



# SILICON SOLUTIONS SUPPORTING THE DIGITAL TRANSFORMATION IN THE AUTOMATION INDUSTRY

**KNUT DETTMER**  
SENIOR MANAGER, PRODUCT MARKETING  
INDUSTRIAL AUTOMATION BUSINESS DIVISION

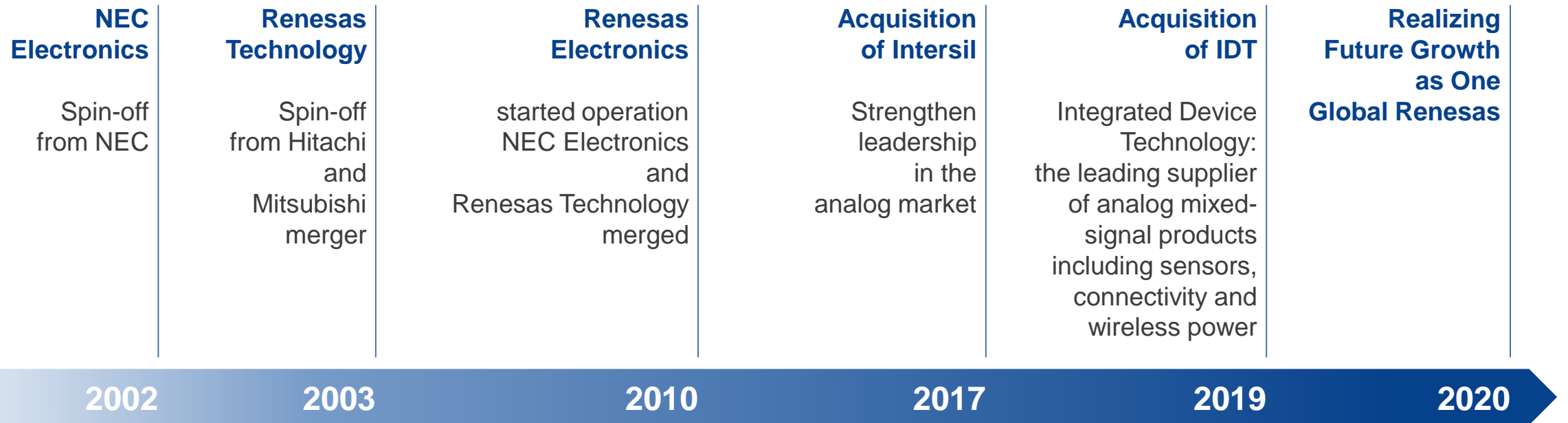
# INDUSTRIAL AUTOMATION

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- Renesas updates **Page 03**
- Industrial Ethernet Module update: EtherNet/IP support **Page 06**
- RX72M Microcontroller: Cost efficient MCU with Built-in EtherCAT slave controller **Page 08**
- R-IN32M4-CL3: An update of the R-IN32M for CC-Link IE TSN **Page 11**
- ASI4U-V5 ASSP: Industry's first silicon solution to fully implement the ASi-5 **Page 13**
- Universal Multi Sensor Platform: A comprehensive Sensor Reference Solution **Page 23**

# OUR HISTORY

Renesas is built on a strong historical foundation of technological innovation originating from Hitachi, Mitsubishi, NEC, and Intersil. In 2019, Renesas plans to address the fast-growing data economy and connected world together with IDT's analog mixed-signal products for data sensing, storage and interconnect.



# COMPLEMENTING PORTFOLIOS : RENESAS AND IDT

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## Renesas Portfolio

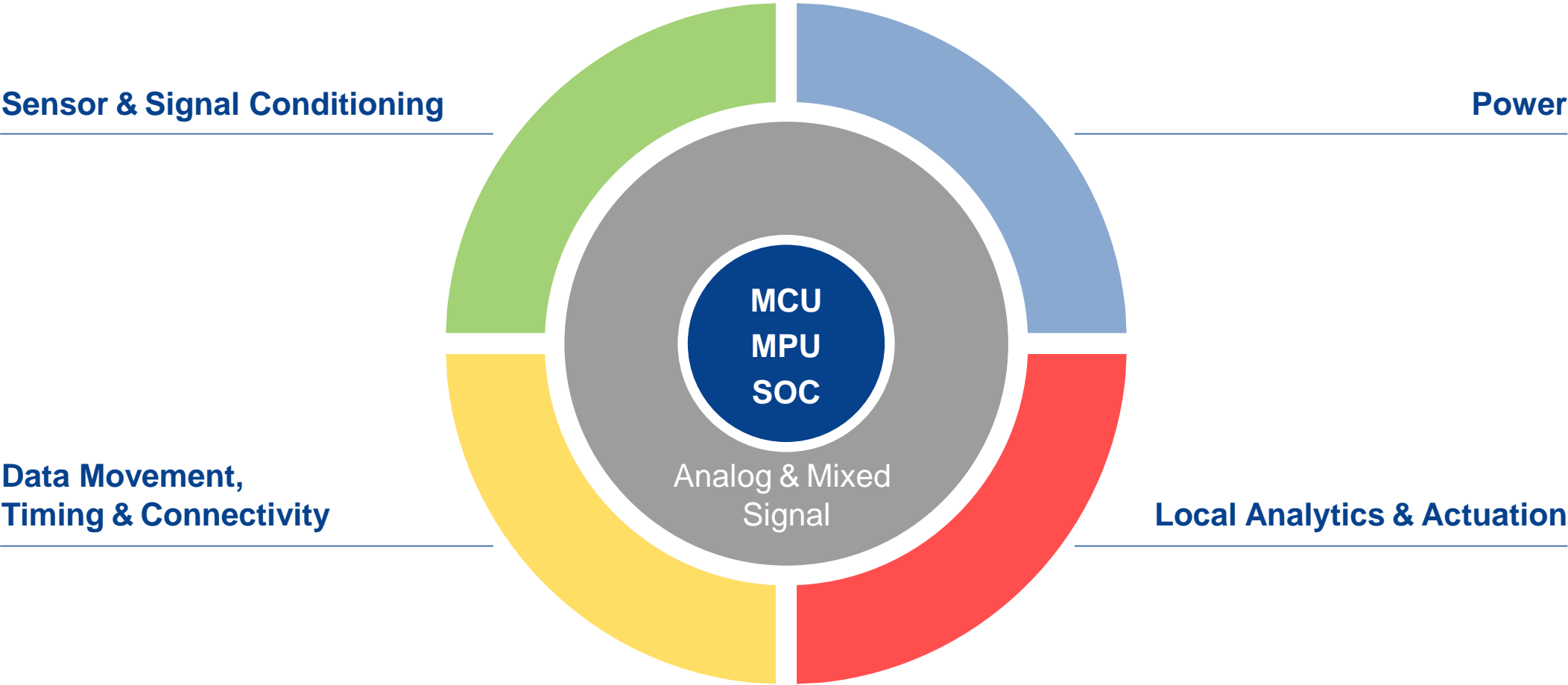
- Microcontrollers (MCUs) & Microprocessors (MPUs)
- Automotive MCUs & MPUs
- Automotive System-on-Chip (SoC)
- Automotive Power Management
- Automotive Battery Management
- Automotive Video & Display
- Embedded System Platforms
- Analog ICs
- Power Management ICs
- Space & Harsh Environment ICs

## IDT Portfolio

- Clocks & Timing
- Memory & Logic
- Interface & Connectivity
- Power Management
- RF Products
- Sensor Products
- Wireless Products

# IIBU: LEADING MCU + A & P SOLUTIONS FOR A DATA-CENTRIC WORLD

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# INDUSTRIAL ETHERNET MODULES

# RENESAS MODULE SOLUTION

## Proven in use

- Certified & tested based on Renesas quality standards

## Easy integration

- Standard SPI interface to connect the application MCU

## Safe time to market

- CE and UL certified solution

## Seamless migration

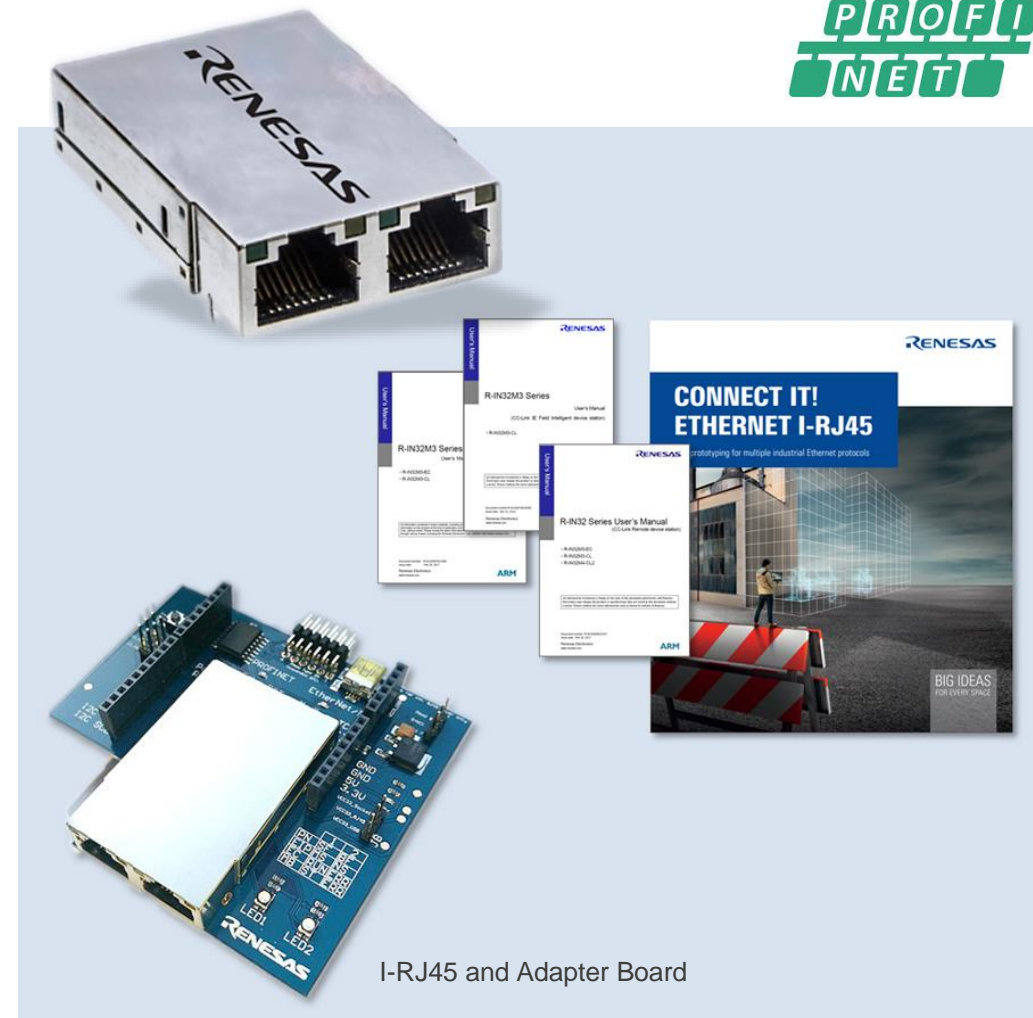
- API allows migration to other Renesas ASSP's and MCUs

## Cost of ownership

- Includes HW cost and software license for protocol stacks

## Single point of contact

- Support & Maintenance for HW & SW by Renesas



I-RJ45 and Adapter Board

# RX72M



# FEATURES OF RX72M

## ETHERCAT ENHANCED INVERTER CONTROL WITH HIGH PRECISION AND EFFICIENCY

### Performance

- High Performance 240MHz RXv3 core
- Large Memory: 4MB Flash, 1MB SRAM
- Trigonometric function unit improves coordinate transformation / position control / phase control / d/q transformation

### Connectivity

- EtherCat slave controller
- Dual Ethernet controller, triple CAN transceiver
- Delta/Sigma converter

### Safety / Security / HMI

- System fail safe function in hardware
- TSIP: Trusted Secure IP encryption module
- LCD controller and 2D drawing engine

### Inverter Control and Motor Solution

- Comprehensive motor timer features for complimentary 3-phase PWMs
- Examples for Sensorless Field Oriented Control, etc.
- Renesas Motor Workbench 2.0 for real-time debugging



# RX72M

## BLOCK DIAGRAM

### Highlights

- High Performance 240MHz RXv3
- Large Memory  
(Flash 4MB, Large SRAM 1MB)
- New Function  
(**EtherCAT** slave controller)
- Package  
(LQFP 144/176 pin, BGA 224 pin)

### Target Applications mainly in Industrial Automation

- AC Drive
- Programmable Logic Controller
- Remote I/O
- Other industrial equipment
- EtherCAT focus

### Availability

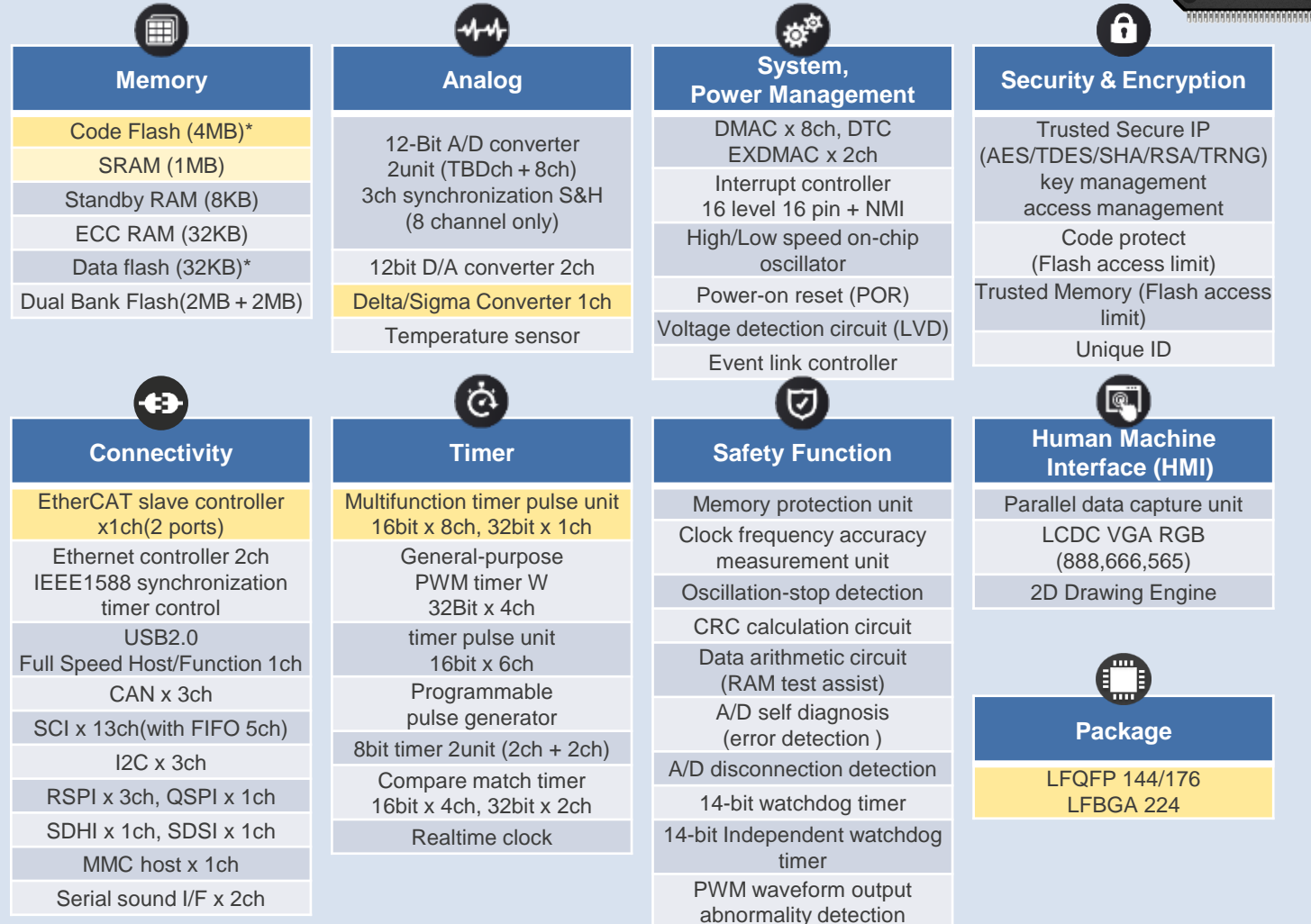
- In mass production

## RXv3 Core w/Context save 240MHz

Max specification



RX72M



\*Background Operation available

**R-IN32M4-CL**

# OUTLINE OF R-IN32M4-CL3

Accelerate smart factory construction with “CC-link IE TSN” technology  
 Realizing Giga-bit Ethernet and low power consumption by Built-in Ethernet PHY

## High-speed Real-time response

- R-IN Engine
  - Arm® Cortex®-M4 processor with FPU @100MHz
  - Real time OS Accelerator
  - Ethernet Accelerator

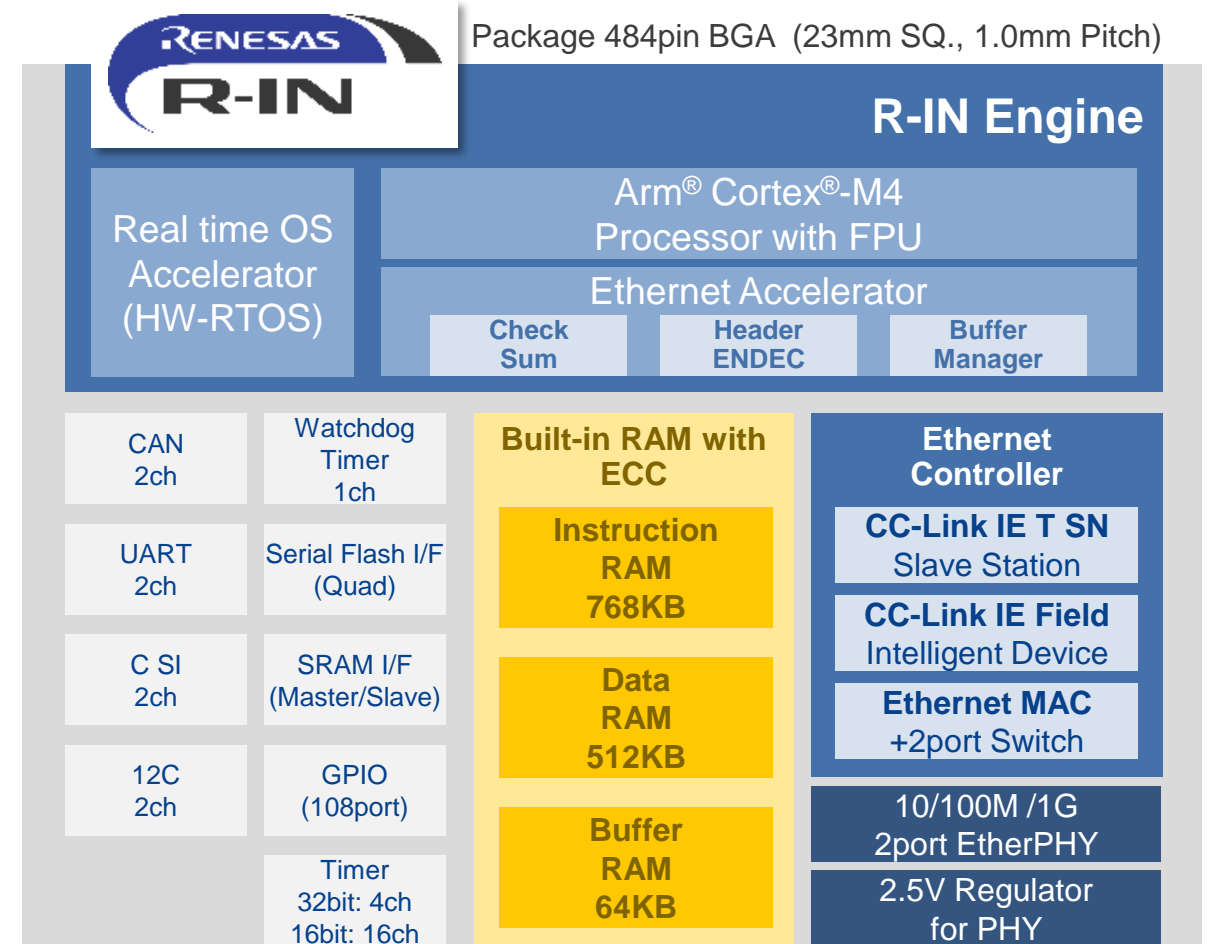
## Advanced Network Controllers

New

- CC-Link IE TSN Controller
- CC-Link IE Field Controller
- 10/100/1000M Built-in Low power Ether PHY
- 2port Ethernet Switch
  - IEEE1588, DLR, Cut-through Hub
- Built-in 1.3Mbyte RAM with ECC

## Peripherals

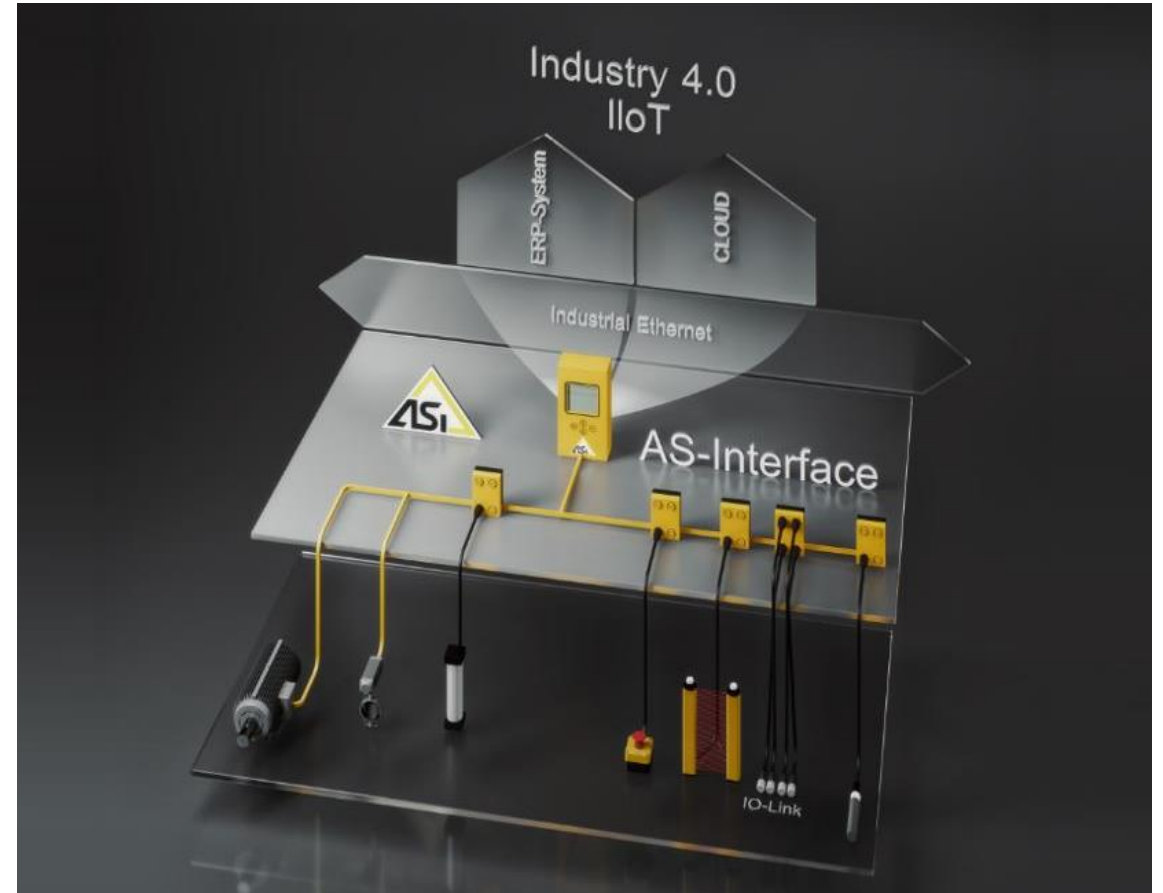
- Quad SPI I/F for Serial Flash
- SRAM and External CPU I/F
- CAN 2ch, IIC 2ch



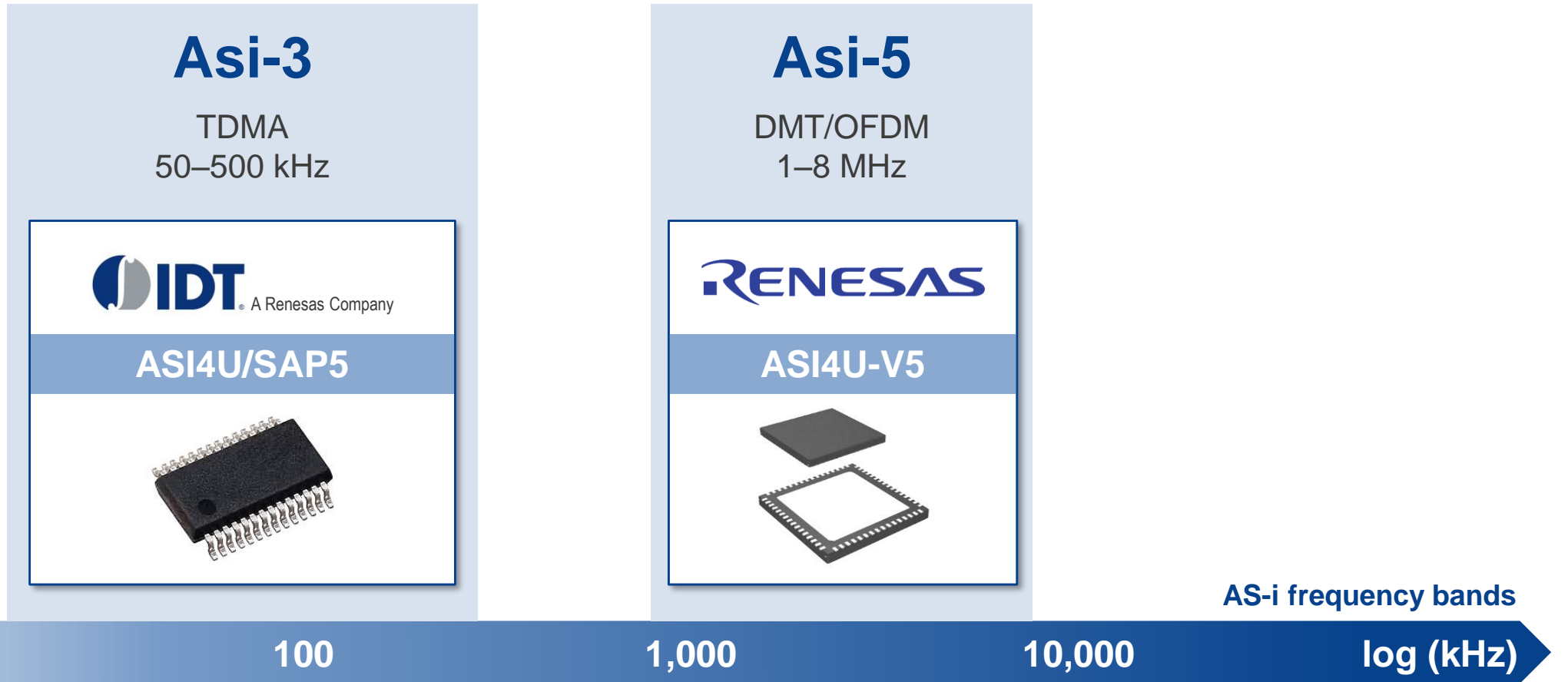
# ASI4U-V5

# INTRODUCTION TO AS-INTERFACE

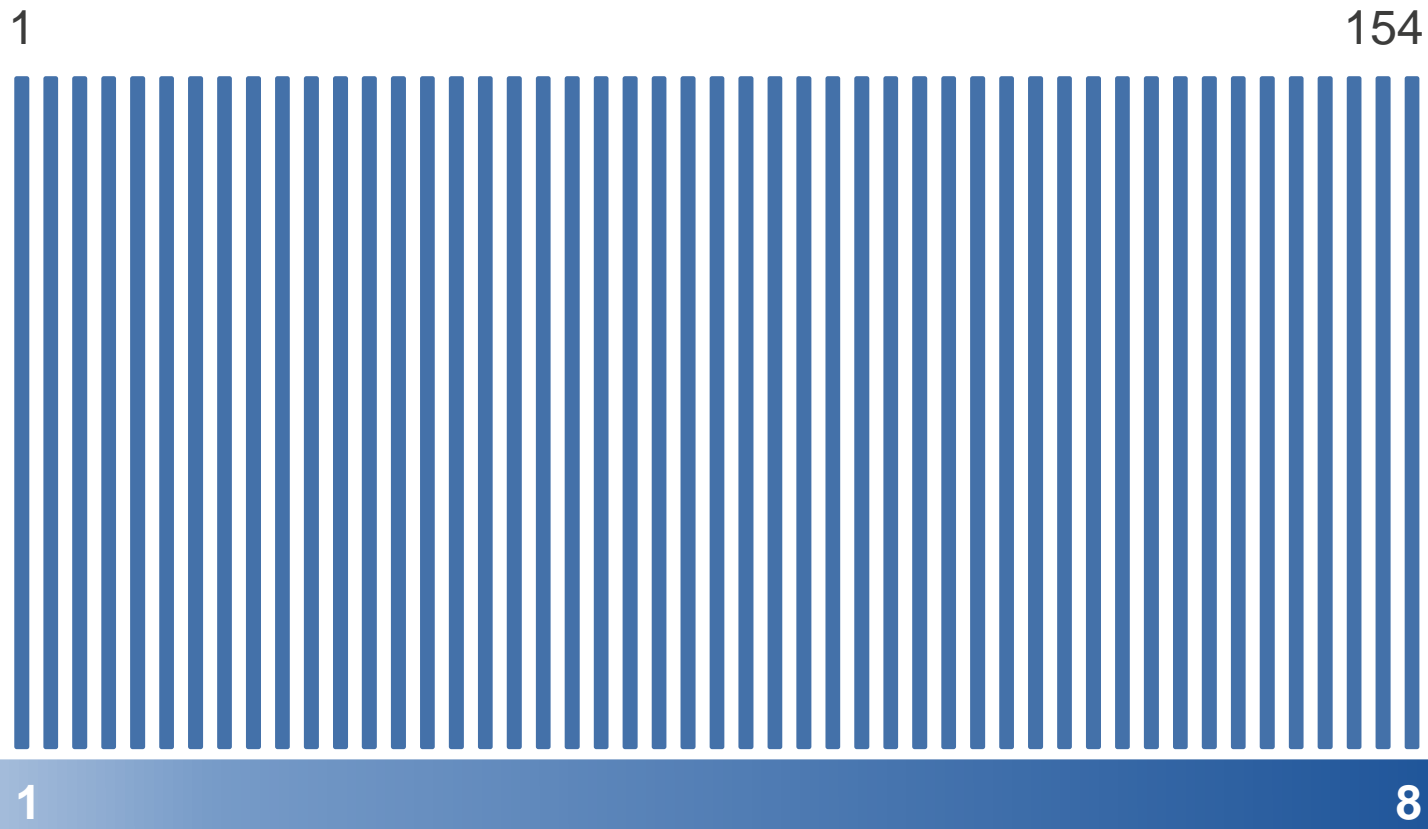
- The Actuator-Sensor-Interface (AS-i) is a **fieldbus standard**
- More than **37 million AS-i nodes** in the field today (count from HMI 2019)
- **CAGR of 5.00%** in the forecast period of 2019–2026
- Yearly integration of **~2 Million AS-i nodes**
- Global AS-interface device market **USD 1.4 Billion** by 2026
- ASI is designed with focus on **Safety** relevant systems



# ASI-5 VS. ASI-3: FULLY BACKWARDS COMPATIBLE



# DMT/OFDM – DQPSK



**Channel**

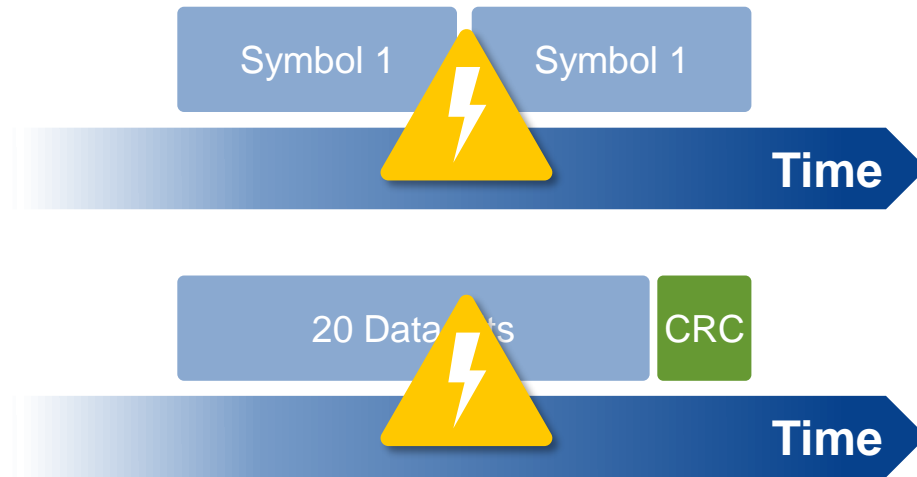
- 58.6 kHz width
- 31.5 kHz net data rate per Channel  
→ 40 bits per 1.27ms



# ASI-5 ROBUSTNESS: 3D REDUNDANCY

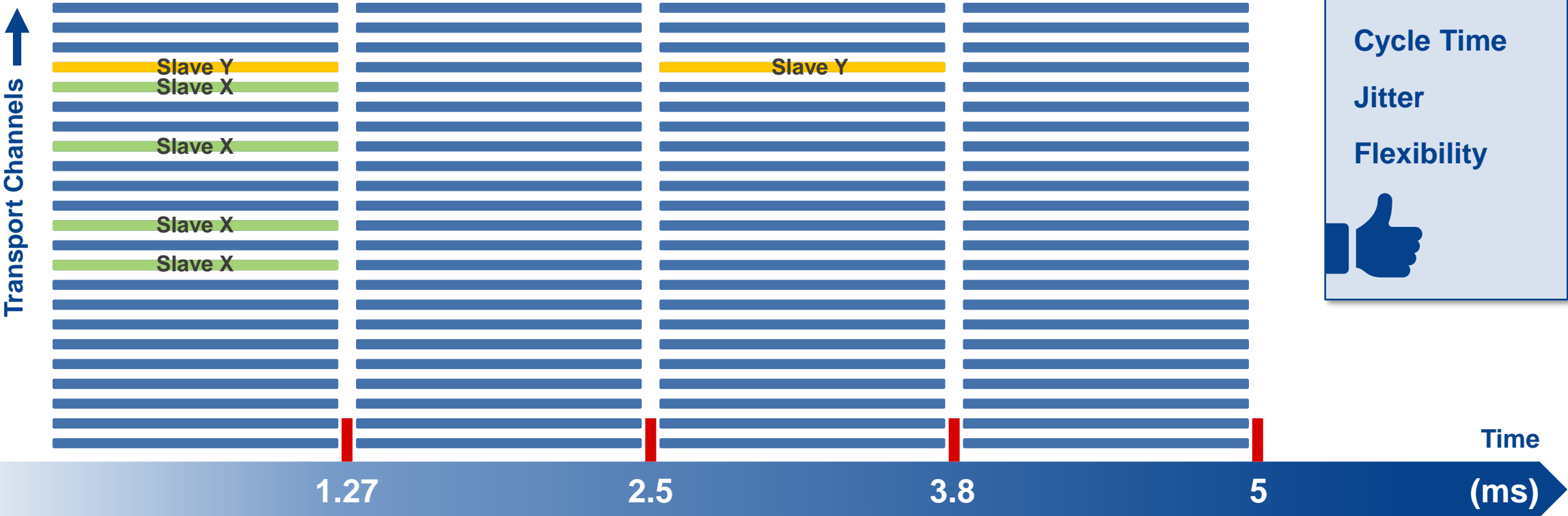
## Time Channel Redundancy Concepts

1. Time Domain:  
each symbol is send twice
2. Time Domain:  
CRC on each data frame
3. Frequency Domain:  
2003 redundancy Transport Channel



# SUBCYCLES / CHANNEL BUNDLING & MULTIPLEXING / JITTER

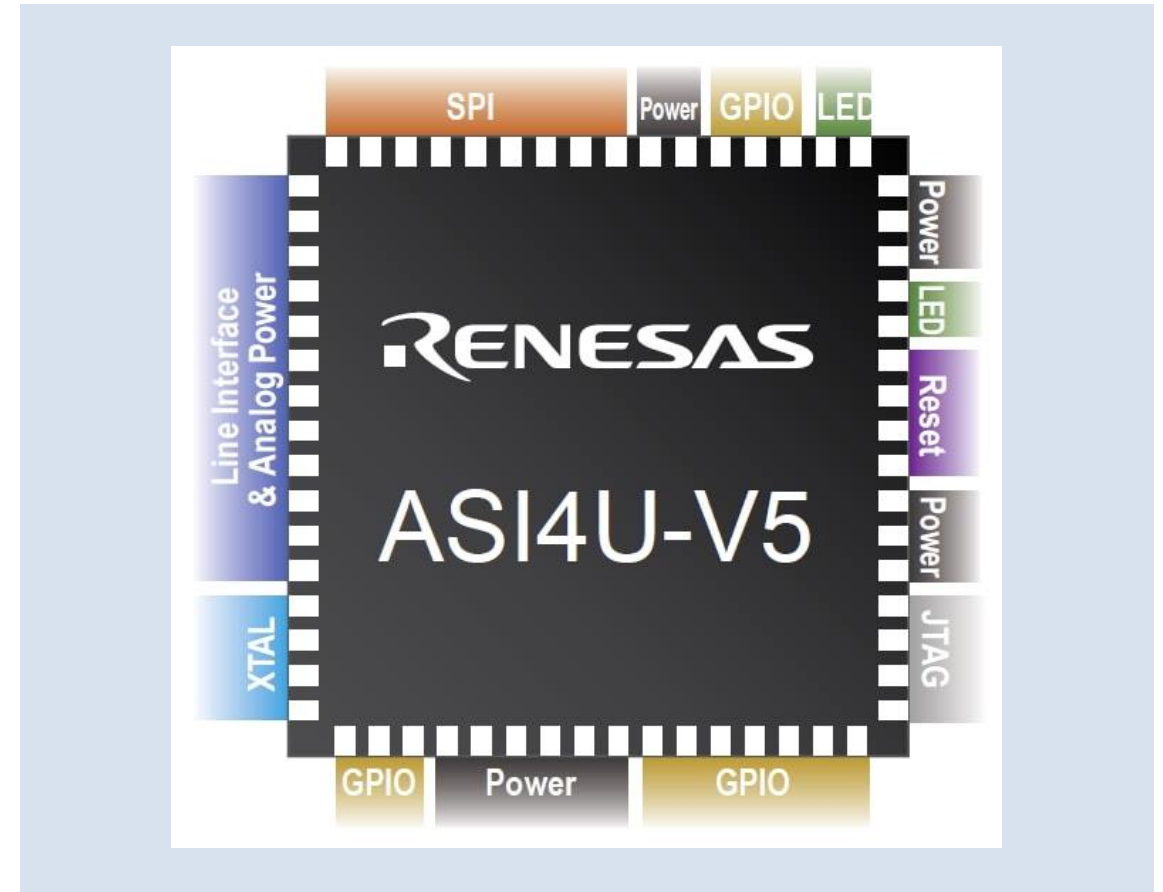
■ Channel Multiplexing   
 ■ Channel Bundling   
 ■ max. 10ns Jitter



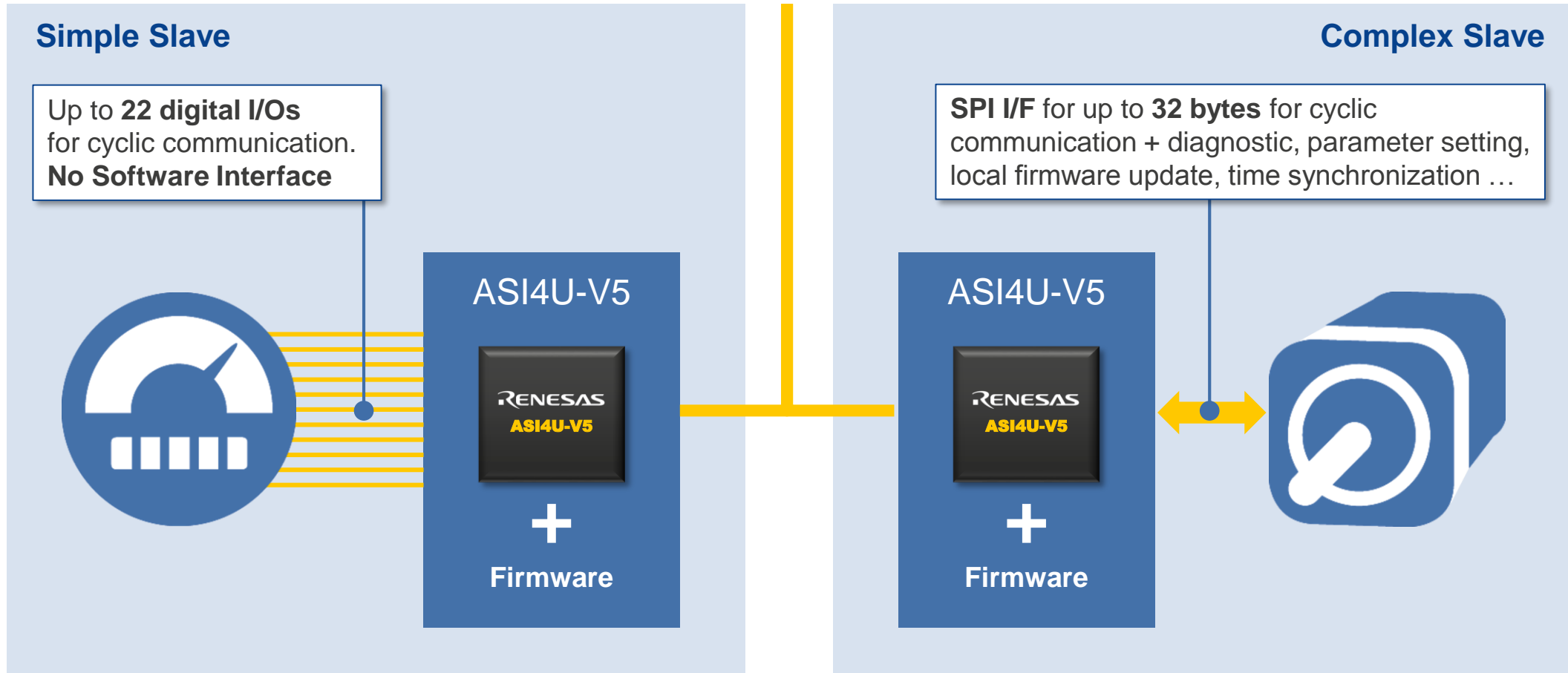
# ASI-5 RENESAS OFFERING

## ASI4U-V5 Silicon Solution

- Fully compliant to the AS-i version 5 standard
- Fully compatible to the AS-i version 3 standard
- The solution consists of the ASSP and a self contained ASi-5 firmware
- 64-pin QFN package
- Support for simple slave applications (digital-IO connection)
- Support for complex slave applications (SPI/IF to the application)
- Operating temperature: -40°C to +85°C
- Supply voltages: 5V & 3.3V
- Package dimensions : 9 x 9 mm, 0.5 mm pitch

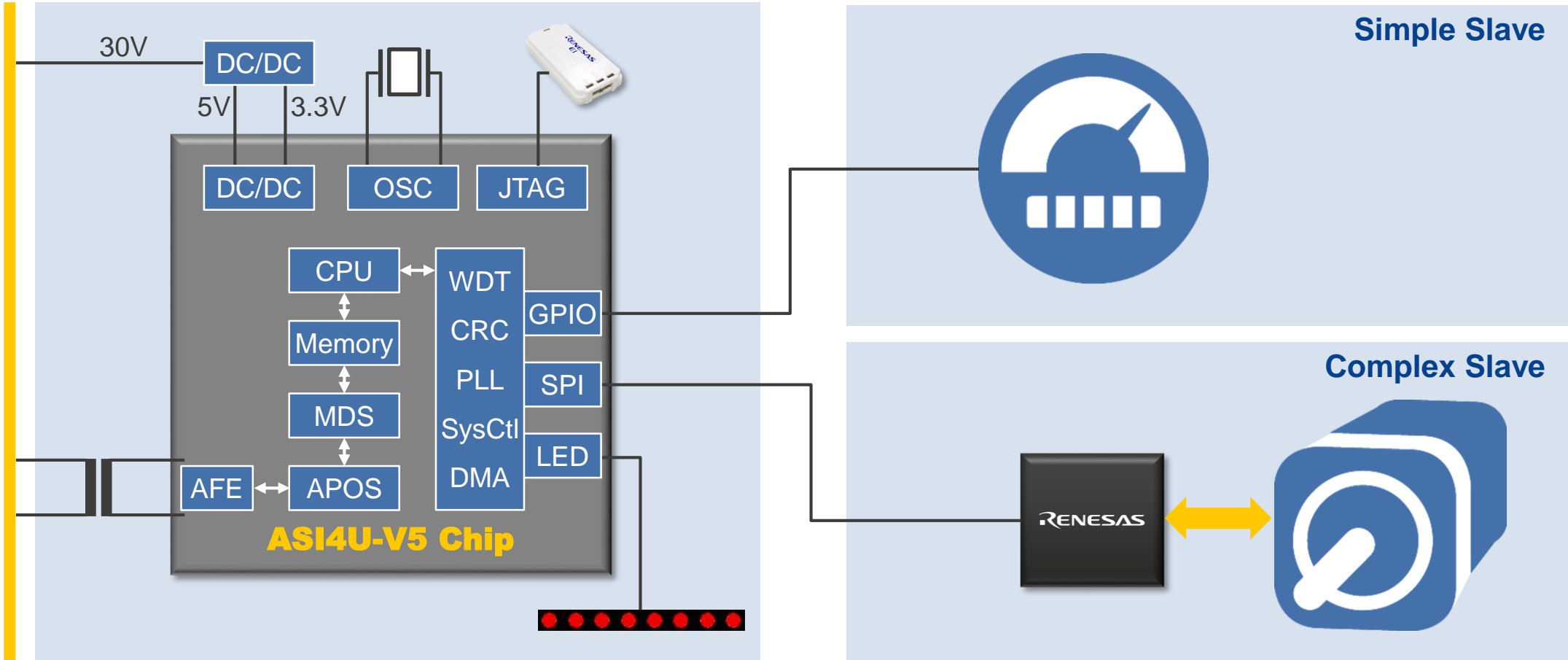


# ASI4U-V5: IMPLEMENTATION OPTIONS ASI-5 SLAVE



# ASI4U-V5

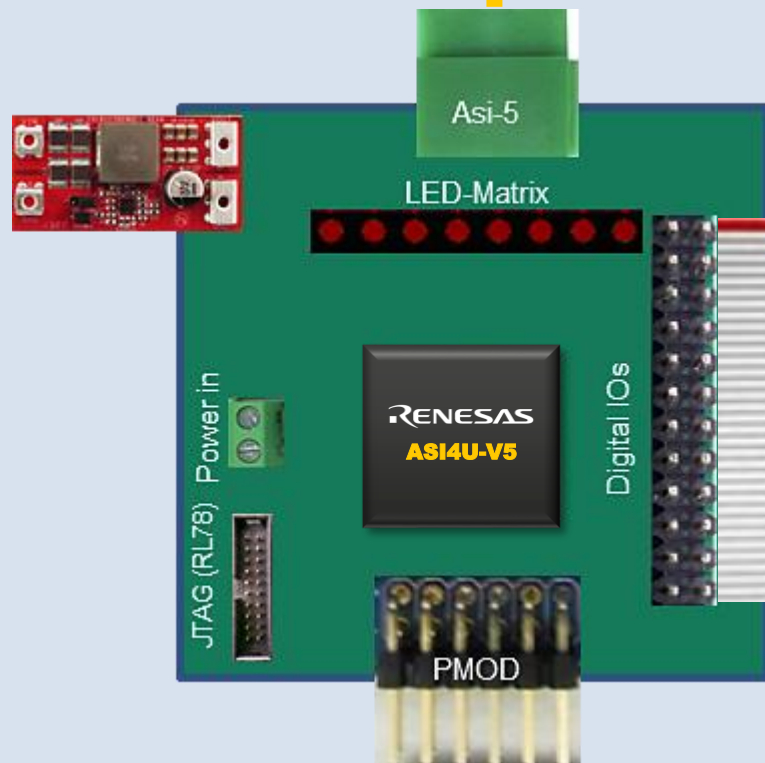
## MAIN INTERFACES AND APPLICATION EXAMPLES



# ASI-5 WINNING COMBO

(RELEASE Q1 2019)

ASI-5 Transceiver Board

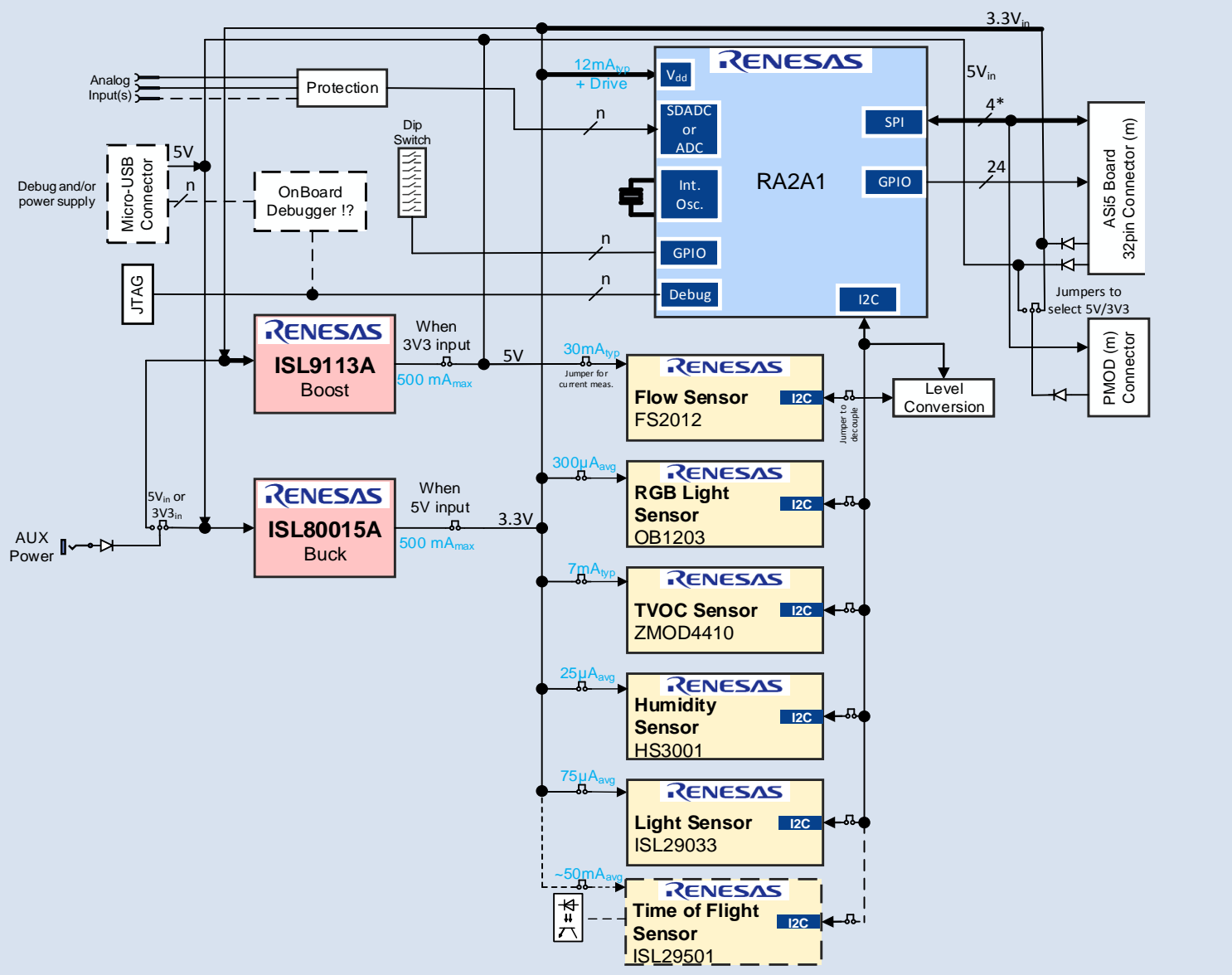


Universal-Multi-Sensor-Platform



# UNIVERSAL-MULTI-SENSOR-PLATFORM

# UNIVERSAL-MULTI-SENSOR-PLATFORM BLOCK DIAGRAM





# UNIVERSAL-MULTI-SENSOR-PLATFORM

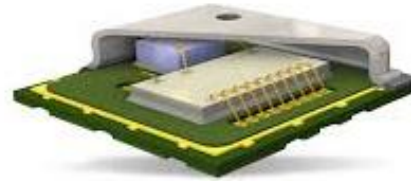
## KEY COMPONENTS



**FS2012**  
Flow Sensor



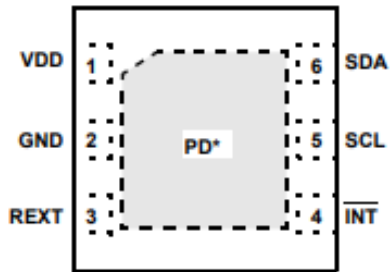
**OB1203RGB**  
Light, Proximity, PPG



**ZMOD4410/ZMOD4510**  
TVOC Sensor / OAQ Sensor



**HS3001**  
Humidity Sensor



**ISL29033**  
Ambient Light Sensor



**ISL29501**  
Time of flight



**ISL9113**  
Boost Converter



**ISL80015**  
Sync Buck DC/DC

# 32-BIT MCU PRODUCT PORTFOLIO

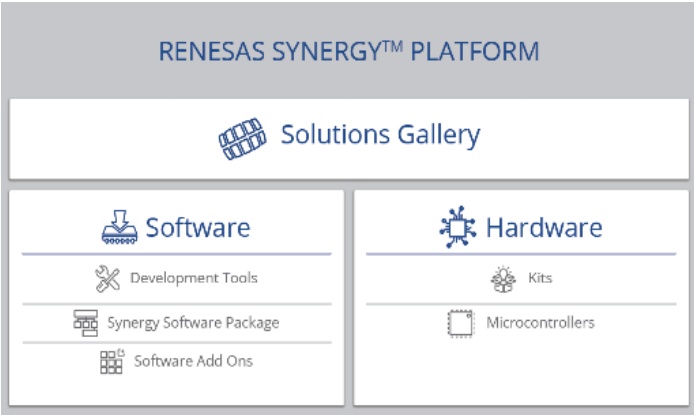


**Industry leading  
32bit CPU performance**  
based on Renesas' proprietary  
RX core

5.82 CoreMark/MHz, FPU, DSP

## Renesas Synergy™

**Integrated software  
and hardware platform**  
based on Cortex-M  
with commercial software



**Industry leading IoT security  
with software flexibility**  
based on Cortex-M  
with complete ecosystem  
from Renesas and our partners

ARM Cortex M33/M23/M4 MCU's

# RENESAS RA FAMILY: KEY VALUES



- Next generation CM23/CM33 ARM cores and also CM4 core
- Including Trustzone for advanced security



- Strong security solutions targeting IoT use cases, with excellent ease-of-use tools and offering end-to-end lifetime security solutions



- Excellent solutions for wired applications
- BLE, 15.4, LORA, LP-WAN e.g. NB-IoT, Wifi, etc
- Supporting 3rd party RF solutions
- Integrated RF solutions planned



- Flexible Software Package (FSP)
- Fast-start software for Security & Connectivity
- Flexible open architecture supporting customers legacy code and environment
- Collaboration with 3rd parties for strong ecosystem support



- Best in class peripheral IP's, built on strong MCU heritage
- Excellence in embedded FLASH, performance & field upgrade
- Class leading Capacitive Touch technology

# RENESAS RA FAMILY LAUNCHED IN OCTOBER 2019



## RA2A1

- 48MHz, Arm® Cortex®-M23
- 256kB Flash, 32kB RAM, 32-64pin
- USB, CAN, 24bit Sigma Delta ADC, 16bit ADC, Security



## RA4M1

- 48MHz, Arm® Cortex®-M4F
- 256kB Flash, 32kB RAM, 40-100pin
- USB, CAN, LCD Controller, Capacitive Touch, Security



## RA6M1

- 120MHz, Arm® Cortex®-M4F
- 512kB Flash, 256kB RAM, 64-100pin
- USB, CAN, Capacitive Touch, Security

## RA6M2

- 120MHz, Arm® Cortex®-M4F
- 1MB Flash, 384kB RAM, 100-145pin
- USB, CAN, Ethernet, Capacitive Touch, Security

## RA6M3

- 120MHz, Arm® Cortex®-M4F
- 2MB Flash, 640kB RAM, 100-176pin
- USB, CAN, Ethernet, TFT, Capacitive Touch, Security

# WRAP-UP

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Industrial Ethernet  
Modules now with  
EtherNet/IP  
support

**RX72M:**  
EtherCAT enhanced  
Inverter  
Control

**R-IN32M4-CL3:**  
CC-link IE TSN ASSP  
incl. Gigabit  
Ethernet-Phys

**ASI4U-V5:**  
The all-in-one  
ASI-5  
Silicon Solution

**Universal-Multi-  
Sensor-Platform:**  
Reference System for  
Sensor Applications

# VISIT US: HALL 10.1, STAND 110

CO-EXHIBITOR @: AS-INTERNATIONAL: HALL 3A, STAND 111; ETHERCAT TECHNOLOGY GROUP: HALL 5, STAND 310



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[www.renesas.com](http://www.renesas.com)