

# IIOT GROWTH TALK

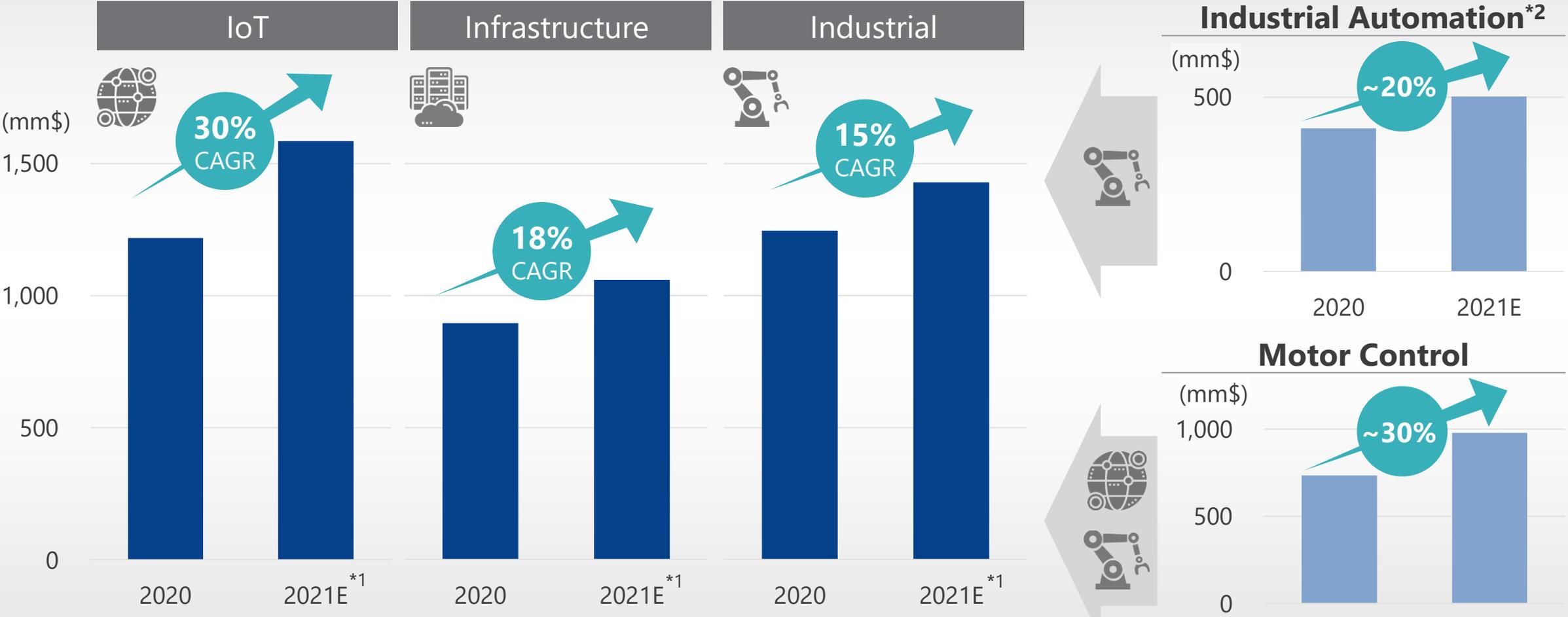
- INDUSTRIAL AUTOMATION AND MOTOR CONTROL -

DECEMBER 9, 2021  
SAILESH CHITTIPEDDI  
EXECUTIVE VICE PRESIDENT AND GENERAL MANAGER  
IOT AND INFRASTRUCTURE BUSINESS UNIT  
RENESAS ELECTRONICS CORPORATION

# AGENDA

- IIOT & INDUSTRIAL GROWTH AND FINANCIALS
- INDUSTRIAL AUTOMATION DEEP DIVE
- PIVOTING for GROWTH: COMBINING ANALOG & POWER WITH DIGITAL
- WIRELESS CONNECTIVITY IN EMERGING LANDSCAPE
- MOTOR CONTROL DEEP DIVE
- ROBOTICS A SNAPSHOT- COMBINING IA, MOTOR CONTROL, ANALOG AND POWER
- DRONES A SNAPSHOT- COMBINING MOTOR CONTROL, ANALOG AND POWER
- LONG-TERM RECAP
- SUMMARY

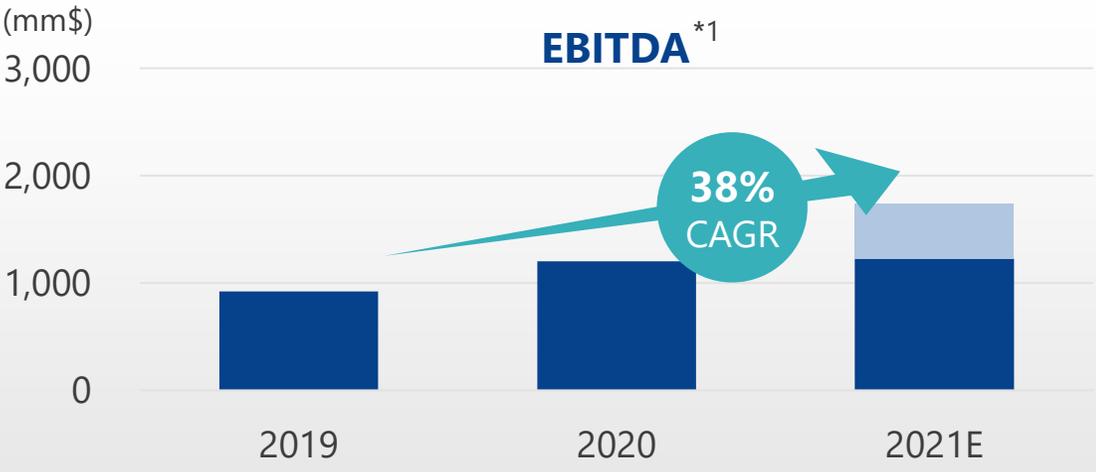
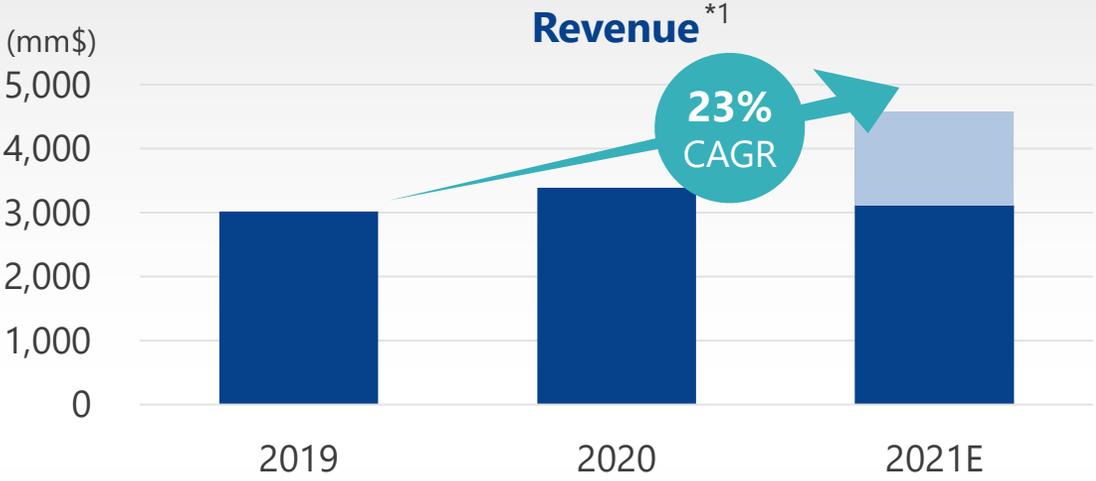
# IIOT AND INDUSTRIAL GROWTH A SNAPSHOT 2020-2021



\*1: 2021 Revenue Estimate /1Q-3Q actual and 4Q guidance  
 \*2: Partially including revenue from IoT and infrastructure subsegment and Automotive business.

# IIOT AND INDUSTRIAL FINANCIAL TRENDS AT A GLANCE

2019, 2020: ■ Act | 2021: ■ 1Q – 3Q Act, ■ 4Q guidance



\*1: The financial data of each fiscal year is converted at the prevailing U.S. dollar rate of each year (guidance rate for 4Q 2021)

# INDUSTRIAL AUTOMATION

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# SELECTED CUSTOMER BASE

## INDUSTRIAL AUTOMATION



# INDUSTRIAL AUTOMATION PYRAMID

## INDUSTRIAL AUTOMATION

Renesas is leading semiconductor supplier in all key areas of Smart Factory enabling 'Industry 4.0'

### Analysis Layer

Cloud computing

### Control Layer

Factory automation

Process / Factory monitoring & control

System / Industrial network

EtherCAT  
Technology Group

EtherNet/IP

PROFINET

PROFINET

- MPU / MCU
- PMIC
- ASIC
- Timing

### Access Layer

System monitoring and control

Remote IO

Local PLC / ECU

Gateway

Field network

ASI  
INTERFACE

IO-Link

SPE  
SINGLE PAIR ETHERNET  
SYSTEM ALLIANCE

HART  
COMMUNICATION PROTOCOL

- Sensor
- SSC
- MCU/MPU
- ASIC
- IO-link
- ASi

(Smart) Sensors and actuators

Sensors

Actuators

Sensors

Actuators

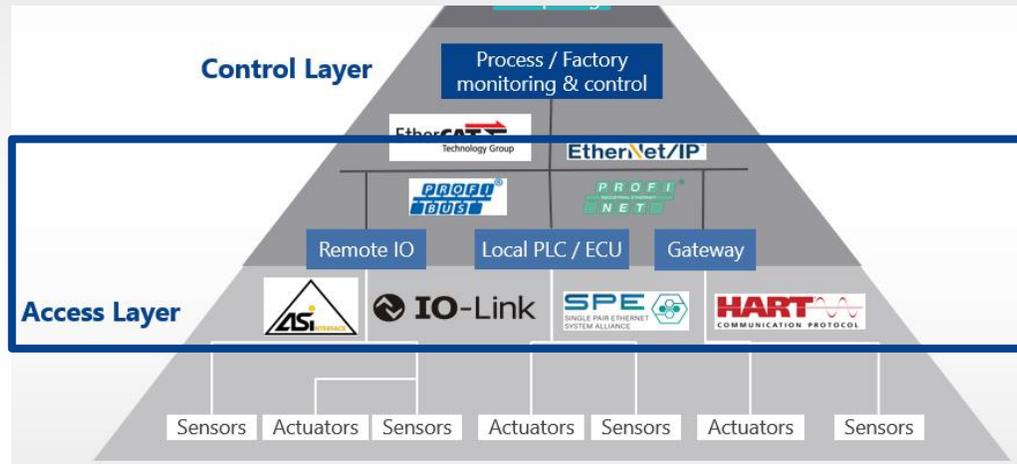
Sensors

Actuators

Sensors

# INDUSTRIAL AUTOMATION CONTROL LAYER

## INDUSTRIAL AUTOMATION



Controller & Communications

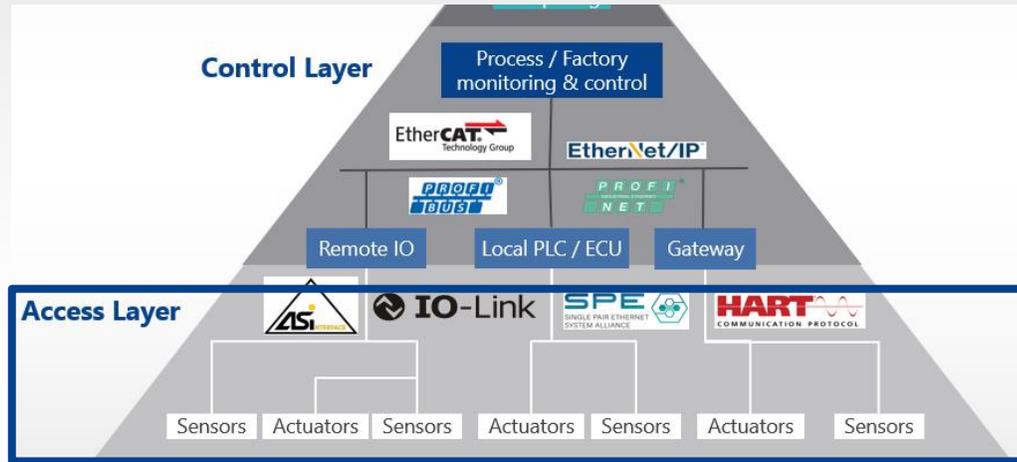
Sensors & Actuators

Logos for various industrial protocols and standards: PROFIsafe, Safety over EtherCAT, DeviceNet, CIP Safety, CC-Link Safety, CANopen, Modbus, PROFIBUS, EtherNet/IP, EtherCAT Technology Group, PROFINET, CC-Link IE, and SERCOS the automation bus.

<p><b>MCU Product Solutions</b></p> <p>RENESAS RA</p> <p>RENESAS RX</p>	<p>RA6 series RA4 series RX700 series RX600 series</p>	<p>RA6T2, RA6T1, RA2A1, RA2E1 RX66T, RX72T, RX24T, RX23E-A RL78/I1E</p>
<p><b>SoC Product Solutions</b></p> <p>RENESAS RL78</p> <p>RENESAS RZ</p> <p>RENESAS R-IN</p>	<p>RZ/N, RZ/T series R-IN32</p>	<p>S1JA, RZ/T series</p>
<p><b>ASIC Solutions</b></p> <p>dialog SEMICONDUCTOR</p>	<p>Sensor AFE ASIC Communication ASIC</p>	<p>Customized MCU with Sensor Frontends Wireline &amp; Wireless ASIC with Industry 4.0 application Ethernet PHY ASIC/ASSP</p>

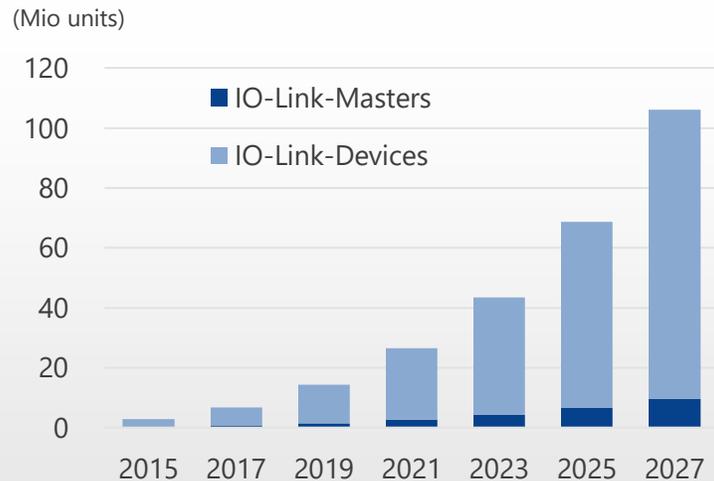
# INDUSTRIAL AUTOMATION ACCESS LAYER

## INDUSTRIAL AUTOMATION



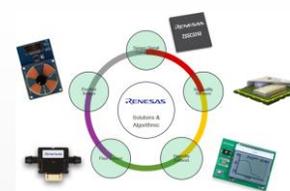
Controller  
&  
Communications

Sensors  
&  
Actuators



Source: Markets and Markets, Renesas

### Sensor Solutions



### Interface Solutions



MCUs  
Smart SSC  
Air quality  
Humidity  
Position  
Flow  
Master / Device

ASIC Solutions

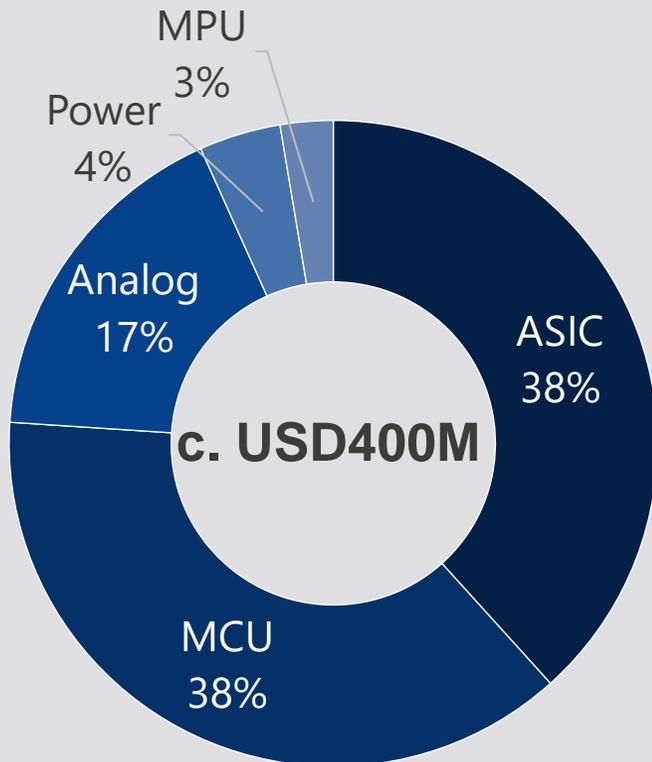
RL78, RA2, RX23, SJ1A  
ZSSC3xxx, ZSSC328x (Toledo)  
ZMOD44xy, ZMOD45xy,  
HT3xxx, HT4xxx  
ZMID2xyz, ZMID52xy  
FS10xy, FS20xy

<b>Device Transceiver</b>	<b>Master Transceiver</b>
CCE450x	CCE451x
RH4Z2501 (IBIZA)	RH4Z2501 (IBIZA)
	ASI4U (3,5), SAP5
Flow Control ASIC with HART	Position Sensor ASIC with IO-Link

# OUR BUSINESS

## INDUSTRIAL AUTOMATION

Product Revenue Mix (FY2020)



Most of MCU revenue overlap with motor control.

### End Products

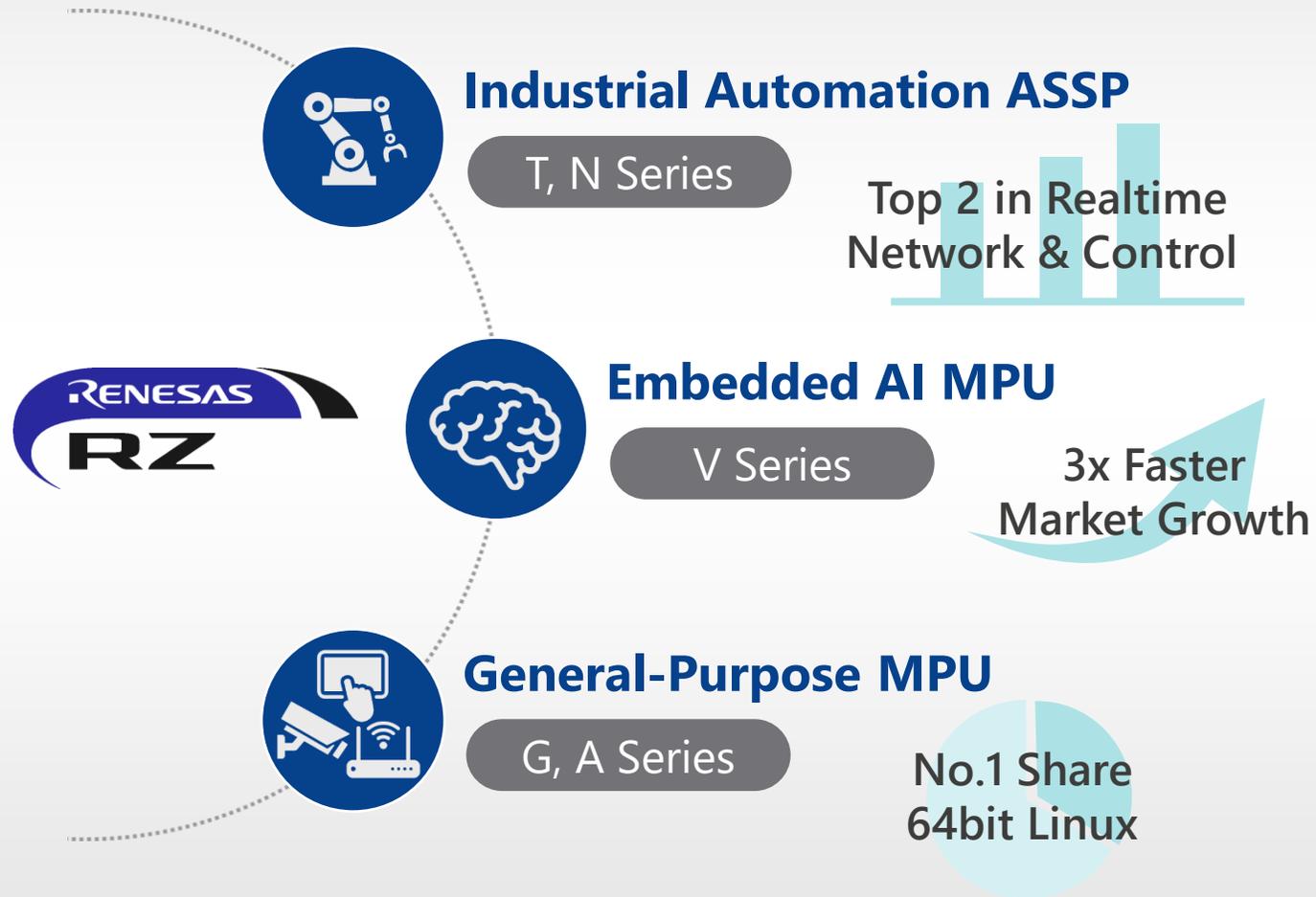
Control system	<ul style="list-style-type: none"> <li>PLC</li> <li>CNC</li> <li>HMI</li> </ul>
Terminal	<ul style="list-style-type: none"> <li>AC servo</li> <li>AC drive</li> <li>Robot</li> <li>Remote I/O</li> <li>Sensor</li> </ul>

### Renesas Products

Digital	<ul style="list-style-type: none"> <li>MCU</li> <li>ASIC</li> <li>MPU</li> </ul>	
Analog	<ul style="list-style-type: none"> <li>Transceiver</li> <li>Op amp</li> <li>Memory</li> </ul>	 N, G, A Series <ul style="list-style-type: none"> <li>Timing</li> <li>PMIC, DC/DC</li> </ul>
Digital	<ul style="list-style-type: none"> <li>MCU</li> <li>MPU</li> </ul>	
Analog	<ul style="list-style-type: none"> <li>Transceiver</li> <li>Smart SSC</li> <li>PMIC</li> <li>AFE</li> </ul>	 T, V Series <ul style="list-style-type: none"> <li>Op amp</li> <li>Timing</li> <li>Delta-sigma modulator</li> </ul>

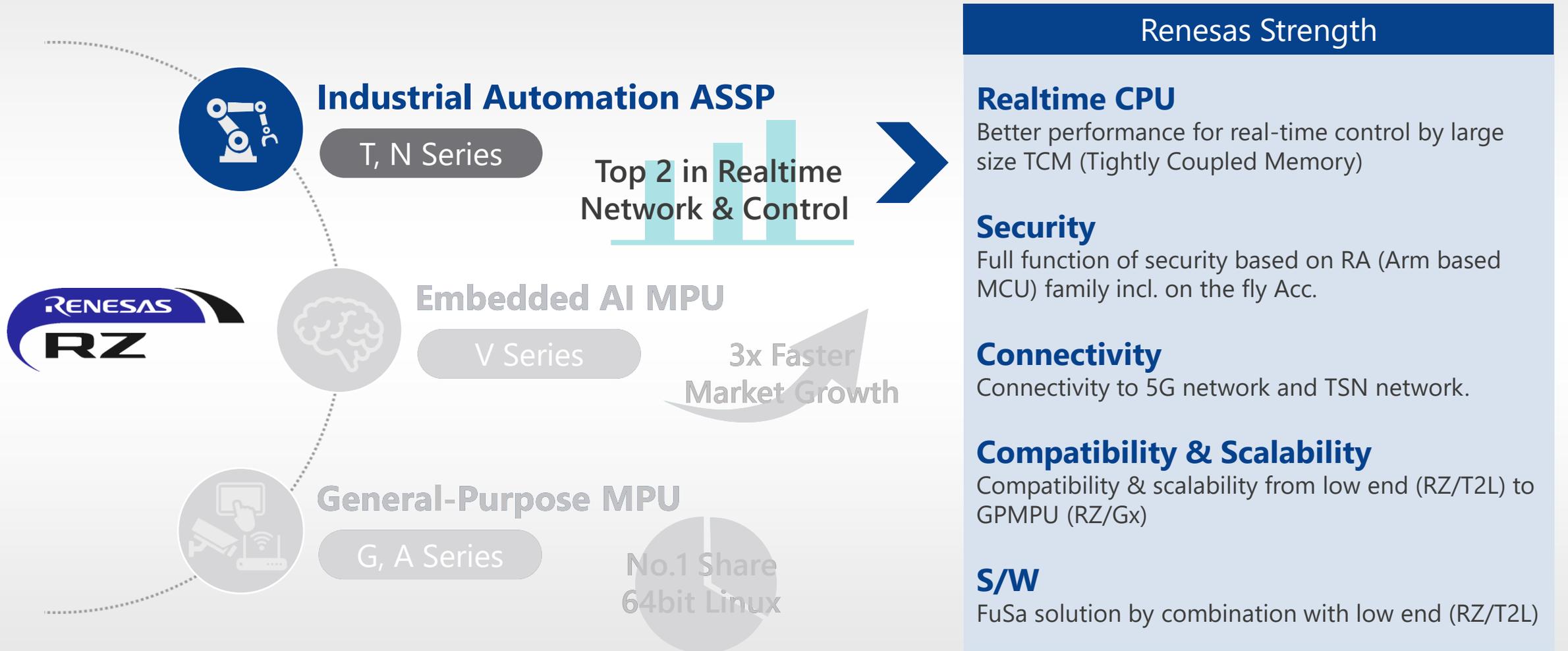
# MPU PRODUCTS AND COMPETITIVENESS

## INDUSTRIAL AUTOMATION



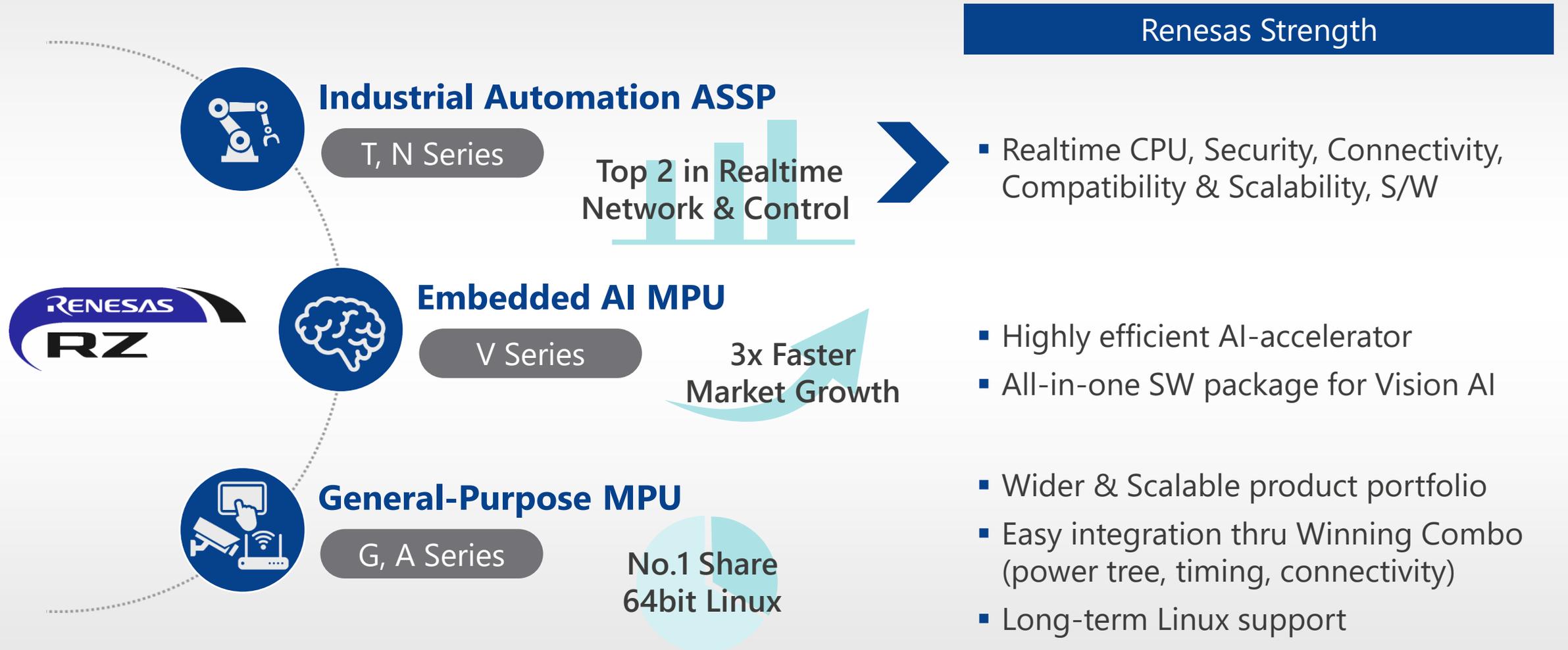
# MPU PRODUCTS AND COMPETITIVENESS

## INDUSTRIAL AUTOMATION



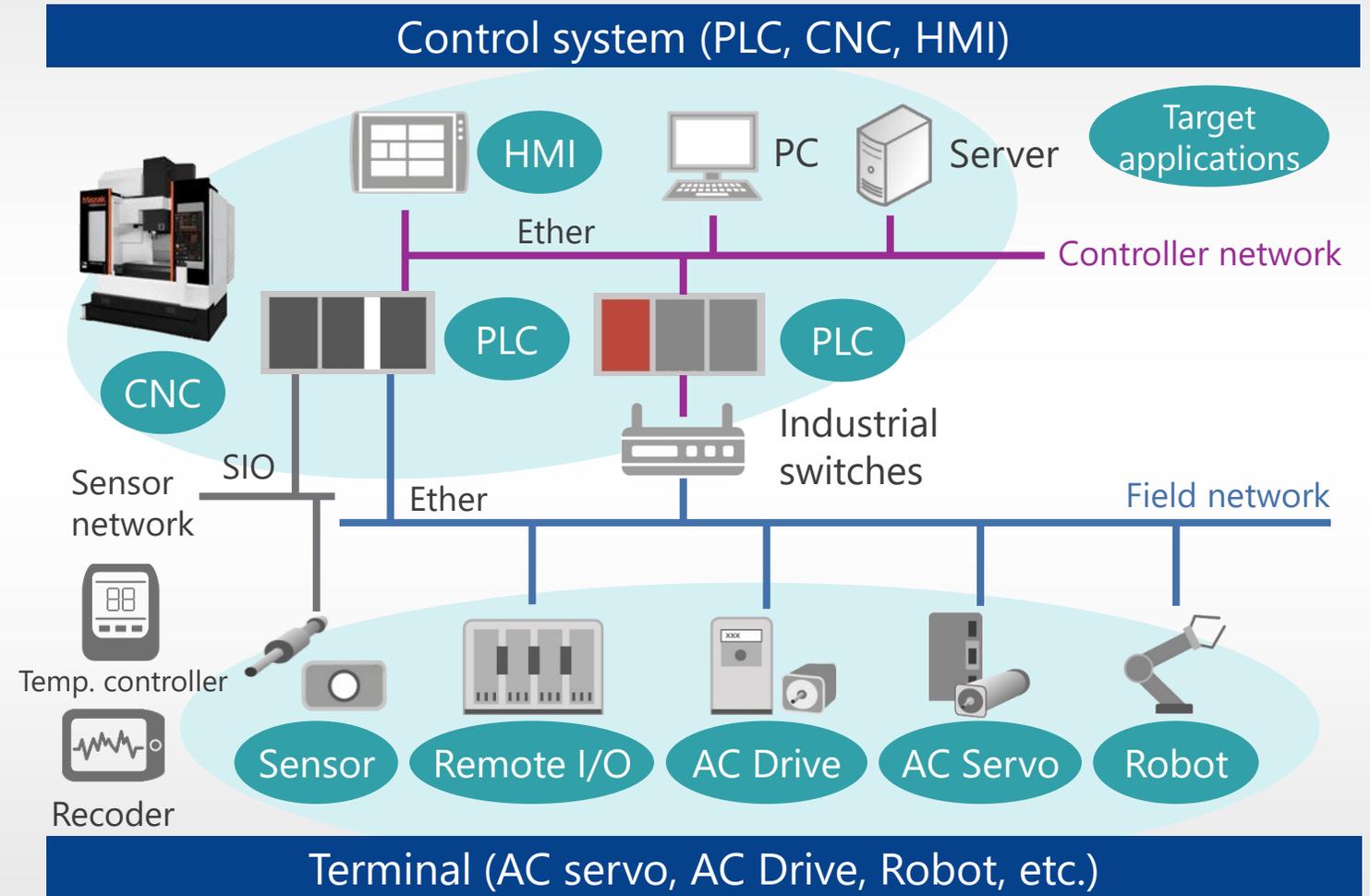
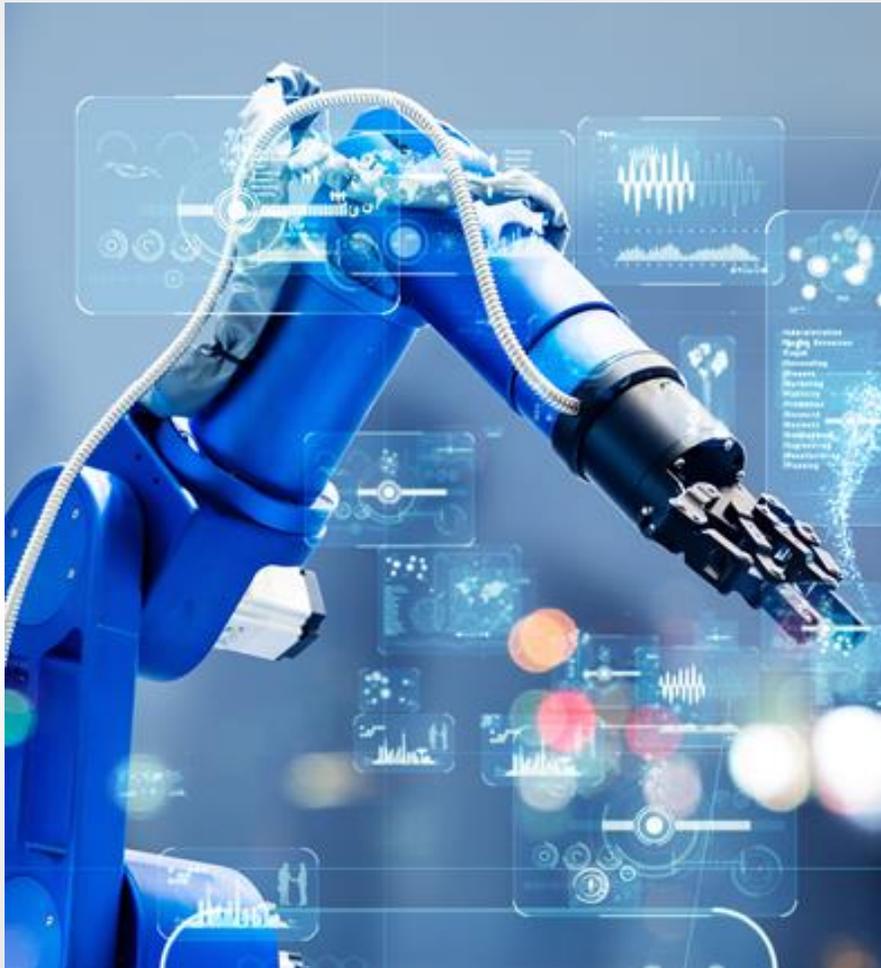
# MPU PRODUCTS AND COMPETITIVENESS

## INDUSTRIAL AUTOMATION



# DRIVING CONTENT GROWTH IN INDUSTRIAL AUTOMATION

## ACCELERATING GROWTH



CNC: Computer Numerical Control, SIO: Serial Input/Output, HMI: Human-Machine Interface, PLC: Programmable Logic Controller

# DRIVING CONTENT GROWTH IN INDUSTRIAL AUTOMATION

## ACCELERATING GROWTH

### MCU/MPU



**Broad offering  
of analog products**

- Power
- Connectivity
- Sensor
- AFE



**More Growth  
More Profit**

### Renesas Content

Digital only

Digital + Analog

PLC



~\$ 20



~\$ 30  
(1.5x)

Servo



~\$ 6



~\$ 15  
(2.3x)

Multi axis  
assembly  
robots



2 or 3 BLDC motors  
XY or XYZ

~\$ 10

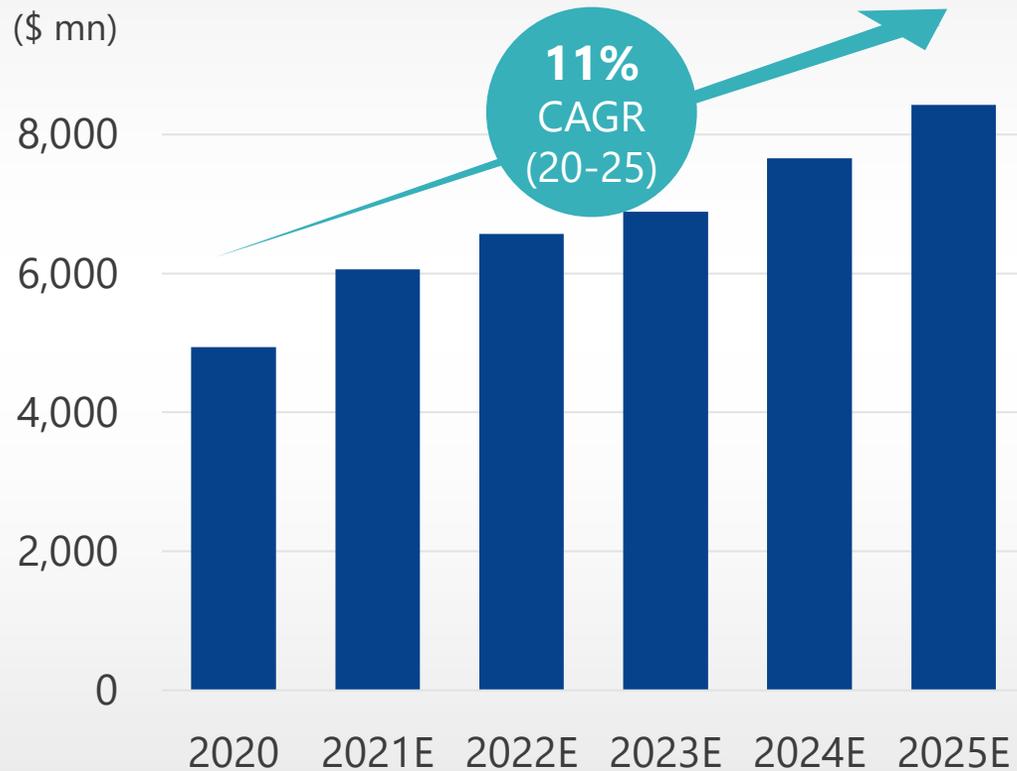


~\$ 25  
(2.5x)

# SAM GROWTH

## INDUSTRIAL AUTOMATION

### Industrial Automation SAM



Source: Gartner Semiconductor\_Forecast\_3Q21

### Market Trend

#### Macro

- Production reshoring due to geopolitical tension
- Investment in new industries to address sustainability challenges

#### Micro

- Changes in the following market requirement

Performance and Power Efficiency



Network / Cloud



Intelligence on the Edge



Safety (FuSa) and Security



# WIRELESS CONNECTIVITY IN INDUSTRIAL APPLICATIONS- A NEW GROWTH VECTOR

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# HOW CELENO'S WIFI6 BENEFITS INDUSTRIAL AUTOMATION

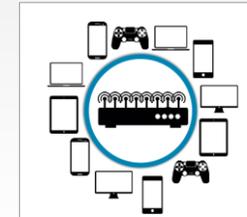
## INDUSTRIAL AUTOMATION

### Wifi 6/6E in Industrial



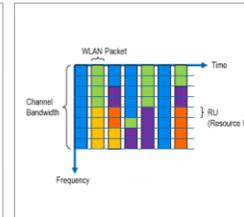
### Wifi 6/6E Key Features

MU-MIMO  
Up to 8x8



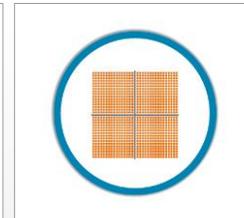
Frequency  
Bands

Scheduling



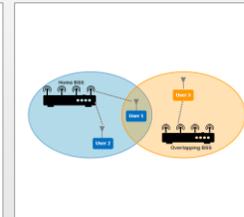
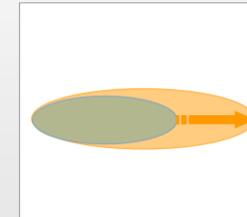
DL&UL  
OFDMA

Target-Wait  
Time



1024QAM

Extended  
Range



Spatial  
Reuse

# HOW CELENO'S WIFI6 BENEFITS INDUSTRIAL AUTOMATION

## INDUSTRIAL AUTOMATION

### Wifi 6/6E in Industrial



### Benefits

Higher network capacity

Signal reliability

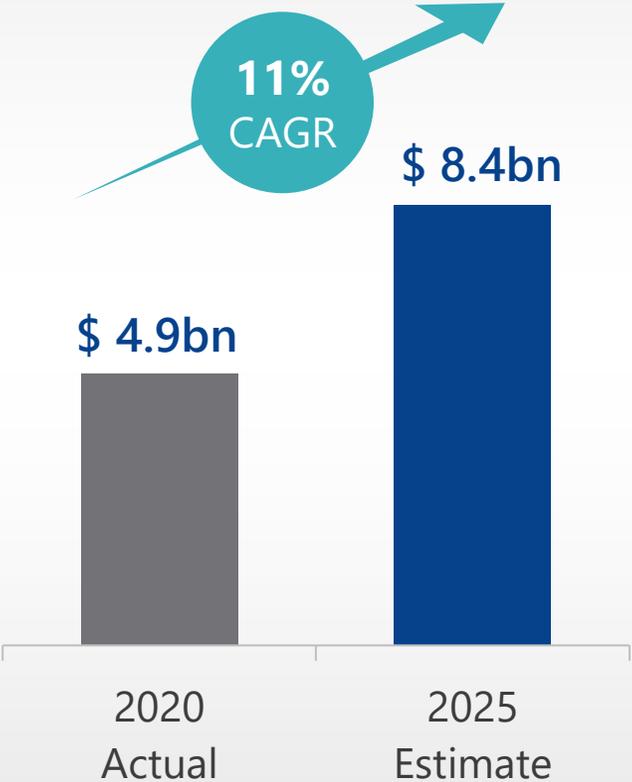
Lower latency

Mitigating crowded networks

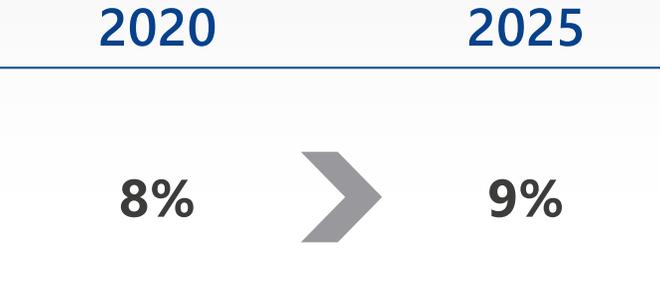
# OUR SOM GROWTH

## INDUSTRIAL AUTOMATION

### SAM



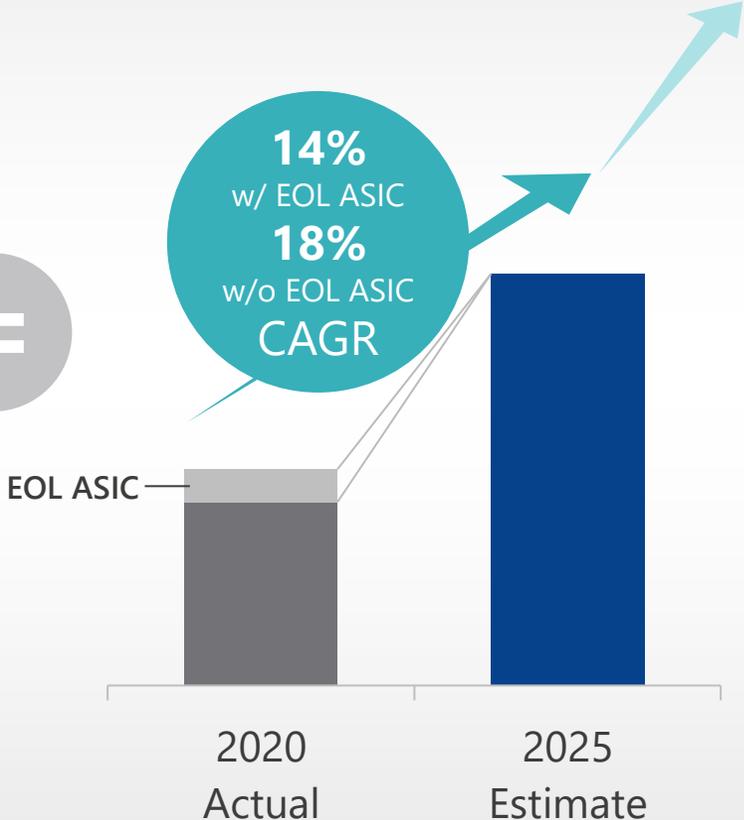
### Market Share



### Trigger for market share gain

- MPU: New product D-in acceleration
- MCU: 32bit MCU D-in conversion to revenue
- Analog: Winning Combo w/ strong digital products

### SOM



# MOTOR CONTROL

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# SELECTED CUSTOMER BASE

## MOTOR CONTROL

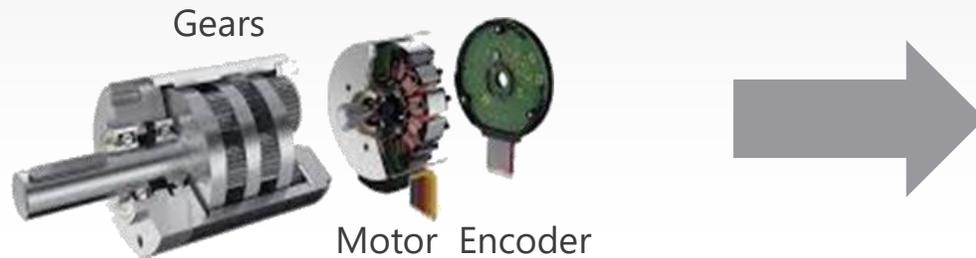


# MOTOR SYSTEM AND SEMI CONTENTS

## MOTOR CONTROL

### Motor Systems

#### Composition of Motor System



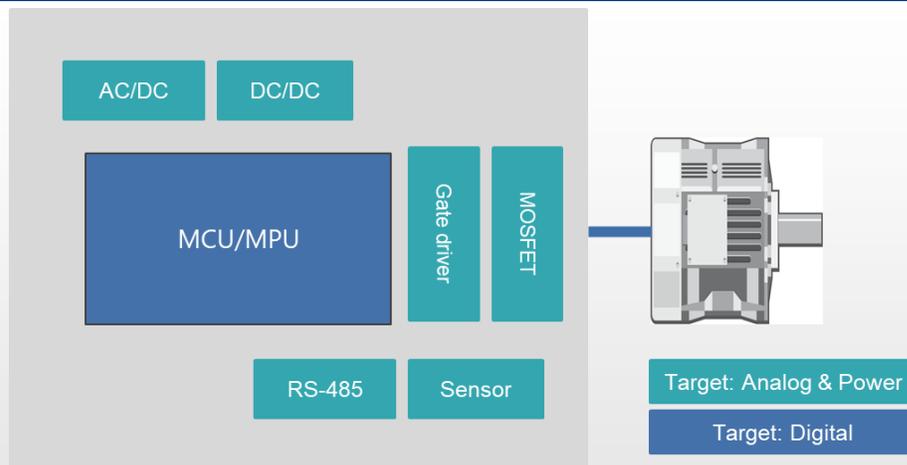
#### Motor Type

BLDC motor  
 AC servo motor  
 Fan motor  
 Stepping motor

#### Major applications

Air conditioner, Refrigerator  
 Industrial automation  
 PC, Server  
 Printer, Camera

### Semi Contents (BLDC Motor)



#### Digital only

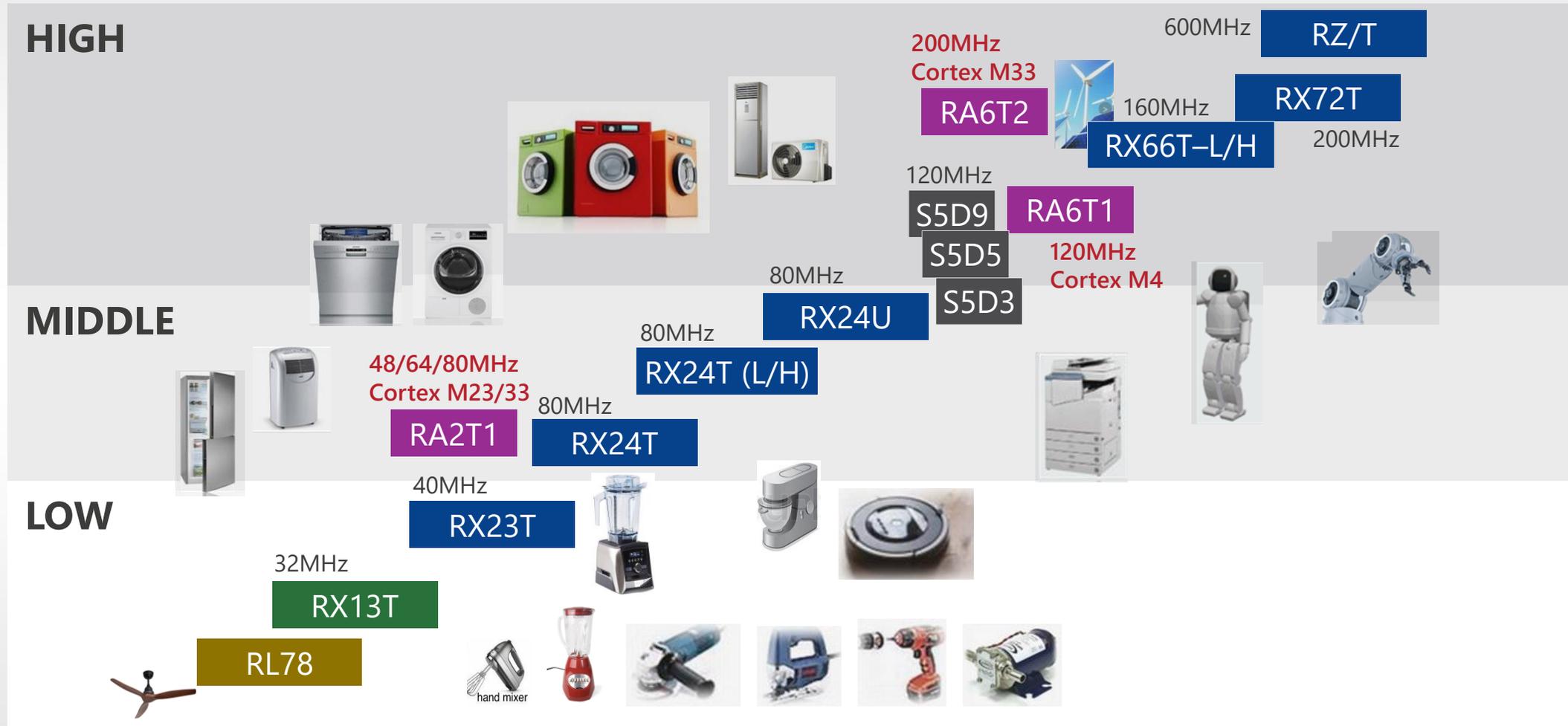
\$1~\$2

#### Digital + Analog

\$5~\$6  
 (3x~5x)

# MCU PRODUCT FOR MOTOR CONTROL APPLICATIONS

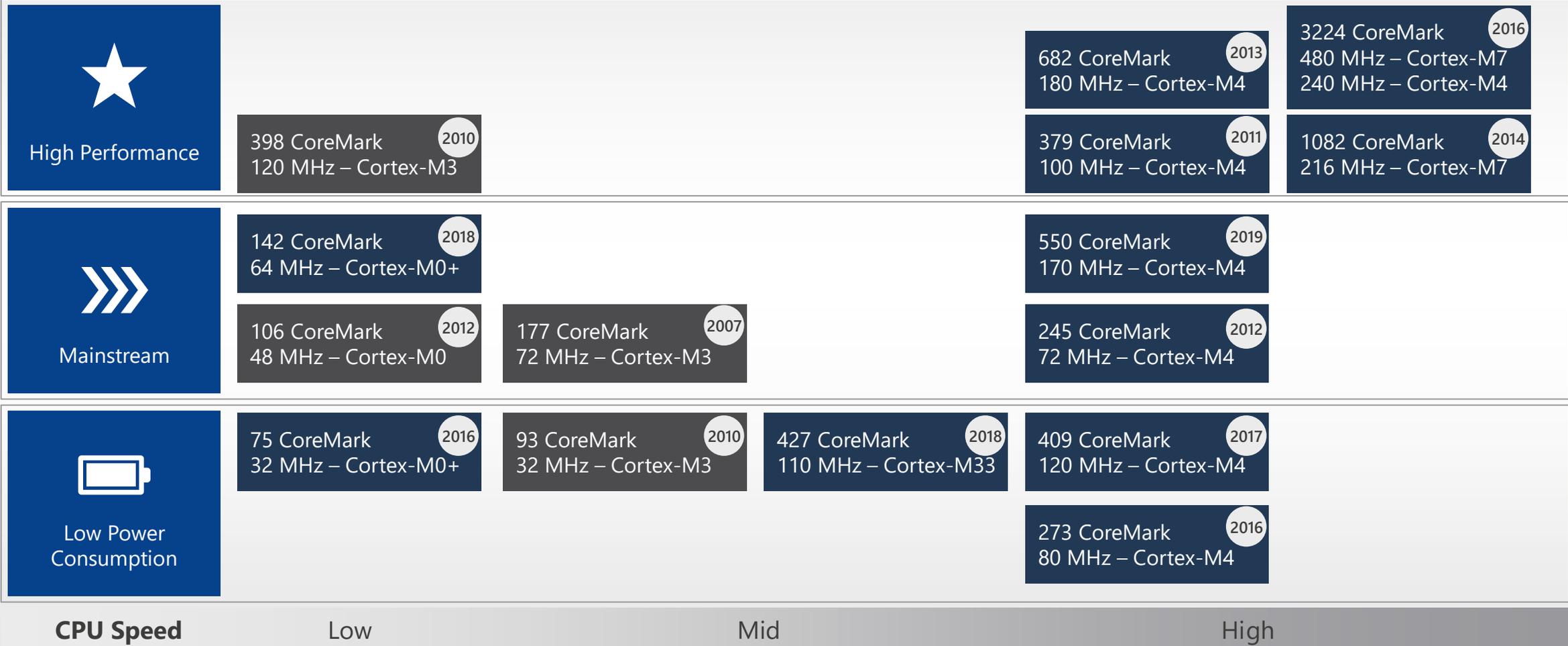
## NO.1 SHARE\* AND FAST PRODUCT ROLL-OUT OF ARM CORE MCU (RA FAMILY)



\* Source: Fuji Keizai Precise Small Motor Market 2019

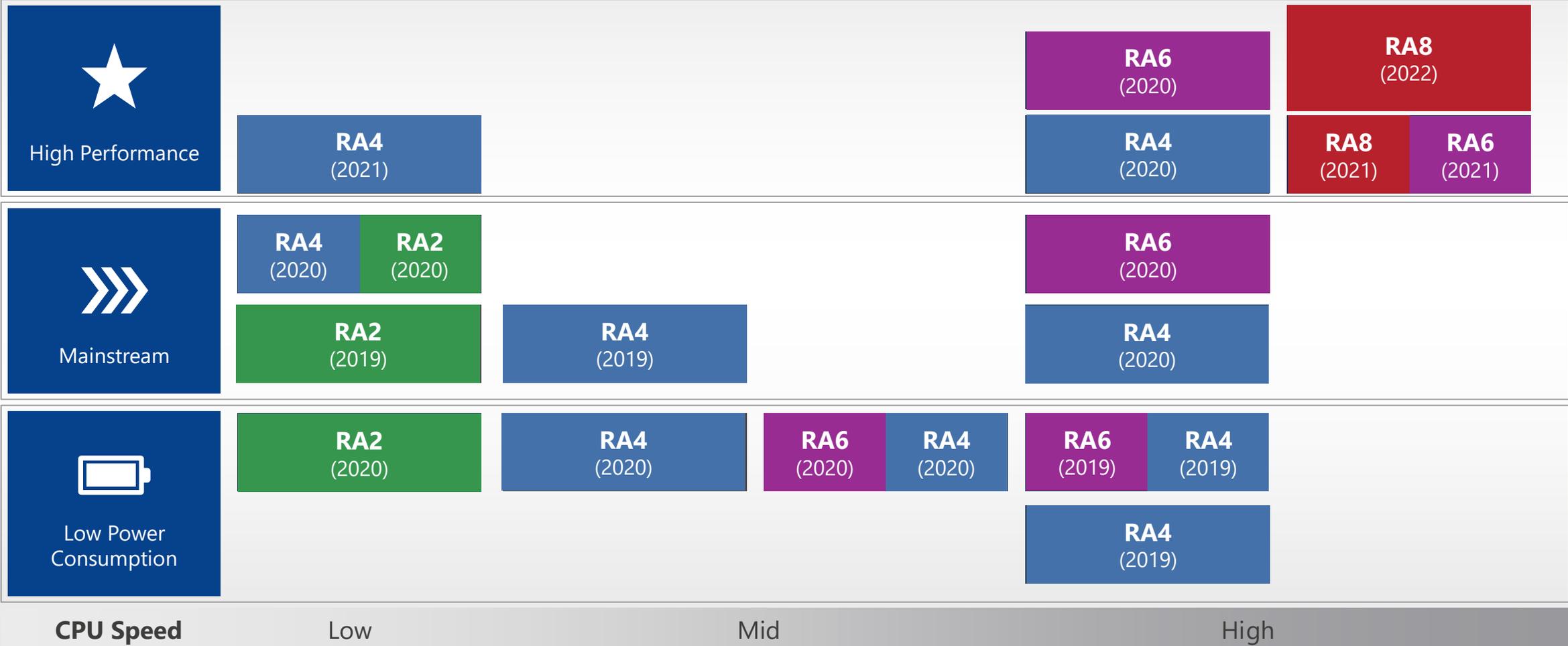
# OUR COMPETITIVENESS – MCU

Catching up with the front-runner for Arm core line-up with the advantages



# OUR COMPETITIVENESS – MCU

Catching up with the front-runner for Arm core line-up with the advantages



# MCU NO.1 SHARE\* AND STRENGTH FOR MOTOR CONTROL

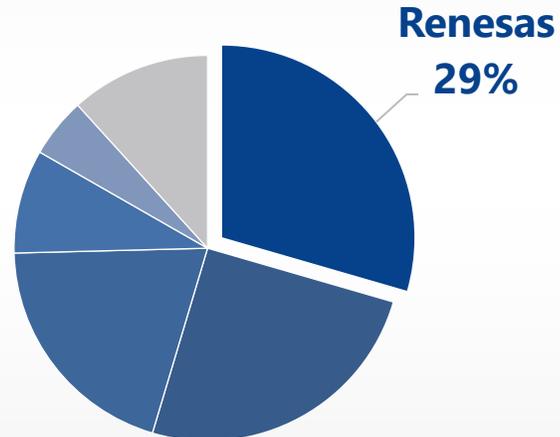
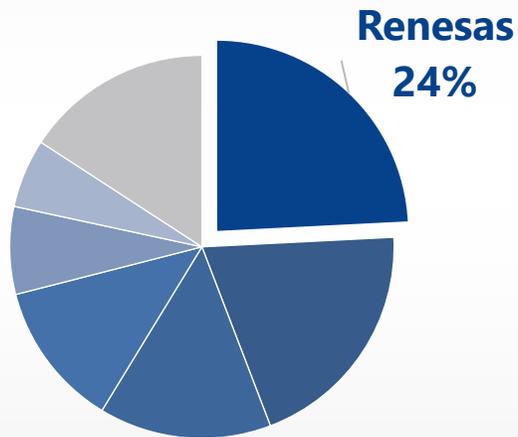
## Market Share



For industrial equipment



For home appliances and home air-conditioning equipment



We estimate that our share is low 20% range for all applications total

## Strength

- Leading inverter control
- Large scalability
- Rich function blocks
- Low power

## Benefit for customer

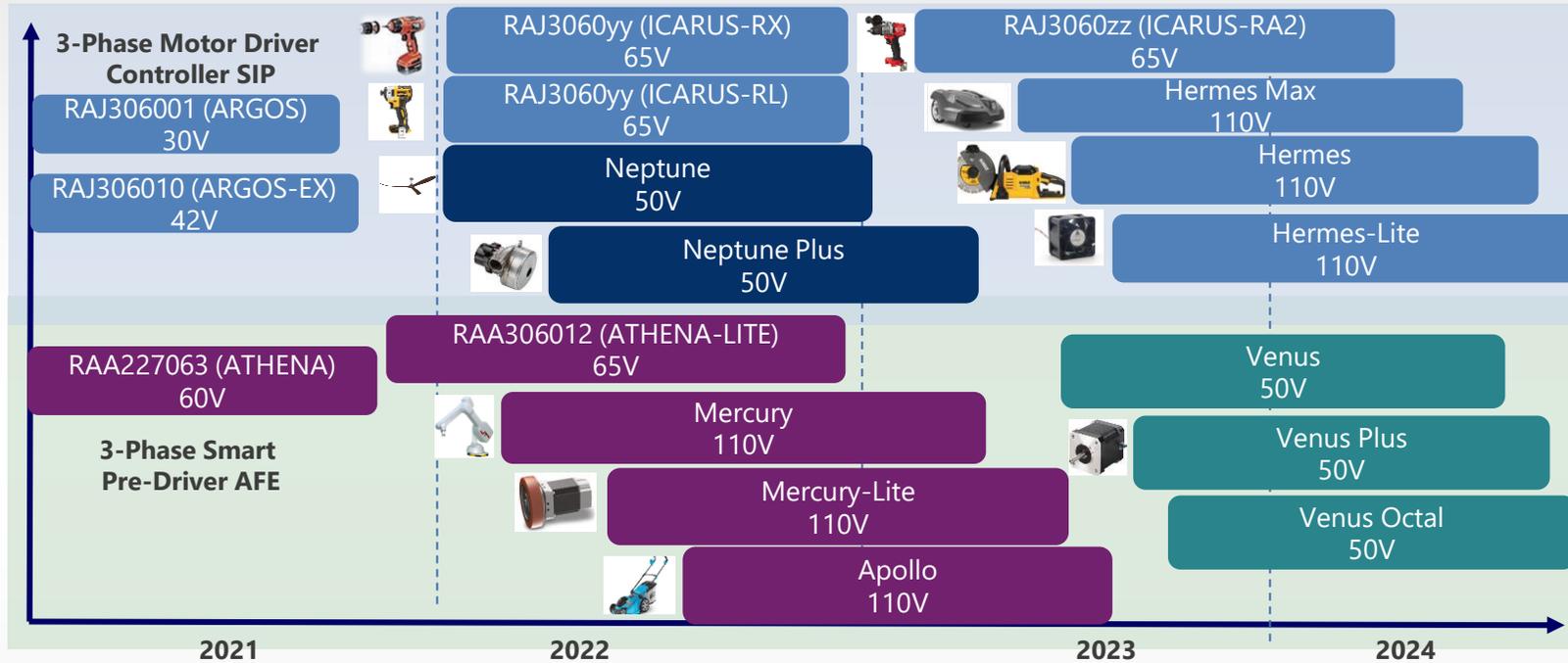
- High performance
- System cost reduction
- Time to market

\* Source: Fuji Keizai Precise Small Motor Market 2019

# MOTOR DRIVER ASSP

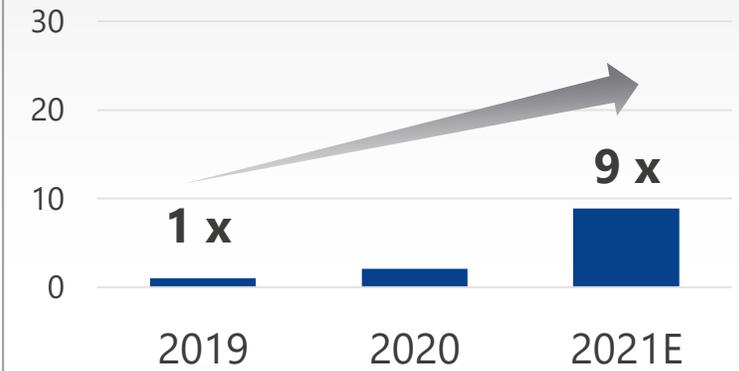
## ADDRESSING A 2B\$ SAM OPPORTUNITY

MCU + Pre-Driver
MCU + Pre-Driver + MOSFET
Pre-Driver
Pre-Driver + MOSFET



Portfolio covering the entire motor driver ASSP domain

### DIN opportunity in LTV



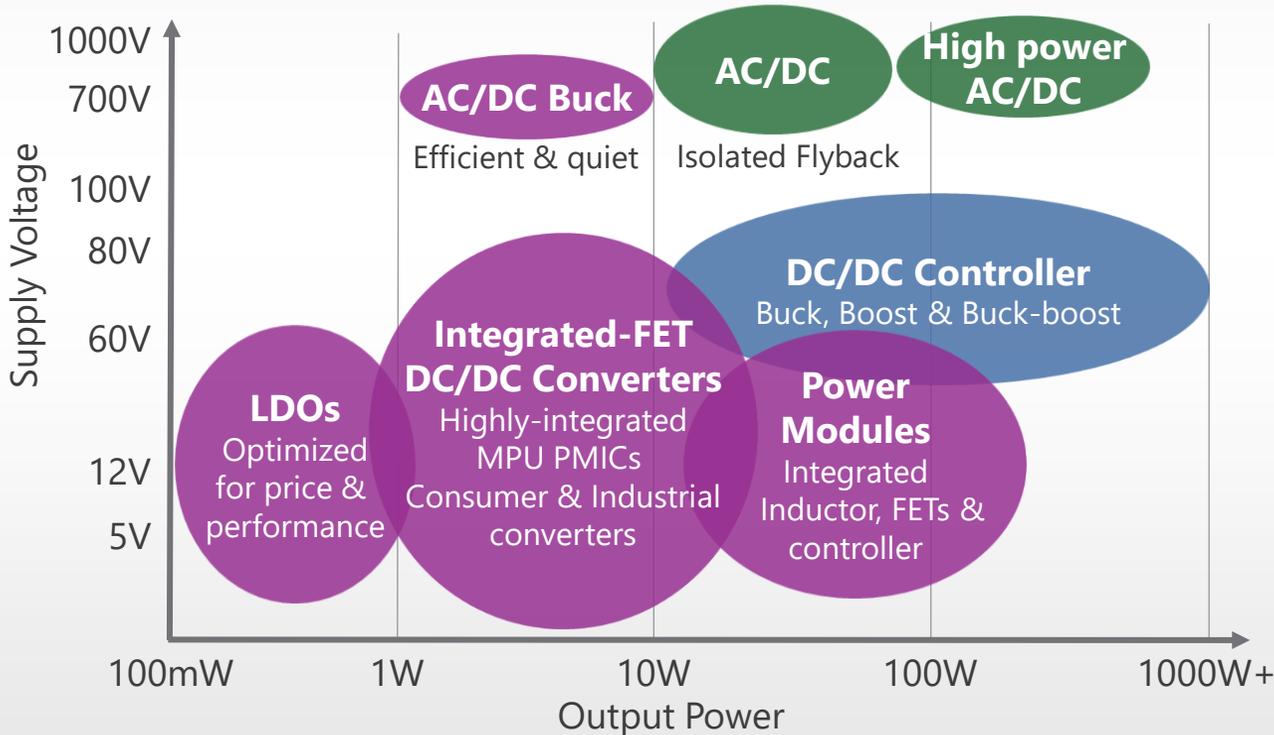
### Strength

- Strong both in MCU and in Analog
- Sensor-less technology – patented IP
- Plug-in-play development tools

# DRIVING SECULAR GROWTH: INDUSTRIAL ANALOG & POWER SOLUTIONS

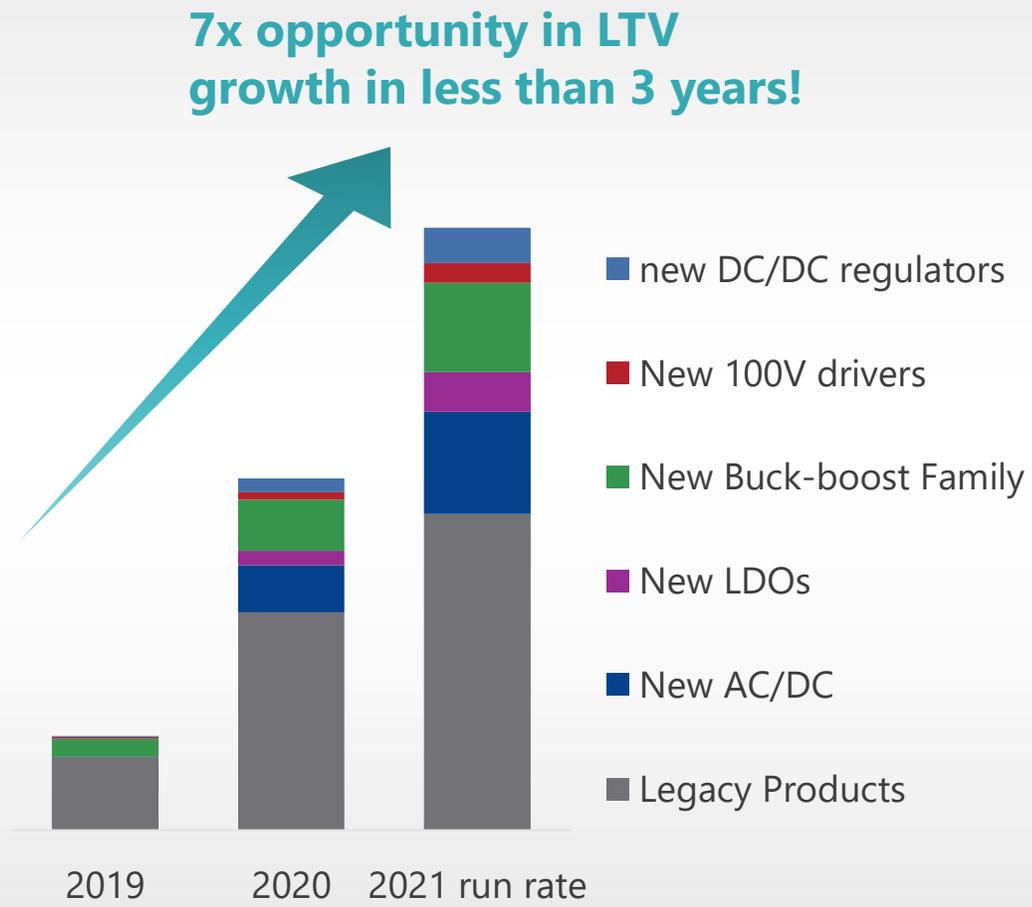
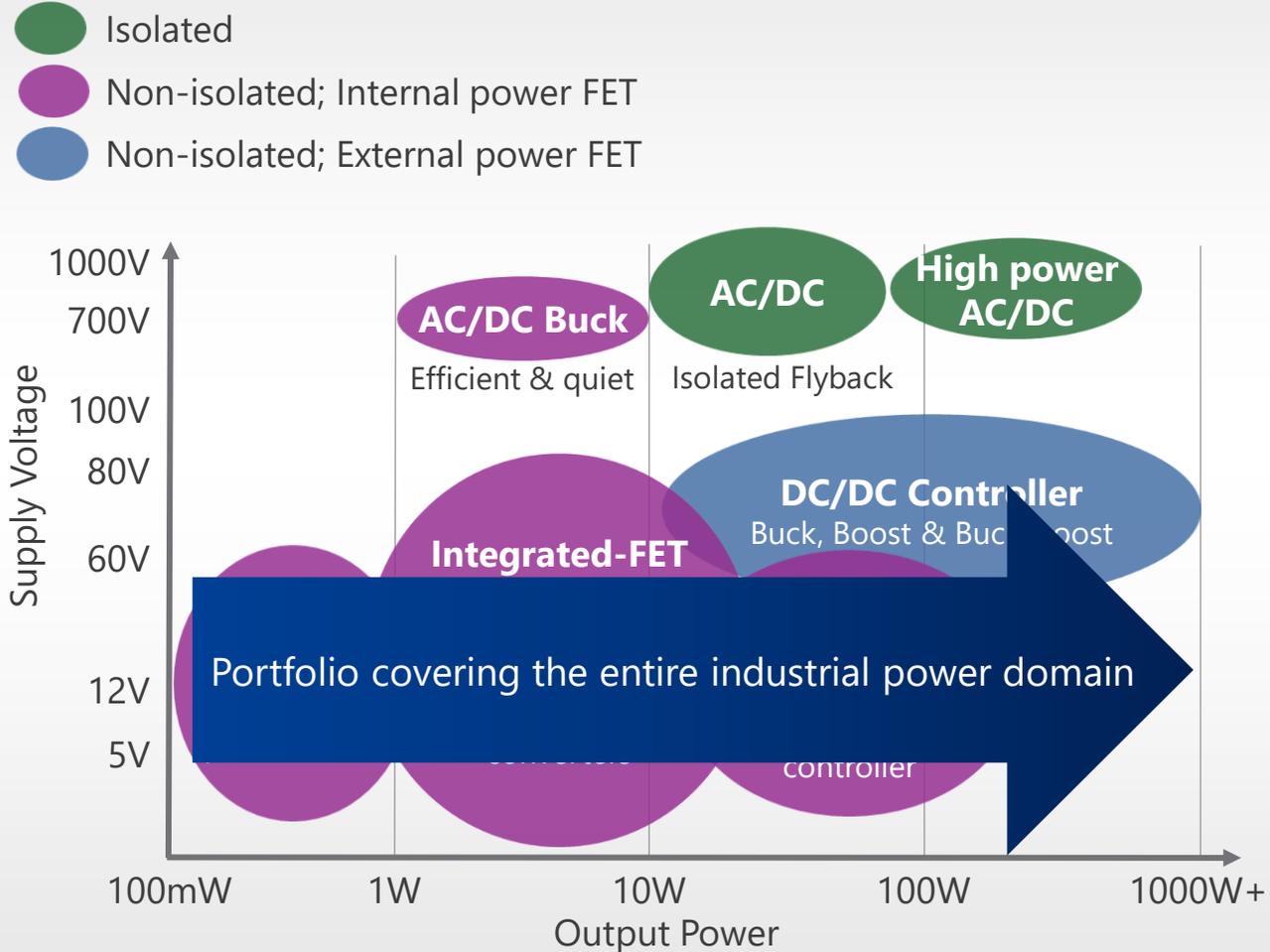
## WINNING IN TARGET MARKETS, AND GOING BROADER- ADDRESSING A 3B\$ SAM OPPORTUNITY

- Isolated
- Non-isolated; Internal power FET
- Non-isolated; External power FET



# DRIVING SECULAR GROWTH: INDUSTRIAL ANALOG & POWER SOLUTIONS

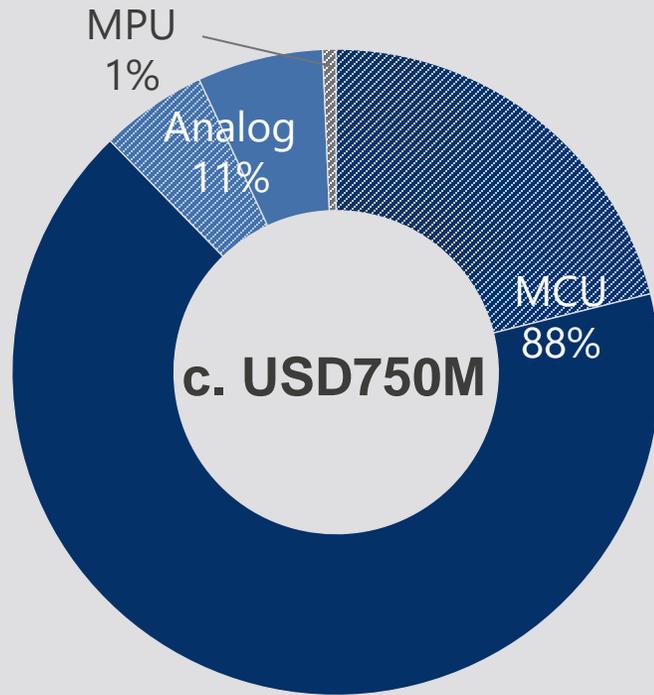
## WINNING IN TARGET MARKETS, AND GOING BROADER- ADDRESSING A 3B\$ SAM OPPORTUNITY



# OUR BUSINESS

## MOTOR CONTROL

Product Revenue Mix (FY2020)



■ 27% of the revenue is from IA  
(24% of MCU, 45% of Analog, 100% of MPU)

### End Products

Motor Control Applications

- IA
  - Servo
  - Inverter
  - Robot
- AC
- Refrigerator
- Washer
- Cleaner
- Power Tools
- Printer
- Storage
- Camera Lens

### Renesas Products

Digital

- MCU
- MPU T Series

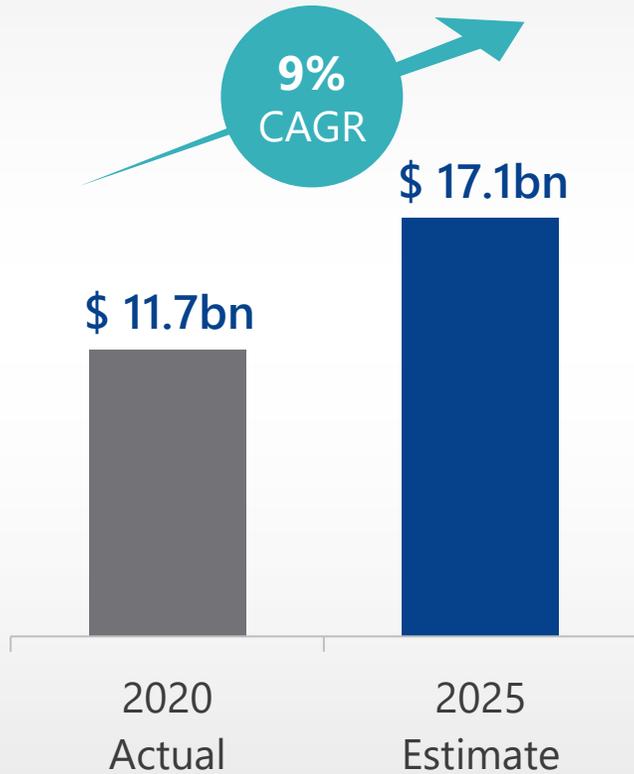
Analog

- Gate Driver IC
- AD/DA Converter
- DC/DC Controller
- LDO
- Amplifier
- Motor Driver ASSP (incl. MCU)
- GPAK and HVPAK

# OUR SOM GROWTH

## MOTOR CONTROL

### SAM



### Market Share

2020                      2025

7%



10%

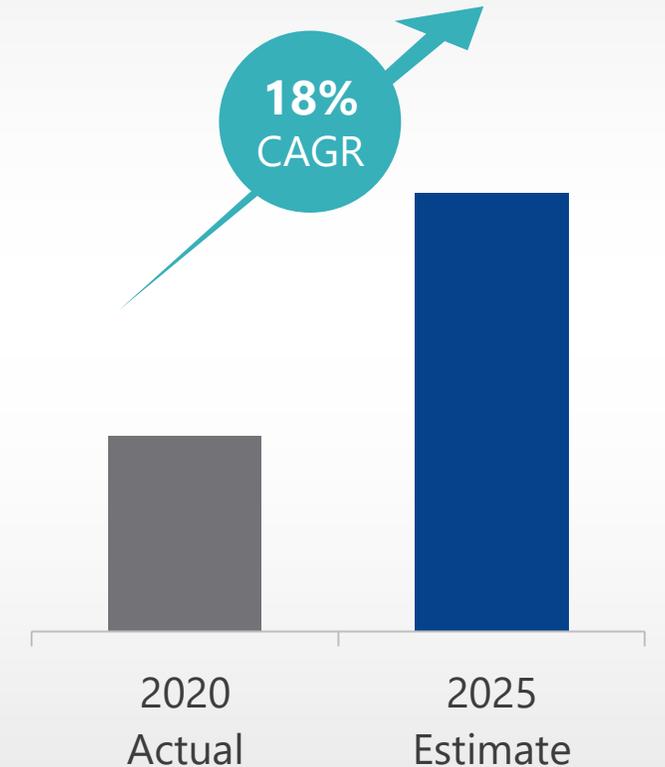


Trigger for market share gain



- Analog: Fast product roll-out with better performance
- MCU: Full line-up of ARM MCU(RA). 32bit MCU D-in conversion to revenue

### SOM



\* Source: Fuji Keizai Precise Small Motor Market 2019, Grandview Research, Renesas

# ROBOTICS: EMERGING OPPORTUNITY COMBINING IA & MC



**Industrial**  
\$99M in 2023  
11% CAGR

**Consumer**  
\$216M in 2023  
21% CAGR



**Enterprise**  
\$52M in 2023  
28% CAGR



Segment	2023 SAM	Categories
Industrial (Factory automation)	\$99M	<ul style="list-style-type: none"> <li>Automotive Factory Robots</li> <li>Electronics Factory Robots</li> <li>Other Industrial Robots</li> </ul>
Enterprise	\$52M	<ul style="list-style-type: none"> <li>Agricultural Robots</li> <li>Construction Robots</li> <li>Customer Service Robots</li> <li>Logistics Robots</li> <li>Police/Fire/Military Robots</li> <li>Telepresence Robots</li> </ul>
Consumer	\$216M	<ul style="list-style-type: none"> <li>Robotic Lawn Mowers</li> <li>Robotic Personal Assistants</li> <li>Robotic Pool Cleaners</li> <li>Robotic Vacuum Cleaners</li> </ul>

**\$370M Total SAM**

**Fixed**

**Roaming**

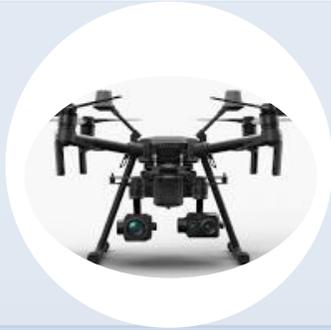
**Renesas Content**

- Axis motors
- Propulsion motor
- System controller
- Navigation
- Batt mgmt.
- Function motor
- Imaging / AI
- Voice recognition

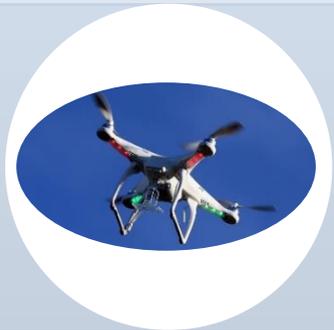
# DRONE SILICON CONTENT: ~25% CAGR OPPORTUNITY



**Industrial**  
\$43M In 2025



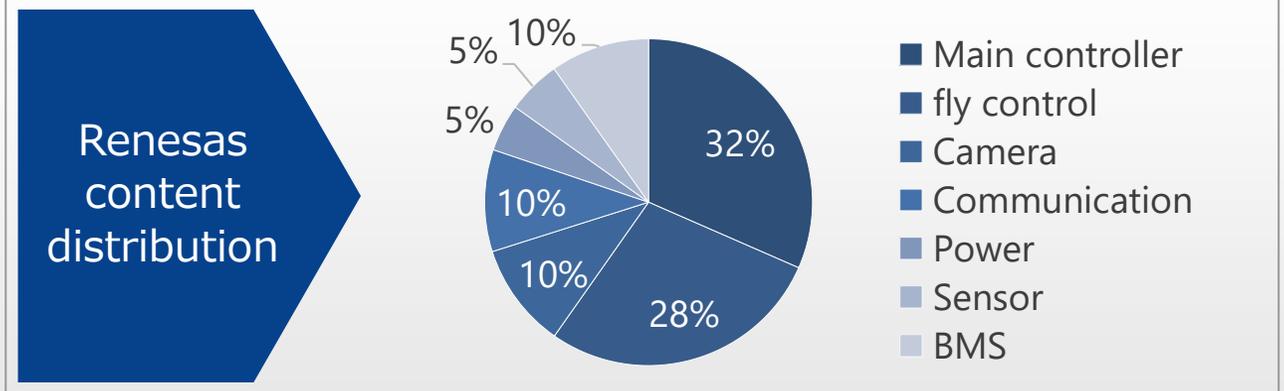
**Delivery & Consumer**  
\$253M In 2025



**Enterprise**  
\$58M In 2025

Segment	2025 SAM	Categories	
Fixed wing	\$43M	<ul style="list-style-type: none"> <li>Agriculture</li> <li>Government</li> </ul>	<ul style="list-style-type: none"> <li>Hobby/DIY</li> <li>Others</li> </ul>
Rotary	\$253M	<ul style="list-style-type: none"> <li>Hobby/DIY</li> <li>Media &amp; Entertainment</li> <li>Government</li> </ul>	<ul style="list-style-type: none"> <li>Delivery</li> <li>Others</li> </ul>
Hybrid	\$58M	<ul style="list-style-type: none"> <li>Media &amp; Entertainment</li> <li>Delivery</li> </ul>	<ul style="list-style-type: none"> <li>Government</li> <li>Others</li> </ul>

**\$354M Total SAM**



# LONG TERM FINANCIAL MODEL

## Previous Model

- ✓ Grow @SAM+
- ✓ GM 55-60%
- ✓ OM 25-30%



## New Model (including Dialog)

- ✓ Grow @SAM++
- ✓ GM ≈60%
- ✓ OM 30-35%

# SUMMARY

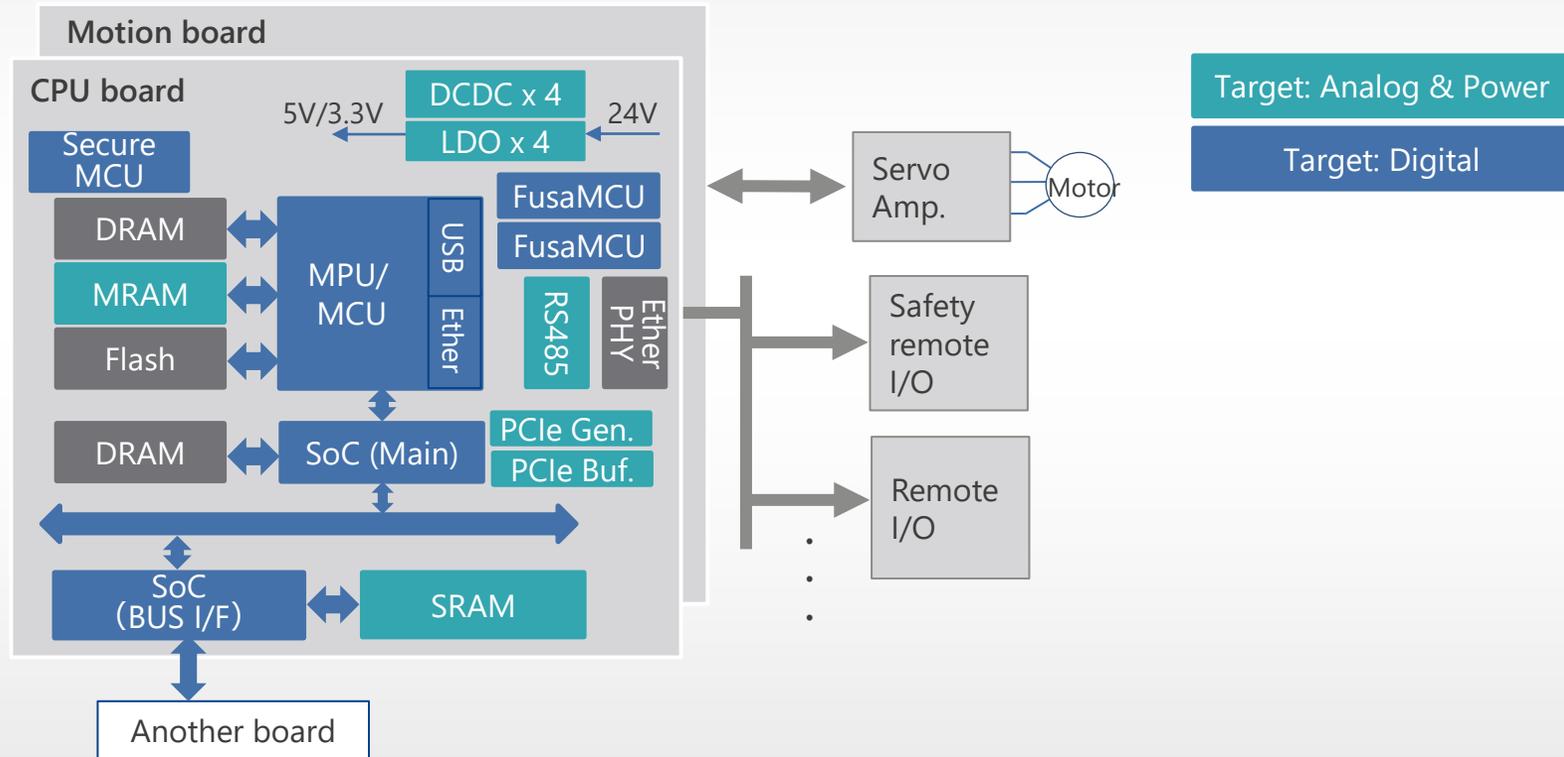
- INDUSTRIAL AUTOMATION PRESENTS A SECULAR GROWTH OPPORTUNITY FOR IIBU
- FINANCIALS FOR THE BUSINESS WHILE STRONG WILL CONTINUE TO IMPROVE
- COMBINATION OF DIGITAL WITH ANALOG, POWER AND CONNECTIVITY ALLOWS FOR GROWTH IN EXCESS OF MARKET
- MOTOR CONTROL FOCUSED ON INDUSTRIAL MARKET WILL SERVE AS A DRIVER FOR GROWTH
- ROBOTICS, DRONES ARE AN EXAMPLE OF COMBINING IA, MC, AS WELL AS ANALOG, POWER AND SENSING FOR FURTHER ACCELERATION IN THESE MARKETS
- OUR LONG-TERM FINANCIAL MODEL CONTINUES TO BE STRONG

[Renesas.com](https://www.renesas.com)

# BLOCK DIAGRAM

## INDUSTRIAL AUTOMATION

### PLC



# BLOCK DIAGRAM

## INDUSTRIAL AUTOMATION

# AC SERVO DRIVE/MOTOR

