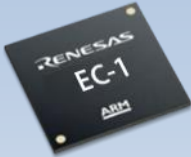


# RZ/N1 SERIES INTRODUCTION

实时工业以太网、多协议支持、, 支持实现智能网关  
和网络化工业物联网解决方案

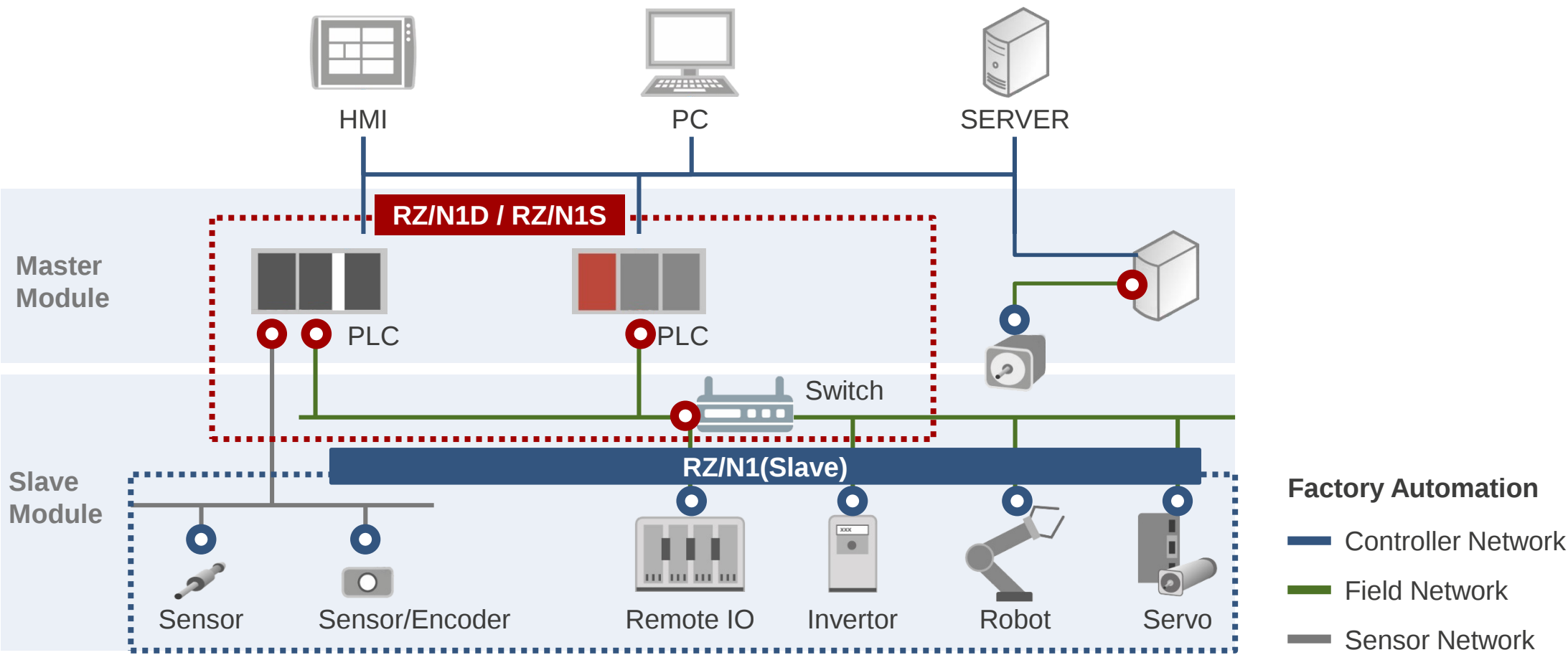
BIG IDEAS  
FOR EVERY SPACE

# RENESAS ASSP LINE UP FOR INDUSTRIAL AUTOMATION

| PROFINET Controller                                                                                               | EtherCAT Controller                                                                                      | Multi Protocol Controller                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                               | New Product<br>March 2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  |                         |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>TPS-1</b><br>2Port (w/PHY)<br>PROFINET CPU                                                                     | <b>EC-1</b><br>ARM Cortex-R4F@150MHz<br>ATCM 512KB w/ECC<br>BTCM 32KB w/ECC<br>EtherCAT Slave Controller | <b>RZ/T1</b><br>Cortex-R4F + M3 Dual CPU*<br>2Port MAC with Switch<br>EtherCAT Slave Controller                                                                                                                                                                                                                                                           | <b>R-IN32M3-EC</b><br>Cortex-M3 CPU<br>2Port (w/ PHY )<br>EtherCAT Slave Controller                                                                                                                                                                                                                                                                           | <b>R-IN32M4-CL2</b><br><b>R-IN32M3-CL</b><br>Cortex-M3 or M4 CPU<br>2Port GMAC with Switch<br>CC-Link IE Field Controller                                                                                                                                                                                                                                     | <b>RZ/N1</b><br>Dual Cortex-A7 + M3 CPU<br>5Port GMAC with Switch<br>True IE multi-protocol<br>PRP/HSR/MRPD                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <br>PROFINET V2.3<br>IRT Support |                         | <br><br><br> | <br><br><br> | <br><br><br> | <br><br><br><br><br> |

\*For “with R-IN engine” ver.

# RZ/N1 CAN BE USED FOR...



# WHAT IS RZ/N1 SERIES?

---

- **Two in one concept supporting multi-protocol stack**
  - Multicore ARM - Single chip solutions
- **Scalability**
  - 3 groups with 5 packages
- **Wide selection of protocol stack**
- **Redundancy**
  - Support redundancy protocol (PRP and HSR) and make downtime to “0”



# WHAT IS RZ/N1 SERIES?

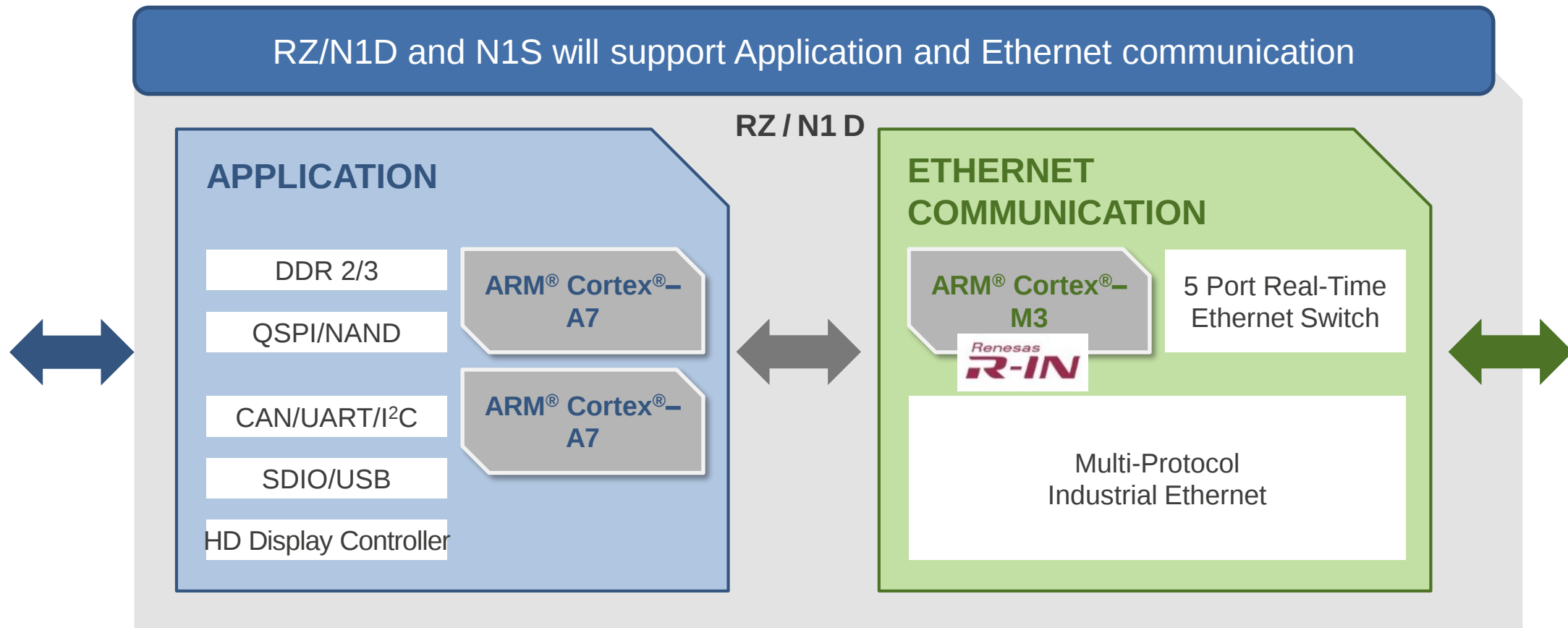
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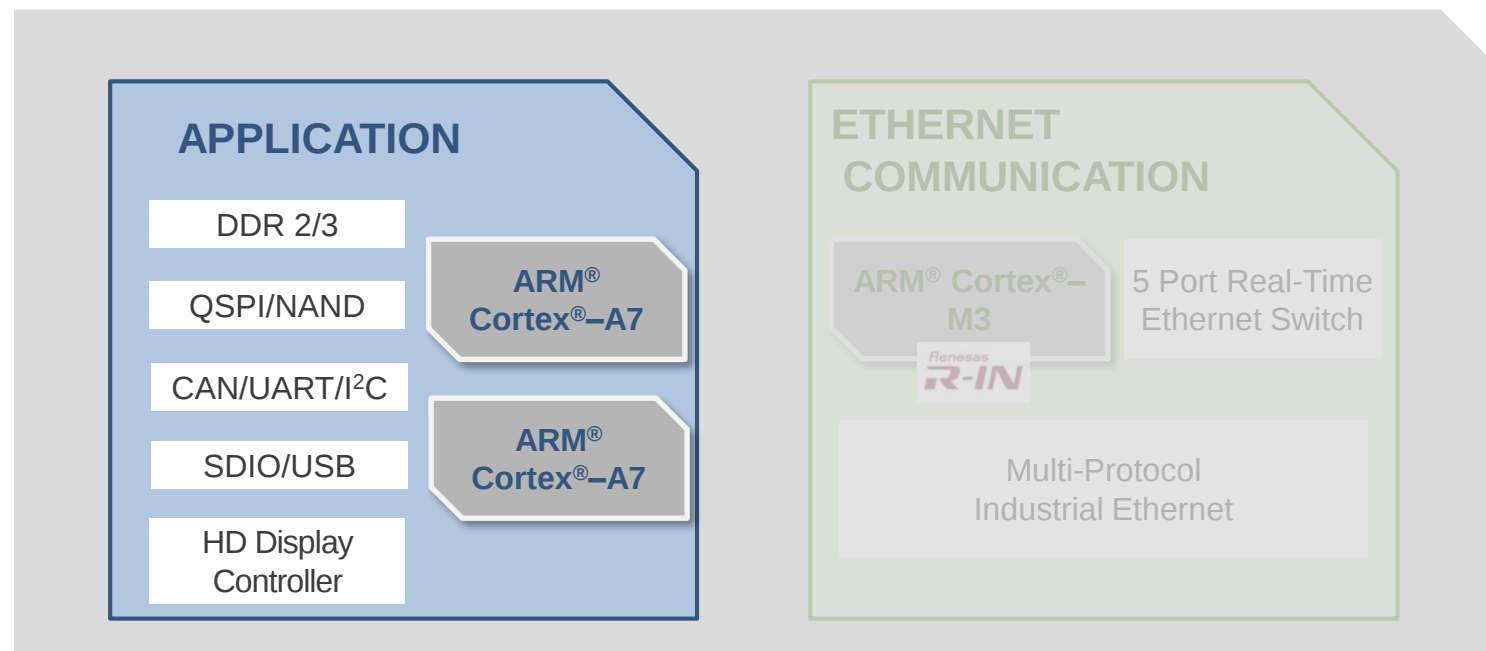
# TWO IN ONE CONCEPT

## MULTICORE ARM - SINGLE CHIP SOLUTIONS



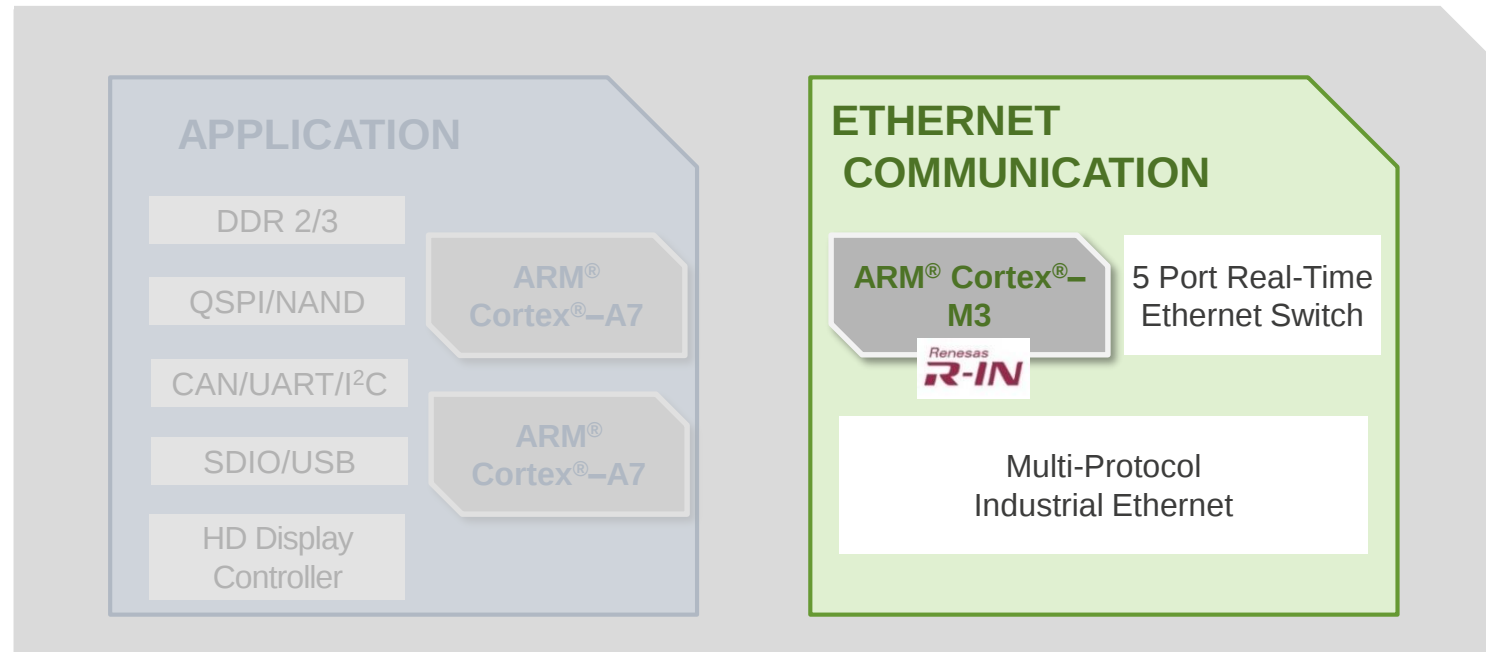
- For more information please check: [www.renesas.com/rzn](http://www.renesas.com/rzn)

# ARM CORTEX-A7 FOR APPLICATION CONTROL



- **Powerful performance:** N1D/Dual Cortex-A7(500MHz), N1S/Single Cortex-A7(500MHz)
- **Multiple OS environment :** Linux, VxWorks, ThreadX are available

# ARM CORTEX-M3 FOR ETHERNET COMMUNICATION



- **Multi-protocol** Industrial Ethernet support
- **Max 5-port** Ethernet with Real time switch

# WHAT IS RZ/N1 SERIES?

---

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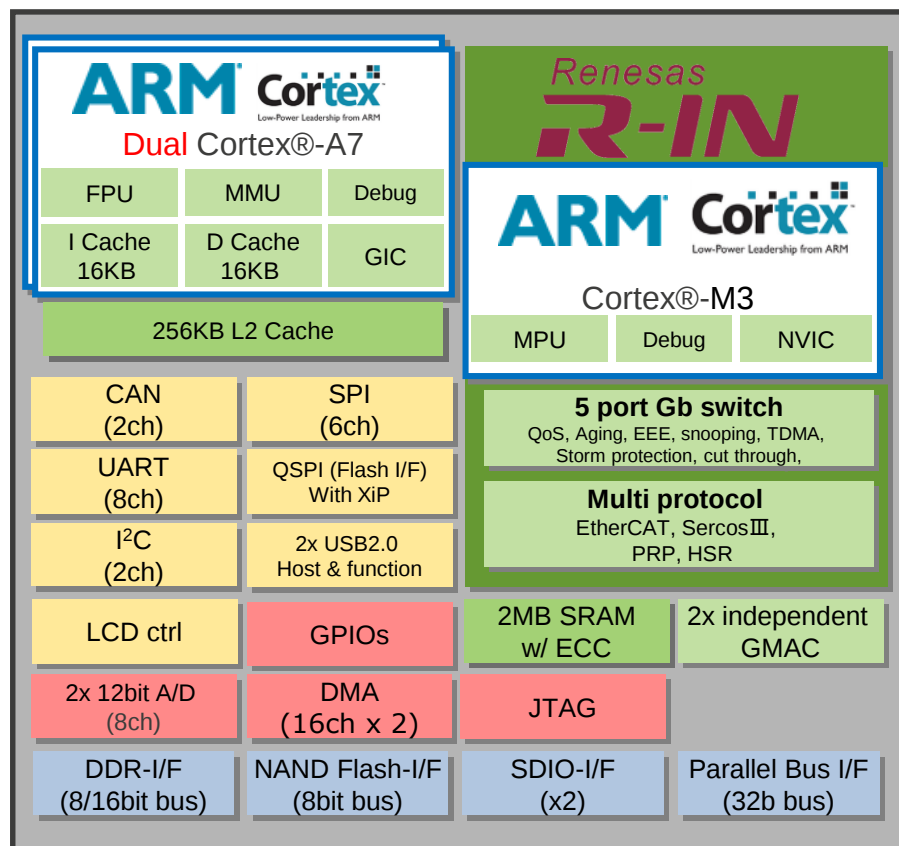
# SCALABILITY

## 3 GROUPS WITH 5 PACKAGES

**N** for **N**etwork  
**D** for **D**ual/**D**DR  
**S** for **S**ingle/**S**RAM  
**L** for **L**ite

|                                   | RZ/N1D                                                            | RZ/N1S                                                      | RZ/N1L                      |
|-----------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------|
| CPU                               | Dual Cortex®-A7 (500MHz)<br>+<br>Cortex®-M3 (R-IN Engine)         | Single Cortex®-A7 (500MHz)<br>+<br>Cortex®-M3 (R-IN Engine) | Cortex®-M3<br>(R-IN Engine) |
| Target Application                | PLC, HMI, Switch                                                  | PLC, HMI, Switch                                            | Remote IO                   |
| Supported Protocol<br>(Ethernet ) | PROFINET RT, EtherCAT, EtherNet/IP, Modbus/TCP, SERCOS, POWERLINK |                                                             |                             |
| Internal SRAM                     | 2MB                                                               | 6MB                                                         | 6MB                         |
| DDR I/F                           | O                                                                 | -                                                           | -                           |
| LCD controller                    | O                                                                 | O                                                           | -                           |
| Ethernet Port                     | 5 port – 400BGA PKG<br>3 port – 324BGA PKG                        | 5 port – 324BGA PKG<br>3 port – 196BGA PKG                  | 3 port                      |
| Redundancy                        | HSR, PRP, DLR, MRP                                                | PRP, DLR, MRP                                               | DLR                         |
| Package                           | 400BGA(17mm)<br>324BGA (15mm)                                     | 324BGA(15mm)<br>196BGA (12mm)                               | 196BGA (12mm)               |
| OS (vendor)                       | CA7: Linux (Renesas)                                              | CA7: VxWorks (Wind river)<br>ThreadX (Express Logic)        | NA                          |
|                                   | CM3: HW-RTOS                                                      |                                                             |                             |
| Sample schedule                   | 2017. Dec (ES)                                                    | 2017.Dec (ES)                                               | 2018.Jan (ES)               |

# RZ/N1D – BLOCK DIAGRAM



400pin : LFBGA 17 x 17 mm, 0.8mm pitch

324pin : LFBGA 15 x 15 mm, 0.8mm pitch

## CPU core

Dual ARM® Cortex®-A7(500MHz)

## Cache memory

L1 I-Cache 16KB×2

D-Cache 16KB×2

L2 256KB

## R-IN Engine

ARM® Cortex®-M3 (125MHz)

HW-RTOS accelerator

Ethernet accelerator

## Internal Memory

2MB (with ECC)

## External Memory

DDR2/DDR3 controller

Quad-I/O SPI

SDIO-eMMC

NAND Flash controller

## Operation Temperature

Tj = -40°C ~ +110°C

## Ethernet Communication

HSR switch

EtherCAT Slave controller

SercosIII Slave controller

Up to 5port Ether switch

## Communication features

UART 8ch

I2C 2ch

USB HOST/Function 1ch, HOST 1ch

SPI 6ch (Master 4ch, Slave 2ch)

CAN

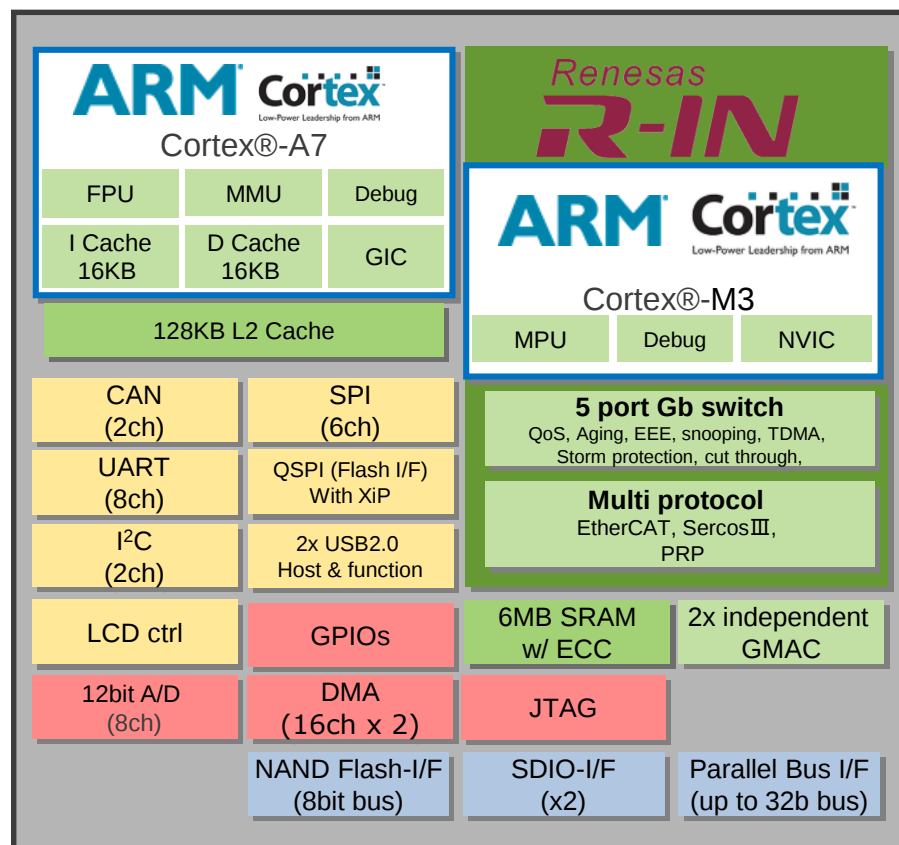
## Others

LCD controller

ADC 12bit×8ch×2unit(400pin)

ADC 12bit×8ch×1unit(324pin)

# RZ/N1S – BLOCK DIAGRAM



324pin : LFBGA 15 x 15 mm, 0.8mm pitch

196pin : LFBGA 12 x 12 mm, 0.8mm pitch

## CPU core

Single ARM® Cortex®-A7(500MHz)

## Cache memory

L1 I-Cache 16KB  
D-Cache 16KB  
L2 128KB

## R-IN Engine

ARM® Cortex®-M3 (125MHz)  
HW-RTOS accelerator  
Ethernet accelerator

## Internal Memory

6MB (with ECC)

## External Memory

Quad-I/O SPI  
SDIO-eMMC  
NAND Flash controller

## Operation Temperature

Tj = -40°C ~ +110°C

## Ethernet Communication

EtherCAT Slave controller  
SercosIII Slave controller  
Up to 5port Ether switch

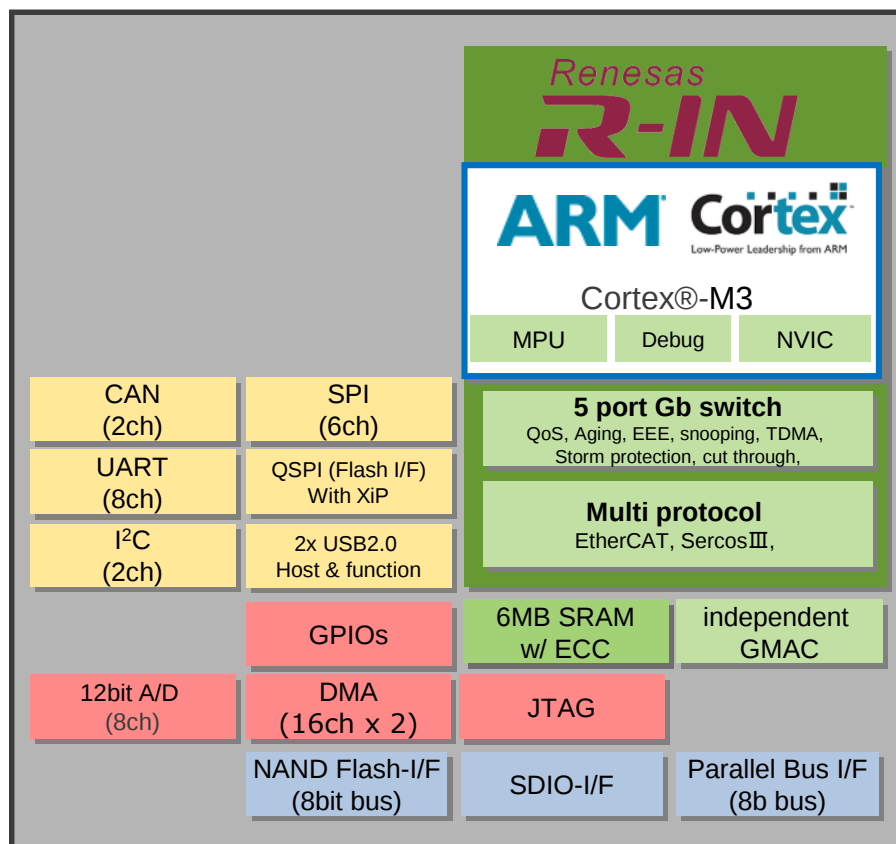
## Communication features

UART 8ch  
I2C 2ch  
USB HOST/Function 1ch, HOST 1ch  
SPI 6ch (Master 4ch, Slave 2ch)  
CAN

## Others

LCD controller  
ADC 12bit×8ch×1unit

# RZ/N1L – BLOCK DIAGRAM



196pin : LFBGA 12 x 12 mm, 0.8mm pitch

## R-IN Engine

ARM® Cortex®-M3 (125MHz)  
HW-RTOS accelerator  
Ethernet accelerator

## Internal Memory

6MB (with ECC)

## External Memory

DDR2/DDR3 controller  
Quad-I/O SPI  
SDIO-eMMC  
NAND Flash controller

## Operation Temperature

Tj = -40°C ~ +110°C

## Ethernet Communication

EtherCAT Slave controller  
SercosIII Slave controller  
3port Ether switch\*

## Communication features

UART 8ch  
I2C 2ch  
USB HOST/Function 1ch, HOST 1ch  
SPI 6ch (Master 4ch, Slave 2ch)  
CAN

## Others

ADC 12bit×8ch×1unit

\*Switch IP is same as N1D and N1S but only 3 port is available in case N1L

# WHAT IS RZ/N1 SERIES?

---

- **Two in one concept supporting multi-protocol stack**
  - Multicore ARM - Single chip solutions
- **Scalability**
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- **Redundancy**
  - Support redundancy protocol (PRP and HSR) and make downtime to “0”



# WIDE SELECTION OF PROTOCOL STACK

| Vendor          | Protocol                      | Core      | Device                             | Release schedule JPN |
|-----------------|-------------------------------|-----------|------------------------------------|----------------------|
| Port.GmbH       | PROFINET RT (Slave)           | Cortex-M3 | RZ/N1D, S, L                       | Released             |
|                 | EtherNet/IP (Slave)           | Cortex-M3 | RZ/N1D, S, L                       | Released             |
|                 | Powerlink (Slave)             | Cortex-M3 | RZ/N1D, S, L                       | Released             |
| TMG             | PROFINET RT (Slave)           | Cortex-M3 | RZ/N1D, S, L                       | Released             |
| Renesas         | EtherCAT (Slave)              | Cortex-M3 | RZ/N1D, S, L                       | Released             |
|                 | Modbus TCP (Slave)            | Cortex-M3 | RZ/N1D, S, L                       | Released             |
| Cannon Automata | SercosIII                     | Cortex-M3 | RZ/N1D, S, L                       | Released             |
| 3S              | Software PLC CODESYS (Master) | Cortex-A7 | RZ/N1D                             | Released             |
| NetModule       | HSR                           | Cortex-A7 | RZ/N1D                             | Released             |
|                 | PRP                           | Cortex-M3 | RZ/N1D (400pin)<br>RZ/N1S (324pin) | Released             |

# WHAT IS RZ/N1 SERIES?

---

- **Two in one concept supporting multi-protocol stack**
  - Multicore ARM - Single chip solutions
- **Scalability**
  - 3 groups with 5 packages
- **Wide selection of protocol stack**
- **Redundancy**
  - Support redundancy protocol (PRP and HSR) and make downtime to “0”



# REDUNDANCY SUPPORT

RZ/N1D and N1S support redundancy protocol  
It makes downtime to “0 (zero)”

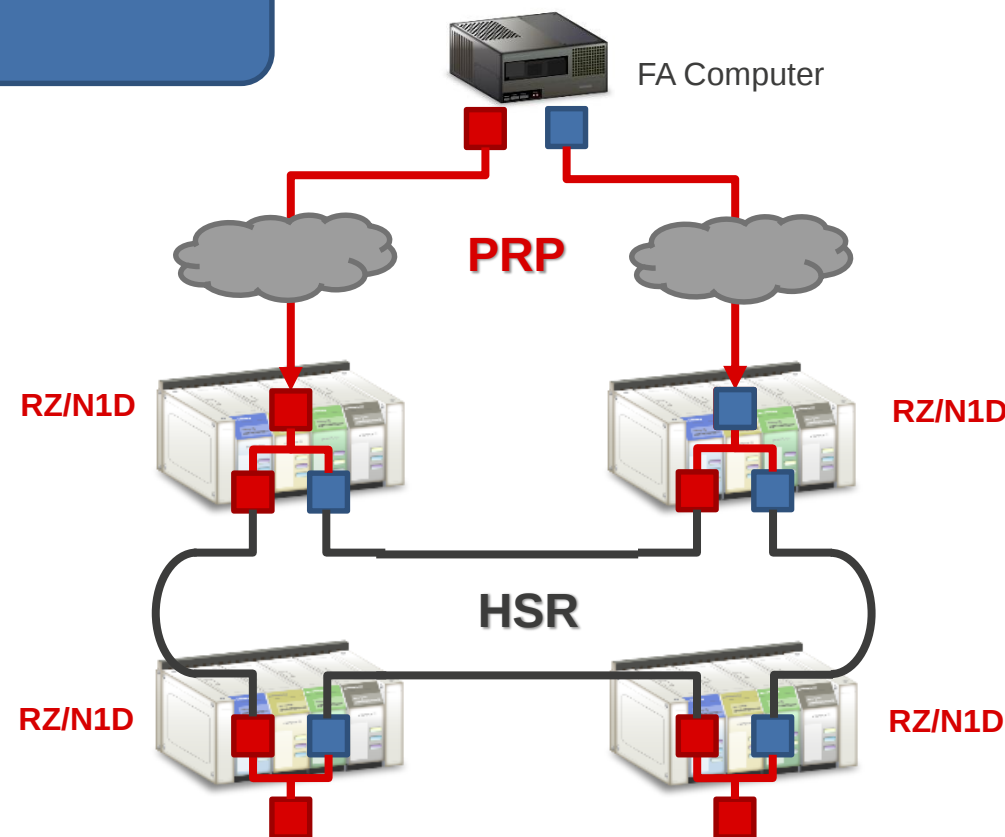
RZ/N1D(400pin) supports PRP and HSR, and PRP is available on N1S(324pin).

PRP and HSR are standard redundancy protocol for Industrial automation network which realize downtime to “0 (zero)”

RZ/N will be a solution for the application (e.g. Substation Automation) which needs to keep systems working even some network breaking is happened.

PRP : Parallel Redundancy Protocol (IEC 62439-3 Clause 4)

HSR : High-availability Seamless Redundancy (IEC 62439-3 Clause 5)



# DEVELOPMENT ENVIROMENT

# DEVELOPMENT ENVIROMENT

## More flexibility with various operating systems

|             | RZ/N1D, RZ/N1S                                                                                                                                                                           |                                                                                                                                                                                   |                                                                                                   | RZ/N1L                                                                                            |                                                                                                   |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| CPU         | Cortex-A7                                                                                                                                                                                |                                                                                                                                                                                   |                                                                                                   | Cortex-M3 (R-IN engine)                                                                           | Cortex-M3 (R-IN engine)                                                                           |
| OS          | Linux<br>(RZ/N1D only)                                                                                  | VxWorks<br>  | ThreadX<br>    | uITRON<br>(HWRTOS)                                                                                | uITRON<br>(HWRTOS)                                                                                |
| Compiler    |  GCC                                                                                                    | GCC 4.8.1<br>or<br>DIAB 5.9.6                                                                  | IAR EWARM<br>  | IAR EWARM<br>  | IAR EWARM<br>  |
| Debugger    |  GDB                                                                                                    | TCF<br>                                                                                        |                                                                                                   |                                                                                                   |                                                                                                   |
| Debug probe | Segger J-Link<br><br> | Lauterbach<br>                                                                                 | I-jet ICE<br> | I-jet ICE<br> | I-jet ICE<br> |

\* I-jet Trace can support ETM trace. I-jet can support ETB trace only.

# SOLUTION KIT

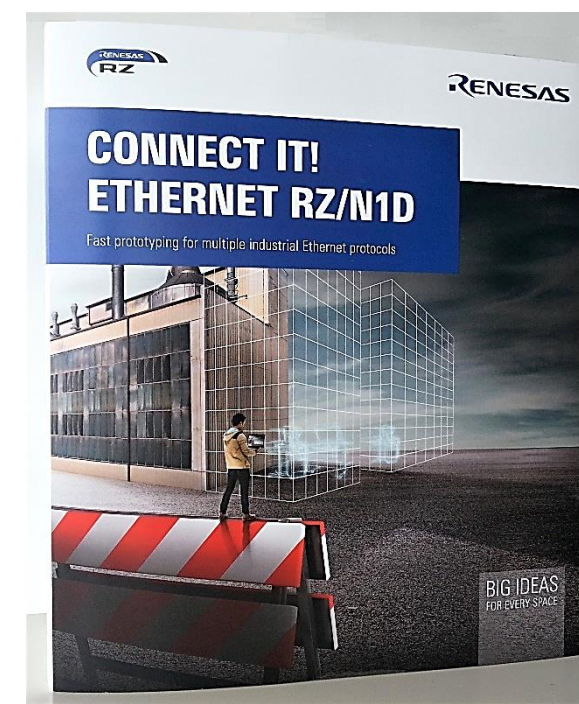
# RZ/N1D SOLUTION KIT DETAILS

## ■ CONNECT IT! ETHERNET RZ/N1D

- Part No. : YCONNECT-T-RZN1D
- Board : RZ/N1D CPU board
- Debug probe : IAR i-Jet lite
- Cables : Ethernet cable, USB cable
- S/W : OS (Linux), Uboot, OSAL and Partner's stack binaries (e.g. : PROFINET, EtherNet/IP, EtherCAT,...)
- Board features :
  - RZ/N1Dx device, Fast Ethernet (MII/RMII) (2 x), NOR flash, DDR3,
  - USB Device/Host, Serial USB debug/power port, LEDs, GPIOs, ...

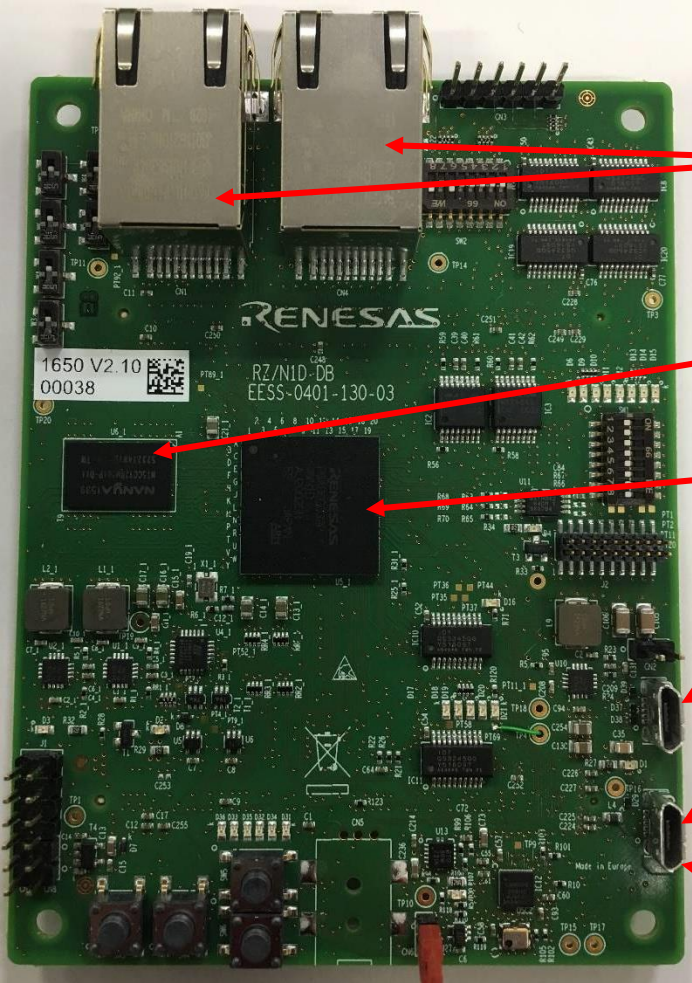
## ■ CONNECT IT! RZ/N1 Expansion

- Part No. : YCONNECT-IT-RZN1-EB
- Board : RZ/N1-EB expansion board
- Others : Power supply for RZ/N1-EB and RZ/N1x-DB
- Features :
  - Gbit Ethernet (RGMII/MII) (3 x), SDIO interface, PMODS (4 x),
  - Parallel Interface, LCD display interface, CAN, RS485, RS232



CONNECT IT! ETHERNET RZ/N1D

# RZ/N1D – CPU BOARD



2x MII/RMII Fast Ethernet

DDR3

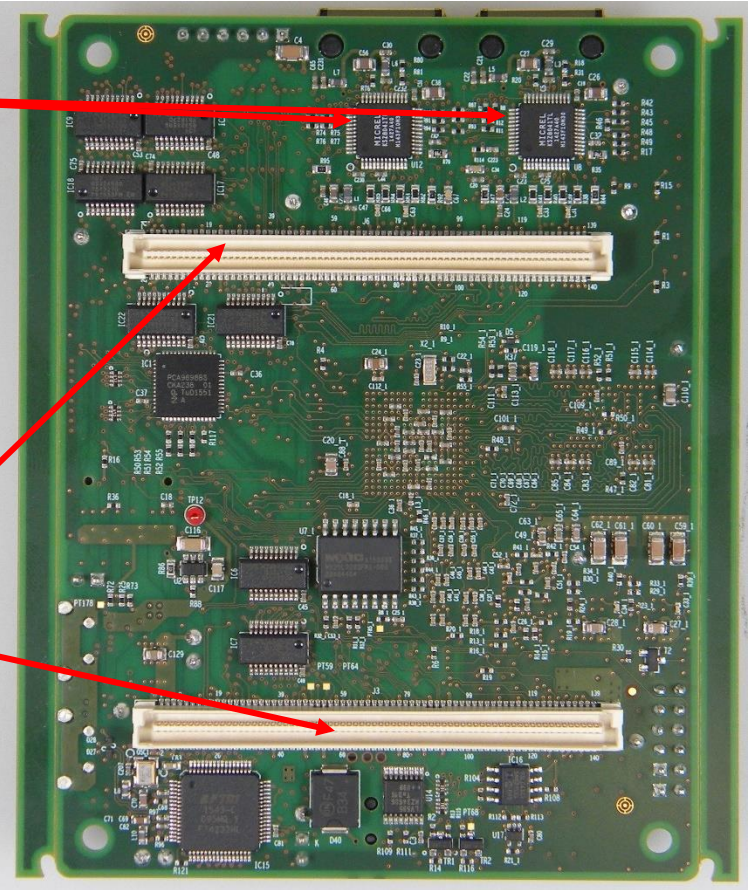
RZ/N1D

1x USB host/Device

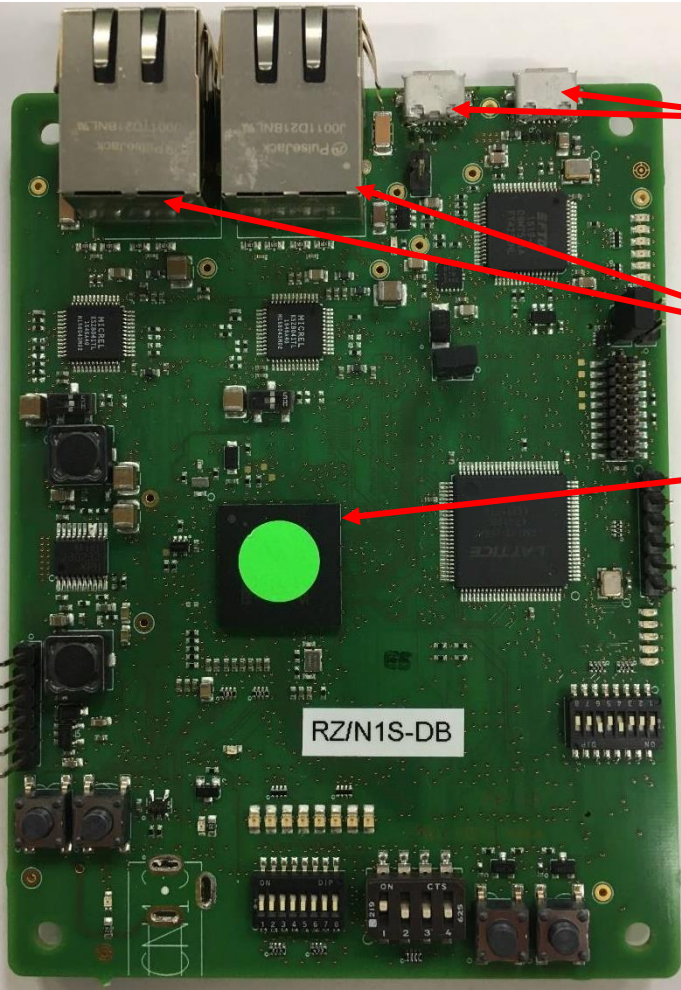
2x Expansion connectors

1x USB Debug (UART/JTAG/I2C)

Power (USB)



# RZ/N1S – CPU BOARD



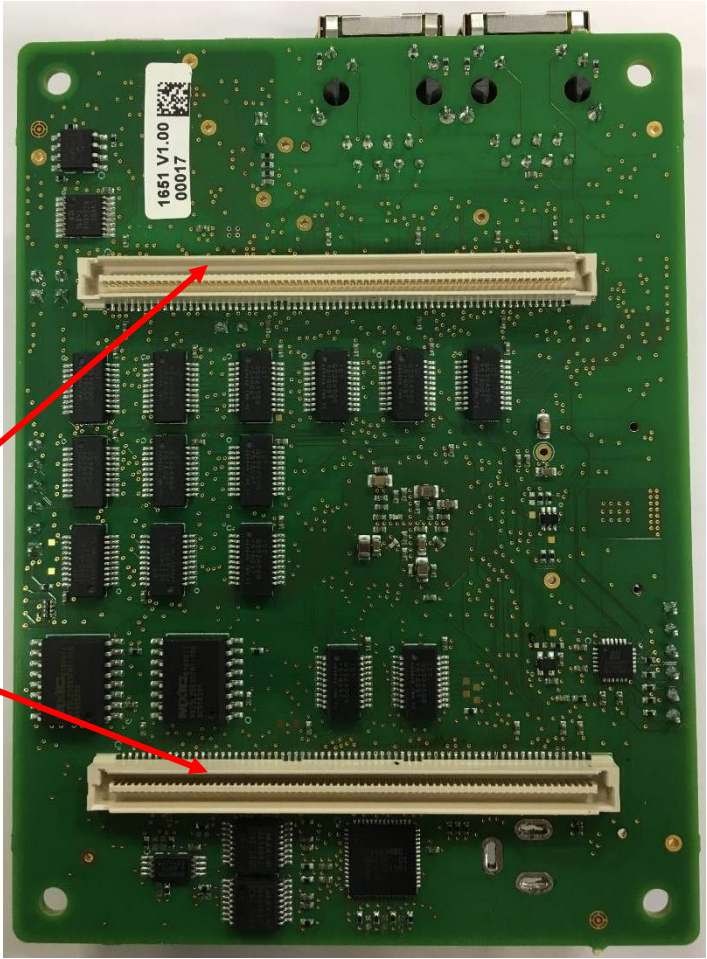
1x USB host/Device

1x USB Debug (UART/JTAG/I2C)  
& Power

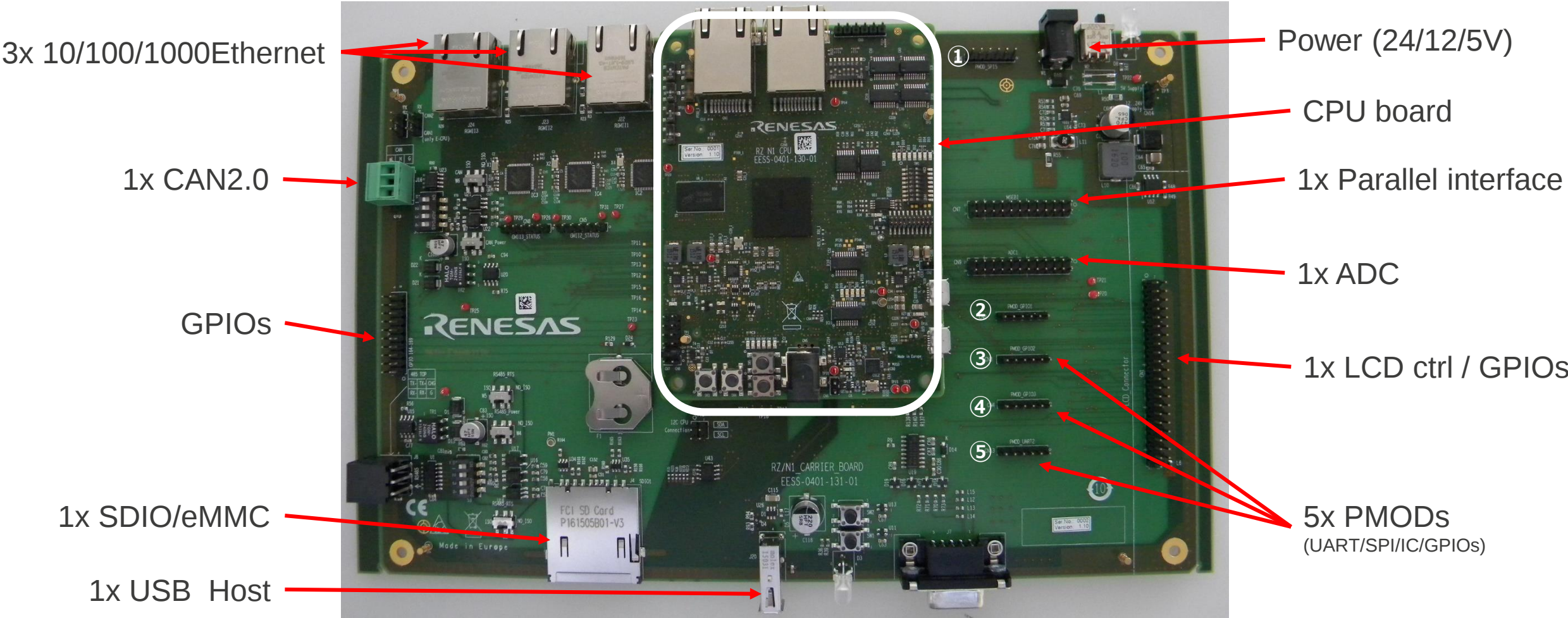
2x MII/RMII Fast Ethernet

RZ/N1S

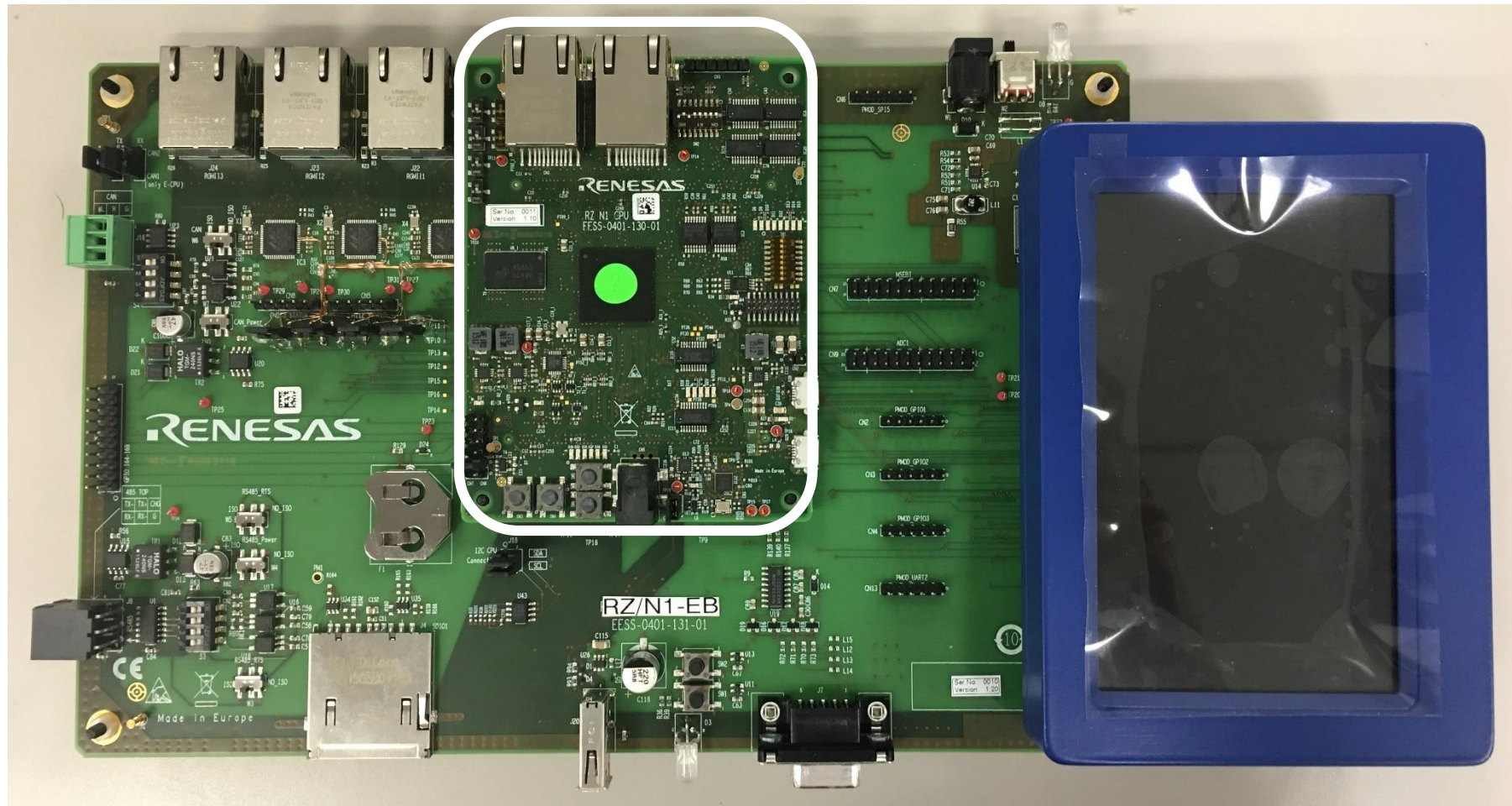
2x Expansion connectors



# RZ/N1 – EXPANSION BOARD



# RZ/N1 – FULL SET



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