eSIM
ST54J (NFC+eSE)

ST54J
(eSIM+NFC+eSE)

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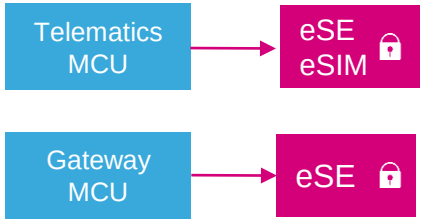
# Secure MCUs
## New Markets



### Machine to Machine

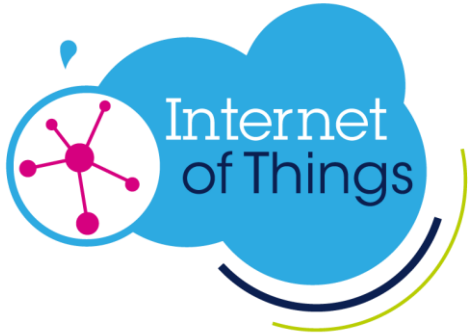

ST32-M
ST33-M
SIM / eSIM M2M

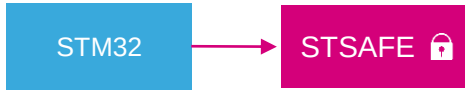
### Automotive




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

### Internet of Things




STM32 , STSAFE

* TCU : Telematics Control Unit

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# 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

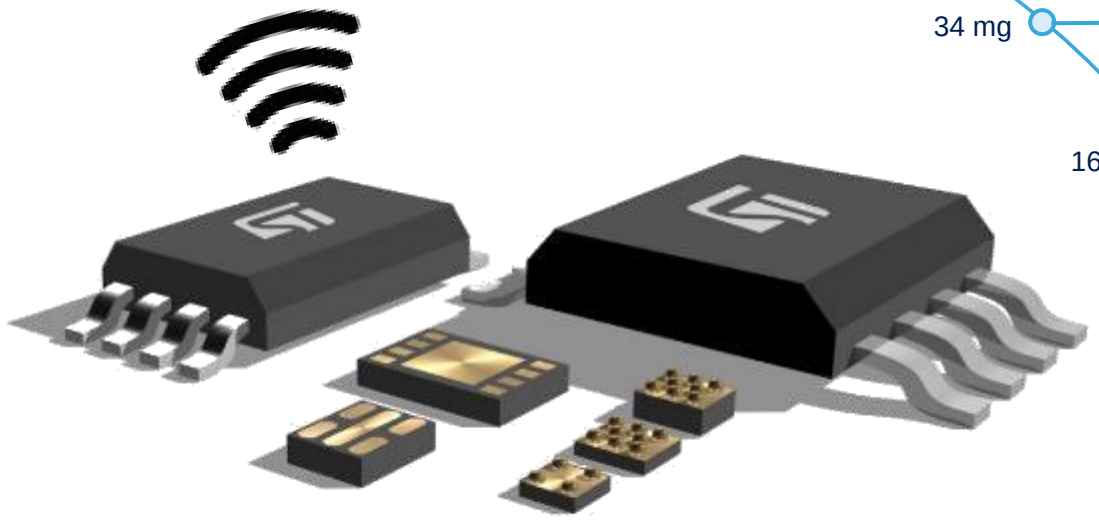
### Asset Tracking

# EEPROM Memory

## Strengthen Leadership



ST25



80 mg — **SO8N** 29.4 mm² Thickness 1.75 mm

34 mg — **TSSOP8** 19 mm² Thickness 1.2 mm

16 mg — **DFN8** 6 mm² Thickness 0.6 mm

6 mg — **DFN5** 2.4 mm² Thickness 0.6 mm

1 mg — **WLCSP** 1 mm² Thickness 0.5 mm

0.4 mg — **Ultra-thin WLCSP** 0.5 mm² Thickness 0.3 mm

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

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# Digital Activity Redeployment



Aerospace & Defense

RF & mmW

Digital & Mixed Signal

| | 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 |

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# 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

# 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** | SPARCLink **A3** | SPARCLink **A4** |
|---|---|---|
| 6 Gbps - SLVS | Standard Interfaces (USB, DisplayPort) | 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**

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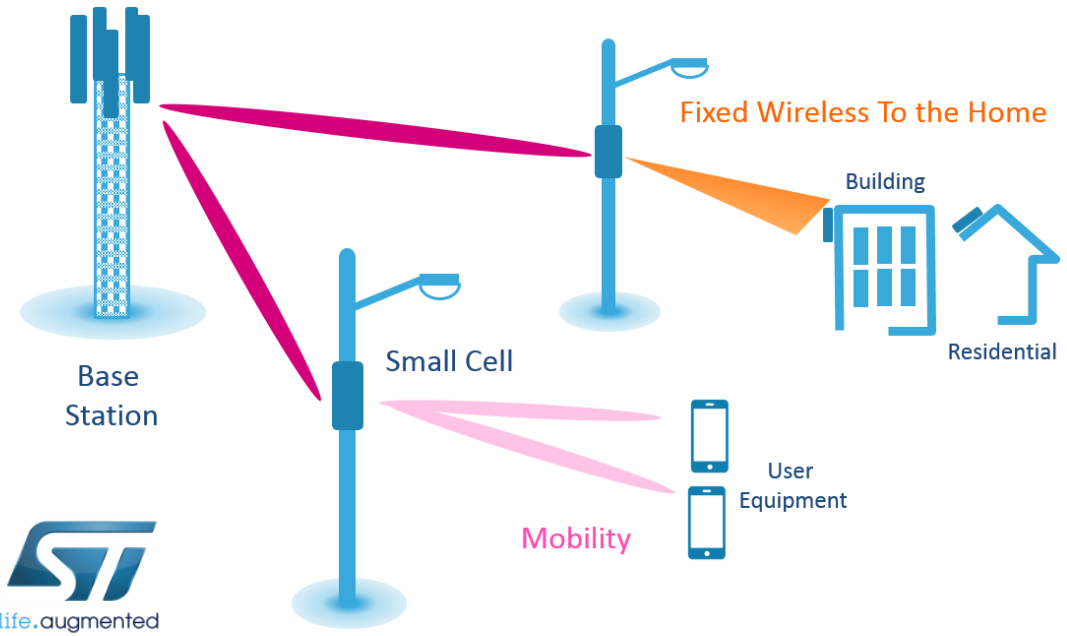
# 5G Network Infrastructure

## 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

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### 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

# 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

# Analog, MEMS & Sensors Group

**Benedetto Vigna**

President
Analog, MEMS and Sensors Group

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**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

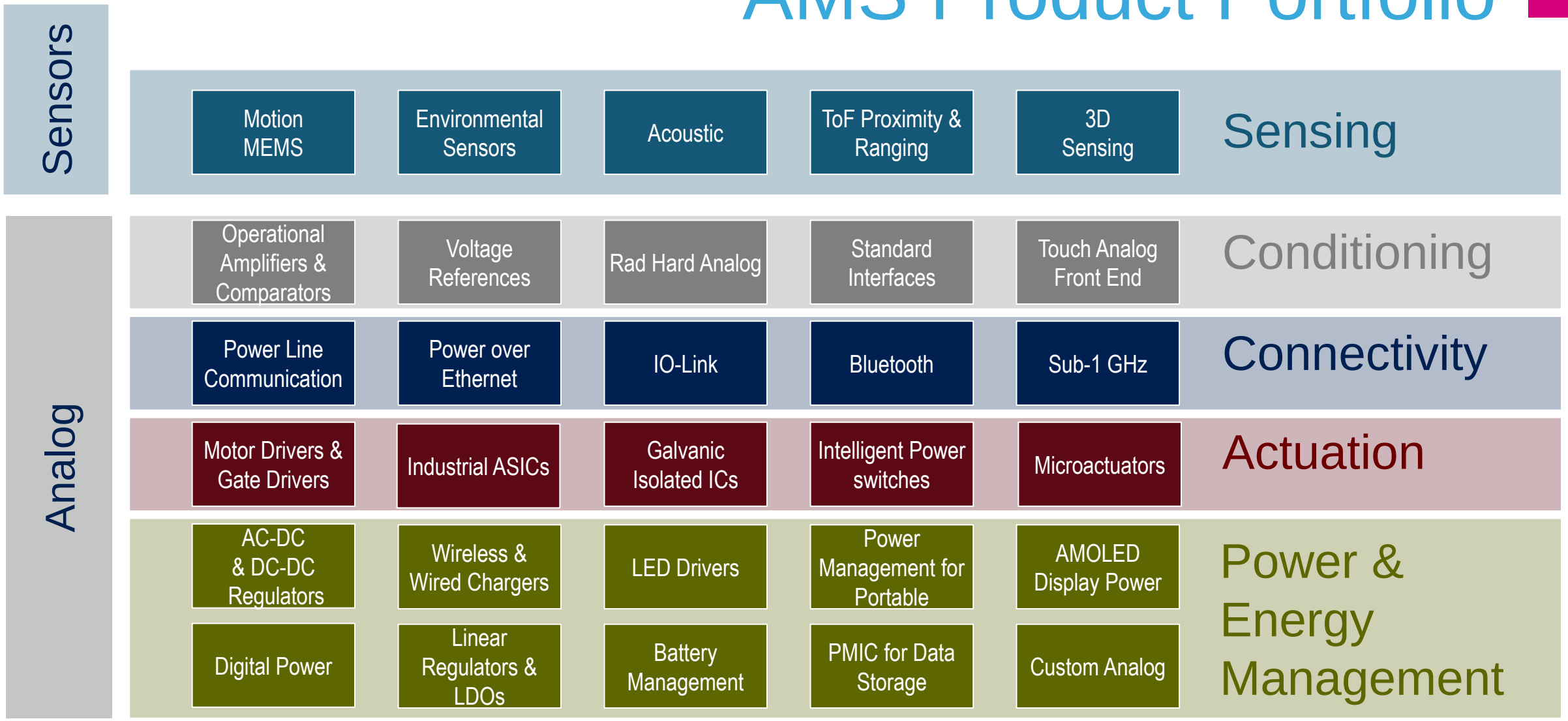
AMS **+27%**

Analog **+19%**

MEMS & Sensors **+35%**

# AMS Product Portfolio



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# AMS Technology Focus

## BCD for Analog



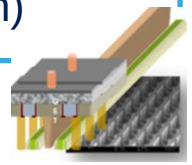
### Increased Digital processing capability

**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)

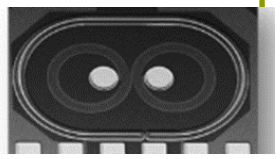


### Power & High Voltage Evolution

**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

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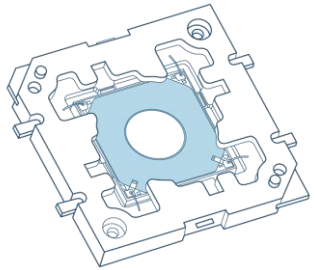
# AMS Technology Focus

## MEMS Sensors & Microactuators





**Thin Film Piezoelectric PεTRA***

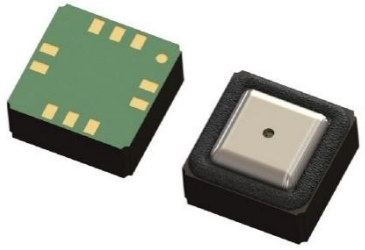
- Innovative piezoelectric materials
- Higher efficiency
- Lower cost

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

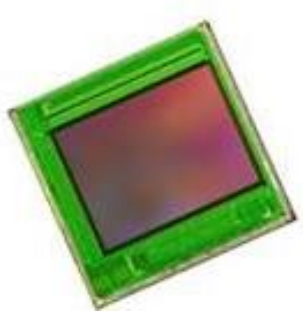



**Time of Flight**

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


**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

Proximity and ranging Sensors for Personal Electronics and Industrial

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

# AMS Manufacturing Strategy



| | |
|---|---|
| **ToF, Specialized Imagers, Analog CMOS** | **Crolles** |
| **Advanced BCD<br>MEMS** | **Agrate** |
| **Advanced BCD** | **Catania** |
| **BCD** | **Singapore** |
| • Advanced BCD<br>• 130 nm analog CMOS for sensor interfaces | Foundry partners |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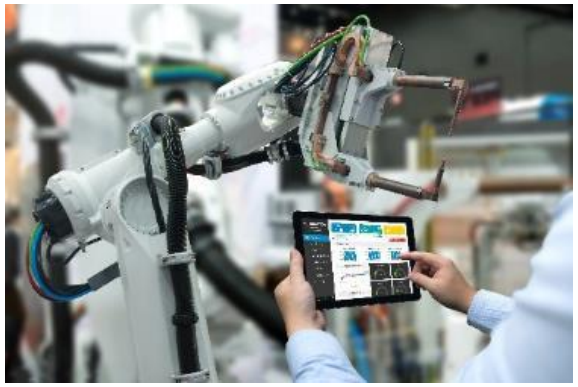
# AMS Balanced Market & Customer Strategy



## 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

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# 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

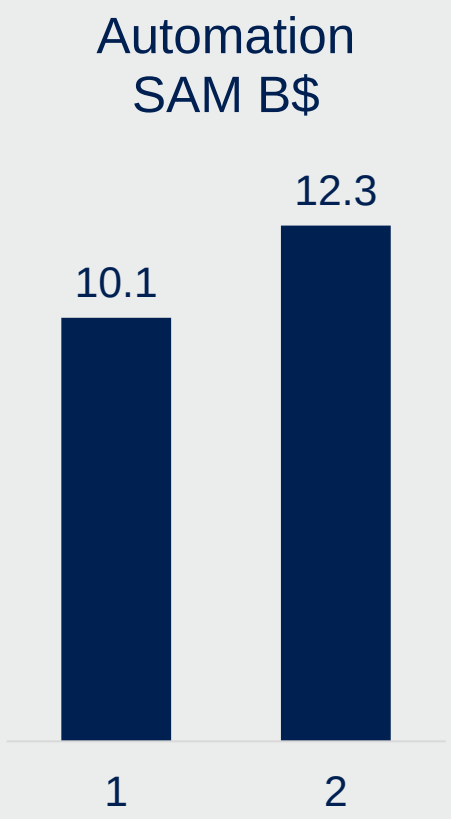
## AMS offering

| 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

# Analog for Factory Automation






## Main building blocks

**Connectivity**

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

**Signal Conditioning & Protections**

**Power & Energy Management**

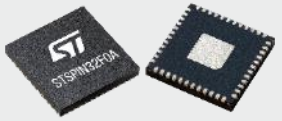
**Motion Control**

- 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

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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

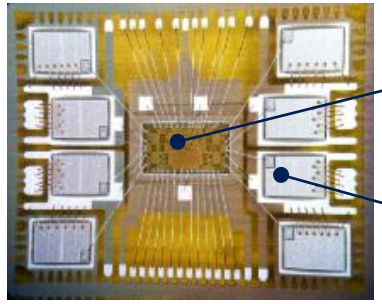
STM32

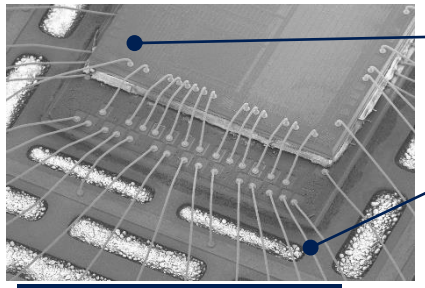
Microcontroller

STSPIN

Motor Control

### System In Package

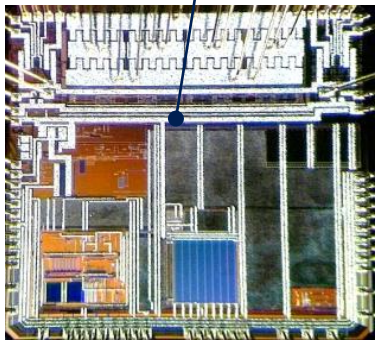



BCD Low Voltage & Microcontroller

### System on Chip

Motion Control with embedded Microcontroller, Memory & Power device



BCD with embedded non-Volatile Memory

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# Analog for Galvanic Isolation



**Key Applications**

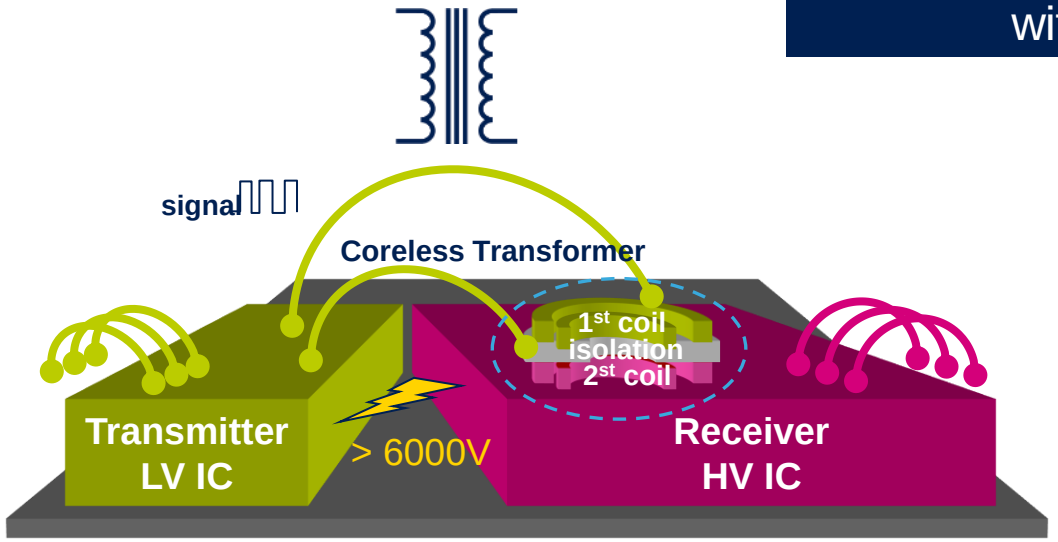
- Motor control
- Factory automation
- Industrial drives and fans
- DC-DC converters
- Welding

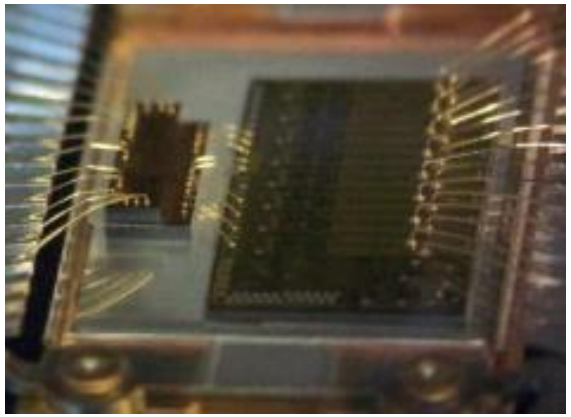
Rugged enough to operate in harsh industrial environments

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**

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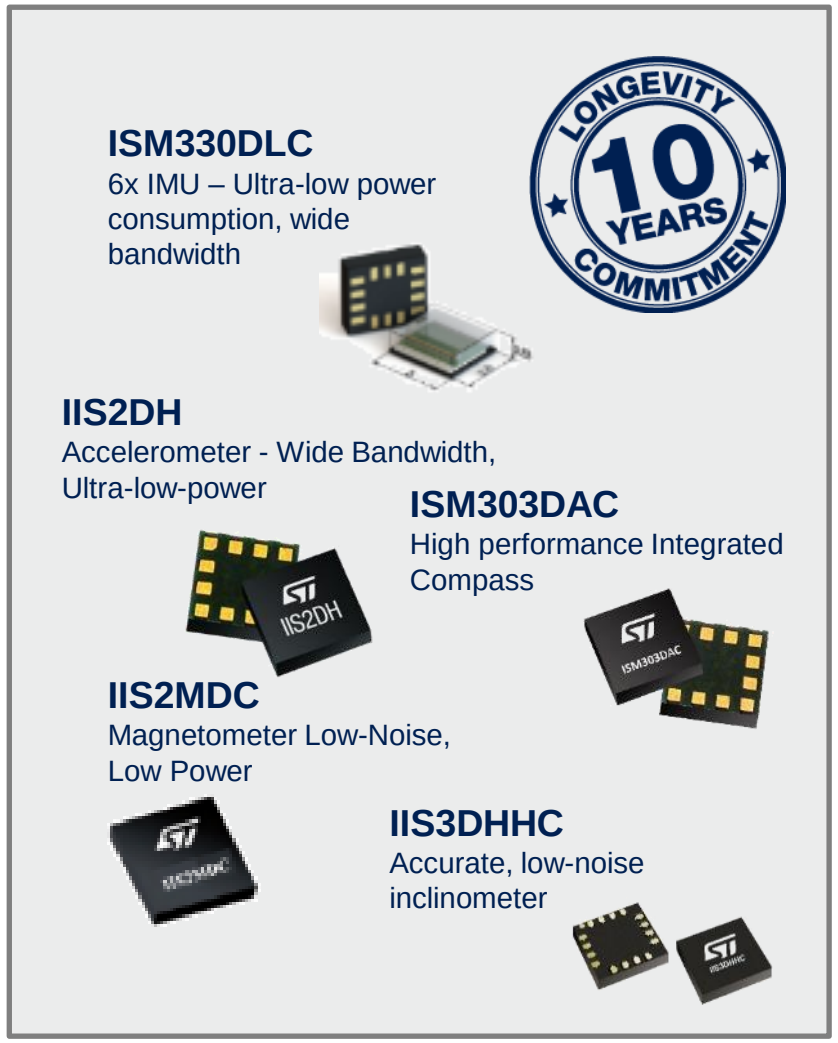
# Sensors for Industrial



Environmental Sensors

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



# 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 |

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# 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

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# Analog for Smart Metering



## Main building blocks

| Smart Sensing | Processing | Actuators |
|---|---|---|
| Anti-tamper & Environmental sensors | Microcontrollers | Relay Drivers<br>Motor Drivers |
| **Connectivity** | **Power Management** | **Signal Conditioning** |
| WAN/NAN Power Line Communication, Radio Frequency | Power Conversion<br>Metrology ICs | 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**

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# Solutions for Home & Building Automation

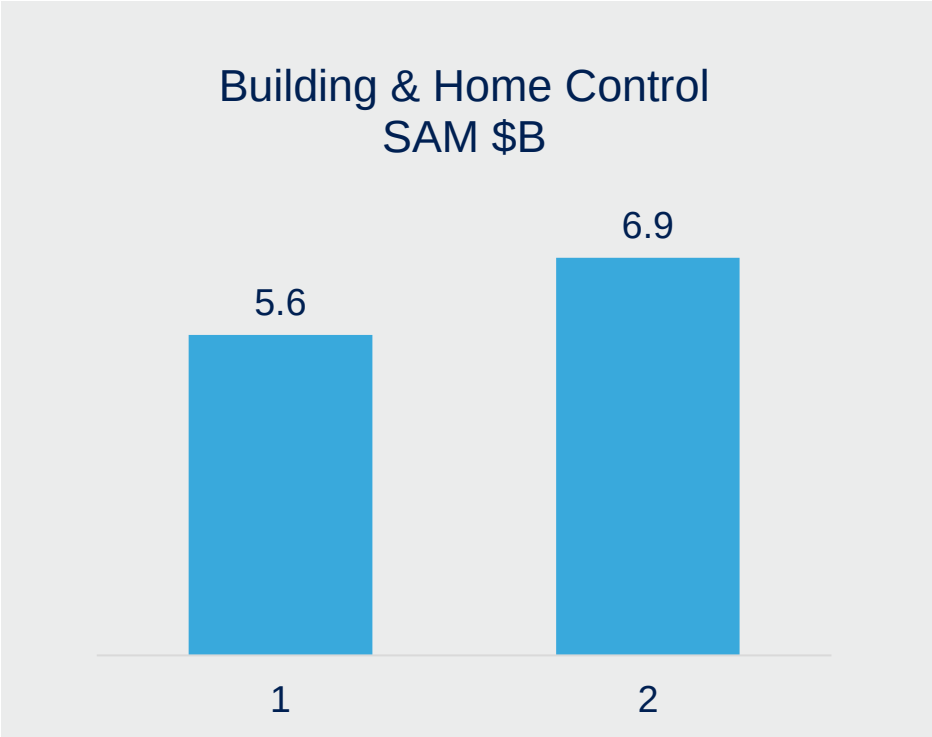


Tiny Transceiver, KNX Certified
Complete Network-Node Solution

light+building
Frankfurt am Main
18. – 23. 3. 2018



Early adopter Vimar for future-focused product line




**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

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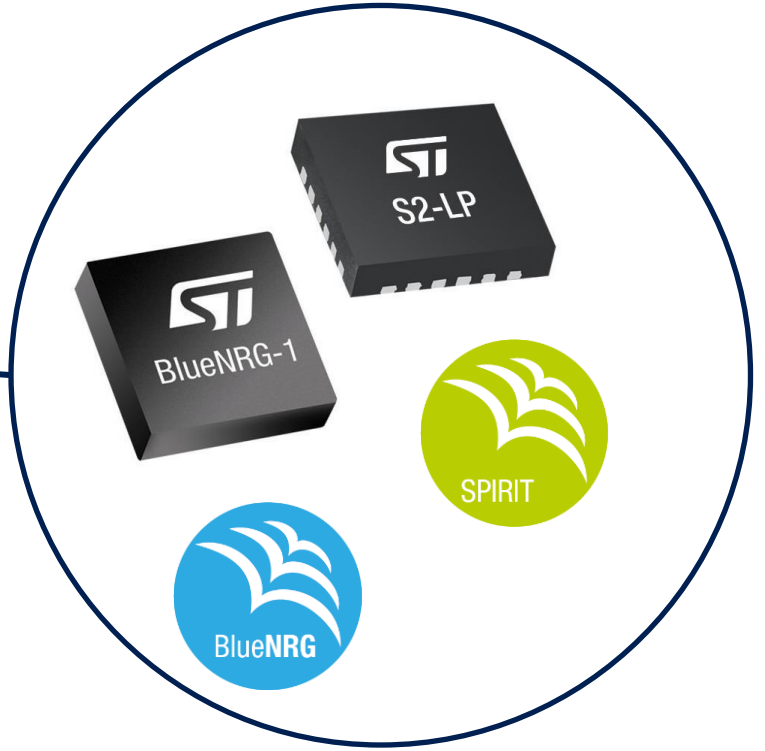
# Ultra-Low-Power Sigfox IoT Module
## with Dual RF Connectivity



**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

JORJIN TECHNOLOGIES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# Powering Connected Devices for Industrial



kamstrup

Smart Water Meter

sigfox

**ST Solutions**

- Sub-1 GHz Transceiver
- Microcontroller

sensolus

Asset tracking

**ST Solutions**

- Sub-1 GHz Transceiver
- Bluetooth Processor

sigfox

Bluetooth™

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# Solutions for Digital Power

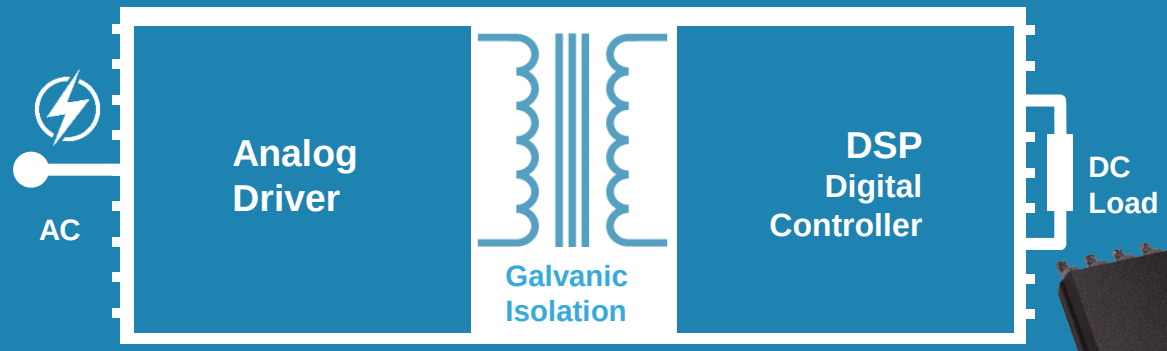


## Analog

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

## DSP

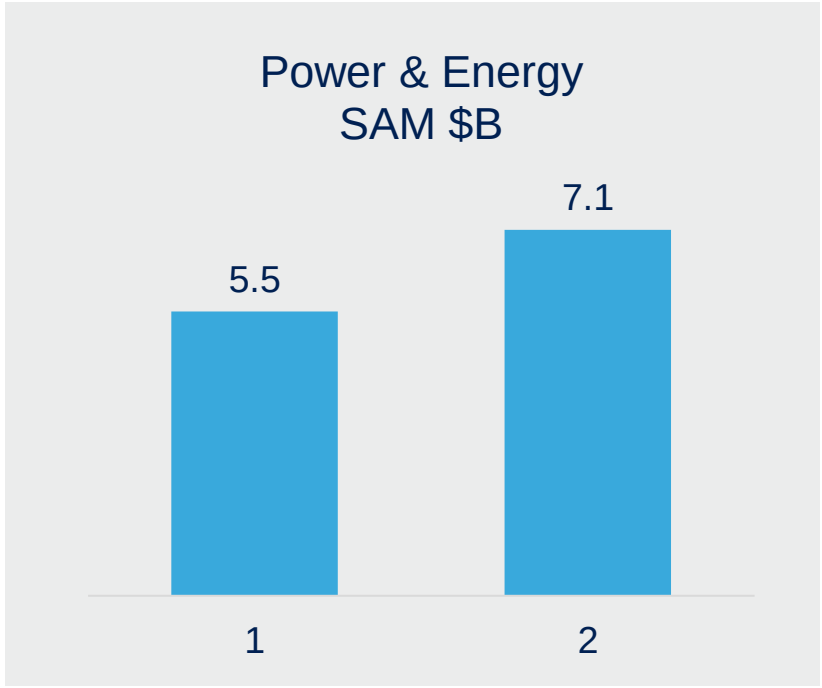
- Improved flexibility
- Adaptive control
- Programmable operation limits and fault handling
- Diagnostics and remote control





## 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)




## Key Applications in Power supply

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

Source: IHS Markit

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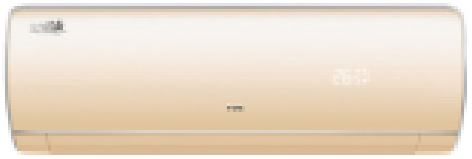
# Powering Leading Industrial Products



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

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# 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



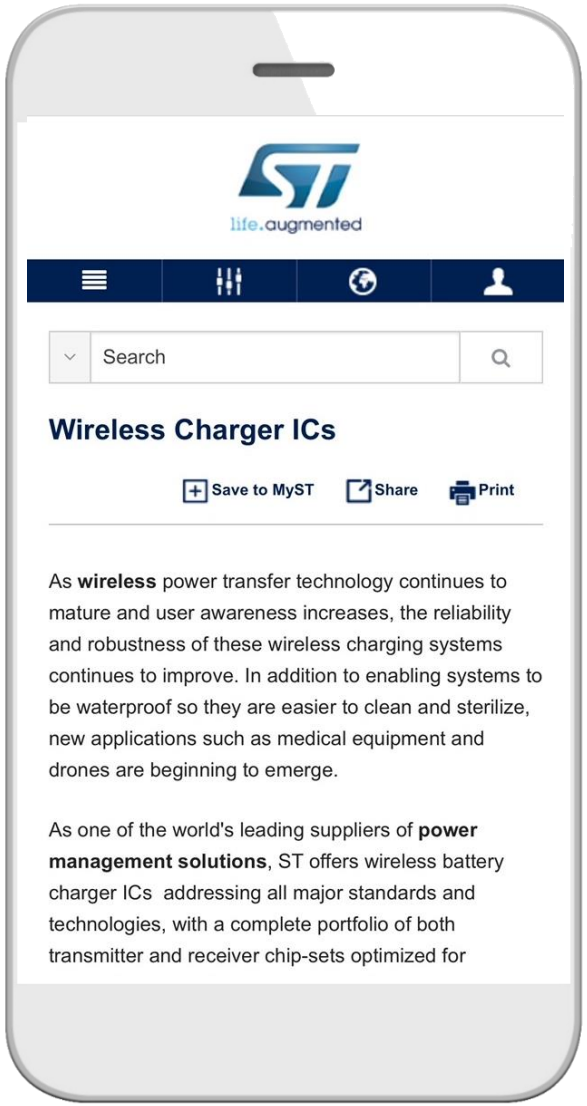
Analog

**Wired & Wireless Charging**

Wireless charging ICs, USB-C

**Display Controllers & Display Power Management**

Touchscreen controller, AMOLED PMIC




**Sensors & Actuators**

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

**Specialized Imaging Solutions**

Depth/3D sensing (ToF, Sensors)

MEMS & Sensors

OIS = Optical Image Stabilization

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# 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

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# Powering Leading Personal Devices







| Sensing | Connectivity | Conditioning | Power |
|---|---|---|---|

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# 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

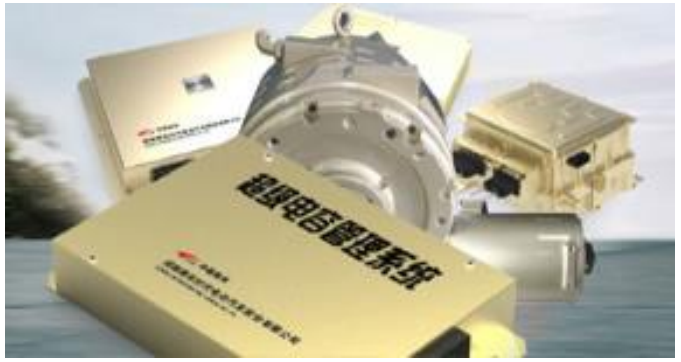
**Gyroscopes**
for vehicle dynamics applications

**LiDAR**
Autonomous Driving
through Sensor Fusion

# Analog Powering Automotive



## Electric vehicles



CRRC

**ST Solutions**

- High end operational amplifiers
- Power Management

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# Communications Equipment, Computers & Peripherals End Market



## Key Applications

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

## AMS offering

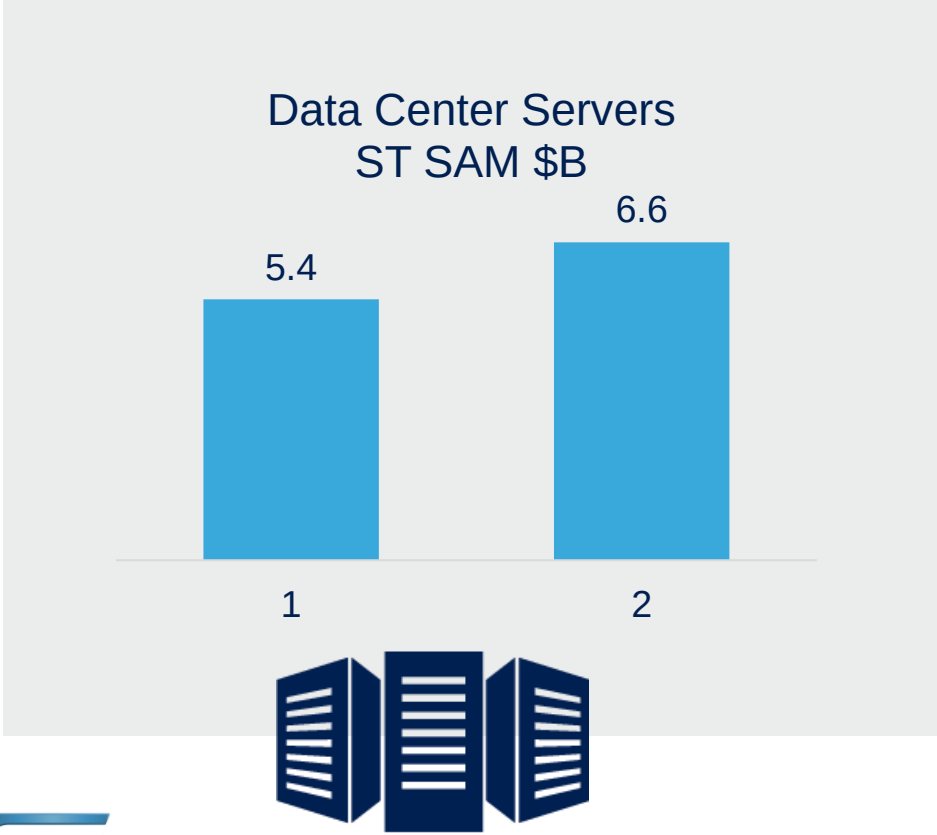
| Sensing | Conditioning | Connectivity | Actuation | Power & Energy Management |
|---|---|---|---|---|

- 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




### 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

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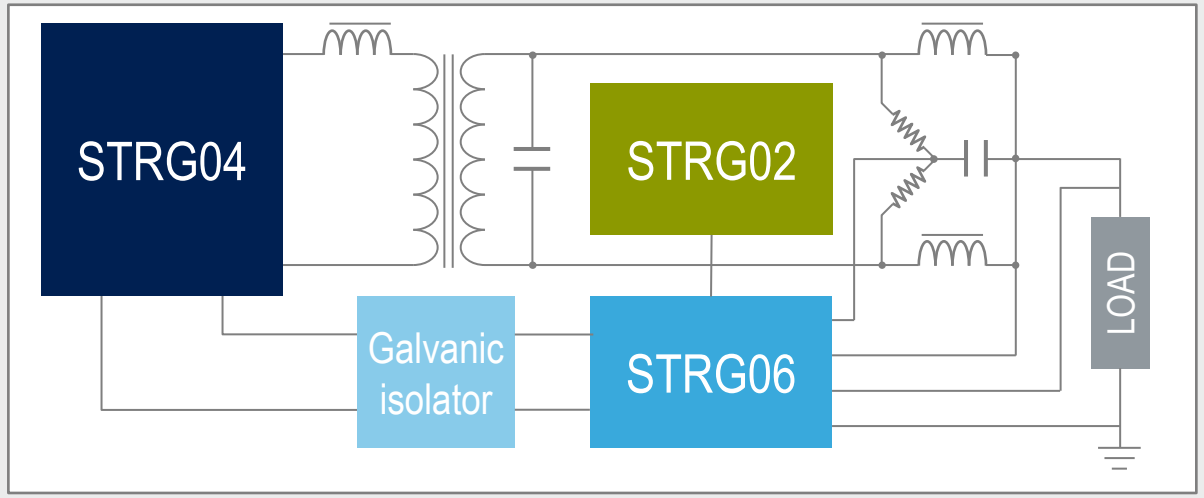
# Driving the Evolution of Power
## in Server & Communications Infrastructure



**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 |

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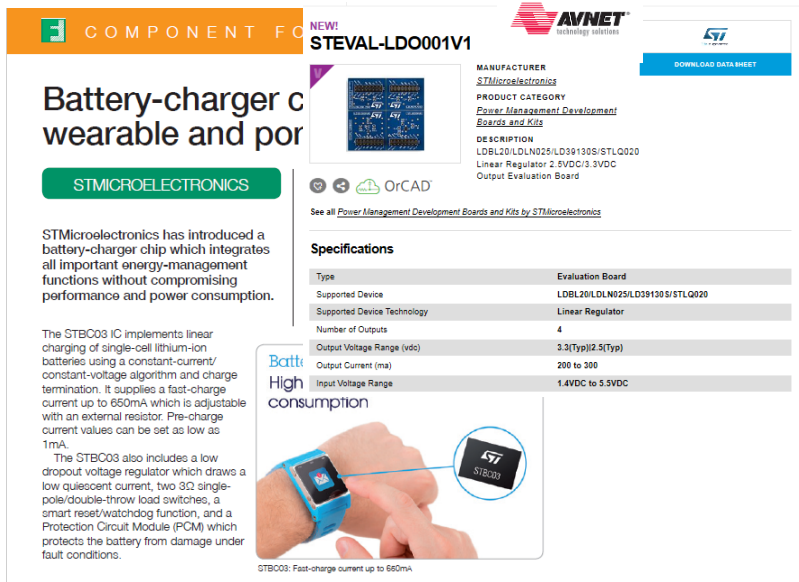
# General Purpose Analog & Low Power RF for Distribution



## 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


ST Op Amps

### 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

BlueNRG

SPIRIT

### Low Power RF

+200% YoY growth

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# 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