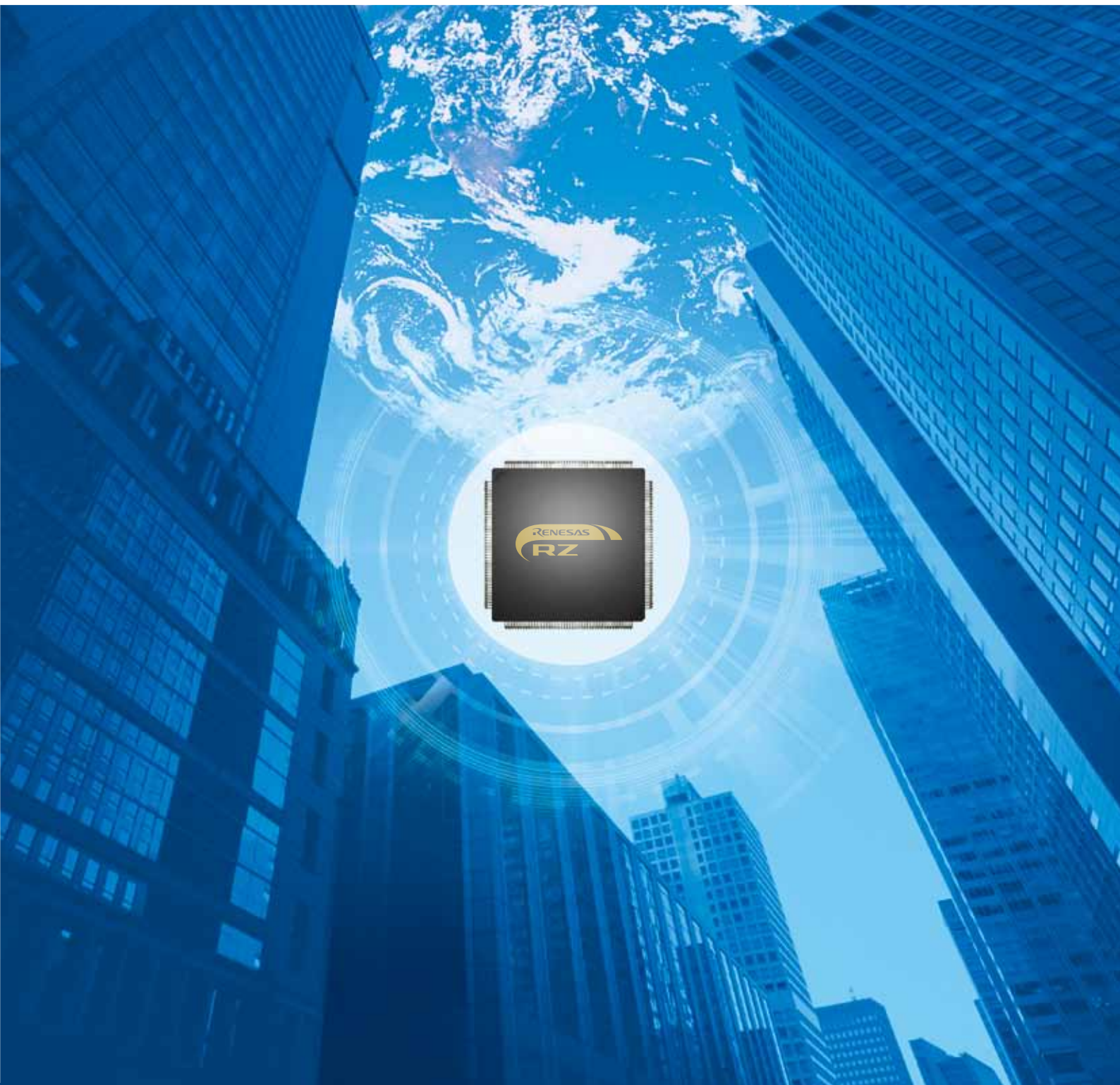


Renesas Microprocessor

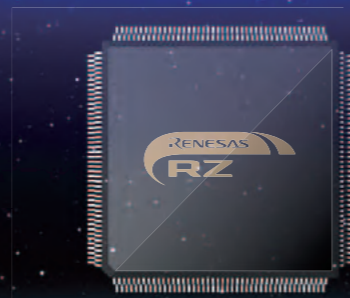
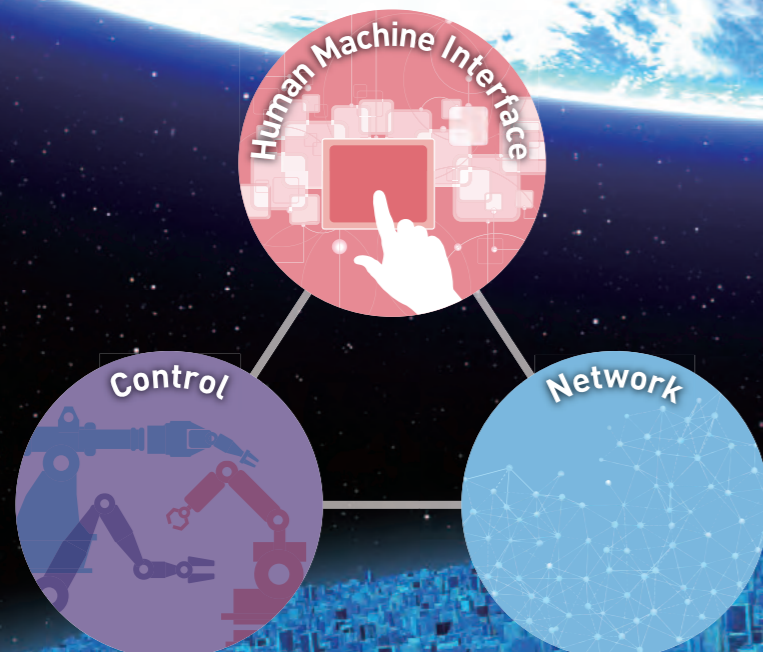
# RZ Family Catalog



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 interoperability 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 new RZ family of embedded processors. The lineup of these "next-generation processors that are as easy to use as conventional microcontrollers" spans three product series 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.



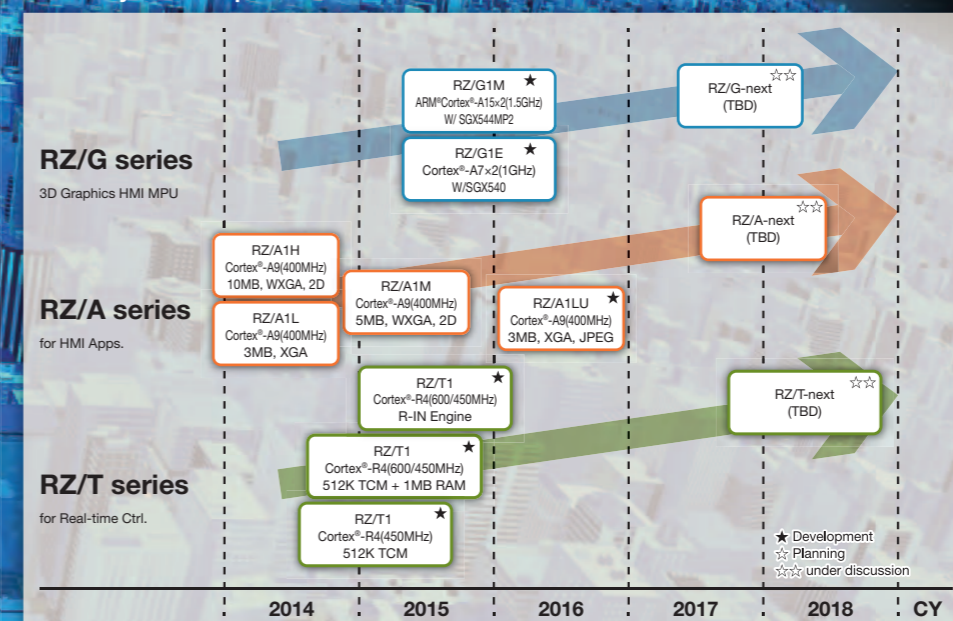
## Renesas RZ Family

### The next-generation processor to meet the needs of the smart society has arrived.



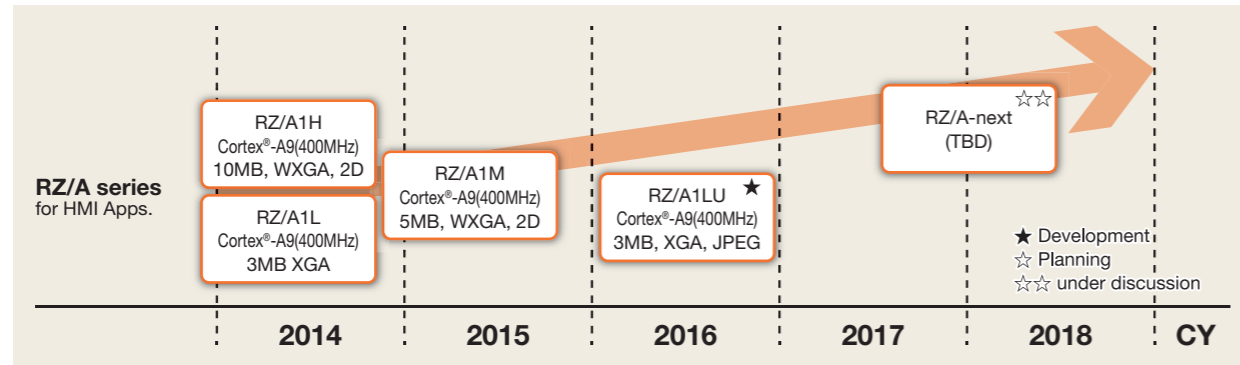
Advanced embedded processors ready to play a key role in the smart society

RZ Family: Roadmap



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## RZ/A Series: Roadmap



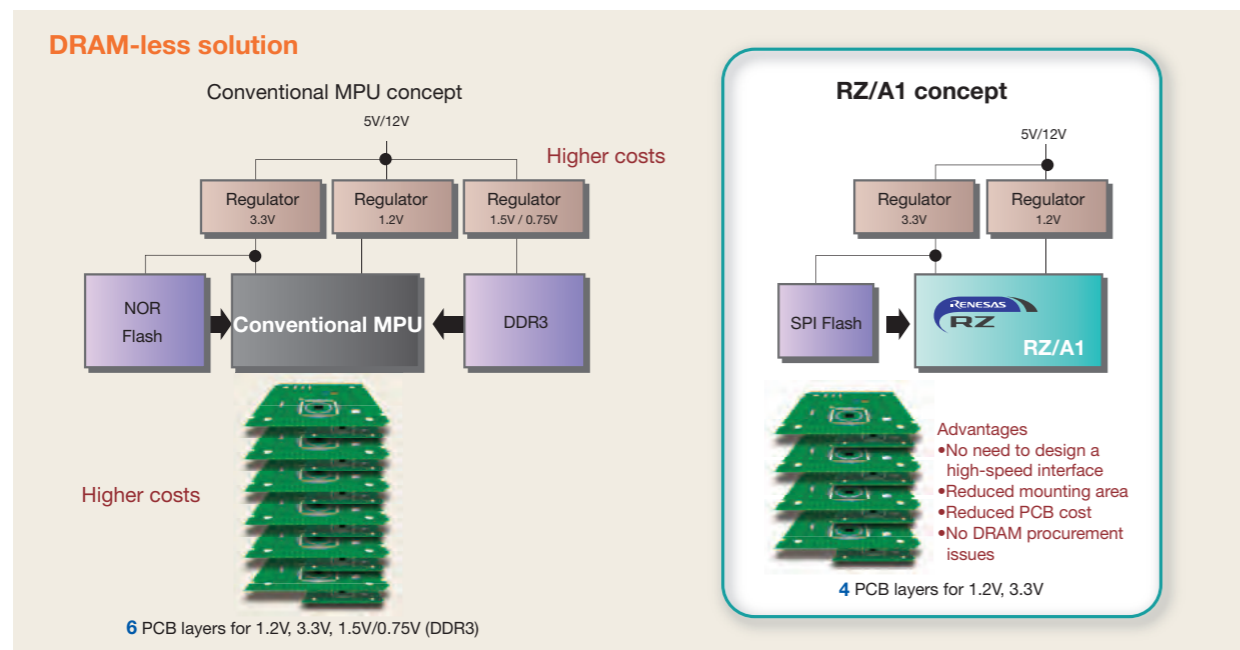
## RZ/A Series: Target Applications



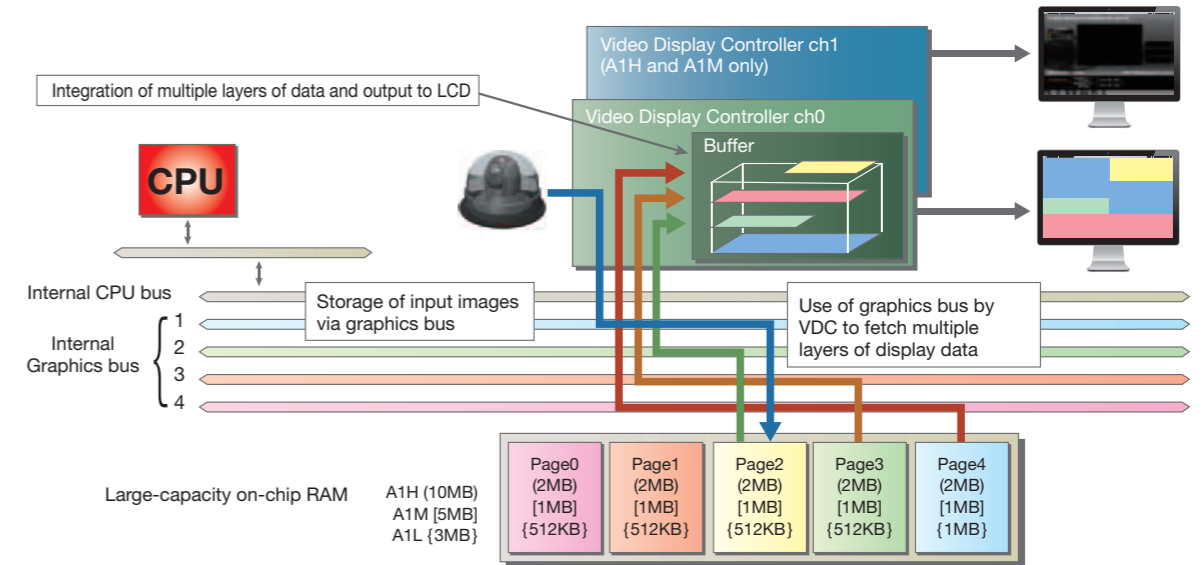
## RZ/A Series Features

- ▶ 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

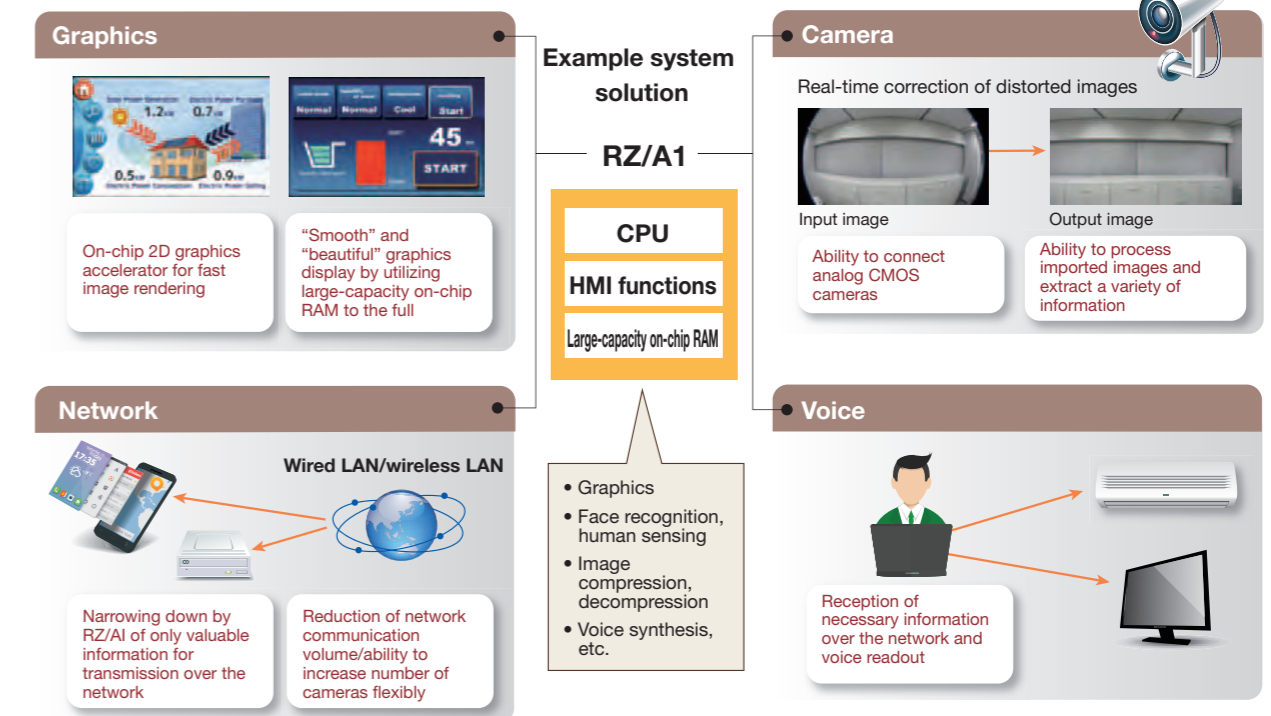


### Graphics display and camera input capabilities on a single chip



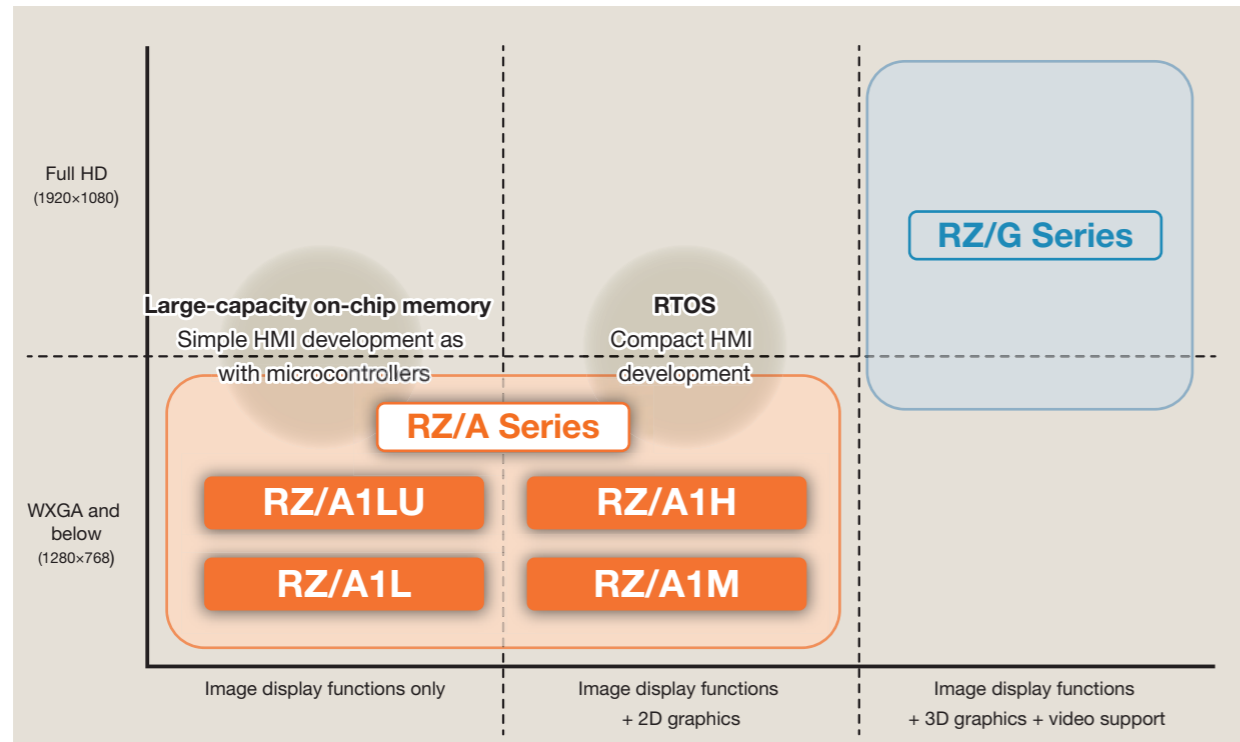
The bus configuration with independent buses for images and hardware-based superimposition processing make it easy to create graphical applications.

### 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

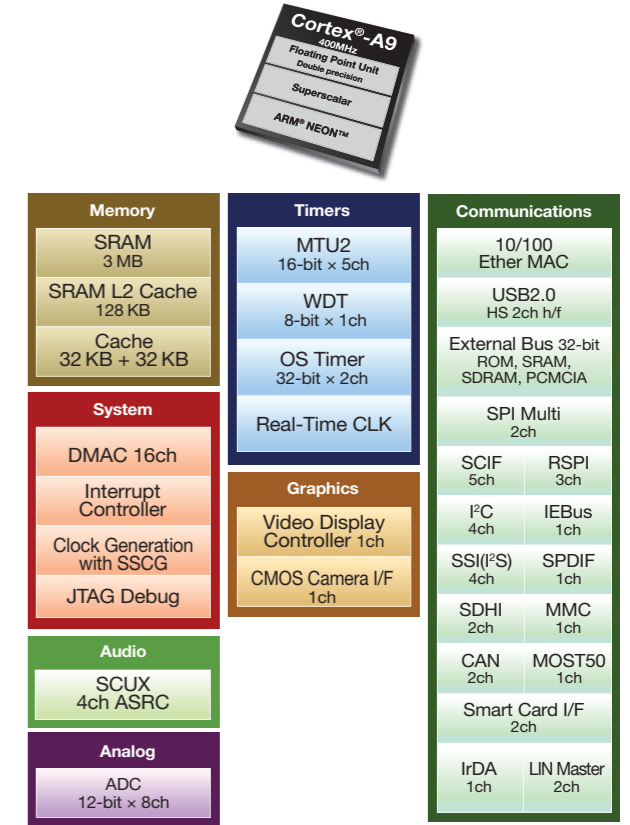


- HMI solutions optimized to match the image resolution, functions, and OS
- RZ/G series: Full HD, functions: 3D Gfx, vide, OS: Linux (RichOS)
- RZ/A series: WXGA and below, functions: 2D Gfx, camera input processing, OS: RTOS

## RZ/A1L Group

- CPU (ARM® Cortex®-A9)**
- Operating frequency: 400MHz
  - Single-precision/double-precision FPU
  - ARM® NEON™
- On-chip memory**
- RZ/A1L: 3MB
- Main graphics and camera input functions**
- LCD controller (VDC5): 1 channel
  - Video input: Max. XGA
  - LCD output: Max. XGA
  - Screen superimposition: 3 layers
  - 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□,0.5mm pitch)
  - 176-LFQFP(24mm□,0.5mm pitch)
  - 208-FBGA(28mm□,0.5mm pitch)

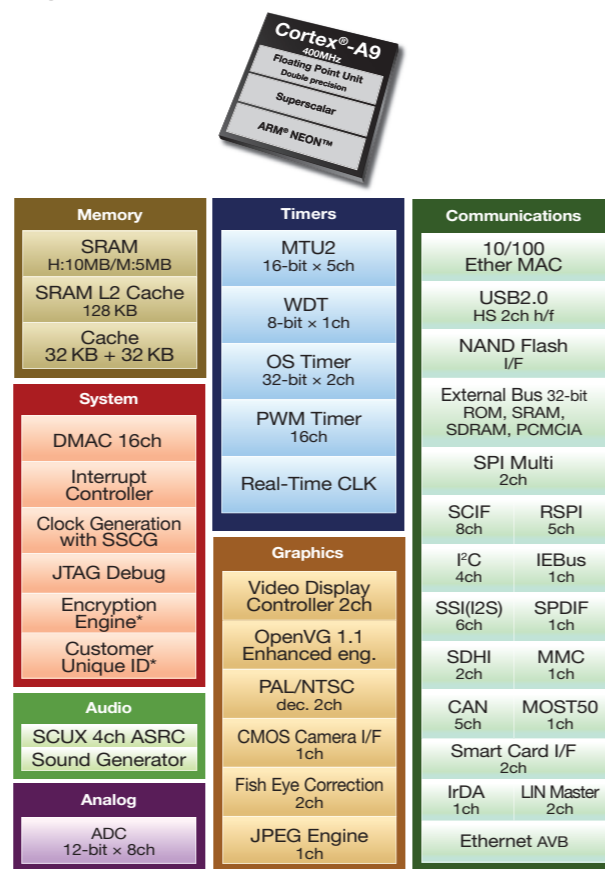
## RZ/A1L block diagram



## 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**
- LCD controller (VDC5): 2 channels
  - Video input: Max. XGA (CVBS analog input supported)
  - LCD output: Max. WXGA
  - Screen superimposition: 4 layers
  - Open VG accelerator: 1 channel
  - JPEG coding engine: 1 channel
  - Distortion compensation unit (IMR): 1 channel
  - CMOS camera input (CEU): 1 channel
  - PAL/NTSC decoder (DVDEC): channels
- 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:1channel
  - SCIF:8 channels
  - I²C:4 channels
  - SSI:6 channels
  - RSPI:5 channels
  - Ethernet AVB:1 channel
  - CAN:5 channels
- Package**
- 256-LFBGA(11mm□,0.5mm pitch)
  - 256-LFQFP(28mm□,0.4mm pitch)
  - 324-FBGA(19mm□,0.8mm pitch)

## RZ/A1H, and RZ/A1M block diagram

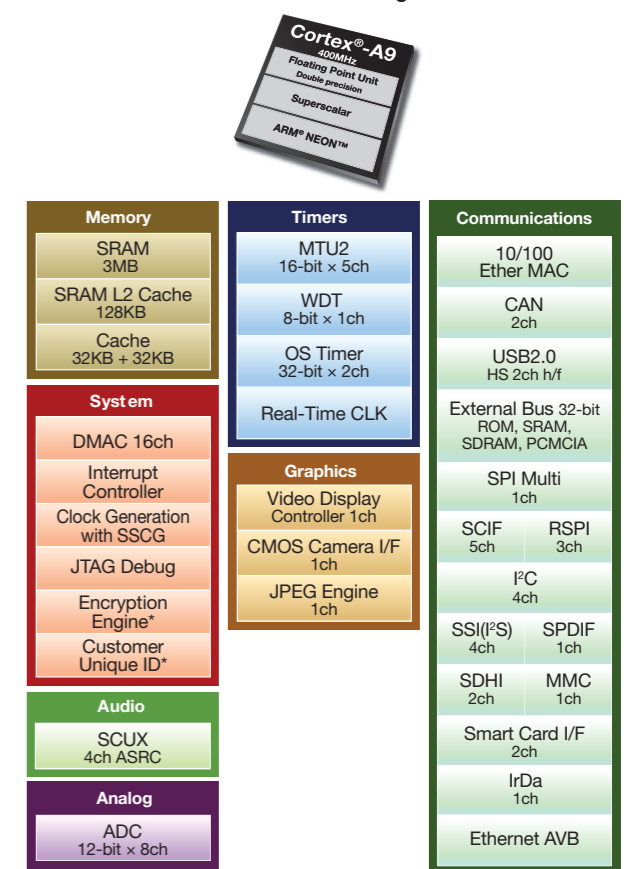


\* =Option

## 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
  - Video input: Max. XGA
  - LCD output: Max. XGA
  - Screen superimposition: 3 layers
  - JPEG coding engine: 1 channel
  - 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
  - Ethernet AVB:1 channel
  - CAN:2 channels
- Package**
- 176-LFBGA(8mm□,0.5mm pitch)
  - 176-LFQFP(24mm□,0.5mm pitch)
  - 208-FBGA(28mm□,0.5mm pitch)

## RZ/A1LU block diagram



\* =Option

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

Development environments	<ul style="list-style-type: none"> <li>DS-5 </li> </ul>	<ul style="list-style-type: none"> <li>IAR Embedded Workbench for ARM </li> </ul>	<ul style="list-style-type: none"> <li>eBinder </li> </ul>	<ul style="list-style-type: none"> <li>e<sup>2</sup>studio<sup>3</sup> </li> </ul>
Compilers	<ul style="list-style-type: none"> <li>ARM CC<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>IAR C/C++ compiler<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>ARM CC<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>KPIT GNU tool<sup>4</sup></li> </ul>
ICEs	<ul style="list-style-type: none"> <li>DSTREAM<sup>TM</sup></li> <li>ULINKpro<sup>TM</sup></li> <li>ULINKproD<sup>TM</sup></li> <li>ULINK2<sup>TM</sup></li> </ul>	<ul style="list-style-type: none"> <li>I-jet</li> <li>JTAGjet-Trace</li> </ul>	<ul style="list-style-type: none"> <li>PARTNER-Jet2 from Kyoto Microcomputer Co., Ltd.</li> <li>adviceLUNAII from Yokogawa Digital Computer Corporation</li> </ul>	<ul style="list-style-type: none"> <li>J-Link LITE from Segger</li> <li>J-Link series from Segger<sup>5</sup></li> </ul>

- \*1. ARM CC is included in DS-5 Starter Kit for RZ, which is available free of charge, and in the popularly priced DS-5 RZ 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. The IAR C/C++ compiler is available in two free versions: one is limited to a code size of 32KB but has no time limit, and the other provides full functionality but is limited to 30 days of use.
- \*3. Eclipse-based development environment from Renesas (<http://japan.renesas.com/e2studio>)
- \*4. GNU tools for RZ/A1 and technical support are provided by KPIT Technologies Ltd. (<http://www.kpitgntools.com/index.php>).
- \*5. Renesas does not handle ICEs from Segger. Contact a sales agent for details.

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

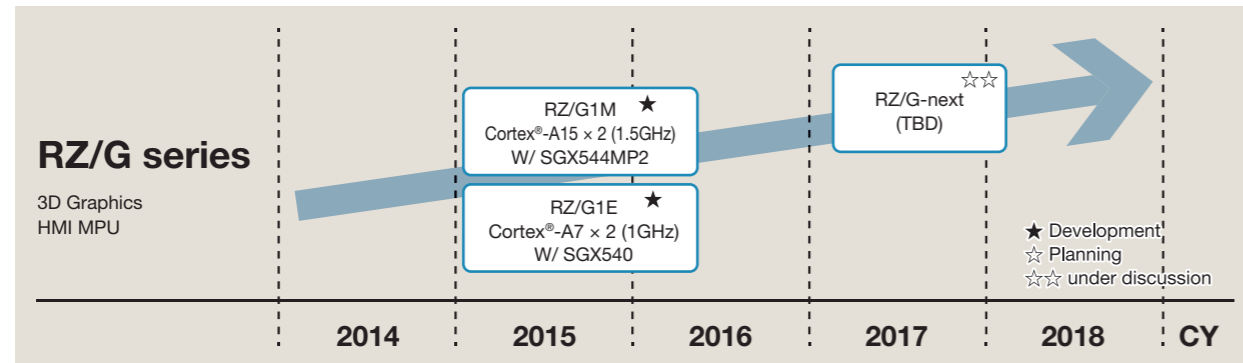
Debuggers	<ul style="list-style-type: none"> <li>PARTNER-Jet2 </li> </ul>	<ul style="list-style-type: none"> <li>microVIEW-PLUS </li> </ul>	<ul style="list-style-type: none"> <li>CSIDE version 6 </li> </ul>
ICEs		<ul style="list-style-type: none"> <li>adviceLUNA II </li> </ul>	<ul style="list-style-type: none"> <li>PALMiCE3 </li> </ul>
Supported compilers	<ul style="list-style-type: none"> <li>exeGCC from Kyoto Microcomputer</li> <li>KPIT GNU tool<sup>1</sup></li> <li>ARM CC<sup>2</sup></li> <li>IAR C/C++ compiler,<sup>3</sup> etc.</li> </ul>	<ul style="list-style-type: none"> <li>ARM CC<sup>2</sup></li> <li>KPIT GNU tool,<sup>1</sup> etc.</li> </ul>	<ul style="list-style-type: none"> <li>ARM CC<sup>2</sup></li> <li>IAR C/C++ compiler<sup>3</sup></li> <li>KPIT GNU tool,<sup>1</sup> etc.</li> </ul>

- \*1. GNU tools for RZ/A1 and technical support are provided by KPIT Technologies Ltd. (<http://www.kpitgntools.com/index.php>).
- \*2. ARM CC is included in DS-5 Starter Kit for RZ, which is available free of charge, and in the popularly priced DS-5 RZ 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.
- \*3. The IAR C/C++ compiler is available in two free versions: one is limited to a code size of 32KB but has no time limit, and the other provides full functionality but is limited to 30 days of use.

## RZ/A Series: Solutions from Partner Companies

Development environments, compilers, code generation and evaluation support	
ARM Ltd.	DS-5 (development studio 5) development environment, ARM CC
Atollic AB	TrueSTUDIO development environment
eSOL Co., Ltd.	eBinder development environment
IAR Systems	EWARM (development environment, compiler, C-SPY debugger)
KPIT Technologies Ltd.	GNU tool C compiler
Emulators and related products	
ARM Ltd.	DSTREAM <sup>TM</sup> , ULINKpro <sup>TM</sup> , ULINKproD <sup>TM</sup> , and ULINK2 <sup>TM</sup> JTAG emulators
Bitran Corporation	Code Debugger DS-A1 JTAG emulator, Debug Writer DW-A1
Computex Co., Ltd.	PALMiCE3 JTAG emulator, CSIDE, CodeRecorder dynamic text tool
IAR Systems	I-jet JTAG emulator
Kyoto Microcomputer Co., Ltd.	PARTNER-Jet2 JTAG emulator
Lauterbach GmbH	TRACE32 PowerDebug JTAG emulator
SEGGER Microcontroller GmbH & Co. KG	J-Link and J-Link Lite JTAG emulators
Yokogawa Digital Computer Corporation	adviceLUNA II JTAG emulator, TRQerS dynamic text/analysis tool
Starter kits, evaluation boards, platforms, etc.	
AlphaProject Co., Ltd.	AP-RZA-0A (RZ/A1H) evaluation board
Computex Co., Ltd.	CEV-RZ/A1L (RZ/A1L) evaluation board, CKB-RZ/A1H (RZ/A1H) embedded board
Core Corporation	Kiri ASURA (RZ/A1H) evaluation board
emtrion GmbH	DIMM-RZ/A1H evaluation board
Mobiveil, Inc.	Ticketing Machine evaluation board
Shimafuji Electric Inc.	SBEV-RZ/A1L (RZ/A1L) and Wallaby-721021 (RZ/A1L) evaluation boards
A-ONE Co., Ltd.	MP-RZA1H/FPGA-01 (RZ/A1H) embedded board
Wakamatsu Tsusyo Co., Ltd.	GR-PEACH (mbed) evaluation board
OS	
A.I. Corporation	RTOS TOPPERS-Pro, Pro/PX, Pro/HRP2, SafeG
eForce Co., Ltd.	RTOS μC3/Standard for RZ/A
EmblTeK Co., Ltd.	RTOS TOPPERS-EM
Enea KK	EneaLinux embedded Linux distribution
eSOL Co., Ltd.	RTOS eT-Kernel
Express Logic, Inc.	RTOS ThreadX
Grape Systems Inc.	ThreadX μTRON
Micrium, Inc.	RTOS μC/OS-III
Micro Digital Inc.	RTOS SMX RTOS
MISPO Co., Ltd.	RTOS NORTI Professional (RZ/ADS), NORTI Professional(RZ/EW)
Real Time Engineers Ltd.	RTOS FreeRTOS
SEGGER Microcontroller GmbH & Co. KG	RTOS embOS
Timesys Corporation	Embedded Linux
Middleware, tools	
Access Co., Ltd.	paneET <sup>TM</sup> UI engine for embedded devices
Altia, Inc.	DeepScreen GUI development environment for embedded devices
Consilient Technologies Pvt. Ltd.	H.264 decoder middleware
Coressent Technology, Inc.	CT-View+ embedded software
Crank Software Inc.	Crank Storyboard Suite GUI development environment for embedded devices
Data Technology Inc.	Cente series embedded middleware
DynaComware Corporation	DynaFont fonts
eForce Co., Ltd.	μNet3 standard TCP/IP stack
eSOL Co., Ltd.	Middleware (file system, USB, network, graphics)
Express Logic, Inc.	GUIX embedded GUI development environment, USBX, FileX (filesystem/SD), and NetX middleware
Grape Systems Inc.	UI Brain GUI development environments for embedded devices
	GR-QR, GR-BARCODE, GR-USB, GR-SD, and IVT BlueLet middleware
International Laboratory Corporation	GENWARE3 and GENWARE4 GUI development environments for embedded devices, INTALOGIC control engine for embedded devices
IS2T S.A.	MicroEJ GUI development environment for embedded devices
IT Access Corporation	Geal GUI development environment for embedded devices
Kyoto Software Research, Inc.	Fugue-NAND and eco-Fugue high-reliability flash file system, Galba high-reliability file system
MCCI Corporation	TrueTask USB middleware
Micrium, Inc.	μC/GUI embedded GUI development environment, μC/USB, μC/FS (filesystem/SD), and μC/TCP-IP middleware
Micro Digital Inc.	smxUSBH/USBD, smxFs (filesystem/SD), and smxNS TCP/IP stack middleware
PUX Corporation	FaceU <sup>®</sup> face recognition software, human detection software, RakuHira <sup>®</sup> handwriting recognition software
SEGGER Microcontroller GmbH & Co. KG	emWin GUI development environment for embedded devices, emUSB middleware
Serious Integrated, Inc.	SHIPTide GUI development environment for embedded devices
Techno Mathematical Co., Ltd.	H.264 BP SD encoder/decoder and hands-free video middleware
Tera Probe, Inc.	TeraFaces <sup>TM</sup> facial verification software
TES Electronic Solutions GmbH	Guiliani GUI development environment for embedded devices
Ubiquitous Corporation	Ubiquitous Network Framework, DeviceSQL, QuickBoot, DTCP-IP/WPA/WPS/Wi-Fi Direct, ECHONET Litev embedded middleware
Uquest, Ltd.	MatrixQuestUSB series middleware
Zuken Elmic, Inc.	MirrorLink, Ethernet AVB, ONVIF, RTP, and TCP/IP (IPv4, IPv6) middleware

## RZ/G Series: Roadmap



## RZ/G Series Features

- ▶ High processing capacity
- ▶ Support for 3D graphics and Full HD video
- ▶ Scalability among products in the series
- ▶ Collaboration with partner companies

### High processing capacity

#### Gigahertz-class dual-core CPU for high-performance operation processing

	RZ/G1E R8A77450	RZ/G1M R8A77430
<b>Core</b>	Cortex®-A7 Dual	Cortex®-A15 Dual
<b>Operating frequency</b>	1.0GHz	1.5GHz
<b>Processing performance</b>	3800DMIPS	10500DMIPS
<b>Cache</b>	L1cache I/32KB D/32KB L2cache 512KB	L1cache I/32KB D/32KB L2cache 1MB
<b>MMU</b>	Supported	Supported
<b>NEON/VFP</b>	NEON supported(SIMDv2) VFP supported(VFPv4)	NEON supported(SIMDv2) VFP supported(VFPv4)

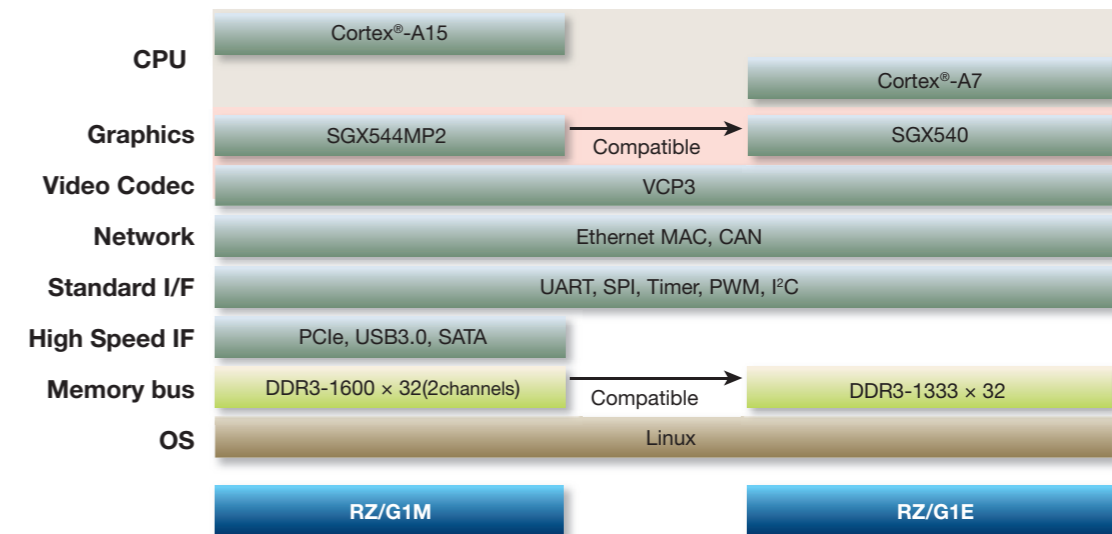
### Support for 3D graphics and Full HD video

#### Capable of handling of Full HD video or 3D graphics with power to spare

	RZ/G1E R8A77450	RZ/G1M R8A77430
<b>3D graphics</b>	SGX540 520Mpx/s	SGX544MP2 2080Mpx/s
<b>Video functions</b>	<ul style="list-style-type: none"> <li>• Video display interface × 2 channels (RGB888 × 2 channels)</li> <li>• Video input interface × 2 channels</li> <li>• Video codec: VCP3</li> <li>• IP converter module</li> <li>• Video image processing functions (color conversion, image enlargement/reduction, filtering)</li> </ul>	<ul style="list-style-type: none"> <li>• Video display interface × 2 channels (LVDS × 1ch/RGB888 × 1 channels)</li> <li>• Video input interface × 3 channels</li> <li>• Video codec: VCP3</li> <li>• IP converter module</li> <li>• Video image processing functions (color conversion, image enlargement/reduction, filtering)</li> </ul>

### Scalability among products in the series

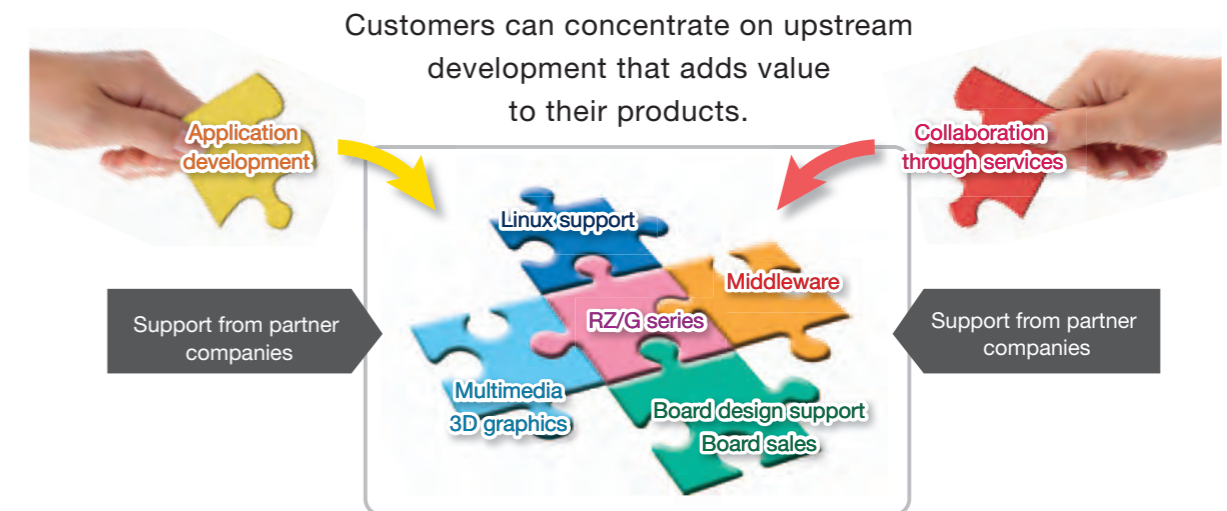
Using the same architecture maintains compatibility with other product versions and software.



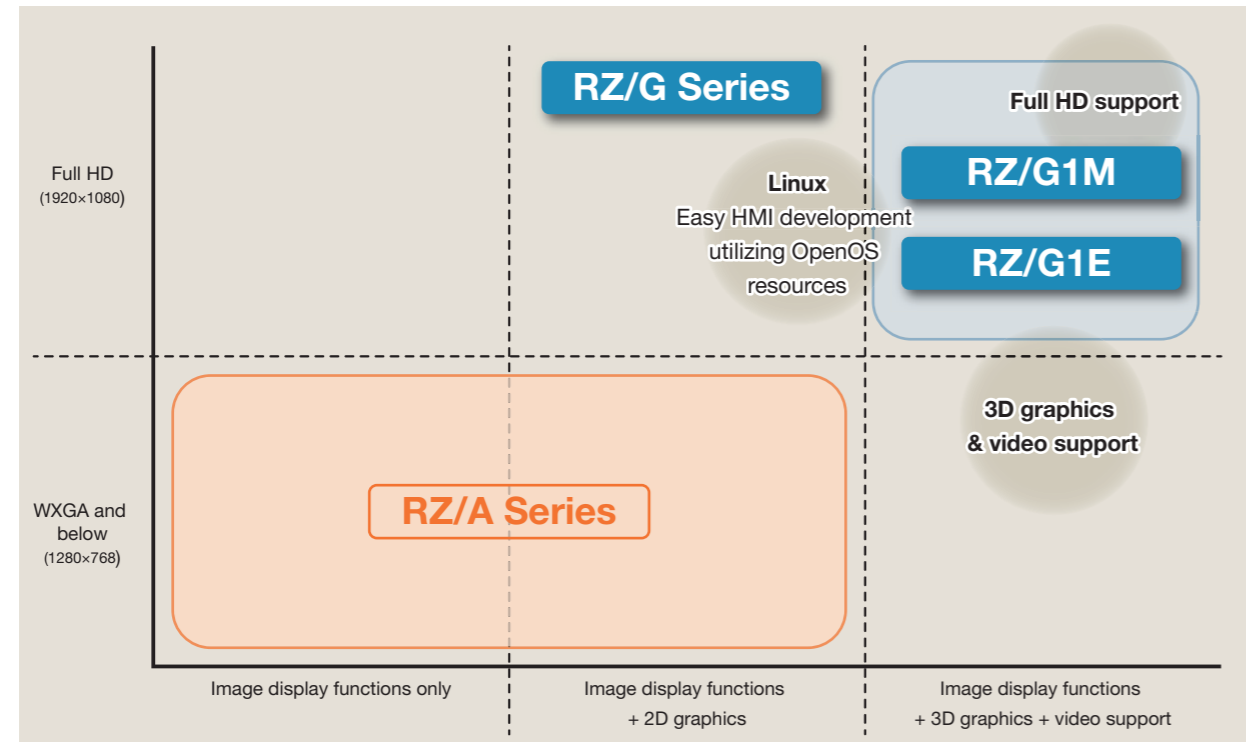
### Collaboration with partner companies

#### Support from partner companies for complex system development

More than ten partner companies provide support in the form of hardware, software, development tools, and services.



## HMI Solutions



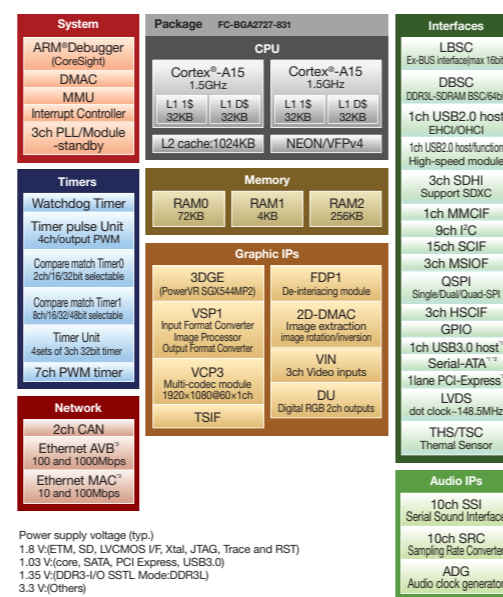
- HMI solutions optimized to match the image resolution, functions, and OS
- RZ/G series: Full HD, functions: 3D Gfx, vide, OS: Linux (RichOS)
- RZ/A series: WXGA and below, functions: 2D Gfx, camera input processing, OS: RTOS

## RZ/G1M Group

- CPU core**
- ARM® Cortex®-A15, dual-core
  - Max. operating frequency: 1.5GHz
- Cache memory**
- L1 instruction cache: 32KB
  - L1 data cache: 32KB
  - L2 cache: 1MB
- External memory**
- Ability to connect DDR3L-SDRAM via DDR dedicated bus
  - Max. operating frequency: 800MHz
  - Data bus width: 32 bits x 2 channels
- External expansion**
- Ability to connect flash ROM or SRAM directly
  - Data bus width: 8/16 bits
  - PCI Express 2.0 (1 lane)
- 3D graphics**
- PowerVR™ SGX544MP2
- Video functions**
- Video display interface x 2 channels (1 channel: LVDS, 1 channel: RGB888)
  - Video input interface x 3 channels
  - Video codec module: VCP3
  - IP converter module
  - Video image processing functions (color conversion, image enlargement/reduction, filtering)
- Audio functions**
- Sampling rate converter x 10 channels
  - Serial sound interface x 10 channels
- Storage interfaces**
- USB 3.0 host interface x 1 port (PHY)

- USB 2.0 host interface x 2 ports (PHY)
  - SD host interface x 3 channels (SDXC and UHS-I support)
  - Multimedia card interface x 1 channel
  - Serial ATA interface x 2 channels
- Other peripheral functions**
- 32-bit timer x 12 channels
  - PWM timer x 7 channels
  - I²C bus interface x 9 channels
  - Serial communication interface (SCIF) x 15 channels
  - Quad serial peripheral interface (QSPI) x 1 channel (boot support)
  - Clock-synchronous serial interface (MSIOF) x 3 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 (IEEE 802.3u-compliant MAC on-chip, RMI interface, ability to connect to PHY device)
  - Controller area network (CAN) interface x 2 channels
  - Interrupt controller (INTC)
  - Clock generator (CPG): on-chip PLL
  - On-chip debug function

### RZ/G1M block diagram



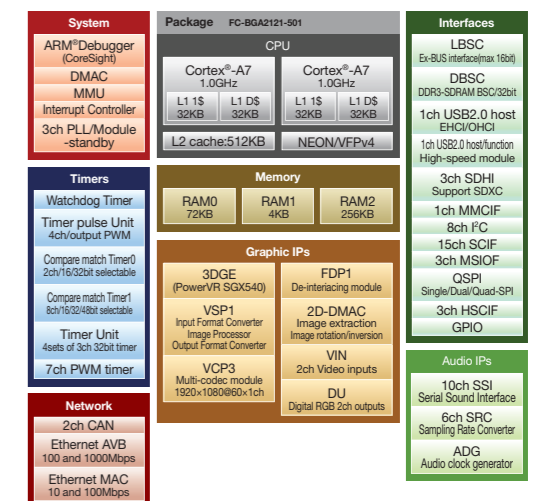
Power supply voltage (typ.)  
 1.8 V<sub>I/ETM, SD, LVCMOS I/F, Xtal, JTAG, Trace and RST</sub>  
 1.03 V<sub>I/core, SATA, PCI Express, USB3.0</sub>  
 1.35 V<sub>I/DDR3-I/O SSTL Mode:DDR3L</sub>  
 3.3 V<sub>I/Other</sub>  
 1. Since the PHY is used by both, the user must select either the USB 3.0 or SATA0 function.  
 2. Since the PHY is used by both, the user must select either the PCI-e or SATA1 function.  
 3. Due to pin matching, the user must select one or the other.  
 Note: This information is subject to change without notice.

## RZ/G1E Group

- CPU core**
- ARM® Cortex®-A7, dual-core
  - Max. operating frequency: 1.0GHz
- Cache memory**
- L1 instruction cache: 32KB
  - L1 data cache: 32KB
  - L2 cache: 512KB
- External memory**
- Ability to connect DDR3-SDRAM via DDR dedicated bus
  - Max. operating frequency: 533MHz
  - Data bus width: 32 bits
- External expansion**
- Ability to connect flash ROM or SRAM directly
  - Data bus width: 8/16 bits
- 3D graphics**
- PowerVR™ SGX540
- Video functions**
- Video display interface x 2 channels (RGB888)
  - Video input interface x 2 channels
  - Video codec module: VCP3
  - IP converter module
  - Video image processing functions (color conversion, image enlargement/reduction, filtering)
- Audio functions**
- Sampling rate converter x 6 channels
  - Serial sound interface x 10 channels
- Storage interfaces**
- USB 2.0 host interface x 2 ports (wPHY)

- SD host interface x 3 channels (SDXC and UHS-I support)
  - Multimedia card interface x 1 channel
- Other peripheral functions**
- 32-bit timer x 12 channels
  - PWM timer x 7 channels
  - I²C bus interface x 8 channels
  - Serial communication interface (SCIF) x 15 channels
  - Quad serial peripheral interface (QSPI) x 1 channel (boot support)
  - Clock-synchronous serial interface (MSIOF) x 3 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 (IEEE 802.3u-compliant MAC on-chip, RMI interface, ability to connect to PHY device)
  - Controller area network (CAN) interface x 2 channels
  - Interrupt controller (INTC)
  - Clock generator (CPG): on-chip PLL
  - On-chip debug function

### RZ/G1E block diagram



Power supply voltage (typ.)  
 1.8 V<sub>I/ETM, SD, LVCMOS I/F, Xtal, JTAG, Trace and RST</sub>  
 1.03 V<sub>I/core</sub>  
 1.5 V<sub>I/DDR3-I/O SSTL Mode:DDR3</sub>  
 3.3 V<sub>I/Other</sub>  
 Note: This information is subject to change without notice.

## RZ/G Series: Applications

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

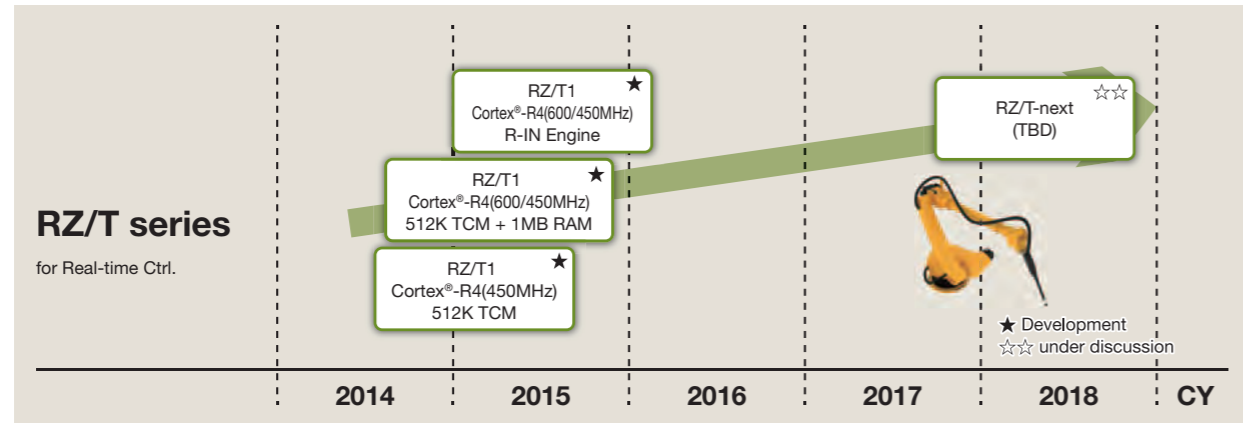


## RZ/G Series: Solutions from Partner Companies

Partner companies provide a variety of services to support developers using the RZ/G series, including GUI frameworks, middleware, OS support, board design support, and sales of evaluation and mass production boards.

Development environments, emulators	
ARM Ltd.	DS-5 (development studio 5) development environment, ARM CC DSTREAM™ JTAG emulator
Computex Co., Ltd.	PALMICE3 JTAG emulator
Kyoto Microcomputer Co., Ltd.	PARTNER-Jet2 JTAG emulator, internal bus load, Linux debugging and dynamic analysis tool
Yokogawa Digital Computer Corporation	adviceLUNA II JTAG emulator, dynamic text/analysis tool, CAN logger, flash programmer
Starter kits, evaluation boards, platforms, etc.	
Atmark Techno, Inc.	Armadillo-EVA 1500 RZ/G1M evaluation board
Hitachi ULSI Systems Co., Ltd.	Solution Engine G1, T-Kernel support, middleware
OS, middleware, tools	
Access Co., Ltd.	ACCESS Connect and HTML browser for IoT
eSOL Co., Ltd.	TRON real-time OS, tools, and middleware with functional safety support
Lineo Solutions, Inc.	"Ultra" high-speed activation and Linux support
Miracle Linux Corporation	Custom Linux distributions and support
Software Research Associates, Inc.	"Qt" GUI framework support, development support

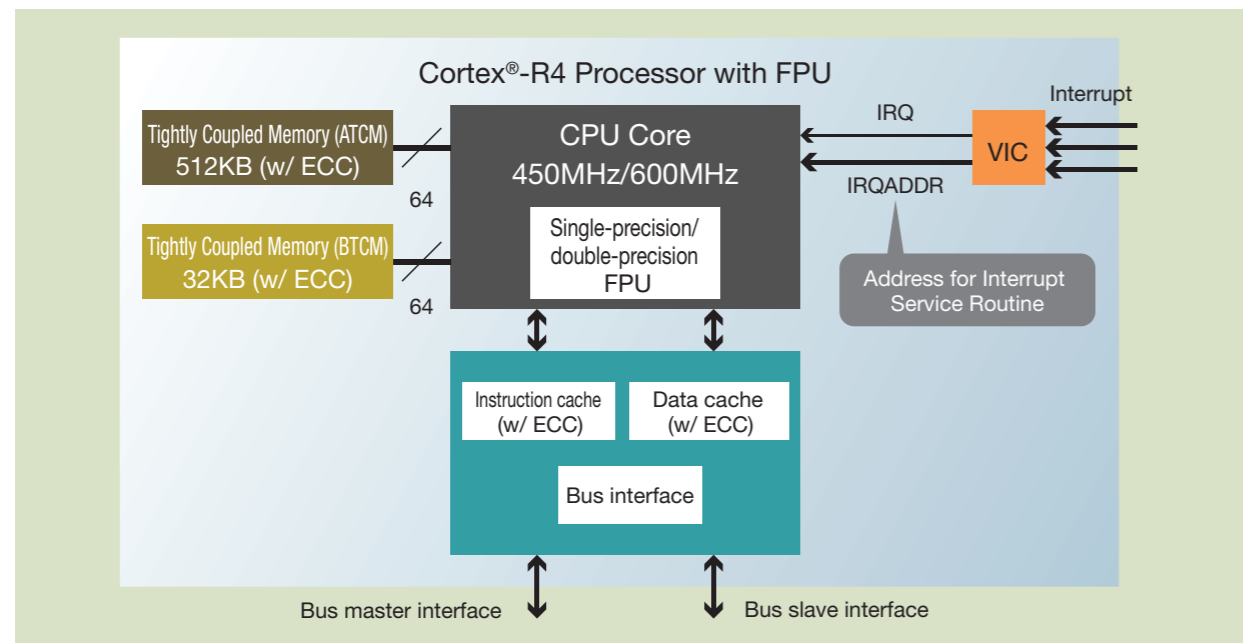
## RZ/T Series: Roadmap



## RZ/T Series Features

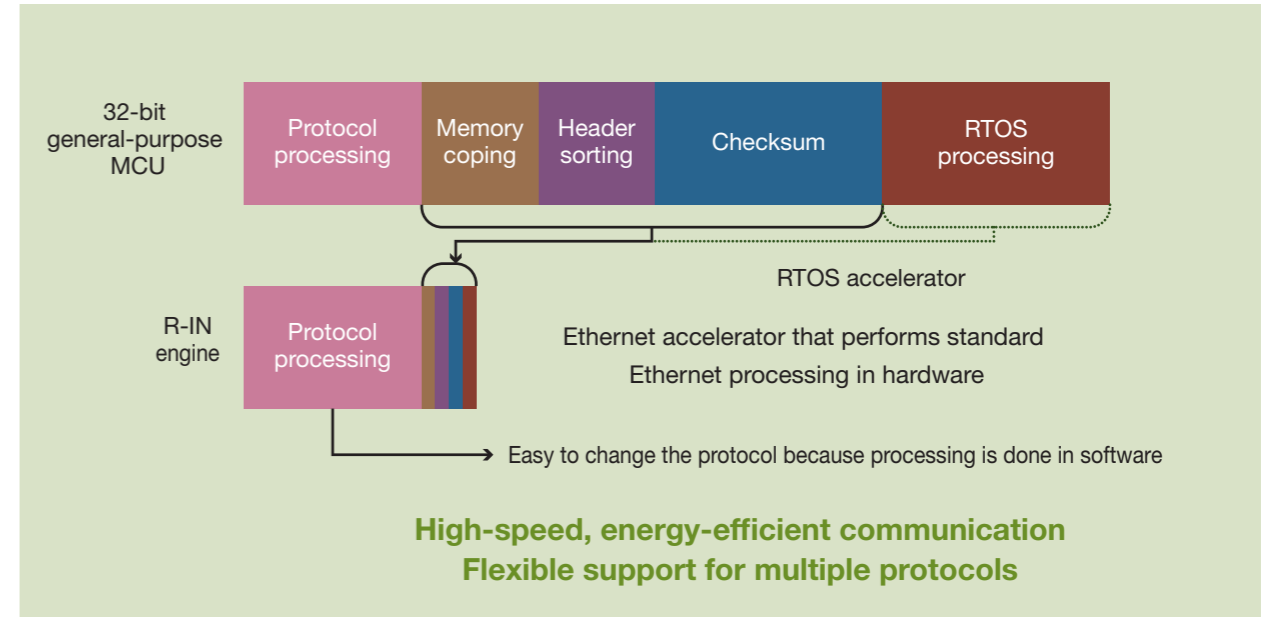
- ▶ High-performance, high-speed real-time control
- ▶ R-IN engine
- ▶ Integrated peripheral functions

### High-performance, high-speed real-time control



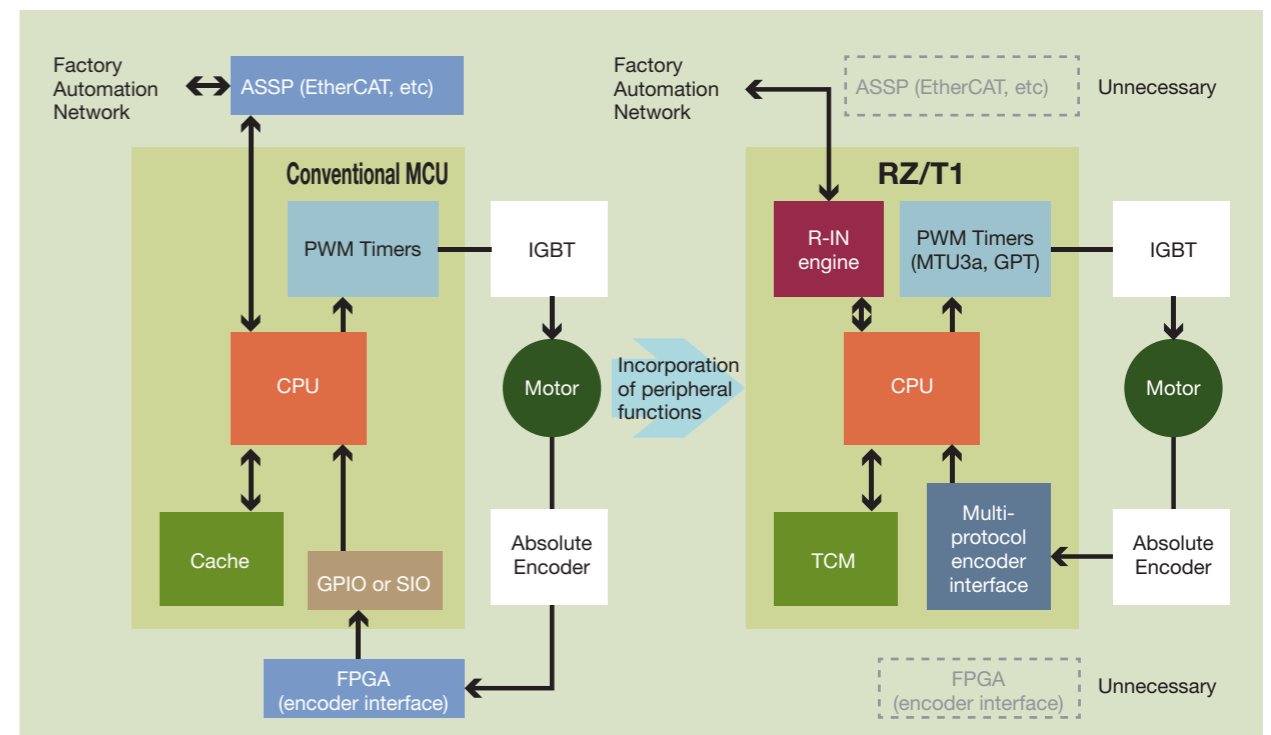
- High-speed RAM directly connected to the CPU for high-speed processing and dependable real-time responsiveness without caching
- ECC for enhanced reliability
- Vectored Interrupt Controller (VIC) to assure interrupt responsiveness suitable for embedded control

### R-IN engine



- 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

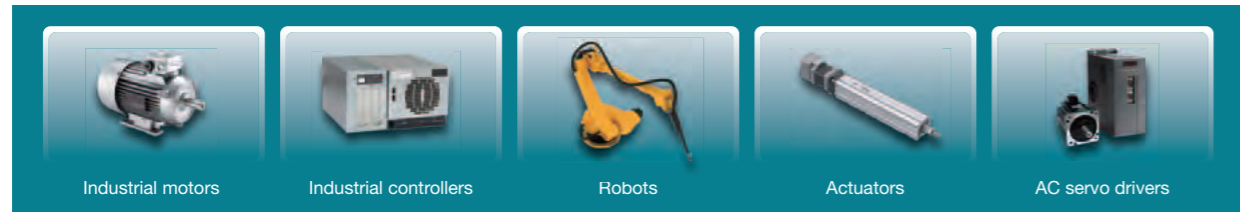


- The encoder interface was external with conventional FPGA or ASIC approaches but is now integrated on-chip.
- This one-chip AC servo solution helps reduce the component count and save space.



## RZ/T Series Application Fields

High-speed operation at 450MHz or 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 (Products with R-IN Engine)

### 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)

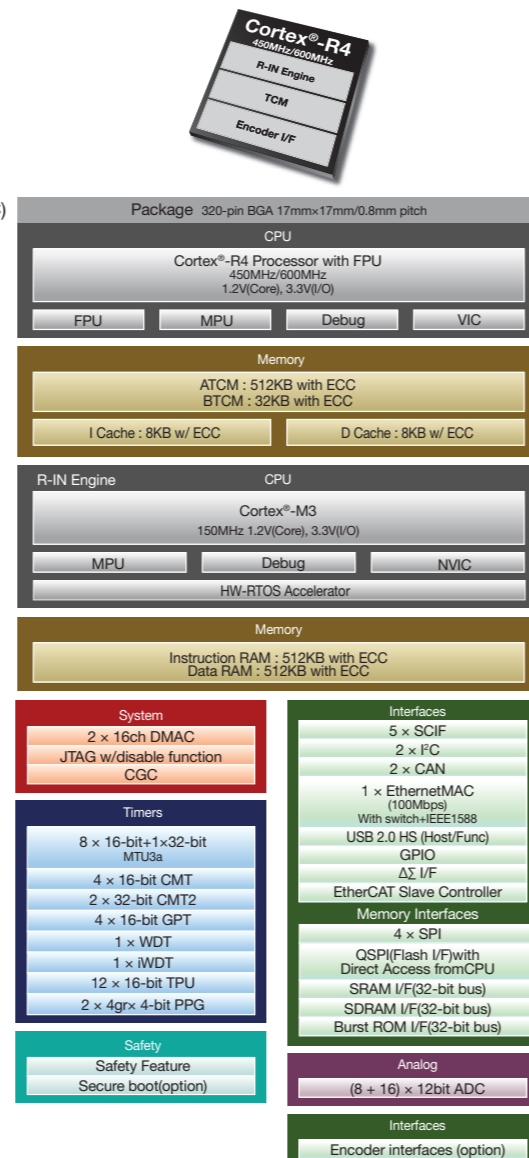
### Features

- Industrial Ethernet communication accelerator with multi-protocol support (R-IN engine)
- EtherCAT slave controller
- PWM timers: MTU3a, GPT
- Encoder interface (Endat 2.2/BISS-B/BISS-C/Nikon A-Format)(option)
- 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□,0.8mm pitch)

## RZ/T1 (Products with R-IN Engine) block diagram



## RZ/T1 (Products without R-IN Engine)

### 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)

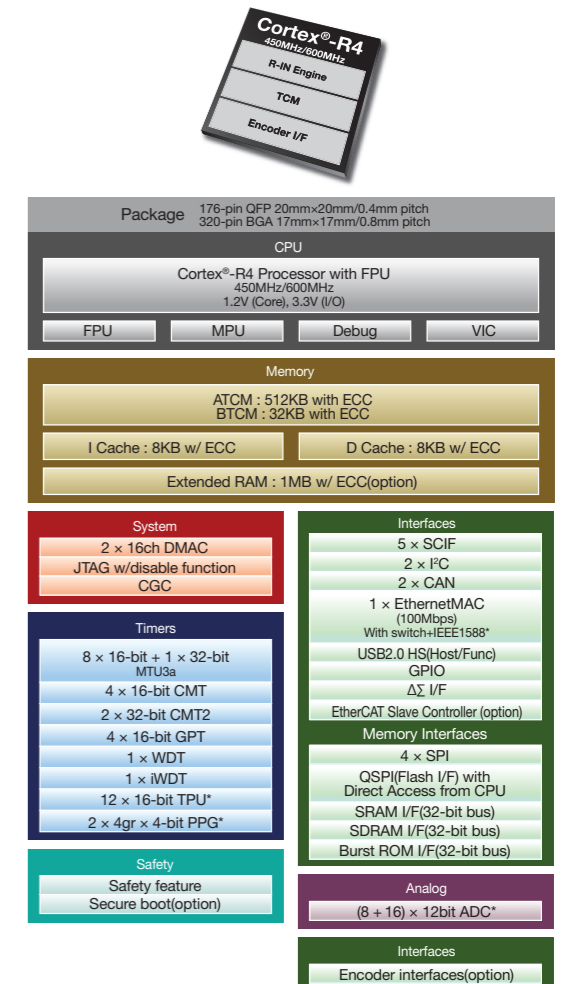
### Features

- EtherCAT slave controller (option)
- PWM timers: MTU3a, GPT
- Encoder interface (Endat 2.2/BISS-B/BISS-C/Nikon A-Format)(option)
- 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□,0.8mm pitch)
- QFP 176pin(20mm□,0.4mm pitch)

## RZ/T1 (Products without R-IN Engine) block diagram



\* 176-pin QFP: 12-bit ADC x 8 channels, TPU x 6 channels, PPG x 1 unit, Ethernet x 1 port

## 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)

Development environments	• IAR Embedded Workbench for ARM	• DS-5	• e²studio¹
Compilers	• IAR C/C++ compiler²	• ARM CC³	• KPIT GNU tool⁴
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 • JTAGjet-Trace	• DSTREAM™ • ULINKpro™ • ULINKproD™ • ULINK2™	• J-Link LITE • J-Link series from Segger⁵

\*1. Eclipse-based development environment from Renesas (<http://japan.renesas.com/e2studio>)  
 \*2. The IAR C/C++ compiler is available in two free versions: one is limited to a code size of 32KB but has no time limit, and the other provides full functionality but is limited to 30 days of use.  
 \*3. ARM CC is available in a free evaluation version that provides full functionality but is limited to 30 days of use. Contact a DS-5 sales agent for details.  
 \*4. GNU tools for RZ/T1 and technical support are provided by KPIT Technologies Ltd. (<http://www.kpitgnu.com/index.php>).  
 \*5. Renesas does not handle ICEs from Segger. Contact a sales agent for details.

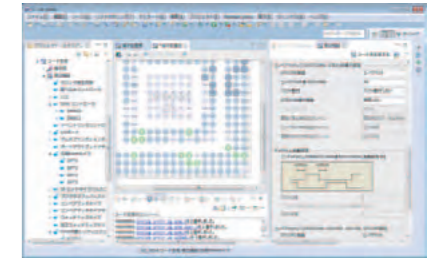
## RZ/T Series: Development Tools (Debuggers, ICEs)

Debuggers	• PARTNER-Jet2	• microVIEW-PLUS	• Code Stage V3	• CSIDE version 6
ICEs		• adviceLUNA II	• DW-A1 • DS-A1	• PALMICE³
Compatible compilers	• exeGCC from Kyoto Microcomputer • KPIT GNU tool¹ • ARM CC2 • IAR C/C++ compiler,³ etc.	• ARM CC² • KPIT GNU tool,¹ etc.	• ARM CC² • IAR C/C++ compiler³ • KPIT GNU tool,¹ etc.	• ARM CC² • IAR C/C++ compiler³ • KPIT GNU tool,¹ etc.

\*1. GNU tools for RZ/T1 and technical support are provided by KPIT Technologies Ltd. (<http://www.kpitgnu.com/index.php>).  
 \*2. ARM CC is available in a free evaluation version that provides full functionality but is limited to 30 days of use. Contact a DS-5 sales agent for details.  
 \*3. The IAR C/C++ compiler is available in two free versions: one is limited to a code size of 32KB but has no time limit, and the other provides full functionality but is limited to 30 days of use.

## 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.

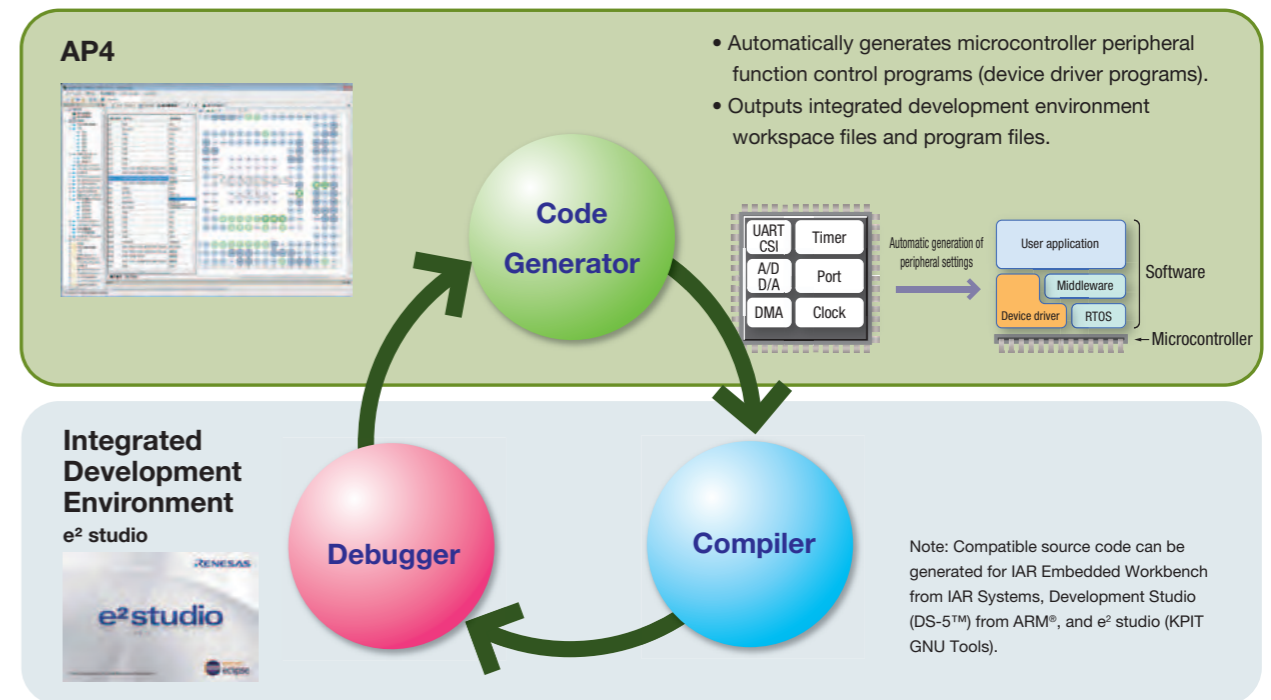
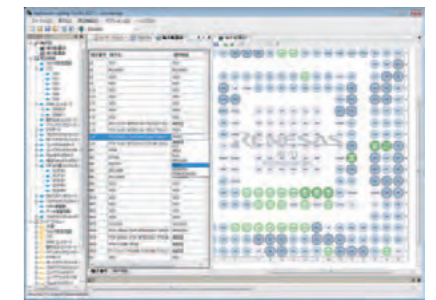


### C/C++ perspective: code generation plug-in

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 interoperability with integrated development environments. The version of AP4 that is compatible with the RZ/T series can generate compatible source code for IAR Embedded Workbench from IAR Systems, Development Studio (DS-5™) from ARM®, and e² studio (KPIT GNU Tools).





## RZ Specifications

### RZ/A1H (256-pin to 324-pin)

Group name	RZ/A1H				
	256-pin			324-pin	
Pin count					
Product name	R7S721000VCBG	R7S721000VCFP	R7S721000VLFP	R7S721001VCBG	R7S721001VLBG
CPU core	ARM® Cortex®-A9				
RAM (bytes)	10M				
Cache memory	Primary cache:64KB(instruction32KB/data32KB), TLB128 Secondary cache:128KB(CoreLink™ Level 2 Cache Controller L2C-310)				
Max. operating frequency (MHz)	400				
Subclock (external: 32.768kHz)	YES				
PLL	YES				
Real-time clock	YES				
Power-on reset	YES				
Floating-point unit	YES				
DMA	DMAC × 16 ch				
External memory interfaces	Serial flash (eXecute-In-Place(XIP) support), SRAM, SDRAM, burst ROM, NAND flash				
External interrupt pins	148			180	
I/O ports	139			171	
16-/32-bit timer (channels)	5/2				
Watchdog timer (channels)	1				
Other timers	Motor Control PWM Timer × 8				
PWM output	16				
3-phase PWM output function	YES				
12-bit A/D converter (channels)	8				
CAN (channels)	5				
Ethernet	YES				
Ethernet AVB	YES				
USB host function	YES				
USB peripheral function	YES				
USB (channels)	2				
USB High Speed support	YES				
USB endpoints	16				
USB isochronous transfer support	YES				
USB additional information	Low-speed Support(Host only)				
SD host interface (channels)	2				
MMC host interface (channels)	1				
Clock-synchronous serial interface (channels)	17				
SPI (channels)	5				
UART (channels)	8				
I <sup>2</sup> C (channels)	4				
LIN (channels)	2				
IEBus (channels)	1				
Serial additional information	SCIF(CSI:8ch/UART:8ch), SCI(CSI:2ch), RSP(SPI:5ch), SPI multi(SPI:2ch), SSI(CSI:6ch), SPDIF(CSI:1ch)				
Other display functions	VDC5: WXGA(1280 × 768), JPEG Engine, OpenVG Accelera to r(2D)				
Power supply voltage (V)	3.3V/1.18V				
Power supplies	VCC = PLLVCC = LVDSPLLVCC = USBAVCC = USBUVCC = USBDVCC = 1.10 to 1.26 V, PVCC = AVCC = USBAPVCC = VDAVCC = LVDSAPVCC = USBDPVCC = 3.0 to 3.6 V, VSS = AVSS = 0 V				
Operating temperature (°C)	T <sub>A</sub> = -40 to 85°C				
Package (size [mm])	256-LFBGA (11 × 11mm)	256-LFQFP(28 × 28mm)		324-FBGA(19 × 19mm)	

## RZ Specifications

### RZ/A1M (256-pin to 324-pin)

Group name	RZ/A1M				
	256-pin			324-pin	
Pin count					
Product name	R7S721010VCBG	R7S721010VCFP	R7S721010VLFP	R7S721011VCBG	R7S721011VLBG
CPU core	ARM® Cortex®-A9				
RAM (bytes)	5M				
Cache memory	Primary cache:64KB(instruction32KB/data32KB), TLB128 Secondary cache:128KB(CoreLink™ Level 2 Cache Controller L2C-310)				
Max. operating frequency (MHz)	400				
Subclock (external: 32.768kHz)	YES				
PLL	YES				
Real-time clock	YES				
Power-on reset	YES				
Floating-point unit	YES				
DMA	DMAC × 16 ch				
External memory interfaces	Serial flash (eXecute-In-Place(XIP) support), SRAM, SDRAM, burst ROM, NAND flash				
External interrupt pins	148			180	
I/O ports	139			171	
16-/32-bit timer (channels)	5/2				
Watchdog timer (channels)	1				
Other timers	Motor Control PWM Timer × 8				
PWM output	16				
3-phase PWM output function	YES				
12-bit A/D converter (channels)	8				
CAN (channels)	5				
Ethernet	YES				
Ethernet AVB	YES				
USB host function	YES				
USB peripheral function	YES				
USB (channels)	2				
USB High Speed support	YES				
USB endpoints	16				
USB isochronous transfer support	YES				
USB additional information	Low-speed Support(Host only)				
SD host interface (channels)	2				
MMC host interface (channels)	1				
Clock-synchronous serial interface (channels)	17				
SPI (channels)	5				
UART (channels)	8				
I <sup>2</sup> C (channels)	4				
LIN (channels)	2				
IEBus (channels)	1				
Serial additional information	SCIF(CSI:8ch/UART:8ch), SCI(CSI:2ch), RSP(SPI:5ch), SPI multi(SPI:2ch), SSI(CSI:6ch), SPDIF(CSI:1ch)				
Other display functions	VDC5: WXGA(1280 × 768), JPEG Engine, OpenVG Accelera to r(2D)				
Power supply voltage (V)	3.3V/1.18V				
Power supplies	VCC = PLLVCC = LVDSPLLVCC = USBAVCC = USBUVCC = USBDVCC = 1.10 to 1.26 V, PVCC = AVCC = USBAPVCC = VDAVCC = LVDSAPVCC = USBDPVCC = 3.0 to 3.6 V, VSS = AVSS = 0 V				
Operating temperature (°C)	T <sub>A</sub> = -40 to 85°C				
Package (size [mm])	256-LFBGA (11×11mm)	256-LFQFP(28×28mm)		324-FBGA(19×19mm)	

## RZ Specifications

### RZ/A1L (176-pin to 208-pin)

Group name	RZ/A1L				
	176-pin			208-pin	
Pin count					
Product name	R7S721020VCBG	R7S721020VCFP	R7S721020VLFP	R7S721021VCFP	R7S721021VLFP
CPU core	ARM® Cortex®-A9				
RAM (bytes)	3M				
Cache memory	Primary cache:64KB(instruction32KB/data32KB), TLB128 Secondary cache:128KB(CoreLink™ Level 2 Cache Controller L2C-310)				
Max. operating frequency (MHz)	400				
Subclock (external: 32.768kHz)	YES				
PLL	YES				
Real-time clock	YES				
Power-on reset	YES				
Floating-point unit	YES				
DMA	DMAC × 16 ch				
External memory interfaces	Serial flash (eXecute-In-Place(XIP) support), SRAM, SDRAM, burst ROM				
External interrupt pins	109			131	
I/O ports	100			122	
16-/32-bit timer (channels)	5/2				
Watchdog timer (channels)	-				
Other timers	-				
PWM output	-				
3-phase PWM output	-				
12-bit A/D converter (channels)	8				
CAN (channels)	2				
Ethernet	YES				
Ethernet AVB	-				
USB host function	YES				
USB peripheral function	YES				
USB (channels)	2				
USB High Speed support	YES				
USB endpoints	16				
USB isochronous transfer support	YES				
USB additional information	Low-speed Support(Host only)				
SD host interface (channels)	2				
MMC host interface (channels)	1				
Clock-synchronous serial interface (channels)	12				
SPI (channels)	3				
UART (channels)	5				
I <sup>2</sup> C (channels)	4				
LIN (channels)	1				
IEBus (channels)	1				
Serial additional information	SCIF(CSI:5ch/UART:5ch), SCI(CSI:2ch), RSPI(SPI:2ch), SPI multi(SPI:1ch), SSI(CSI:4ch), SPDIF(CSI:1ch)				
Other display functions	VDC5: XGA(1024 × 768)				
Power supply voltage (V)	3.3V/1.18V				
Power supplies	VCC = PLLVCC = LVDSPLL VCC = USBVCC = USBUVCC = USBDVCC = 1.10 to 1.26 V, PVCC = AVCC = USBAPVCC = VDAVCC = LVDSAPVCC = USBDPVCC = 3.0 to 3.6 V, VSS = AVSS = 0 V				
Operating temperature (°C)	T <sub>A</sub> = -40 to 85°C				
Package code	176-LFBGA (8×8mm)	176-LFQFP(24×24mm)		208-LFQFP(28×28mm)	

## RZ Specifications

### RZ/A1LU (176-pin to 208-pin)

Group name	RZ/A1LU				
	176-pin			208-pin	
Pin count					
Product name	R7S721030VCBG	R7S721030VCFP	R7S721030VLFP	R7S721031VCFP	R7S721031VLFP
CPU core	ARM® Cortex®-A9				
RAM (bytes)	3M				
Cache memory	Primary cache:64KB(instruction32KB/data32KB), TLB128 Secondary cache:128KB(CoreLink™ Level 2 Cache Controller L2C-310)				
Max. operating frequency (MHz)	400				
Subclock (external: 32.768kHz)	YES				
PLL	YES				
Real-time clock	YES				
Power-on reset	YES				
Floating-point unit	YES				
DMA	DMAC × 16 ch				
External memory interfaces	Serial flash (eXecute-In-Place(XIP) support), SRAM, SDRAM, burst ROM				
External interrupt pins	109			131	
I/O ports	100			122	
16-/32-bit timer (channels)	5/2				
Watchdog timer (channels)	1				
Other timers	-				
PWM output	-				
3-phase PWM output	-				
12-bit A/D converter (channels)	8				
CAN (channels)	2				
Ethernet	YES				
Ethernet AVB	YES				
USB host function	YES				
USB peripheral function	YES				
USB (channels)	2				
USB High Speed support	YES				
USB endpoints	16				
USB isochronous transfer support	YES				
USB additional information	Low-speed Support(Host only)				
SD host interface (channels)	2				
MMC host interface (channels)	1				
Clock-synchronous serial interface (channels)	12				
SPI (channels)	3				
UART (channels)	5				
I <sup>2</sup> C (channels)	4				
LIN (channels)	-				
IEBus (channels)	-				
Serial additional information	SCIF(CSI:5ch/UART:5ch), SCI(CSI:2ch), RSPI(SPI:2ch), SPI multi(SPI:1ch), SSI(CSI:4ch), SPDIF(CSI:1ch)				
Other display functions	VDC5: XGA(1024 × 768), JPEG Engine				
Power supply voltage (V)	3.3V/1.18V				
Power supplies	VCC = PLLVCC = LVDSPLL VCC = USBVCC = USBUVCC = USBDVCC = 1.10 to 1.26 V, PVCC = AVCC = USBAPVCC = VDAVCC = LVDSAPVCC = USBDPVCC = 3.0 to 3.6 V, VSS = AVSS = 0 V				
Operating temperature (°C)	T <sub>A</sub> = -40 to 85°C				
Package code	176-LFBGA (8×8mm)	176-LFQFP(24×24mm)		208-LFQFP(28×28mm)	

## RZ Specifications RZ/G1E (501-pin)

Group name	RZ/G1E
Pin count	501-pin
Product name	R8A77450HA01BG
CPU core	ARM® Cortex®-A7
RAM (bytes)	RAM0 of 72 Kbytes / RAM1 of 4 Kbytes / RAM2 of 256 Kbytes
Cache memory	L1 I/D cache 32/32 Kbytes, L2 cache 512 Kbytes
Max. operating frequency (GHz)	1.0
Subclock (external: 32.768kHz)	—
PLL	YES
Real-time clock	YES
Power-on reset	YES
Floating-point unit	YES
DMA	LBSC DMAC : 3ch/ SYS-DMAC : 30ch/ Audio-DMAC : 13ch/ Audio(peripheral)-DMAC : 29ch
External bus expansion	YES
External interrupt pins	10
I/O ports	208
16-/32-bit timer (channels)	4/12
Watchdog timer (channels)	1
Other timers	Compare match timer0(CMT0)× 2 Compare match timer1(CMT1)× 8
PWM output	7
3-phase PWM output	—
12-bit A/D converter (channels)	—
CAN (channels)	2
Ethernet	YES
USB host function	YES
USB peripheral function	YES
USB (channels)	USB2.0 Host × 1 / Host/Function × 1
USB High Speed support	YES
USB endpoints	16
USB isochronous transfer support	YES
USB additional information	—
Clock-synchronous serial interface (channels)	3
SPI (channels)	1
UART (channels)	18
I <sup>2</sup> C (channels)	8
LIN (channels)	—
IEBus (channels)	—
Serial additional information	SCIF:6ch, SCIFA:6ch, SCIFB:3ch, HSCIF:3ch, MSIOF:3ch, QSPI:1ch
Other display functions	PowerVR SGX540(3D) Video signal processor1(VSP1) Video processing unit(VCP3)
Power supply voltage (V)	3.3V/1.8V/1.5V/1.03V
Power supplies	VDD=0.98 to 1.08V, VCCQ=3.0 to 3.6V, VCCQ33_MLBP=3.0 to 3.6V(3.3V-I/O), VCCQ_SD0 to VCCQ_SD3,VCCQ_MMC_SD=3.0 to 3.6V(3.3V-I/O), VCCQ18=1.7 to 1.9V, VCCQ_SD0 to VCCQ_SD3,VCCQ_MMC_SD=1.7 to 1.9V(1.8V-I/O), VDDQ_M0,VDDQ_M1,VDDQ_M1A=1.425 to 1.575V, VDD_CPGPLL=1.7 to 1.9V, VDDQ_M0DPLL,VDDQ_M1DPLL,VDDQ_M1MPLL,VDDQ_M0APLL,VDDQ_M1APLL=1.7 to 1.9V, AVDD=1.7 to 1.9V, VD331=3.0 to 3.6V, VD181=1.7 to 1.9V
Operating temperature (°C)	T <sub>A</sub> = -40 to 85°C
Package (size [mm])	501-FBGA(21×21mm)

## RZ Specifications RZ/G1M (831-pin)

Group name	RZ/G1M
Pin count	831-pin
Product name	R8A77430HA01BG
CPU core	ARM® Cortex®-A15
RAM (bytes)	RAM0 of 72 Kbytes / RAM1 of 4 Kbytes / RAM2 of 256 Kbytes
Cache memory	L1 I/D cache 32/32 Kbytes, L2 cache 1024 Kbytes
Max. operating frequency (GHz)	1.5
Subclock (external: 32.768kHz)	—
PLL	YES
Real-time clock	YES
Power-on reset	YES
Floating-point unit	YES
DMA	LBSC DMAC : 3ch/ SYS-DMAC : 30ch/ Audio-DMAC : 26ch/ Audio(peripheral)-DMAC : 29ch
External bus expansion	YES
External interrupt pins	10
I/O ports	244
16-/32-bit timer (channels)	4/12
Watchdog timer (channels)	1
Other timers	Compare match timer0(CMT0)× 2 Compare match timer1(CMT1)× 8
PWM output	7
3-phase PWM output	—
12-bit A/D converter (channels)	—
CAN (channels)	2
Ethernet	YES
USB host function	YES
USB peripheral function	YES
USB (channels)	USB3.0 Host × 1 USB2.0 Host × 1 / Host/Function × 1
USB High Speed support	YES
USB endpoints	16
USB isochronous transfer support	YES
USB additional information	—
Clock-synchronous serial interface (channels)	3
SPI (channels)	1
UART (channels)	18
I <sup>2</sup> C (channels)	9
LIN (channels)	—
IEBus (channels)	—
Serial additional information	SCIF:6ch, SCIFA:6ch, SCIFB:3ch, HSCIF:3ch, MSIOF:3ch, QSPI:1ch
Other display functions	PowerVR SGX544MP2(3D) Video signal processor1(VSP1) Video processing unit(VCP3)
Power supply voltage (V)	3.3V/1.8V/1.35V/1.03V
Power supplies	VDD=0.98 to 1.08V, VCCQ=3.0 to 3.6V, VCCQ33_MLBP=3.0 to 3.6V,VCCQ_SD0 to VCCQ_SD3,VCCQ_MMC_SD=3.0 to 3.6V, VCCQ_ISO=1.7 to 1.9V, VCCQ18=1.7 to 1.9V, VCCQ_SD0 to VCCQ_SD3,VCCQ_MMC_SD=1.7 to 1.9V, VDDQ_LVDS=1.7 to 1.9V, VDDQ_M0,VDDQ_M1,VDDQ_M1A=1.283 to 1.450V, VDDA_SATA0=1.7 to 1.9V, VDDD_SATA0=0.98 to 1.08V, VDDA_SATA1=1.7 to 1.9V, VDDD_SATA1=0.98 to 1.08V, VDDA_SATA0,VDDA_SATA1=1.7 to 1.9V, VDDD_SATA0,VDDD_SATA1=0.98 to 1.08V, VDD_CPGPLL=1.7 to 1.9V, VDDQ_M0DPLL,VDDQ_M1DPLL,VDDQ_M1MPLL,VDDQ_M0APLL,VDDQ_M1APLL=1.7 to 1.9V, DU/DU0_LVDS0/LVDS_PLL1_VCC=1.7 to 1.9V, AVDD=1.7 to 1.9V, VD331=3.0 to 3.6V, VD181=1.7 to 1.9V
Operating temperature (°C)	T <sub>A</sub> = -40 to 85°C
Package (size [mm])	831-FBGA(27×27mm)

## RZ Specifications RZ/T1 (176-pin to 320-pin)

Group name	RZ/T1					
Pin count	176-pin		320-pin			
Product name	R7S910001CFP	R7S910002CBG	R7S910006CBG	R7S910007CBG	R7S910011CBG	R7S910013CBG
CPU core	ARM® Cortex®-R4 Processor with FPU					
RAM (KB)	544		1568		544, 1568	
Cache memory	Primary cache:16KB(instruction8KB/data8KB)					
Max. operating frequency (MHz)	450		600		450, 600	
On-chip oscillator frequency (MHz)	0.24					
PLL	YES					
Power-on reset	YES					
Floating-point unit	YES					
DMA	DMAC × 2Unit(16ch × 2)					
External memory interfaces	Serial flash (eXecute-In-Place(XIP) support), SRAM, SDRAM, burst ROM					
External interrupt pins	20					
I/O ports	97		209			
16-/32-bit timer (channels)	24/1					
Watchdog timer (channels)	2					
Other timers	General PWM Timer × 4					
PWM output	4					
3-phase PWM output	YES					
12-bit A/D converter (channels)	1 Unit : 8ch		2 Unit(Unit 0 : 8ch,Unit 1 : 16ch)			
CAN (channels)	2					
Ethernet	10/100Mbps					
R-IN engine	—					
Industrial network	—					
Encoder I/F	—		YES			
USB host function	YES					
USB peripheral function	YES					
USB (channels)	1					
USB High Speed support	YES					
USB endpoints	10					
USB isochronous transfer support	YES					
Clock-synchronous serial interface (channels)	9					
SPI (channels)	4					
UART (channels)	9					
I <sup>2</sup> C (channels)	2					
Power supply voltage (V)	3.3V (I/O block), 1.2V (internal)					
Power supplies	VDD = PLLVDD0 = PLLVDD1 = DVDD_USB = 1.14 to 1.26 V, VCCQ33 = AVCC0 = AVCC1 = VREFH0 = VREFH1 = VDD33_USB = 3.0 to 3.6 V					
Operating temperature (°C)	T <sub>J</sub> = -40 to 125°C					
Package (size [mm])	176-HLQFP (20×20mm)		320-FBGA(17×17mm)			

## RZ Specifications RZ/T1 (320-pin)

Group name	RZ/T1							
Pin count	320-pin							
Product name	R7S910015CBG	R7S910016CBG	R7S910017CBG	R7S910018CBG	R7S910025CBG	R7S910026CBG	R7S910027CBG	R7S910028CBG
CPU core	ARM® Cortex®-R4 Processor with FPU							
RAM (KB)	1568							
Cache memory	Primary cache:16KB(instruction8KB/data8KB)							
Max. operating frequency (MHz)	450		600		450		600	
On-chip oscillator frequency (MHz)	0.24							
PLL	YES							
Power-on reset	YES							
Floating-point unit	YES							
DMA	DMAC × 2Unit(16ch × 2)							
External memory interfaces	Serial flash (eXecute-In-Place(XIP) support), SRAM, SDRAM, burst ROM							
External interrupt pins	20							
I/O ports	209							
16-/32-bit timer (channels)	24/1							
Watchdog timer (channels)	2							
Other timers	General PWM Timer × 4							
PWM output	4							
3-phase PWM output	YES							
12-bit A/D converter (channels)	2 Unit(Unit 0 : 8ch,Unit 1 : 16ch)							
CAN (channels)	2							
Ethernet	10/100Mbps							
R-IN engine	YES				—			
Industrial network	Multi Protocol				EtherCAT			
Encoder I/F	—	YES	—	YES	—	YES	—	YES
USB host function	YES							
USB peripheral function	YES							
USB (channels)	1							
USB High Speed support	YES							
USB endpoints	10							
USB isochronous transfer support	YES							
Clock-synchronous serial interface (channels)	9							
SPI (channels)	4							
UART (channels)	9							
I <sup>2</sup> C (channels)	2							
Power supply voltage (V)	3.3V (I/O block), 1.2V (internal)							
Power supplies	VDD = PLLVDD0 = PLLVDD1 = DVDD_USB = 1.14 to 1.26 V, VCCQ33 = AVCC0 = AVCC1 = VREFH0 = VREFH1 = VDD33_USB = 3.0 to 3.6 V							
Operating temperature (°C)	T <sub>J</sub> = -40 to 125°C							
Package (size [mm])	320-FBGA(17×17mm)							

## Package Lineup

### ▼ HLQFP

**176-HLQFP** (20x20mm)

Pitch	0.40mm
Thickness (max.)	1.70mm
Mounted product	RZ/T1

### ▼ LFQFP

**176-LFQFP** (24x24mm)

Pitch	0.50mm
Thickness (max.)	1.70mm
Mounted product	RZ/A1L,A1LU

**208-LFQFP** (28x28mm)

Pitch	0.50mm
Thickness (max.)	1.70mm
Mounted product	RZ/A1L,A1LU

**256-LFQFP** (28x28mm)

Pitch	0.40mm
Thickness (max.)	1.70mm
Mounted product	RZ/A1H,A1M

### ▼ FBGA

**320-FBGA** (17x17mm)

Pitch	0.80mm
Thickness (max.)	2.30mm
Mounted product	RZ/T1

**324-FBGA** (19x19mm)

Pitch	0.80mm
Thickness (max.)	2.10mm
Mounted product	RZ/A1H,A1M

**501-FBGA** (21x21mm)

Pitch	0.80mm
Thickness (max.)	2.40mm
Mounted product	RZ/G1E

### ▼ LFBGA

**831-FBGA** (27x27mm)

Pitch	0.80mm
Thickness (max.)	2.40mm
Mounted product	RZ/G1M

**176-LFBGA** (8x8mm)

Pitch	0.50mm
Thickness (max.)	1.40mm
Mounted product	RZ/A1L,A1LU

**256-LFBGA** (11x11mm)

Pitch	0.50mm
Thickness (max.)	1.40mm
Mounted product	RZ/A1H,A1M

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