



IFX Day 2018

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PMM's growth is built on many applications from different sectors in power and non-power

PMM

Computing



- › Data Center
- › PC, Notebook
- › Peripherals



Industrial



- › Power supplies
- › EV on-board charger
- › PV inverter
- › Power tools
- › Lighting
- › Industry 4.0
- › Internet of Things



Consumer / Misc



- › eBikes
- › Multicopter
- › Aviation
- › LSEV
- › Space
- › Gaming
- › Smart home



Communications



- › Handsets
- › Wearables
- › 5G massive MIMO



● AC-DC ● DC-DC ● RF and sensors (non-power)



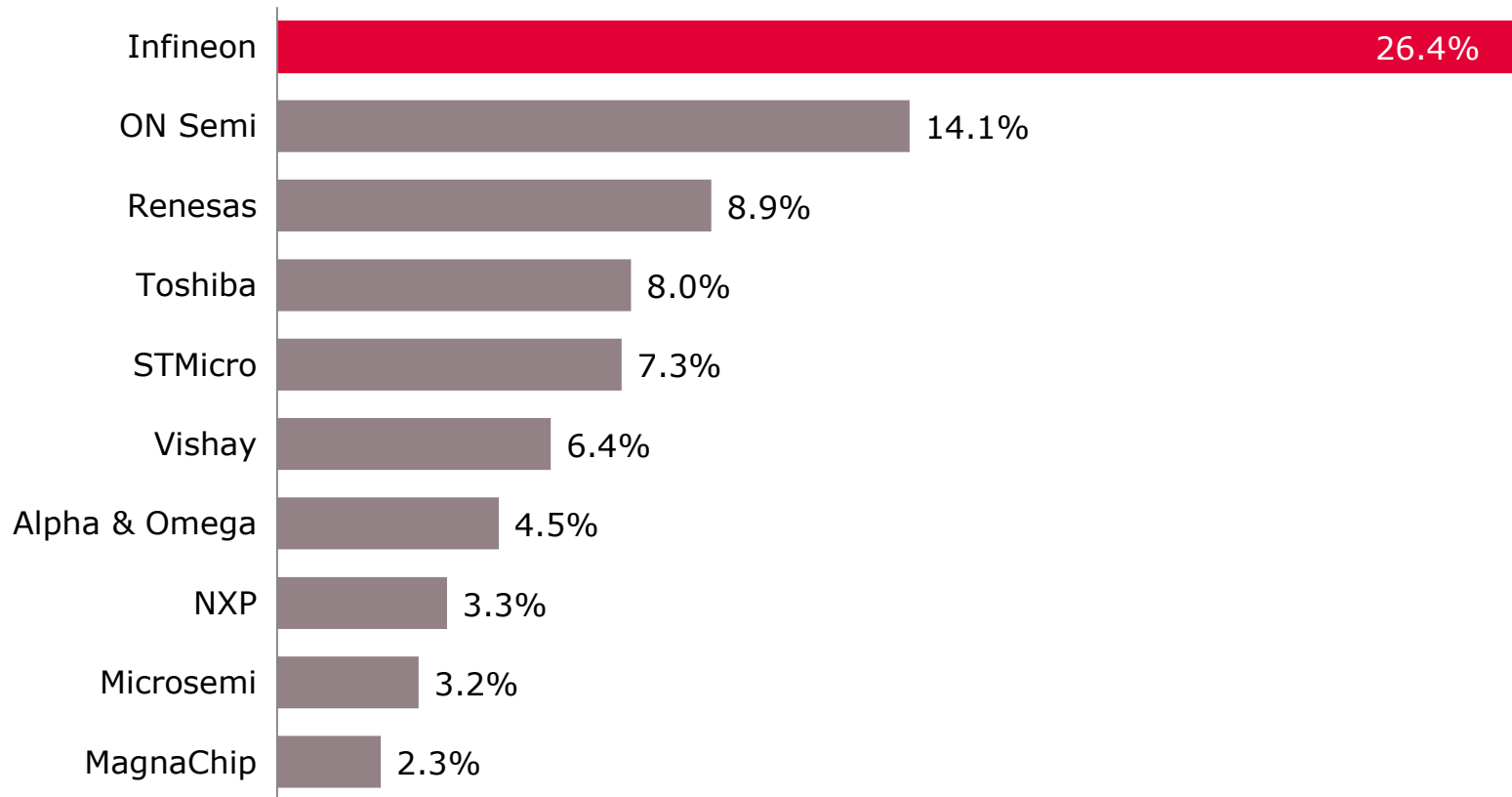
PMM – Power



PMM is the undisputed market leader in power MOSFETs



Discrete power MOSFETs market shares total market in 2016: \$5.78bn



Source: Based on or includes content supplied by IHS Markit, Technology Group, "Power Semiconductor Discretes & Modules Report", August 2017; incl. automotive MOSFETs

Three strategic levers to outgrow the power semiconductor market



Strengthen core

- › Complement technology leadership and #1 position in CoolMOS™ and OptiMOS™ with next-generation WBG power semis (CoolGaN™, CoolSiC™)
- › Continuously increase scale leadership with 300 mm
- › Exploit scale in R&D



Grow in adjacent fields

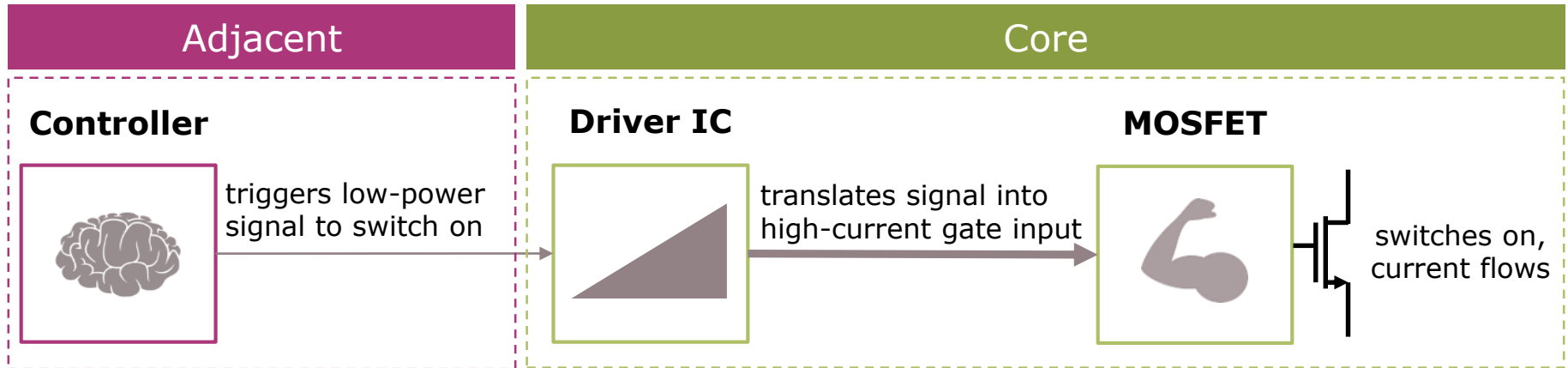
- › Complement core (= switch and driver ICs) by adding further (digital) power management ICs
- › Grow into adjacent markets such as class D audio amplifiers or PoL in telecom and data center



Broaden scope to new applications

- › System understanding and strong R&D force allow us to enter emerging power applications like AI data center, wireless power, EV on-board charger, infrastructure and LSEV

Technology leadership in MOSFETs and digital power: highest efficiency and power density

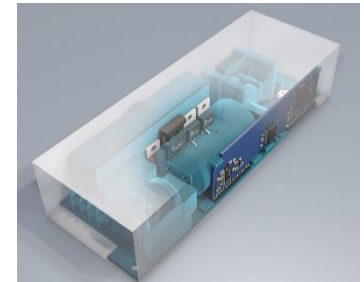


Power management solutions reduce TCO



More efficient semiconductors

- › lower power consumption
- › lower opex

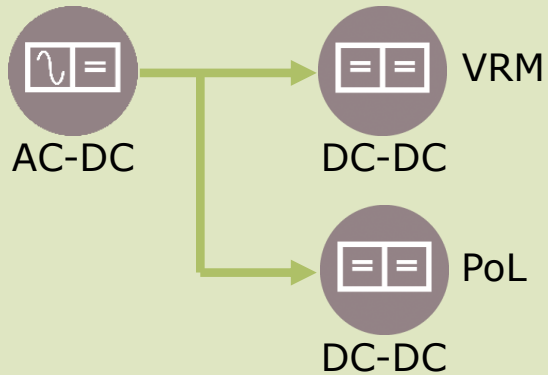


Higher power-density

- › more compact system designs
- › lower capex

Highly differentiating solution for data center enables significant opex and capex reduction

Powerflow (schematic)

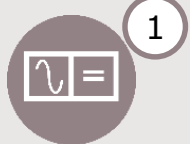


Customer benefit

- > reducing opex and capex by >10%
- > saving >3bn kWh annually for US data centers
- > doubling compute power per server rack



Infineon-enabled optimization of data center powerflow – examples:



AC-DC



DC-DC

CoolGaN™ allows for 2x output power in a given slot size and thus frees up space for the backup battery in more efficient architecture.

Benchmark **digital power solutions** including fully integrated PoL devices: highest efficiency, highest power density; supporting latest processor technologies.

AC-DC power supply by Eltek using CoolGaN™



Eltek "Flatpack2 SHE"

- › 3 kW / 48 V
- › Fixed and wireless telecom applications
- › Size: 4.25 x 1.61 x 13 inch³
- › Weight: 4.5 lbs
- › High power density: 33 W/inch³

98%

efficiency

-50%

reduction in
power loss

> -6%

proven operational
cost reduction

Infineon content per device

- › 2x **CoolGaN™** 600 V
- › 2x **CoolMOS™** C7
- › 2x **CoolMOS™** CFD7
- › 4x **OptiMOS™** 150 V
- › Gate driver

~ US\$30

Server eco-system is supported by PMM's various DC-DC solutions



Data center market trends

Increasing memory and processing power

Adoption of AI drives high-end analytics and data management

Expanding CPU supplier base: AMD, IBM, NVIDIA, ARM, Intel etc.

Hyperscale users invest in proprietary processor designs (e.g. Google)

Saving space is a key requirement and a focus of product development



Digital controllers
with flexible communications interface



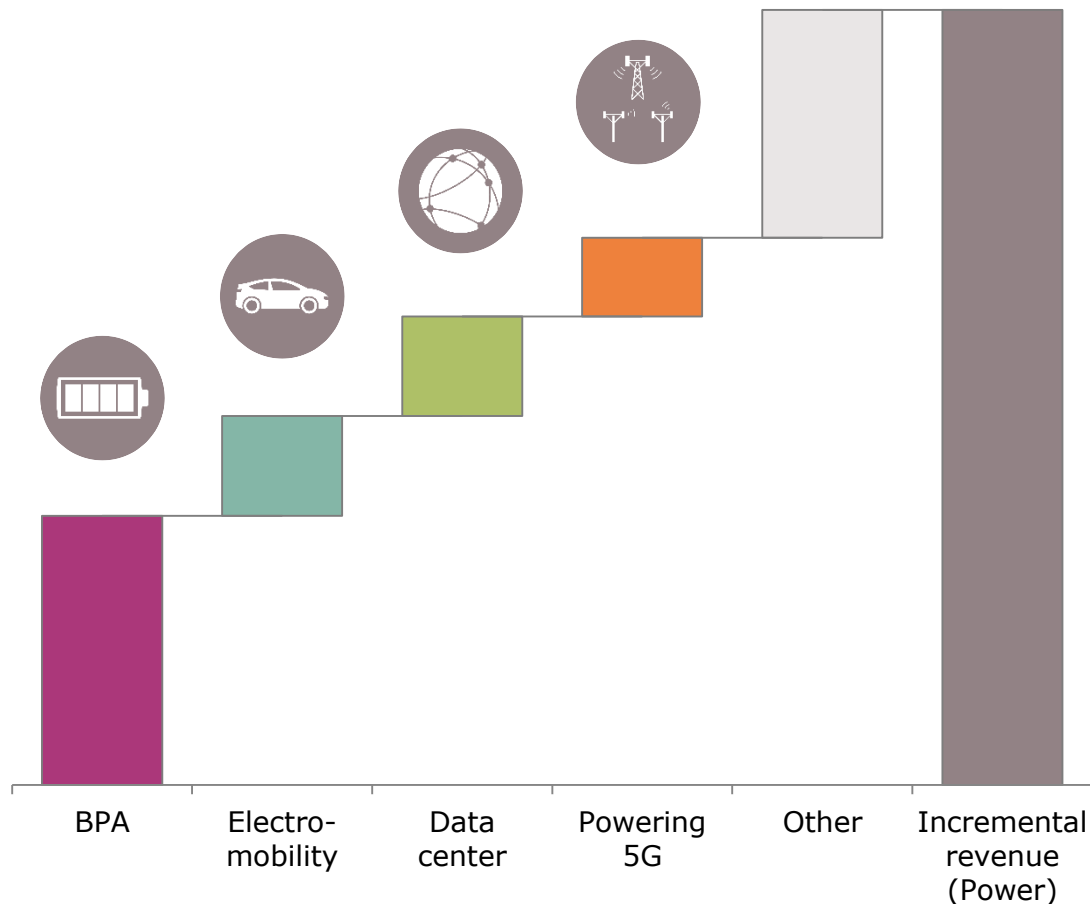
Integrated power stages and iPoL
for high power density



* devices per server

PMM's mid-term growth in power is strongly driven by several high-growth applications

Composition of incremental € revenue over five year planning horizon by application



Battery-powered applications

E.g. power tools, consumer devices, robots and drones

xEV and LSEV

Densification of charging infrastructure; power semis for OBC and battery switch (CoolMOS™)

Data center

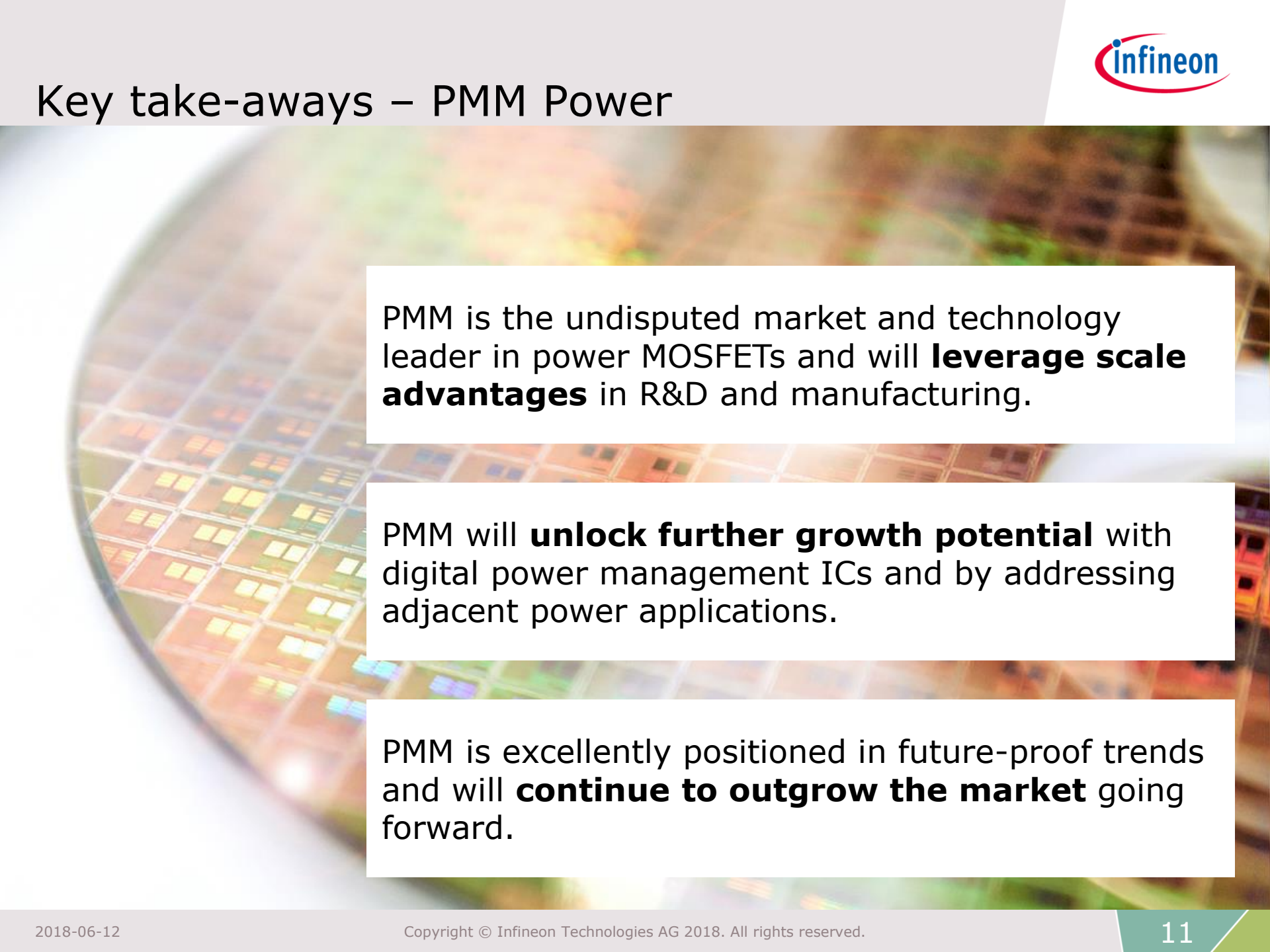
Classical data centers and high-computing data centers for AI

Powering 5G

Densification of infrastructure; massive MIMO to drive power MOSFET content by a factor of 5 (to >250 pieces per system)

PMM power's trendline growth:
~9%

Key take-aways – PMM Power

A close-up, slightly blurred image of a silicon wafer, showing a grid of square dies with various colors (yellow, orange, green, blue) indicating different circuit components or materials.

PMM is the undisputed market and technology leader in power MOSFETs and will **leverage scale advantages** in R&D and manufacturing.

PMM will **unlock further growth potential** with digital power management ICs and by addressing adjacent power applications.

PMM is excellently positioned in future-proof trends and will **continue to outgrow the market** going forward.



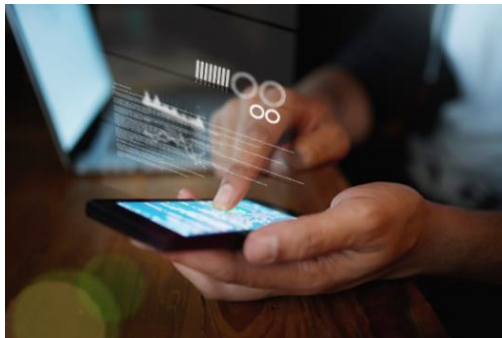
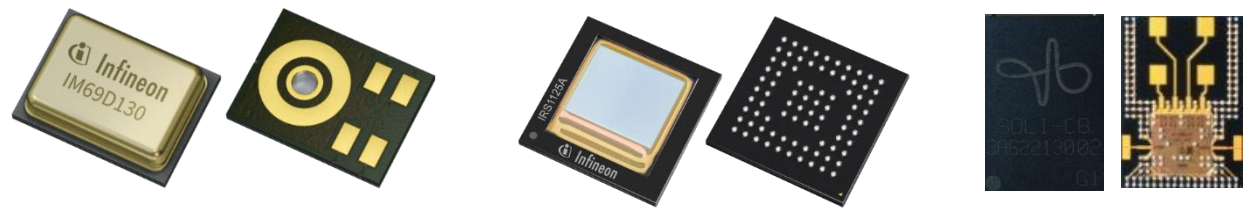
PMM – RF and Sensing

RF and Sensing: Existing core competencies help seize additional growth opportunities



Strengthen core

- › Technology leadership in key sensing technologies:
 - MEMS: XENSIV™ silicon microphone
 - 3D ToF imaging: REAL3™
 - RF: 60 GHz radar for gesture sensing



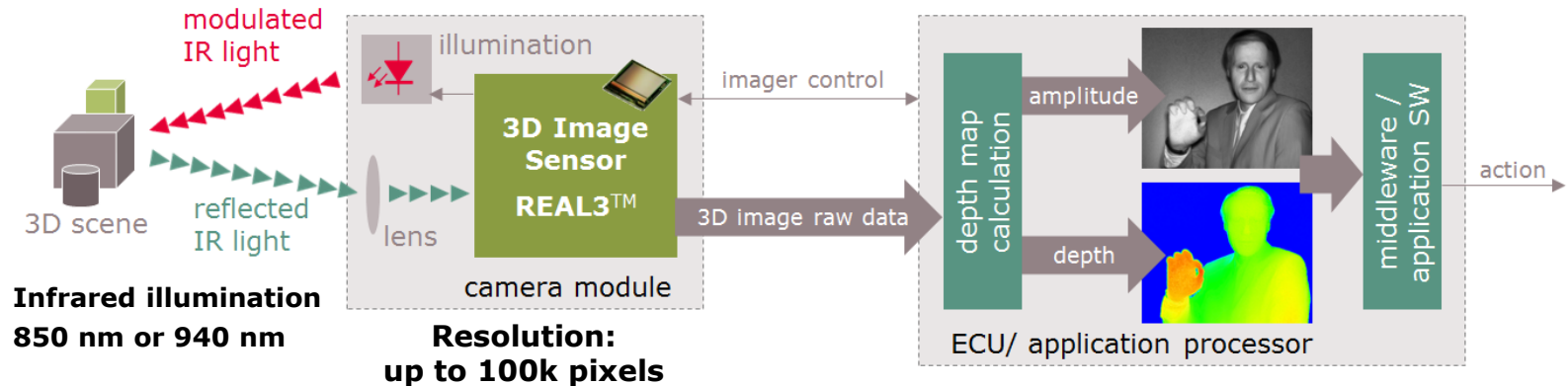
Grow in adjacent fields and address new markets

- › Leverage technological capabilities to tap into adjacent sensor use cases (e.g. MEMS-based pressure sensors)
- › Address new markets with high growth potential
 - Human-machine interaction
 - 3D face recognition
 - 5G mmWave and sub-6-GHz for user equipment and basestations

Leading base technologies for sensor solutions: Time-of-Flight

Time-of-Flight

Time-of-Flight: Modulated infrared-light is emitted and reflected by objects. Phase-shift of returned light is measured in each pixel of the image sensor.



Examples of uses cases enabled by Time-of-Flight technology

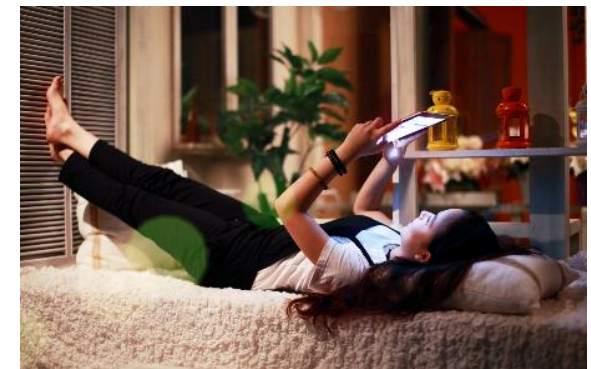
3D scanning



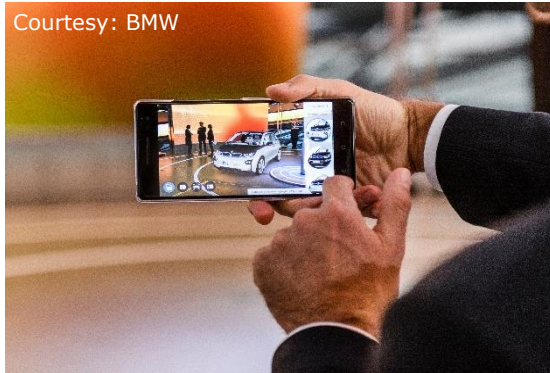
AR / VR / gaming



Secure face recognition



RF and Sensing devices enable new services and will shape the way we live and work



Courtesy: BMW

Augmented Reality



Voice-controlled devices

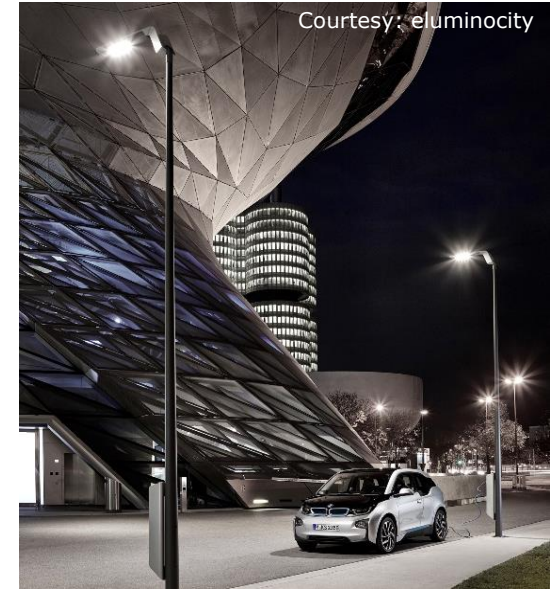
Various use cases are enabled by a small set of versatile core technologies



Commercial and consumer multicopters



Gesture control



Courtesy: eluminocity

Smart streetlights



Industrial robotics

Key take-aways – PMM RF and Sensing

PMM will **leverage its technology leadership** in MEMS microphones and broaden the success in smartphones to new emerging applications.

Strong core in MEMS is complemented by leading 3D Time-of-Flight imaging and radar technology, enabling **leadership in intuitive sensing and HMI**.

PMM's sensor portfolio emulates human senses, thus enabling attractive new uses cases with **significant revenue potential**.

PMM RFS is set to deliver **~9% revenue CAGR** over five year planning horizon.

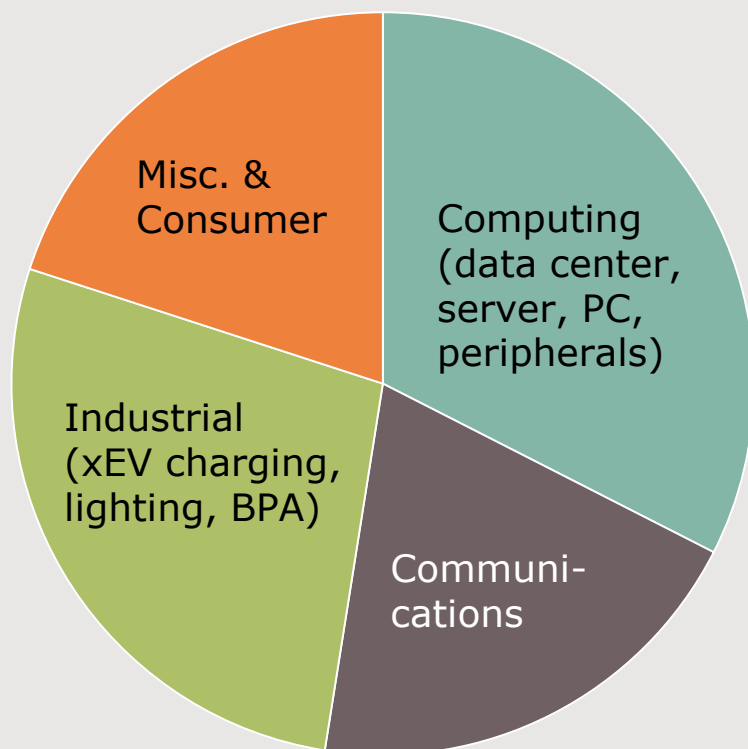


Part of your life. Part of tomorrow.

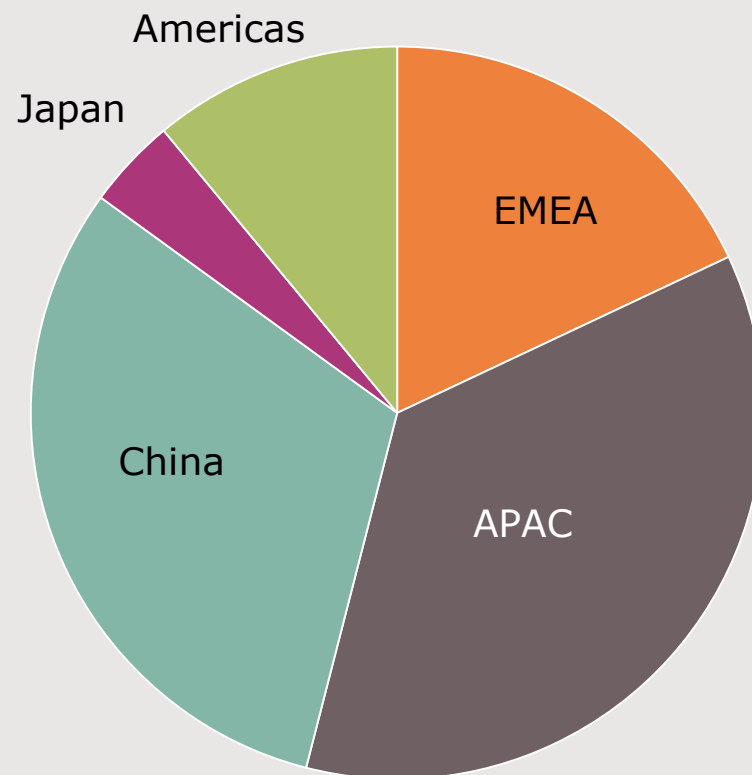


Dashboard

PMM FY17 revenue by application

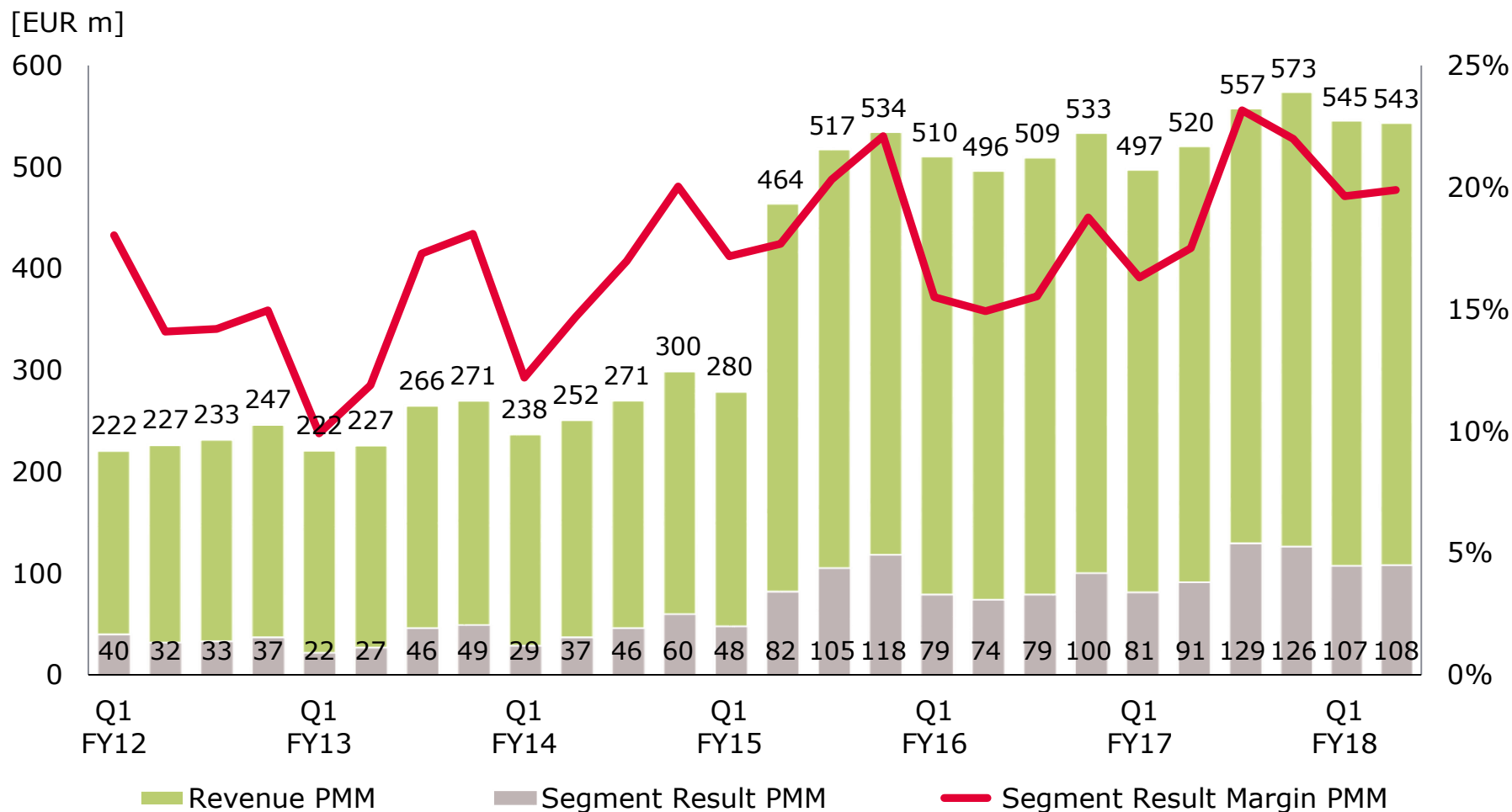


PMM FY17 revenue by region



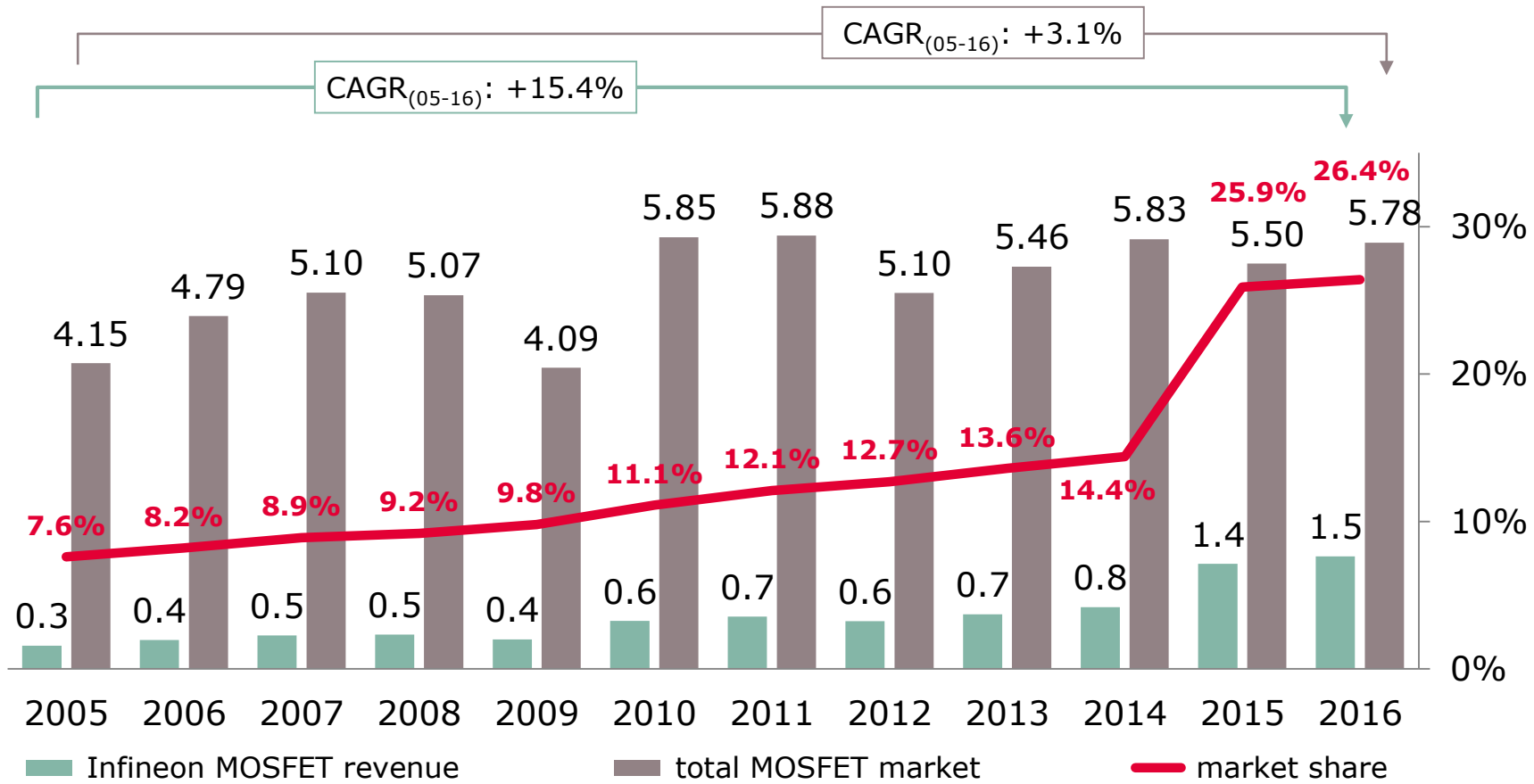
PMM historic financial figures

Revenue and segment result development



Continuous gain in market share in standard MOSFETs

Infineon's historic market share development 2005 – 2016



Source: Based on or includes content supplied by IHS Markit, Technology Group, several reports from 2004 through 2015 and 2017

Note: No backward revision of market shares and market sizes; except for year 2015

Glossary

3D	three dimensional	MOSFET	metal-oxide silicon field-effect transistor
5G	fifth generation of cellular infrastructure standard	nm	nanometer
AC-DC	alternating current – direct current	OBC	on-board computer
AI	artificial intelligence	opex	operational expenditure
AR	augmented reality	PoL	point-of-load
capex	capital expenditure	PV	photovoltaic
CPU	central processing unit	RF	radio frequency
DC-DC	direct current – direct current	Rx	receiver
ECU	electronic control unit	Si	silicon
EV	electric vehicle	SW	software
IC	integrated circuit	TCO	total cost of operations
iPoL	image processing line	ToF	time of light
IR	infrared	Tx	transmitter
kWh	kilowatt hour	VR	virtual reality
LSEV	low-speed electric vehicle	VRM	voltage regulator module
MEMS	micro electro-mechanical systems	WBG	wide bandgap material
MIMO	multiple input, multiple output	xEv	all degrees of vehicle electrification (EV, FHEV, PHEV)
mmWave	millimeter wave		

Andreas Urschitz, Division President Power Management & Multimarket



- › since 2012: Division President Power Management & Multimarket (PMM)
- › 2011: Head of Distribution of the PMM Division
- › 2001 – 2011: several management positions within PMM Division
- › Andreas Urschitz was born in Klagenfurt, Austria, in 1972. He holds a master's degree in Commercial Science from the Vienna University of Economics and Business.
- › He joined Infineon (Siemens AG until 1999) in 1995.

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