Deutsche Bank ADAS conference

London, 21 June 2016



Anton Müller
Senior Vice President Automotive

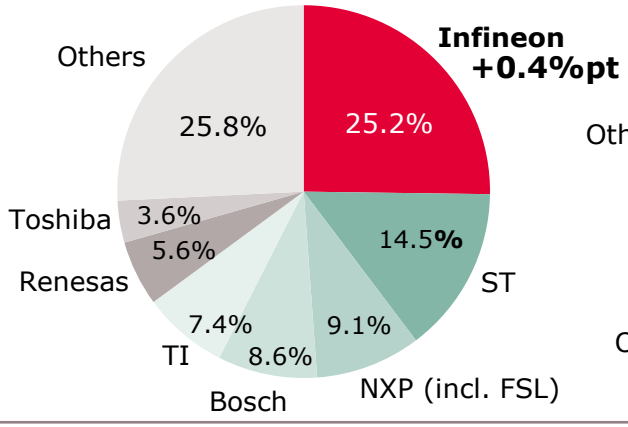
System leadership with most balanced portfolio in the market

Global market shares

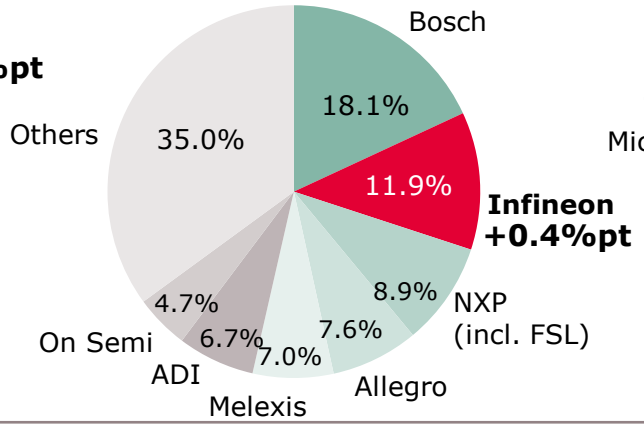
		2014	Delta	2015
1	NXP (incl. FSL)	13.3%	+0.9%	14.2%
2	**Infineon**	**10.5%**	**-0.1%**	**10.4%**
3	Renesas	12.0%	-1.7%	10.3%
4	STMicro	7.8%	-0.1%	7.7%
5	TI	6.1%	+0.9%	7.0%
6	Bosch	6.2%	-0.8%	5.4%

Market shares by product category

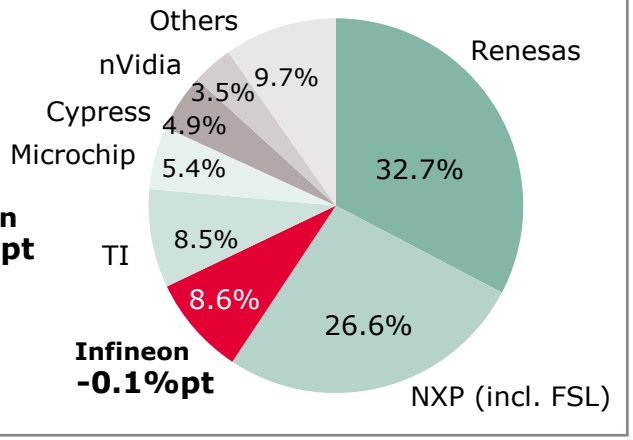
Power



Sensors



Microcontrollers



Source: Strategy Analytics, Vendor Ranking 2015 April 2016 (for company revenue 2015 & 2014)

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Four megatrends are shaping the automotive market, significantly increasing the semi content per vehicle

ADAS/Autonomous driving

- From ADAS to semi-automated and finally autonomous driving
- Every world region is striving for "0-accident"



xEV/eMobility

- Mandated CO_2 reductions make electrification of powertrain inevitable





- Advanced connectivity is driven by making the car part of the Internet
- The car will be fully connected (V2I, V2V, in-vehicle)

Connectivity



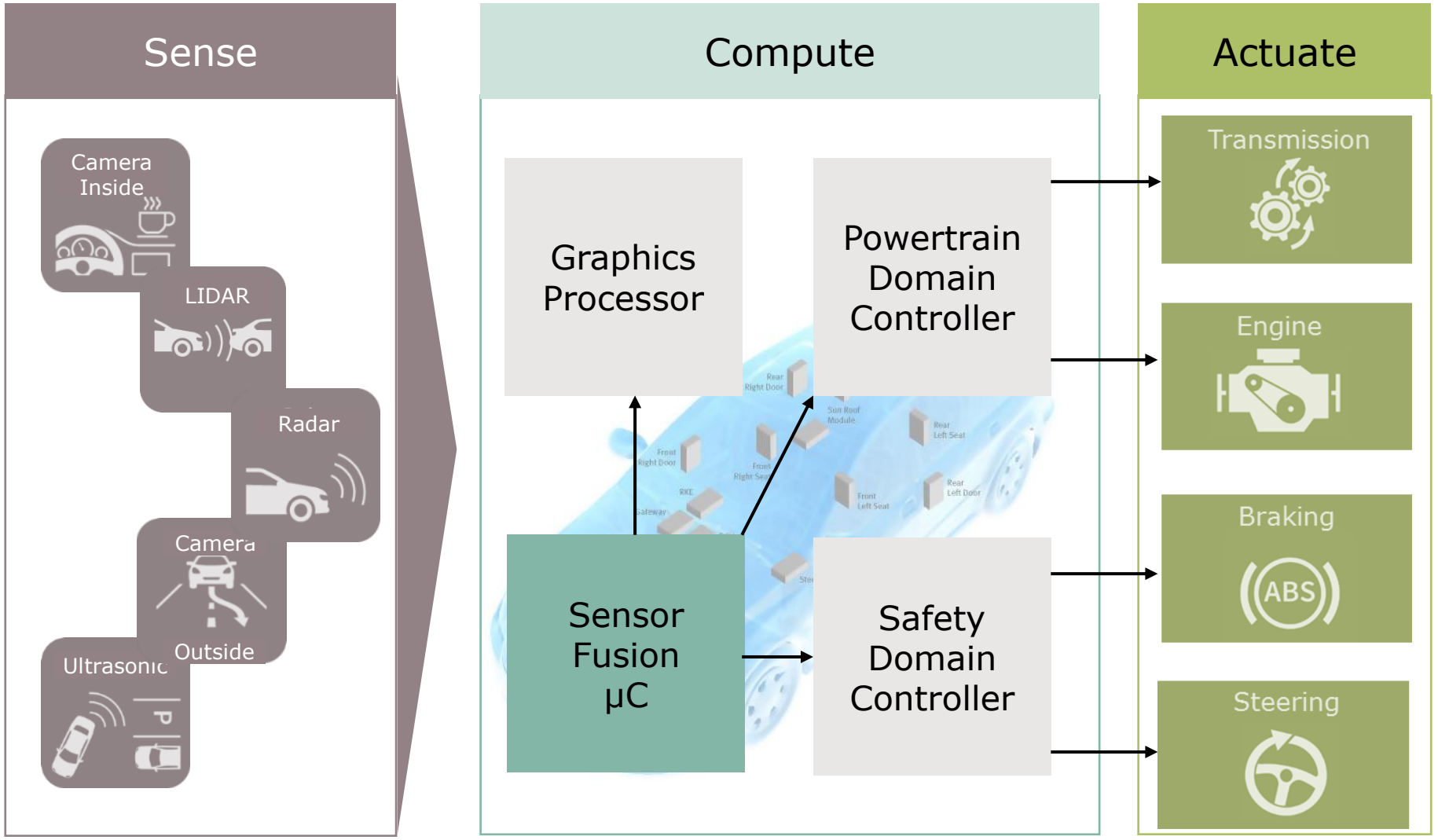
- Increased connectivity and software content increase risk exposure to hackers
- Internal/external connectivity must be secured

Advanced security

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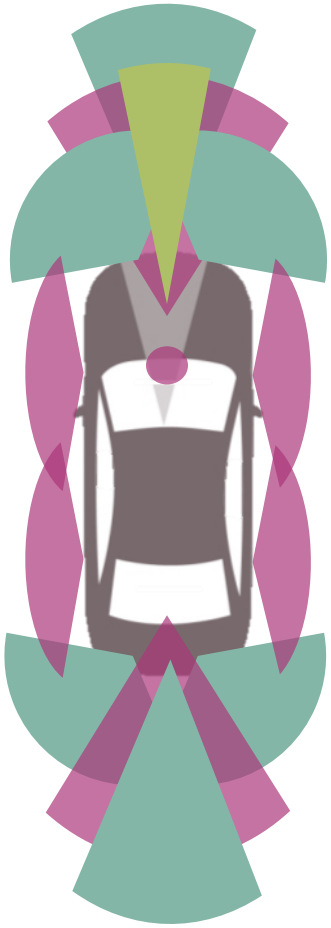
ADAS system overview

Sense | Compute | Actuate



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More sensors required for each automation level – sensor “cocoon” in level 4/5



Sensor technologies
Front looking camera Front looking radar Front looking lidar
Surround camera Corner radar Surround radar
Rear looking camera Rear looking radar
Driver monitoring Camera
V2X sensor

Radar Camera Lidar

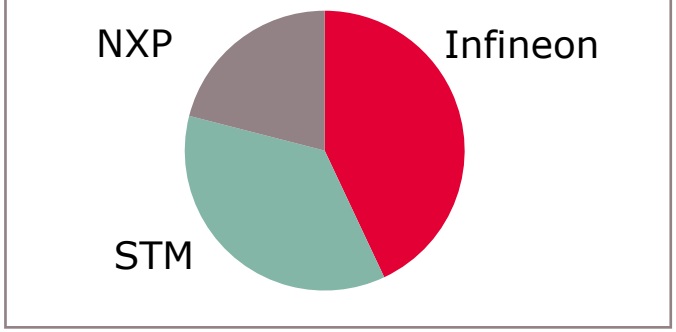
* Euro-NCAP is focusing on collision avoidance, requirements are increasing over time

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Infineon market leader in radar; 20m sensor chips sold; ~50% $CAGR_{16-21}$ based on design wins

Sense

2015 radar sensor market share*



Innovation for performance

Innovation for cost

Vision Zero
+ Autonomous Driving

ACC radar
1st SiGe 77 GHz transceiver



mid-range radar
1st radar product
eWLB package



Blind Spot Detection
(24 GHz)

mid- & long-range radar
Dual Chip System solution:
µC, power supply



next gen. of mid- & long-range radar
AURIX™ 3rd gen., power supply
SiGe

short to mid-range radar
CMOS solution
CMOS

2009 | Today | Tomorrow

* Source: IHS Inc., "Advanced Driver Assistance Applications Sensor Market Database – H2 2015", February 2016

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Depending on test cases, AEB will be either BiCMOS or CMOS

Sense

	SiGe BiCMOS	CMOS (< 40 nm)
77 GHz performance	excellent	ok
f_{max}	> 400 GHz	> 300 GHz
Noise	1x	2x .. 3x
System-on-chip capabilities	good	excellent
77 GHz automotive-qualified product	in high volume production	not yet available

Application	ACC, Highway Assist	AEB	Parking Assist, Blind Spot Detection

- Today, SiGe is state of the art.
- Beyond 2020, CMOS will find its sweet spot in 360° applications.

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Infineon‘s automotive offering in ADAS camera systems

Sense | Compute

Driver monitoring

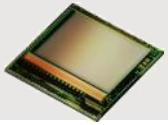
- Most robust detection of head position, head orientation and eye closure
- Observe the state of the driver and passengers
- Optimize head-up displays and augmented reality to driver’s head position



Kostal camera system



REAL3™ sensor



Front collision warning

- AURIX™ microcontroller is today the reference for safety allowing ASIL-D systems
- The safe & secure microcontroller is represented in most of today’s camera systems
- OEMs prefer software on AURIX™

Image processor e.g.

MOBILEYE

+

Infineon safe & secure µC



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AURIX™ as market reference for safe and secure applications

ADAS/AD

Sensor fusion

AURIX™ as main or host controller



Shipping 2016

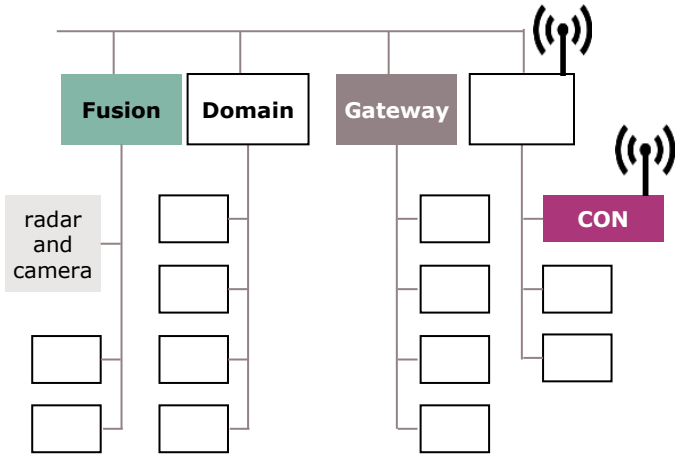
Radar and camera

AURIX™ as main* or host controller

Shipping 2016

Domain control

AURIX™ as real-time main controller



Shipping 2015

› More than $1bn design win volume

New infotainment

Connectivity gateway

AURIX™ as real-time main controller



Shipping 2017

Always-on connectivity

AURIX™ as host controller



Shipping 2018

* for radar

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Infineon AURIX™ microcontrollers make autonomous driving reliable

Compute



The central driver assistance ECU ("zFAS*") is the core of future systems for piloted driving for Audi

Key components from Infineon, designed for reliability:

- AURIX™ controller as decision maker and interface to the car architecture
- DC-DC – safety system supply

Strategic cooperation with TTTech to enable zFAS* based architecture and position Infineon as leading supplier

* zFAS = zentrales Fahrerassistenzsystem

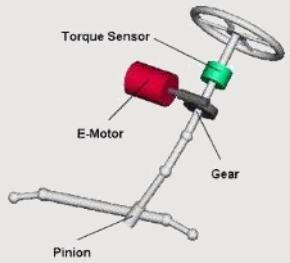
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30%+ higher BoM on fail operational systems in level 3-compliant vehicles

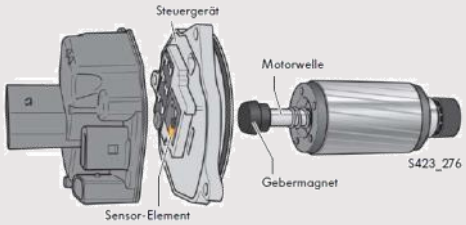
Sense | Compute | Actuate

P2S example: electric power steering

System



Electric motor

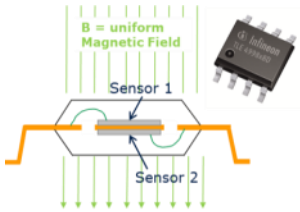


Courtesy: ZF Lenksysteme

Electronic control unit



Sense



2 independent dies

Compute



multicore

Actuate



multi-phase control

Safe power supply

Infineon with 100% BoM coverage

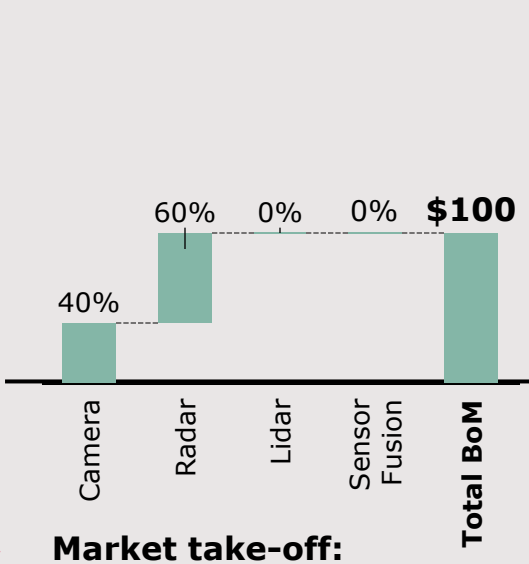
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ADAS semi growth driven by radar and camera sensor modules

Sense | Compute | Actuate

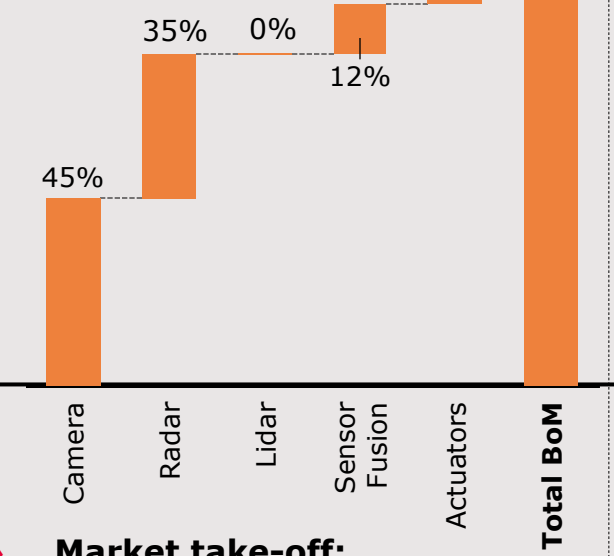
Average ADAS semiconductor content per level of automation

Level 2



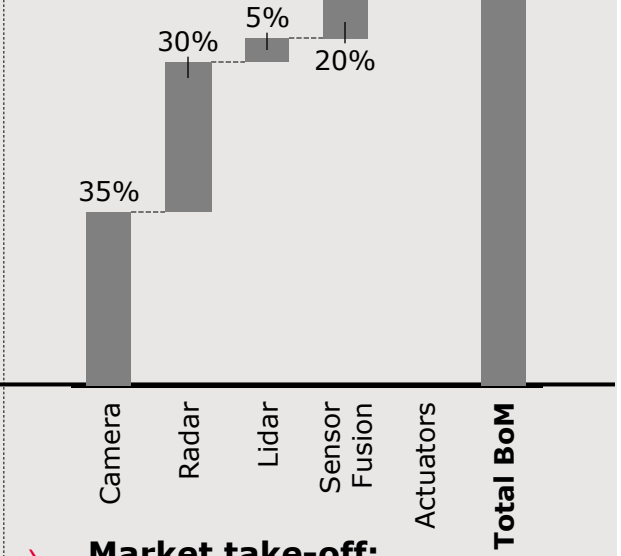
- **Market take-off:** 2015-2020 (up to 30m vehicles p.a.)
- **Key market driver:** NCAP, Automatic Emergency Brake, Blindspot Detection

Level 3



- **Market take-off:** 2020-2025 (up to 10m vehicles p.a.)
- **Key market driver:** Automated Driving in specific situations (e.g. parking, highway)

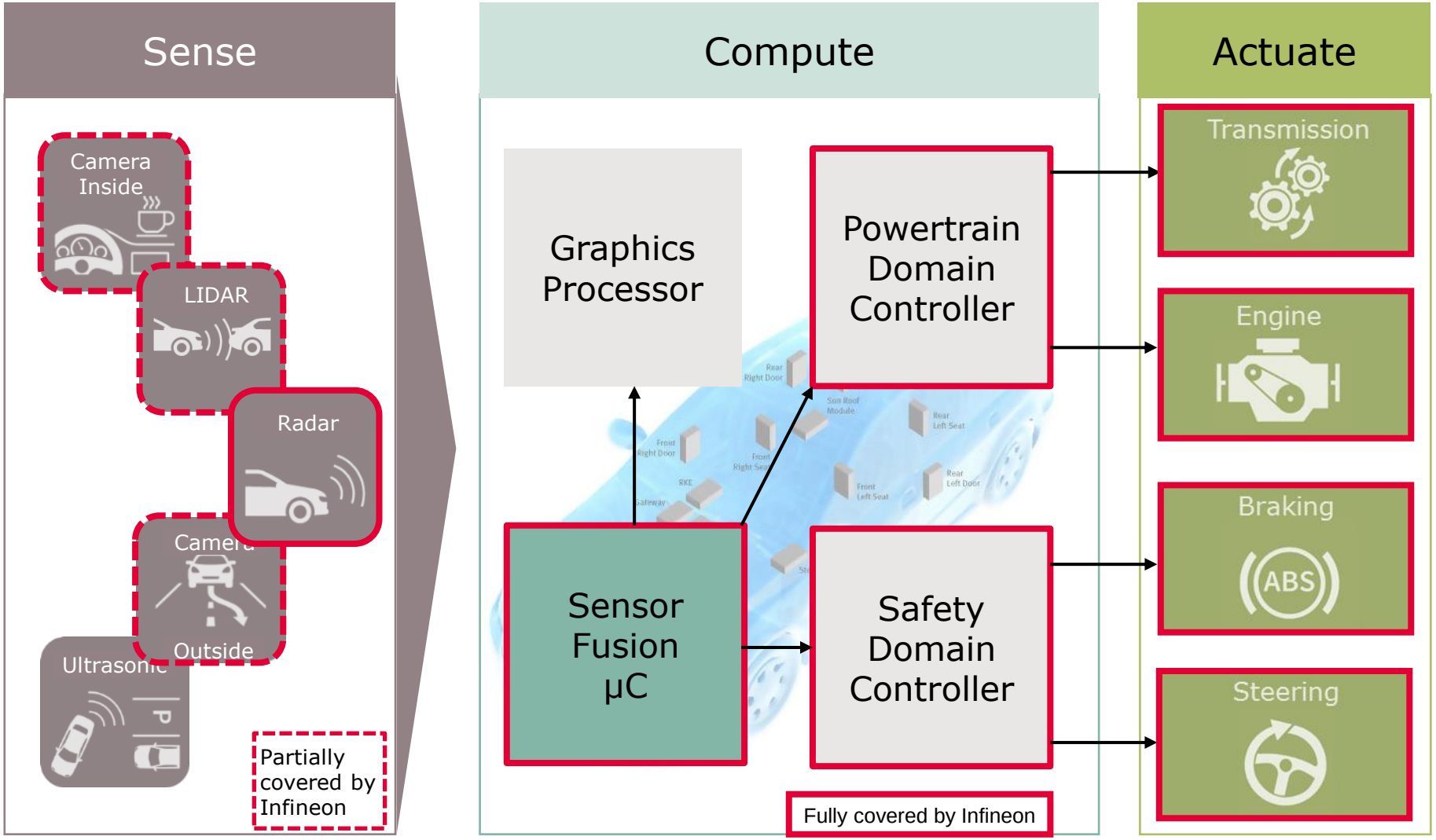
Level 4



- **Market take-off:** 2025-2030 (up to 5m vehicles p.a.)
- **Key market driver:** Autonomous Driving

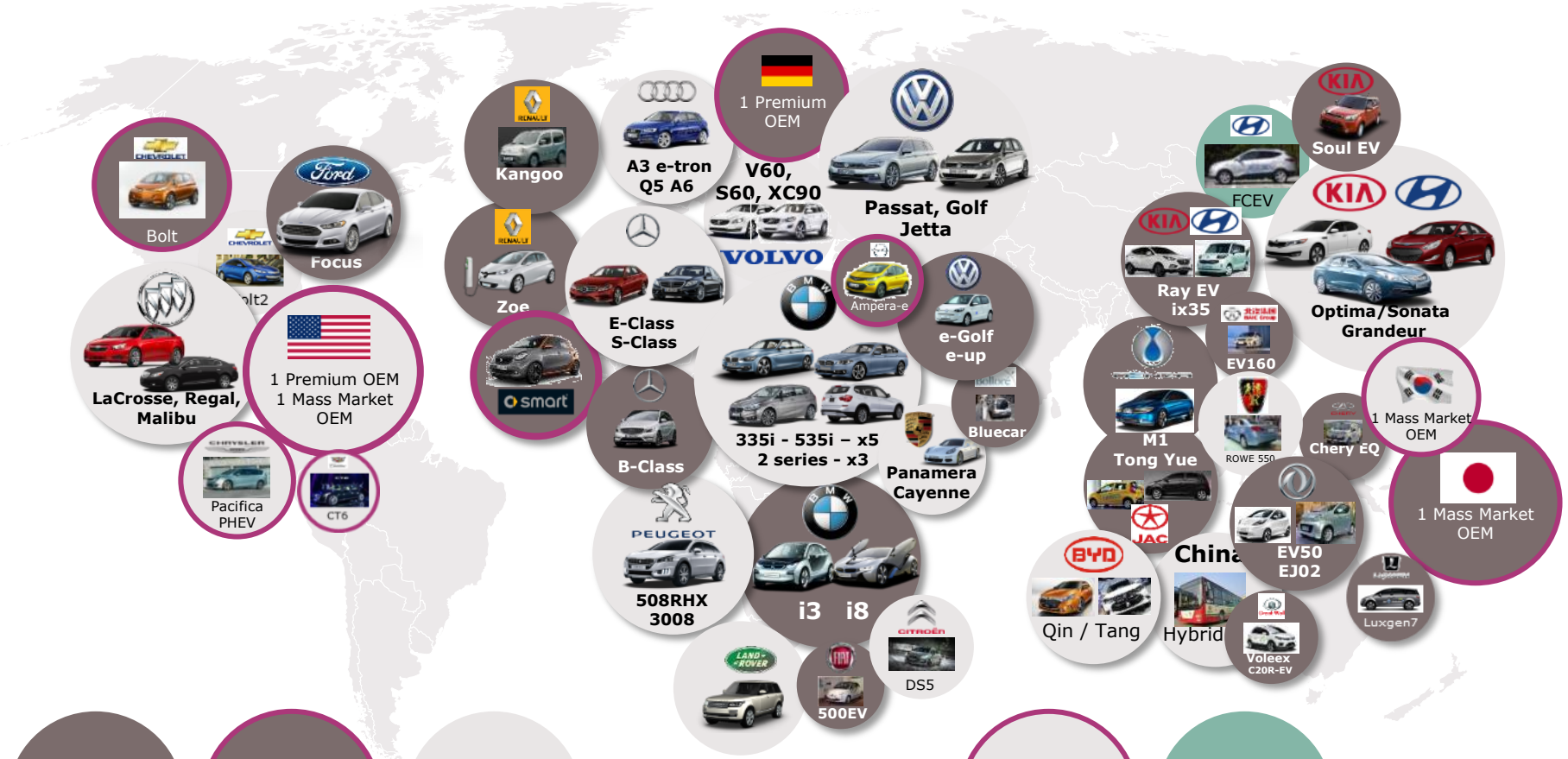
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ADAS system chipset coverage by Infineon



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Infineon is well positioned globally to benefit over-proportionally from xEV boom



EV in production

EV future SOP

HEV in production

HEV future SOP

Fuel Cell in production

SOP = Start of production

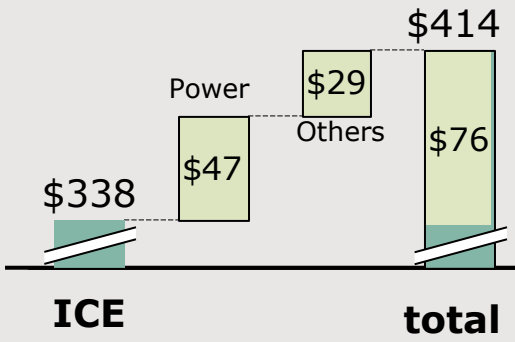
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xEV growth driven by power semis

Average xEV semiconductor content by degree of electrification

48 V

Adder for DCDC and starter/generator

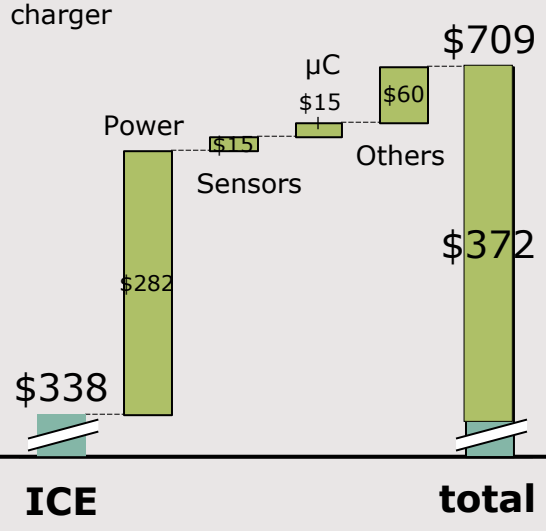


2020: 1.6m*

› high growth for 48 V (not even including 48 V auxiliaries nor mild hybrid)

HEV / PHEV

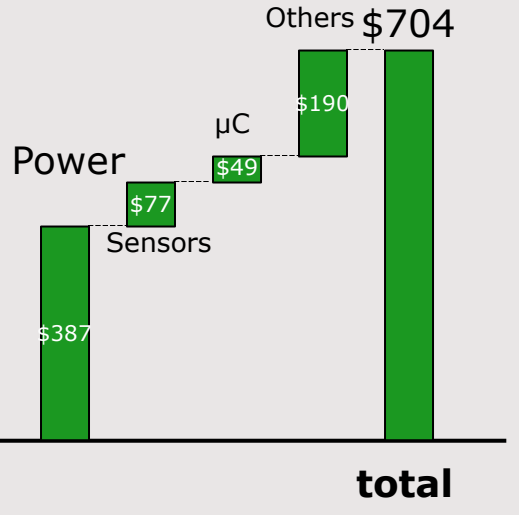
Adder for DC-DC, inverter, onboard charger



2020: 3.5m HEVs* 1.9m PEHs*

› PHEV to overtake HEV after 2020, especially in Europe

EV



2020: 1.4m EVs*

› strong growth driven by Chinese OEMs

* expected number of vehicles; source: IHS, "Alternative Propulsion Forecast", January 2016

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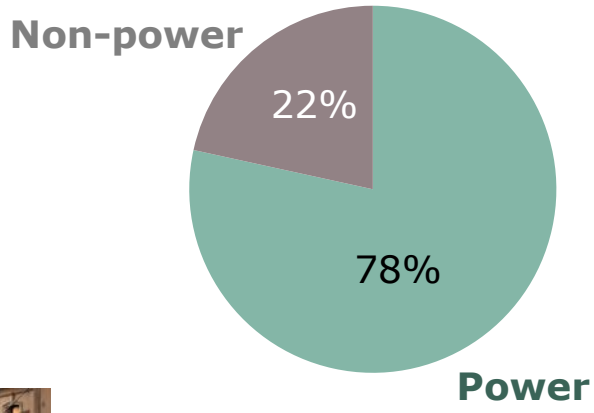
#1 semi supplier of German premium OEMs

Powered by Infineon

> $500 **semiconductor content**



Courtesy: BMW



740e

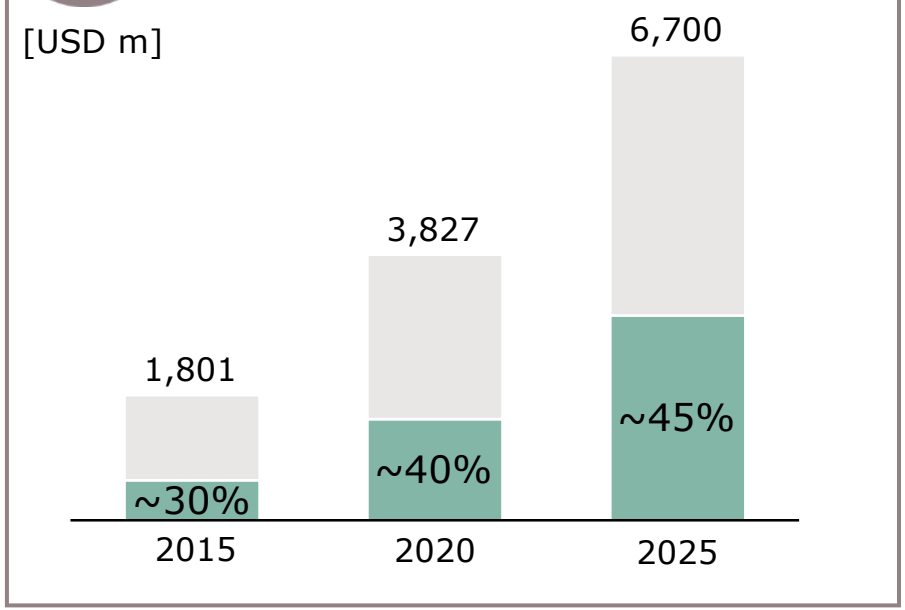
Plug-in hybrid

The expected big expansion of PHEV model line-up from premium OEMs will boost Infineon revenues

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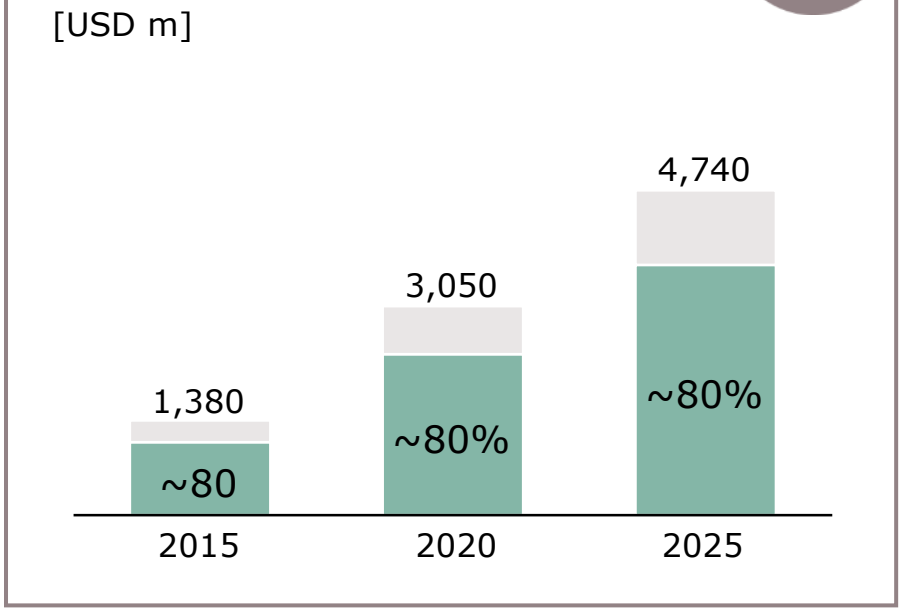
Infineon is ideally positioned to benefit most from megatrends ADAS, xEV, and security

ADAS/autonomous driving semiconductor market



› higher market coverage driven by radar penetration, AURIX™ penetration and actuators

xEV/electro-mobility semiconductor market



› high market coverage already in 2015 will be kept with ramp-up of new power products (e.g. HybridPACK™ DSC and SiC MOSFETs)

Source: IHS, Strategy Analytics, Infineon

Addressed by Infineon | Not addressed by Infineon

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ADAS, CO_2 reduction and adoption of premium features drive Infineon growth

Vehicle production	Drivers for semiconductor content per car		
	CO_2 reduction	Advanced safety	Comfort, premium
	 Courtesy: BMW	 Courtesy: Audi	
› ~2% growth p.a. › Further growth in Western Europe, China, and ASEAN › Electro-mobility gaining momentum, especially in China	› Driven by legislation › Improvements of ICE (e.g. electric steering, electric pumps and motors) › Adoption of EV/HEV	› Current: crash avoidance › Next: assisted driving › Future: autonomous driving	› Premium cars are early adopters of high-end comfort and safety features › Trickling down to mid-range

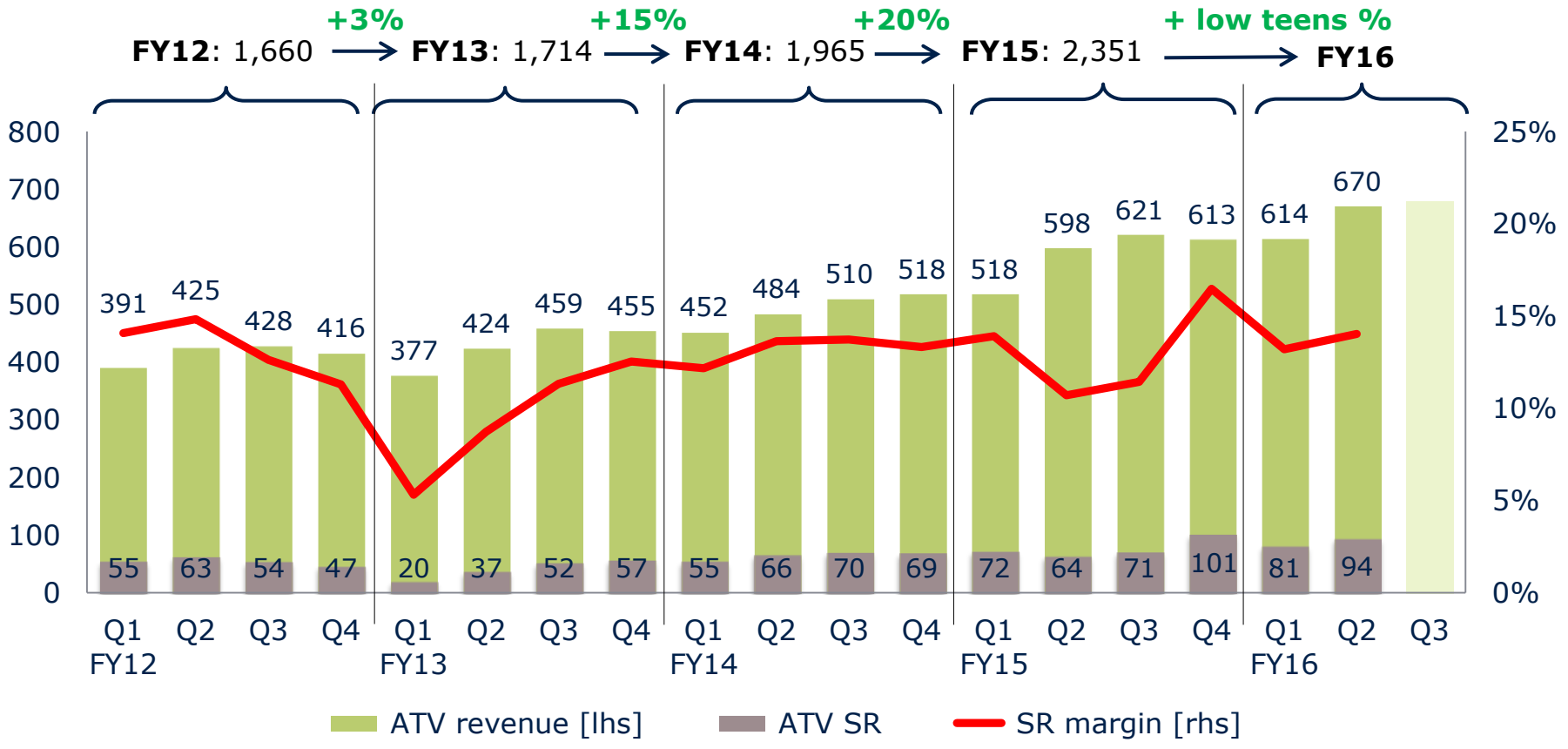
~8% p.a. through-cycle growth

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Infineon automotive financials at a glance

Revenue and segment result development

[EUR m]



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Infineon as best positioned semi player to overall benefit from two biggest megatrends

Automotive market

- 50% of Infineon automotive market growth driven by ADAS/xEV
- Infineon addresses
  - up to 80% of xEV BoM and
  - 40% of ADAS BoM

Infineon ADAS

#2	automotive semiconductor
#1	power semiconductors
#2	sensor semiconductors
#3	microcontrollers
#1	xEV semiconductors

Infineon ADAS



1. Infineon is the market leader for radar
2. Infineon develops camera solutions (e.g. driver monitoring, safety and security in front collision warning)
3. AURIX™ as ADAS market reference for safety and security applications (e.g. camera, sensor fusion)



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