RENESAS

BIG IDEAS FOR EVERY SPACE

RZ FAMILY

64-Bit & 32-Bit Arm-based high-end MPUs



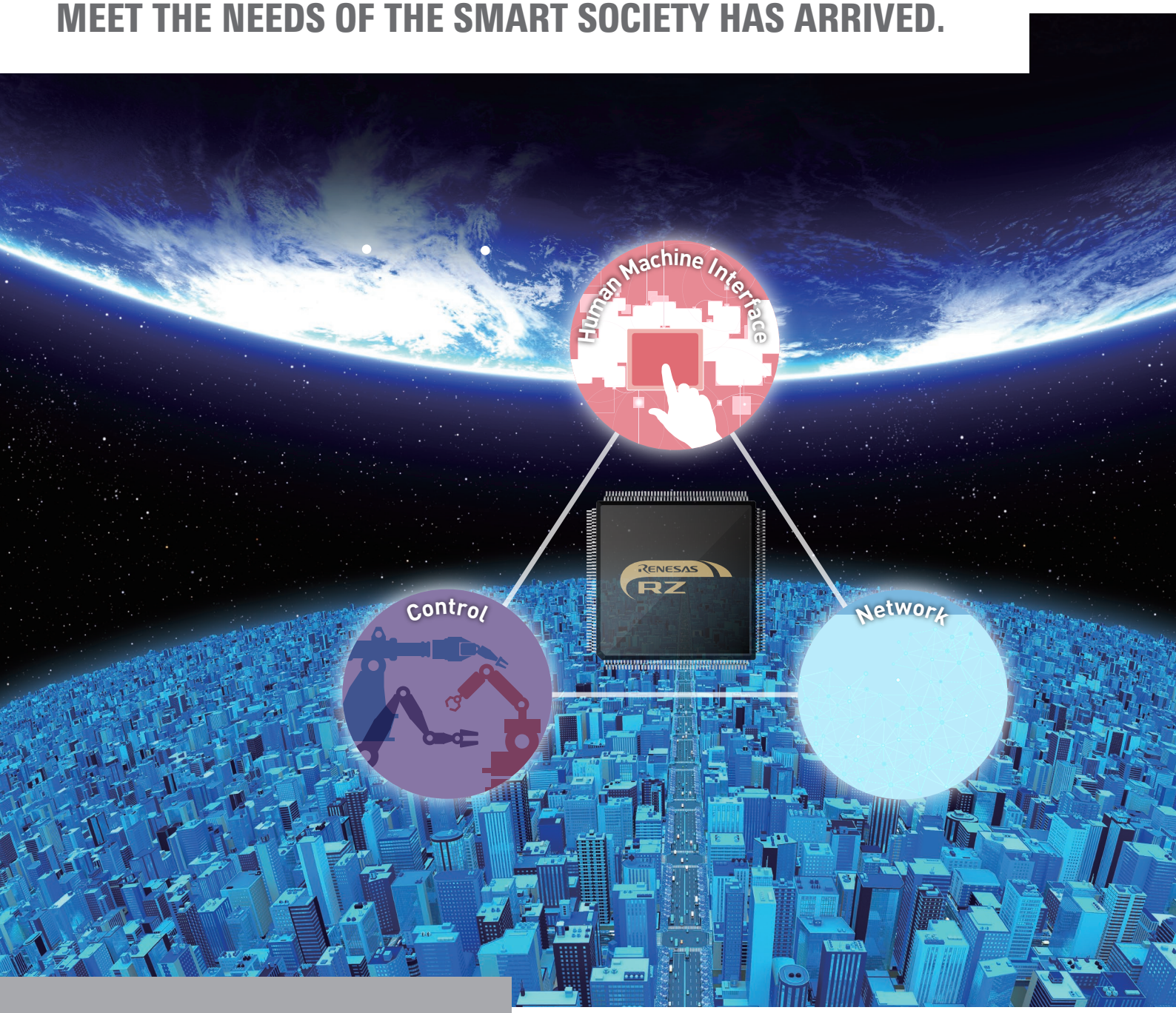




2020.02

RENESAS RZ

THE NEXT-GENERATION PROCESSOR TO MEET THE NEEDS OF THE SMART SOCIETY HAS ARRIVED.



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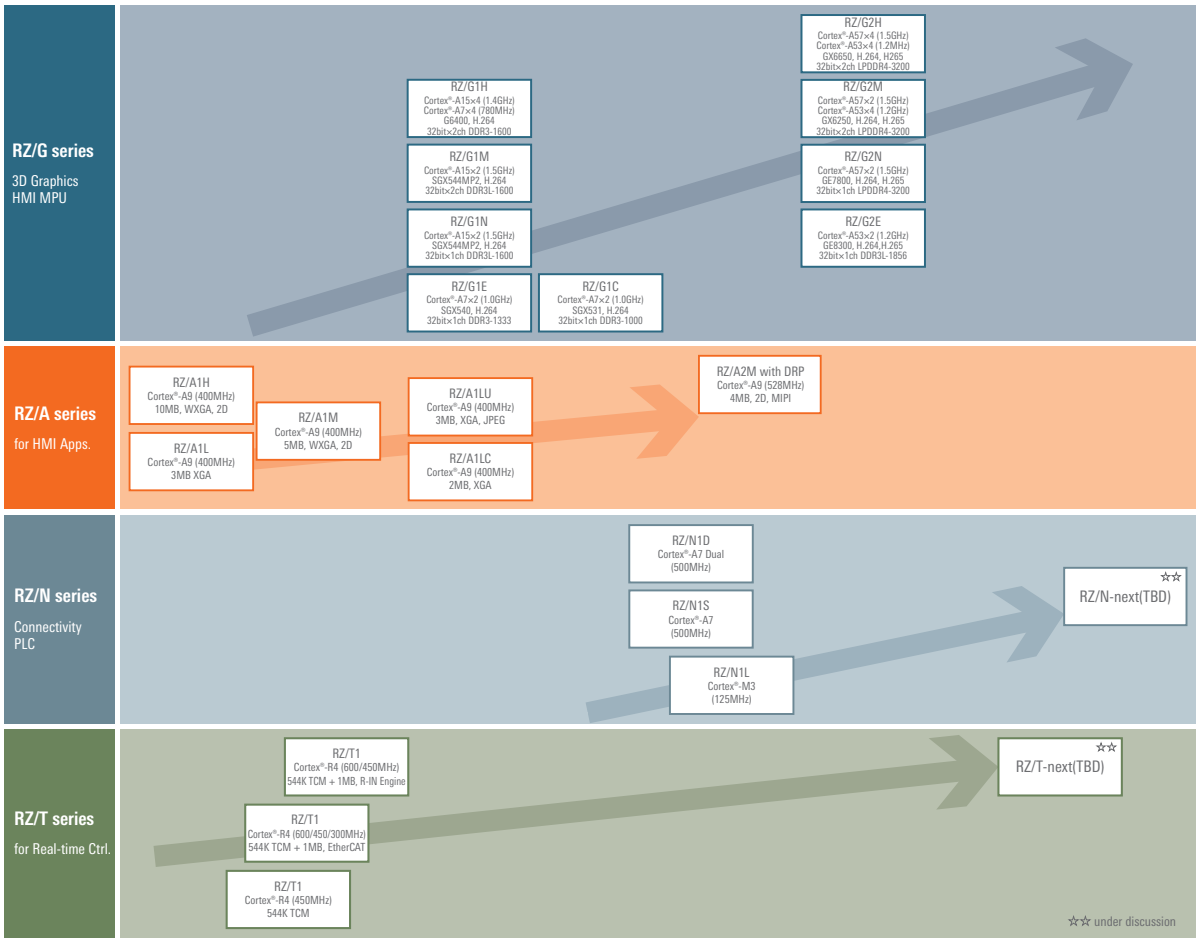


The utilization of intelligent technology is advancing in all aspects of our lives, including electric household appliances, industrial equipment, building management, power grids, and transportation. The cloud-connected “smart society” is coming ever closer to realization. Microcontrollers are now expected to provide powerful capabilities not available previously, such as high-performance and energy-efficient control combined with interoperation with IT networks, support for human-machine interfaces, and more. To meet the demands of this new age, Renesas has drawn on its unmatched expertise in microcontrollers to create the RZ family of embedded processors. The lineup of these “next-generation processors that are as easy to use as conventional microcontrollers” to meet different customer requirements.

The Zenith of the Renesas micro

As embedded processors to help build the next generation of advanced products, the RZ family offers features not available elsewhere and brings new value to customer applications.

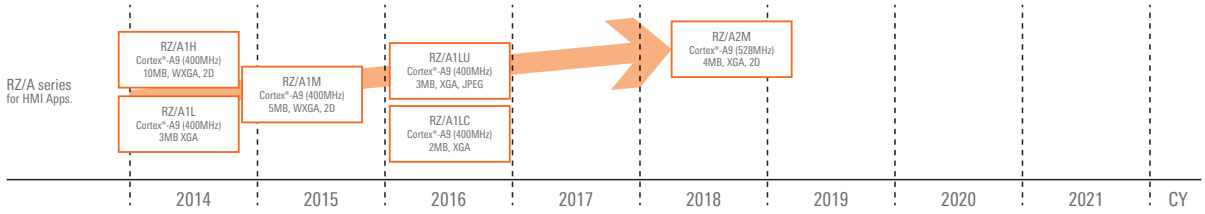
RZ Family Roadmap



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RZ/A Series

RZ/A Series: Roadmap



RZ/A Series: Application Fields

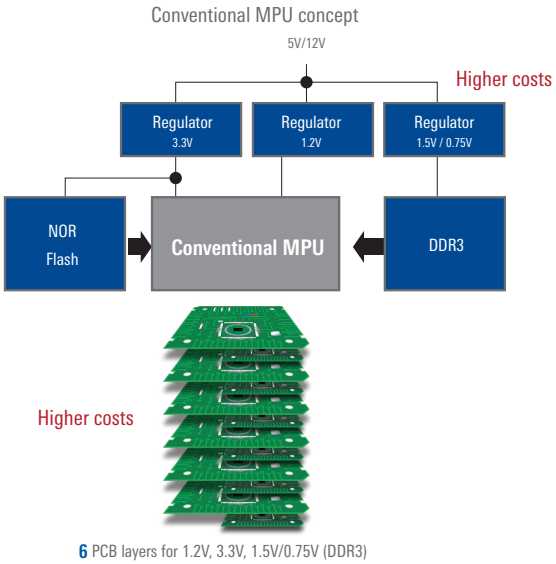


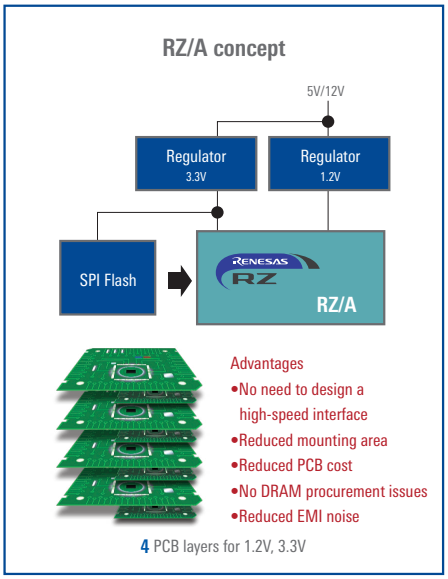
RZ/A Series Features

- Large-capacity on-chip RAM: 10MB
- Graphics display and camera input capabilities on a single chip
- Rich peripheral functions and software

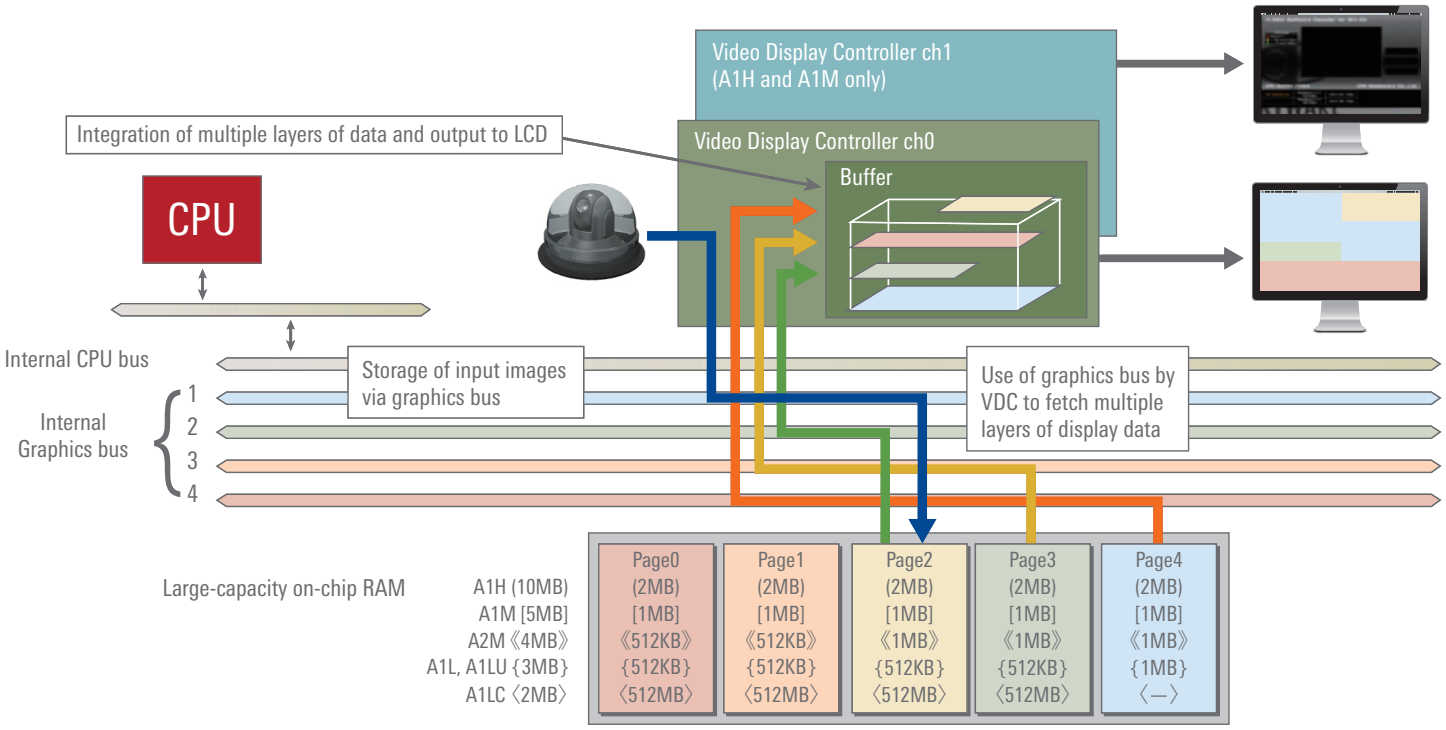
Large-capacity on-chip RAM: 10MB

DRAM-less solution



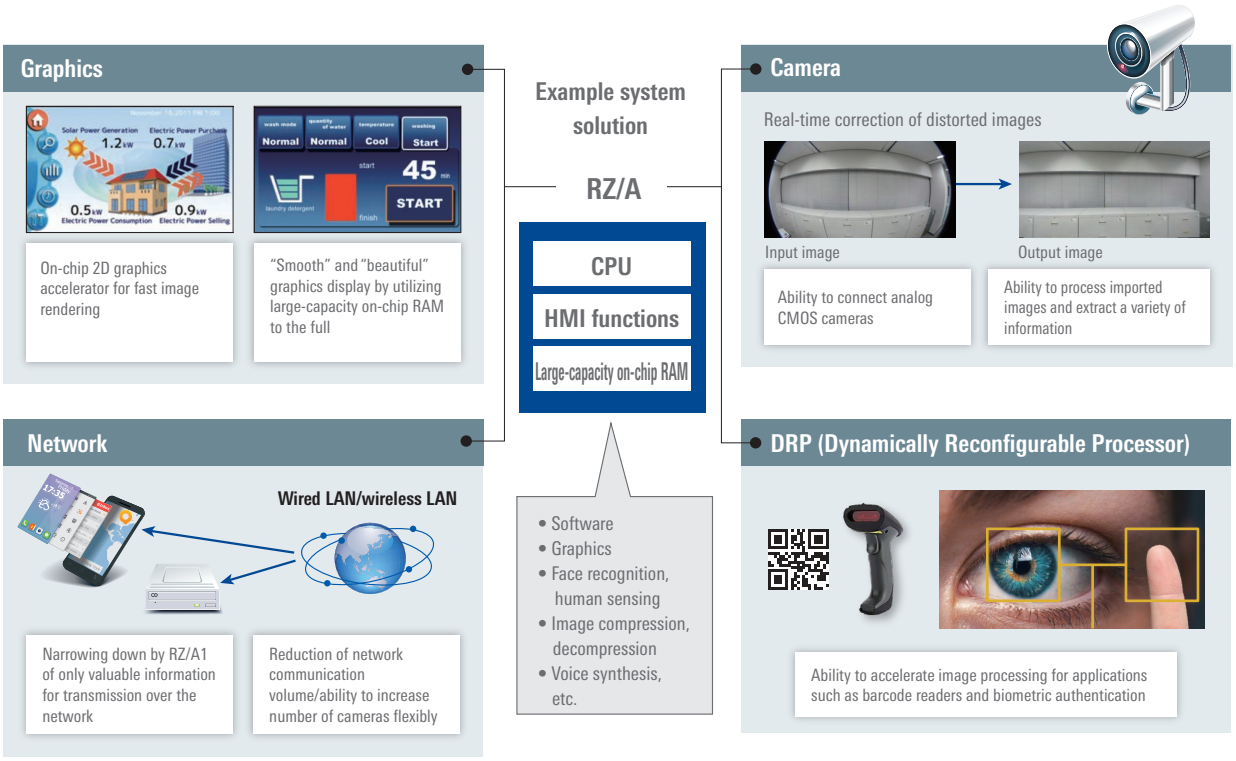


Graphics display and camera input capabilities on a single chip



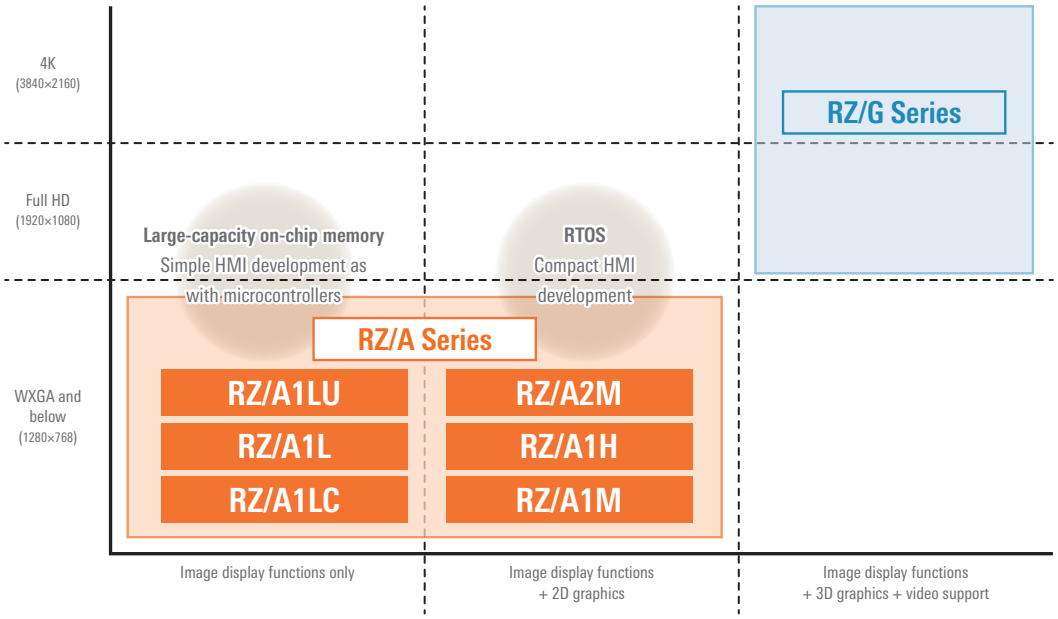
The bus configuration with independent buses for images and hardware-based superimposition processing make it easy to create graphical applications.

Rich peripheral functions and software



With ample peripheral functions and software, a single chip can cover a wide range of fields, including display, camera input, communication, and audio functions.

HMI Solutions



- HMI solutions optimized to match the image resolution, functions, and OS
- RZ/G series: Full HD, functions: 3D Gfx, vide, OS: Linux (RichOS)
- RZ/A series: WXGA and below, functions: 2D Gfx, camera input processing, OS: RTOS

RZ/A2M Group

CPU (Arm® Cortex®-A9)
- Operating frequency: 528MHz
- Single-precision/double-precision FPU
- Arm® NEON™

On-chip memory
- 4MB

Main graphics and camera input functions
- Video display controller (VDC6): 1 channel
  LCD output: Max. WXGA
  Screen superimposition: 3 layers
  Video input: Max. XGA
- CMOS camera input (CEU): 1 channel
- MIPI-CSI2 interface: 1 channel
- Distortion compensation unit (IMR): 1 channel
- 2D graphics engine: 1 channel
- Sprite engine: 1 channel
- JPEG coding engine: 1 channel

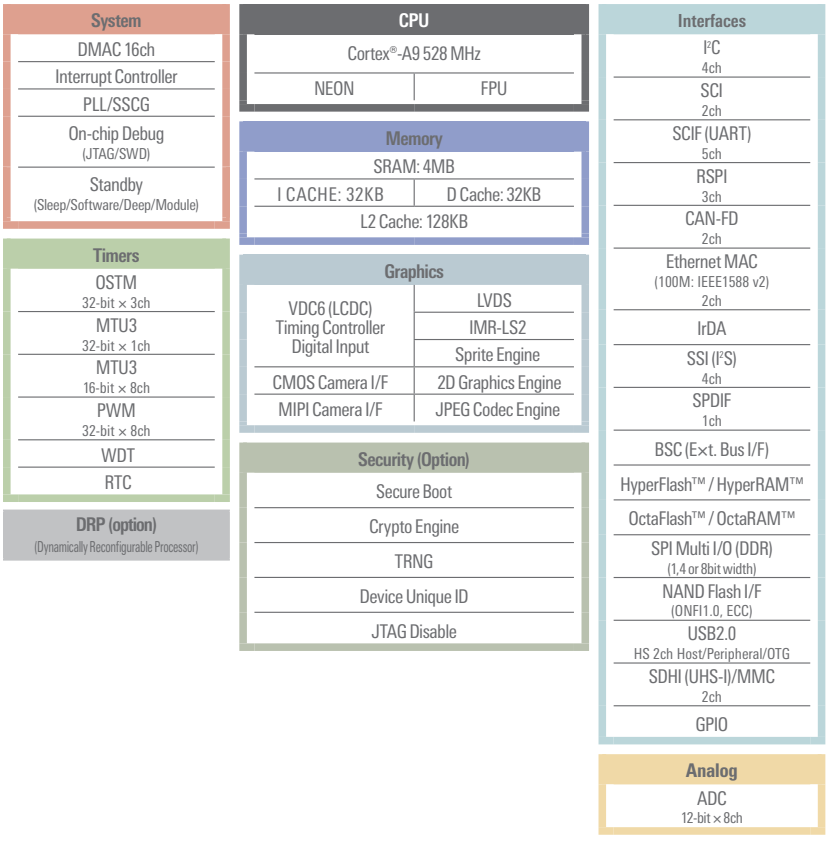
Main memory interface functions
- NOR flash, SDRAM, NAND flash
- Serial flash: 1-bit/4-bit/8-bit: 1 channel, 8-bit: 1 channel
  (ability to run stored programs directly)
- SD/MMC host interface: 2 channels

Main communication functions
- USB 2.0 High Speed: 2 channels (Host/Function switchable)
- 10M/100M EtherMAC: 2 channels
- SCIF: 5 channels
- I²C: 4 channels
- SSI: 4 channels
- RSPI: 3 channels
- CAN-FD: 2 channels

Optional functions
- DRP (Dynamically Reconfigurable Processor)

Package
- 176-LFBGA (13mm×13mm, 0.8mm pitch)
- 256-LFBGA (11mm×11mm, 0.5mm pitch
- 272-FBGA (17mm×17mm, 0.8mm pitch
- 324-FBGA (19mm×19mm, 0.8mm pitch

RZ/A2M block diagram



RZ/A1H Group and RZ/A1M Group (Pin Compatible)

CPU (Arm® Cortex®-A9)
- Operating frequency: 400MHz
- Single-precision/double-precision FPU
- Arm® NEON™

On-chip memory
- RZ/A1H: 10MB
- RZ/A1M: 5MB

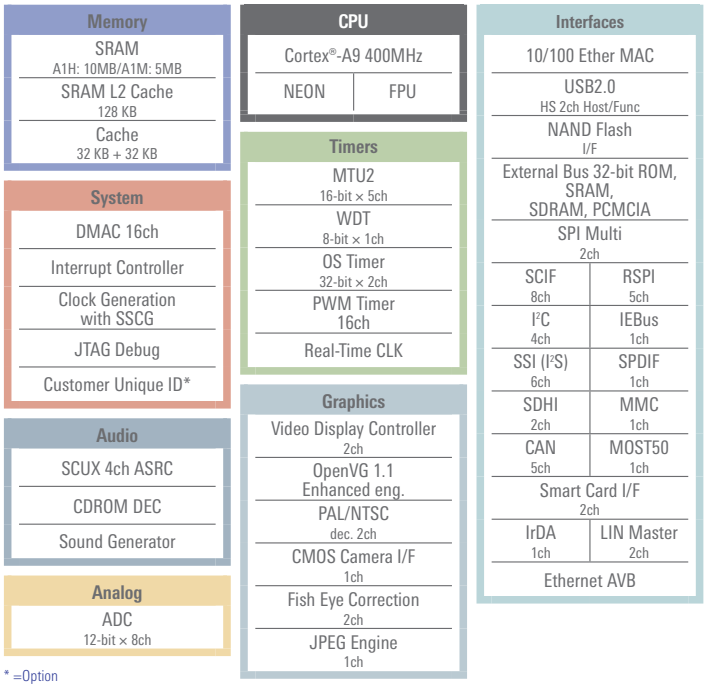
Main graphics and camera input functions
- Video display controller (VDC5): 2 channels
  LCD output: Max. WXGA
  Screen superimposition: 4 layers
  Video input: Max. XGA (CVBS analog input supported)
- CMOS camera input (CEU): 1 channel
- PAL/NTSC decoder (DVDEC): 2 channels
- Distortion compensation unit (IMR): 1 channel
- Open VG accelerator: 1 channel
- JPEG coding engine: 1 channel

Main memory interface functions
- NOR flash, SDRAM, NAND flash
- QSPI serial flash: 2 channels (ability to run stored programs directly)
- SD host interface: 2 channels
- MMC host interface: 1 channel

Main communication functions
- USB 2.0 High Speed: 2 channels (Host/Function switchable)
- 10M/100M EtherMAC: 1channel
- SCIF: 8 channels
- I²C: 4 channels
- SSI: 6 channels
- RSPI: 5 channels
- Ethernet AVB: 1 channel
- CAN: 5 channels

Package
- 256-LFBGA (11mm × 11mm,0.5mm pitch)
- 256-LFQFP (28mm × 28mm,0.4mm pitch)
- 324-FBGA (19mm × 19mm,0.8mm pitch)

RZ/A1H,and RZ/A1M block diagram



* =Option

RZ/A1LU Group

CPU (Arm® Cortex®-A9)
- Operating frequency: 400MHz
- Single-precision/double-precision FPU
- Arm® NEON™

On-chip memory
- RZ/A1LU: 3MB

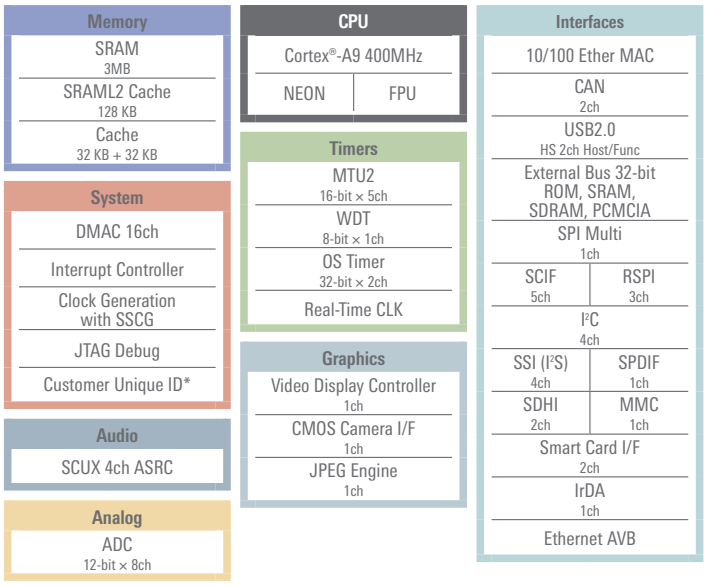
Main graphics and camera input functions
- LCD controller (VDC5): 1 channel
  LCD output: Max. WXGA
  Screen superimposition: 3 layers
  Video input: Max. XGA
- CMOS camera input (CEU): 1 channel
- JPEG coding engine: 1 channel

Main memory interface functions
- NOR flash, SDRAM
- QSPI serial flash: 1 channel (ability to run stored programs directly)
- SD host interface: 2 channels
- MMC host interface: 1 channel

Main communication functions
- USB 2.0 High Speed: 2 channels (Host/Function switchable)
- 10M/100M EtherMAC: 1 channel
- SCIF: 5 channels
- I²C: 4 channels
- SSI: 4 channels
- RSPI: 3 channels
- Ethernet AVB: 1 channel
- CAN: 2 channels

Package
- 176-LFBGA (8mm × 8mm,0.5mm pitch)
- 176-LFQFP (24mm × 24mm,0.5mm pitch)
- 208-LFQFP (28mm × 28mm,0.5mm pitch)

RZ/A1LU block diagram



* =Option

RZ/A1L, RZ/A1LC Group

CPU (Arm® Cortex®-A9)
- Operating frequency: 400MHz
- Single-precision/double-precision FPU
- Arm® NEON™

On-chip memory
- RZ/A1L: 3MB
- RZ/A1LC: 2MB

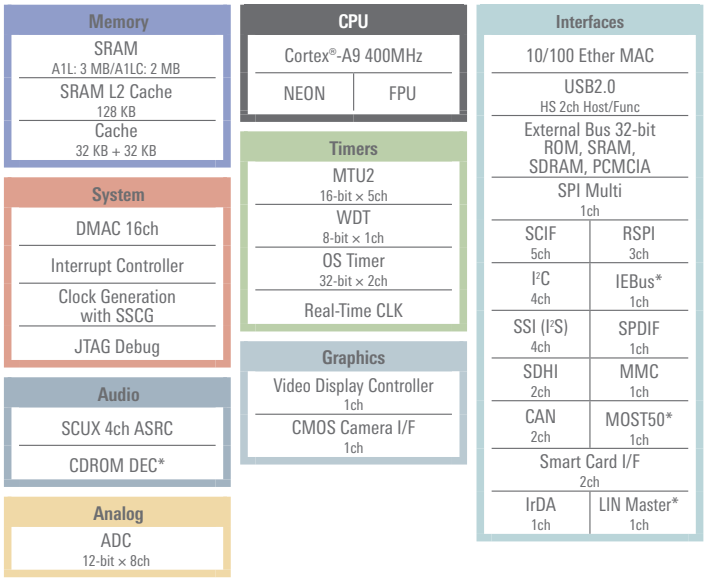
Main graphics and camera input functions
- LCD controller (VDC5): 1 channel
  LCD output: Max. WXGA
  Screen superimposition: 3 layers
  Video input: Max. XGA
- CMOS camera input (CEU): 1 channel

Main memory interface functions
- NOR flash, SDRAM, NAND flash
- QSPI serial flash: 1 channel (ability to run stored programs directly)
- SD host interface: 2 channels
- MMC host interface: 1 channel

Main communication functions
- USB 2.0 High Speed: 2 channels (Host/Function switchable)
- 10M/100M EtherMAC: 1 channel
- SCIF: 5 channels
- I²C: 4 channels
- SSI: 4 channels
- RSPI: 3 channels
- CAN: 2 channels

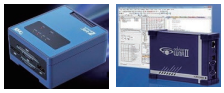
Package
- 176-LFBGA (8mm × 8mm,0.5mm pitch)
- 176-LFQFP (24mm × 24mm,0.5mm pitch)
- 208-LFQFP (28mm × 28mm,0.5mm pitch)
- 233-FBGA (15mm × 15mm, 0.8mm pitch)

RZ/A1L, RZ/A1LC block diagram



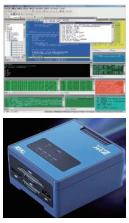
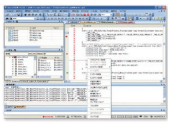
* RZ/A1L Group specification only.

RZ/A Series: Development Environments (Integrated Development Environments)

	arm	IAR SYSTEMS	eSOL	RENESAS
Development environments	• DS-5 	• IAR Embedded Workbench® for Arm® 	• eBinder 	• e² studio*3 
Compilers	• Arm CC*1	• IAR C/C++ compiler*2	• Arm CC*1	• GNU tool*4
ICEs	• DSTREAM™ • ULINKpro™ • ULINKproD™ • ULINK2™  	• I-jet™/I-jet Trace™ for Arm Cortex®-A/R/M • JTAGjet-Trace 	• PARTNER-Jet2 from Kyoto Microcomputer Co., Ltd. • adviceLUNAII from DTS INSIGHT Corporation 	• J-Link LITE from Segger • J-Link series from Segger*5 

*1. Arm CC is included in DS-5 Starter Kit for RZ/A and RZ/T, which is available free of charge, and in the popularly priced DS-5 RZ/A Edition. There is also a free evaluation version that provides full functionality but is limited to 30 days of use. Contact a DS-5 sales agent for details.
*2. A free evaluation license is available provided the 30-day time-limited evaluation or the permanent 32KB size-limited evaluation (www.iar.com/EWARM)
*3. Eclipse-based development environment from Renesas (https://www.renesas.com/e2studio)
*4. GNU TOOLS & SUPPORT Website (https://gcc-renesas.com)
*5. Renesas does not handle ICEs from Segger. Contact a sales agent for details.

RZ/A Series: Development Tools (Debuggers, ICEs)

	KYC Kyoto Microcomputer Co., Ltd.	DTS INSIGHT Our insight, your value	Computex
Debuggers	• PARTNER-Jet2 	• microVIEW-PLUS 	• CSIDE version 7 
ICEs		• adviceLUNA II 	• PALMiCE4  JTAG model  Large capacity trace model
Supported compilers	• exeGCC from Kyoto Microcomputer • GNU tool*1 • Arm CC*2 • IAR C/C++ compiler,*3 etc.	• Arm CC*2 • GNU tool,*1 etc.	• Arm CC*2 • IAR C/C++ compiler*3 • GNU tool,*1 etc.

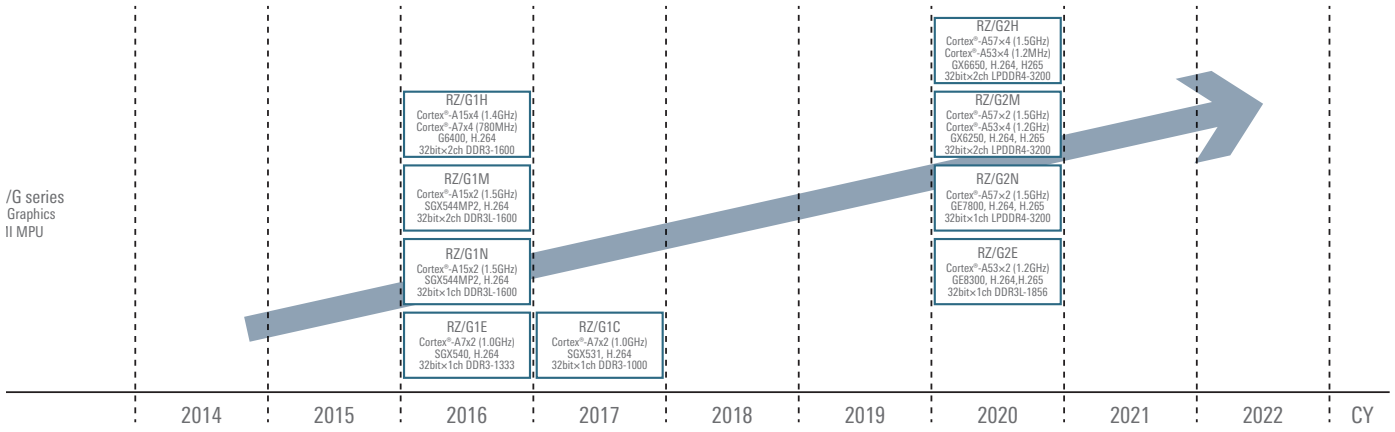
*1. GNU TOOLS & SUPPORT Website (https://gcc-renesas.com)
*2. Arm CC is included in DS-5. In addition to the popularly priced DS-5 RZ/A and RZ/T editions, a fully functional evaluation version of DS-5 that expires after 30 days is available free of charge. Contact your DS-5 dealer for details.
*3. Two versions of the software are available for download free of charge. One limits the code size to 32KB and can be used with no time limitation. The other has no limit on code size and expires after 30 days. (www.iar.com/EWARM)

RZ/A Series: Solutions from Partner Companies

Visit the webpage below for the latest information on RZ/A Series development tools, including solutions from partner companies.
https://www.renesas.com/products/microcontrollers-microprocessors/rz/softtools.html#rza

RZ/G Series

RZ/G Series: Roadmap



RZ/G2 Platform Highlights

- **High Performance**

  64-bit Arm®v8-A cores, plus powerful graphics engine and 4k UHD video engine, to offer the highest performance per dollar

- **High Reliability**

  Built-in Error Correction Code (ECC) for internal and external memory, which is essential for high-reliability mission critical systems

- **Super Long Term Support (SLTS) for Linux**

  Civil Infrastructure Platform (CIP) offers 10+ years support for Linux kernel

- **RZ/G Linux Platform Solution**

  Reduce development cost and time with Renesas verified software for RZ/G MPUs

RZ/G2 Group Specifications

	RZ/G2H	RZ/G2M	RZ/G2N	RZ/G2E
CPU	4× Cortex®-A57@1.5GHz 4× Cortex®-A53@1.2GHz L1,L2 Parity/ECC	2× Cortex®-A57@1.5GHz 4× Cortex®-A53@1.2GHz L1,L2 Parity/ECC	2× Cortex®-A57@1.5GHz L1,L2 Parity/ECC	 2× Cortex®-A53@1.2GHz L1,L2 Parity/ECC
DRAM I/F	32-bit ×2ch LPDDR4(3200) w/ECC	32-bit ×2ch LPDDR4(3200) w/ECC	32-bit ×1ch LPDDR4(3200) w/ECC	32-bit ×1ch DDR3L(1856) w/ECC
Video in	2×MIPI-CSI2, 2×Digital (RGB/YCbCr) up to 8 input image can be captured	2×MIPI-CSI2, 2×Digital (RGB/YCbCr) up to 8 input image can be captured	2×MIPI-CSI2, 2×Digital (RGB/YCbCr) up to 8 input image can be captured	1×MIPI-CSI2, 1×Digital(RGB/YCbCr) up to 2 input image can be captured
Video Codec	Support up to 4k resolutions Decoding : H.265, Encoding and Decoding : H.264	Support up to 4k resolutions Decoding : H.265, Encoding and Decoding : H.264	Support up to 4k resolutions Decoding : H.265, Encoding and Decoding : H.264	Support up to FHD resolutions Decoding : H.265, Encoding and Decoding : H.264
3D GFX	PowerVR GX6650@600MHz	PowerVR GX6250@600MHz	PowerVR GE7800@600MHz	PowerVR GE8300@600MHz
Display out	1×HDMI, 1×LVDS, 1×Digital RGB	1×HDMI, 1×LVDS, 1×Digital RGB	1×HDMI, 1×LVDS, 1×Digital RGB	2×LVDS or 1×LVDS, 1×Digital RGB
USB	USB2.0×2ch (1H, 1H/F/OTG) USB3.0/2.0×1ch (DRD)	USB2.0×2ch (1H, 1H/F/OTG) USB3.0/2.0×1ch (DRD)	USB2.0×2ch (1H, 1H/F/OTG) USB3.0/2.0×1ch (DRD)	USB2.0×1ch (H/F) USB3.0/2.0×1ch (DRD)
Gbit Ether	1ch	1ch	1ch	1ch
PCIe	2ch (Rev2.0 1Lane) one of the 2ch is shared with SATA	2ch (Rev2.0 1Lane)	2ch (Rev2.0 1Lane) one of the 2ch is shared with SATA	1ch(Rev2.0 1Lane)
SATA	1ch (Pin Shared)	No	1ch (Pin Shared)	No
Package	1022pin FCBGA, 29mm×29mm 0.8mm ball pitch	1022pin FCBGA, 29mm×29mm 0.8mm ball pitch	1022pin FCBGA, 29mm×29mm 0.8mm ball pitch	552pin FCBGA, 21mm×21mm 0.8mm ball pitch

Pin Compatible

Super Long Term Software Support

Renesas RZ/G2 microprocessors are the only embedded MPUs that meet the long-term support demands for industrial and infrastructure equipment manufacturers through the 10+ year support offered by the Super Long Term Support (SLTS) kernel maintained by the Civil Infrastructure Platform (CIP). The CIP SLTS Linux kernel supports countermeasures against vulnerability to security attacks with a long-term maintenance period of 10 years or more. This reduces Linux maintenance costs and simplifies adoption of reliable industrial-grade Linux.

RZ/G Linux Platform Reduces Cost and Simplifies Design

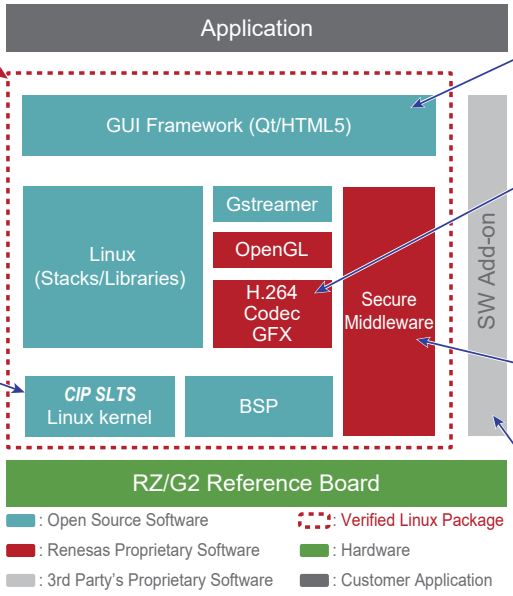
Start developing applications quickly with reduced costs. Minimize resources for maintenance.
The RZ/G Linux Platform includes a reference board and the following no-charge development package:

Verified Linux Package (VLP) with CIP SLTS kernel
- GUI framework and multimedia middleware for HMI
- Security middleware
- A complete software development environment
- Verification test software so customers can perform re-verification in their own systems

CIVIL INFRASTRUCTURE PLATFORM

CIP SLTS Kernel
- Civil Infrastructure Platform project
- 10+ years super long term support Reliability/Security/Real-time

Civil Infrastructure Platform (CIP) Project adopted Renesas RZ/G2M-96CE board as Arm64 reference board for the next CIP SLTS Kernel



GUI Framework
- Qt application framework
- HTML5 application framework

Multimedia
- H.264 codec
- H.265 decoder for 4k UHD
- 3D graphics

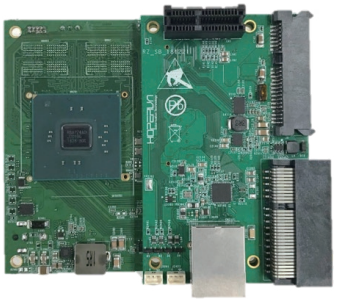
Secure Middleware
- Encrypted kernel boot
- Security communication
- Secure key storage

Renesas Sample Applications
3rd-party Software Add-ons

Flexible Development Kits

RZ/G2 development kits support the industry standard 96Boards specification to enable evaluation and speed development with a wide variety of mezzanine boards. Renesas provides circuit schematics, component BOMs, and board layout data to make it easy to spin your own custom hardware.

RZ/G2M 96 Development Kit



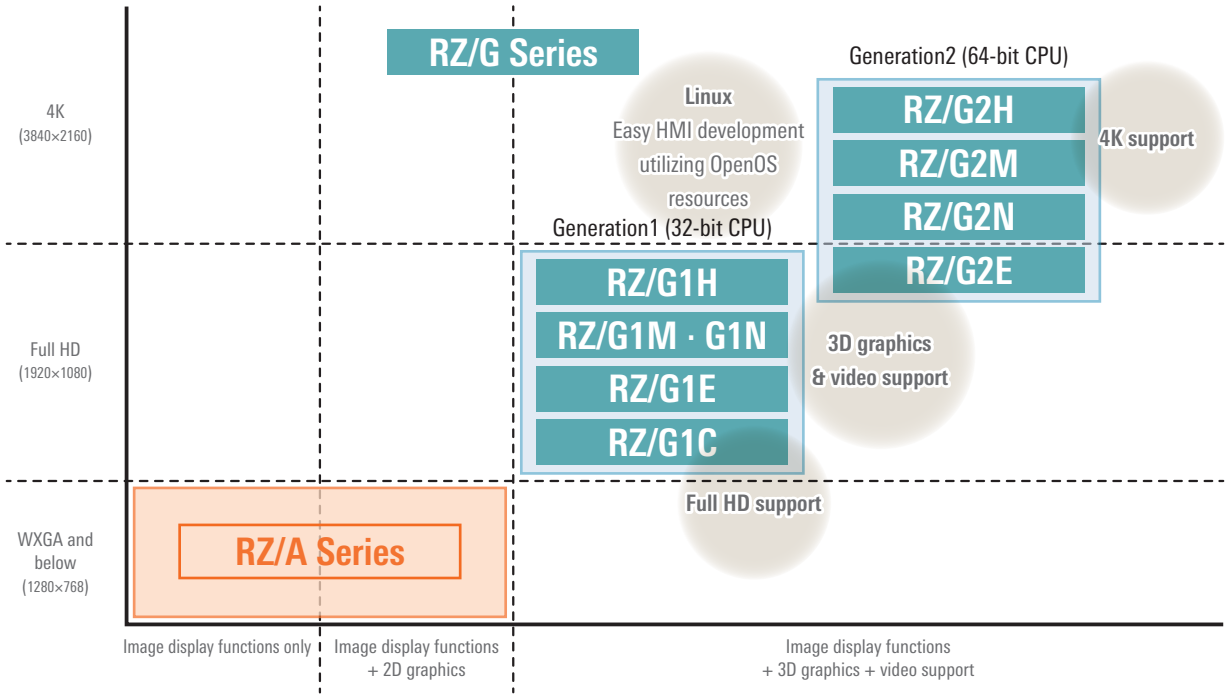
- Main Memory: 4 GB DDR4
- QSPI NOR FLASH 64 MByte
- I²C EEPROM 512 Byte
- External Storage: micro SD × 1
- Connectivity: USB 2.0 × 2ch, USB 3.0 × 1ch, GbE × 1
- HDMI out / LVDS out or MIPI DSI out
- Wi-Fi + BT

RZ/G2E 96 Development Kit



- Main Memory: 2 GB DDR3L
- QSPI NOR FLASH 64 MByte
- I²C EEPROM 512 Byte
- External Storage: micro SD × 1
- Connectivity: USB 2.0 × 2ch, USB 3.0 × 1ch, GbE × 1
- HDMI out / LVDS out or MIPI DSI out
- Wi-Fi + BT

HMI Solutions



- HMI solutions optimized to match the image resolution, functions, and OS
- RZ/G series: Full HD to 4K, functions: 3D Gfx, video, OS: Linux (RichOS)
- RZ/A series: WXGA and below, functions: 2D Gfx, camera input processing, OS: RTOS

RZ/G2H (R8A774Ex)

CPU core
- Arm® Cortex®-A57, quad-core
  Max. operating frequency: 1.5GHz
- Arm® Cortex®-A53, quad-core
  Max. operating frequency: 1.2GHz

Cache memory (Cortex®-A57)
- L1 instruction cache: 48KB
- L1 data cache: 32KB
- L2 cache: 2MB

Cache memory (Cortex®-A53)
- L1 instruction cache: 32KB
- L1 data cache: 32KB
- L2 cache: 512KB

External memory
- Ability to connect LPDDR4-SDRAM via DDR dedicated bus
- Data bus width: 32 bits × 2 channels

External expansion
- Ability to connect flash ROM or SRAM directly
- Data bus width: 8/16 bits
- PCI Express 2.0 : 1 Lane × 2 channels (one of PHY is shared with Serial ATA)

3D graphics
- PowerVR™ GX6650

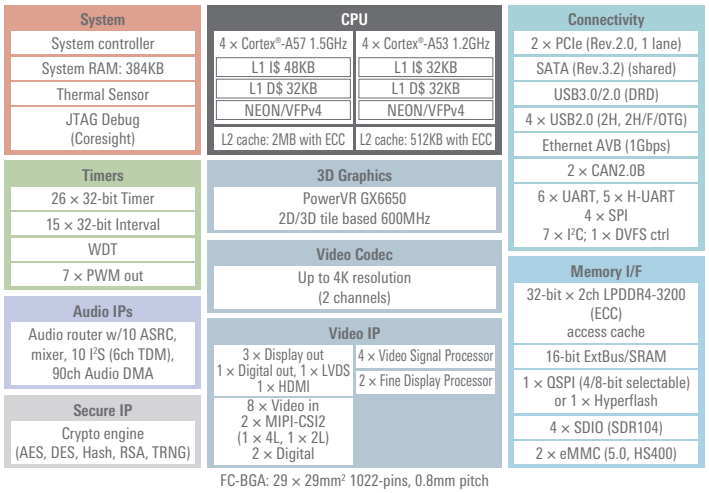
Video functions
- Video display interface × 3 channels (1 channel: HDMI(option), 1 channel: LVDS, 1 channel: RGB888)
- Video input interface × 4 channels (2 channels: MIPI-CSI2, 2 channels: Digital(RGB/YCbCr))
- Video codec module: VCP4 × 1 channel
- IP converter module
- Video image processing functions (color conversion, image enlargement/reduction, filtering)

Audio functions
- Sampling rate converter × 10 channels
- Serial sound interface × 10 channels

Storage interfaces
- USB 3.0 DRD × 1 channel
- USB 2.0 × 2 channels (Host only 1 channel/ Host-Function 1channel)
- SD host interface × 4 channels
- Multimedia card interface × 2 channels
- Serial ATA interface × 1 channel

Other peripheral functions
- 32-bit timer × 15 channels
- PWM timer × 7 channels
- I²C bus interface × 7 channels
- Serial communication interface (SCIF) × 6 channels
- Quad serial peripheral interface (QSPI) × 2 channels (boot support)
- Clock-synchronous serial interface (MSIOF) × 4 channels (SPI/IIS support)
- Ethernet controller with AVB support (support for IEEE 802.1BA, IEEE 802.1AS, IEEE 802.1Qav, and IEEE 1722)
- Controller area network (CAN) interface × 2 channels
- Interrupt controller (INTC)
- Clock generator (CPG): on-chip PLL
- On-chip debug function

RZ/G2H (R8A774Ex) block diagram



FC-BGA: 29 × 29mm² 1022-pins, 0.8mm pitch

RZ/G2M (R8A774Ax)

CPU core
- Arm® Cortex®-A57, dual-core
  Max. operating frequency: 1.5GHz
- Arm® Cortex®-A53, quad-core
  Max. operating frequency: 1.2GHz

Cache memory (Cortex®-A57)
- L1 instruction cache: 48KB
- L1 data cache: 32KB
- L2 cache: 2MB

Cache memory (Cortex®-A53)
- L1 instruction cache: 32KB
- L1 data cache: 32KB
- L2 cache: 512KB

External memory
- Ability to connect LPDDR4-SDRAM via DDR dedicated bus
- Data bus width: 32 bits × 2 channels

External expansion
- Ability to connect flash ROM or SRAM directly
- Data bus width: 8/16 bits
- PCI Express 2.0 : 1 Lane × 2 channels

3D graphics
- PowerVR™ GX6250

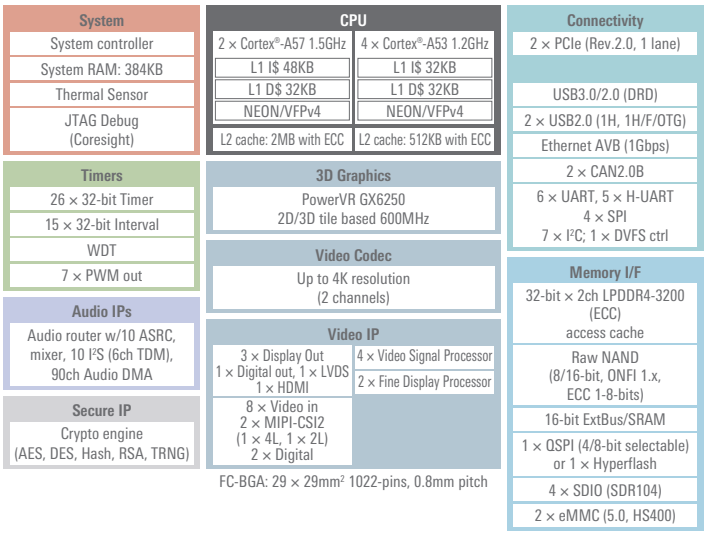
Video functions
- Video display interface × 3 channels (1 channel: HDMI(option), 1 channel: LVDS, 1 channel: RGB888)
- Video input interface × 4 channels (2 channels: MIPI-CSI2, 2 channels: Digital(RGB/YCbCr))
- Video codec module: VCP4 × 1 channel
- IP converter module
- Video image processing functions (color conversion, image enlargement/reduction, filtering)

Audio functions
- Sampling rate converter × 10 channels
- Serial sound interface × 10 channels

Storage interfaces
- USB 3.0 DRD × 1 channel
- USB 2.0 × 2 channels (Host only 1 channel/ Host-Function 1channel)
- SD host interface × 4 channels
- Multimedia card interface × 2 channels

Other peripheral functions
- 32-bit timer × 15 channels
- PWM timer × 7 channels
- I²C bus interface × 7 channels
- Serial communication interface (SCIF) × 6 channels
- Quad serial peripheral interface (QSPI) × 2 channels (boot support)
- Clock-synchronous serial interface (MSIOF) × 4 channels (SPI/IIS support)
- Ethernet controller with AVB support (support for IEEE 802.1BA, IEEE 802.1AS, IEEE 802.1Qav, and IEEE 1722, GMII/MII interface, PHY device connection support)
- Ethernet controller with AVB support (support for IEEE 802.1BA, IEEE 802.1AS, IEEE 802.1Qav, and IEEE 1722)
- Controller area network (CAN) interface × 2 channels
- Interrupt controller (INTC)
- Clock generator (CPG): on-chip PLL
- On-chip debug function

RZ/G2M (R8A774Ax) block diagram



FC-BGA: 29 × 29mm² 1022-pins, 0.8mm pitch

RZ/G2N (R8A774Bx)

CPU core
- Arm® Cortex®-A57, dual-core
  Max. operating frequency: 1.5GHz

Cache memory (Cortex®-A57)
- L1 instruction cache: 48KB
- L1 data cache: 32KB
- L2 cache: 2MB

External memory
- Ability to connect LPDDR4-SDRAM via DDR dedicated bus
- Data bus width: 32 bits × 1 channel

External expansion
- Ability to connect flash ROM or SRAM directly
- Data bus width: 8/16 bits
- PCI Express 2.0 : 1 Lane × 2 channels (one of PHY is shared with Serial ATA)

3D graphics
- PowerVR™ GE7800

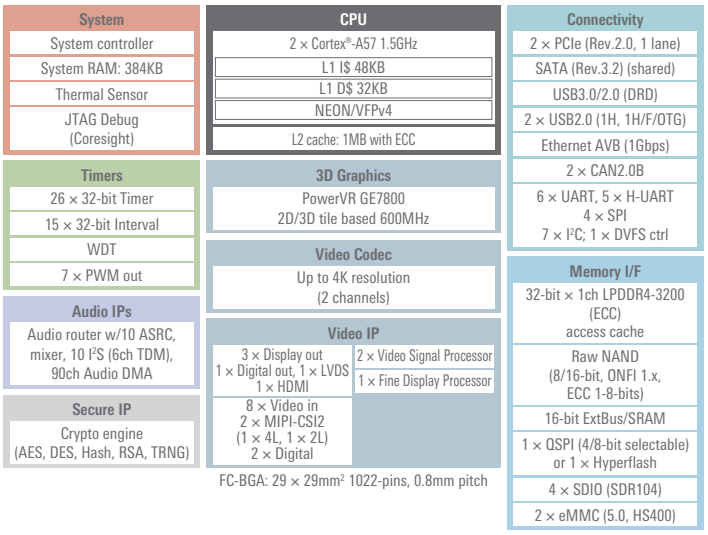
Video functions
- Video display interface × 3 channels (1 channel: HDMI(option), 1 channel: LVDS, 1 channel: RGB888)
- Video input interface × 4 channels (2 channels: MIPI-CSI2, 2 channels: Digital(RGB/YCbCr))
- Video codec module: VCP4 × 1 channel
- IP converter module
- Video image processing functions (color conversion, image enlargement/reduction, filtering)

Audio functions
- Sampling rate converter × 10 channels
- Serial sound interface × 10 channels

Storage interfaces
- USB 3.0 DRD × 1 channel
- USB 2.0 × 2 channels (Host only 1 channel/ Host-Function 1channel)
- SD host interface × 4 channels
- Multimedia card interface × 2 channels
- Serial ATA interface × 1 channel

Other peripheral functions
- 32-bit timer × 15 channels
- PWM timer × 7 channels
- I²C bus interface × 7 channels
- Serial communication interface (SCIF) × 6 channels
- Quad serial peripheral interface (QSPI) × 2 channels (boot support)
- Clock-synchronous serial interface (MSIOF) × 4 channels (SPI/IIS support)
- Ethernet controller with AVB support (support for IEEE 802.1BA, IEEE 802.1AS, IEEE 802.1Qav, and IEEE 1722)
- Controller area network (CAN) interface × 2 channels
- Interrupt controller (INTC)
- Clock generator (CPG): on-chip PLL
- On-chip debug function

RZ/G2N (R8A774Bx) block diagram



FC-BGA: 29 × 29mm² 1022-pins, 0.8mm pitch

RZ/G2E (R8A774C0)

CPU core
- Arm® Cortex®-A53, dual-core
  Max. operating frequency: 1.2GHz

Cache memory (Cortex®-A53)
- L1 instruction cache: 32KB
- L1 data cache: 32KB
- L2 cache: 256KB

External memory
- Ability to connect DDR3L-SDRAM via DDR dedicated bus
- Data bus width: 32 bits × 1channel

External expansion
- Ability to connect flash ROM or SRAM directly
- Data bus width: 8/16 bits
- PCI Express 2.0 : 1 Lane × 1 channel

3D graphics
- PowerVR™ GE8300

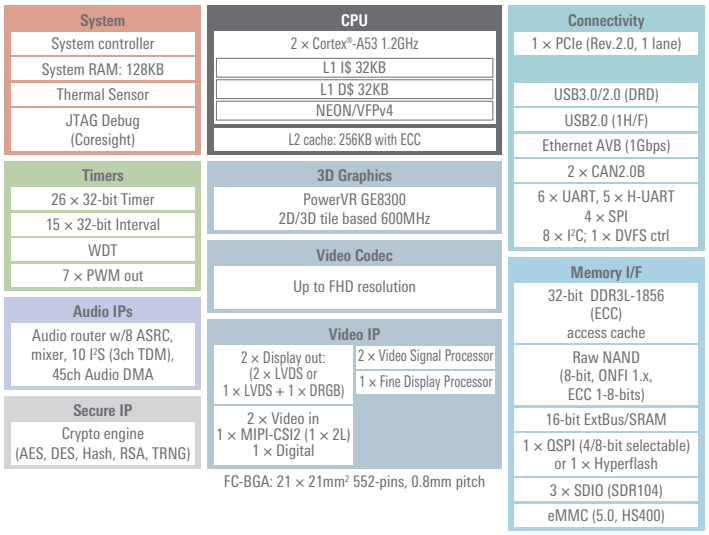
Video functions
- Video display interface × 2 channels (2 channels: LVDS, 1 channel: RGB888)
- Video input interface × 3 channels (1 channels: MIPI-CSI2, 2 channels: Digital(RGB/YCbCr))
- Video codec module: VCP4 × 1 channel
- IP converter module
- Video image processing functions (color conversion, image enlargement/reduction, filtering)

Audio functions
- Sampling rate converter × 10 channels
- Serial sound interface × 10 channels

Storage interfaces
- USB 3.0 DRD × 1 channel
- USB 2.0 × 1 channel (Host-Function 1channel)
- SD host interface × 3 channels
- Multimedia card interface × 1 channel

Other peripheral functions
- 32-bit timer × 15 channels
- PWM timer × 7 channels
- I²C bus interface × 8 channels
- Serial communication interface (SCIF) × 6 channels
- Quad serial peripheral interface (QSPI) × 2 channels (boot support)
- Clock-synchronous serial interface (MSIOF) × 4 channels (SPI/IIS support)
- Ethernet controller with AVB support (support for IEEE 802.1BA, IEEE 802.1AS, IEEE 802.1Qav, and IEEE 1722)
- Controller area network (CAN) interface × 2 channels
- Interrupt controller (INTC)
- Clock generator (CPG): on-chip PLL
- On-chip debug function

RZ/G2E (R8A774C0) block diagram



FC-BGA: 21 × 21mm² 552-pins, 0.8mm pitch

RZ/G Series: Application Fields

The HMI can be made more expressive by making full use of the 3D graphics and video capabilities.


KIOSK/POS Terminal


Measuring Equipment

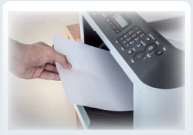

Inspection Device


Medical Display


Nurse Call System


CNC Equipment


Doorbell System


Multifunction Printer


Building Automation Control Panel


Digital Signage


Monitoring System


Industrial Display

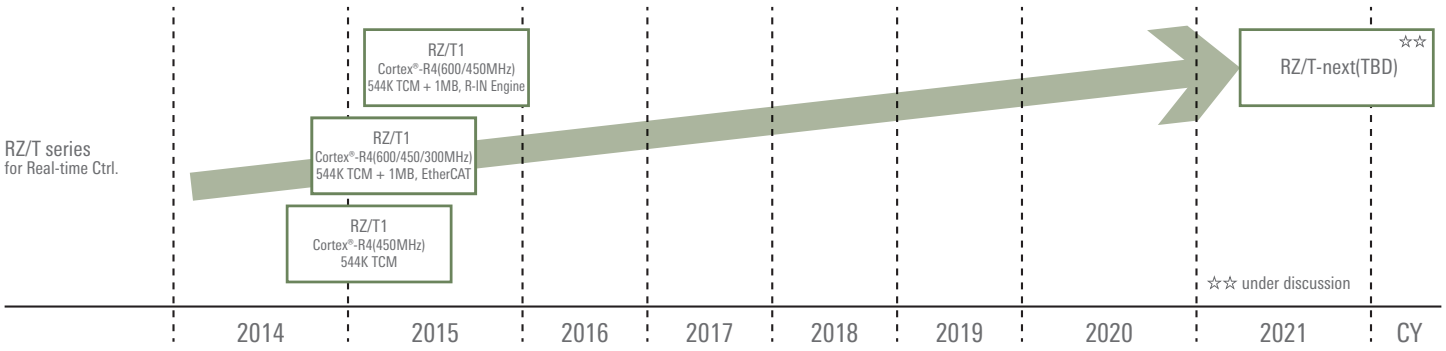

Surveillance Camera

RZ/G Linux Platform Solutions from Partner Companies

Visit the webpage below for the latest information on RZ/G Linux Platform development tools, including solutions from partner companies.
https://www.renesas.com/products/microcontrollers-microprocessors/rz/softtools.html#rzg

RZ/T Series

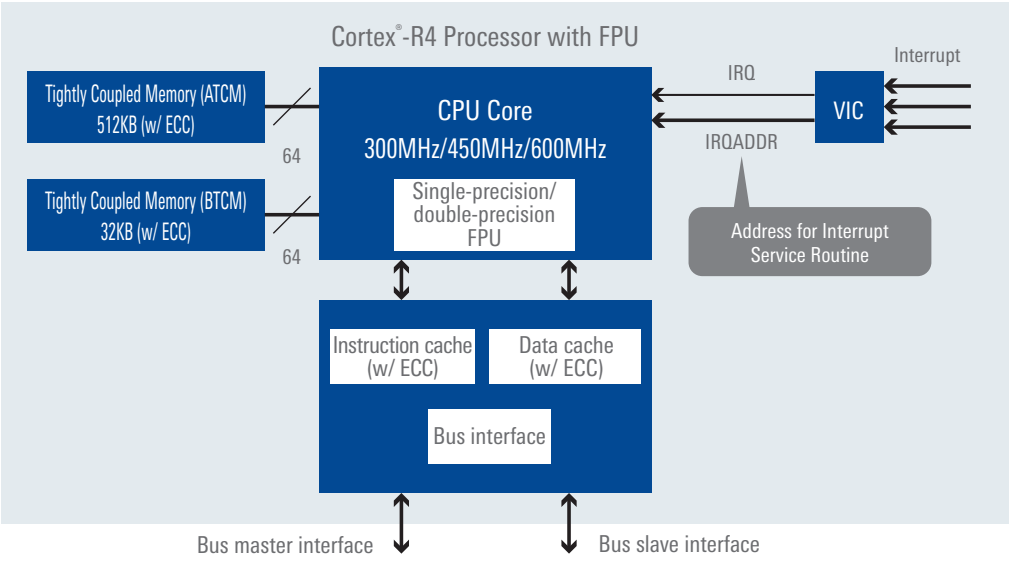
RZ/T Series: Roadmap



RZ/T Series Features

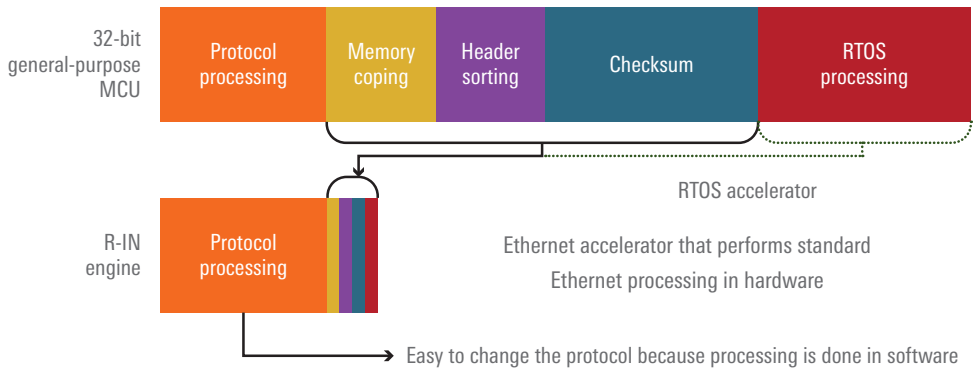
- High-performance, high-speed real-time control
- R-IN engine
- Integrated peripheral functions

High-performance, high-speed real-time control



- High-speed RAM directly connected to the CPU for high-speed processing and dependable real-time responsiveness without caching
- ECC for enhanced reliability
- Vectored Interrupt Controller (VIC) to assure interrupt responsiveness suitable for embedded control

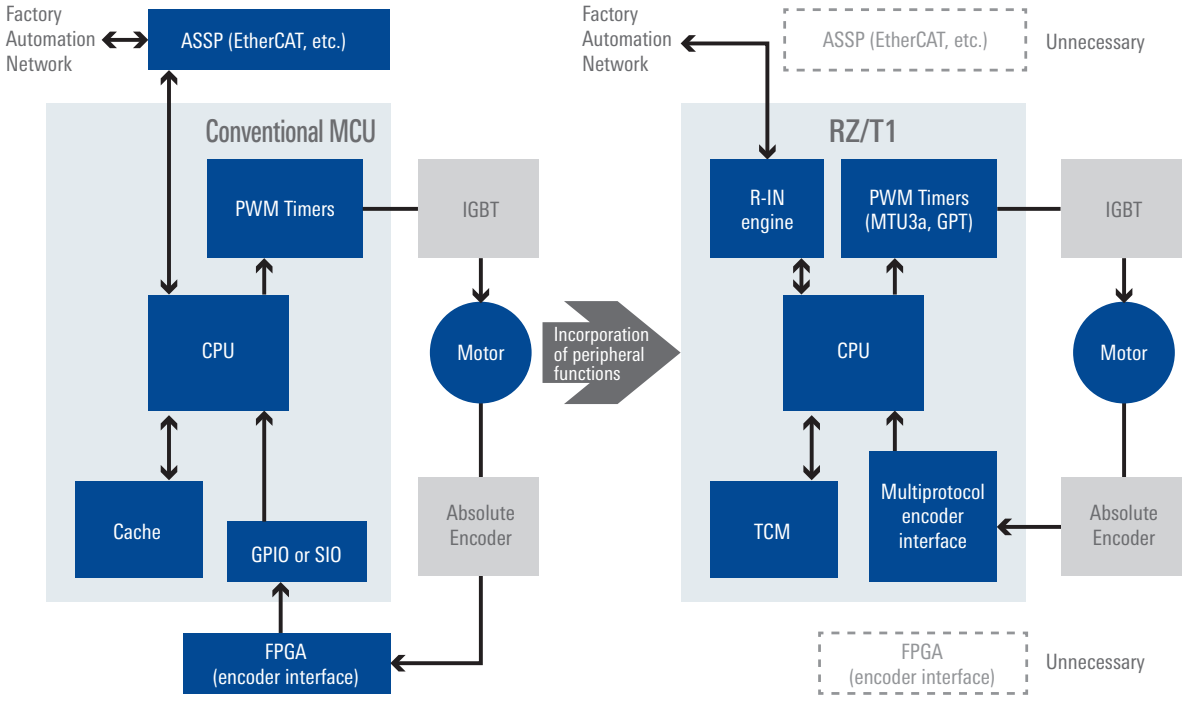
R-IN engine



High-speed, energy-efficient communication
Flexible support for multiple protocols

- R-IN engine industrial Ethernet communication accelerator performs standard Ethernet processing in hardware.
- Network processing is up to four times as fast.

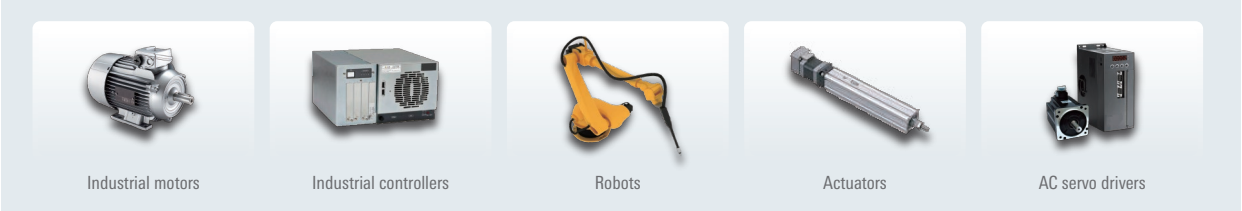
Integrated peripheral functions



- The encoder interface was external with conventional FPGA or ASIC approaches but is now integrated on-chip.
- This one-chip AC servo solution helps reduce the component count and save space.

RZ/T Series: Application Fields

High-speed operation at 300MHz/450MHz/600MHz provides higher performance and improved functionality for industrial equipment such as industrial motors or AC servo drivers. Products incorporating the R-IN engine accelerator for industrial Ethernet communication can also handle a variety of industrial Ethernet processing tasks without sacrificing real-time performance.



RZ/T1 (with multi-protocol support)

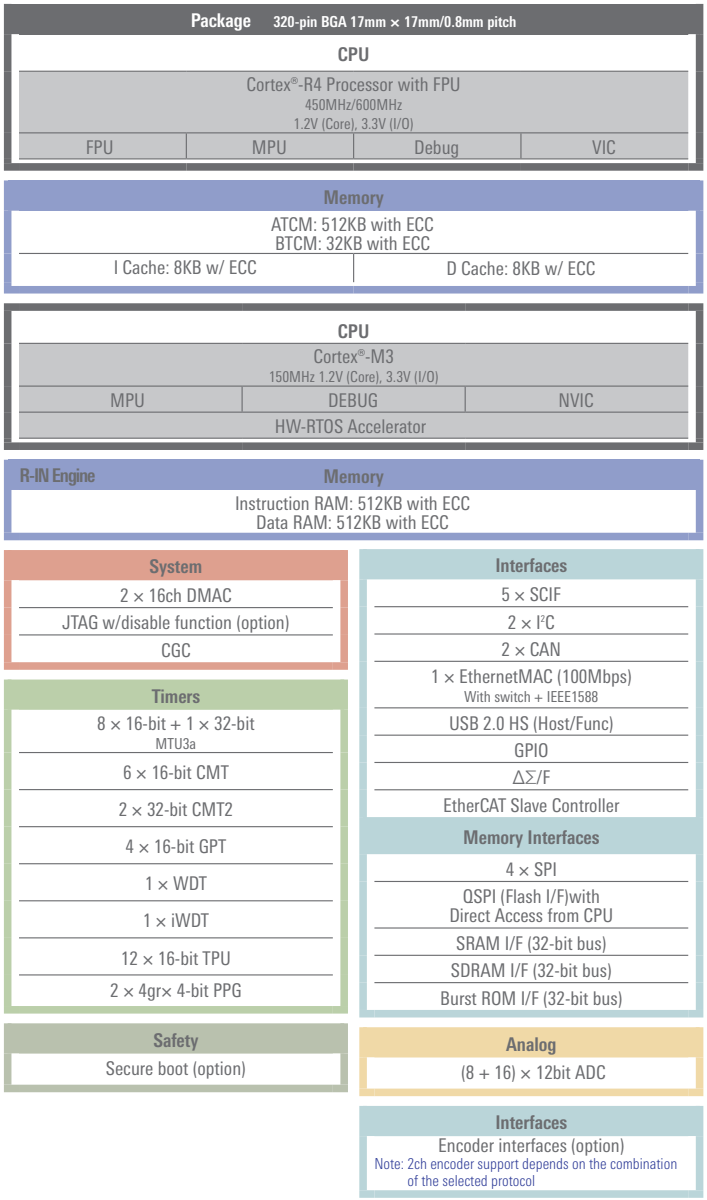
High performance CPU (Arm® Cortex®-R4 Processor with FPU)
- Operating frequency: 450MHz/600MHz
- High-performance, high-speed real-time control
- Single-precision/double-precision floating-point unit

On-chip memory
- Tightly Coupled Memory: 512KB (w/ ECC) + 32KB (w/ ECC)
- R-IN engine instruction memory: 512KB (w/ ECC) + data memory: 512KB (w/ ECC)

Features
- Industrial Ethernet communication accelerator with multi-protocol support (R-IN engine)
- EtherCAT slave controller
- PWM timers: MTU3a, GPT
- Encoder interface (Nikon A-format™/BiSS-C/EnDat2.2/HIPERFACE DSL®/Tamagawa) (option)
  Note: 2ch encoder support depends on the combination of the selected protocol
- High Speed USB
- Secure boot (option)
- Safety functions
  – ECC memory
  – CRC (32-bit)
  – Independent WDT: Operating on dedicated on-chip oscillator
- ΔΣ interface
- 100Mbps EtherMAC (with Ethernet switch)
- Ethernet accelerator
- Power supply voltage: 1.2V, 3.3V

Package
- FBGA 320pin (17mm × 17mm,0.8mm pitch)

RZ/T1 (with multi-protocol support) block diagram



RZ/T1 (with EtherCAT support)

High performance CPU (Arm® Cortex®-R4 Processor with FPU)
- Operating frequency: 300MHz/450MHz/600MHz
- High-performance, high-speed real-time control
- Single-precision/double-precision floating-point unit

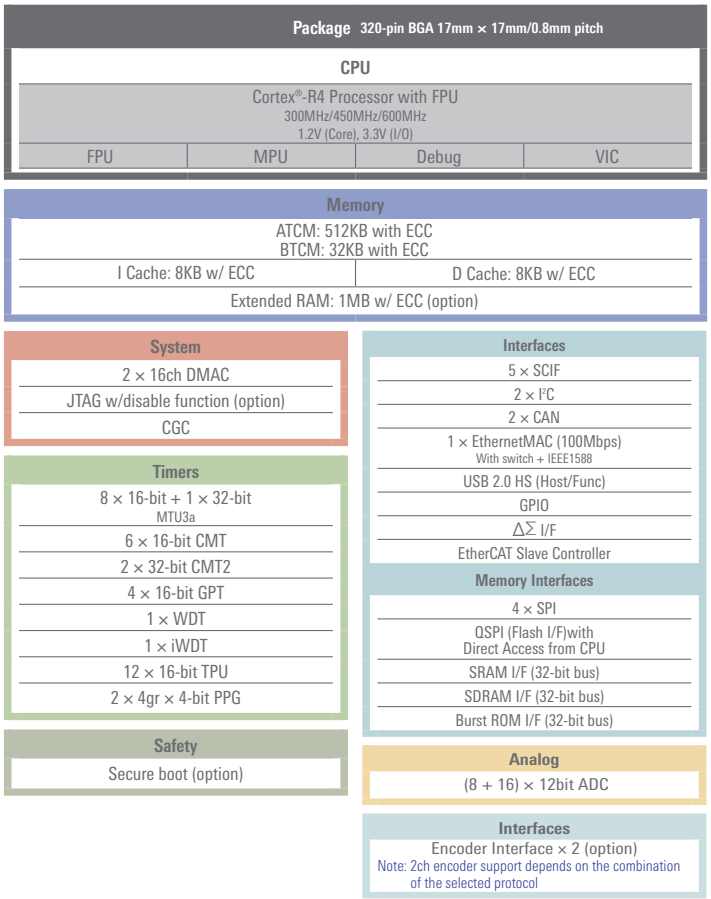
On-chip memory
- Tightly Coupled Memory: 512KB (w/ ECC) + 32KB (w/ ECC)
- Expanded RAM: 1MB, w/ ECC (option)

Features
- EtherCAT slave controller
- PWM timers: MTU3a, GPT
- Encoder interface (Nikon A-format™/BiSS-C/EnDat2.2/HIPERFACE DSL®/Tamagawa) (option)

  Note: 2ch encoder support depends on the combination of the selected protocol
- High Speed USB
- Secure boot (option)
- Safety functions
  - ECC memory
  - CRC (32-bit)
  - Independent WDT: Operating on dedicated on-chip oscillator
- ΔΣ interface
- 100Mbps EtherMAC (with Ethernet switch)
- Ethernet accelerator
- Power supply voltage: 1.2V, 3.3V

Package
- FBGA 320pin (17mm × 17mm, 0.8mm pitch)

RZ/T1 (with EtherCAT support) block diagram



RZ/T1 (no industrial communication support)

High performance CPU (Arm® Cortex®-R4)
- Operating frequency: 450MHz/600MHz
- High-performance, high-speed real-time control
- Single-precision/double-precision floating-point unit

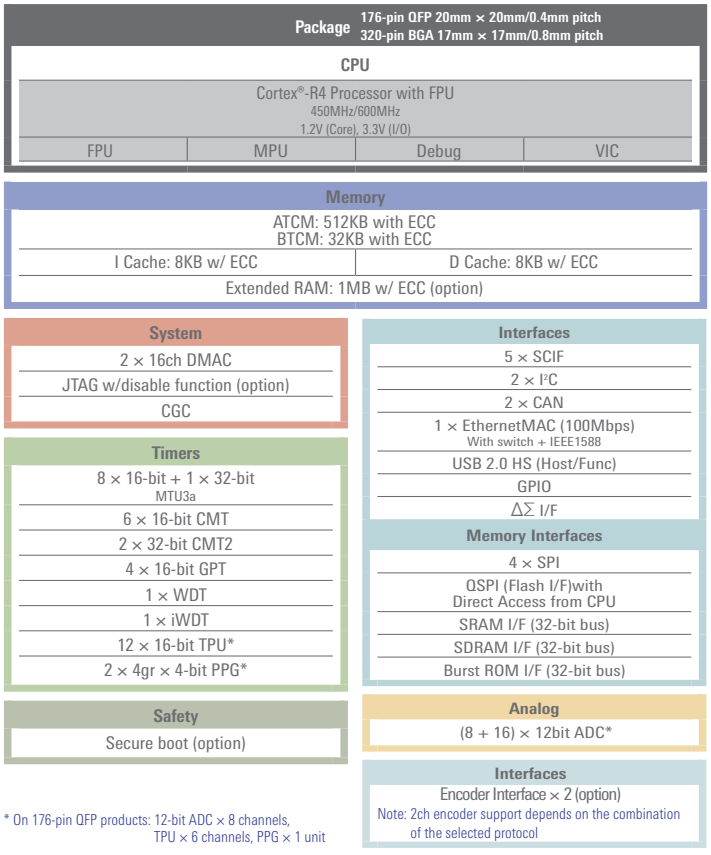
On-chip memory
- Tightly Coupled Memory: 512KB (w/ ECC) + 32KB (w/ ECC)
- Expanded RAM: 1MB, w/ ECC (option)

Features
- PWM timers: MTU3a, GPT
- Encoder interface (Nikon A-format™/BiSS-C/EnDat2.2/HIPERFACE DSL®/Tamagawa) (option)

  Note: 2ch encoder support depends on the combination of the selected protocol
- High Speed USB
- Secure boot (option)
- Safety functions
  - ECC memory
  - CRC (32-bit)
  - Independent WDT: Operating on dedicated on-chip oscillator
- ΔΣ interface
- 100Mbps EtherMAC (with Ethernet switch)
- Ethernet accelerator
- Power supply voltage: 1.2V, 3.3V

Package
- FBGA 320pin (17mm × 17mm,0.8mm pitch)
- QFP 176pin (20mm × 20mm,0.4mm pitch)

RZ/T1 (no industrial communication support) block diagram



* On 176-pin QFP products: 12-bit ADC × 8 channels,
TPU × 6 channels, PPG × 1 unit

Utilizing the Arm® Ecosystem

Utilizing Renesas' Experience and the Arm® Ecosystem

Customers can benefit from solutions combining Renesas' accumulated experience in the microcontroller industry and the global ecosystem of Arm® partners. Products such as development environments, OS, and middleware are available from partner companies supporting the RZ/T series.

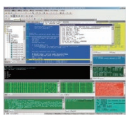


RZ/T Series: Development Environments (Integrated Development Environments)

	IAR SYSTEMS	arm	RENESAS
Development environments	• IAR Embedded Workbench® for Arm® 	• DS-5 	• e² studio*1 
Compilers	• IAR C/C++ compiler*2	• Arm CC*3	• GNU tool*4
Other tools	• AP4 code generation tool from Renesas is compatible.	• AP4 code generation tool from Renesas is compatible.	• Code generation function available as a plug-in.
ICEs	• I-jet™/I-jet Trace™ for Arm Cortex®-A/R/M • JTAGjet-Trace  	• DSTREAM™ • ULINKpro™ • ULINKproD™ • ULINK2™ 	• J-Link LITE from Segger • J-Link series from Segger*5 

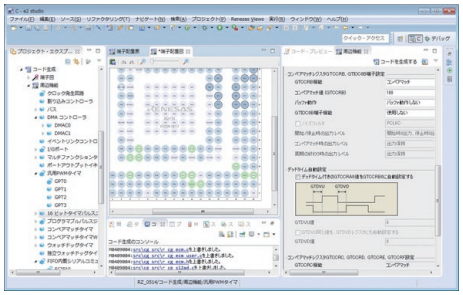
*1. Eclipse-based development environment from Renesas (http://renesas.com/e2studio)
*2. Two versions of the software are available for download free of charge. One limits the code size to 32KB and can be used with no time limitation. The other has no limit on code size and expires after 30 days. (www.iar.com/EWARM)
*3. Arm CC is included in DS-5. In addition to the popularly priced DS-5 RZ/A and RZ/T editions, a fully functional evaluation version of DS-5 that expires after 30 days is available free of charge. Contact your DS-5 dealer for details.
*4. GNU TOOLS & SUPPORT Website (https://gcc-renesas.com)
*5. Renesas does not handle ICEs from Segger. Contact a sales agent for details.

RZ/T Series: Development Tools (Debuggers, ICEs)

	KUC Kyoto Microcomputer Co., Ltd.	DTS INSIGHT Our insight, your value	Computex
Debuggers	• PARTNER-Jet2  	• microVIEW-PLUS 	• CSIDE version 7 
ICEs		• adviceLUNA II 	• PALMiCE4  JTAG model  Large capacity trace model
Supported compilers	• exeGCC from Kyoto Microcomputer • GNU tool*1 • Arm CC*2 • IAR C/C++ compiler,*3 etc.	• Arm CC*2 • GNU tool,*1 etc.	• Arm CC*2 • IAR C/C++ compiler*3 • GNU tool,*1 etc.

*1. GNU TOOLS & SUPPORT Website (https://gcc-renesas.com)
*2. Arm CC is included in DS-5. In addition to the popularly priced DS-5 RZ/A and RZ/T editions, a fully functional evaluation version of DS-5 that expires after 30 days is available free of charge. Contact your DS-5 dealer for details.
*3. Two versions of the software are available for download free of charge. One limits the code size to 32KB and can be used with no time limitation. The other has no limit on code size and expires after 30 days. (www.iar.com/EWARM)

e² studio: Integrated Development Environment Based on Eclipse

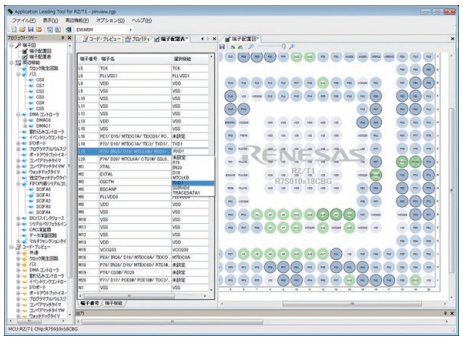


e² studio is an integrated development environment based on the Eclipse open source integrated development environment and CDT plug-ins supporting development in C/C++. The version of e² studio that is compatible with the RZ/T series provides support for a code generation plug-in.

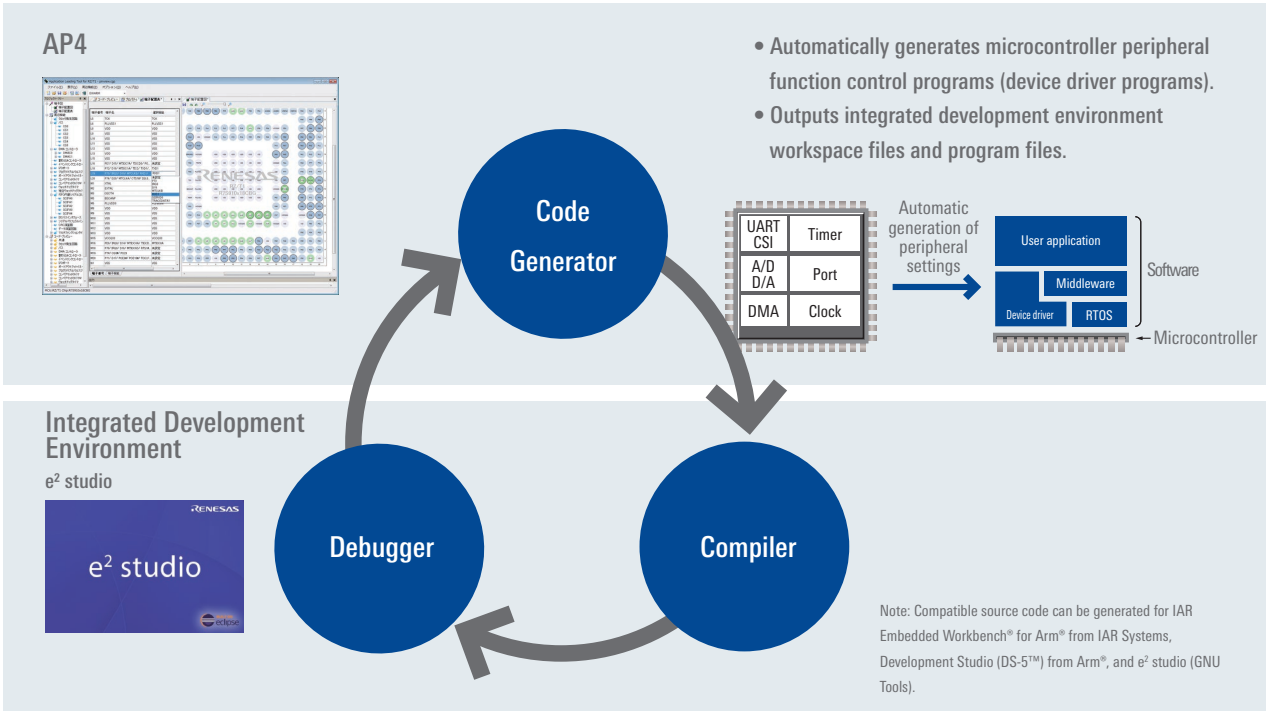
C/C++ perspective: code generation plug-in

A code generation plug-in is available that enables the user to generate device driver programs for peripheral functions of Renesas microcontrollers (timers, UART, A/D converter, etc.) by entering settings in a graphical user interface. It is possible to specify the processing of multiplexed pins in a pin table and view a pin assignment diagram to confirm the settings.

AP4: Code Generation Support Tool



AP4 is a standalone tool that automatically generates peripheral function control programs (device driver programs) based on settings entered by the user. The build tool (compiler) is selectable. This makes it possible to generate peripheral function control program code to match a specific build tool and enables interoperation with integrated development environments. (https://www.renesas.com/ap4)
The version of AP4 that is compatible with the RZ/T series can generate compatible source code for IAR Embedded Workbench® for Arm® from IAR Systems, Development Studio (DS-5™) from Arm®, and e² studio (GNU Tools).

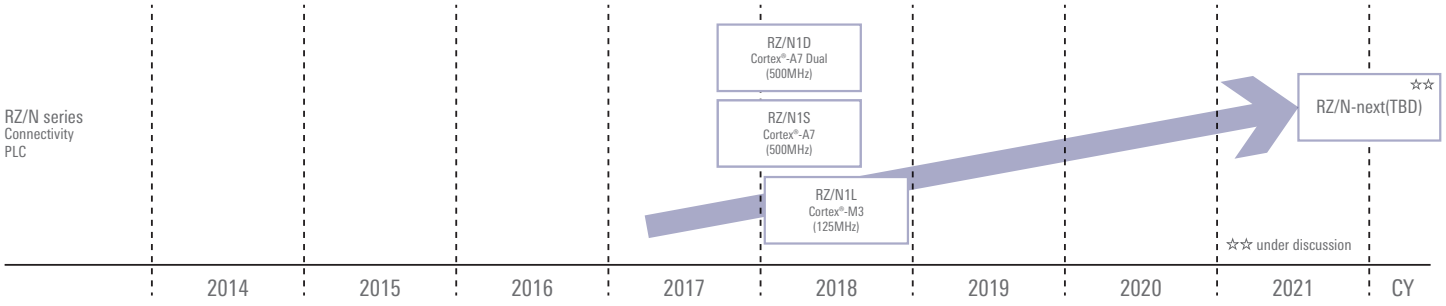


RZ/T Series: Solutions from Partner Companies

Visit the webpage below for the latest information on RZ/T Series development tools, including solutions from partner companies.
https://www.renesas.com/products/microcontrollers-microprocessors/rz/softtools.html#rzt

RZ/N Series

RZ/N Series: Roadmap



RZ/N Series Features

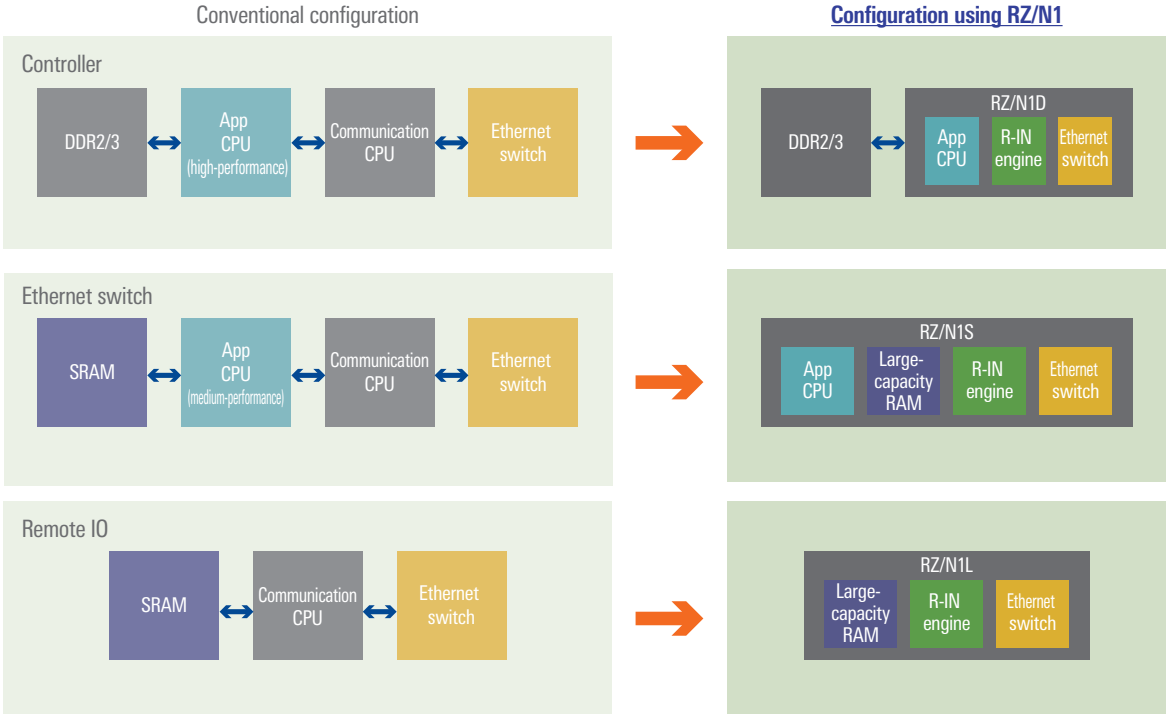
1. Provides optimized microcontrollers for a variety of industrial network applications
2. Integrated R-IN engine (accelerator) supporting main industrial Ethernet protocols
3. Redundant network configuration reduces network downtime to zero

1. Provides optimized microcontrollers for a variety of industrial network applications

The three CPU types lineup and integrated 5-port gigabit Ethernet switch make it possible to provide the optimal microcontrollers for a wide range of industrial network applications.

— Lineup of three CPU types for excellent hardware scalability: Dual-core Cortex®-A7 (500MHz × 2), single-core Cortex®-A7 (500MHz), and R-IN engine only (125MHz).

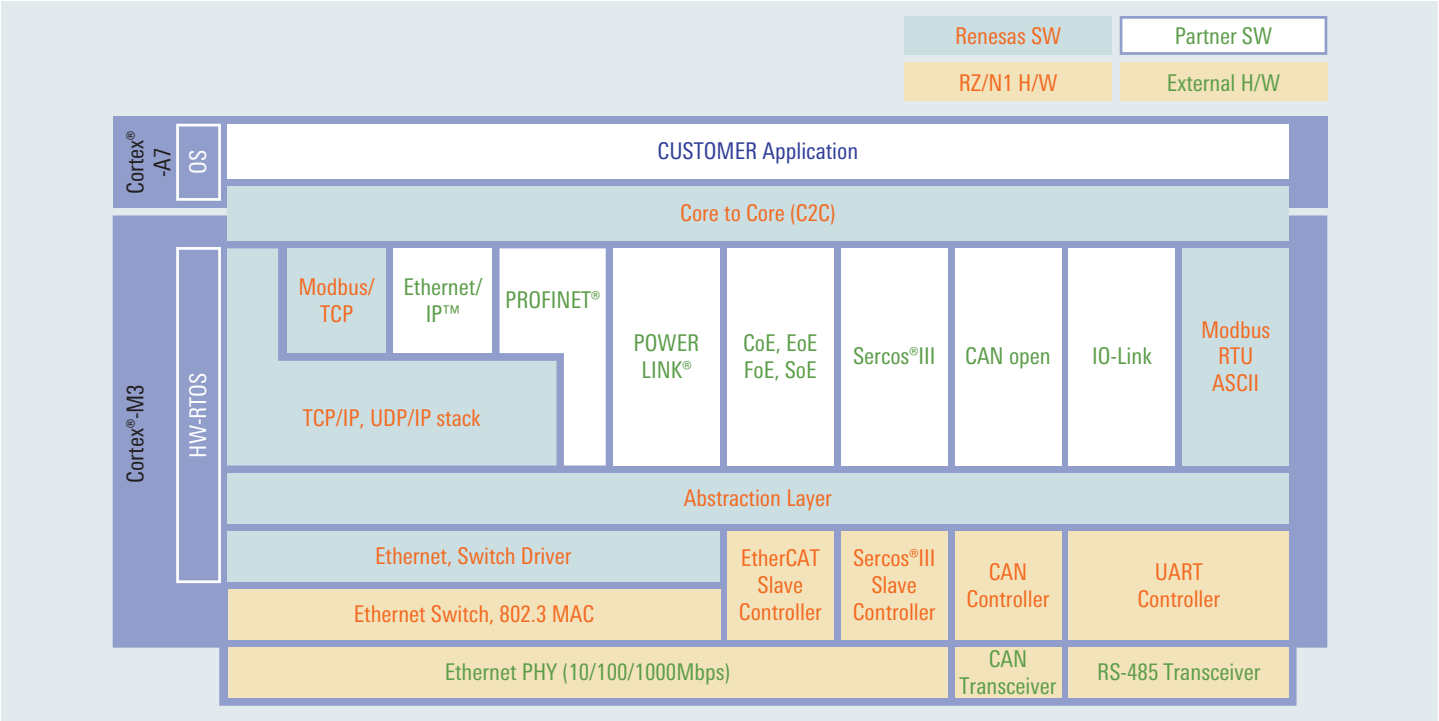
— 5-port gigabit Ethernet switch and two independent MAC units support applications such as PLC devices and Ethernet switches. Integration of peripheral components helps reduce BOM cost.



2. Integrated R-IN engine (accelerator) supporting main industrial Ethernet protocols

The R-IN engine accelerator supports a wide range of protocols and enables high-speed processing.

It reduces the load on the main CPU (Arm® Cortex®-A7) and contributes to highly efficient application control.



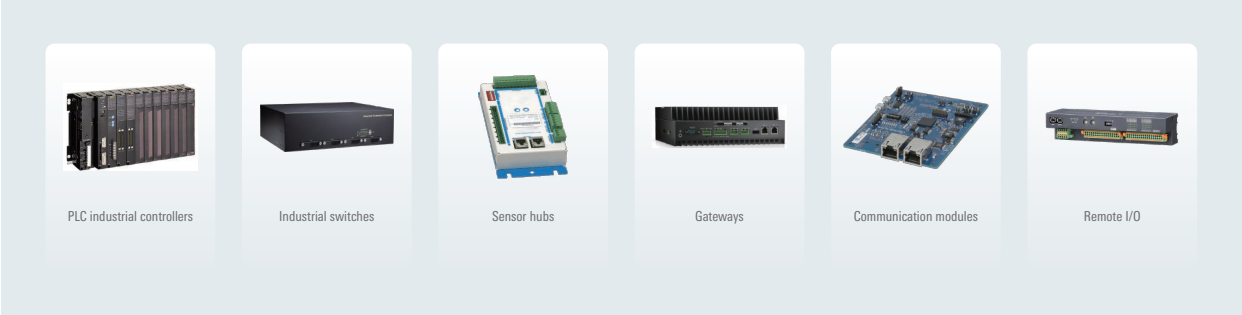
3. Redundant network configuration reduces network downtime to zero

Advanced redundant network configuration support helps eliminate network downtime.

— Redundant network connections: Parallel Redundancy Protocol (PRP)

— Looped network connections: HSR (High-availability Seamless Redundancy), DLR (Device Level Ring), RSTP (Rapid Spawning Trees)

RZ/N Series: Target Applications



RZ/N1D Group

CPU core
- Arm® Cortex®-A7 dual-core processor
- Operating frequency: 500MHz

Cache memory
- L1 I-cache: 16KB × 2, D-cache: 16KB × 2
- L2: 256KB

Internal memory
- 2MB (ECC)

External memory
- DDR2/DDR3 controller
- Quad I/O SPI
- SDIO eMMC
- NAND flash controller

R-IN engine
- Arm® Cortex®-M3
- Operating frequency: 125MHz
- HW-RTOS accelerator
- Ethernet accelerator

Main Ethernet communication functions
- EtherCAT slave controller
- Sercos® III slave controller
- HSR switch (400-pin)
- 5-port Ethernet switch

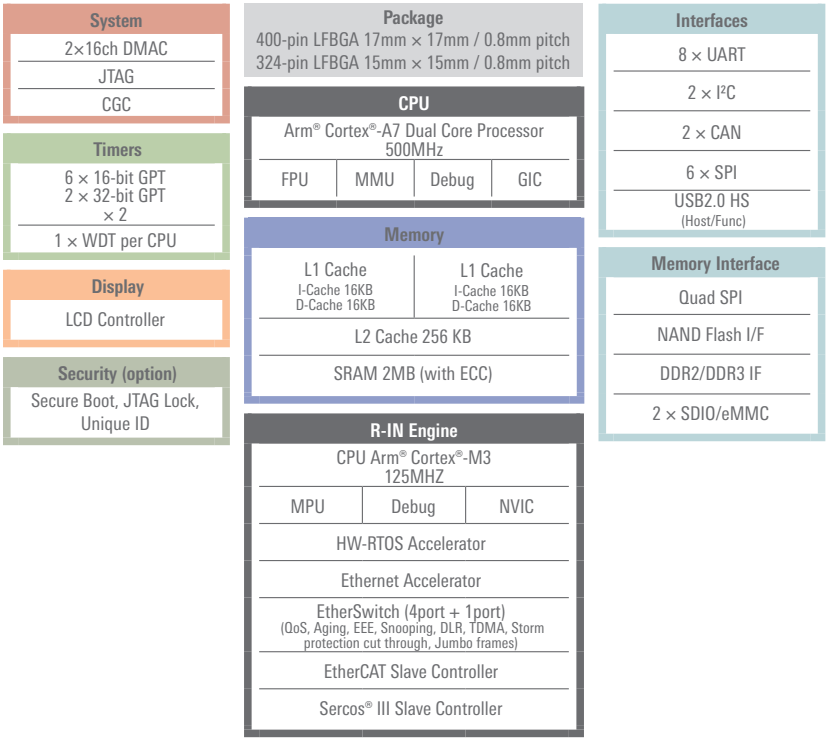
Other communication functions
- UART × 8 channels
- I²C × 2 channels
- USB Host/Function × 1 channel, Host 1 channel
- SPI × 6 channels (master × 4 channels, slave × 2 channels)
- CAN

Other functions
- LCD controller
- ADC: 12-bit × 8 channels × 2 units (400-pin)
- ADC: 12-bit × 8 channels × 1 unit (324-pin)

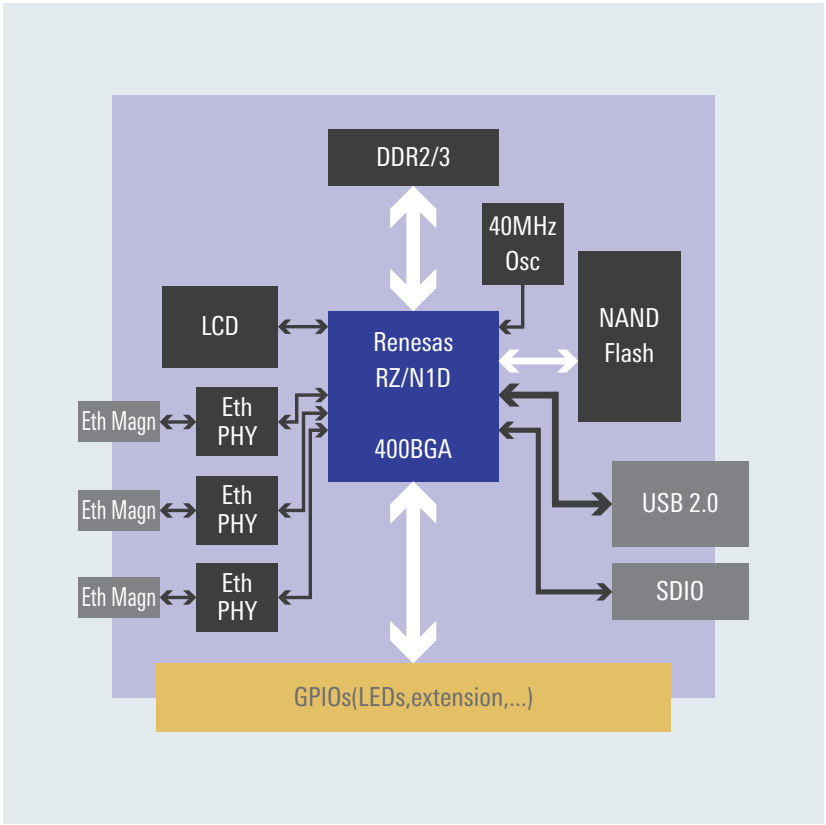
Package
- 400-pin: LFBGA, 17 × 17mm, 0.8mm pin pitch
- 324-pin: LFBGA, 15 × 15mm, 0.8mm pitch

Operating temperature
- Tj = –40°C to +110°C

RZ/N1D block diagram



Application example: Programmable logic controller Block diagram



RZ/N1S Group

CPU core
- Arm® Cortex®-A7 single-core processor
- Operating frequency: 500MHz

Cache memory
- L1 I-cache: 16KB, D-cache: 16KB
- L2: 128KB

Internal memory
- 6MB (ECC)

External memory
- Quad I/O SPI
- SDIO eMMC
- NAND flash controller

R-IN engine
- Arm® Cortex®-M3
- Operating frequency: 125MHz
- HW-RTOS accelerator
- Ethernet accelerator

Main Ethernet communication functions
- EtherCAT slave controller
- Sercos® III slave controller
- 5-port Ethernet switch

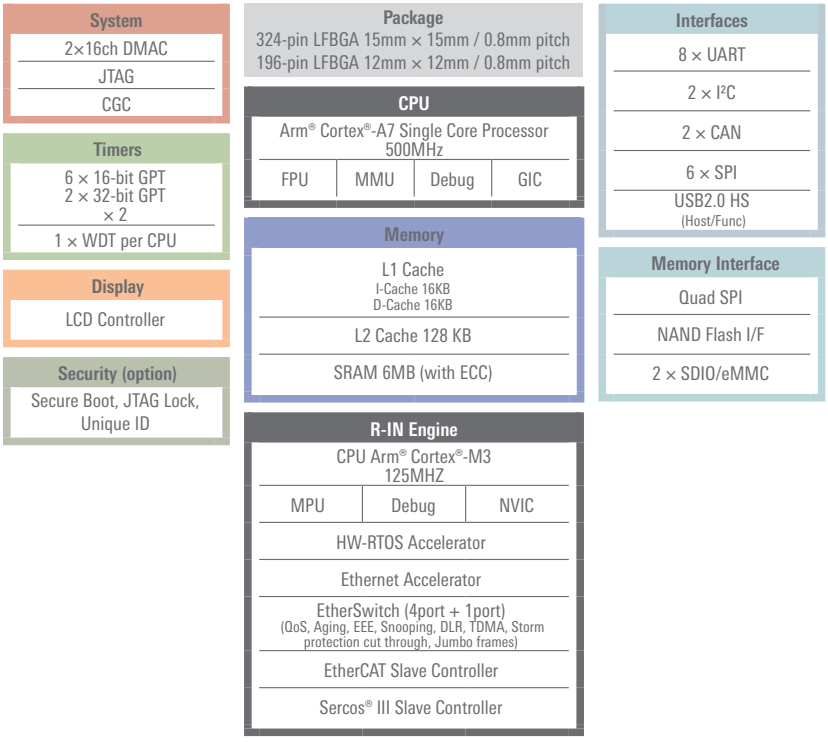
Other communication functions
- UART × 8 channels
- I²C × 2 channels
- USB Host/Function × 1 channel, Host 1 channel
- SPI × 6 channels (master × 4 channels, slave × 2 channels)
- CAN

Other functions
- LCD controller
- ADC: 12-bit × 8 channels × 1 unit

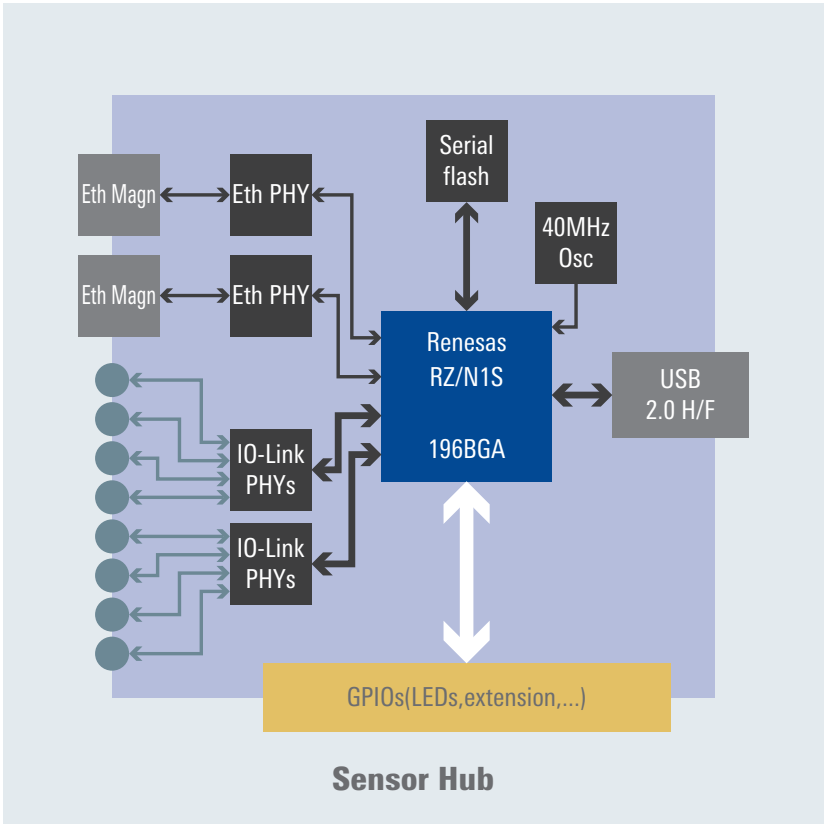
Package
- 324-pin: LFBGA, 15 × 15mm, 0.8mm pin pitch
- 196-pin: LFBGA, 12 × 12mm, 0.8mm pin pitch

Operating temperature
- Tj = –40°C to +110°C

RZ/N1S block diagram



Application example: Sensor Hub block diagram



RZ/N1L Group

R-IN engine
- Arm® Cortex®-M3
- Operating frequency: 125MHz
- HW-RTOS accelerator
- Ethernet accelerator

Internal memory
- 6MB (ECC)

External memory
- Quad I/O SPI
- SDIO eMMC
- NAND flash controller

Main Ethernet communication functions
- EtherCAT slave controller
- Sercos® III slave controller
- GbE Ethernet switch

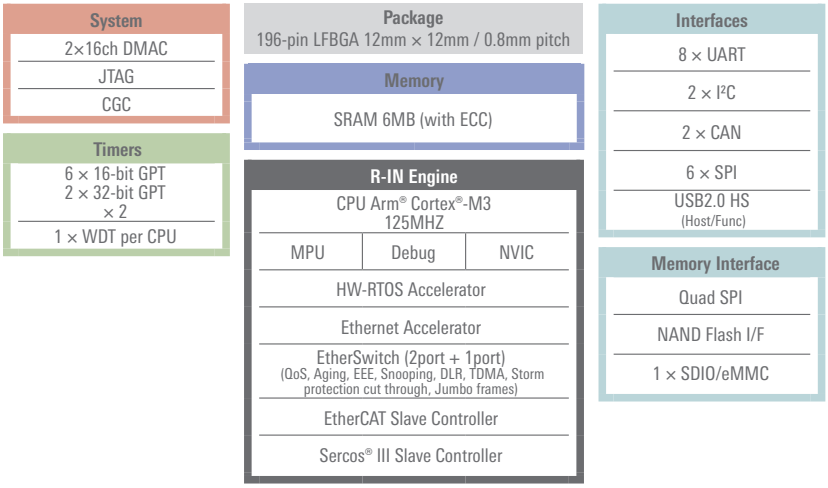
Other communication functions
- UART × 8 channels
- I²C × 2 channels
- USB Host/Function × 1 channel, Host 1 channel
- SPI × 6 channels (master × 4 channels, slave × 2 channels)
- CAN × 2 channels

Other functions
- ADC: 12-bit × 8 channels × 1 unit

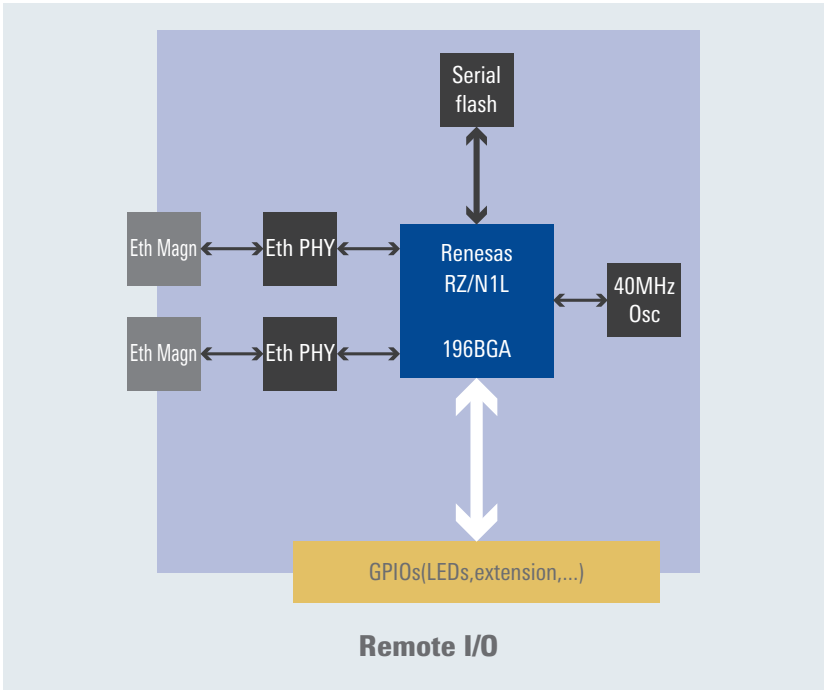
Package
- 196-pin: LFBGA, 12 × 12mm, 0.8mm pin pitch

Operating temperature
- Tj = –40°C to +110°C

RZ/N1L block diagram



Application example: Remote I/O



RZ/N Series: Development Environments

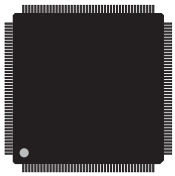
OS	Compiler	Debugger	ICE
Linux	GCC (GNU compiler)	GDB (GNU debugger)	J-Link series (SEGGER)
ThreadX®	EWARM (IAR systems: for Arm® Cortex®-A7)		I-Jet
HW-RTOS	EWARM (IAR systems: for On-chip R-IN engine Arm® Cortex®-M3)		I-Jet

RZ/N Series: Solutions from Renesas Partners

Visit the webpage below for the latest information on RZ/N Series development tools, including solutions from partner companies.

https://www.renesas.com/products/microcontrollers-microprocessors/rz/softtools.html#rzn

RZ Family Package Lineup



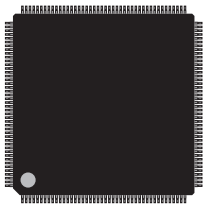
Pin-type:	176-HLQFP
Size:	20 x 20 mm
Pitch:	0.40 mm
Thickness:	1.70 mm
Group:	RZ/T1



Pin-type:	176-LFBGA
Size:	8 x 8 mm
Pitch:	0.50 mm
Thickness:	1.40 mm
Group:	RZ/A1L, A1LC, A1LU



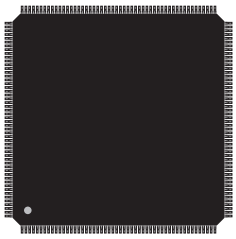
Pin-type:	176-LFBGA
Size:	13 x 13 mm
Pitch:	0.80 mm
Thickness:	1.40 mm
Group:	RZ/A2M



Pin-type:	176-LFQFP
Size:	24 x 24 mm
Pitch:	0.50 mm
Thickness:	1.70 mm
Group:	RZ/A1L, A1LU



Pin-type:	196-LFBGA
Size:	12 x 12 mm
Pitch:	0.80 mm
Thickness:	1.70 mm
Group:	RZ/N1L, N1S



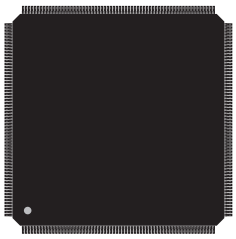
Pin-type:	208-LFQFP
Size:	28 x 28 mm
Pitch:	0.50 mm
Thickness:	1.70 mm
Group:	RZ/A1L, A1LU



Pin-type:	233-FBGA
Size:	15 x 15 mm
Pitch:	0.80 mm
Thickness:	1.9 mm
Group:	RZ/A1LU



Pin-type:	256-LFBGA
Size:	11 x 11 mm
Pitch:	0.50 mm
Thickness:	1.40 mm
Group:	RZ/A2M, A1H, A1M



Pin-type:	256-LFQFP
Size:	28 x 28 mm
Pitch:	0.40 mm
Thickness:	1.70 mm
Group:	RZ/A1H, A1M



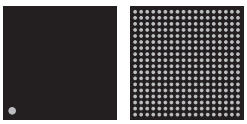
Pin-type:	272-FBGA
Size:	17 x 17 mm
Pitch:	0.8 mm
Thickness:	1.90 mm
Group:	RZ/A2M



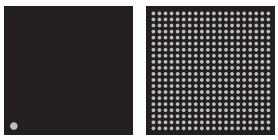
Pin-type:	320-FBGA
Size:	17 x 17 mm
Pitch:	0.80 mm
Thickness:	2.30 mm
Group:	RZ/T1



Pin-type:	324-FBGA
Size:	19 x 19 mm
Pitch:	0.80 mm
Thickness:	2.10 mm
Group:	RZ/A2M, A1H, A1M



Pin-type:	324-LFBGA
Size:	15 x 15 mm
Pitch:	0.80 mm
Thickness:	1.70 mm
Group:	RZ/N1D, N1S



Pin-type:	400-LFBGA
Size:	17 x 17 mm
Pitch:	0.80 mm
Thickness:	1.70 mm
Group:	RZ/N1D



Pin-type:	501-FBGA
Size:	21 x 21 mm
Pitch:	0.80 mm
Thickness:	2.40 mm
Group:	RZ/G1E, G1C



Pin-type:	552-FBGA
Size:	21 x 21 mm
Pitch:	0.80 mm
Thickness:	2.45 mm
Group:	RZ/G2E



Pin-type:	552-FBGA
Size:	21 x 21 mm
Pitch:	0.80 mm
Thickness:	2.45 mm
Group:	RZ/G2E



Pin-type:	831-FBGA
Size:	27 x 27 mm
Pitch:	0.80 mm
Thickness:	2.40 mm
Group:	RZ/G1H, G1M, G1N



Pin-type:	1022-FBGA	
Size:	29 x 29 mm	
Pitch:	0.80 mm	
Thickness:	2.5 mm	3.15 mm
Group:	RZ/G2M, G2N	RZ/G2H

RENESAS

BIG IDEAS FOR EVERY SPACE

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