RZ/G SERIES EMBEDDED MICROPROCESSORS

High-End Graphics, Video, Embedded Vision and More

BIG IDEAS
FOR EVERY SPACE

10.2017

RZ/G SERIES MULTI-CORE MPUs FOR
HIGH-END GRAPHICS, VIDEO, EMBEDDED VISION, AND MORE

RZ/G Series microprocessors (MPUs) enable rapid development of game-changing Linux, Android, and QNX-based embedded systems. Designed for use in industrial, home appliance, office, and medical equipment, the RZ/G Series extends the capabilities of the successful Renesas RZ/A Series MPUs to deliver high-end performance in applications such as graphics, multistream video, and embedded vision.

The RZ/G Series features up to 1.5 GHz CPUs, 3D graphics acceleration, 1080p@60fps H.264 video processing, and DDR3 memory interfaces, providing ample performance margin for highly differntiated Human-Machine Interface (HMI)-type applications. Other features include USB, PCIe, SATA, Fast Ethernet, and Gigabit Ethernet interfaces.

KEY FEATURES		KEY BENEFITS
World-class Imagination Technologies 3D graphics engine for image rendering, plus 1080p 60fps video codec	▶	Enhance GUI expressiveness and add value to your end application with 3D graphics and real-time video
Arm® Cortex®-A7 and A15 CPU cores for power or performance optimization	▶	Tune your design to minimize power dissipation or maximize performance to suit your specific requirements
Shared IP and memory map over entire RZ/G Series MPU lineup	▶	Build scalable software with common device drivers
Rich ecosystem of design and system integration partners	▶	Compress your development cycle by tapping into a growing network of RZ/G MPU design experts
RZ/G Linux Platform with super-long-term supported Civil Infrastructure Platform (CIP) Linux	▶	Dramatically reduce risk and cost of implementing and maintaining industrial-grade Linux systems
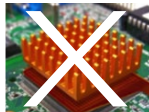
No Heat Sink with RZ/G1E

R8A77450, R8A77470
RZ/G1E, RZ/G1C
1 GHz Dual
Arm Cortex-A7
(3,800 DMIPS)

R8A77440
RZ/G1N
1.5 GHz Dual
Arm Cortex-A15
(10,500 DMIPS)

R8A77430
RZ/G1M
1.5 GHz Dual
Arm Cortex-A15
with 64b memory bus
and enhanced graphics
(10,500 DMIPS)

R8A77420
RZ/G1H
1.4 GHz Quad
Arm Cortex-A15 &
780 MHz Quad
ARM Cortex-A7
(25,528 DMIPS)

Performance Optimization

Shared IP for Software Scalability

Power Savings

Over 25,000 DMIPS with RZ/G1H

RZ/G LINUX PLATFORM WITH
INDUSTRIAL-GRADE CIP LINUX REDUCES RISK AND COST OF OWNERSHIP

The Renesas RZ/G Linux Platform makes it easy to implement and maintain Industrial-Grade Linux in electronic equipment thanks to a unique software-design framework with Renesas' Verified Linux Package, advanced code verification and analysis tools, and cloud-build from within Renesas' e² studio development environment. The Verified Linux Package is built with Civil Infrastructure Platform (CIP) Linux with super long-term (10+ year) support for a given Linux kernel, which eliminates the need for costly upgrades.

The RZ/G Linux Platform enables users of all types to excel with Linux – from those upgrading from microcontrollers to MPUs who don't want to deal with setting up a Linux server of their own, to experts who are already accustomed to a manual Yocto build process. https://**www.cip-project.org/**
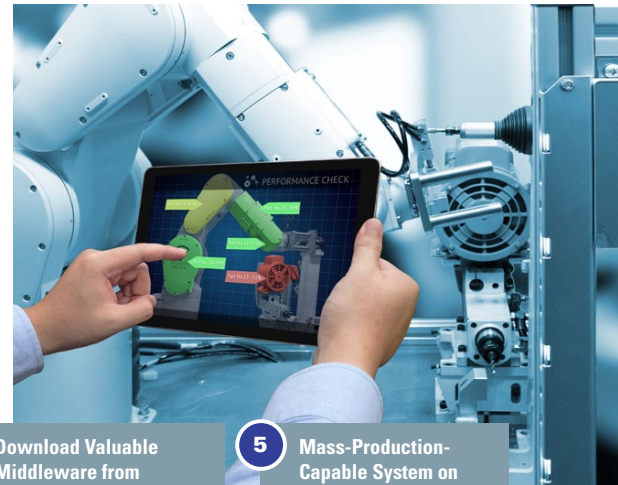
1 **RZ/G Processor**
– RZ/G processor with multimedia functions and security

2 **One-Package Software Framework**
– Verified Linux Package
| GUI framework |
| H-264 Codec OpenGL | Security |
| Linux |

3 **Linux Development and Verification Provided in the Cloud**
– Verification and Analysis tools
– Cloud-build from within Renesas e² studio

4 **Download Valuable Middleware from Renesas Marketplace**
– Verified middleware and software add-ons

5 **Mass-Production-Capable System on Module (SoMs)**
– Mass-production-ready SoMs and prototyping kits

High-Performance Processing with Support for 3D Graphics and Full HD Video

	RZ/G1C R8A77470	RZ/G1E R8A77450	RZ/G1N R8A77440	RZ/G1M R8A77430	RZ/G1H R8A77420
Core	Dual Cortex-A7	Dual Cortex-A7	Dual Cortex-A15	Dual Cortex-A15	Quad Cortex-A15 Quad Cortex-A7
Operating Frequency	1.0 GHz	1.0 GHz	1.5 GHz	1.5 GHz	1.4 GHz 780 MHz
Processing Performance	3,800 DMIPS	3,800 DMIPS	10,500 DMIPS	10,500 DMIPS	25,528 DMIPS
Cache Size	L1 cache I/32 KB D/32 KB L2 cache 512 KB	L1 cache I/32 KB D/32 KB L2 cache 512 KB	L1 cache I/32 KB D/32 KB L2 cache 1 MB	L1 cache I/32 KB D/32 KB L2 cache 1 MB	L1 cache I/32 KB D/32 KB L2 cache 2 MB (A15) 512 KB (A7) S3 cache 2 MB
MMU	Yes				
NEON/VFP	SIMDv2/VFPv4				
3D Graphics	SGX531, 260 Mpx/s	SGX540, 520 Mpx/s	SGX544MP2, 1240 Mpx/s	SGX544MP2, 2080 Mpx/s	SG6400, 4160 Mpx/s
Video Functions	2 ch digital video inputs	2 ch digital video inputs	3 ch digital video inputs		4 ch digital video inputs
	2 ch RGB video display interfaces	2 ch RGB video display interfaces	1 ch RGB video display interface		
	1 ch analog input		1 ch LVDS video output		2 ch LVDS video interfaces
	H.264 – 1920x1080 @ 60 x 1 ch				H.264 – 1920x1080 @ 60 x 2 ch
	Video image processing functions, including color conversion and scaling				

RZ/G SERIES MULTI-CORE MPUs
BIG IDEAS FOR EVERY SPACE WITH RZ/G MPUs

Human Machine Interface (HMI)

Create winning human machine interface solutions for building and office automation, healthcare, and industrial markets with RZ/G MPUs. Take advantage of the multitude of graphics and multimedia examples to get your prototypes up and running quickly and to get to market early.

EtherCAT Master with HMI for Industrial Automation

RZ/G1E with EtherCAT Master stack from partner, Acontis GmbH, is ideal for industrial PCs, HMI master devices, and motion controllers, especially when combined with Renesas RZ/T EtherCat slave devices.
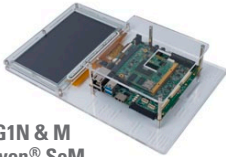
EtherCAT Master Applications for Industrial Automation

3D Rendering for Medical Imaging

High-End Human Machine Interface Displays

Prototyping Kits and Production-Ready SoMs Available Through Renesas Partners

iWave Systems	emtrion GmbH	Mistral Solutions

RZ/G1C SBC

RZ/G1E SoDIMM

RZ/G1E emCON module

RZ/G1M emCON module

RZ/G1N & M Qseven® SoM

RZ/G1H Qseven SoM

RZ/G emCON module with carrier board and LCD screen

RZ/G1E SMARC module with carrier board

Embedded Vision

Embedded vision and AI are areas of growing interest today as they hold huge promise to revolutionize human-to-machine and machine-to-machine interaction. Renesas is ideally positioned to enable this capability in products with a range of examples, created in conjunction with our software partners, for face recognition, object identification, optical flow, and more.
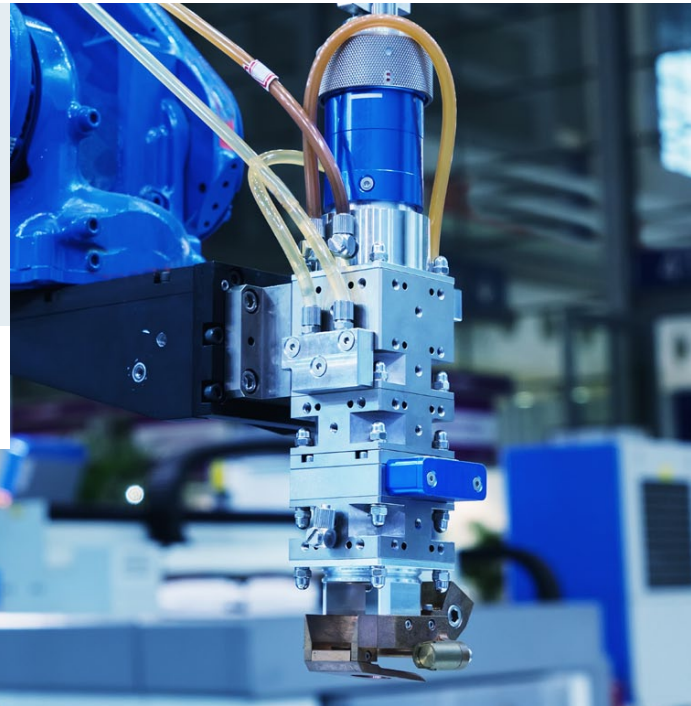
Embedded Vision (e.g., Gesture, Face, and Object Recognition)

2-Way Video Telephony

Networked Video Camera Systems

Renesas Marketplace for Verified Software Add-Ons

The online Renesas Marketplace connects product developers to value-adding Renesas partners, enabling developers to immediately bring to life RZ/G silicon with leading software solutions, including embedded vision, EtherCAT, and fast-boot, among others.

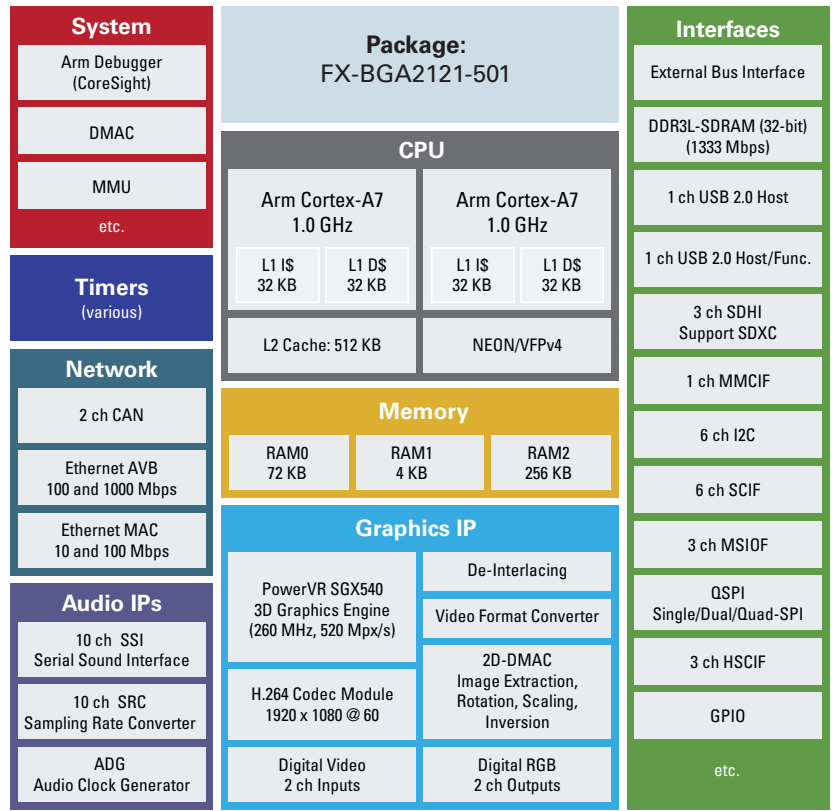|	
U.S.:	https://mp.renesas.com/en-us/rzg/
Europe:	https://mp.renesas.com/en-eu/rzg/
Singapore:	https://mp.renesas.com/en-sg/rzg/
Japan:	https://mp.renesas.com/ja-jp/rzg/
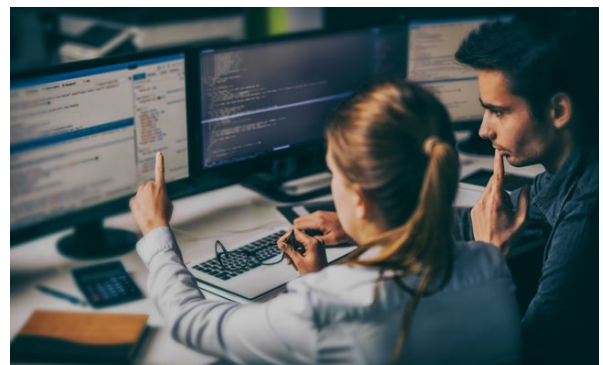
RZ/G SERIES BLOCK DIAGRAMS

RZ/G1E (R8A77450)

Bring huge value to your low-cost embedded design with over 3,800 Dhrystone (DMIPS) performance at a low power footprint via Arm's lowest power processor, the Cortex-A7, while enjoying dual Ethernet, 3D graphics, and a 1080p60 H.264 video codec.

RZ/G1C (R8A77470)

(block diagram not shown)

Keep BOM costs down with a 4-layer PCB and no need for a PMIC. With a dual-core, 3,800 DMIPS Arm Cortex-A7 processor, you can build brilliant HMI systems with accelerated graphics from a PowerVR SGX531 3D GPU and a 1080p60 H.264 video codec. Available in a FX-BGA2121-501 package.

System
- Arm Debugger (CoreSight)
- DMAC
- MMU
- etc.

Timers
(various)

Network
- 2 ch CAN
- Ethernet AVB 100 and 1000 Mbps
- Ethernet MAC 10 and 100 Mbps

Audio IPs
- 10 ch SSI Serial Sound Interface
- 10 ch SRC Sampling Rate Converter
- ADG Audio Clock Generator

Package: FX-BGA2121-501

CPU
- Arm Cortex-A7 1.0 GHz
  - L1 I$ 32 KB | L1 D$ 32 KB
- Arm Cortex-A7 1.0 GHz
  - L1 I$ 32 KB | L1 D$ 32 KB
- L2 Cache: 512 KB
- NEON/VFPv4

Memory
- RAM0 72 KB
- RAM1 4 KB
- RAM2 256 KB

Graphics IP
- PowerVR SGX540 3D Graphics Engine (260 MHz, 520 Mpx/s)
- De-Interlacing
- Video Format Converter
- H.264 Codec Module 1920 x 1080 @ 60
- 2D-DMAC Image Extraction, Rotation, Scaling, Inversion
- Digital Video 2 ch Inputs
- Digital RGB 2 ch Outputs

Interfaces
- External Bus Interface
- DDR3L-SDRAM (32-bit) (1333 Mbps)
- 1 ch USB 2.0 Host
- 1 ch USB 2.0 Host/Func.
- 3 ch SDHI Support SDXC
- 1 ch MMCIF
- 6 ch I2C
- 6 ch SCIF
- 3 ch MSIOF
- QSPI Single/Dual/Quad-SPI
- 3 ch HSCIF
- GPIO
- etc.

RZ/G1M (R8A77430)

Take your high-end MPU design to the next level with over 10,000 DMIPS performance from two Arm Cortex-A15 cores; USB 3.0, SATA and PCIe interfaces; 3D graphics; a 1080p60 H.264 video codec; and a 64-bit wide external DDR3 SDRAM bus to deliver immense memory bandwidth and an incredible end-user experience.
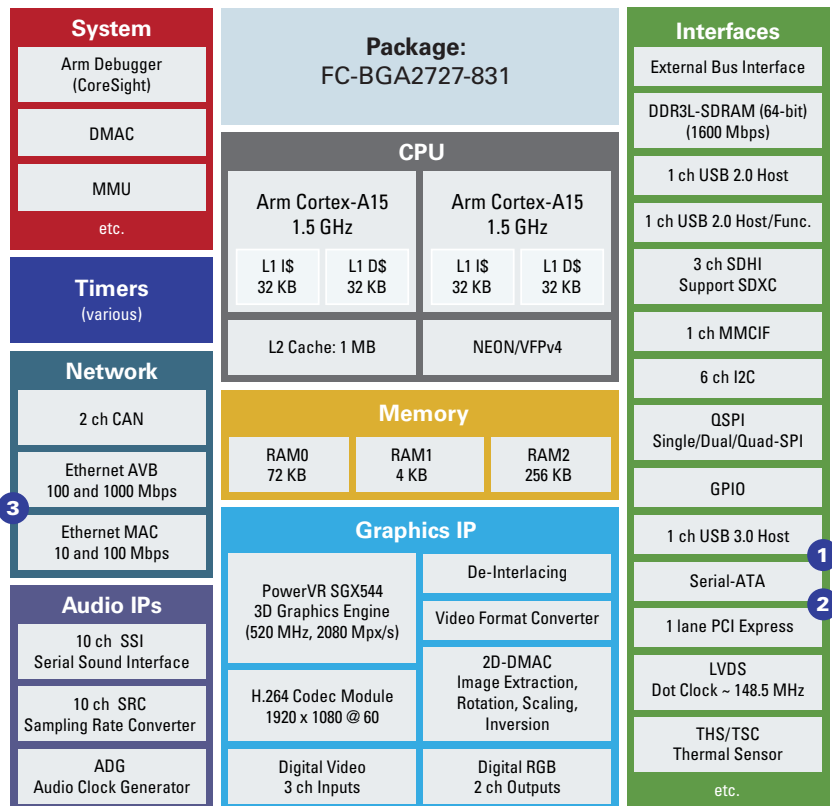
1 USB 3.0 and SATA0 share same PHY.

2 PCIe and SATA1 share same PHY.

3 Ethernet AVB and 10/100 Ethernet share the same pins.

System
- Arm Debugger (CoreSight)
- DMAC
- MMU
- etc.

Timers
(various)

Network
- 2 ch CAN
- Ethernet AVB 100 and 1000 Mbps
- **3** Ethernet MAC 10 and 100 Mbps

Audio IPs
- 10 ch SSI Serial Sound Interface
- 10 ch SRC Sampling Rate Converter
- ADG Audio Clock Generator

Package: FC-BGA2727-831

CPU
- Arm Cortex-A15 1.5 GHz
  - L1 I$ 32 KB | L1 D$ 32 KB
- Arm Cortex-A15 1.5 GHz
  - L1 I$ 32 KB | L1 D$ 32 KB
- L2 Cache: 1 MB
- NEON/VFPv4

Memory
- RAM0 72 KB
- RAM1 4 KB
- RAM2 256 KB

Graphics IP
- PowerVR SGX544 3D Graphics Engine (520 MHz, 2080 Mpx/s)
- De-Interlacing
- Video Format Converter
- H.264 Codec Module 1920 x 1080 @ 60
- 2D-DMAC Image Extraction, Rotation, Scaling, Inversion
- Digital Video 3 ch Inputs
- Digital RGB 2 ch Outputs

Interfaces
- External Bus Interface
- DDR3L-SDRAM (64-bit) (1600 Mbps)
- 1 ch USB 2.0 Host
- 1 ch USB 2.0 Host/Func.
- 3 ch SDHI Support SDXC
- 1 ch MMCIF
- 6 ch I2C
- QSPI Single/Dual/Quad-SPI
- GPIO
- 1 ch USB 3.0 Host **1**
- Serial-ATA
- 1 lane PCI Express **2**
- LVDS Dot Clock ~ 148.5 MHz
- THS/TSC Thermal Sensor
- etc.

RENESAS RZ

RZ/G1N (R8A77440)

Leverage a rich set of high-end embedded capabilities with 10,500 DMIPS from two Arm Cortex-A15 CPUs; a USB 3.0, SATA or PCIe interface; a 3D graphics engine; and a 1080p60 H.264 video codec to propel your application beyond the reach of your competition.

System
- Arm Debugger (CoreSight)
- DMAC
- MMU
- etc.

Timers
(various)

Network
- 2 ch CAN
- Ethernet AVB 100 and 1000 Mbps
- Ethernet MAC 10 and 100 Mbps

2

Audio IPs
- 10 ch SSI Serial Sound Interface
- 10 ch SRC Sampling Rate Converter
- ADG Audio Clock Generator

Package: FC-BGA2727-831

CPU
Arm Cortex-A15 1.5 GHz	Arm Cortex-A15 1.5 GHz
L1 I$ 32 KB / L1 D$ 32 KB	L1 I$ 32 KB / L1 D$ 32 KB
L2 Cache: 1 MB	NEON/VFPv4

Memory
RAM0 72 KB	RAM1 4 KB	RAM2 256 KB

Graphics IP
- PowerVR SGX544 3D Graphics Engine (312 MHz, 1240 Mpx/s)
- De-Interlacing
- Video Format Converter
- 2D-DMAC Image Extraction, Rotation, Scaling, Inversion
- H.264 Codec Module 1920 x 1080 @ 60
- Digital Video 3 ch Inputs
- Digital RGB 2 ch Outputs

Interfaces
- External Bus Interface
- DDR3L-SDRAM (32-bit)(1600 Mbps)
- 1 ch USB 2.0 Host
- 1 ch USB 2.0 Host/Func.
- 3 ch SDHI Support SDXC
- 1 ch MMCIF
- 6 ch I2C
- QSPI Single/Dual/Quad-SPI
- GPIO
- 1 ch USB 3.0 Host
- Serial-ATA **1**
- 1 lane PCI Express
- LVDS Dot Clock ~ 148.5 MHz
- THS/TSC Thermal Sensor
- etc.

1 USB 3.0, SATA and PCIe share same PHY.
2 Ethernet AVB and 10/100 Ethernet share the same pins.

RZ/G1H (R8A77420)

Harness the ultimate in embedded MPU performance with this 8-core "Big-Little" quad Arm Cortex-A15 and quad Arm Cortex-A7 based MPU that delivers over 25,000 DMIPS; USB 3.0, SATA and PCIe interfaces; ultra high-end 3D graphics with two-channel 1080p60 H.264 codecs; and a 64-bit wide DDR3 SDRAM memory bus.

System
- Arm Debugger (CoreSight)
- DMAC / MMU
- S3 Cache: 2 MB
- etc.

Timers
(various)

Network
- 2 ch CAN
- Ethernet AVB 100 and 1000 Mbps
- Ethernet MAC 10 and 100 Mbps

3

Audio IPs
- 10 ch SSI Serial Sound Interface
- 10 ch SRC Sampling Rate Converter
- ADG Audio Clock Generator

Package: FC-BGA2727-831

CPU
Arm Cortex-A15 **4x** 1.4 GHz	Arm Cortex-A7 **4x** 780 MHz
L1 I$ 32 KB / L1 D$ 32 KB	L1 I$ 32 KB / L1 D$ 32 KB
L2 Cache: 2 MB	L2 Cache: 512 KB
NEON/VFPv4	NEON/VFPv4

Memory
RAM0 72 KB	RAM1 4 KB	RAM2 256 KB

Graphics IP
- PowerVR G6400 3D Graphics Engine (520 MHz, 4,160 Mpx/s)
- 3 ch De-Interlacing
- Video Format Converter
- 2D-DMAC Image Extraction, Rotation, Scaling, Inversion
- H.264 Codec Module 1920 x 1080 @ 60 (2 ch)
- Digital Video 4 ch Inputs
- Digital RGB 2 ch Outputs (plus 2 ch LVDS Outputs)

Interfaces
- External Bus Interface
- DDR3L-SDRAM (64-bit) (1600 Mbps)
- 2 ch USB 2.0 Host
- 1 ch USB 2.0 Host/Func.
- 4 ch SDHI Support SDXC
- 2 ch MMCIF
- 4 ch I2C
- QSPI Single/Dual/Quad-SPI
- GPIO
- 1 ch USB 3.0 Host
- Serial-ATA **1**
- 1 lane PCI Express **2**
- 2 ch LVDS Dot Clock ~ 148.5 MHz
- THS/TSC Thermal Sensor
- etc.

1 USB 3.0 and SATA0 share same PHY.
2 PCIe and SATA1 share same PHY.
3 Ethernet AVB and 10/100 Ethernet share the same pins.

RZ/G EXTENDS RENESAS RZ MPU FAMILY WITH 3D GRAPHICS, H.264 VIDEO CODEC, AND HIGH-PERFORMANCE DDR3 MEMORY INTERFACES

Software Development Environment

Linux   Android

QNX

Partners & Affiliations

Design Services
Witekio
EMBEDDING SUCCESS

COGENTEMBEDDED

timesys®

System-on-Module (SoM) and Design Services
iWave
Embedding Intelligence

emtrion
embedded systems

MISTRAL
... Partners in Real Time

Graphics
Crank
software inc.

Qt

TES
Electronic Solutions

Embedded Vision
embedded VISION ALLIANCE

Uncanny Vision®

Evaluation Kits
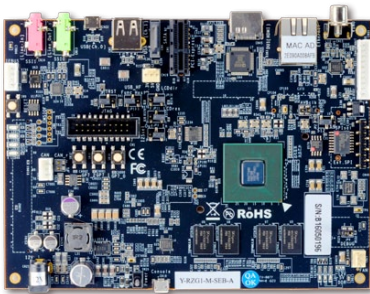
RZ/G1M Starter Kit
Part No.: YR8A77430S000BE

RZ/G1E Starter Kit
Part No.: YR8A77450S000BE

Various partner kits and SoMs also available through iWave Systems, emtrion embedded systems, Mistral Solutions and others

www.renesas.com/en-us/products/microcontrollers-microprocessors/rz.html

Renesas MCU Ecosystem

RENESAS PARTNER Alliance

Consultant and tool vendor network
www.renesas.com/Alliance

MyRenesas

Customized updates
www.renesas.com/MyRenesas

RENESAS UNIVERSITY PROGRAM

University program
www.renesas.com/University

RenesasRulz.com

Renesas INTERACTIVE

Online training
www.RenesasInteractive.com

Software Library *Free SW*
www.renesas.com/softwarelibrary

Free Samples
www.renesassamples.com

Technical Support
www.renesas.com/tech_support

Renesas Electronics America Inc.

renesas.com

Printed on Recycled Paper.