SPS IPC DRIVES 2018

PRESS CONFERENCE

NIELS TRAPP
INDUSTRIAL SOLUTION BUSINESS UNIT
RENESAS ELECTRONICS EUROPE

BIG IDEAS
FOR EVERY SPACE

RENESAS

AGENDA

THE "SMART FACTORY" AIMS FOR …

Digital Transformation

10010

Cyber Physical Systems

Mass Customization
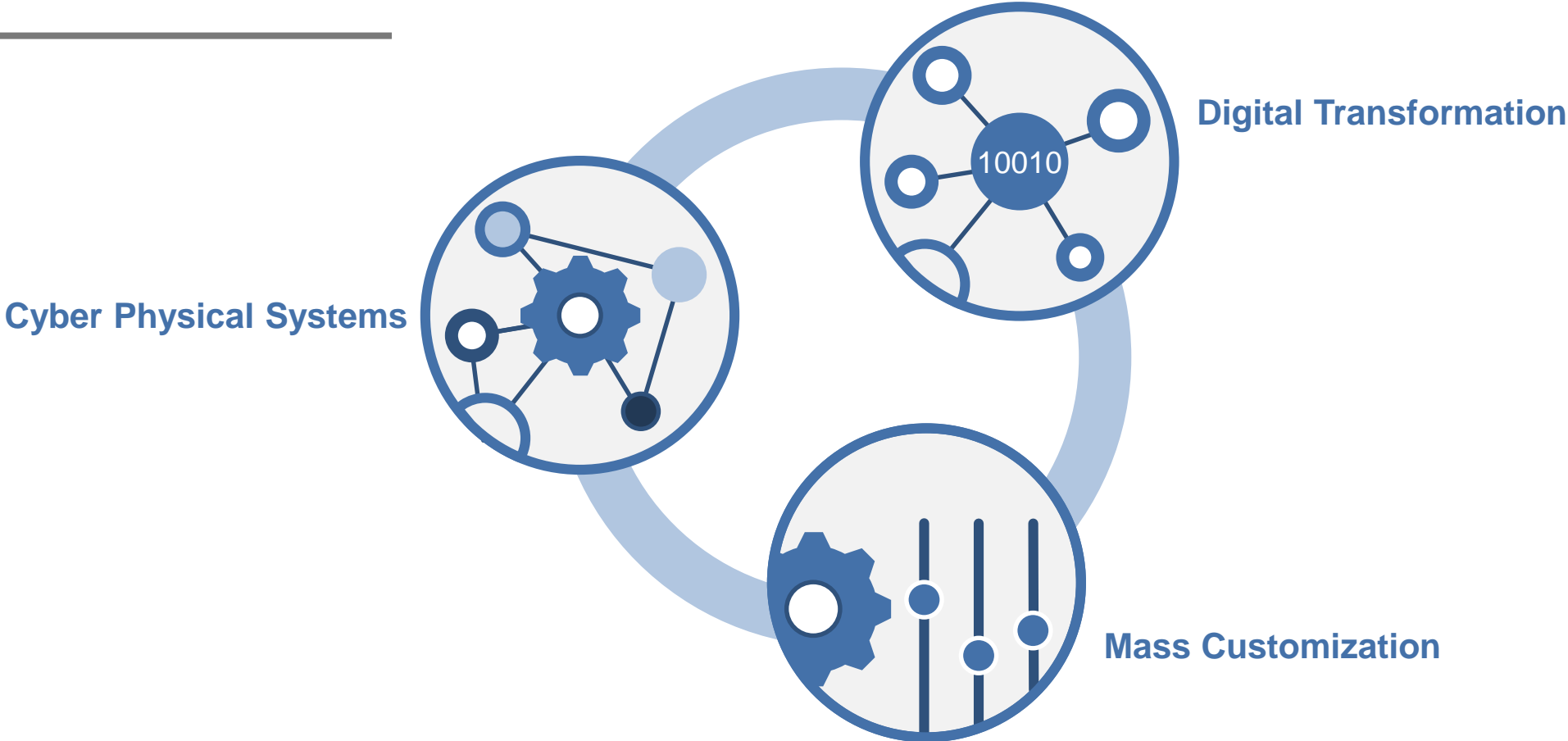
2018: CONCRETE STANDARDS AND IMPLEMENTATION DRIVES NEW BUSINESS

BIG IDEAS FOR EVERY SPACE

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OUR FOCUS:
INTELLIGENT INDUSTRIAL IOT ENDPOINTS IN THE FACTORY
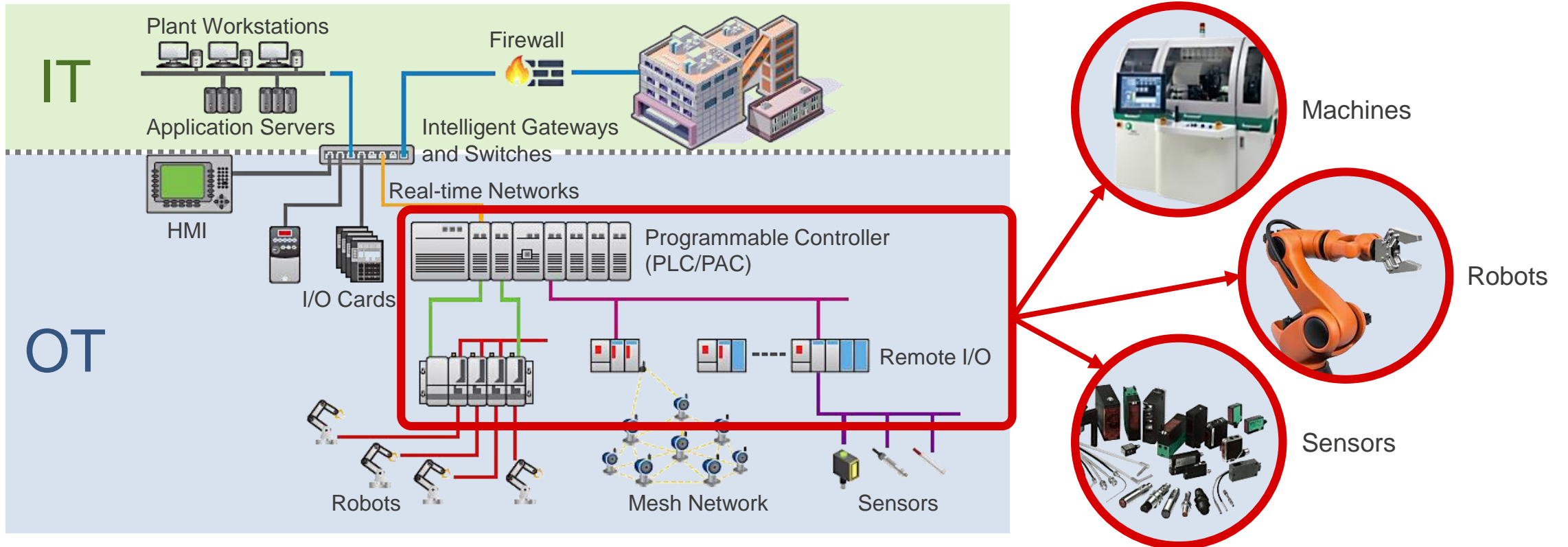
Embedded Controllers, Processors and Power Management for Industrial IoT Systems

INDUSTRIAL NETWORKS: RZ/N1 SOLUTION FOR IO-LINK APPLICATIONS

SENSOR GATEWAYS ON SINGLE CHIP

New Press Release

BIG IDEAS FOR EVERY SPACE

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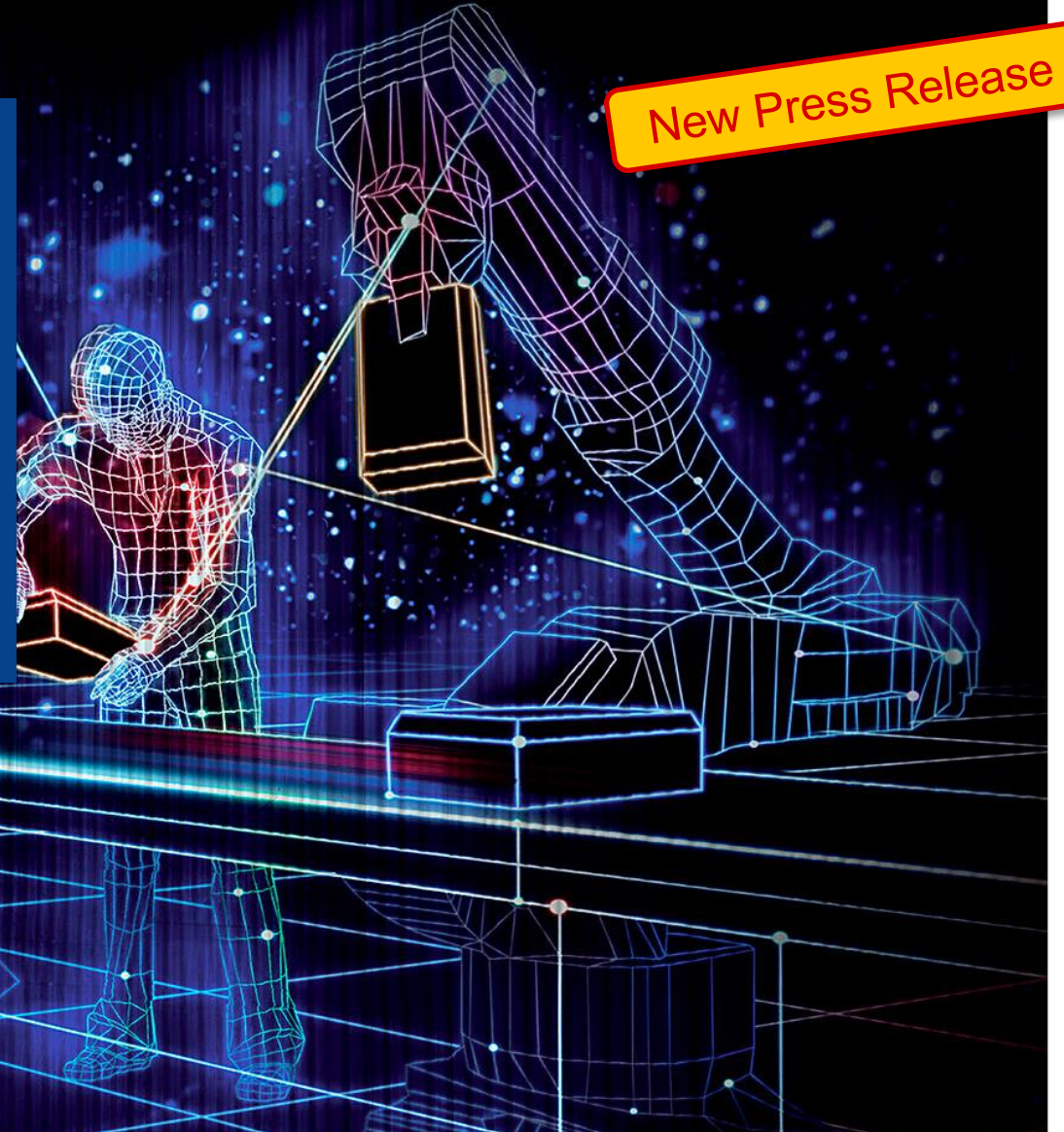
RZ/N1 – SINGLE CHIP SOLUTIONS
COMPACT AND POWER EFFICIENT DEVICES

Conventional Solutions **Renesas Solution**

PLCs		Generic MCU ↔ Real-Time Ethernet Switch		
Industrial Switches		Generic MCU ↔ Real-Time Ethernet Switch		RZ/N1
Operator Terminal PLCs		Generic MCU ↔ Real-Time Ethernet Switch		
IO Link Master		Generic MCU ↔ Real-Time Ethernet Switch		LOW POWER CONSUMPTION

New Solution

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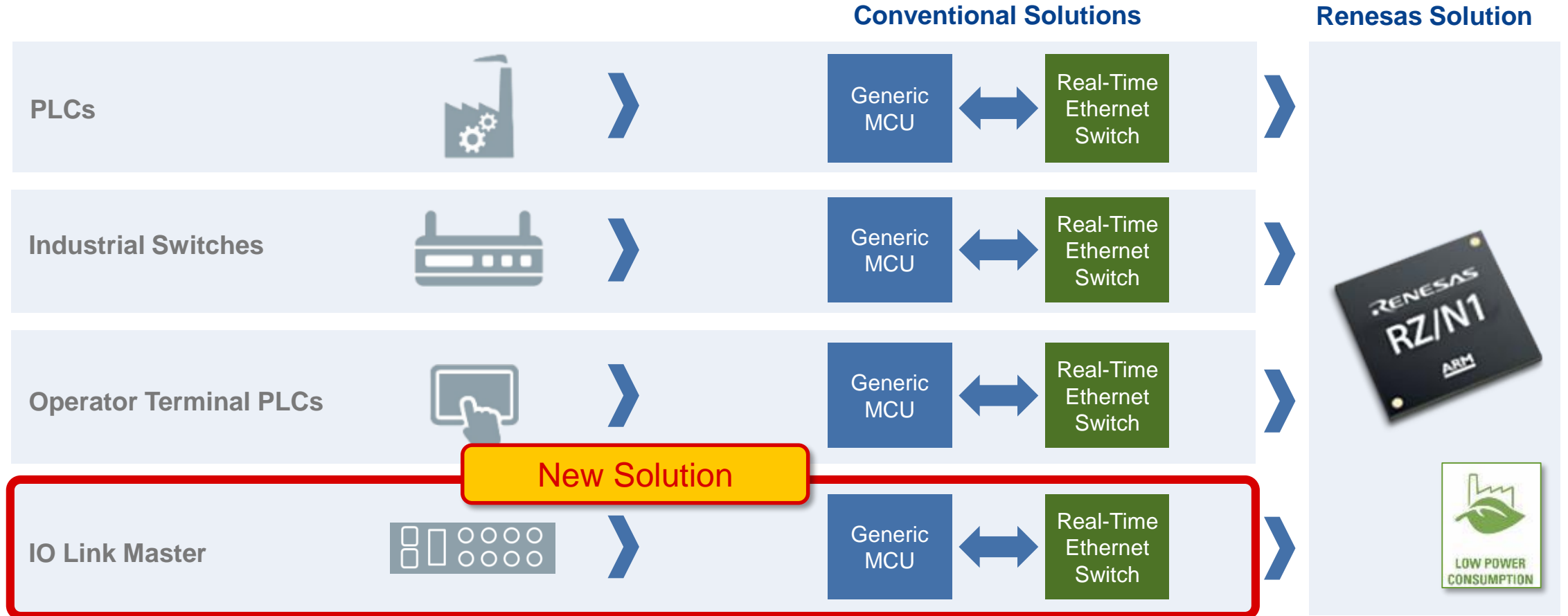
RZ/N1 LINE-UP
ENHANCEMENT WITH IO-LINK

	RZ/N1D	RZ/N1S	RZ/N1L
CPU	Dual Cortex®-A7 (500MHz) + Cortex®-M3 (R-IN Engine)	Single Cortex®-A7 (500MHz) + Cortex®-M3 (R-IN Engine)	Cortex®-M3 (R-IN Engine)
Target Application	PLC, HMI, Switch	PLC, HMI, Switch, **IO-Link master**	Remote IO
Supported Protocol (Ethernet)	PROFINET RT, EtherCAT, EtherNet/IP, Modbus/TCP, SERCOS, POWERLINK		
Internal SRAM	2MB	6MB	6MB
DDR I/F	Available	-	-
LCD controller	Available	Available	-
Ethernet Port	5 port - 400BGA PKG 3 port – 324BGA PKG	5 port - 324BGA PKG 3 port – 196BGA PKG	3 port
Redundancy	HSR, PRP, DLR, MRP	PRP, DLR, MRP	DLR
Package	400BGA(17mm) 324BGA (15mm)	324BGA(15mm) 196BGA (12mm)	196BGA (12mm)
OS (vendor)	CA7: Linux (Renesas) CM3: HW-RTOS	CA7: VxWorks (Wind river) ThreadX (Express Logic) CM3: HW-RTOS	NA CM3: HW-RTOS
ES Sample	Available	Available	Available

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WHERE IS IO-LINK MASTER?

Management level ERP
Data server, vizualization of productivity

Process control level MES
Engineering tool, control room, HMI

Factory

Control level
Open/closed loop control (PLC)

◈ **IO**-Link

Field level
Remote I/O, IO-Link Master

Sensor/actuator level
IO-Link Device, binary/analog
sensors/actuators

PLC

HMI

Master

IO-Link Master

Device

IO-Link Sensors

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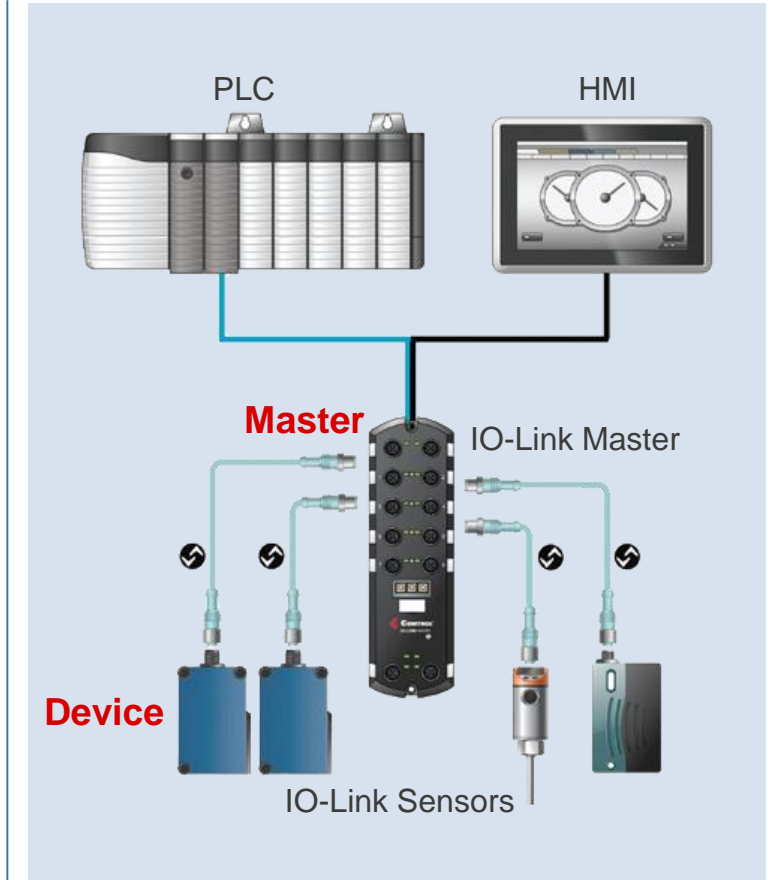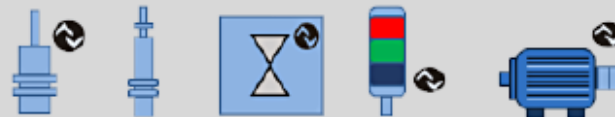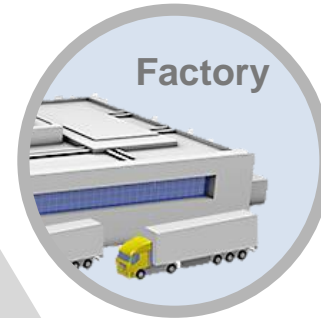
RZ/N1 SENSOR GATEWAY SOLUTION
KEY ADVANTAGES

New

Solution benefits:

- All-in-one development kit makes it easy for users to start evaluation

- Rapid prototyping with eight-port IO-Link board and connections to any IO-Link slave device

- Pre-qualified sample software shortens the development time
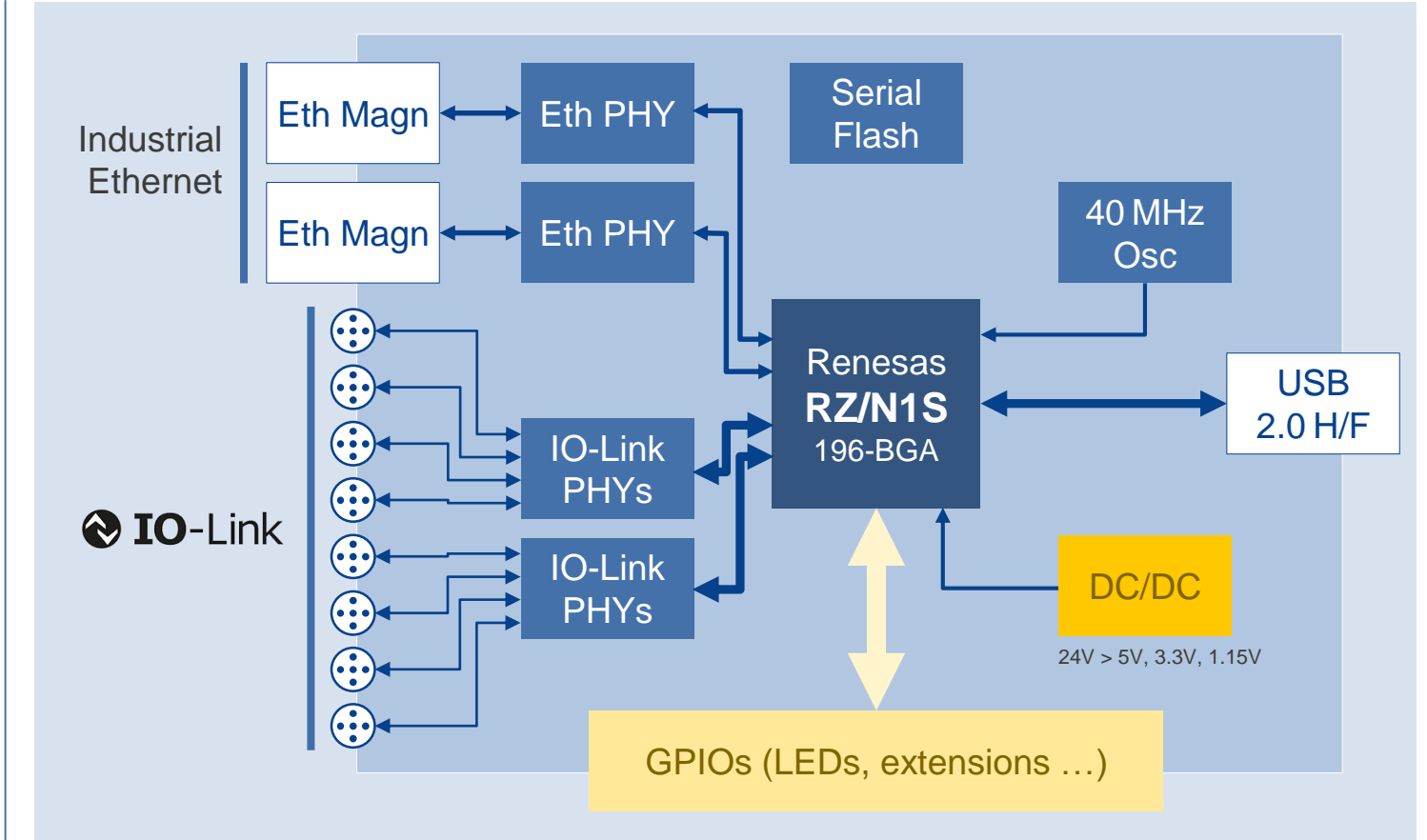
RZ/N1S – PROFINET IO-LINK MASTER GATEWAY
EASY TO START EVALUATION

New

Evaluation Kit contains:

- RZ/N1S-IO_LINK-M board

- Evaluation version (binary) of the IO-Link master stack (TMG)

- Sample SW of PROFINET slave stack (TMG)

- IO-Link Tool integration

- Documentation

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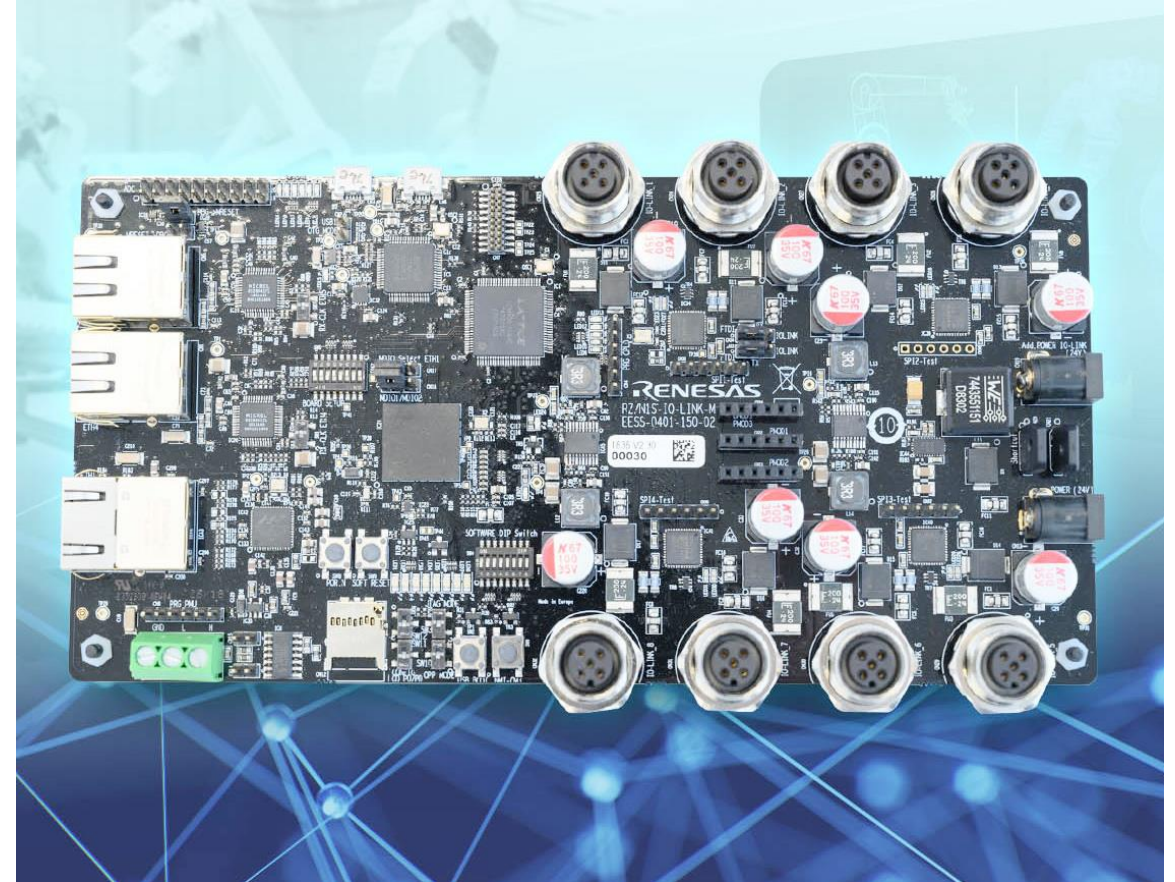
SENSORS:

SYNERGY™ LOW-POWER S1JA MICROCONTROLLERS

INDUSTRIAL IOT SENSOR APPLICATIONS

New Press Release

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TARGET MARKETS AND APPLICATIONS

Industrial Automation

 Flow Control Meters

 Industrial Temperature Systems

 Industrial Multisensory Systems:
- PH sensor
- Force Sensor
- Load sensor
- Proximity sensor

Medical

 Pulse Oximeters

 Portable Electro-cardiogram

 Portable Pressure Monitor

EMS

 Single Phase Meter

Instrumentation

 Portable Data Acquisition Systems:
- Multi-Meters
- Headless Scopes

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SYNERGY MICROCONTROLLER ROADMAP

		2016 and before	2017	2018	2019
S7	High Performance	**S7G2** CM4, 240 MHZ, FPU 4 MB / 640 KB			
S5	High Integration		**S5D9** CM4, 120 MHZ, FPU 2 MB / 640 KB **S5D5** CM4, 120 MHZ, FPU 1 MB / 384 KB		
S3	High Efficiency	**S3A7** CM4, 48 MHZ, FPU 1 MB / 192 KB	**S3A3** CM4, 48 MHZ, FPU 512 KB / 96 KB	**S3A1** CM4, 48 MHZ, FPU 1 MB / 192 KB **S3A6** CM4, 48 MHZ, FPU 256 KB / 32 KB	
S1	Ultra-Low Power	**S124** CM0+, 32 MHZ 128 KB / 16 KB	**S128** CM0+, 32 MHZ 256 KB / 24 KB	**S1JA** CM23, 48 MHZ 256 KB / 32 KB	

1st Synergy MCU with Arm® M23 core

S1JA MCU GROUP

Technology

108 µA/MHz (Normal Mode)
56 µA/MHz (Sleep Mode)
500 nA (Software Standby Mode)

Performance / Flash Density

Arm® Cortex®

Arm® Cortex®

Arm® Cortex®

Arm® Cortex®

M23
48 MHz
1.6 V-5.5 V

- 130-nm processes
- Operating temperature range: -40°C to 105°C
- GPIO pins: Up to 49
- Package QFN: 40, 48
- Package LQFP: 32, 64
- Package BGA: 36

48 MHz Arm® Cortex®-M23 CPU

S1JA

Memory	Analog	Timing & Control	HMI
Code Flash (256 KB)	24-Bit S/D ADC (8 ch.)	General PWM Timer 32-Bit	Capacitive Touch Sensing Unit (26 ch.)
Data flash (8 KB)	16-Bit SAR ADC (17 ch.)		
SRAM (32 KB)	12-Bit DAC (1 ch.)	General PWM Timer 16-Bit x6	
Flash Cache	8-Bit DAC (2 ch.)		
Memory Protection Unit	High-Speed Comparator	Asynchronous General Purpose Timer x2	
Memory Mirror Function	Low-Power Comparator x2		
	OPAMP x3	WDT	

Connectivity	System & Power Mgmt.	Safety	Security & Encryption
USBFS	Data Transfer Controller	ECC in SRAM	128-Bit Unique ID
CAN	Event Link Controller	Flash Area Protection	TRNG
Serial Communications Interface x3	Low Power Modes	ADC Diagnostics	AES (128/256)
SPI x2	Multiple Clocks	Clock Frequency Accuracy Measurement Circuit	
12C x2	Port Function Select	CRC Calculator	
	RTC	Data Operation Circuit	
	SysTick	Port Output Enable for GPT	
		IWDT	

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S1JA VALUE PROPOSITION
HIGH INTEGRATION, LOW COST, SOFTWARE DEFINED ANALOG

RENESAS *synergy*™

Key Benefits:

- Best-in-class programmable AFE to adjust to various sensor types (Capacitive, inductive …)

- Ultra low power capability for extended battery life in battery-operated or battery back-up applications

- Integrated security functions

- Configurable qualified drivers for analog components (Synergy Software Package)

High Precision Analog Front End Integration

16bit SAR ADC
- Wide rang support 1.7-5.5V
- High accuracy 15 bit ENOB is the number one in industry
- High speed conversion time 1Msps.

24bit SD ADC
- PGIA x1 to x32
- With Sensor Bias and Common Bias

12bit DAC
- Full Scale Setting time 1us @ 20pF

Op-AMP
- Typ. 9uA @ Low Power Mode
- Smaller Off-set

Configurable Analog Fabric
- Configurable connection for Voltage follower, Cascaded voltage follower, Programmable Non-inverting / Trans impedance Amplifier

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S1JA SOLUTION ENVIRONMENT
DEVELOPMENT TOOLS AND ORDER INFORMATION

New

Starter Kit, Order information

Part Number:
YSTBS1JAE10

S1JA Group MCUs	Package
R7FS1JA783A01CFJ	32-pin QFP
R7FS1JA782A01CBT	36-pin BGA
R7FS1JA783A01CNF	40-pin QFN
R7FS1JA783A01CNE	48-pin QFN
R7FS1JA783A01CFM	64-pin LQFP

Synergy Software, Integrated Development Environments (IDE)

Synergy Software Package (SSP)

Application Programming Interface (API)

ThreadX® RTOS	Application Framework		Middleware				Functional Libraries
Fully Preemptive Scheduler	Audio	Wi-Fi	**FileX™**	**USBX™**	**GUIX™**	**NetX™ and NetX Duo™**	Encryption Library
Inter-process and Inter-thread Communication	Console	BLE	FAT 12/16/32 Formats	Host Classes (Storage, CDC, HID, Hub)	Run Time Library	FTP / SNTP	CMSIS DSP Library
	JPEG	Cellular Framework	SDSC, SDHC, eMMC Support	Host Stack	Image Processing	TFTP / NAT	Software Safety Library
Memory Management	Touch Panel	ADC	Simultaneous Media Support	Host Controller	Widget Library	Telnet / TCP	
	Capacitive Touch	Thread Monitor	Fault tolerant, Journal-Based	Device Classes (Storage, CDC, HID, UVC)	Event Processing	PPP / IPv4/v6	
Interrupt Management	Messaging	Power Profile	LevelX	Device Stack	Canvas Processing	SMTP / UDP	
				Device Controller	Rotation, Scaling	POP3 / ICMP	
Execution Profiling	X-Ware Interface	External Interrupt		Isochronous Transfer	Blend, Anti-alias	TLS / MQTT	
	SPI, I2C, UART	Block Media			SDSC, SDHC, eMMC Support	DNS / ARP	
Picokernel™ Architecture						DHCP / RARP	
Event-Chaining™ Technology						HTTP, HTTPS / SNMP	
Preemption-Threshold™ Scheduling						BSD Socket Library	

Hardware Abstraction Layer (HAL) Drivers

UART	SPI	ADC 12	Code Flash	Data Flash	QSPI	SDHI	CRC
USBHS	I2C	ADC 14	CAN	GPIO	RTC	JPEG Codec	PDC
USBFS	SSI	DAC 8	Timer	Watchdog Timer	DMA Controller	AGT 16-BitTimer	GPT 32-BitTimer
Ethernet MAC Controller	Factory MCU Information	DAC 12	Independent Watchdog Tmr	2D Drawing Engine	Low Voltage Detection	Low Power Modes	Segment LCD Controller
Clock Management	Functional Safety	Data Transfer Controller	Capacitive Touch Sensing Unit	Event Link Controller	Interrupt Control Unit	Security and Encryption	Graphics LCD Controller

Board Support Package (BSP)

IAR Embedded Workbench for Renesas Synergy™

IAR SYSTEMS

- Synergy Software Package (SSP) version 1.5.0
- Qualified HAL Drivers
- EW-based, IAR Arm® C compiler only

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New Technology

SENSORS:

NEW ACTUATOR-SENSOR INTERFACE STANDARD ASI-5

THE SHUTTLE INTO DIGITALIZATION

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NEW ASI-5 STANDARD – NEW TECHNOLOGY
THE SHUTTLE INTO DIGITALISATION

New

Enhanced ASi-3 standard with complete new system – backward compatible:

- More subscribers lead to reduced system cost

- System analytics to reduce maintenance cost

- More performance:

  - 96 IOs – 1,2ms cycle time – 200m cable length

- Allows connection to complex sensors and actuators incl inverter, valves, and "intelligent" sensors

- Backward compatible to widely adopted ASi-3
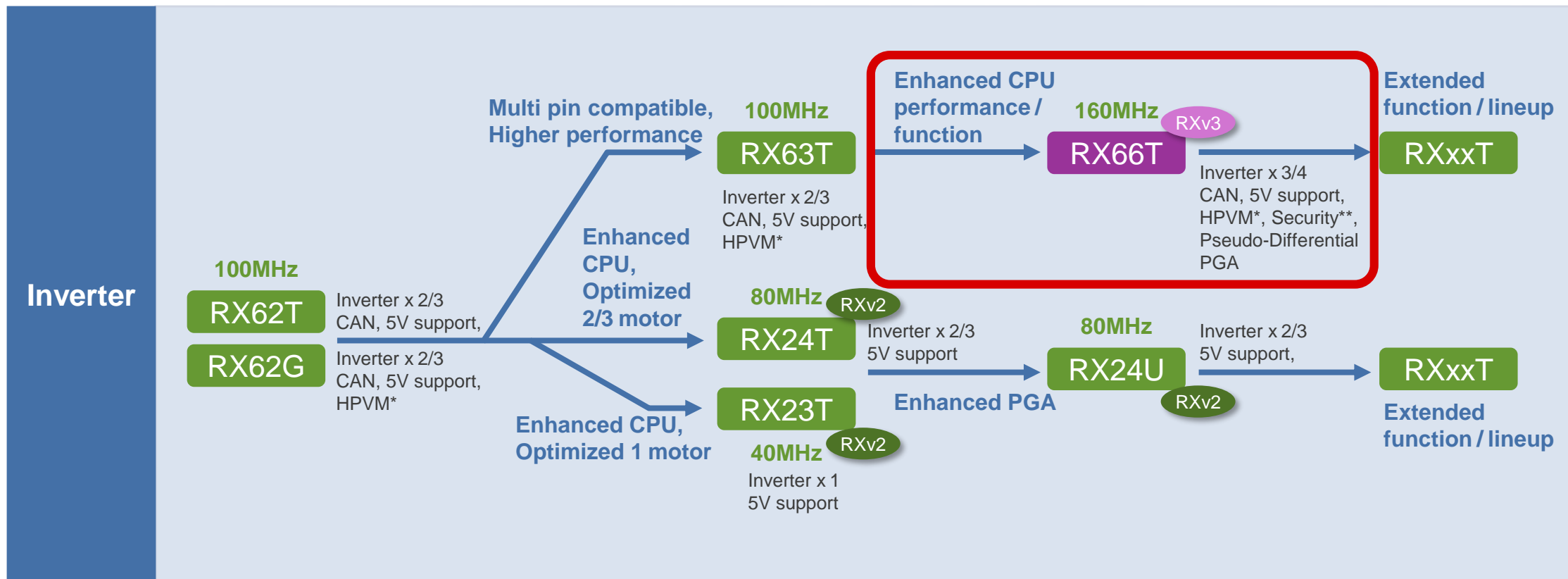
- See also AS-interface booth - Hall 3a

http://www.as-interface.net/

DRIVES

RX66T INVERTER CONTROL

HIGH PERFORMANCE MULTI-AXIS
MICROCONTROLLER

New Press Release

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RX INDUSTRIAL MOTOR CONTROL ROADMAP

Inverter

100MHz
RX62T
Inverter x 2/3 CAN, 5V support,

RX62G
Inverter x 2/3 CAN, 5V support, HPVM*

Multi pin compatible, Higher performance

100MHz
RX63T
Inverter x 2/3 CAN, 5V support, HPVM*

Enhanced CPU, Optimized 2/3 motor

80MHz RXv2
RX24T
Inverter x 2/3 5V support

Enhanced CPU, Optimized 1 motor

40MHz RXv2
RX23T
Inverter x 1 5V support

Enhanced CPU performance / function

160MHz RXv3
RX66T
Inverter x 3/4 CAN, 5V support, HPVM*, Security**, Pseudo-Differential PGA

Enhanced PGA

80MHz
RX24U RXv2
Inverter x 2/3 5V support,

Extended function / lineup
RXxxT

Extended function / lineup
RXxxT

* HPWM : High-resolution PWM
** Trusted Secure IP

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INVERTER USE CASE EXAMPLE
THREE 3-PHASE INVERTER CONTROL SYSTEM CONFIGURATION

Control three 3-phase inverter using one timer!

- GPTW outputs up to three 3-phase complementary PWM

Process two 3-shunt current detection simultaneously!

- Six PGA and S/H circuit enable to control two 3-shunt inverter simultaneously
- Up to 3-unit ADC

Reduce external components!

- Integrated reset circuit, data flash, OpAmp, and comparator

Improved functions for advanced safety!

- 2-unit x 3ch comparator to forcibly shut off PWM outputs
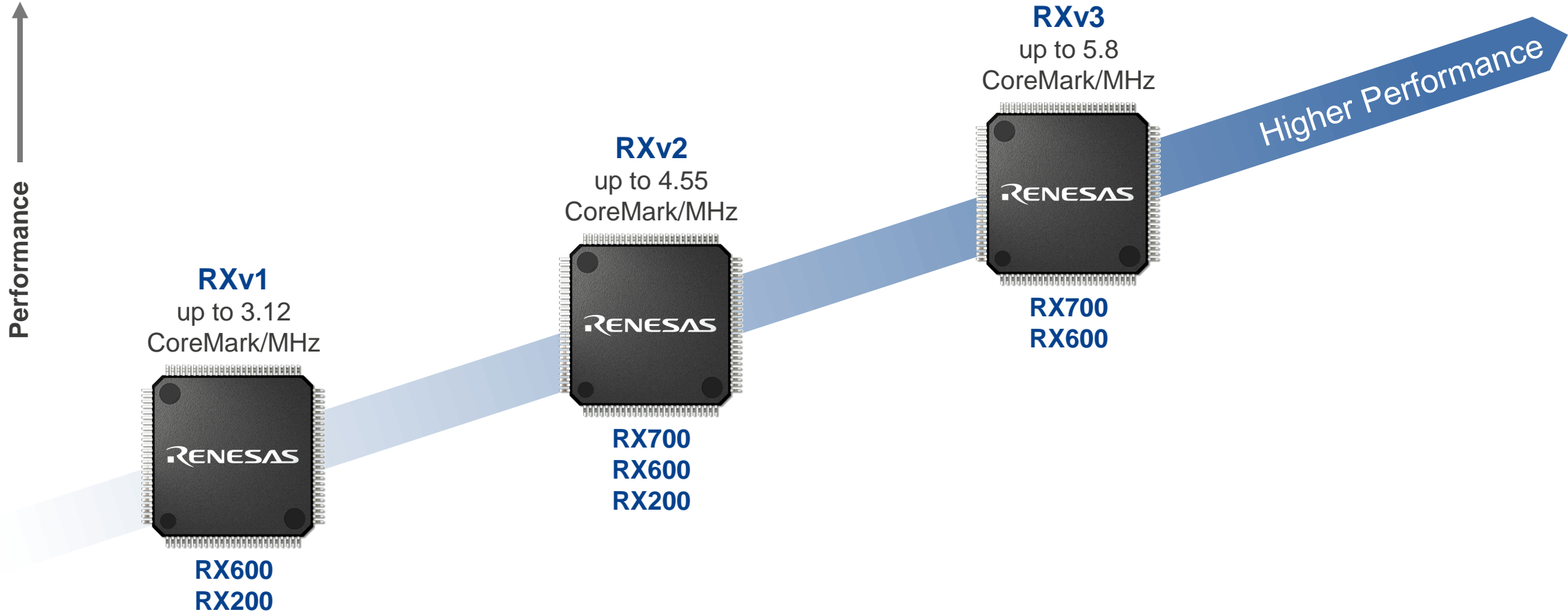- Output protection circuit dedicated to GPTW(POEG)

Support functional safety!

- Integrated function supports IEC60730 safety standards for home appliances class B (Fail-Safe)
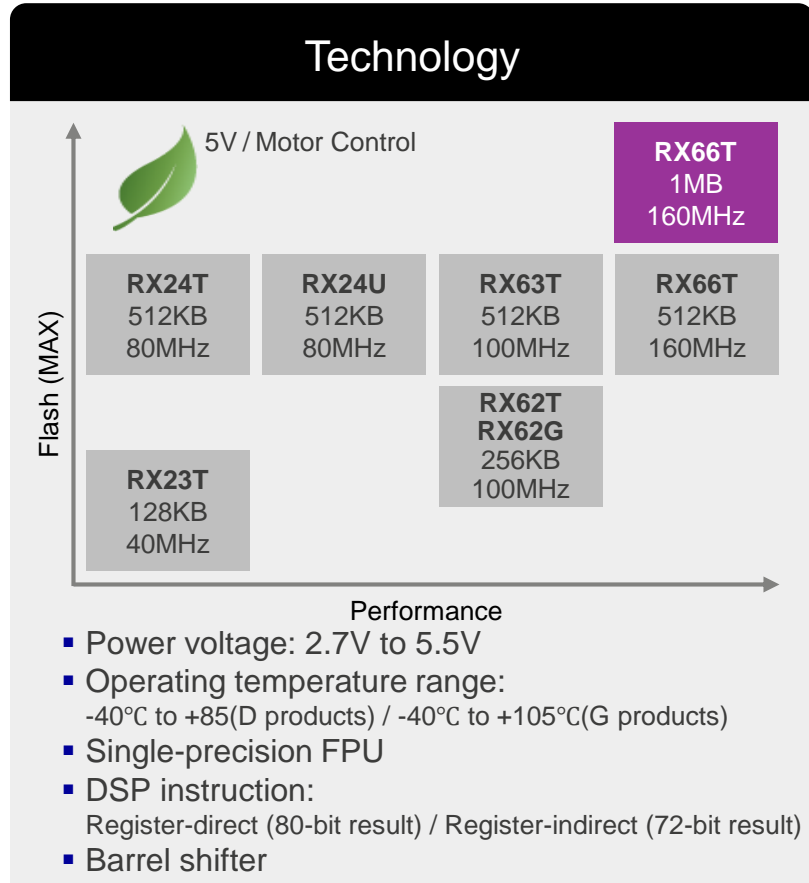- Enables system fail-safe with less SW load
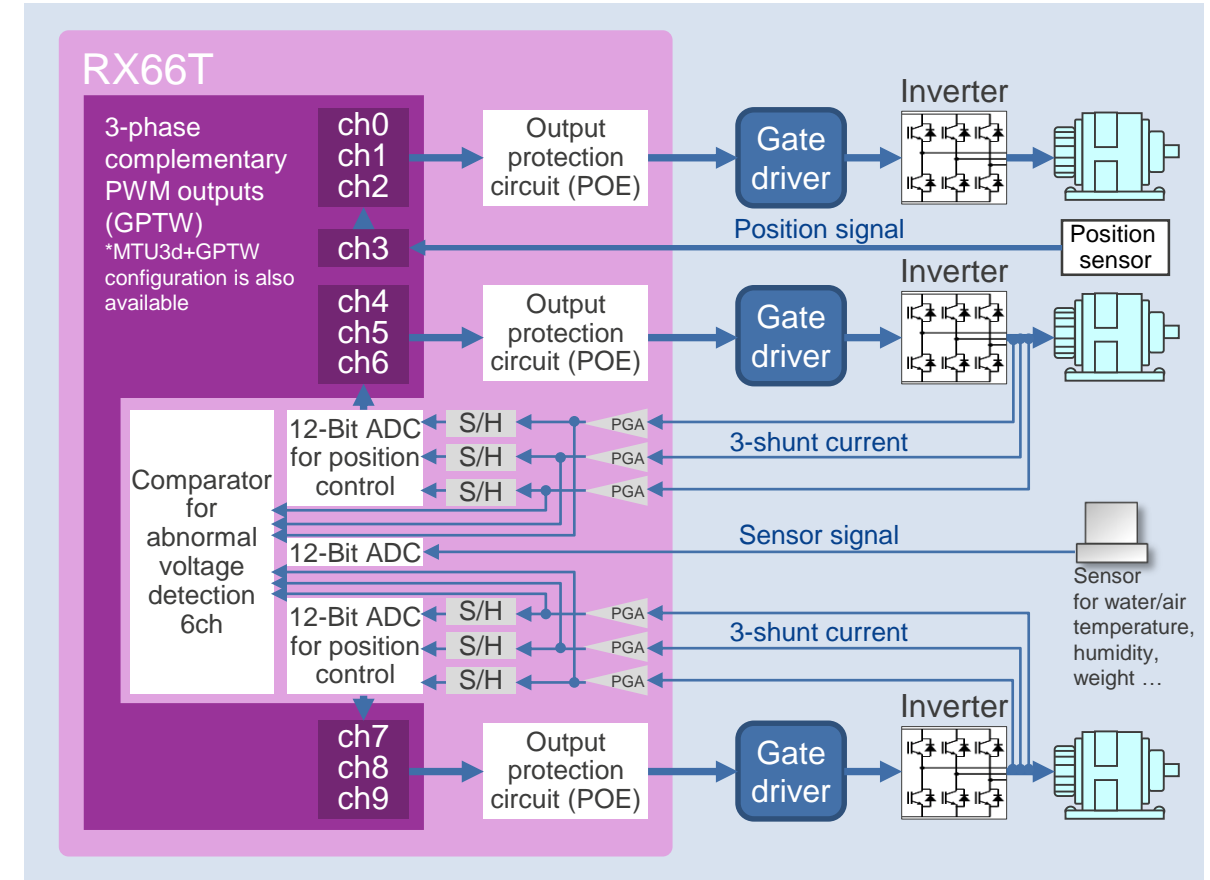
PGA: Programmable Gain Amp / S/H: Sample & Hold / * Left hand side figure shows just image

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RENESAS UNVEILED RXV3 CPU CORE
WITH INDUSTRY-LEADING PERFORMANCE

Performance →

Higher Performance →

RXv3
up to 5.8
CoreMark/MHz

RX700
RX600

RXv2
up to 4.55
CoreMark/MHz

RX700
RX600
RX200

RXv1
up to 3.12
CoreMark/MHz

RX600
RX200

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RX66T (RAM128KB)

Technology

5V / Motor Control

			RX66T 1MB 160MHz
RX24T 512KB 80MHz	**RX24U** 512KB 80MHz	**RX63T** 512KB 100MHz	**RX66T** 512KB 160MHz
		RX62T RX62G 256KB 100MHz	
RX23T 128KB 40MHz			

Flash (MAX) ↑ → Performance

- Power voltage: 2.7V to 5.5V
- Operating temperature range:
  -40℃ to +85(D products) / -40℃ to +105℃(G products)
- Single-precision FPU
- DSP instruction:
  Register-direct (80-bit result) / Register-indirect (72-bit result)
- Barrel shifter

RXv3 Core 160 MHz

RX66T (RAM 128 KB)

Memory
- Code Flash (1MB)
- SRAM 128KB
- Data Flash (32KB)*
- SRAM with ECC 16KB

Analog
- 12-Bit A/D converter 3 unit (8ch, 8ch, 14 ch) 3ch simultaneous S&H for 2 unit only Pseudo-Differential programmable gain amp (6ch)
- 12-Bit D/A converter 2ch
- Temperature sensor
- Comparator x 6ch

System, Power Mgmt.
- DMAC x8ch, DTC
- Interrupt controller 16 level 16 pin + NMI
- On-chip oscillators
- Power-on reset (POR)
- Voltage detection circuit (LVD)
- Event link controller

Safety Functions
- Memory protection unit
- Register write protection unit
- Clock frequency accuracy measurement circuit
- Oscillation-stop detection
- CRC32 calculator
- Data Operation Circuit (RAM test assist)
- A/D self-diagnostics (fault detection)
- A/D disconnection detection
- 14-Bit watchdog timer
- 14-Bit independent watchdog timer
- Port Output Enable

Connectivity
- USB 2.0 Full Speed Host / Function 1ch
- CAN x1ch
- SCI x7ch (with FIFO 1ch)
- I2C x1ch
- RSPI x1ch
- 8/16-Bit external bus

Timers
- Multifunction timer pulse unit (MTU3d) 16-Bit x9ch
- General-purpose PWM timers 32-Bit x10ch**
- 8-Bit timers 4 unit (2ch x4ch)
- Compare match timer 16-Bit x4ch

Security & Encryption
- Trusted Secure IP Lite (AES/TRNG) Key mgmt., Access mgmt.
- Code protect (flash access limited)
- Trusted Memory (flash access limited)
- Unique ID

Human-Machine Interface

Package
- LFQFP 100/144

* Back Ground Operation / ** High-resolution PWM: 4ch / (This table shows the maximum specification. The details depends on the part no.)

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RX66T VALUE PROPOSITION
REALIZATION OF HIGHLY PRECISE AND HIGHLY EFFICIENT INVERTER CONTROL
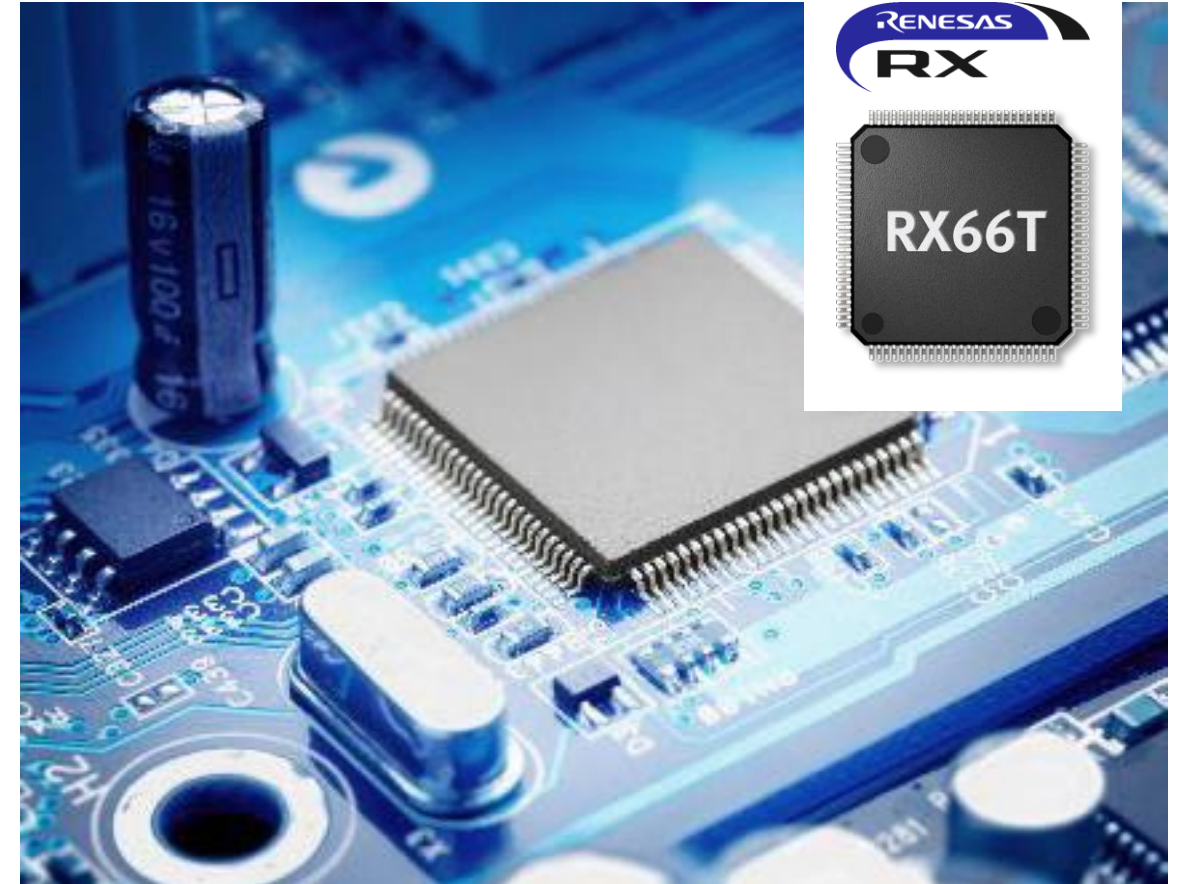
Performance

- 160MHz, 928Coremark, Supporting 5V, x2.5 higher performance in Vector control*

Inverter control peripherals

- Enable output max 4-axis 3ch complementary PWM by Enhanced MTU&GPT / 4ch adjustable high resolution PWM with minimum 195ps (5.12GHz)

Security

- Firmware update under secured environment and capable to support e-AI

*Compared with existing products(RX62T/63T 100MHz), able to achieve x2.5 higher performance in Vector control program of Renesas
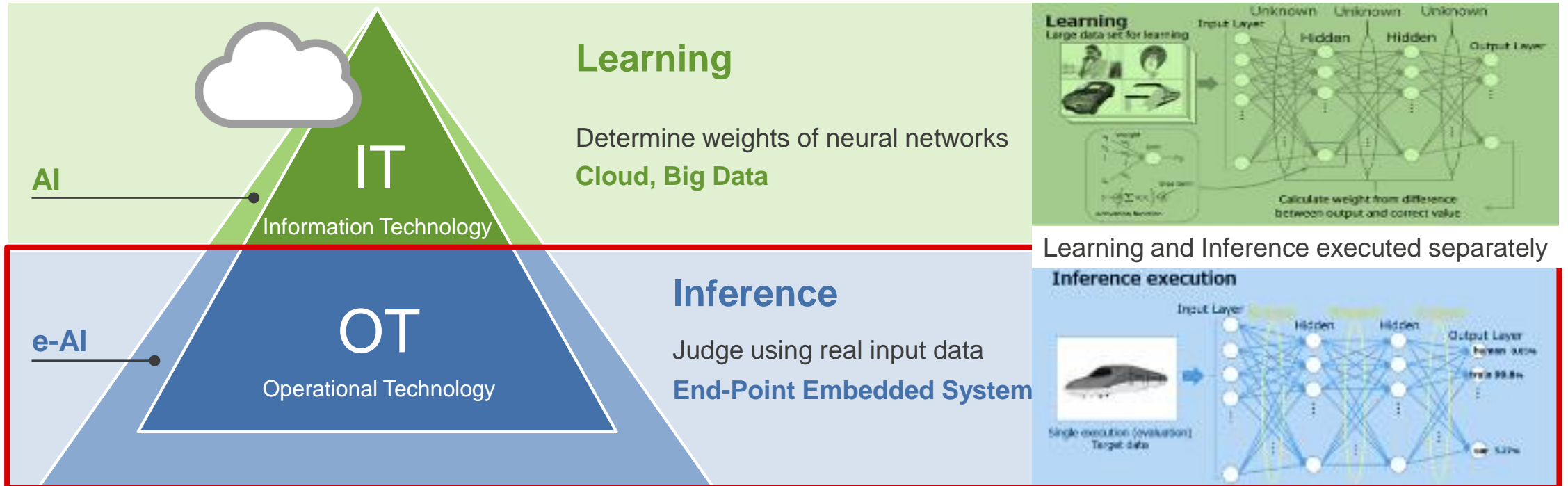
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END-POINT INTELLIGENCE IN MICROCONTROLLERS

PROOF OF CONCEPT WITH EMBEDDED AI

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RENESAS 'e-AI' CONCEPT
OFFER TO EXECUTE "LEARNING" ON IT AND "INFERENCE" ON OT SEPARATELY

AI

IT
Information Technology

e-AI

OT
Operational Technology

Learning

Determine weights of neural networks
Cloud, Big Data

Inference

Judge using real input data
End-Point Embedded System

Learning and Inference executed separately

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ESTABLISHED e-AI FLOW
APPLY AI TO ALL MCU AND MPU FAMILIES

Open Source Software Frameworks

Server
Cloud
PC

Data

Caffe
TensorFlow
Learning

Inference

Commercial Frameworks

Inference

Commercial
Framework
Learning

PC

Data

e-AI Translater

e-AI Checker

e-AI Importer

e2 studio
（Renesas Development Environment)

Validation Build

Rule Based Programming

Inference

RENESAS RZ

RENESAS RX

RENESAS RL78

RENESAS Synergy™

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EMBEDDED ARTIFICAL INTELLIGENCE
TECHNOLOGY DEMONSTRATOR GEARBOX

Technology Demonstrator

Enhance the end point intelligence by utilizing e-AI on MCUs for smart factory applications:

- AI unit capable to collect machine data and to apply deep learning on it

- Enable customers to use AI algorithm (PC/cloud) on Renesas MCU/MPU embedded in equipment

- Support use cases like abnormal detection or predictive maintenance

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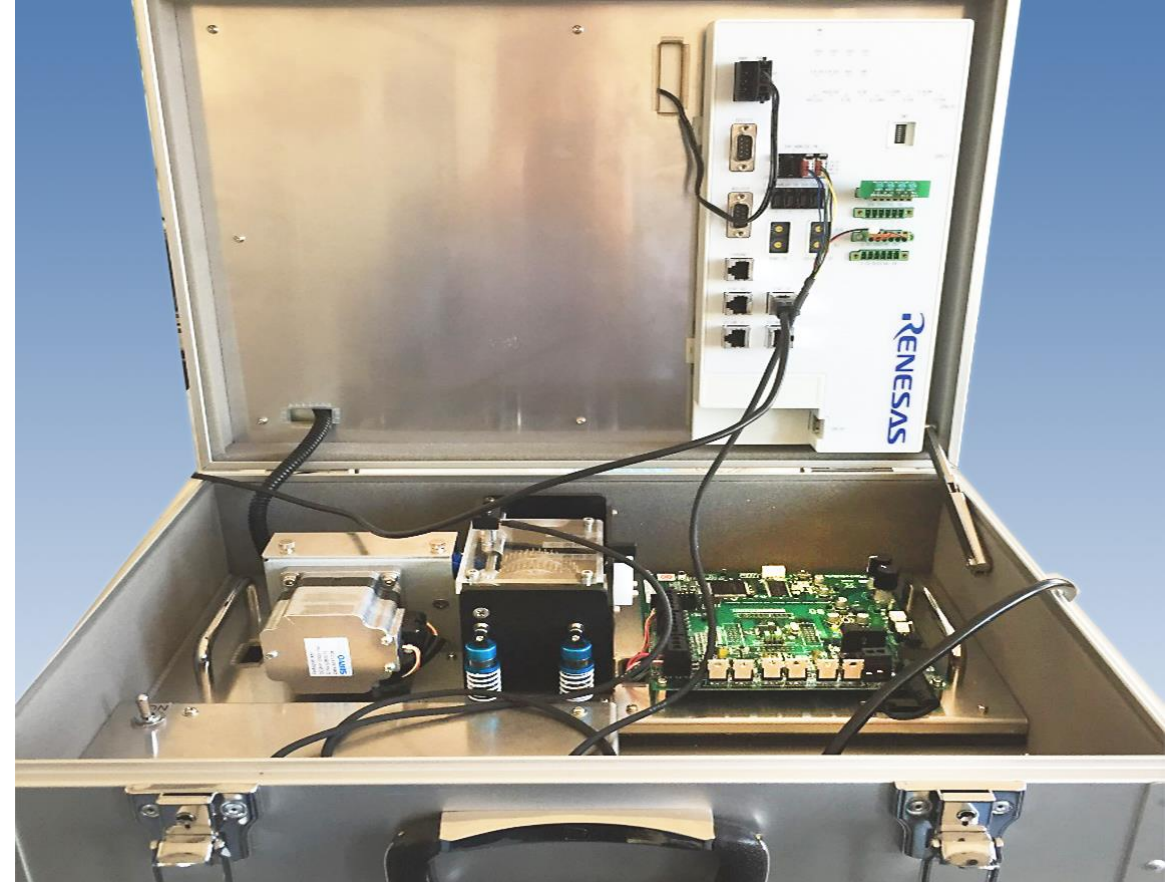
SUMMARY
THE WORLD SWITCHED ON – INNOVATIVE SEMICONDUCTOR SOLUTIONS FOR THE IIOT

NEW key products and solution enhancements

- RZ/N1 series enhanced with IO-LINK Master Gateway solution – rapid prototyping and pre-qualified software

- Synergy™ S1JA Sensor Solution with configurable analog front-end

- RX66T for high performance multi-axis inverter control

NEW technology and innovations

- Technology Launch of new sensor network standard ASi-5

- Renesas Microcontroller enabled for embedded AI

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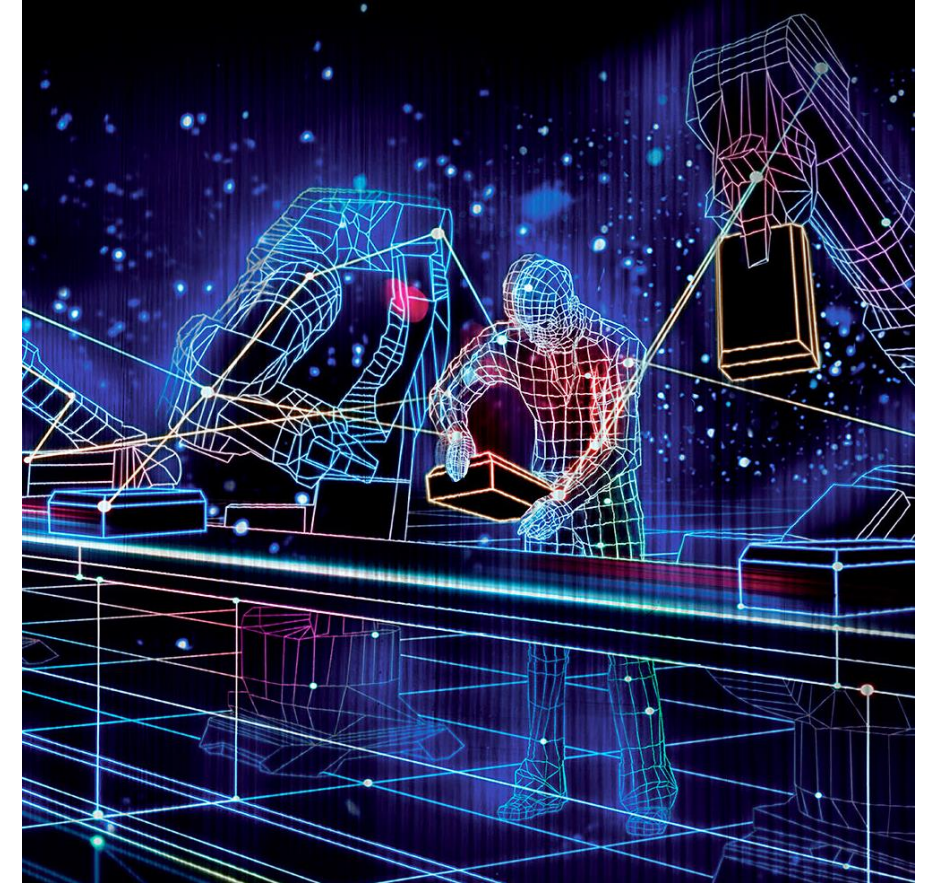
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THANK YOU

Meet us at:

Renesas Booth: Hall 10.1 – 130

and …

    PNO Booth: Hall 5 – 210

    ETG Booth: Hall 5 – 310

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