

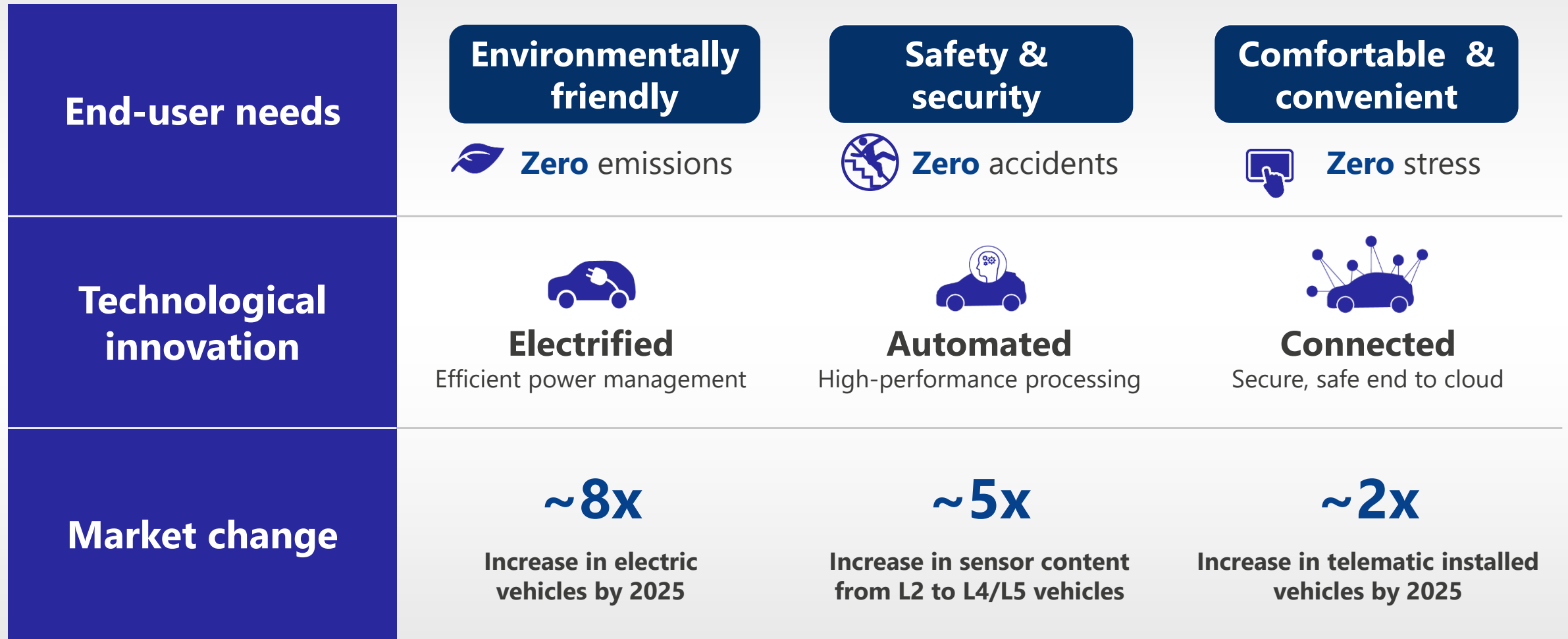
# AUTOMOTIVE STRATEGY

FEBRUARY 17, 2020  
AUTOMOTIVE BUSINESS SOLUTION UNIT  
RENESAS ELECTRONICS CORPORATION

# OVERALL

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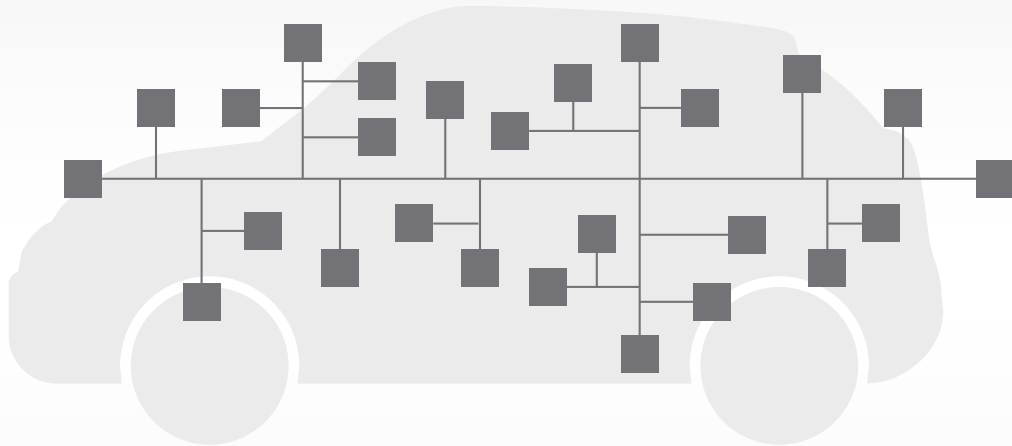
# MEGATRENDS – FROM NEEDS TO MARKET CHANGE



Source: Strategy Analytics data

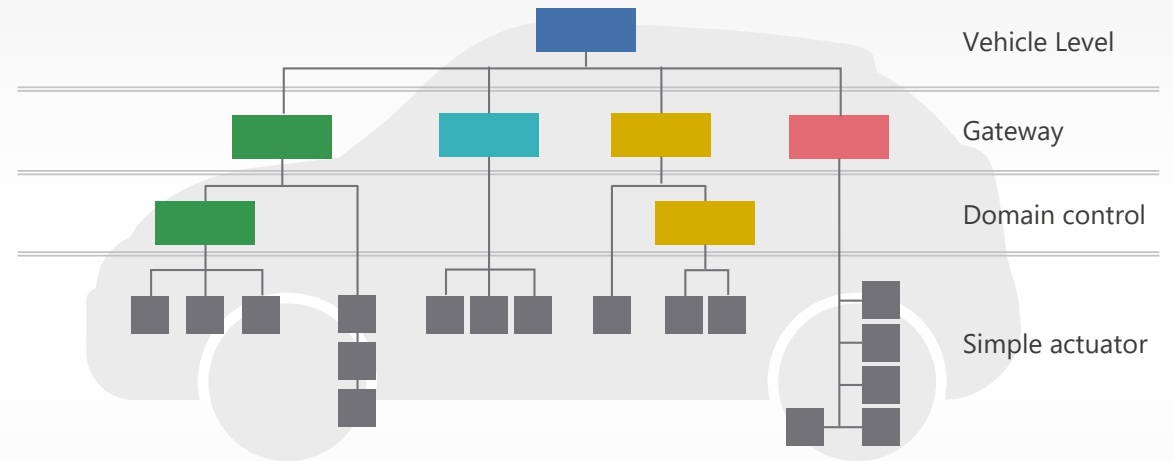
# MEGATREND – ARCHITECTURE TRANSFORMATION

## TODAY - Distributed architecture



- Increasing hardware varieties
- Increasing lines of code in vehicle
- Inefficient development
- Security & functional safety challenges
- Not easily upgraded or scaled

## TOMORROW - Centralized architecture



- Scalable and easy to develop hardware
- Reusable software
- Efficient to develop
- Safe and redundant network
- Upgradable and scalable platform

# 2016 MID-TERM GROWTH STRATEGY REVIEW

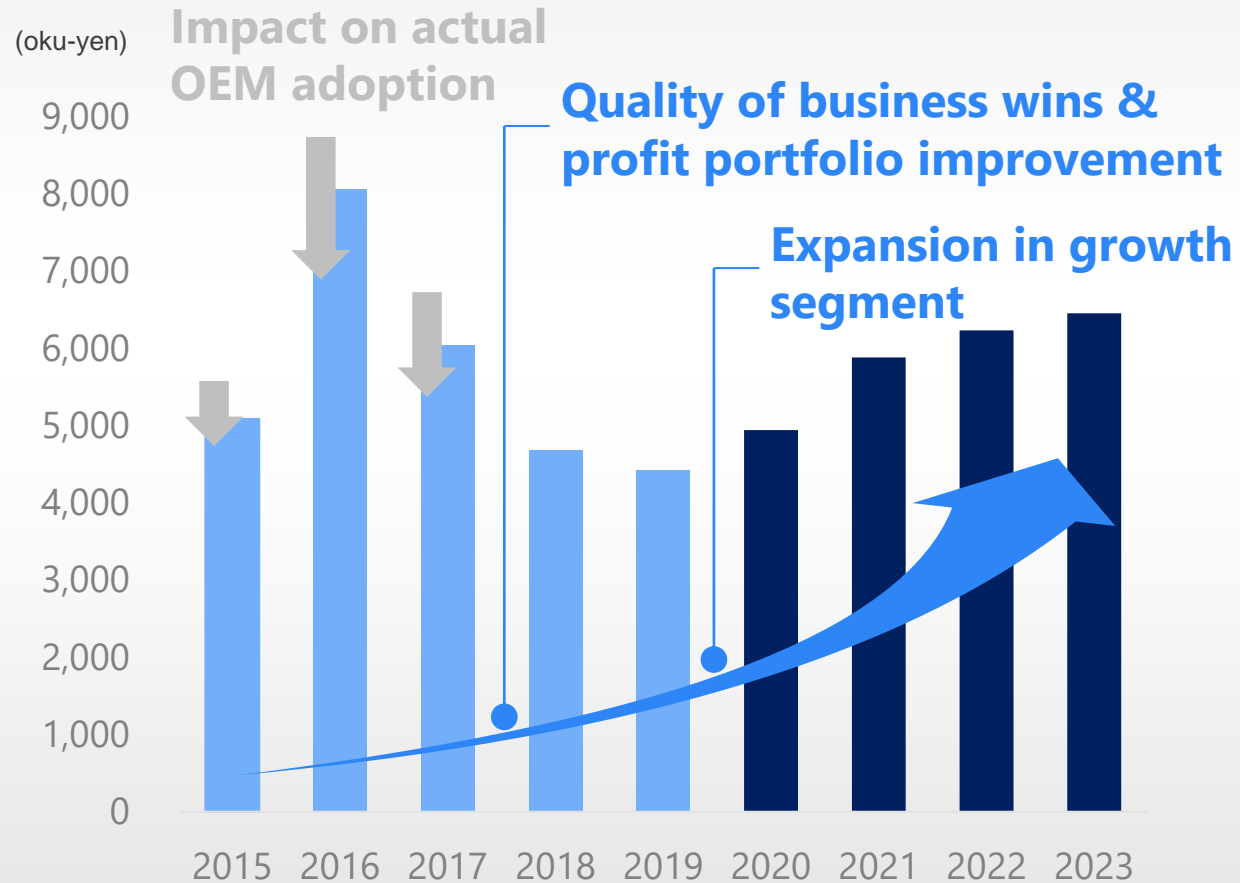
	Result	New guiding principle
Profitability	<ul style="list-style-type: none"> <li>▪ Short fall in GM</li> <li>▪ Excessively optimistic Fab utilization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Optimize fab utilization</li> <li>▪ High added value solution transition</li> </ul>
Design in (D-in)	<ul style="list-style-type: none"> <li>▪ Accumulation of a mountain of D-in</li> <li>▪ Low quality of D-in</li> </ul>	<ul style="list-style-type: none"> <li>▪ Select high confidence business</li> <li>▪ Strengthen strategic OEM relationship</li> </ul>
Solution	<ul style="list-style-type: none"> <li>▪ Product-orientated</li> <li>▪ Insufficient solution offering</li> </ul>	<ul style="list-style-type: none"> <li>▪ Enhance product combination</li> <li>▪ Synergy with Intersil /IDT product</li> </ul>



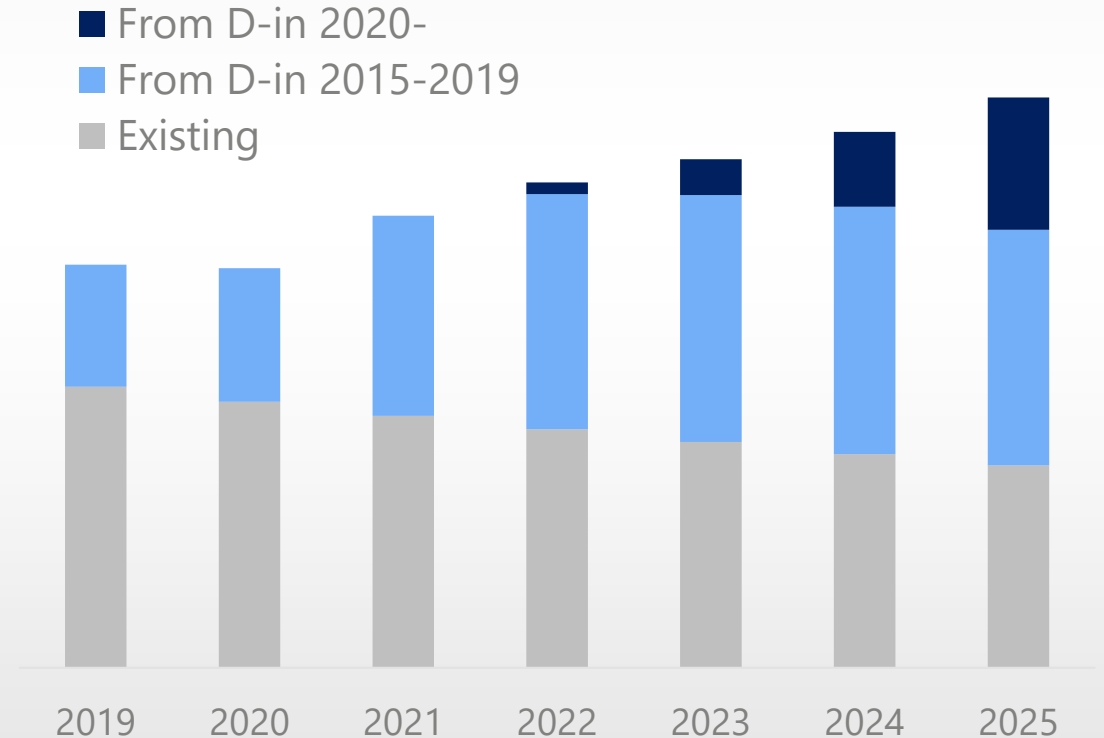
**Pursue balanced biz growth & profitability**

# PROSPECT OF D-IN TO REVENUE CONVERSION

## D-in LTV



## D-in to revenue conversion



\* FX 2019: Actual record, 2020:1USD=100yen, 1EUR=110yen, 2021-2025: 1USD=100yen, 1EUR=120yen

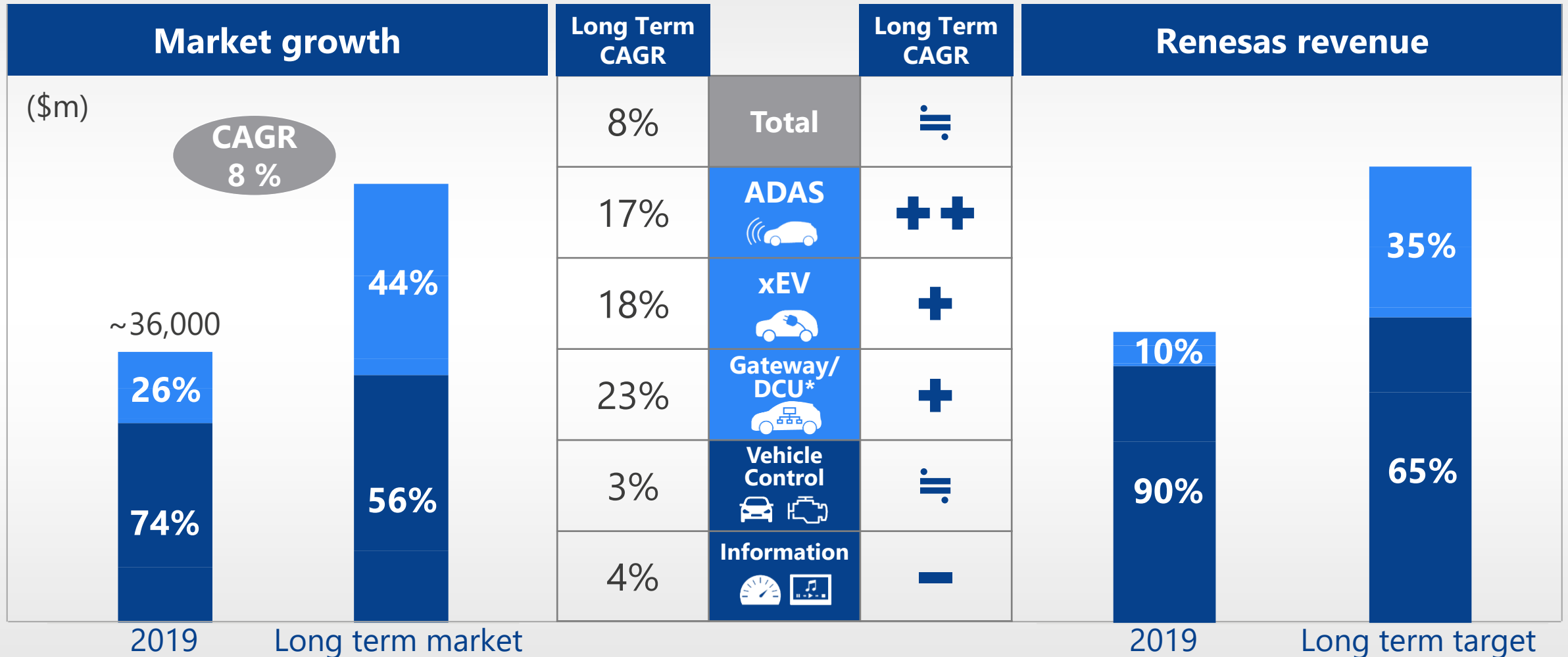
# TARGET FINANCIAL MODEL

	2019 Adjusted*		Long-term target*
Revenue	3,330 oku-yen	➤	Grow @SAM
Gross margin	< 40%**	➤	40 - 45%
Operating margin	< 10%	➤	10 - 15%

\* FX 1USD=100yen, 1EUR=120yen. Continuing business only

\*\* After reclassification (part of SG&A reclassified to CoGs and R&D)

# PORTFOLIO EXPANSION BY MARKET GROWTH DRIVER



Source: Strategy Analytics data ,SAM defined by Renesas \*DCU: Domain Control Unit



# VALUE PROPOSITION

Open



**Scalable & Reusable** assets & **Open Platform**  
accelerating time to market

Trusted



**Automotive safety** & **Long-term commitment**  
to customer

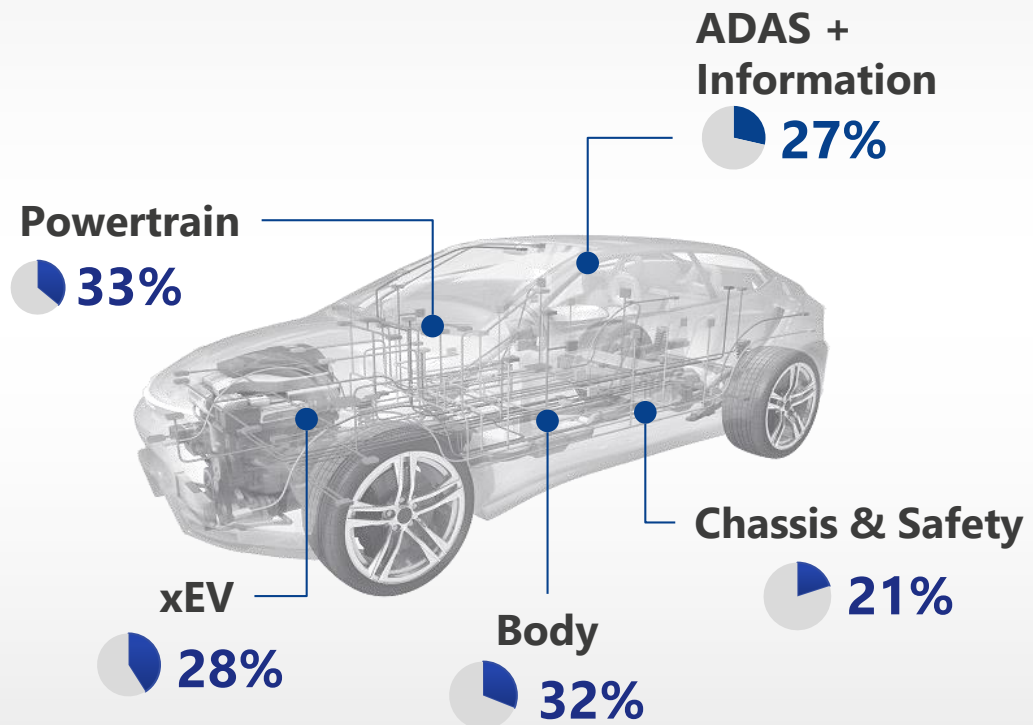
Innovative



**End point computing** & **Power consumption**  
suitable for mass production

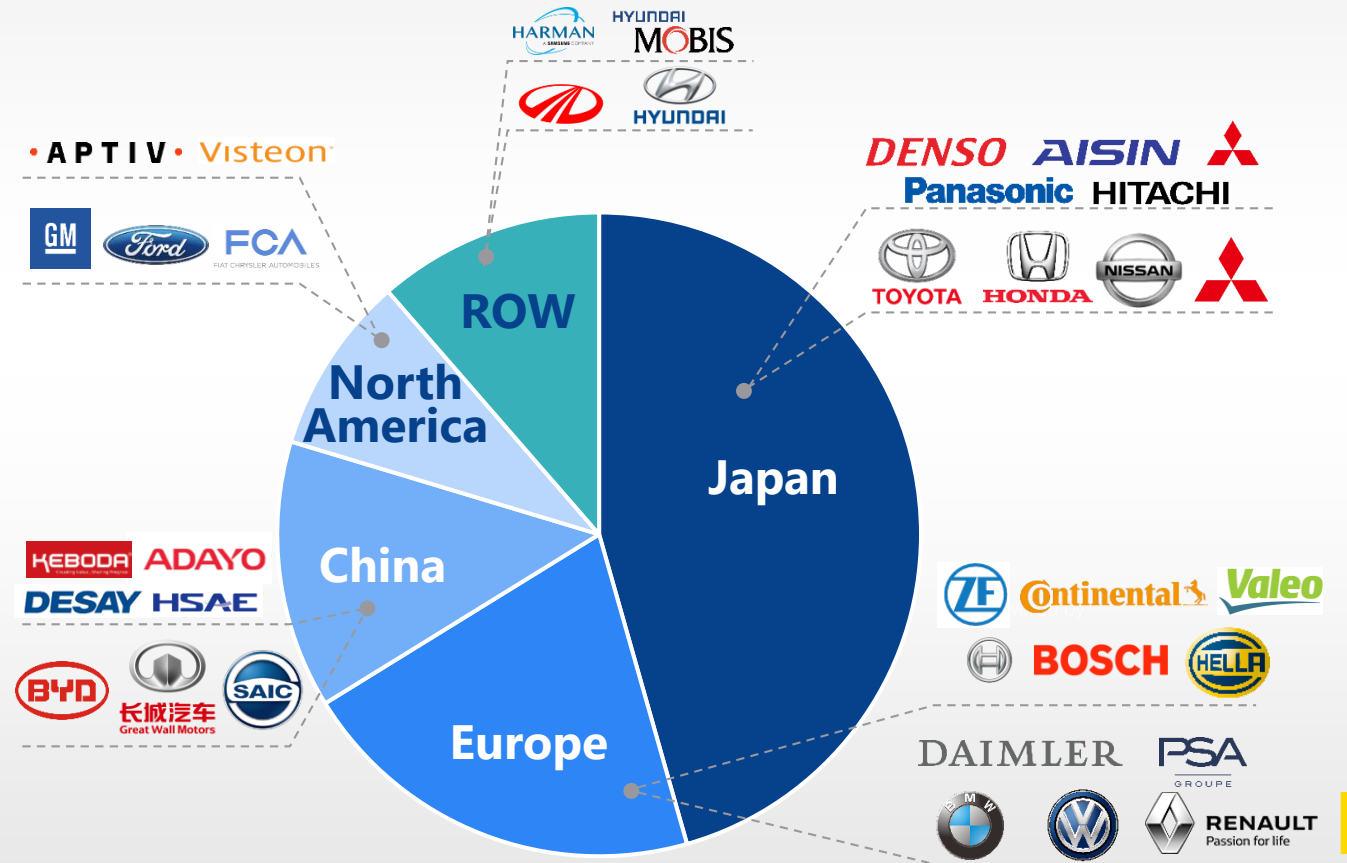
# OUR FOOTPRINT

Market share in Auto MCU/SoC (2018)

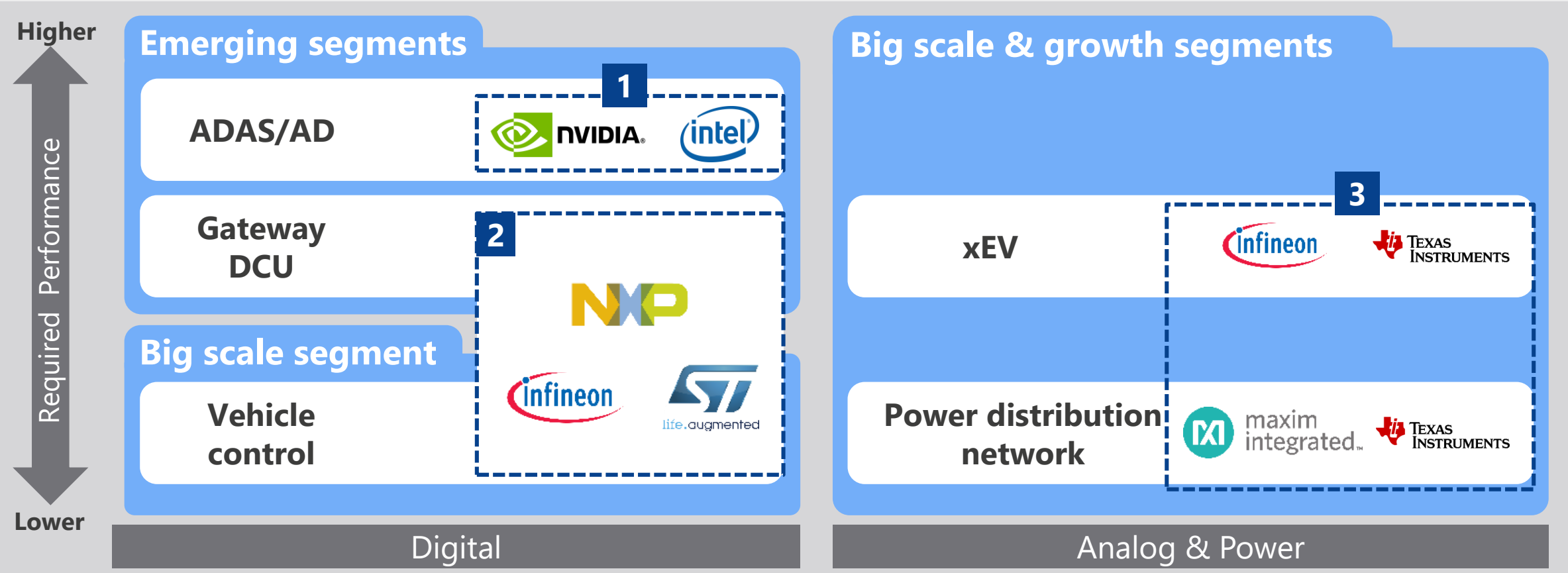


Source: Renesas estimate based on Strategy Analytics data

Revenue by region (2018)



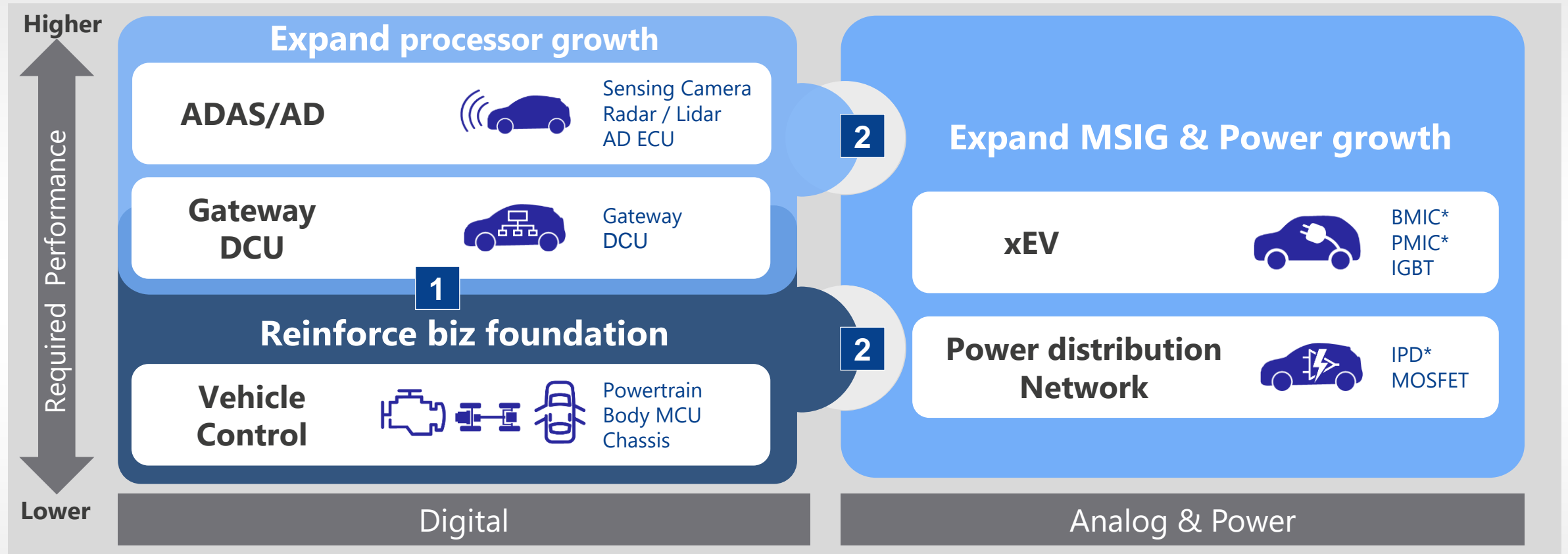
# OUR COMPETITORS



- 1** New competitors enter ADAS/AD
- 2** Old rivals who have been fighting for years

- 3** Existing proven players waiting on sidelines

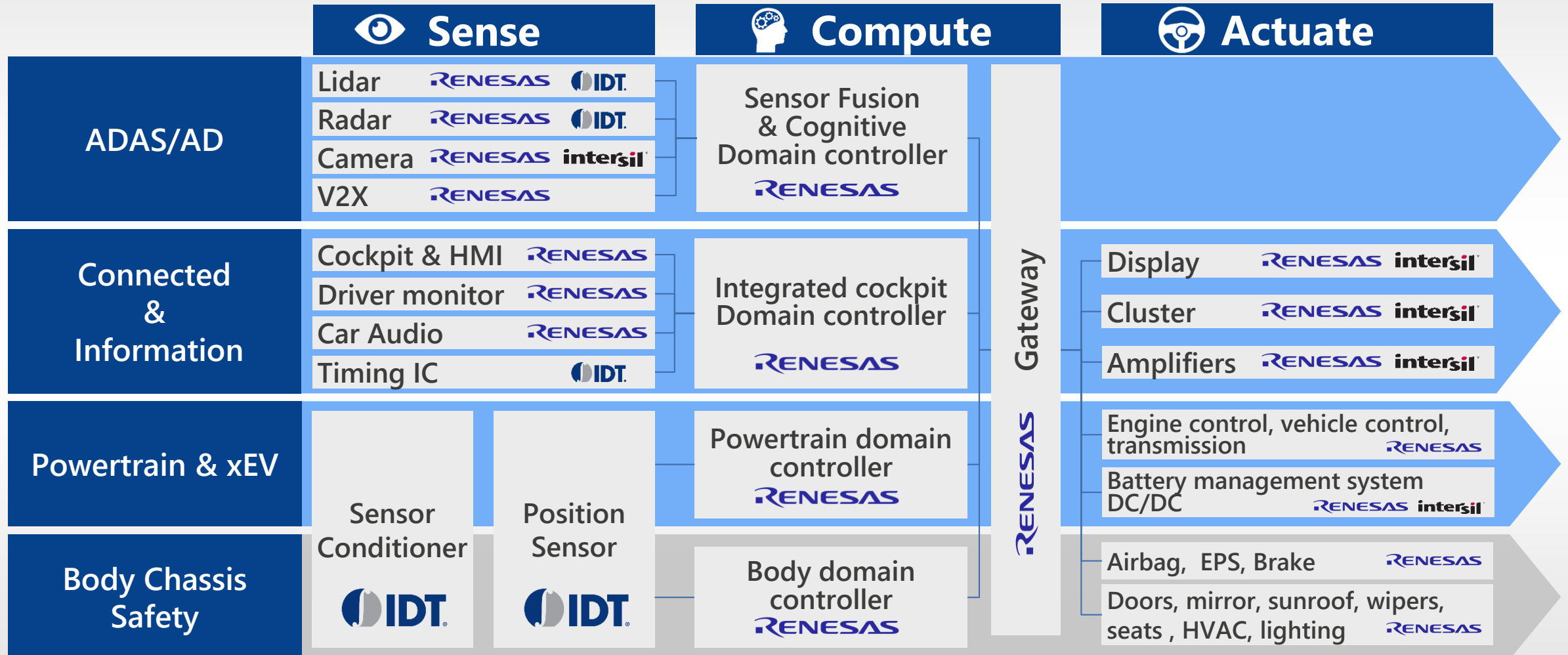
# HOW WE WIN - GROWTH STRATEGY



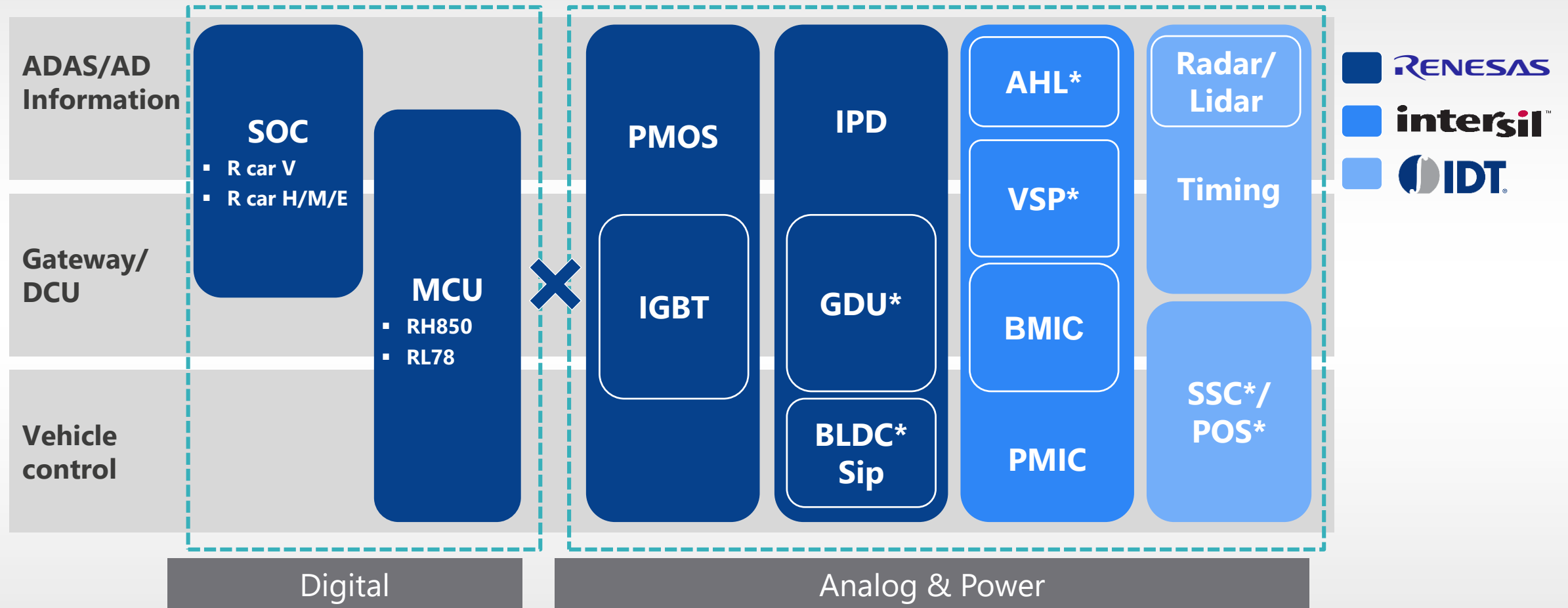
- 1** Expand scalability with reusable processor & functional safety/security knowledge
- 2** Leverage system solution based on processor footprint to capture MSIG & Power

\*BMIC : battery management IC / PMIC : Power management IC / IPD : Intelligence power device

# HOW WE WIN - SYSTEM-LEVEL & END-TO-END SOLUTION

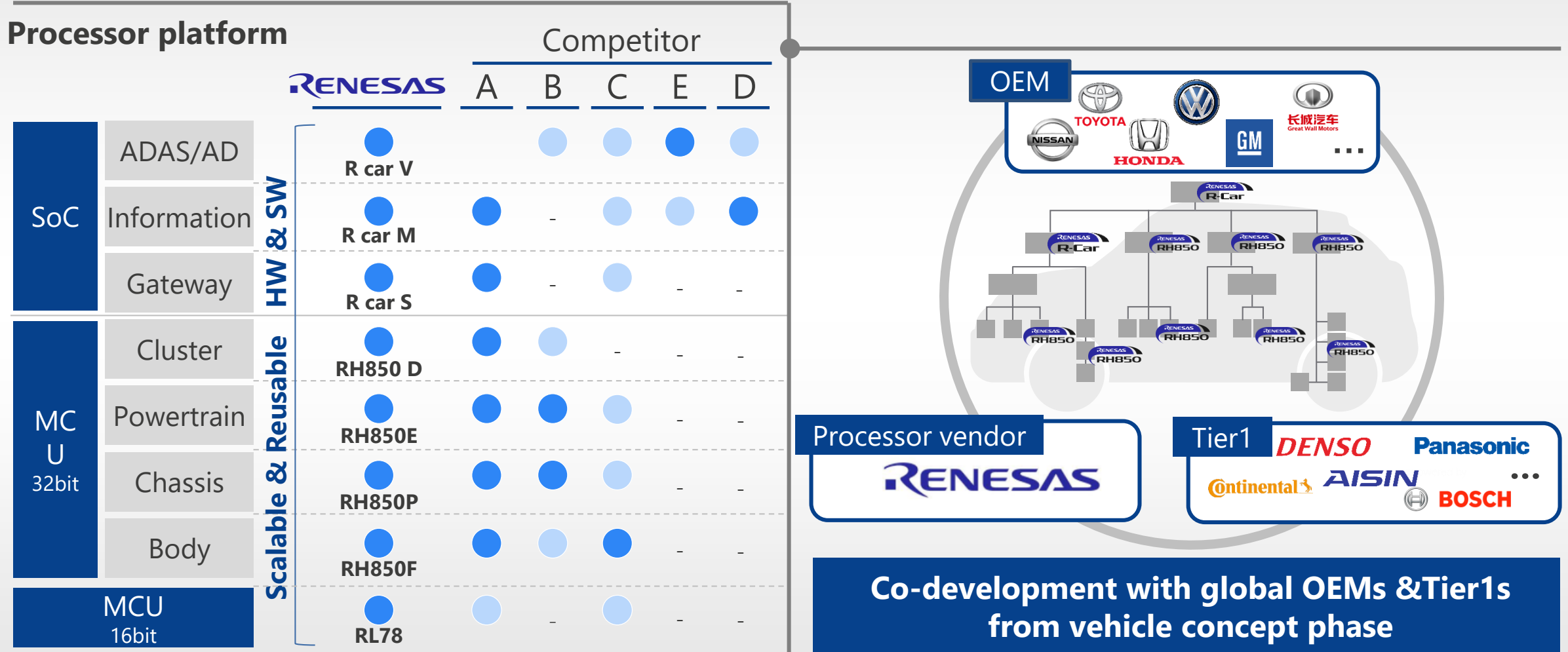


# HOW WE WIN – WINNING COMBINATIONS



\*AHL: Automotive HD Link / VSP: Video Signal Processor / GDU: Gate Driver Unit / BLDC: Brushless Direct Current / SSC: Sensor Conditioner / POS: Position sensor

# HOW WE WIN – #1 PRODUCT SCALABILITY



# DIGITAL

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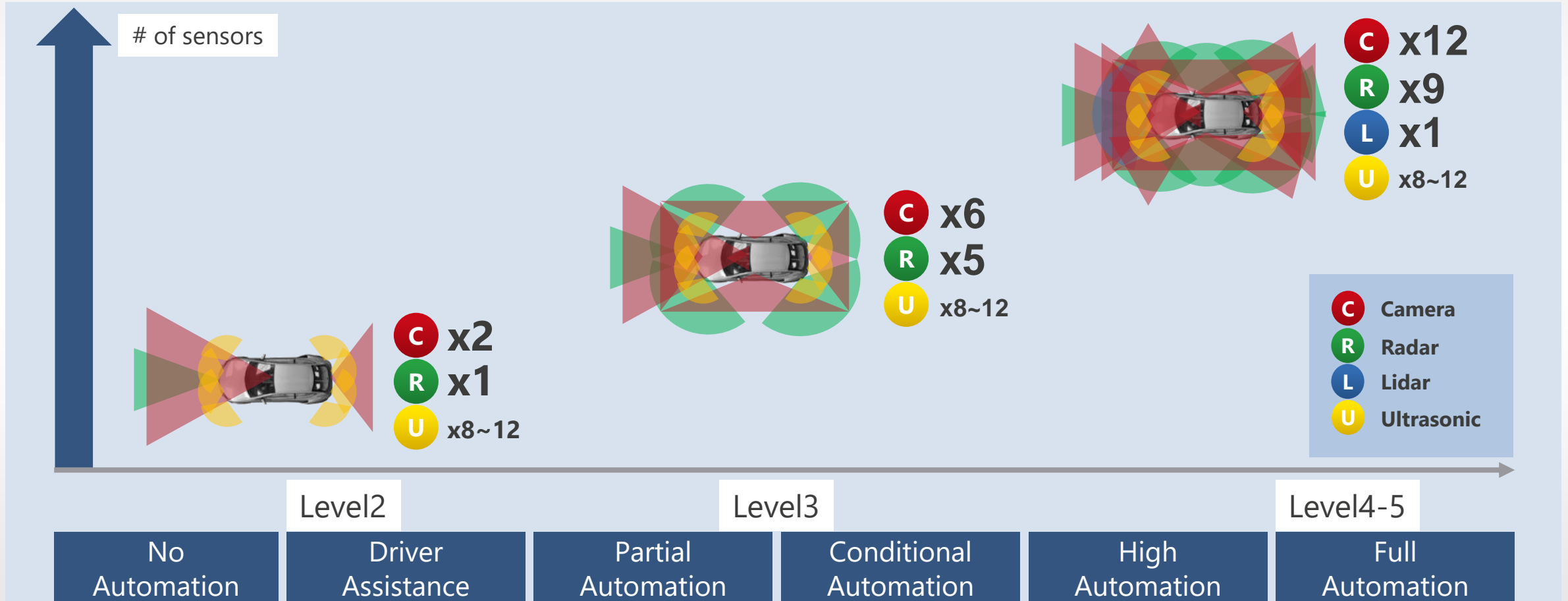


# ADAS

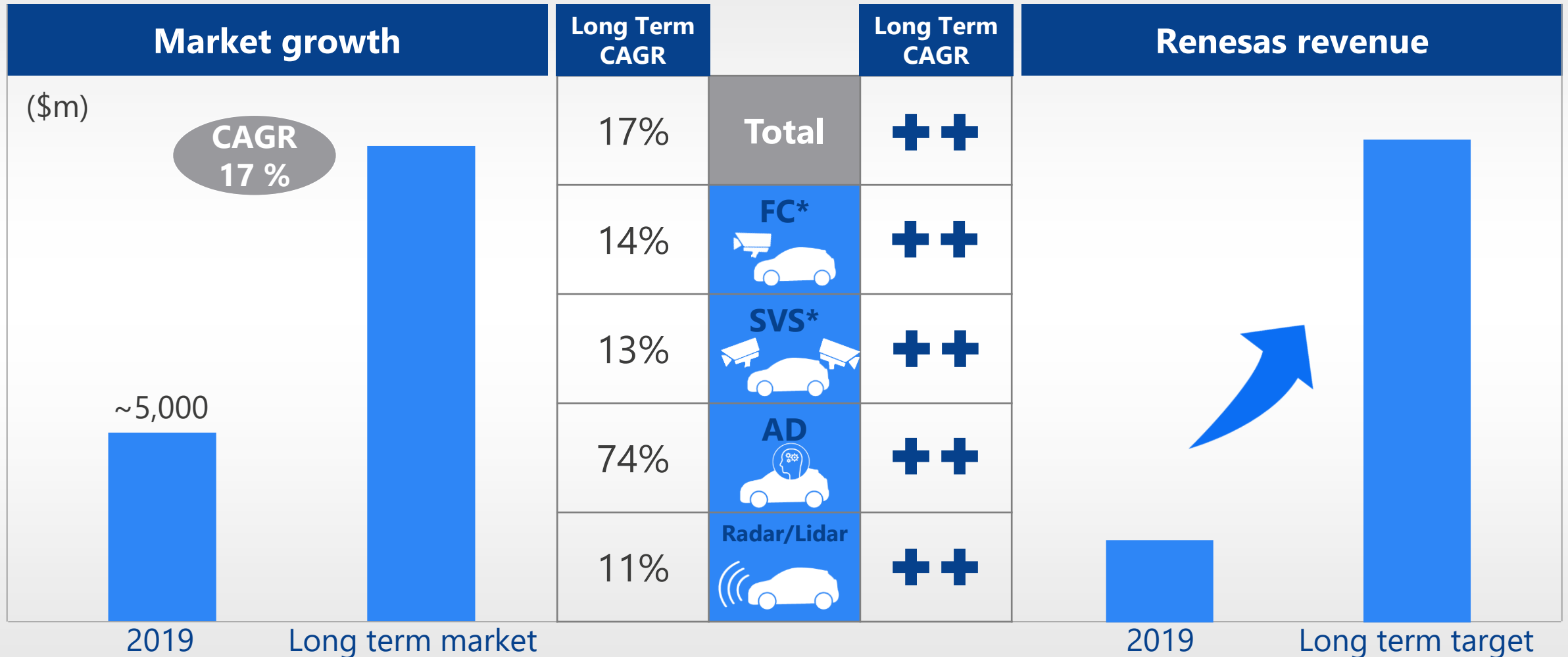
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# ADAS/AD SYSTEM TREND

More cars with sensors, more sensors per car, more high-performance processors



# ADAS/AD GROWTH OUTLOOK

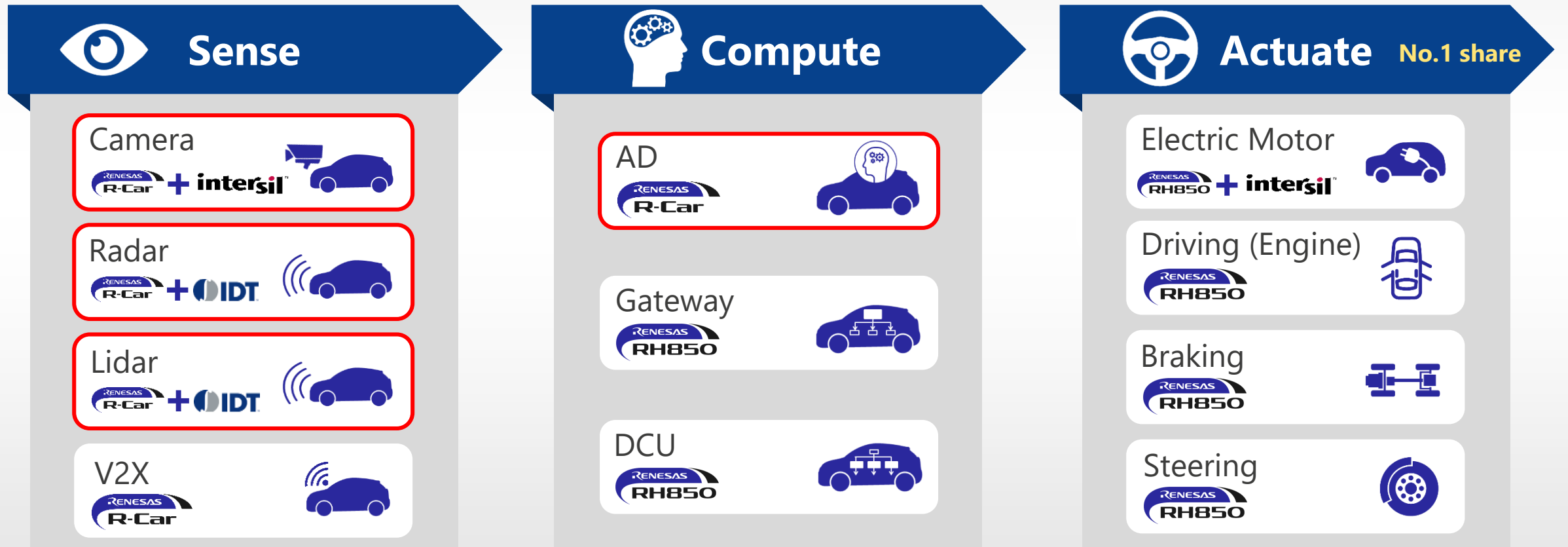


\*FC: Front Camera / SVS : Surround View System

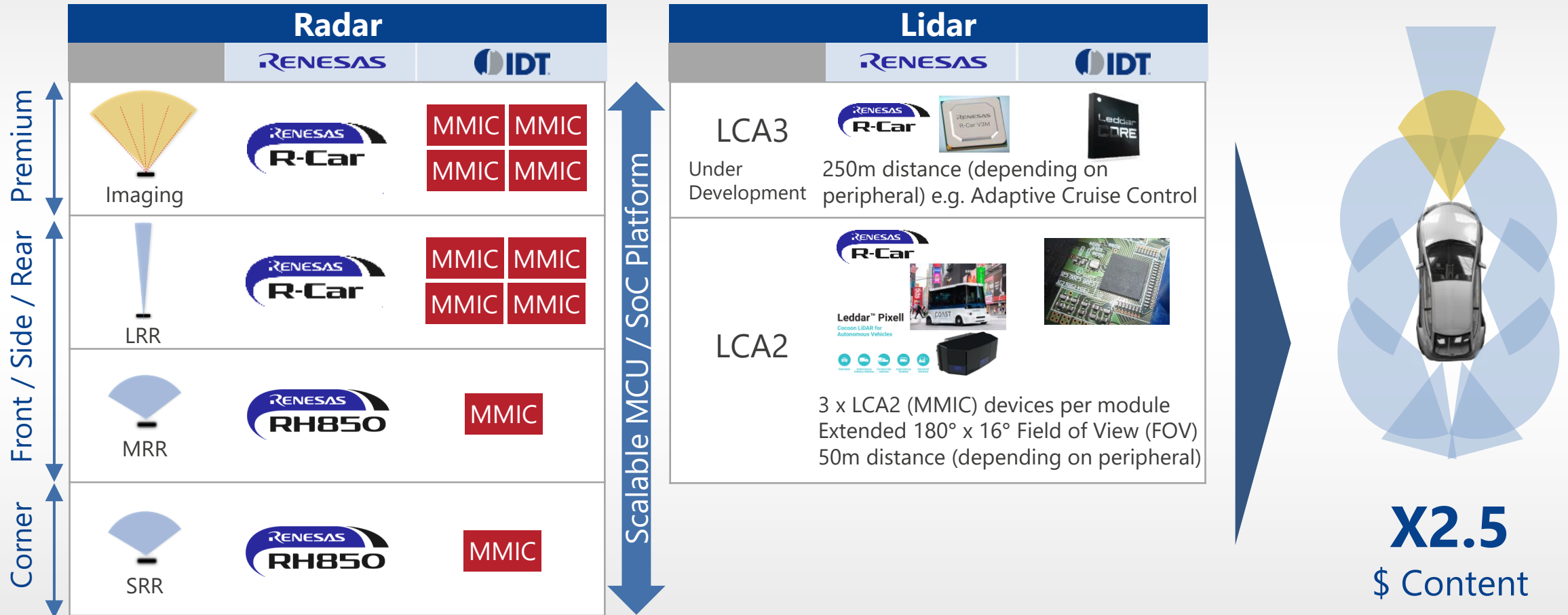
Source: Strategy Analytics data ,SAM defined by Renesas

# HOW WE WIN - EXPANDING ADAS/AD PRODUCT PORTFOLIO

- Launching camera and cognitive mass production for major Tier1s/OEMs
- Expanding Radar/Lidar by combination R-Car Digital Processors and IDT Analog products

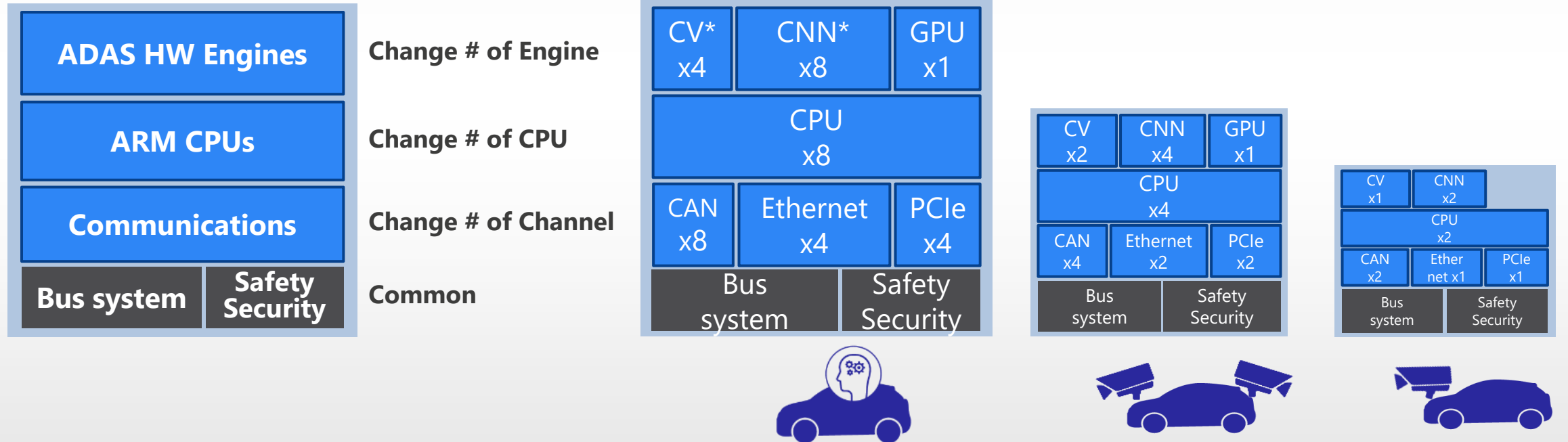


# DIGITAL & ANALOG VALUE FOR RADAR/LIDAR



# HOW WE WIN - SCALABILITY FOR SW DEVELOPMENT

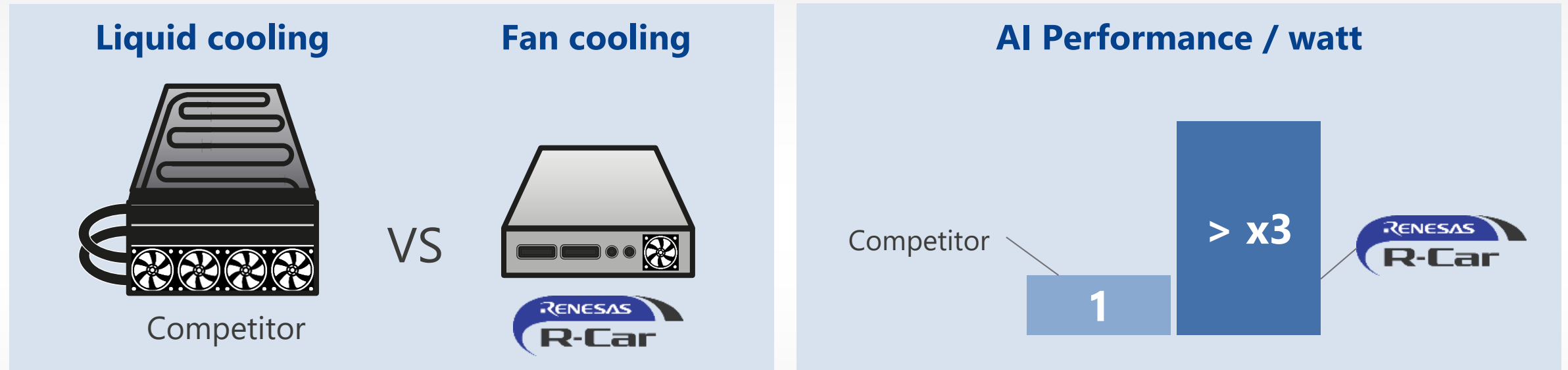
ADAS/AD PF maximizes customer SW reuse across ADAS applications



\*CV: Computer Vision / CNN: Convolution Neural Network

# HOW WE WIN - LOW POWER CONSUMPTION W/ R-CAR

Providing the best in class saves cooling cost and AI performance / watt



**More cost competitive**

**Less space and weight**

**More fuel efficient**

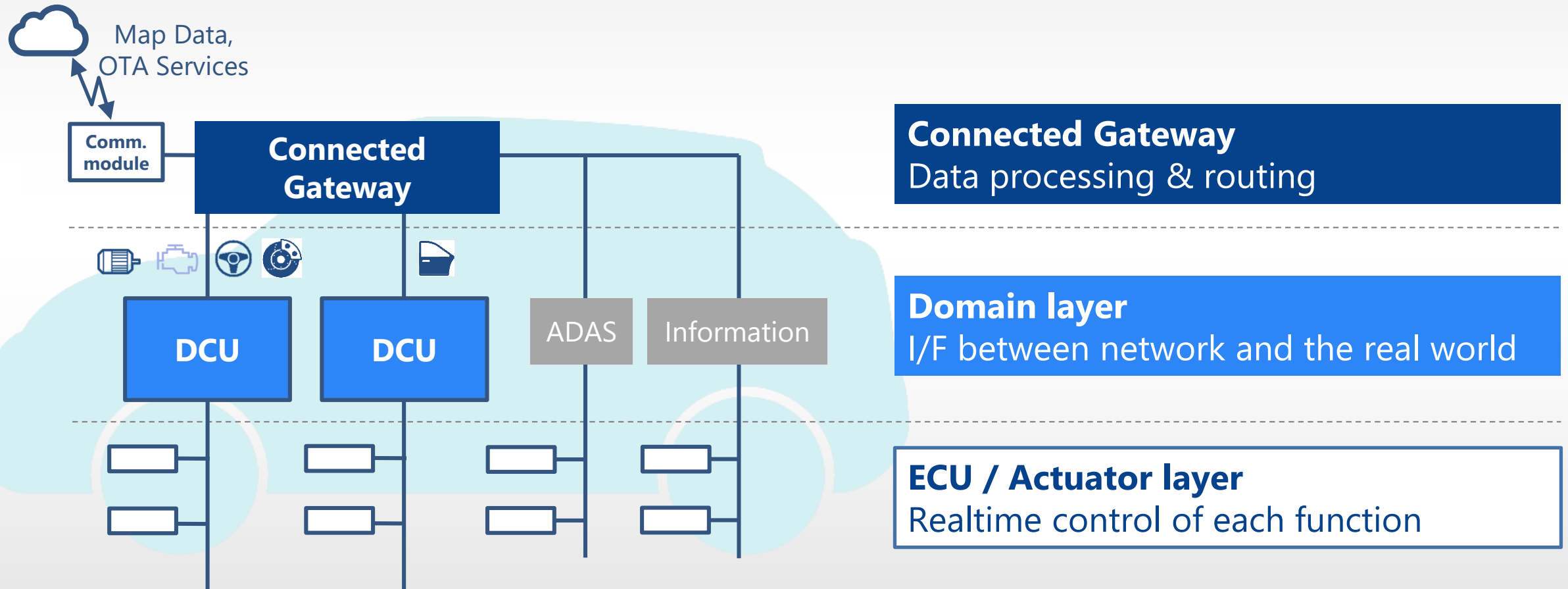
# DOMAIN CONTROL UNIT (DCU) & GATEWAY

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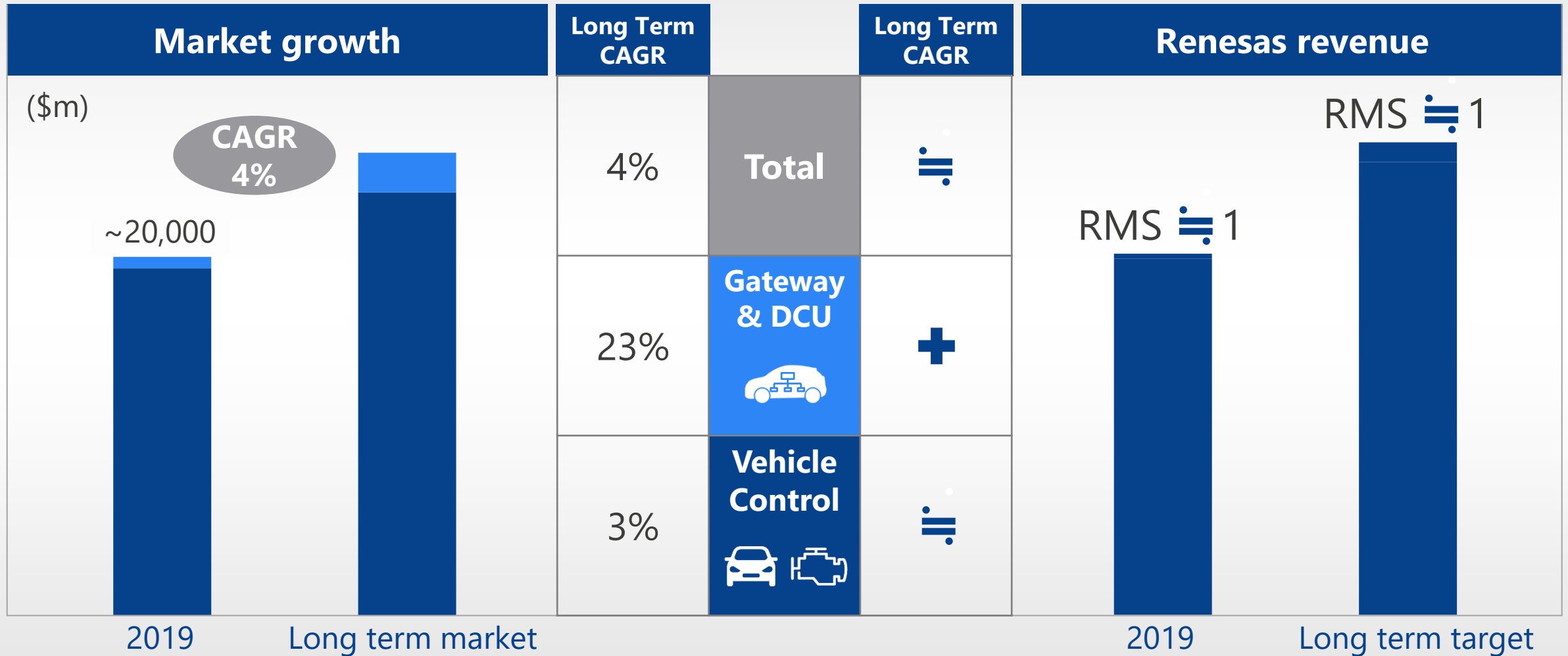


# E/E ARCHITECTURE TRENDING TOWARDS "C A S E"

Connected Gateway and DCU to play key role for "C A S E" implementations



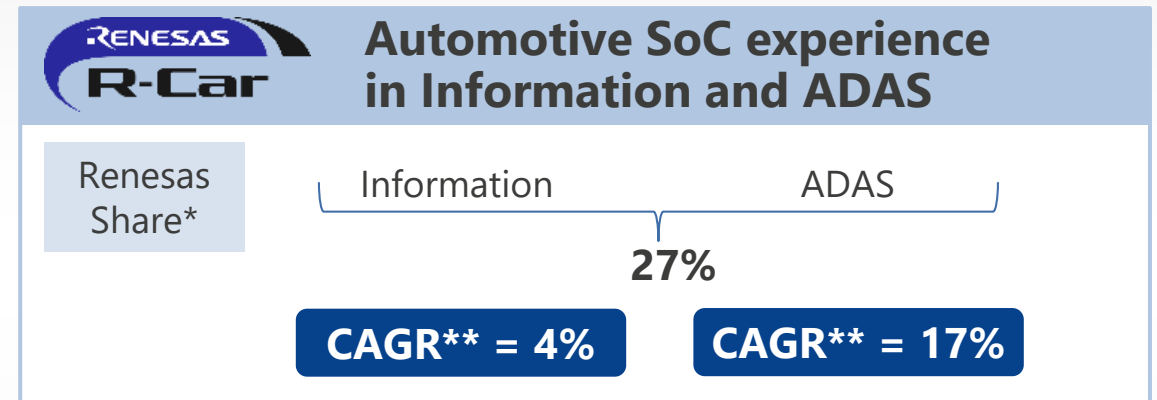
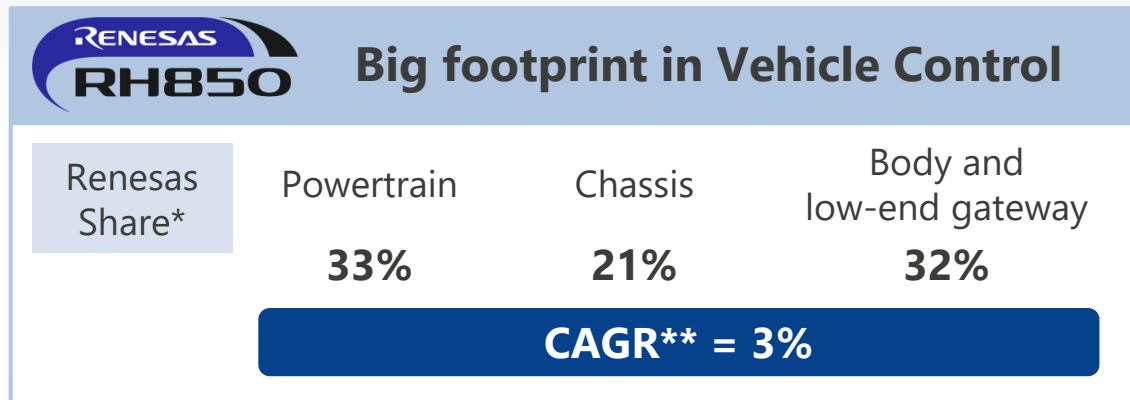
# DCU & GATEWAY GROWTH OUTLOOK



Source: Strategy Analytics data ,SAM defined by Renesas

# HOW WE WIN - GROWTH STRATEGY FOR DCU & GATEWAY

Enhancing our footprint in Gateway & DCU with wide Automotive portfolio across MCU & SoC, with strong RH850 Software assets in Vehicle Controller market



- SW Scalability
- Automotive Quality

**Gateway & DCU**  
**CAGR = 23%**  
(Long term market)

- Security IP
- Network IP Accelerator IP

\* Digital only \*\* Long term market

# HOW WE WIN - SOFTWARE SCALABILITY

- Automotive Software > 100,000,000 Lines of code
- R-CAR and RH850 Software scalability to reduce OEM/Tier1's Software development cost

		Within generation		From generation to generation	
		Within application	Across application		
ADAS/AD	R-CAR V	75%~95%	30~40%	45~60%	70%~80%
Information	R-CAR H/M/E			60~70%	
<b>Gateway &amp; DCU</b>	R-CAR(New) RH850				
<b>Vehicle Control</b>	RH850				
<b>Competitor A:</b>		●	●	No scalable asset	
<b>Competitor B:</b>		● Limited Scalability		●	
<b>Competitor C:</b>		● (Only MCU)		●	

# BUSINESS FOUNDATION ON DCU & GATEWAY

Continuously winning the new opportunities in DCU and Gateway

## Major D-in in 2019

### DCU



**Cross Domain  
MCU Platform**

Standard MCU platform for  
**major tier1s**  
(mainly for DCU &  
Powertrain)

### Gateway



**Connected Gateway  
Controller (SoC)**

**Major OEM's** gateway  
controller for 2021  
start of production  
(at multiple Tier1s)



**Gateway MCU**

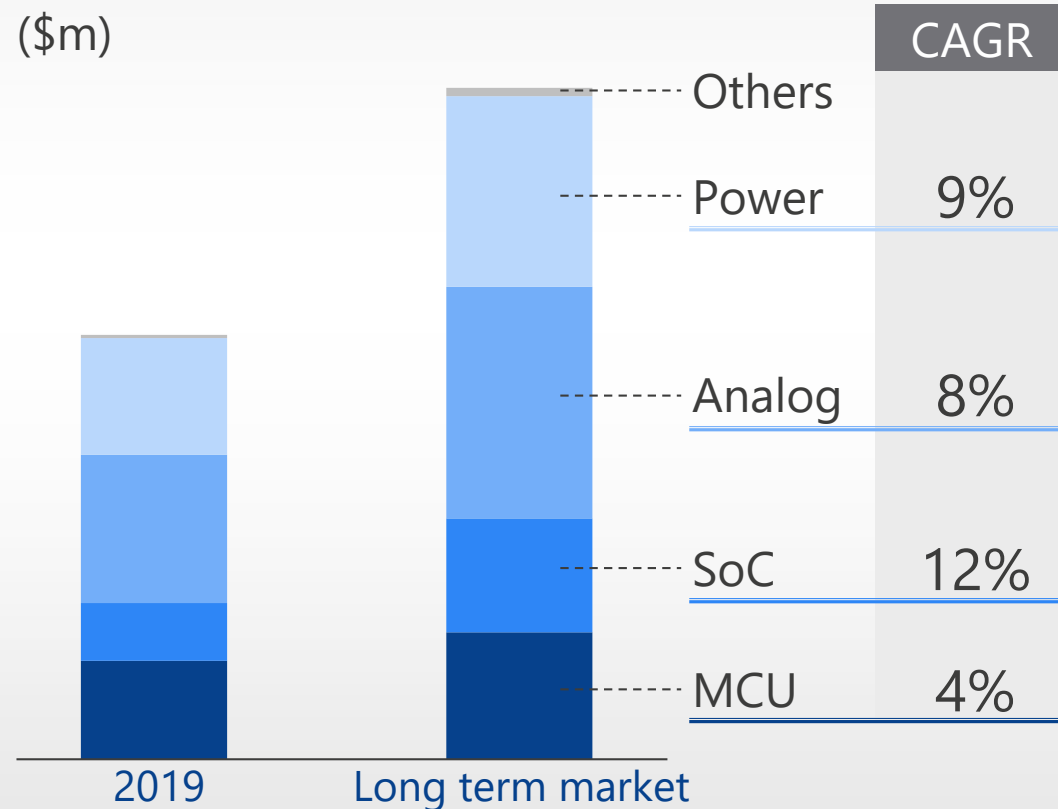
Standard MCU platform  
for **major tier1s**  
(central gateway  
for ASIL-B / ASIL-D)

# ANALOG & POWER

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# ANALOG AND POWER MARKET OUTLOOK

Automotive Analog & Power semiconductor market continues to grow driven by higher semiconductor content for CASE+E/E architecture trend



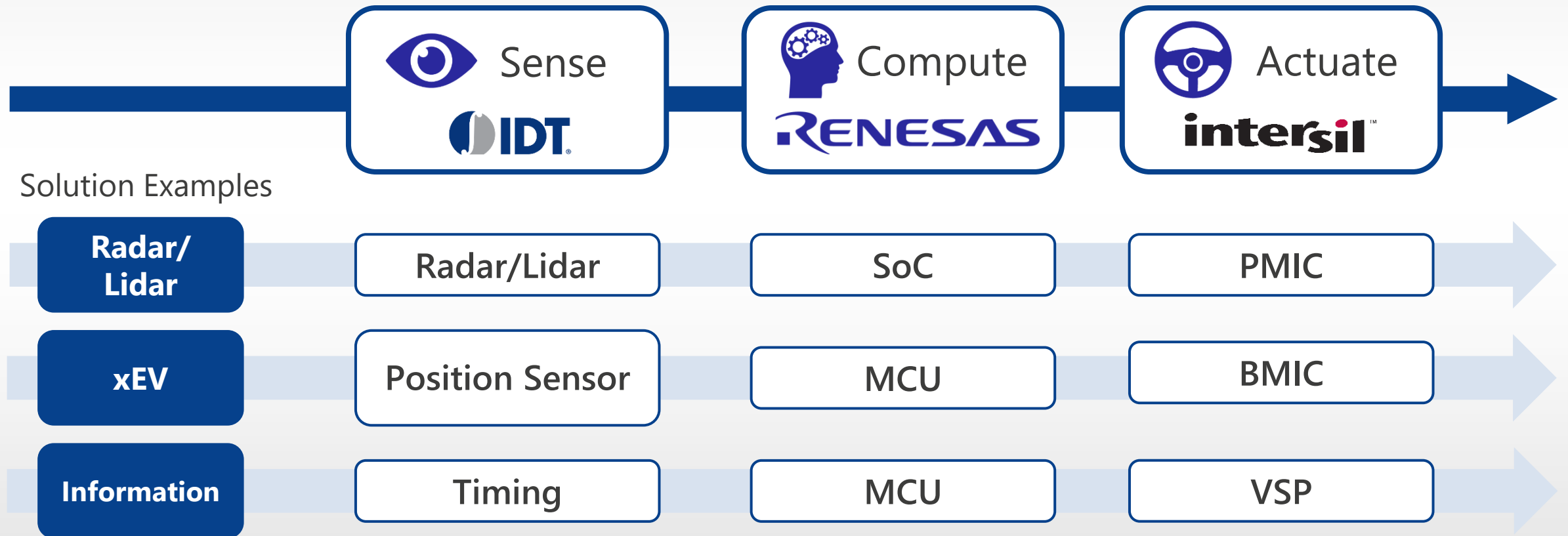
### Market Drivers

- Growth of high voltage power discrete market driven by electrification of vehicles
- Diversified analog semiconductor products to control battery-driven vehicles
- Accelerated usage of semiconductor devices to replace conventional mechanical components
- Multiplication of sensor modules to support sophisticated ADAS functionality

"Strategy Analytics Powertrain, Body, Chassis & Safety Data:CY19Q2, Aug 2019

# NEW CAPABILITIES GAINED THROUGH ACQUISITION

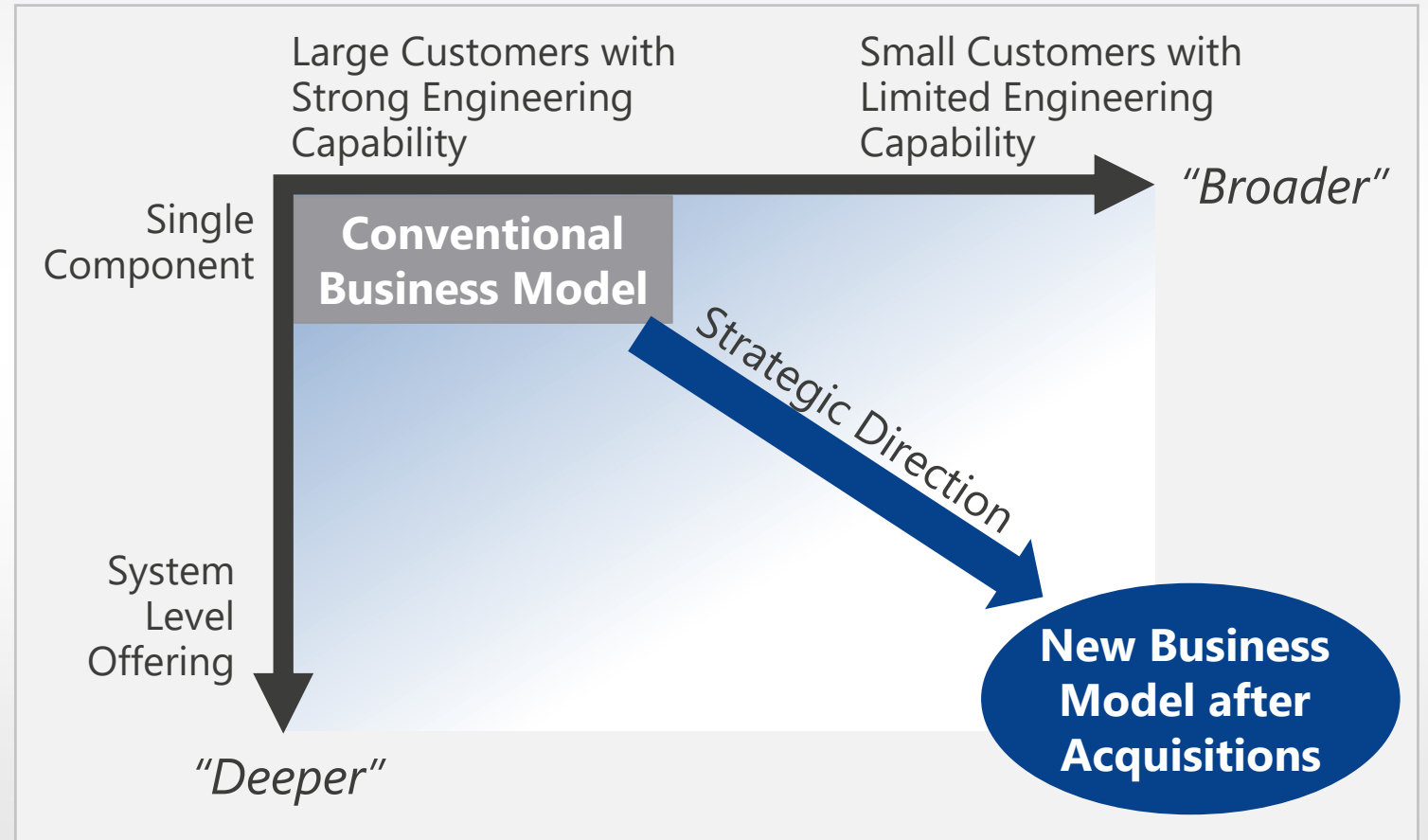
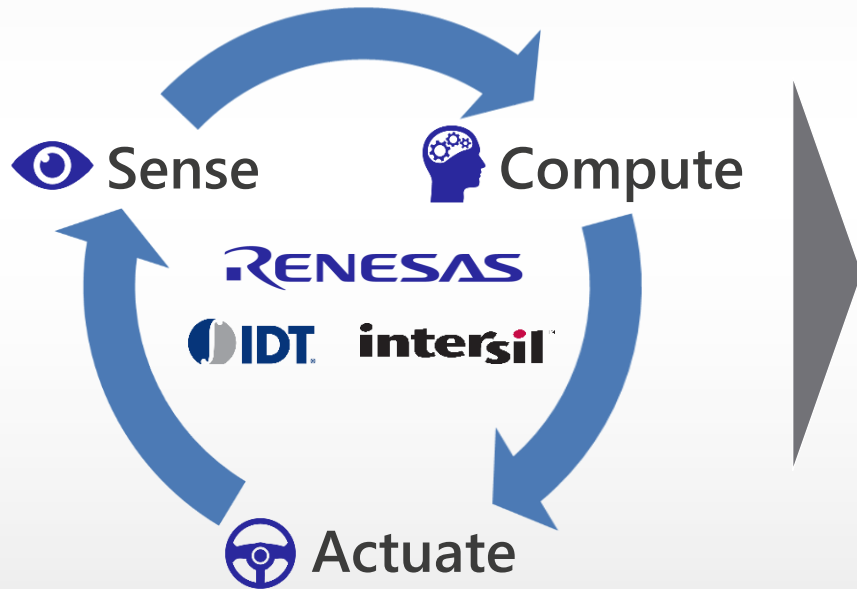
Analog/Mixed Signal product portfolio complements signal chain and supports to establish end-to-end solution





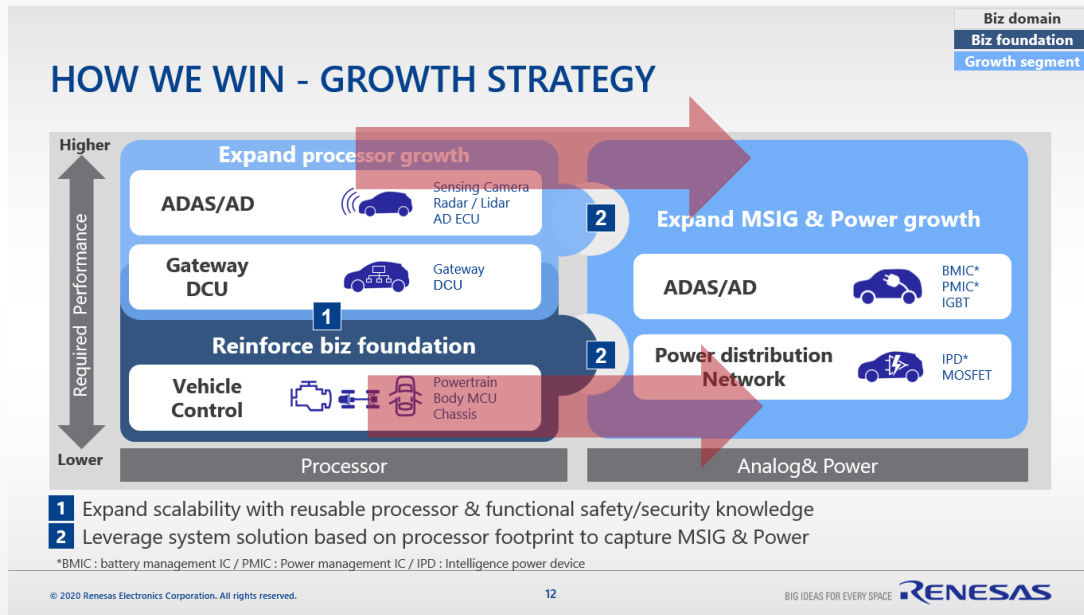
# SOLUTION CAPABILITY TO BUSINESS MODEL ENHANCEMENT

End-to-end solution capability enables "Deeper" and "Broader" transformation of business model

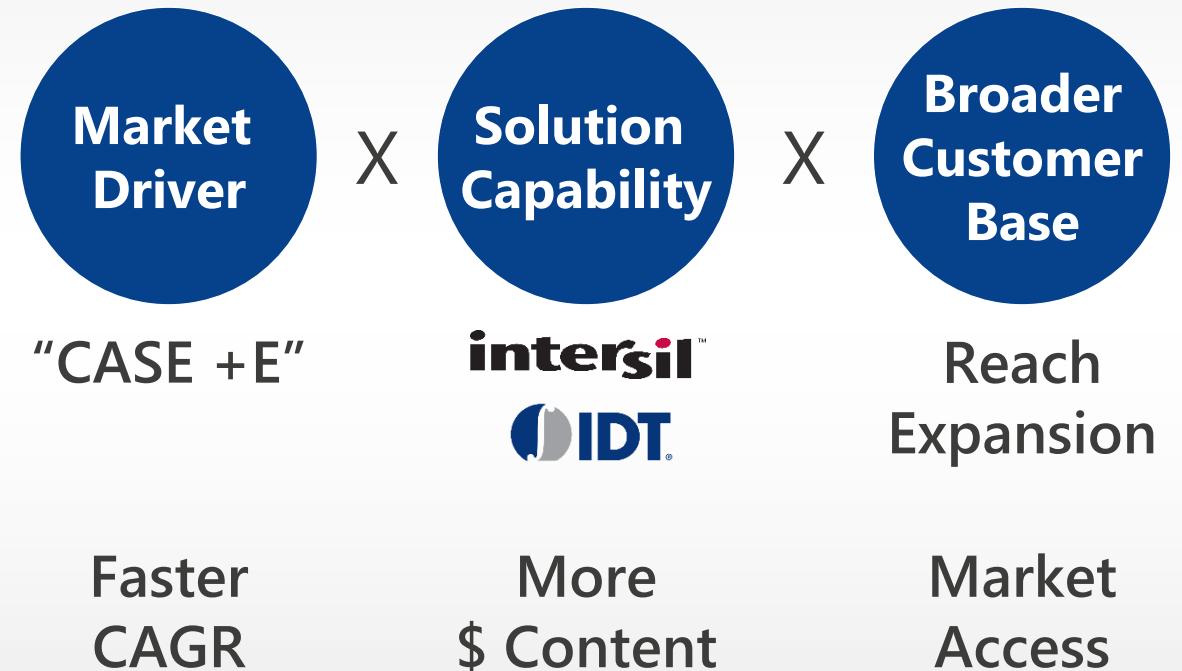


# NEW GROWTH MODEL

Leveraging digital product footprint and enhancing business model to accelerate growth

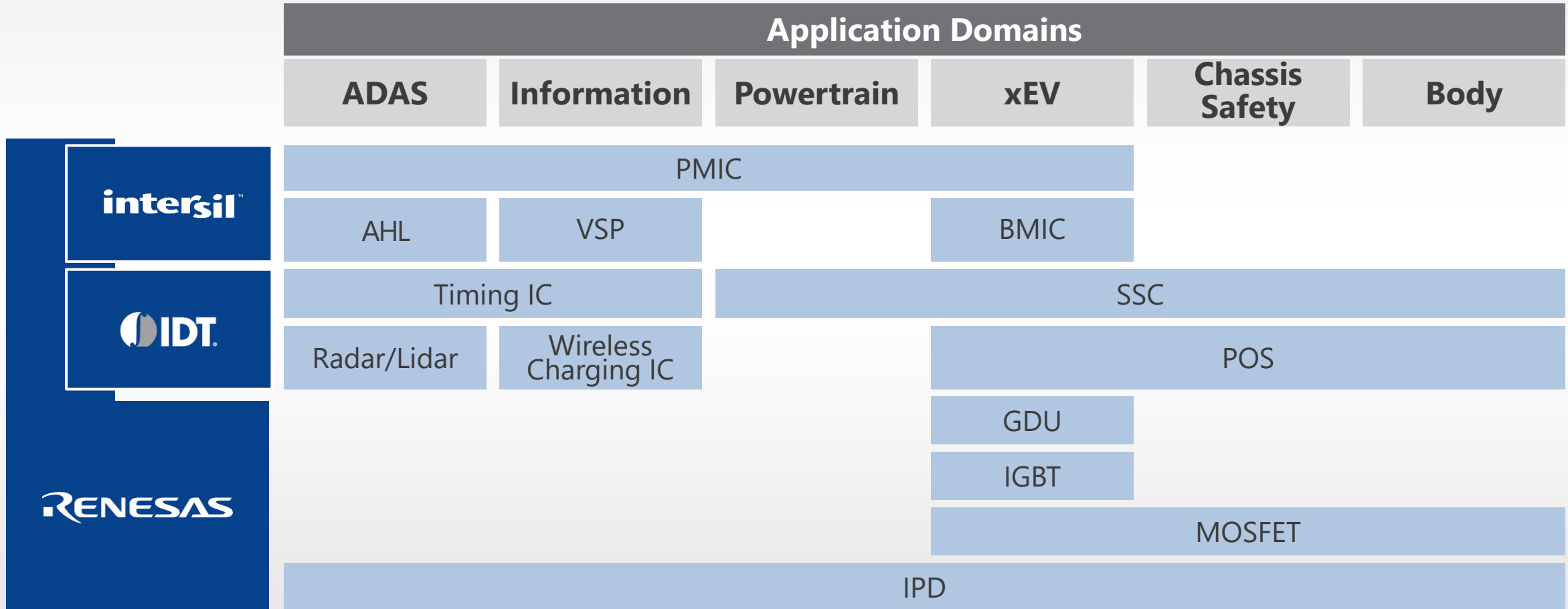


Leveraging processor footprint



# ANALOG & POWER PRODUCT LINE UP

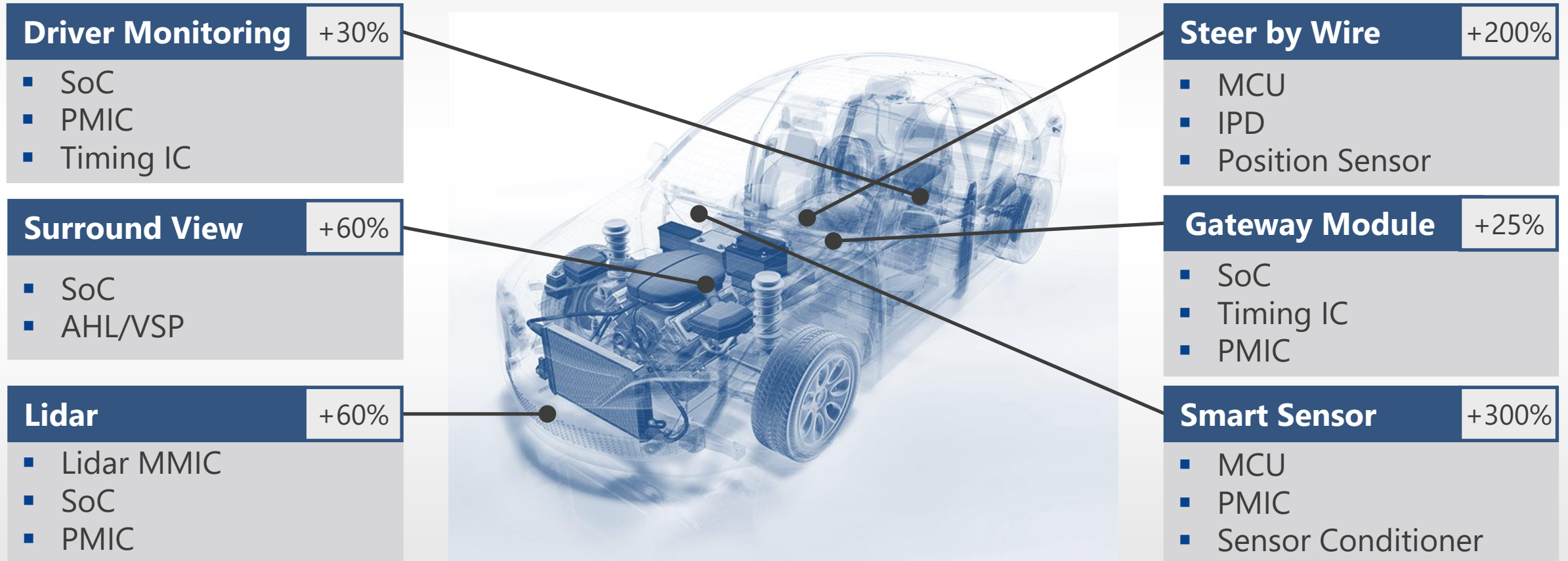
Rich analog and power products to cover growing application fields



# FUNCTIONALITY ENHANCEMENT BY SEMICONDUCTOR

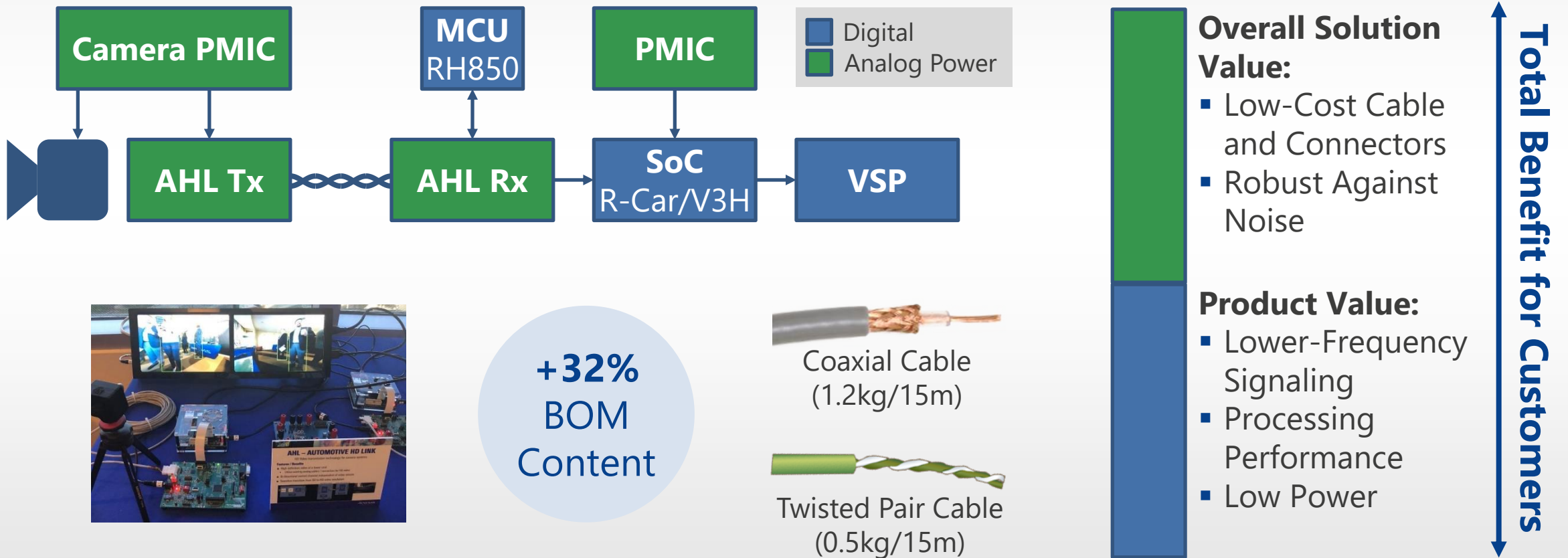
As vehicles are equipped with more sophisticated functions, more semiconductor content is necessary

□ \$ content increase % with Analog and Power



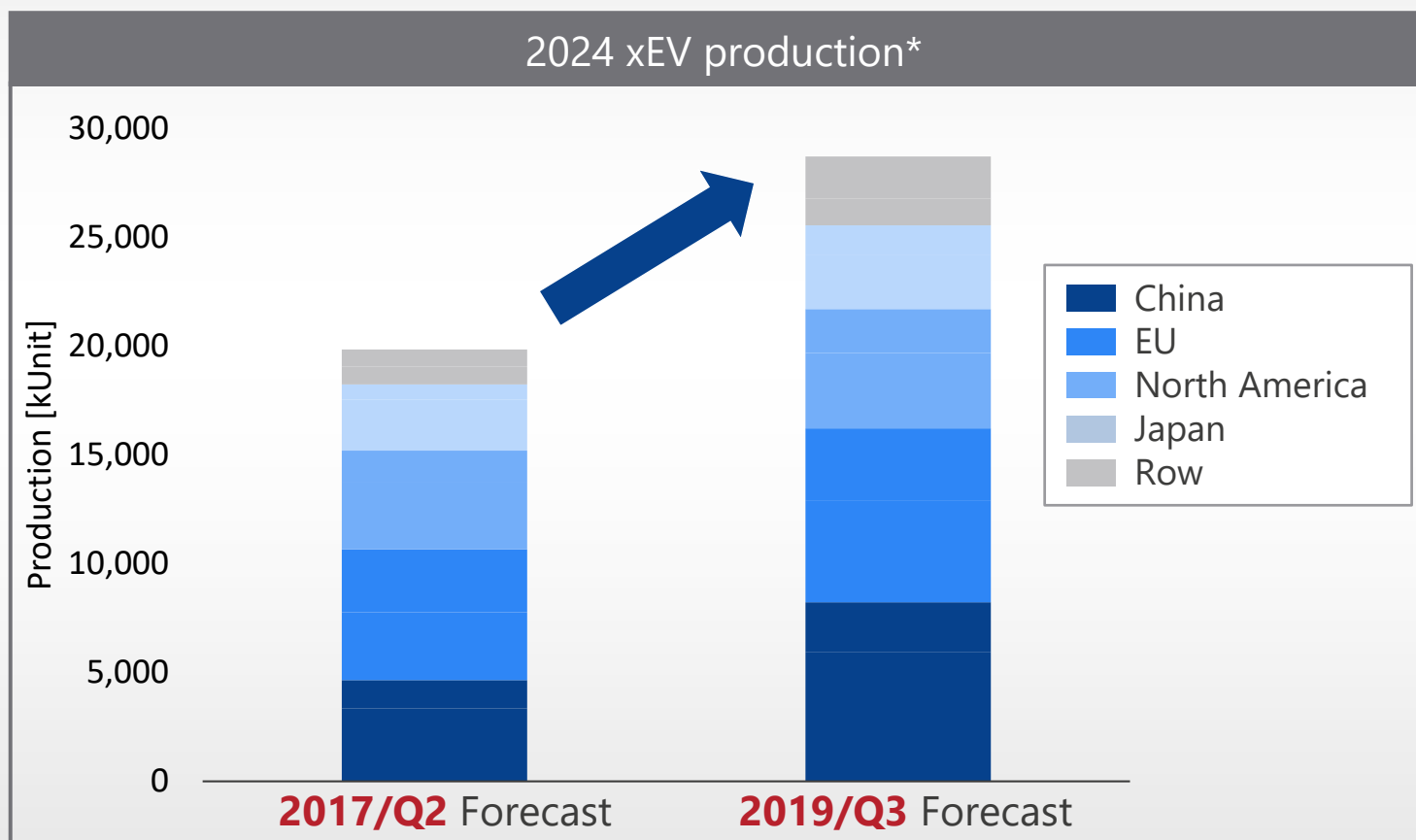
# WINNING COMBINATIONS – VIDEO SIGNALING

Flexible and robust connectivity enabled by AHL can provide system level benefit for video camera attached system



# xEV MARKET OUTLOOK

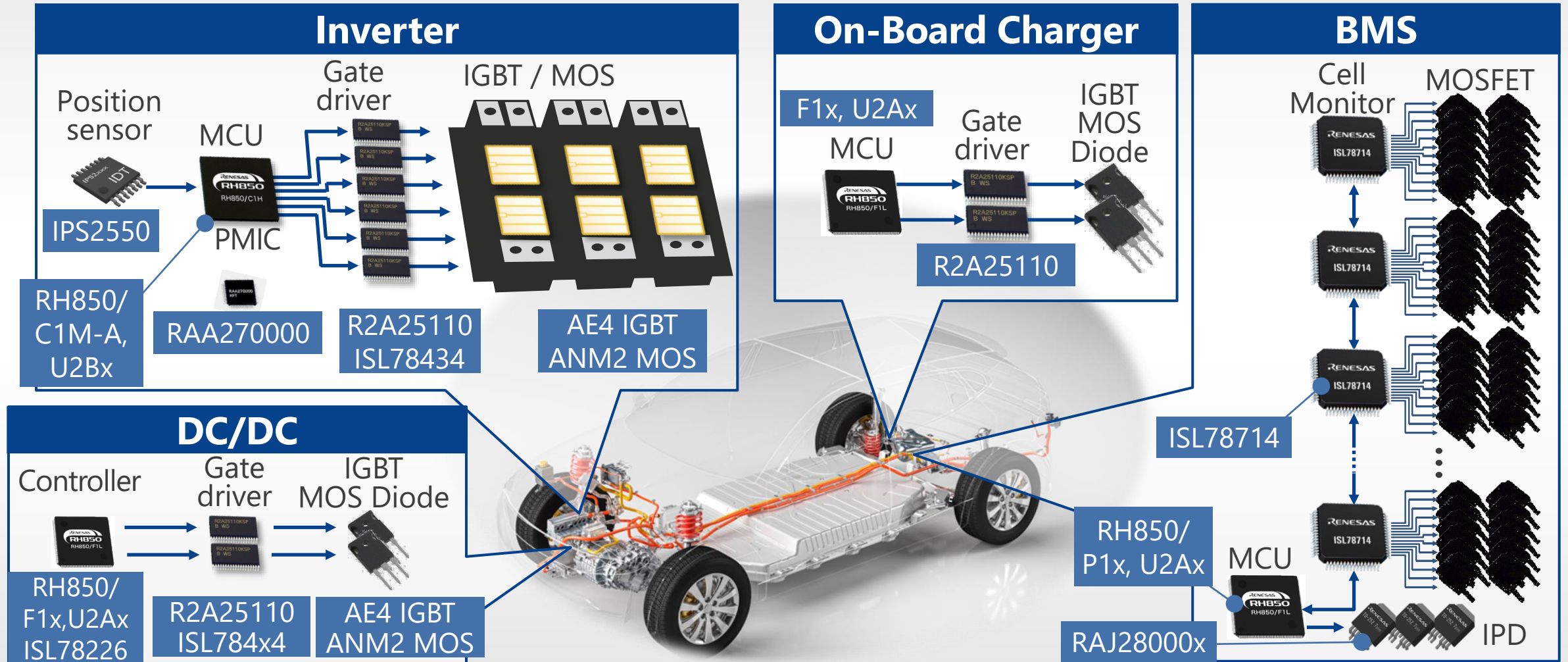
Forecasts for high-voltage Inverter in China and EU, MHEV in China are upward adjusted



Source: Strategy Analytics

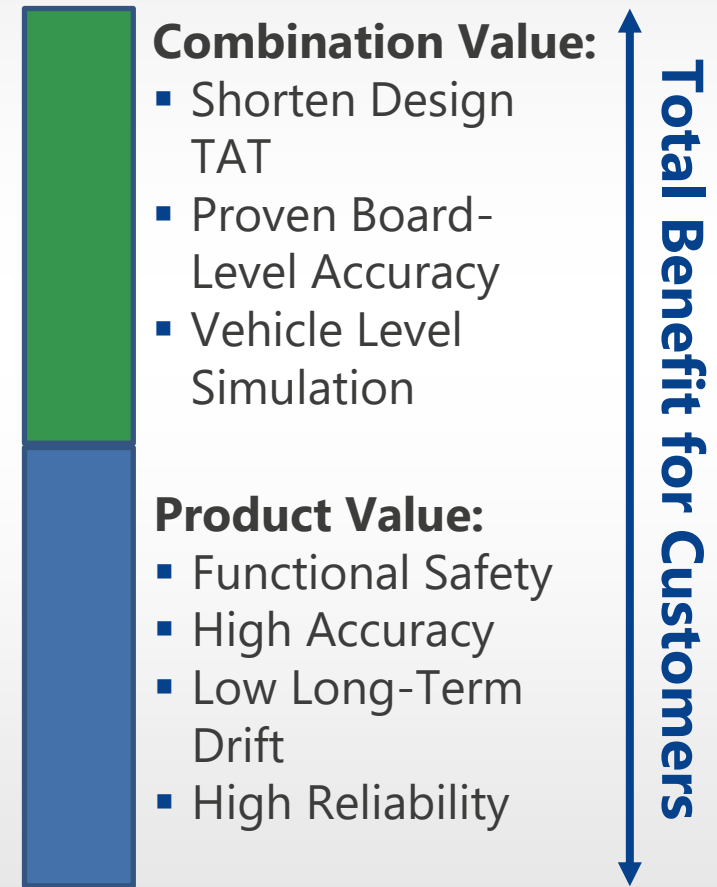
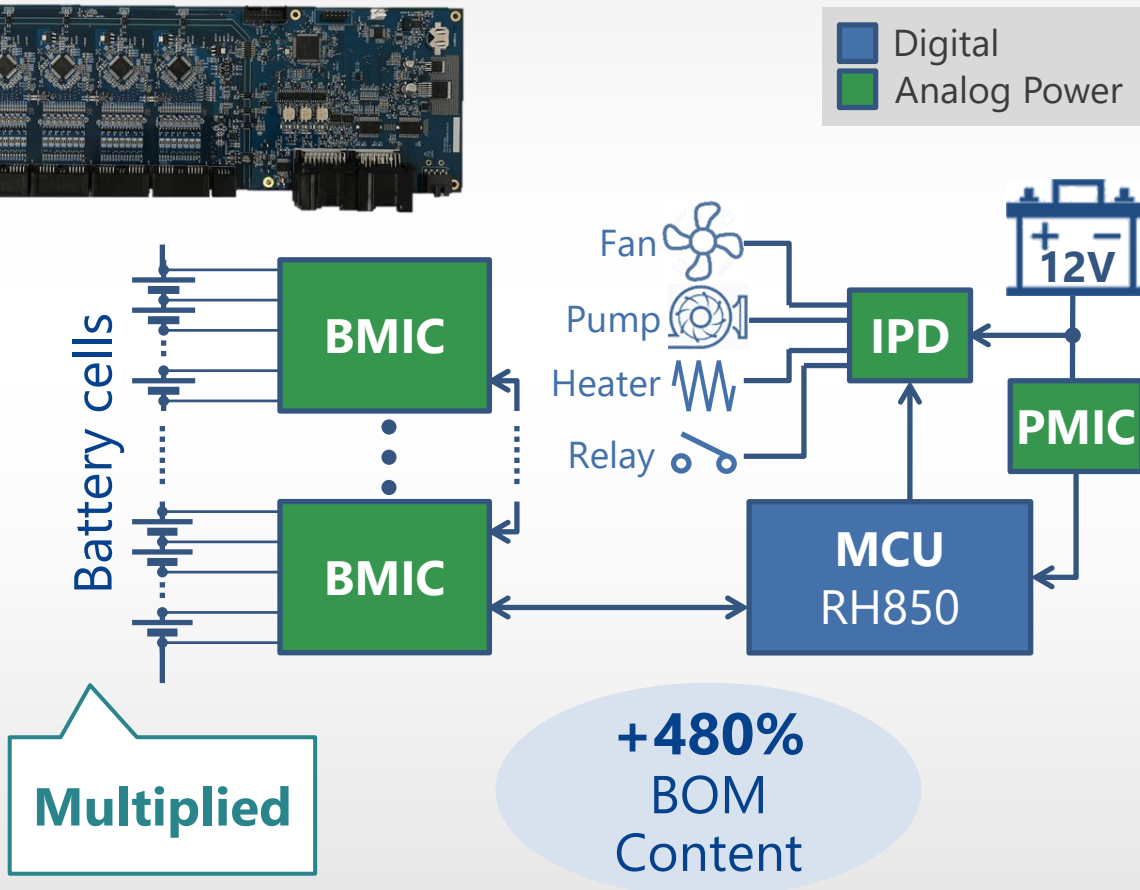
- Most market research companies have adjusted forecasts for xEV upward.  
→ **More confidence** for the xEV market outlook
- The bullish outlook after 2021 is backed by the European and Chinese governments' policy to support xEV purchase and to limit ICE vehicles.
- The trend of low price for battery continues.

# xEV SYSTEM ARCHITECTURE AND SOLUTION OFFERING



# WINNING COMBINATIONS – BATTERY MANAGEMENT

High accuracy of BMIC is enhanced by combination with MCU for vehicle level simulation

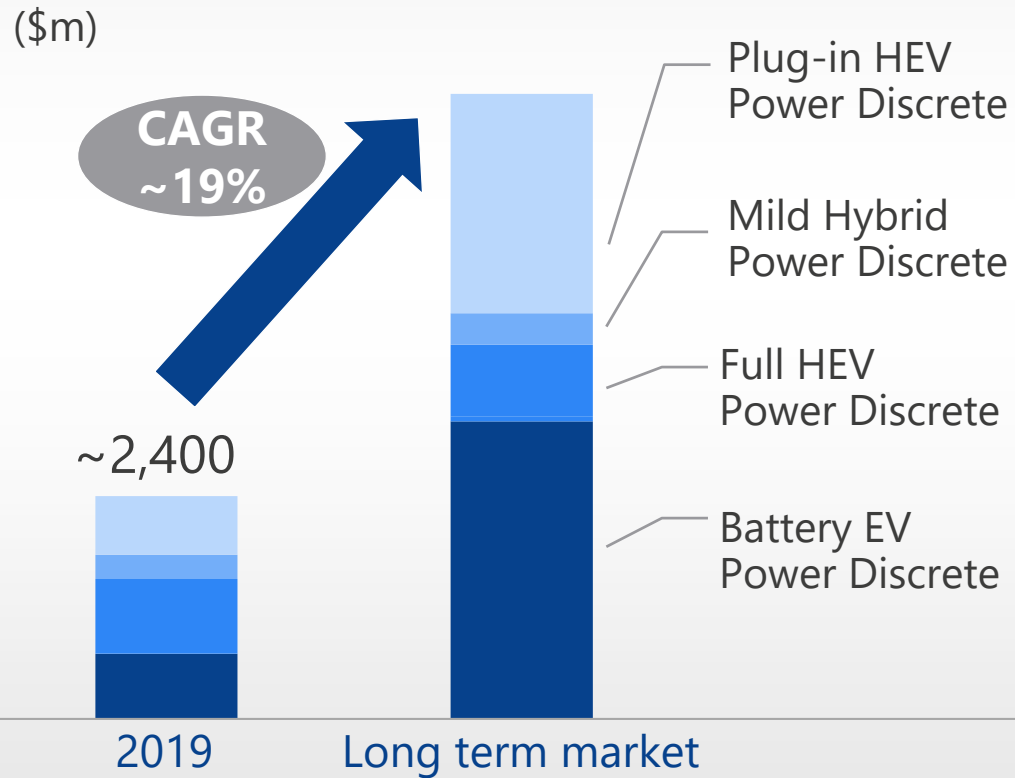




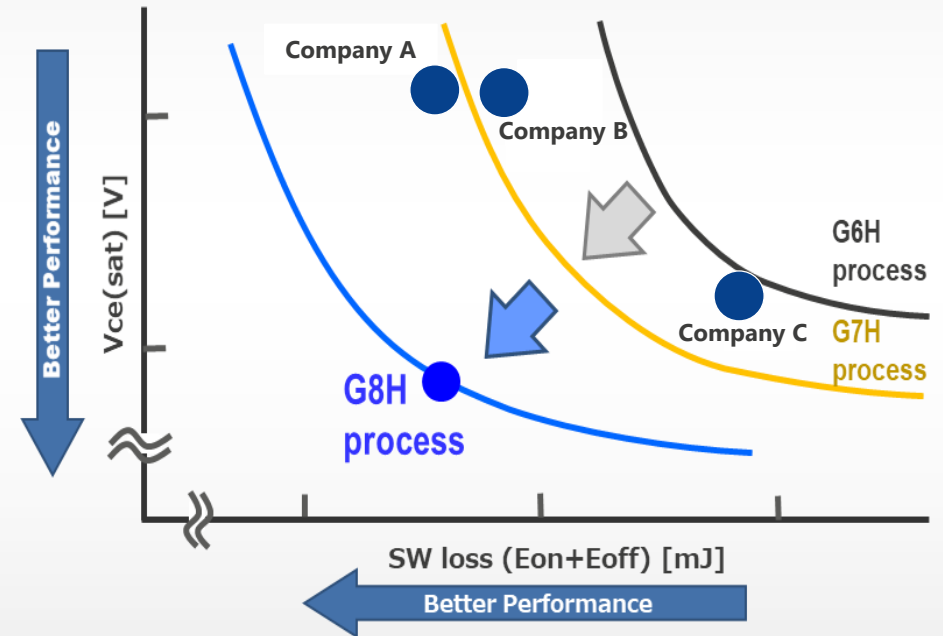
# xEV MARKET POTENTIAL FOR POWER DISCRETE

xEV market growth brings proliferation of new application for power discrete

## Power Discrete Market Size



## Power Discrete Product Strength



**Renesas IGBT has clear competitive edge in its product feature**

Source: Strategy Analytics \* Power Discrete include IGBT , MOSFET , PIC.

# 48V SYSTEM TREND

Battery-driven vehicles are creating new market for 48V: new requirement for Analog & Power

## Benefit of 48V

- Higher efficiency for Electric Vehicle (Low current)
- Cost efficiency for safety requirement
- Easier packaging
- Fitness to existing system (12V)

*Mechanical to Electric:*

**Replacement of mechanical drive or hydraulic drive**

*New Category:*  
**Light Vehicle**



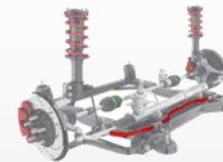
48V traction



48V turbo



HVAC



Roll stabilizer



2/3-wheelers  
Light Vehicle

# xEV INVERTER SOLUTION

MCU capability creates additional value for strong IGBT product feature

## MCU

- Powertrain Platform MCU
- >100,000rpm with EMU/ RDC
- Built-in dual RDC and Functional Safety

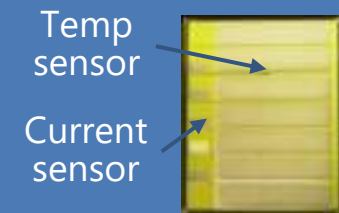
## Gate Driver

- Switching loss reduction, reducing cooling cost
- Higher-voltage(5kV) and Isolation
- Functional Safety



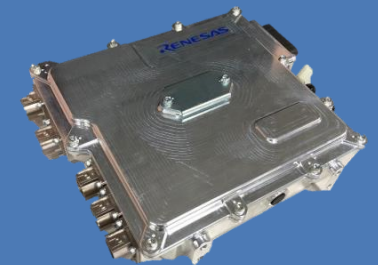
## IGBT

- Higher current (350A/cm<sup>2</sup>), lower loss
- Built-in sensor for preventing destruction.



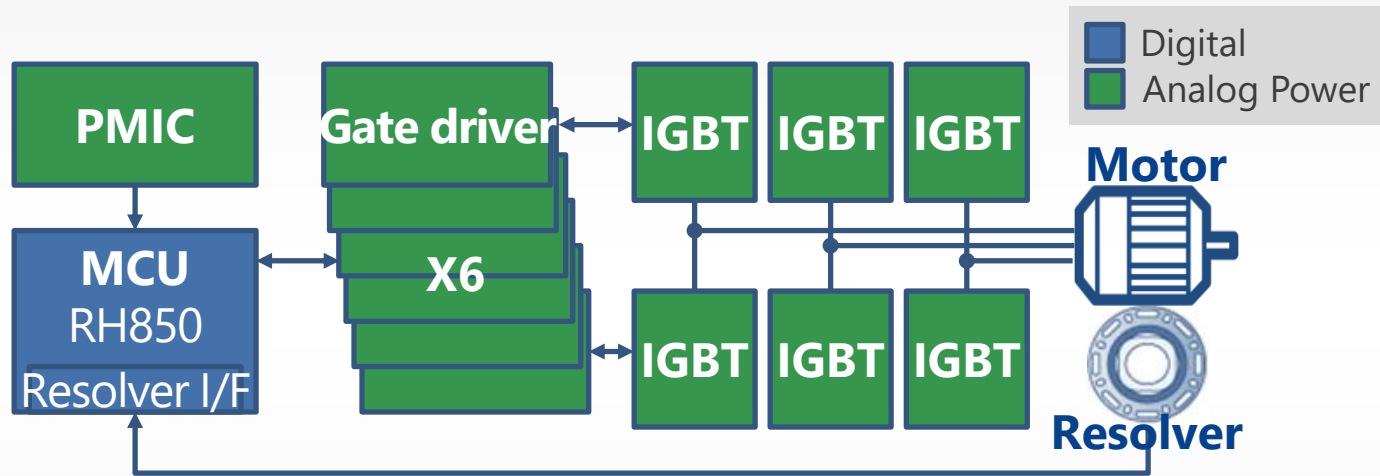
## Inverter Kit Solution

- Easy to develop, Reducing TAT
- More power can be derived by accurate TJ sensing with built-in temp sensor & SW.

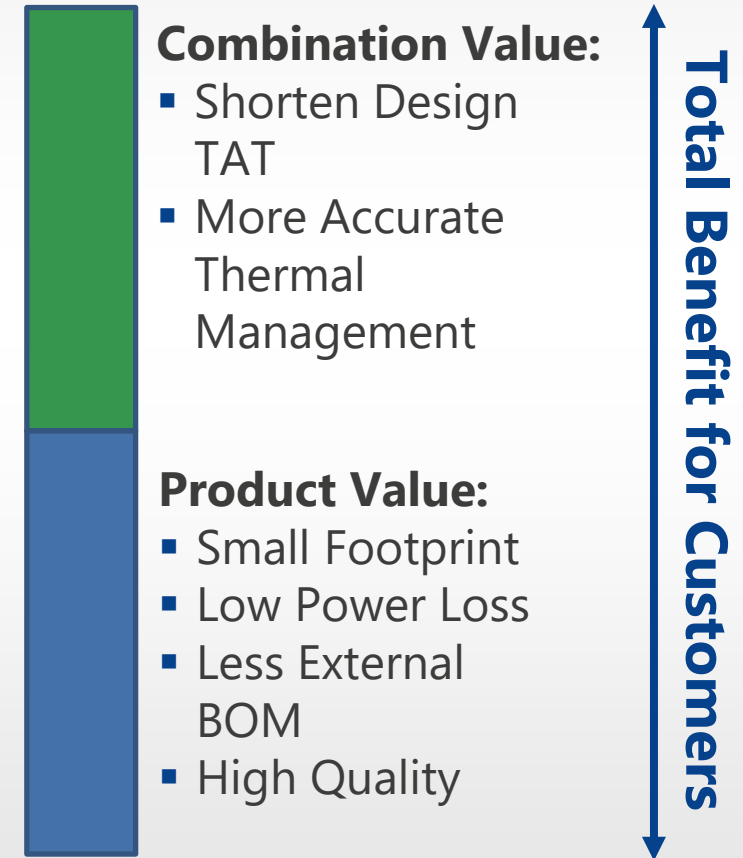


# WINNING COMBINATIONS- xEV INVERTER

Sensor embedded feature of IGBT is enhanced by MCU's system optimization for thermal management

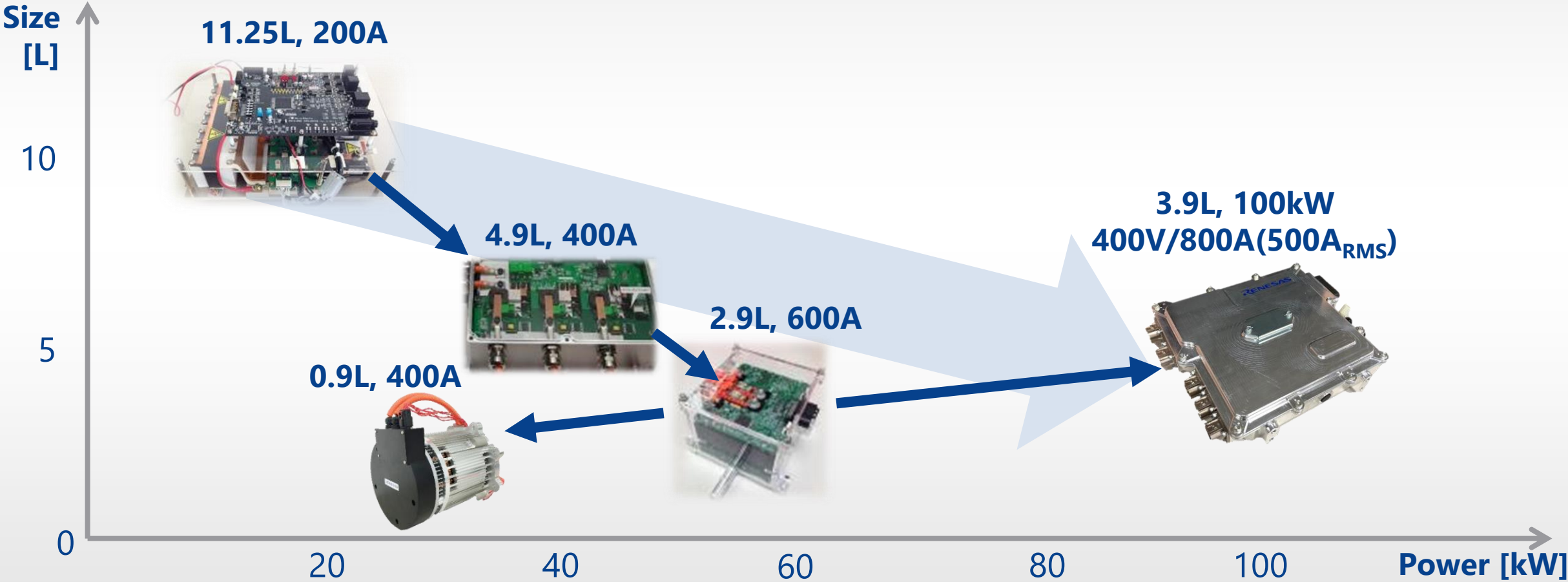


**+1140%**  
BOM  
Content



# SOLUTION CAPABILITY FOR xEV MAIN INVERTER

Combination of MCU, IGBT and Driver expertise can provide the optimal solution at system level



# POSITION SENSING

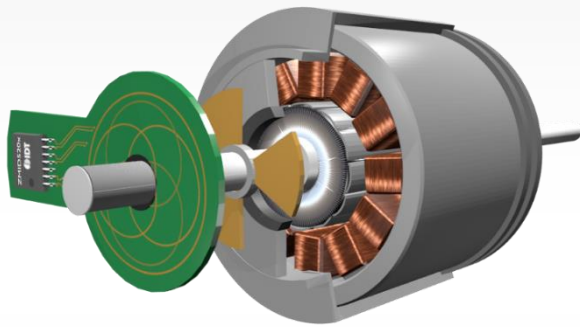


**Thin, Light, Cost Effective, Field Immune**

**Rotation**

**Narrow Angle**

**Linear Slider**



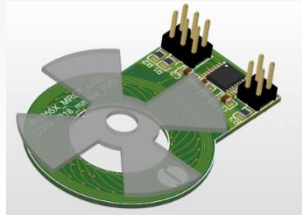
**x5 to x10 thinner**

**x2 to x100 lighter**

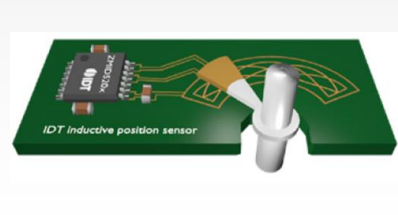
**Total Stray Field immune**

## Cost Effective

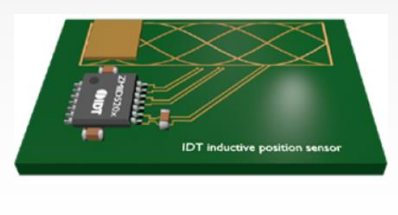
- No magnet
- No resolver
- Can reduce number of wires (single-ended)



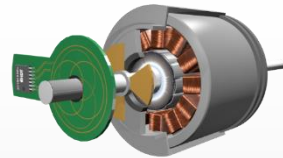
Motor control



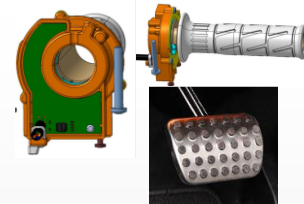
Pedal / Handle



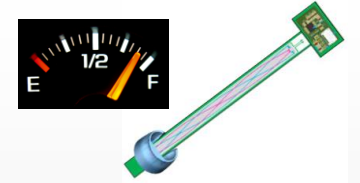
Fuel / Oil / Fluid Gauge



Dial



Valve control



Gear Selector



# ANALOG AND POWER GROWTH OUTLOOK

By leveraging market drivers and Renesas strengths, Analog product revenue to outgrow the market, while Power Discrete growth is offset by planned EOL

