



IFX Day 2018
Peter Wawer
Division President Industrial Power Control

London, 12 June 2018



Electricity becomes the most important energy carrier of the 21st century



Primary energy demand¹⁾

electricity

+35%

+58%

2016

2040

Shaping the electric power supply chain

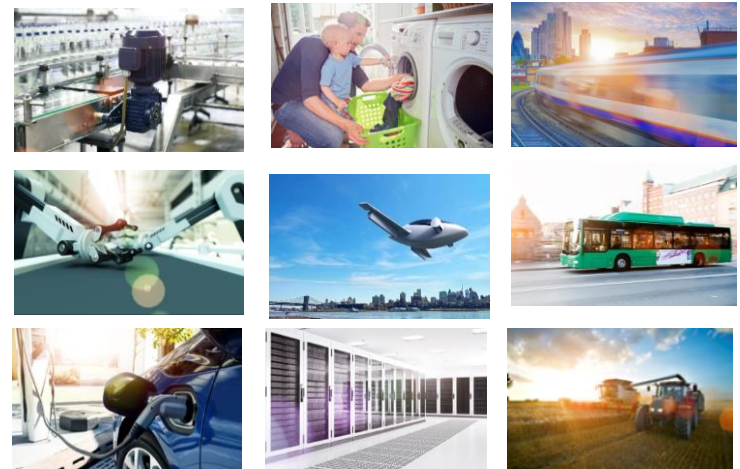
Generation



Transmission



Consumption



1) Source: BP 2018 Energy Outlook, February 2018

IPC will foster its #1 position in power by strengthening its differentiating advantages



#1 in the market* for discrete IGBTs, IGBT-based modules and total market; #4 in IPMs

Broad product, technology and packaging portfolio; addressing broadest range of applications

Unique manufacturing capability, e.g. 300 mm thin-wafer manufacturing for power semiconductors

Key areas of innovation

System leader with digitalization of the control loop and functional integration of μ C & SW, Driver, Switch

Leader in next-generation power semiconductor materials SiC and GaN



IPC is well positioned to gain further market share and earn clearly above market-average margins in power semiconductors

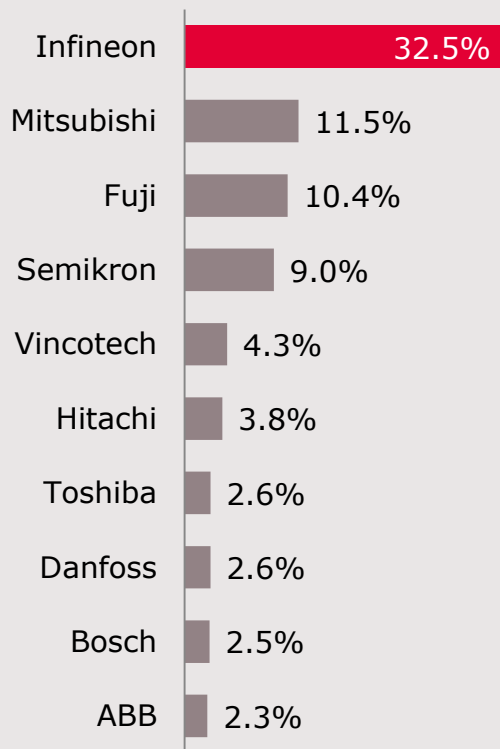
* Source: based on or includes content supplied by IHS Markit, Technology Group, "Power Semiconductor Annual Market Share Report", August 2017

Clear leader in IGBT standard modules and discrete IGBTs; IPMs improved from #7 to #4



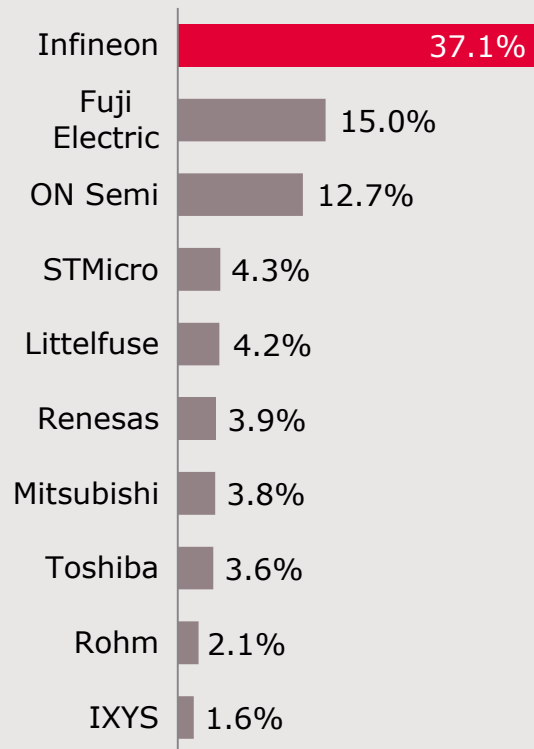
IGBT std. modules

total market in 2016: \$1.88bn



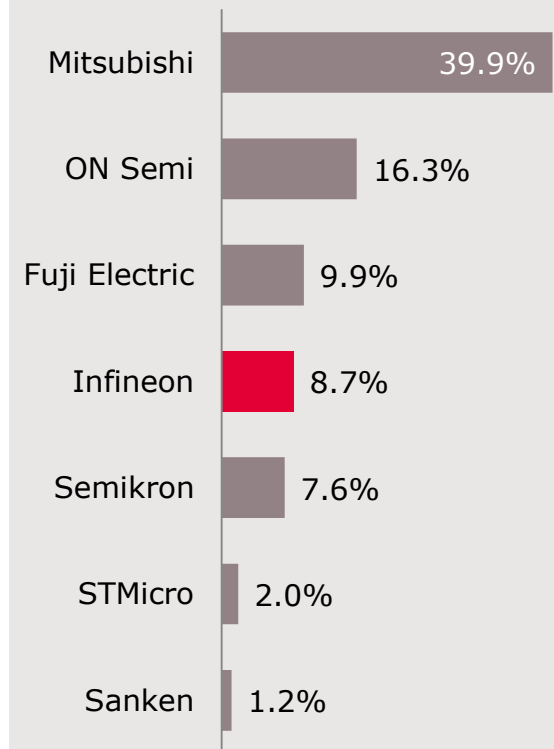
Discrete IGBTs

total market in 2016: \$0.93bn



IPMs

total market in 2016: \$1.19bn



Source: Based on or includes content supplied by IHS Markit, Technology Group, "Power Semiconductor Annual Market Share Report", August 2017

Three strategic levers to outgrow the industrial power semiconductor market



Strengthen core

- › Complement technology leadership and #1 position in IGBT standard modules with next-generation WBG power semis with focus on SiC (CoolSiC™)
- › Continuously increase scale leadership with 300 mm
- › Exploit scale in R&D



Grow in adjacent fields

- › Invest into growth of IPM business, using existing IGBT, driver and iMotion portfolio to become top-3 player in IPMs soon
- › Invest into products for digital control chain for IPC including algorithms for drives



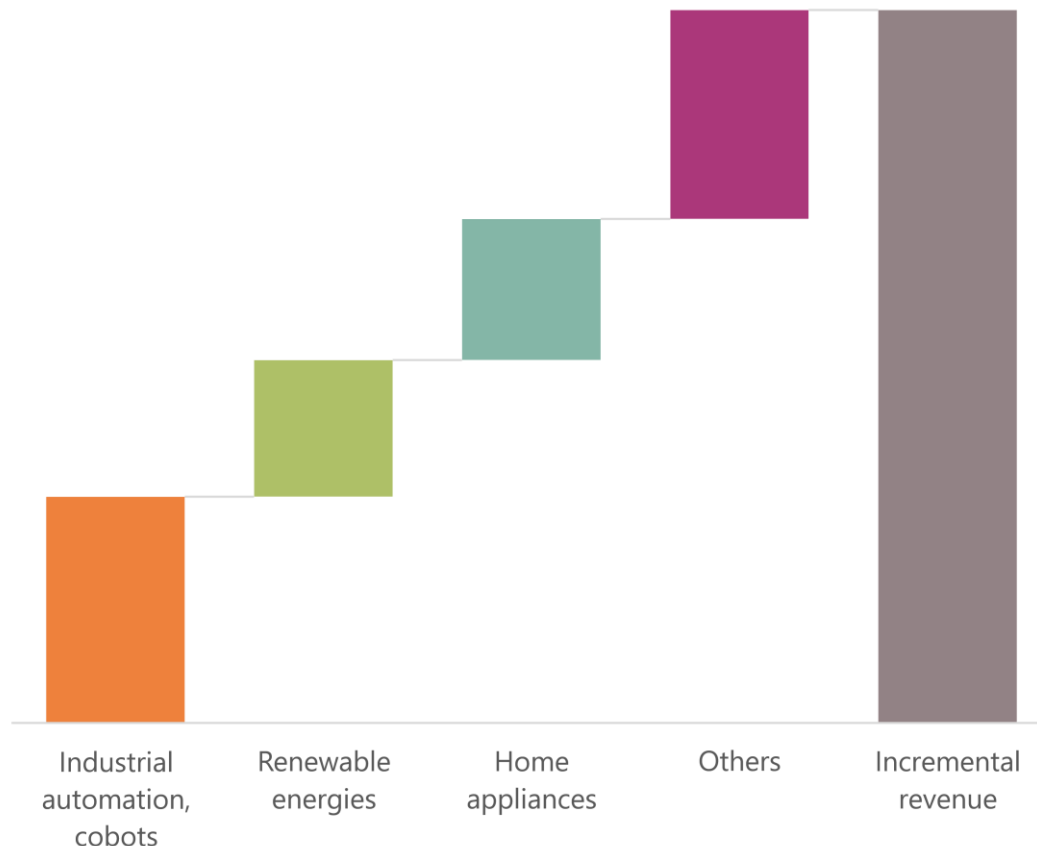
Broaden scope to new applications

- › System understanding and strong R&D force enable entering emerging power applications like charging infrastructure for xEV, Commercial and Agriculture Vehicles (CAV), eMarine, eAviation

IPC's mid-term growth is based on a broad range of applications



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



Industrial automation, cobots

inverterization; cobots: acceptance to accelerate due to ever higher safety levels and ease of use

Renewable energies

grid parity reached; higher growth from China, India, RoW

Home appliances

inverterization; growth in China; strong market success with IPMs

Others

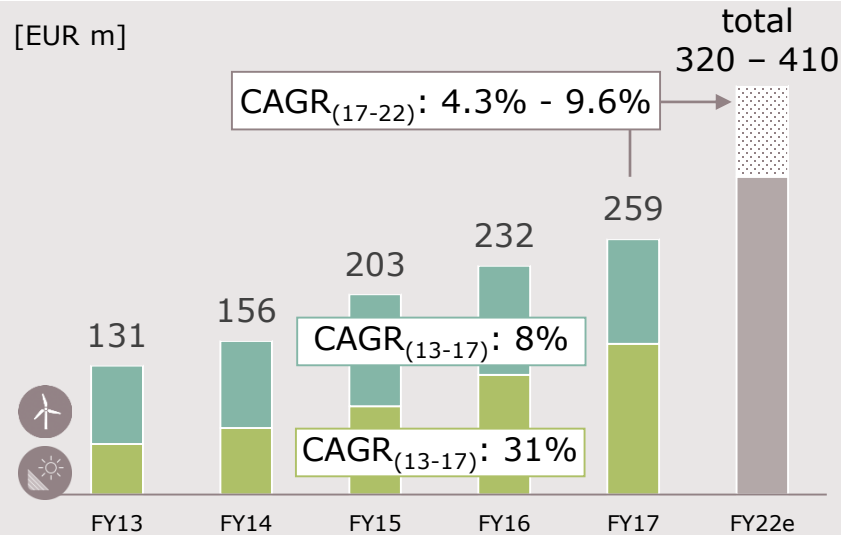
energy storage; electric buses; electric delivery vehicles; eV infrastructure

IPC's trendline growth: ~8%

Infineon serves all major players for PV inverters and wind turbines



IPC revenue in renewables



Installed wind capacity³⁾

CAGR₍₁₃₋₁₇₎

+7%

IPC wind revenue

CAGR₍₁₃₋₁₇₎

+8%

Installed PV capacity¹⁾

CAGR₍₁₃₋₁₇₎

+25%

IPC PV revenue

CAGR₍₁₃₋₁₇₎

+31%

Infineon is powering all leading renewable energy players*

PV inverter²⁾

- 1 | Huawei ✓
- 2 | Sungrow ✓
- 3 | SMA ✓
- 4 | TBEA Sunoasis ✓
- 5 | Wuxi Sineng ✓
- 6 | ABB ✓
- 7 | Kstar ✓
- 8 | Goodwe ✓
- 9 | Growatt ✓
- 10 | Power Electr. ✓

Wind⁴⁾

- 1 | Siemens/Gamesa ✓
- 2 | Vestas ✓
- 3 | Goldwind ✓
- 4 | GE ✓
- 5 | Enercon ✓
- 6 | Envision ✓
- 7 | Nordex ✓
- 8 | Senvion ✓
- 9 | United Power ✓
- 10 | Mingyang ✓

* Infineon is serving the top-10 of each category but not necessarily as a sole supplier.

Source: 1) based on or includes content supplied by IHS Markit, Technology Group, "PV Installations Tracker - Q1 2018"; March 2018; including off-grid

2) by shipped capacity in MW: based on or includes content supplied by IHS Markit, Technology Group, "PV Inverter Market Tracker - Q1 2018"; June 2018

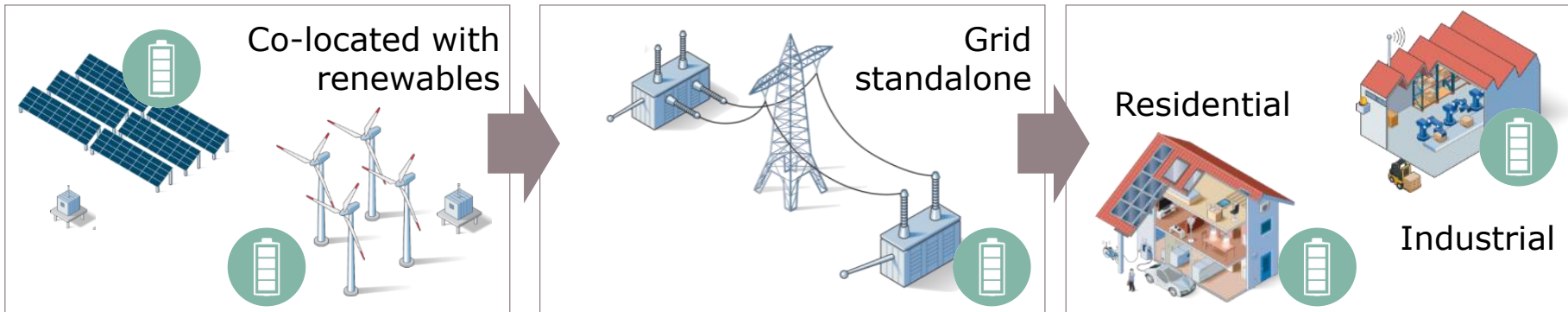
3) MAKE Consulting - Market Outlook Update Q1 2018; March 2018

4) by shipped/installed capacity (in MW): MAKE Consulting - Historical Wind Turbine OEM Market Share; April 2018

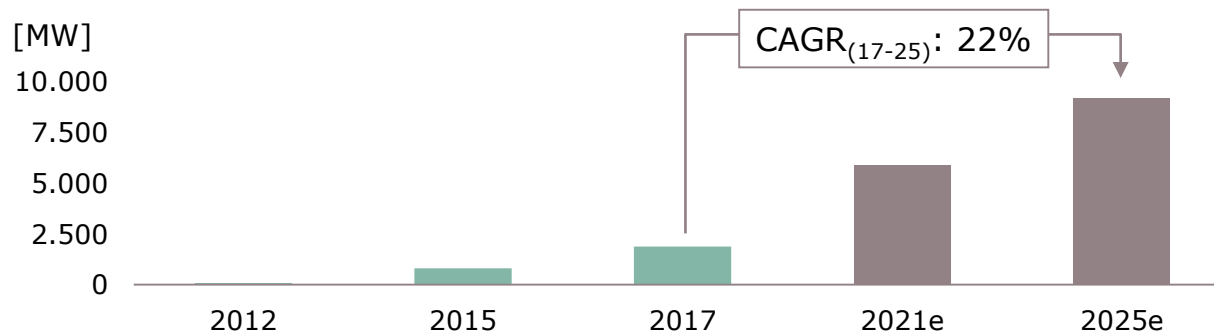
Energy storage is essential to further deploy decentral and renewable energy generation

Key drivers:

- › **Decentralization** of power generation
- › **Peak shaving** of energy generation and energy consumption
- › **Limited capacity** and flexibility of today's grids
- › **Reduction of standby cost** of fossil power plants



Annual energy storage installations¹⁾



~€3,200 of power semiconductor content per MW of installed energy storage capacity²⁾

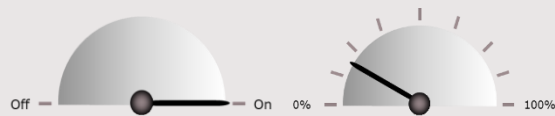
Source: 1) based on or includes content supplied by IHS Markit, Technology Group, "Grid-Connected Energy Storage Market Tracker - H2 2017", February 2018

2) Infineon estimate

Inverterization of home appliances is a key driver for our business

Uncontrolled motor

Variable speed drive



Extended lifetime



Less noise



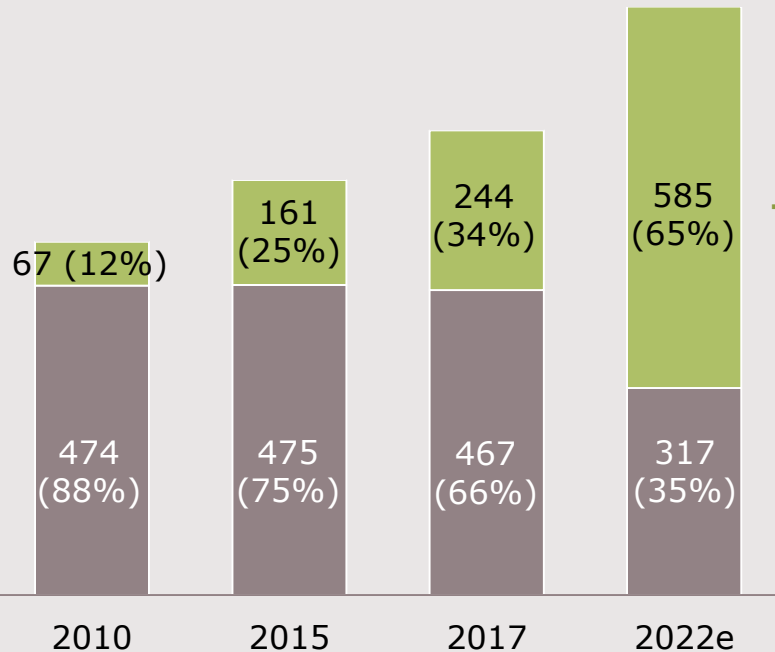
Up to 40% less energy¹⁾

Number of home appliances by motor type²⁾

[units m]

CAGR₍₁₇₋₂₂₎

Semi content³⁾



+19%

~€9.50

-7%

~€0.70

■ Uncontrolled motor ■ Motor with variable speed drive

Source:

1) Compared to devices without inverter

2) Source: based on or includes content supplied by IHS Markit, Technology Group, "Home Appliance Database: All Devices and Associated Electronics", May 2018

3) Infineon estimate for a typical aircon

IPC's business success in home appliances is based on several success factors



Early identification of trend for **inverterization**

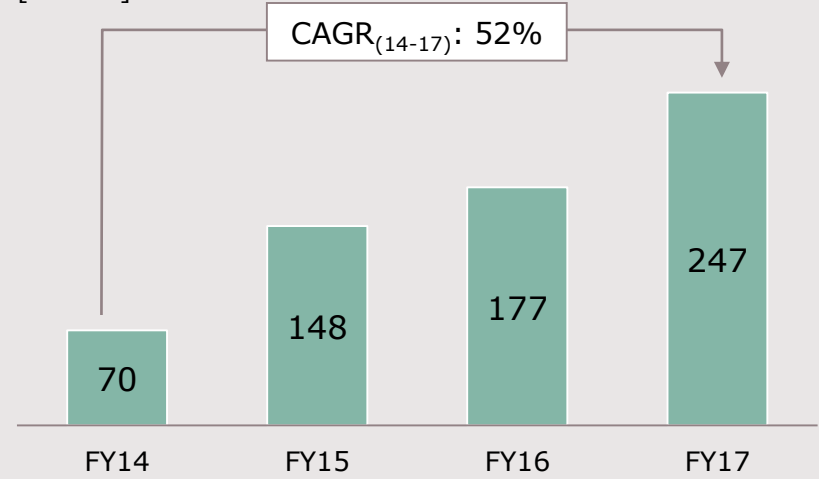
Market access through inorganic growth (acquisit. of LSPS and IRF)

Improved delivery capability through **capacity increase**

Extension of portfolio of **integrated products** to gather higher semiconductor share at customers

IPC revenue in home appliances is showing outstanding growth

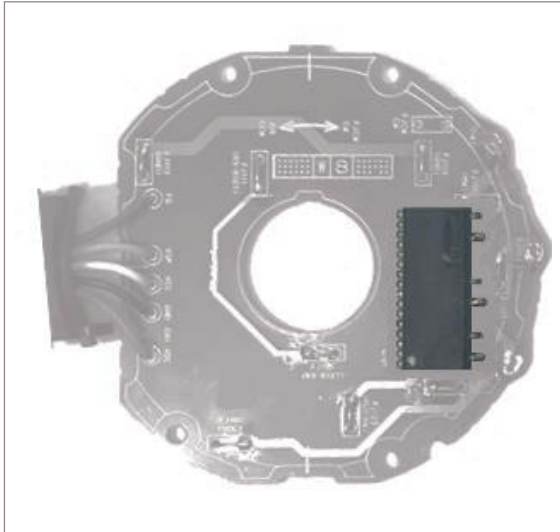
[EUR m]



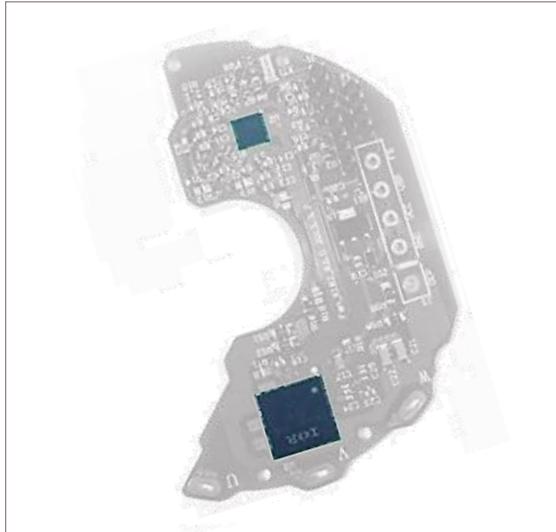
IPC's digital control strategy enables customers to shrink their system

Example: motor control solution for aircon indoor fan

Solution based on standard IPM



Solution based on CIPOS™ Nano



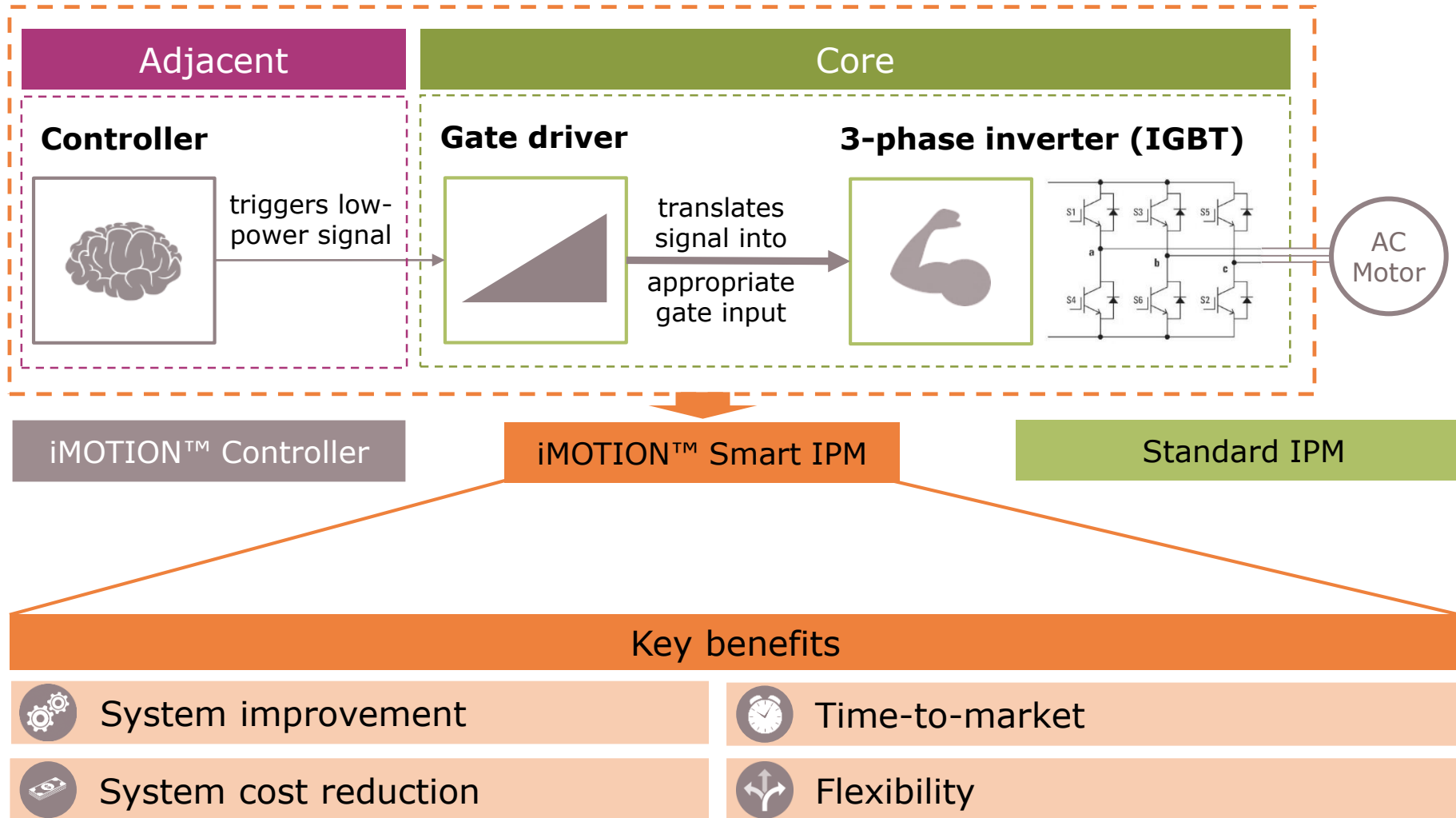
Solution based on iMOTION™ Smart IPM



Customer benefits of highly integrated power ICs

- › Significant system cost reduction with BoM savings of ~30%
- › Reduction in engineering efforts
- › Reduction in time-to-market

Digitalization: motor control platform with scalable integration of HW and SW



HMI and AI are driving the penetration of collaborative robots (cobots)

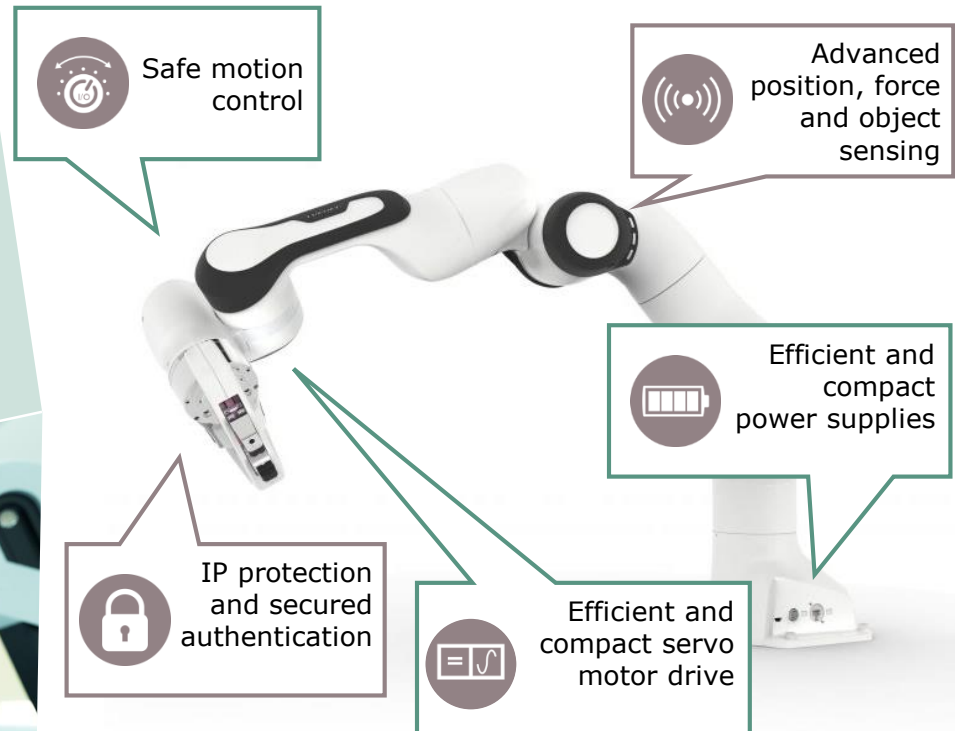
700,000 new cobots by 2025¹⁾

~€350 semiconductor content²⁾ per cobot of which

~€200 for power semiconductors²⁾

~€150 for sensors, μ C, and security controllers

System understanding and extended product portfolio allow for growth in adjacent markets



□ Power □ Non-power

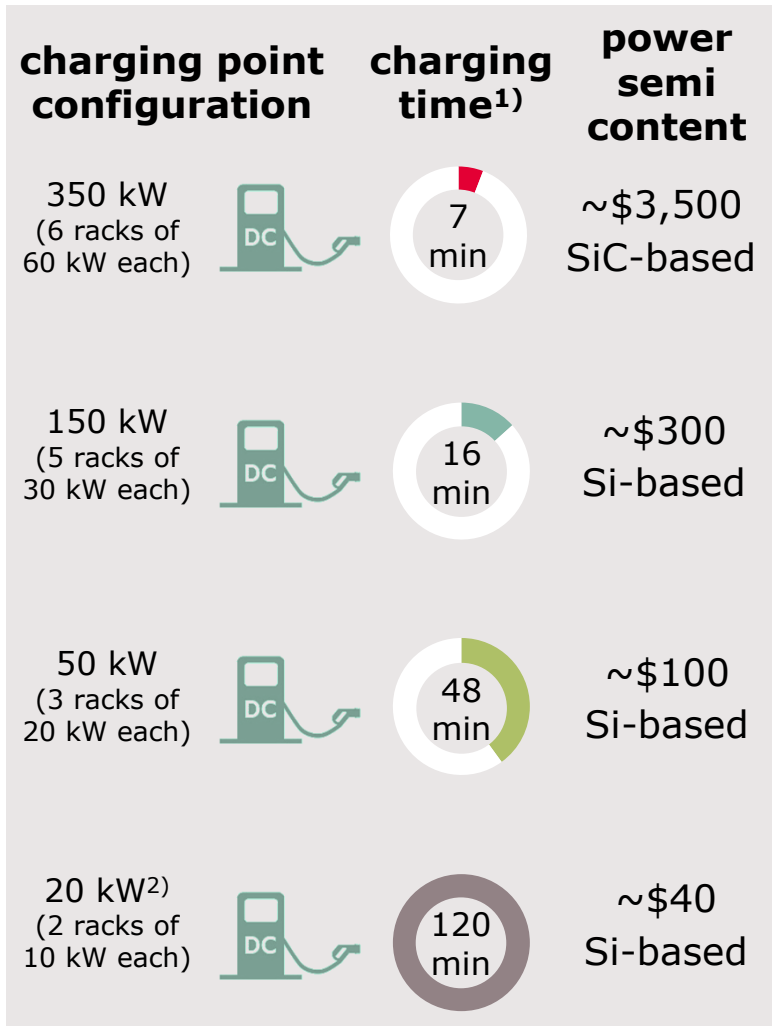
Source:

1) Barclays Equity Research, "The rise of co-bots: Sizing the market", 2016

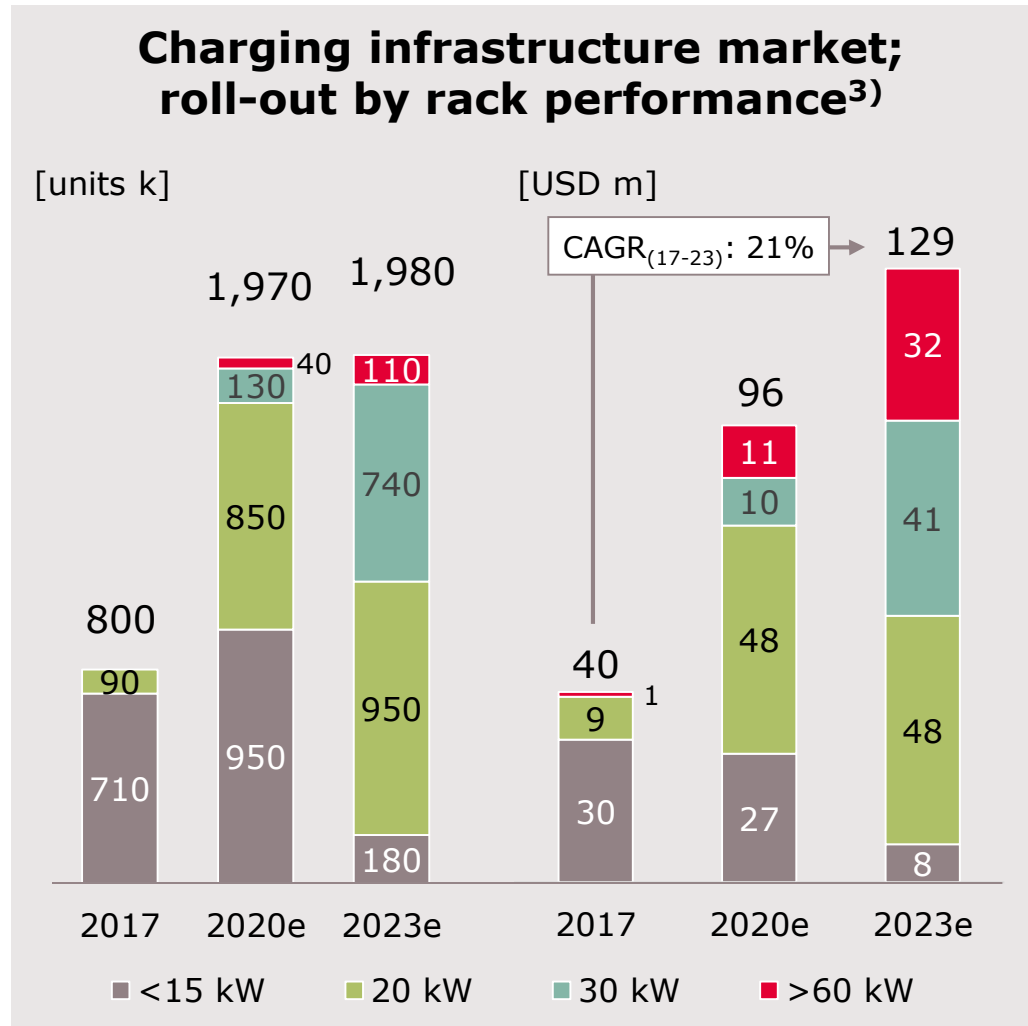
2) Infineon estimate; excl. tools

Courtesy: Franka Emika

Growing penetration of electric vehicles will drive roll-out of charging infrastructure

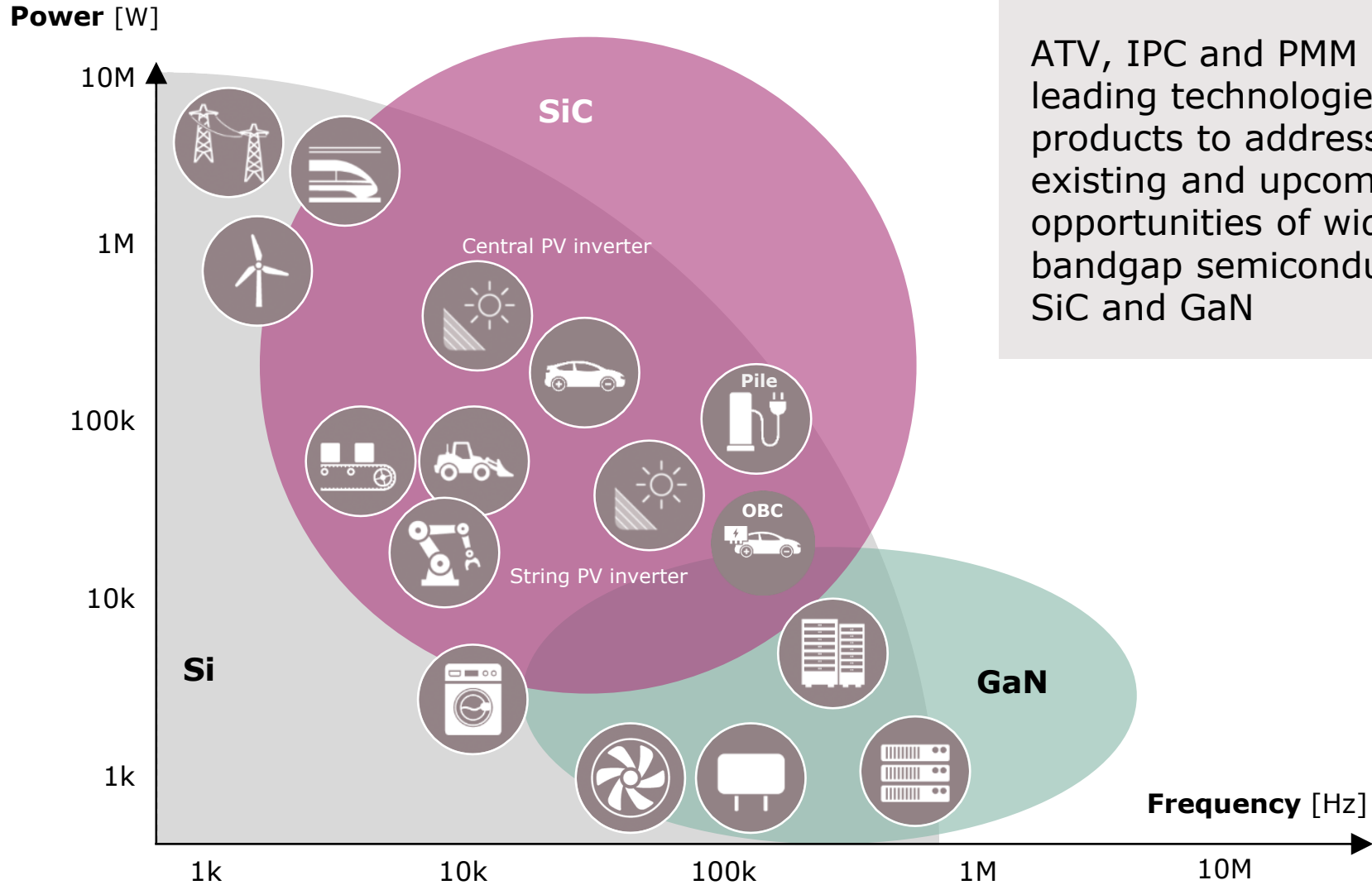


- 1) to charge for a reach of 200 km
2) incl. DC wall boxes



3) Source: Infineon estimate

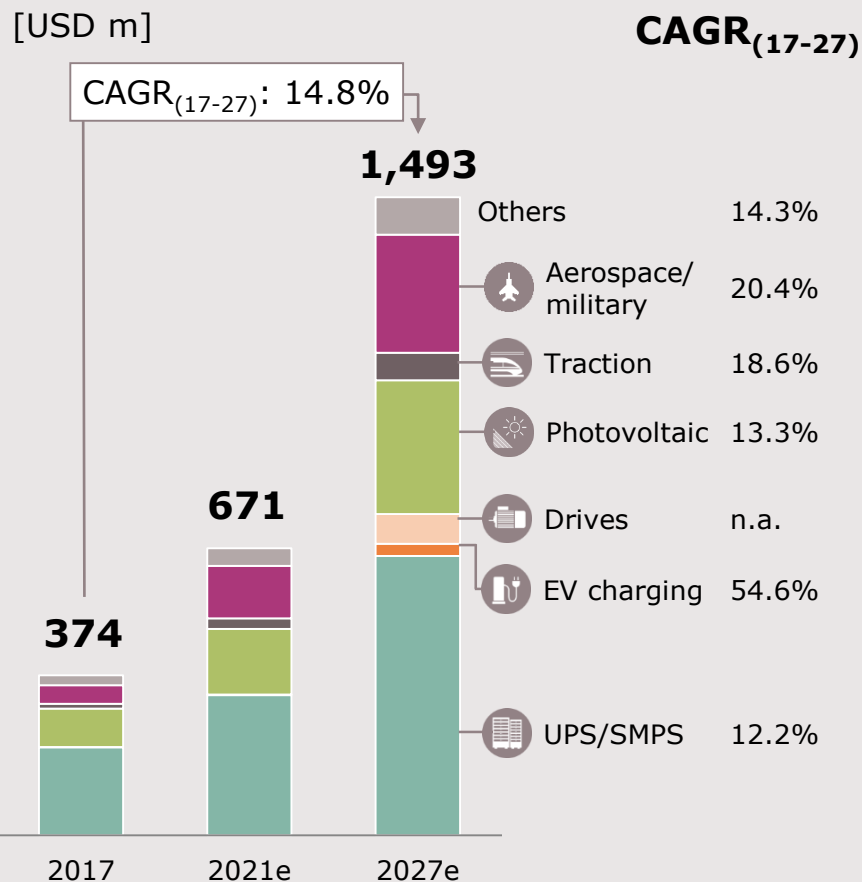
At higher frequencies and higher power ranges SiC and GaN have advantages compared to Si



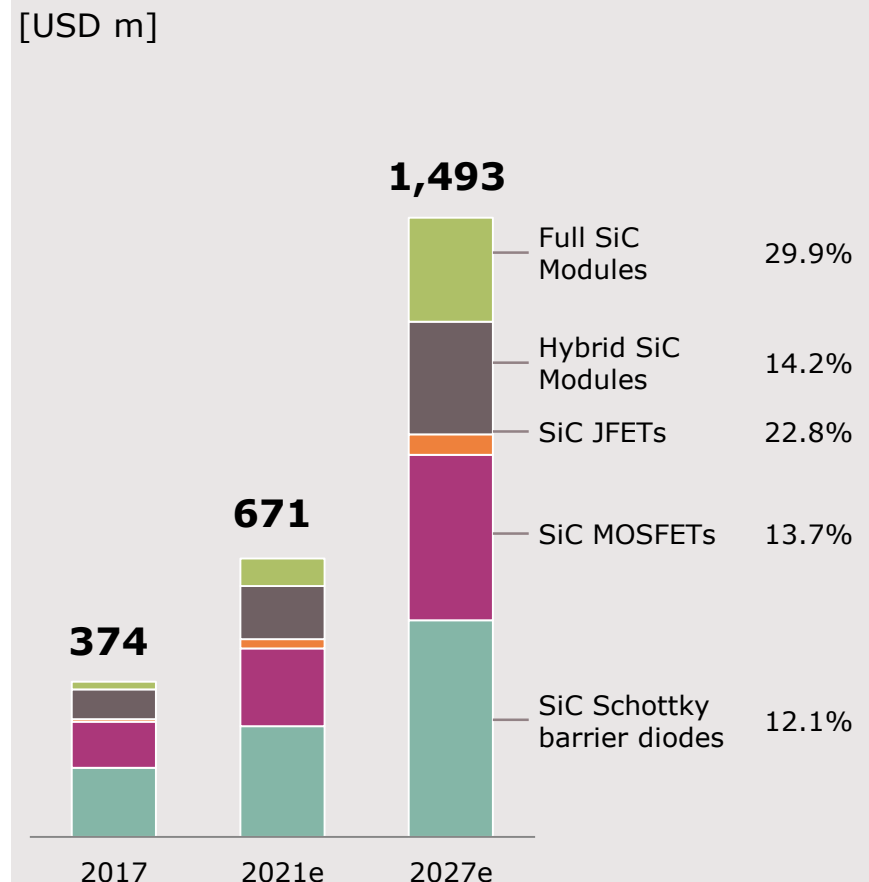
ATV, IPC and PMM have leading technologies and products to address the existing and upcoming opportunities of wide-bandgap semiconductors SiC and GaN

With an increasing number of applications, particularly module players will win in SiC

SiC power semiconductors by application excl. xEV



SiC power semiconductors by product type excl. xEV



Sources: based on or includes content supplied by IHS Markit, Technology Group, "SiC and GaN Power Semiconductors Report - 2018", April 2018, mid case

Upcoming applications in adjacent markets will drive demand for power semis for decades



Courtesy: Siemens AG

eMarine

- › Ferries are perfect candidates for electrification, due to a) short travel distances, and b) long docking periods at established ports, where they can be charged
- › Electrification of propulsion and auxiliary inverters
- › Charging infrastructure required

Business potential by **FY28**



Courtesy: Volocopter

Utility multicopters

- › Multicopters will enter freight and transport duties
- › Automotive OEMs incorporate multicopters in their mobility services
- › First autonomous aerial passenger taxis by 2022

Business potential by **FY30**



Courtesy: Lilium GmbH

eAviation

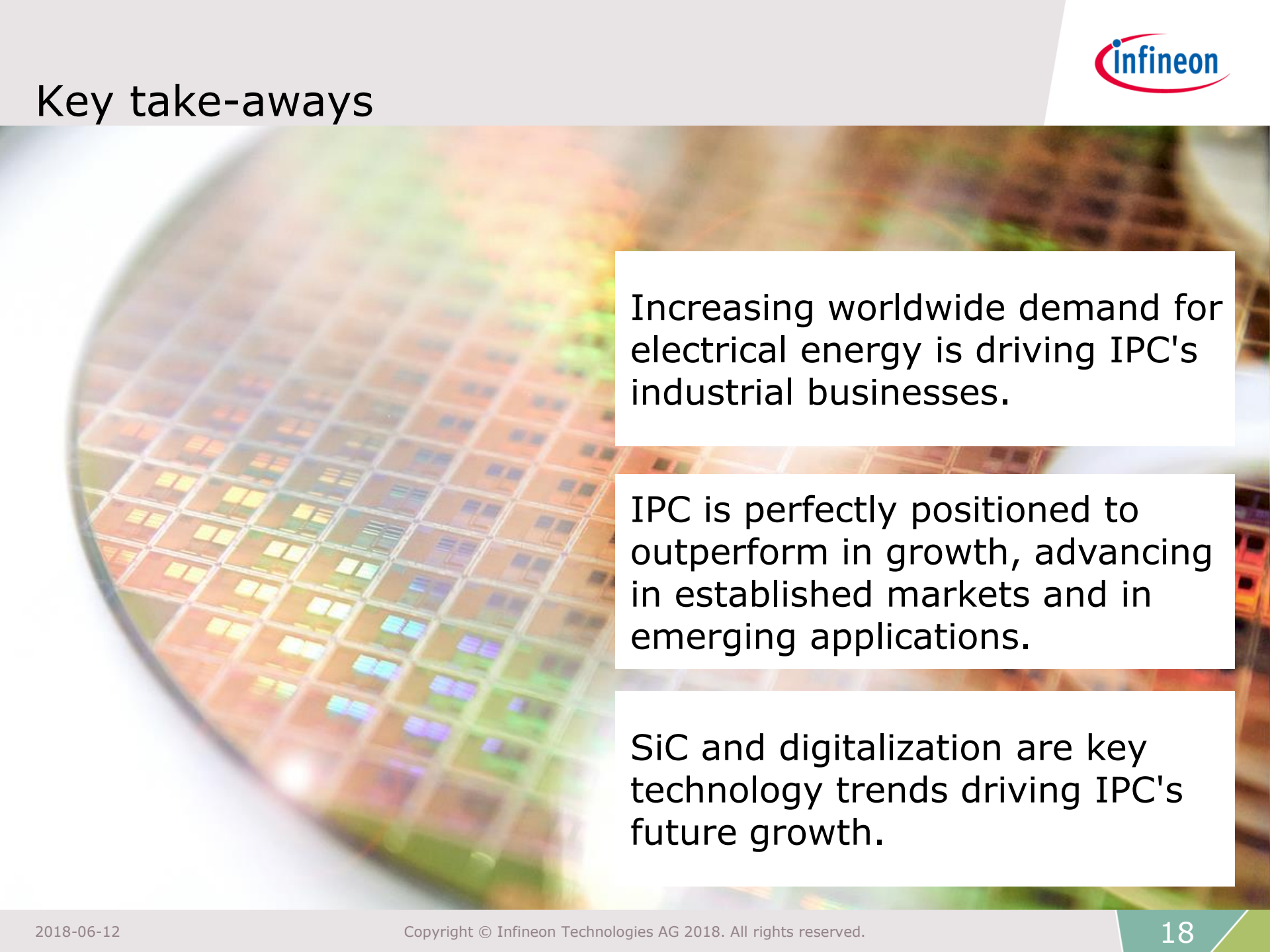
- › Fuel cost and regulations will drive electrification of airplanes
- › In 2035, more than 45% of all drives¹⁾ in airplanes will be (partially) electrified

Business potential by **FY35**

Source:

1) mainly auxiliary power supplies such as aircon and pumps

Key take-aways

A close-up, slightly blurred image of a silicon wafer with a grid of microchips, showing various colors like orange, yellow, and blue. The wafer is curved, and the background is out of focus.

Increasing worldwide demand for electrical energy is driving IPC's industrial businesses.

IPC is perfectly positioned to outperform in growth, advancing in established markets and in emerging applications.

SiC and digitalization are key technology trends driving IPC's future growth.

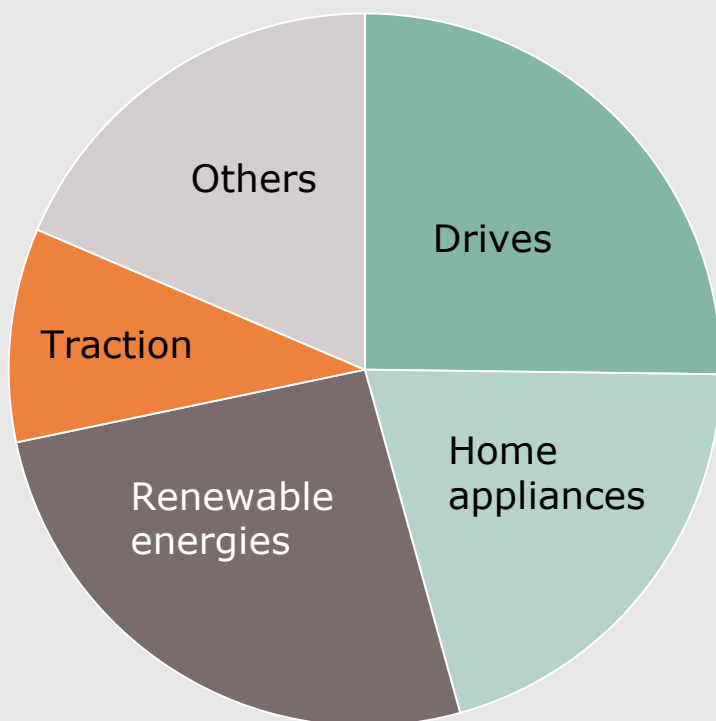


Part of your life. Part of tomorrow.

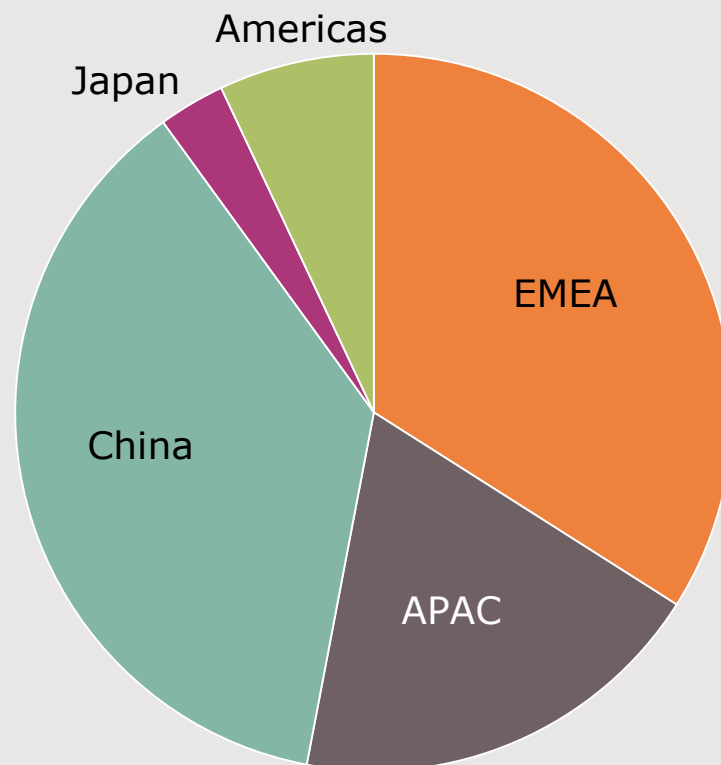


Dashboard

IPC FY17 revenue by application

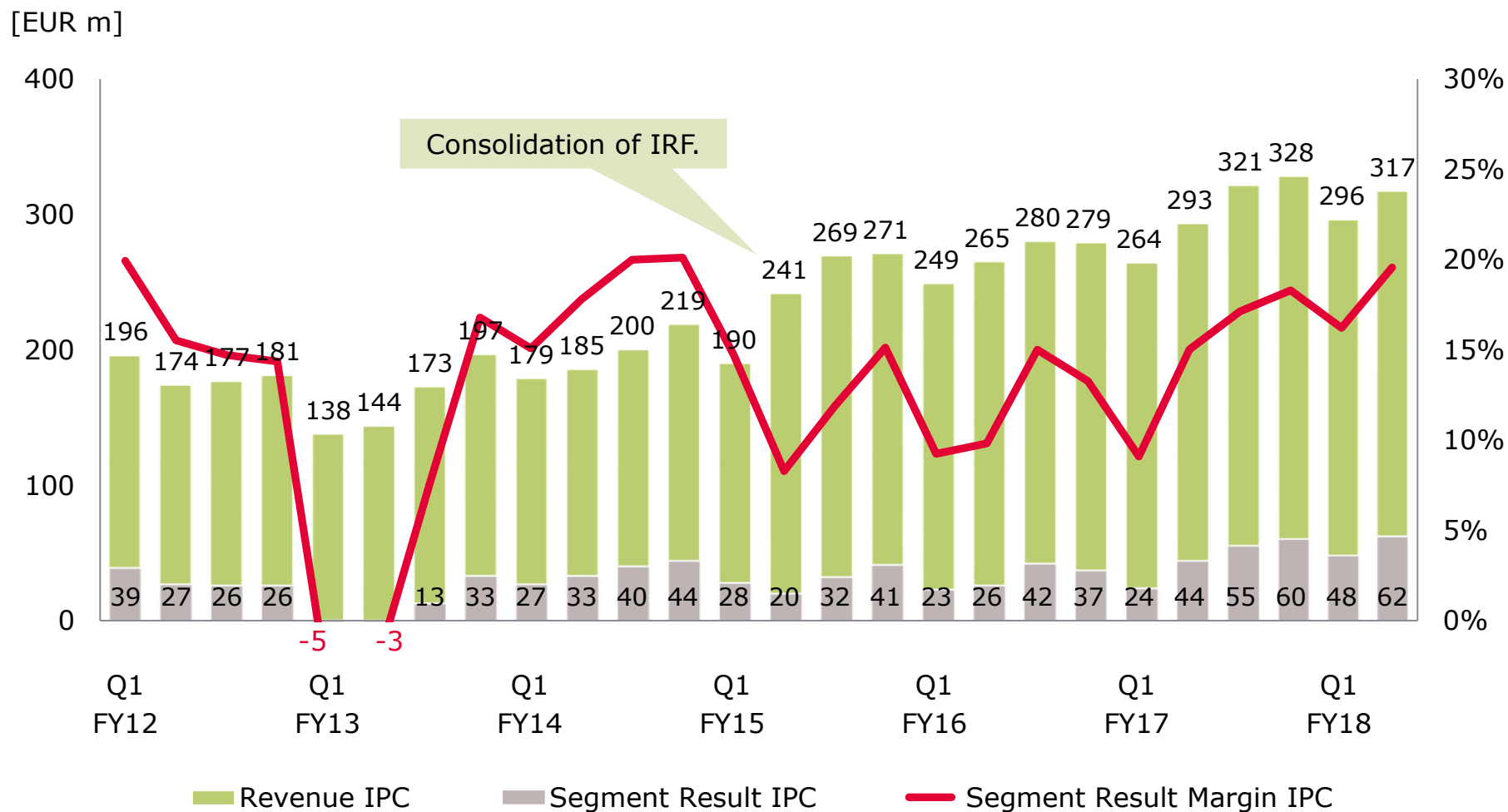


IPC FY17 revenue by region



IPC historic financial figures

Revenue and segment result development

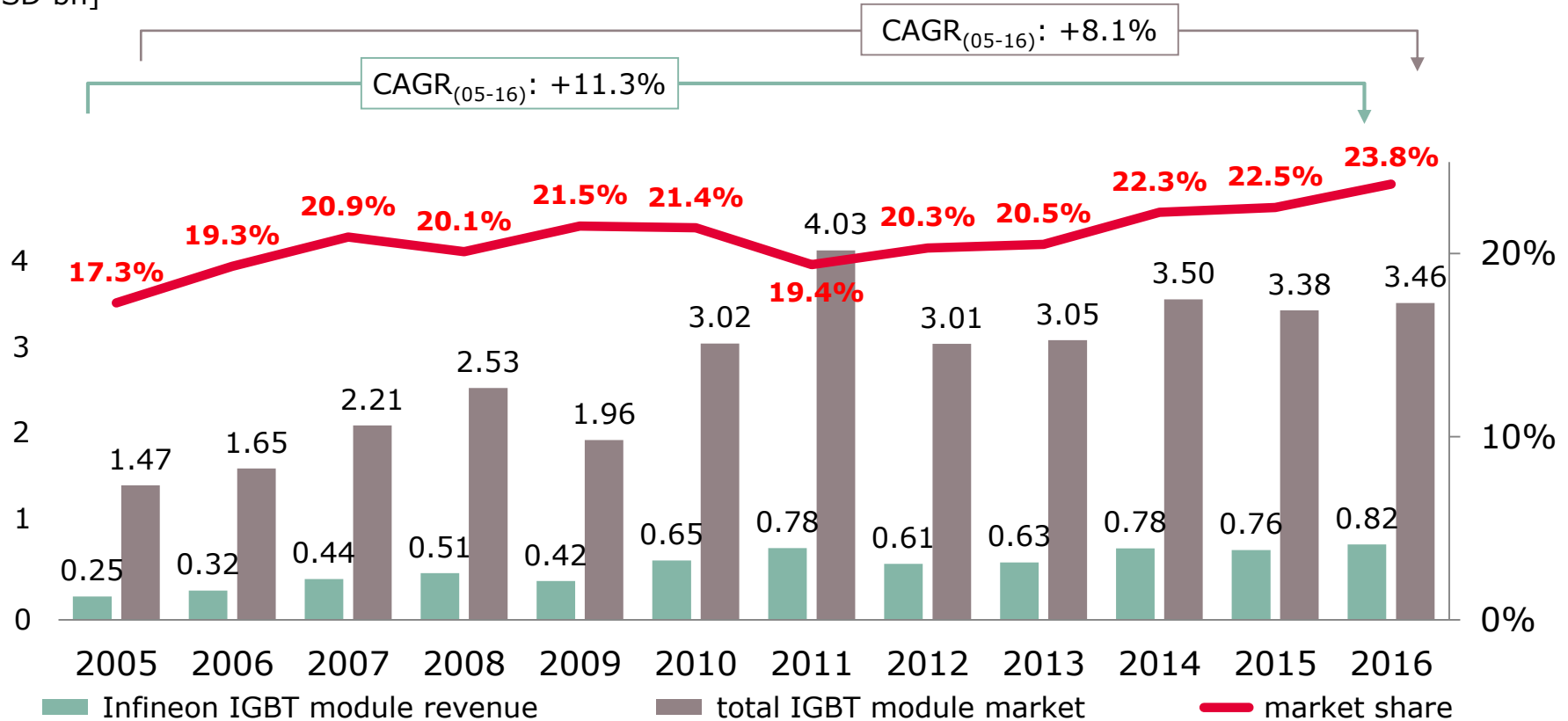


Infineon's IGBT modules business is outgrowing the market since 2005



Infineon IGBT module* market share development

[USD bn]



* including standard IGBT modules, IPMs, and other non-standard IGBT modules.

Source: based on or includes content supplied by IHS Markit, Technology Group, several reports from 2006 through 2015 and 2017

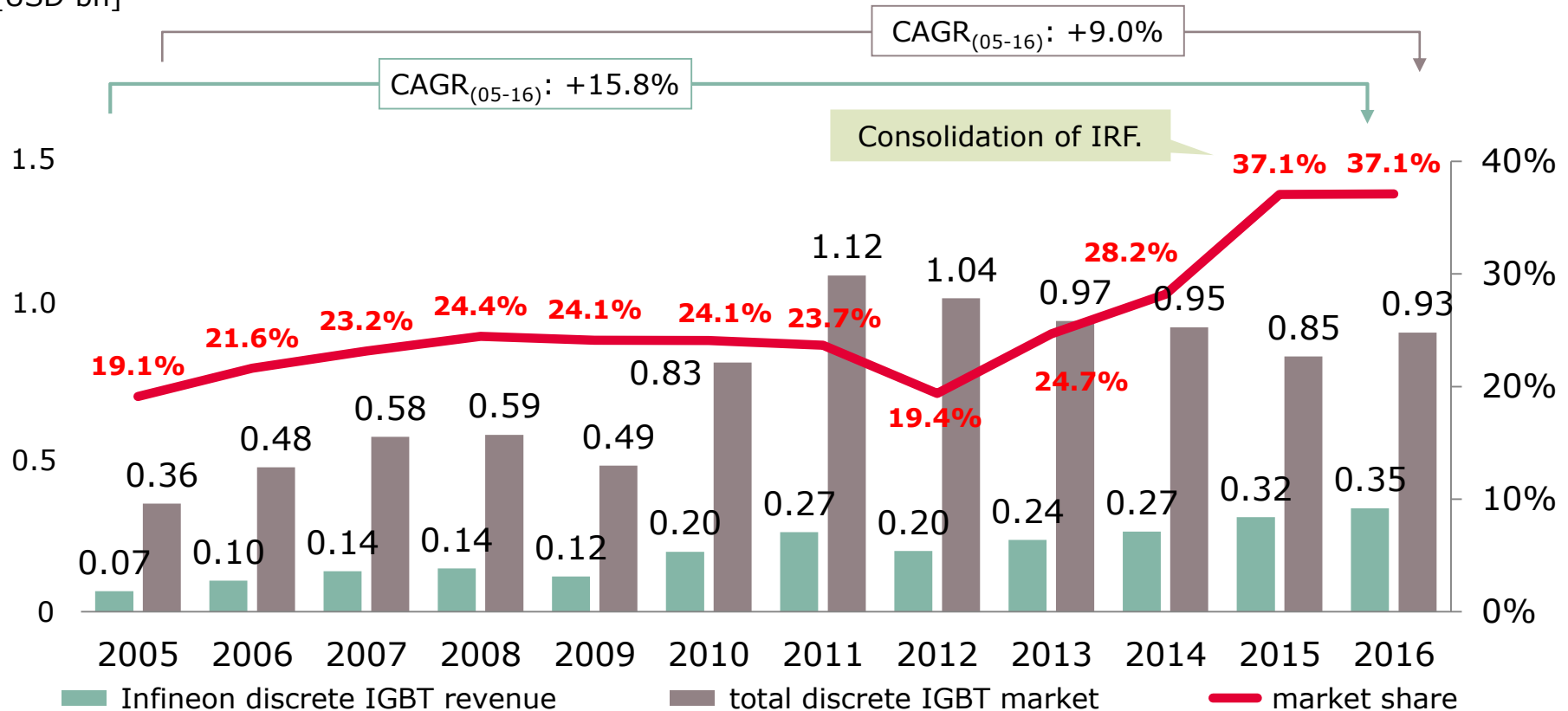
Note: No backward revision of market shares and market sizes; except for year 2015

Infiniteon's discrete IGBT market share almost doubled over the past ten years



Infineon discrete IGBT market share development

[USD bn]

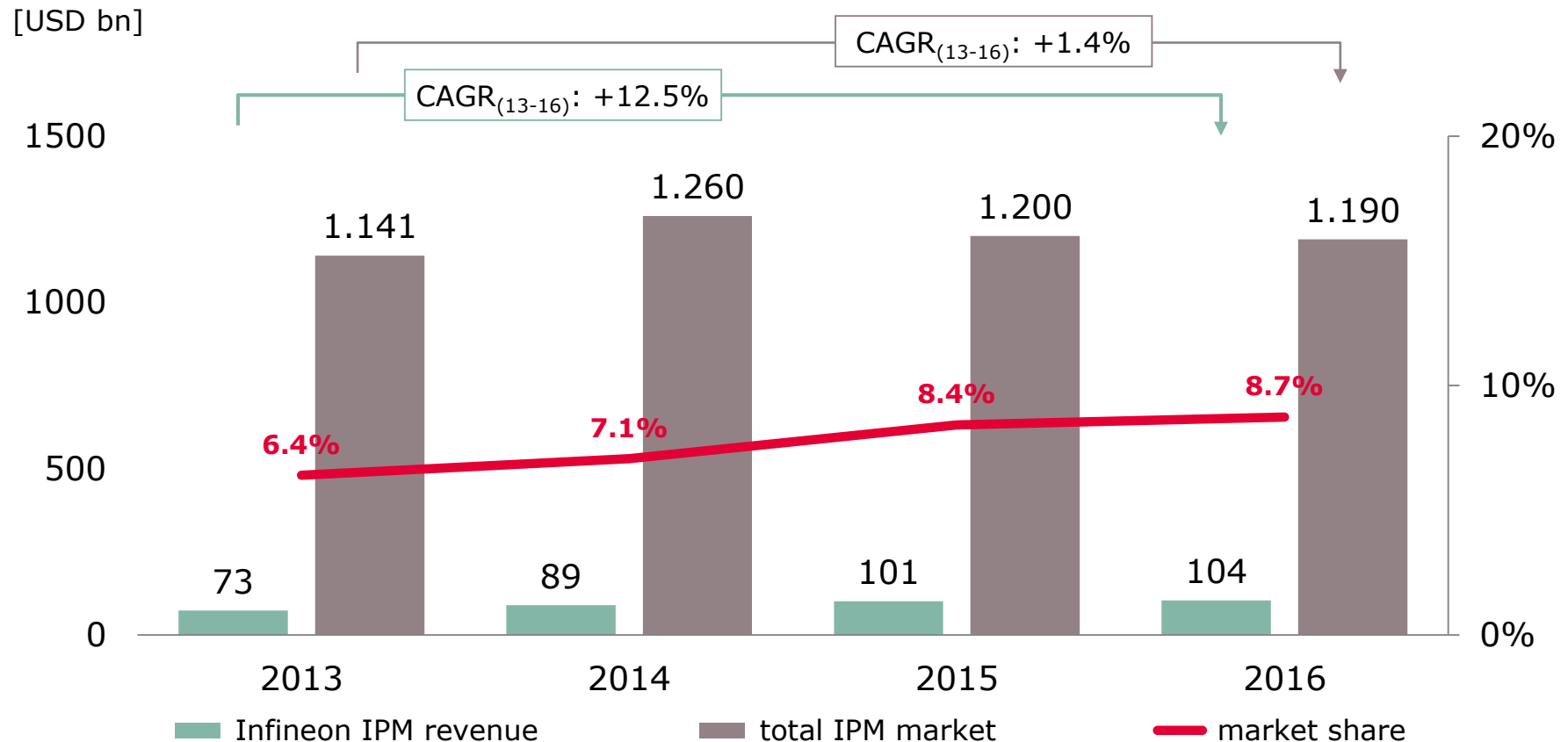


Source: based on or includes content supplied by IHS Markit, Technology Group, several reports from 2006 through 2015 and 2017

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

Share gains in IPMs driven by acquisitions (LSPS, IRF) and organically

Infineon IPM market share development



Source: based on or includes content supplied by IHS Markit, Technology Group, reports from 2015 and 2017; Infineon.

Glossary

AC	alternating current
AI	artificial intelligence
BoM	bill of material
EMU	electric multiple unit
GaN	gallium nitride
HMI	human machine interaction
HST	high-speed train
HW	hardware
IGBT	insulated gate bipolar transistor
IPM	intelligent power module
OBC	on-board charger
PFC	power factor correction
PMSM	permanent magnet synchronous motor
PV	photovoltaic
Si	silicon
SiC	silicon carbide
SMPS	switch-mode power supply
SW	software
UPS	uninterruptable power supply
VSD	variable speed drive

Dr. Peter Wawer

Division President Industrial Power Control



- › since 2016: Division President Industrial Power Control
- › 2012: Member of the Management Board of the Power Management & Multimarket Division
- › 2011: Senior VP Technology and Production at Q-Cells SE in Bitterfeld, Germany
- › 2008 – 2011: Senior VP Technology at Q-Cells SE
- › 1997 – 2008: various position at Infineon
- › Dr. Peter Wawer was born in Berlin, Germany, in 1967. He holds a Diploma in Electrical Engineering from the Technical University in Berlin where he also received his PhD.
- › He joined Infineon (Siemens AG until 1999) in 1997.

Disclaimer

This presentation contains forward-looking statements about the business, financial condition and earnings performance of the Infineon Group.

These statements are based on assumptions and projections resting upon currently available information and present estimates. They are subject to a multitude of uncertainties and risks. Actual business development may therefore differ materially from what has been expected.

Beyond disclosure requirements stipulated by law, Infineon does not undertake any obligation to update forward-looking statements.

Specific disclaimer for IHS Markit reports, data and information referenced in this document:

The IHS Markit reports, data and information referenced herein (the "IHS Markit Materials") are the copyrighted property of IHS Markit Ltd. and its subsidiaries ("IHS Markit") and represent data, research, opinions or viewpoints published by IHS Markit, and are not representations of fact. The IHS Markit Materials speak as of the original publication date thereof and not as of the date of this document. The information and opinions expressed in the IHS Markit Materials are subject to change without notice and neither IHS Markit nor, as a consequence, Infineon have a duty or responsibility to update the IHS Markit Materials or this presentation. Moreover, while the IHS Markit Materials reproduced herein are from sources considered reliable, the accuracy and completeness thereof are not warranted, nor are the opinions and analyses which are based upon it. IHS Markit and the trademarks used in the data, if any, are trademarks of IHS Markit. Other trademarks appearing in the IHS Markit Materials are the property of IHS Markit or their respective owners.