RENESAS

## The Right Choice for HMI Designs
# RZ/A1 Embedded ARM® Microprocessors
*Expanded product family – now with Linux support*

RENESAS RZ

SMART HOMES

HEALTHCARE

**400 MHz**

**1000 DMIPS**

**10 MB SRAM**

**WXGA CAPABLE**

AUTOMOTIVE

INDUSTRY

## RZ/A1 Embedded ARM® Microprocessors
# Innovative Architecture & Advanced Integration

Renesas RZ/A1 series microprocessors (MPUs) offer an innovative architecture based on the ARM Cortex®-A9 processor and up to an industry-leading 10 MB of on-chip memory. RZ/A1 MPUs can execute code at 1000 DMIPS from the abundant on-chip memory or in-place from inexpensive QSPI memory, while using on-chip memory for graphics buffering up to WXGA (1280×800) resolution. The 128-bit wide internal memory bus with x4 parallel access enables higher-throughput memory access as compared to systems with external DDR memory. The RZ/A1 series offers enormous advantages in terms of BOM cost, performance, power consumption, and system design time, making it the right choice for Human Machine Interface (HMI) and other system-on-chip applications.

- ARM Cortex®-A9 processor that can execute code at 1000 DMIPS
- Remove need for external RAM with up to 10 MBs of on-chip RAM
- Execute-In-Place (XIP) from QSPI memory enabled with three layers of cache

- Up to two Camera inputs available for video and graphics blending usages
- Scalable line-up with three sizes of on-chip RAM to choose from: 3 MB (RZ/A1L or RZ/A1LU), 5 MB (RZ/A1M), and 10 MB (RZ/A1H)

- Implement up to two independent LCD displays with WXGA (1280×800) resolution for impressive graphical user interfaces

## Renesas RZ/A1 solution streamlines board design and reduces BOM cost
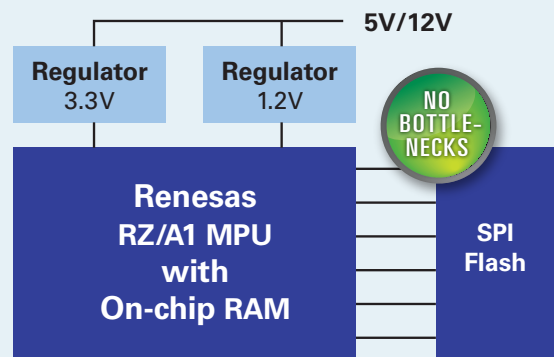
### Conventional Solution
– *Complicated power-management and PCB layout*
– *Memory bandwidth split between code and graphics*
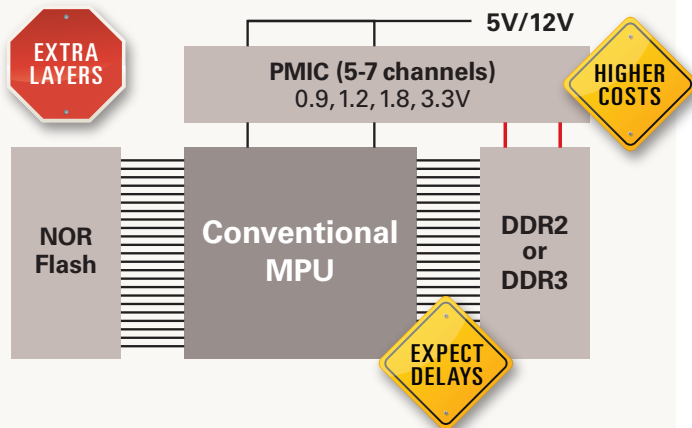


| BOM Component | Conventional Solution | |
|---|---|---|
| Flash | $$$ | (NOR Flash) |
| RAM | $$$ | (DDR2) |
| Regulators | $$$ | (5-7 PMIC channels) |
| PCB layers | $$$ | (DDR2 supplies, routing) |
| Total BOM cost | $$$ | |

### Renesas RZ/A1 HMI Solution
– *Easy system design and testing*



| BOM Component | RZ/A1 Solution | |
|---|---|---|
| Flash | $ | (SPI Flash) |
| RAM | n/a (internal) | |
| Regulators | $ | (3.3V, 1.2V regulator) |
| PCB layers | $ | (as few as two) |
| Total BOM cost | $ | |

# Create superior HMI designs with fewer components

On-chip functions provided by RZ/A1 MPUs reduce BOM cost, save board space and minimize integration tasks. Typical applications like the one shown below take advantage of a rich portfolio of intellectual property from Renesas and can utilize a range of built-in peripherals, including: CMOS camera interface, JPEG Codec Unit, 12-bit ADC, and OpenVG 2D graphics engine, among others.

## RZ/A1 Series System Diagram



Build full-featured HMI solutions with digital audio and WXGA (1280×800) resolution using a single RZ/A1 MPU and SPI Flash
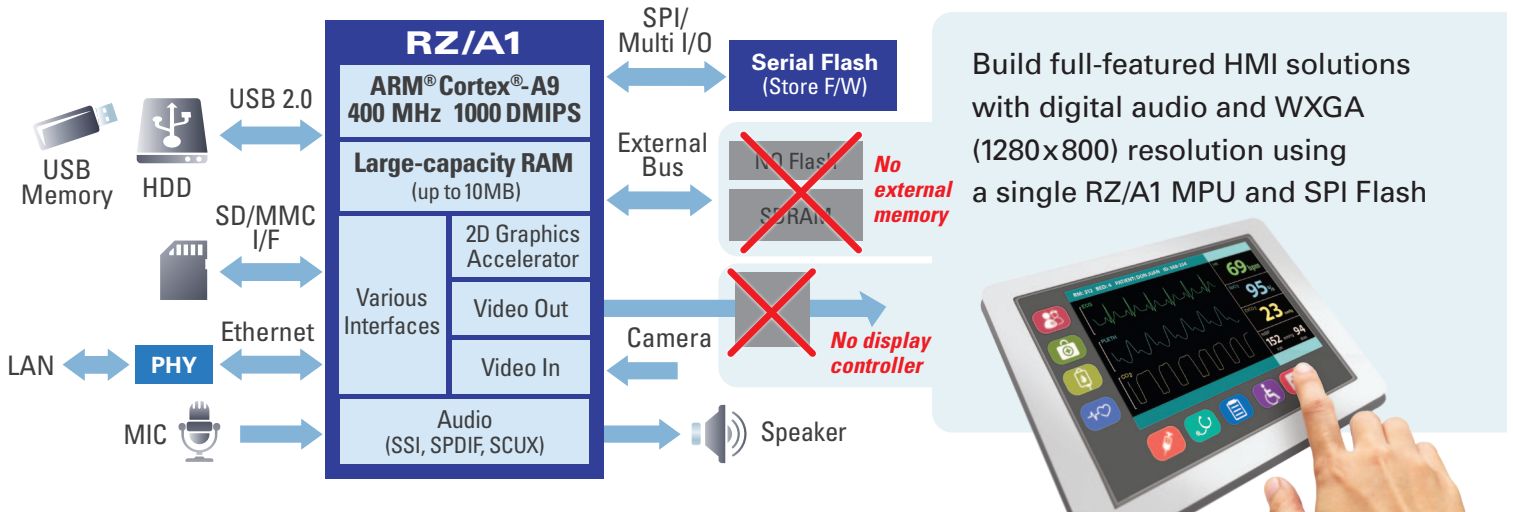
## Features

**Up to 10 MB on-chip RAM**
- For code execution/data buffering

**128-bit memory bus**
- With parallel (x4) access to deliver superior memory throughput

**Execute-In-Place (XIP) from inexpensive QSPI memory**
- With three layers of cache

**LCD controller to drive up to two independent WXGA displays**
- For vivid displays

## Benefits

**Lower BOM Cost**
- No external SDRAM or LCD controller
- Simpler voltage regulators
- Reduced PCB layers

**Increased Performance**
- 1000 DMIPS at 400 MHz
- 6x throughput of 333 MHz 16-bit DDR2

**Decreased Power Consumption**
- Fewer board components
- No copying of code from flash to RAM

**Accelerate Time to Market**
- Simpler PCB design
- Decreased EMI via reduced switching
- No DDR procurement issues

*One RZ/A1 MPU can accommodate an entire software stack (libraries, operating system and application code), plus a graphics frame buffer.*

## Graphics Capabilities

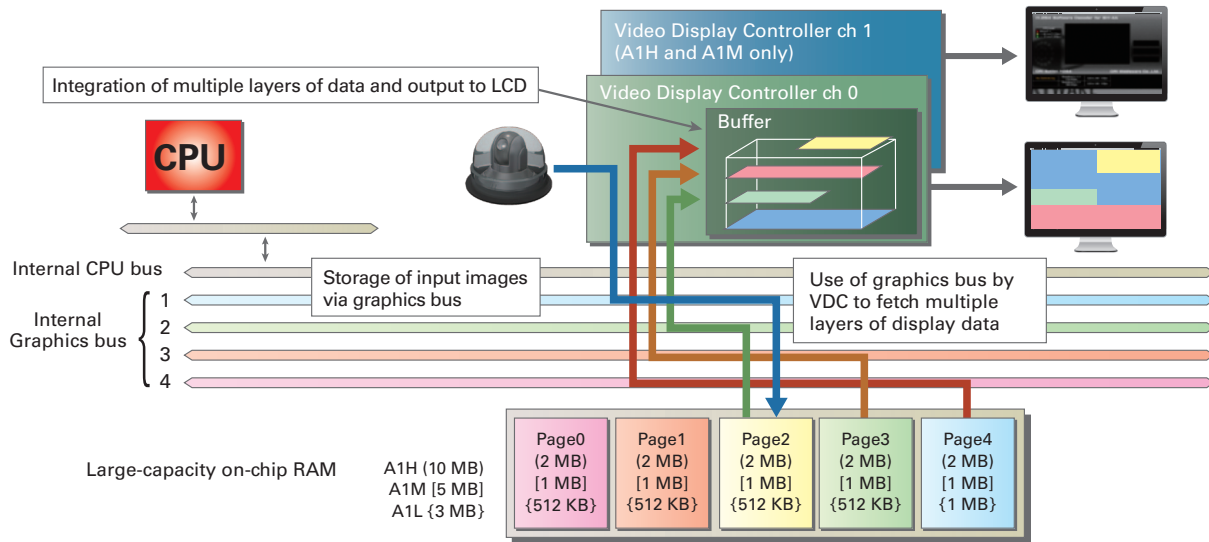| Number of Images in Frame Buffer | RZ/A1L | | RZ/A1M | | RZ/A1H | | | |
|---|---|---|---|---|---|---|---|---|
| 4 | 0.6 MB | 1.0 MB | 4.7 MB | 5.9 MB | 7.3 MB | 9.4 MB | | |
| 3 | 0.4 MB | 0.7 MB | 3.5 MB | 4.4 MB | 5.5 MB | 7.0 MB | 9.0 MB | |
| 2 | 0.3 MB | 0.5 MB | 2.3 MB | 2.9 MB | 3.7 MB | 4.7 MB | 6.0 MB | 7.8 MB |
| 1 | 0.1 MB | 0.2 MB | 1.2 MB | 1.5 MB | 1.8 MB | 2.3 MB | 3.0 MB | 3.9 MB |
| | QVGA 320x240 16bpp | WQVGA 480x272 16bpp | VGA 640x480 32bpp | WVGA 800x480 32bpp | SVGA 800x600 32bpp | WSVGA 1024x600 32bpp | XGA 1024x768 32bpp | WXGA 1280x800 32bpp |

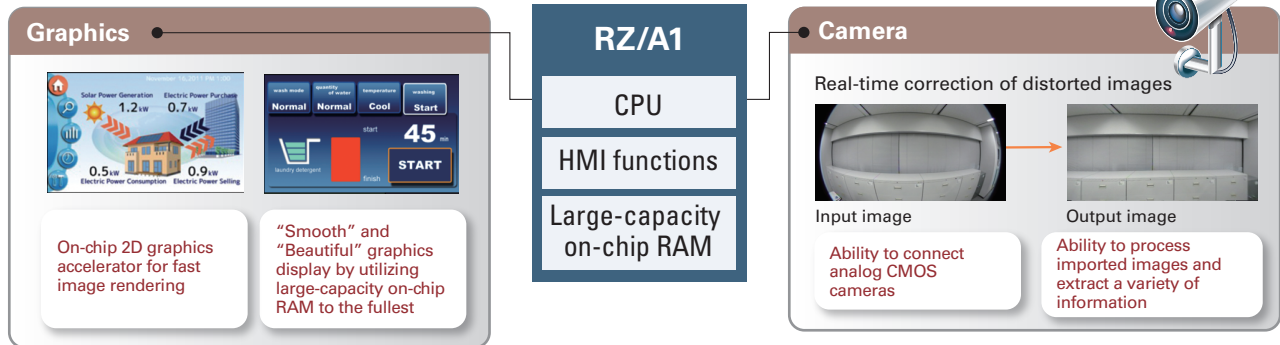Display Resolutions Supported by RZ/A1 MPUs

# Graphics display and camera input capabilities on a single chip

RZ/A1 MPUs have a unique combination of graphics display and camera functions that, coupled with their parallel-access, 128-bit memory bus, enables systems with rich graphical and video capabilities.

Integration of multiple layers of data and output to LCD

**CPU**

Video Display Controller ch 1 (A1H and A1M only)

Video Display Controller ch 0

Buffer

Internal CPU bus

Internal Graphics bus
1
2
3
4

Storage of input images via graphics bus

Use of graphics bus by VDC to fetch multiple layers of display data

Large-capacity on-chip RAM
A1H (10 MB)
A1M [5 MB]
A1L {3 MB}

| Page0 (2 MB) [1 MB] {512 KB} | Page1 (2 MB) [1 MB] {512 KB} | Page2 (2 MB) [1 MB] {512 KB} | Page3 (2 MB) [1 MB] {512 KB} | Page4 (2 MB) [1 MB] {1 MB} |
|---|---|---|---|---|

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

## Example system solutions

**Graphics**

On-chip 2D graphics accelerator for fast image rendering

"Smooth" and "Beautiful" graphics display by utilizing large-capacity on-chip RAM to the fullest

**RZ/A1**

CPU

HMI functions

Large-capacity on-chip RAM

**Camera**

Real-time correction of distorted images

Input image

Output image

Ability to connect analog CMOS cameras

Ability to process imported images and extract a variety of information

# Target applications

The performance of the ARM Cortex-A9 MPU and the simplicity of a MCU-style platform design makes the RZ/A1 MPU the ideal choice for a range of applications, such as those shown below.
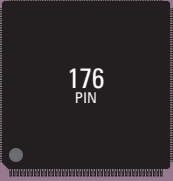
| Intercoms | White goods | Smart meters | Vending machines | Diagnostic panels | Home audio | Display audio | Car audio |
|---|---|---|---|---|---|---|---|
| Industrial panels | Barcode scanners | Office equipment | Monitoring cameras | Data communication modules | Multi-function displays | Backup cameras | Handwriting recognition input devices |

# Renesas RZ/A1 packaging options

## 176-LFBGA

176 PIN

(8×8 mm)

| Pitch | 0.50 mm |
|---|---|
| Thickness (max.) | 1.40 mm |
| Mounted product | RZ/A1L, A1LU |
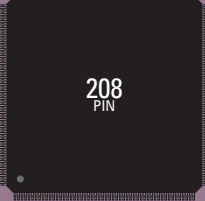
## 176-LFQFP

176 PIN

(24×24 mm)

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

## 208-LFQFP

208 PIN

(28×28 mm)

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

## 256-LFBGA

256 PIN

(11×11 mm)

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

## 324-FBGA

324 PIN

(19×19 mm)

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

## 256-LFQFP

256 PIN

(28×28 mm)

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

# RZ Family of ARM-based MPUs

**Performance** ▲

Mass Production

Under Development

**RZ/A1**
Single Core Cortex-A9
Large Embedded RAM

**Linux & RTOS**
- 2-chip HMI
- Easy MCU-like development with MPU performance

**RZ/A1LU**

**RZ/A1L**
(3 MB)
400 MHz Cortex-A9
1000 DMIPS

**RZ/A1M**
(5 MB)
400 MHz Cortex-A9
1000 DMIPS

**RZ/A1H**
(10 MB)
400 MHz Cortex-A9
1000 DMIPS

(3 MB)          (5 MB)          (10 MB)

**On-Chip RAM**

**Linux & Android**
- High-end graphics, video and network gateways
- Easy development with Linux and Android open-source software

**RZ/G1**
Dual Core
Cortex-A7 &
Cortex-A15
options

**RZ/G1M**
1.5 GHz
Dual Cortex-A15
10500 DMIPS

**RZ/G1E**
1 GHz
Dual Cortex-A7
3800 DMIPS

**RZ/T** | **RTOS**
- Industrial Ethernet

**RZ/T1**
(1.5 MB)
450-600 MHz Cortex-R4F
& Cortex-M3 (RIN)
747-996 DMIPS

DDR3 (1 ch)    DDR3 (2 ch)

**External DDR**

# RZ/A1H and RZ/A1M MPUs

Best choices for higher-end HMI designs (up to WXGA resolution)

- Buffer up to two independent WXGA (1280x800) images with a single RZ/A1H MPU chip
- Buffer up to two WSVGA (1024x600) images or a single WXGA (1280x800) image with one RZ/A1M MPU chip
- Utilize the on-chip OpenVG graphics engine for impressive 2D graphics acceleration

- Connect to one or two independent LCD displays
- Exploit additional peripherals, including: NAND Flash interface, JPEG Codec Unit, IMR engine, sound generator, NTSC/PAL decoder for video, and PWM timer
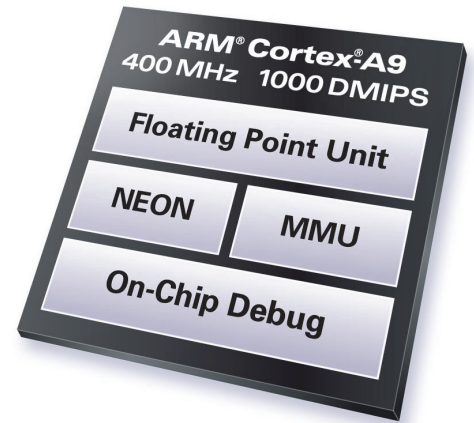
**ARM® Cortex®-A9**
**400 MHz    1000 DMIPS**
- Floating Point Unit
- NEON
- MMU
- On-Chip Debug

## Highly Efficient 32-bit CPU Core (ARM Cortex-A9)

- 1000 DMIPS performance at 400MHz
- ARM NEON multimedia engine
- Boots from parallel or serial flash

## 10 MB (RZ/A1H) and 5 MB (RZ/A1M) Internal RAM

- Use as large data buffer or to run system from internal memory
- Employs parallel bus structure dedicated to SRAM to speed processing

## Execute-In-Place Operation from QSPI Flash

- Take full advantage of cost-effective external serial flash
- Simplifies program execution

## Single- and Double-Precision Floating Point Unit, IEEE754 Compliant

- Accelerates trigonometric operations such as scaling and rotation

## 2D-Graphics Engine with OpenVG 1.1 Capability

- Fully supports the Khronos™ OpenVG 1.1 API
- Offloads CPU for rendering, animation and video acceleration operations

## LCD Controller with 24-bit RGB and 16-bit LVDS Interfaces

- Handles 4-layer overlays
- Provides 2-ch video input, 2-ch display output with 1 ch of LVDS
- Implements alpha blending
- Supports chroma keying

## Bus Interface Controller

- Directly connects to SRAM, SDRAM, and flash (NOR, NAND, eMMC), as well as 128 KB L2 cache
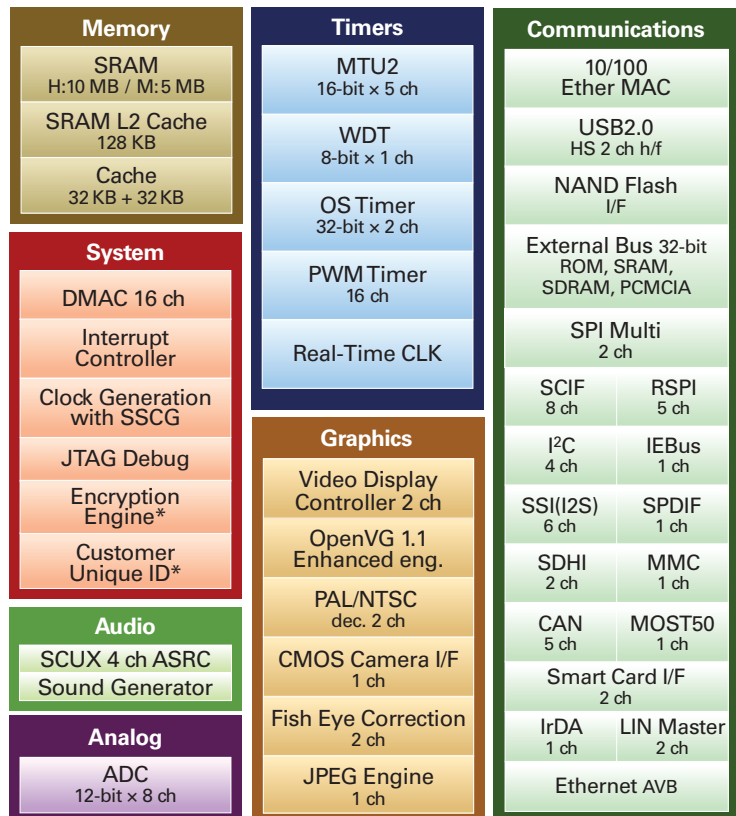
## Multiple Network Connectivity Interfaces

- Integrates 10/100 EtherMAC controller (1 ch)
- Includes USB 2.0 host and function controller with integrated USB transceiver (2 ch)
- Offers up to 5 CAN channels

## Three Package Options

- 324-pin BGA (0.8 mm)
- 256-pin QFP (0.4 mm)
- 256-pin BGA (0.5 mm)

### RZ/A1H and RZ/A1M Block Diagram

**Memory**
- SRAM
  H:10 MB / M:5 MB
- SRAM L2 Cache
  128 KB
- Cache
  32 KB + 32 KB

**System**
- DMAC 16 ch
- Interrupt Controller
- Clock Generation with SSCG
- JTAG Debug
- Encryption Engine*
- Customer Unique ID*

**Audio**
- SCUX 4 ch ASRC
- Sound Generator

**Analog**
- ADC
  12-bit × 8 ch

**Timers**
- MTU2
  16-bit × 5 ch
- WDT
  8-bit × 1 ch
- OS Timer
  32-bit × 2 ch
- PWM Timer
  16 ch
- Real-Time CLK

**Graphics**
- Video Display Controller 2 ch
- OpenVG 1.1 Enhanced eng.
- PAL/NTSC
  dec. 2 ch
- CMOS Camera I/F
  1 ch
- Fish Eye Correction
  2 ch
- JPEG Engine
  1 ch

**Communications**
- 10/100 Ether MAC
- USB2.0
  HS 2 ch h/f
- NAND Flash I/F
- External Bus 32-bit
  ROM, SRAM, SDRAM, PCMCIA
- SPI Multi
  2 ch
- SCIF
  8 ch
- RSPI
  5 ch
- I²C
  4 ch
- IEBus
  1 ch
- SSI(I2S)
  6 ch
- SPDIF
  1 ch
- SDHI
  2 ch
- MMC
  1 ch
- CAN
  5 ch
- MOST50
  1 ch
- Smart Card I/F
  2 ch
- IrDA
  1 ch
- LIN Master
  2 ch
- Ethernet AVB

∗ =Option

# RZ/A1L MPUs

Ideal solutions for cost-sensitive designs
(up to WSVGA resolution)

- Buffer up to WSVGA (1024×600) images in internal memory
- Accelerate multimedia processing with ARM NEON™ SIMD (Single Instruction, Multiple Data) engine
- Connect to single LCD display

# RZ/A1LU MPUs

More features to expand system capabilities

- Secure Boot and Secure Communications with optional security unit
- Simplify designs with JPEG Codec Unit
- Transport audio and video over Ethernet with Ethernet AVB support
- Use Dual-Data-Rate QSI support to get higher bandwidth access to the SPI Flash

## Highly Efficient 32-bit CPU Core (ARM Cortex-A9)

- 1000 DMIPS performance at 400 MHz
- ARM NEON multimedia engine
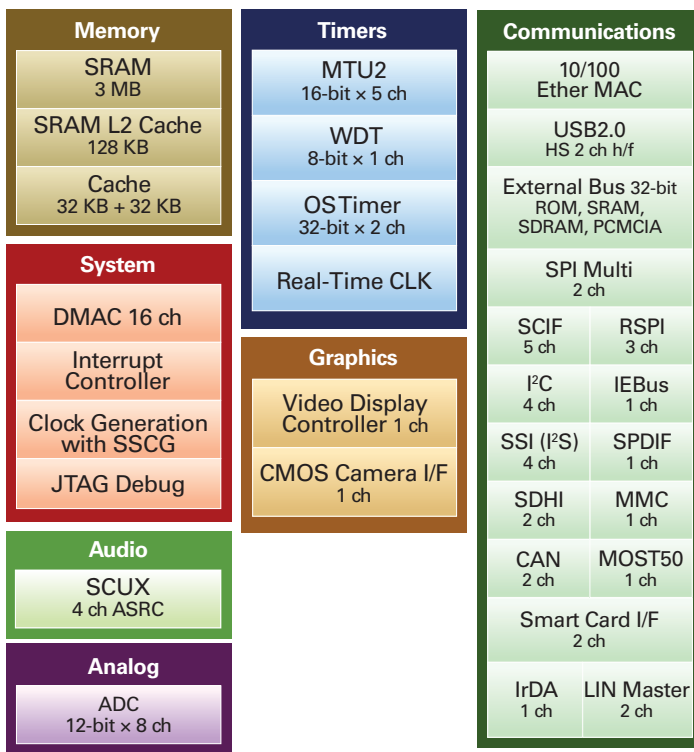- Boots from parallel or serial flash

## 3 MB Internal RAM

- Use as large data buffer or to run system from internal memory
- Employs parallel bus structure dedicated to SRAM to speed processing

## Execute-In-Place Operation from QSPI Flash

- Take full advantage of cost-effective external serial flash
- Simplifies program execution

## Single- and Double-Precision Floating Point Unit, IEEE754 Compliant

- Accelerates trigonometric operations such as scaling and rotation

## LCD Controller with 24-bit RGB Interface

- Handles 3-layer overlays
- Provides 1-ch video input, 1-ch display output
- Implements alpha blending
- Supports chroma keying

## Bus Interface Controller

- Directly connects to SRAM, SDRAM, and flash (NOR, NAND, eMMC), as well as 128 KB L2 cache
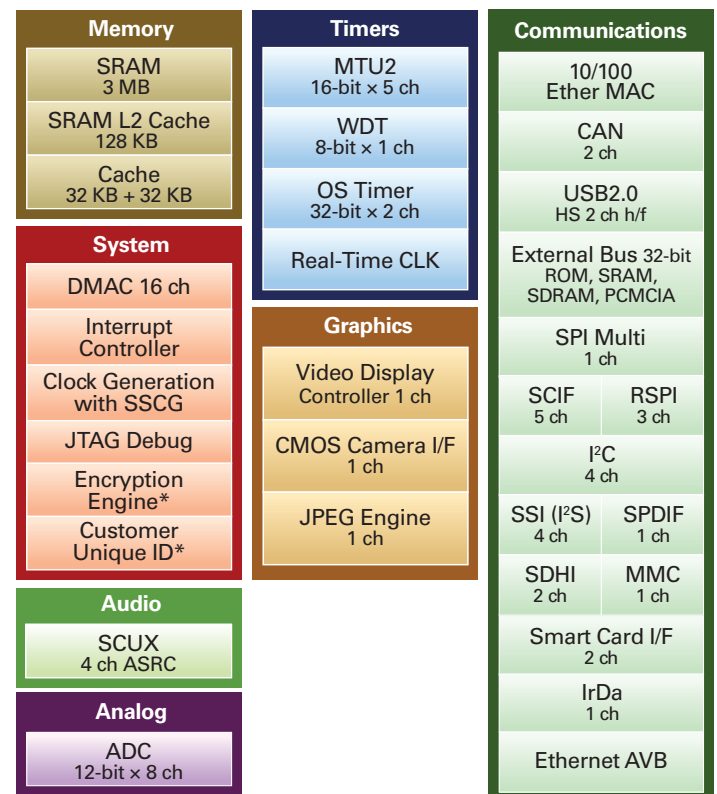
## Multiple Network Connectivity Interfaces

- Integrates 10/100 EtherMAC controller (1 ch)
- Includes USB 2.0 host and function controller with integrated USB transceiver (2 ch)
- Offers up to 2 CAN channels

## Three Package Options

- 208-pin QFP (0.5 mm)
- 176-pin QFP (0.5 mm)
- 176-pin BGA (0.5 mm)

## RZ/A1L Block Diagram

**Memory**
- SRAM 3 MB
- SRAM L2 Cache 128 KB
- Cache 32 KB + 32 KB

**System**
- DMAC 16 ch
- Interrupt Controller
- Clock Generation with SSCG
- JTAG Debug

**Audio**
- SCUX 4 ch ASRC

**Analog**
- ADC 12-bit × 8 ch

**Timers**
- MTU2 16-bit × 5 ch
- WDT 8-bit × 1 ch
- OS Timer 32-bit × 2 ch
- Real-Time CLK

**Graphics**
- Video Display Controller 1 ch
- CMOS Camera I/F 1 ch

**Communications**
- 10/100 Ether MAC
- USB2.0 HS 2 ch h/f
- External Bus 32-bit ROM, SRAM, SDRAM, PCMCIA
- SPI Multi 2 ch
- SCIF 5 ch | RSPI 3 ch
- I²C 4 ch | IEBus 1 ch
- SSI (I²S) 4 ch | SPDIF 1 ch
- SDHI 2 ch | MMC 1 ch
- CAN 2 ch | MOST50 1 ch
- Smart Card I/F 2 ch
- IrDA 1 ch | LIN Master 2 ch

## RZ/A1LU Block Diagram

**Memory**
- SRAM 3 MB
- SRAM L2 Cache 128 KB
- Cache 32 KB + 32 KB

**System**
- DMAC 16 ch
- Interrupt Controller
- Clock Generation with SSCG
- JTAG Debug
- Encryption Engine*
- Customer Unique ID*

**Audio**
- SCUX 4 ch ASRC

**Analog**
- ADC 12-bit × 8 ch

**Timers**
- MTU2 16-bit × 5 ch
- WDT 8-bit × 1 ch
- OS Timer 32-bit × 2 ch
- Real-Time CLK

**Graphics**
- Video Display Controller 1 ch
- CMOS Camera I/F 1 ch
- JPEG Engine 1 ch

**Communications**
- 10/100 Ether MAC
- CAN 2 ch
- USB2.0 HS 2 ch h/f
- External Bus 32-bit ROM, SRAM, SDRAM, PCMCIA
- SPI Multi 1 ch
- SCIF 5 ch | RSPI 3 ch
- I²C 4 ch
- SSI (I²S) 4 ch | SPDIF 1 ch
- SDHI 2 ch | MMC 1 ch
- Smart Card I/F 2 ch
- IrDa 1 ch
- Ethernet AVB

＊ =Option

# Renesas RZ/A1 Device Selector

| | RZ/A1H | | | | | RZ/A1M | | | | | RZ/A1L | | | | | RZ/A1LU | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pin count** | 256-pin | | | 324-pin | | 256-pin | | | 324-pin | | 176-pin | | | 208-pin | | 176-pin | | | 208-pin | |
| **Product name** | R7S721000VCBG | R7S721000VCFP | R7S721000VLFP | R7S721001VCBG | R7S721001VLBG | R7S721010VCBG | R7S721010VCFP | R7S721010VLFP | R7S721011VCBG | R7S721011VLBG | R7S721020VCBG | R7S721020VCFP | R7S721020VLFP | R7S721021VCFP | R7S721021VLFP | R7S721030VCBG | R7S721030VCFP | R7S721030VLFP | R7S721031VCFP | R7S721031VLFP |
| CPU core | ARM® Cortex®-A9 | | | | | | | | | | | | | | | | | | | |
| RAM | 10 MB | | | | | 5 MB | | | | | 3 MB | | | | | 3 MB | | | | |
| Cache memory | Primary cache: 64 KB (instruction 32 KB/data32 KB), TLB128 / Secondary cache: 128 KB (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 | | | | | Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM, NAND flash | | | | | Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM | | | | | Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM | | | | |
| External interrupt pins | 148 | | | 180 | | 148 | | | 180 | | 109 | | | 131 | | 109 | | | 131 | |
| I/O ports | 139 | | | 171 | | 139 | | | 171 | | 100 | | | 122 | | 100 | | | 122 | |
| 16-/32-bit timer (ch) | 5/2 | | | | | | | | | | | | | | | | | | | |
| Watchdog timer (ch) | 1 | | | | | 1 | | | | | – | | | | | 1 | | | | |
| Other timers | Motor Controll PWM Timer × 8 | | | | | Motor Controll PWM Timer × 8 | | | | | – | | | | | – | | | | |
| PWM output | 16 | | | | | 16 | | | | | – | | | | | – | | | | |
| 3-phase PWM output function | Yes | | | | | Yes | | | | | – | | | | | – | | | | |
| 12-bit A/D converter (channels) | 8 | | | | | | | | | | | | | | | | | | | |
| CAN (channels) | 5 | | | | | 5 | | | | | 2 | | | | | 2 | | | | |
| Ethernet | Yes | | | | | | | | | | | | | | | | | | | |
| Ethernet AVB | Yes | | | | | Yes | | | | | – | | | | | 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 (ch) | 17 | | | | | 17 | | | | | 12 | | | | | 12 | | | | |
| SPI (channels) | 5 | | | | | 5 | | | | | 5 | | | | | 3 | | | | |
| UART (channels) | 8 | | | | | 8 | | | | | 8 | | | | | 5 | | | | |
| I²C (channels) | 4 | | | | | | | | | | | | | | | | | | | |
| LIN (channels) | 2 | | | | | 2 | | | | | 2 | | | | | – | | | | |
| IEBus (channels) | 1 | | | | | 1 | | | | | 1 | | | | | – | | | | |
| Serial additional information | SCIF (CSI: 8 ch/UART: 8 ch), SCI (CSI: 2 ch), RSPI (SPI: 5 ch), SPI multi (SPI: 2 ch), SSI (CSI: 6 ch), SPDIF (CSI: 1 ch) | | | | | SCIF (CSI: 8 ch/UART: 8 ch), SCI (CSI: 2 ch), RSPI (SPI: 5 ch), SPI multi (SPI: 2 ch), SSI (CSI: 6 ch), SPDIF (CSI: 1 ch) | | | | | SCIF (CSI: 5 ch/UART: 5 ch), SCI (CSI: 2 ch), RSPI (SPI: 2 ch), SPI multi (SPI: 1 ch), SSI (CSI: 4 ch), SPDIF (CSI: 1 ch) | | | | | SCIF (CSI: 5 ch/UART: 5 ch), SCI (CSI: 2 ch), RSPI (SPI: 2 ch), SPI multi (SPI: 1 ch), SSI (CSI: 4 ch), SPDIF (CSI: 1 ch) | | | | |
| Other display functions | VDC5: WXGA (1280 × 768), JPEG Engine, OpenVG Accelerator (2D) | | | | | VDC5: WXG(1280 × 768), JPEG Engine, OpenVG Accelerator (2D) | | | | | VDC5: XGA (1024 × 768) | | | | | VDC5: XGA (1024 × 768), JPEG Engine | | | | |
| 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 temp (°C) | TA = -40 to +85°C | | | | | | | | | | | | | | | | | | | |
| Package (size [mm]) | 256-LFBGA (11 × 11 mm) | 256-LFQFP (28 × 28 mm) | | 324-FBGA (19 × 19 mm) | | 256-LFBGA (11 × 11 mm) | 256-LFQFP (28 × 28 mm) | | 324-FBGA (19 × 19 mm) | | 176-LFBGA (8×8 mm) | 176-LFQFP (24×24 mm) | | 208-LFQFP (28×28 mm) | | 176-LFBGA (8×8 mm) | 176-LFQFP (24×24 mm) | | 208-LFQFP (28×28 mm) | |

# Renesas RZ/A1 Series Starter Kit

Shorten product development cycles with the Renesas Starter Kit (RSK). The RZ/A1 kit includes everything you need to jump-start your system development and ease the design and debug process.

**The kit includes:**

- 800 x 480 touch panel for HMI development (optional)
- Segger JTAG-lite debugger
- Embedded IDE and compiler with evaluation license
- Sample code and peripheral drivers

| Part Number | TFT Display | Debugger |
|---|---|---|
| YR0K77210S001BE | No | Yes |
| YR0K77210S003BE | Yes | Yes |

am.renesas.com/rskrza1

# Renesas (GR-PEACH) ARM® mbed™ Platform

GR-PEACH from Renesas is an mbed enabled platform that combines the advantages of the mbed ecosystem and Arduino form factor. It is the first and only ARM mbed platform powered by a Cortex®-A class MPU.
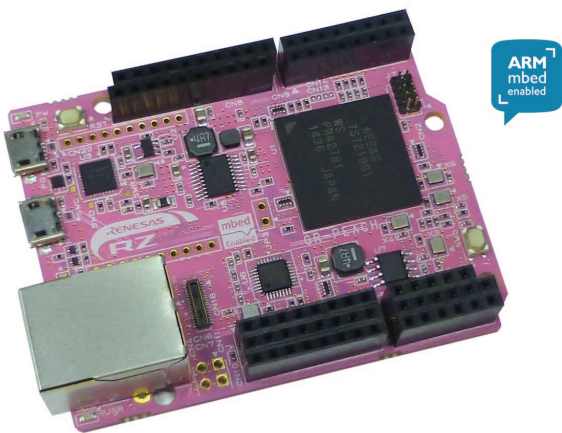
## Features

- 8 MB Flash
- 2xUSB Host/Device Interface, 1x Ethernet
- 3xSPI, 3xI²C, 8xUART, 7x12-bits ADC, 2xCAN
- 2xCamera Input

## Arduino form-factor

- Compatible with a wide range of commercially available shields
- Built-in USB 'drag & drop' Flash programmer

## mbed.org Developer Website

- Online Compiler
- High-level C/C++ SDK
- Active developer community

https://developer.mbed.org/platforms/Renesas-GR-Peach/

| Part Number | Description |
|---|---|
| YGRPEACHFULL | GR-PEACH |
| YGRPEACHAUDIOCAMERASHIELD | GR-PEACH Audio Camera Shield |
| YGRPEACHLCDSHIELD | GR-PEACH LCD Shield |

# Linux support now available on RZ/A1 MPUs

## Implementation Options

1. **XIP Linux (Execute-in-Place) with Advanced XIP File System (AXFS)**
   - Run from QSPI NOR Flash or on-chip SRAM
   - Buildroot and Yocto build options available
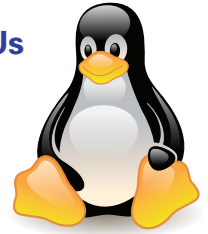
2. **Execute from SDRAM (up to 128 MB SDRAM)**

*Commercial support*

**timesys**®
Embedded Linux from a Trusted Source
www.timesys.com

*Community support*

**Renesas Rulz.com**

## Benefits of XIP Linux on RZ/A1 MPUs

- Direct execution from low-cost Quad-SPI Flash
- Memory size expansion without changing board layout
- Dual QSPI interface provides data access up to 528 Mb/s
- No external memory required
- Kernel memory usage as low as 1.5 MB of RAM
- Advanced XIP File System (AXFS) allows for lowest possible memory usage
- Faster system boot and application startup times
- Faster zero-copy page faults
- Separate buses allow simultaneous instruction fetches, data accesses and LCD frame buffer displaying without contention

## Renesas RZ/A1 XIP Linux Solution

### Device drivers provided for:

- Ethernet
- USB Host/ USB Gadget
- RTC (real-time clock)
- NOR Flash
- LCD Display
- Touch Panel
- Audio
- SDHC
- MMC
- QSPI
- SPI
- GPIO
- UART
- I²C

## Wi-Fi Support – SX-SDCAN for RZ/A1 XIP Linux

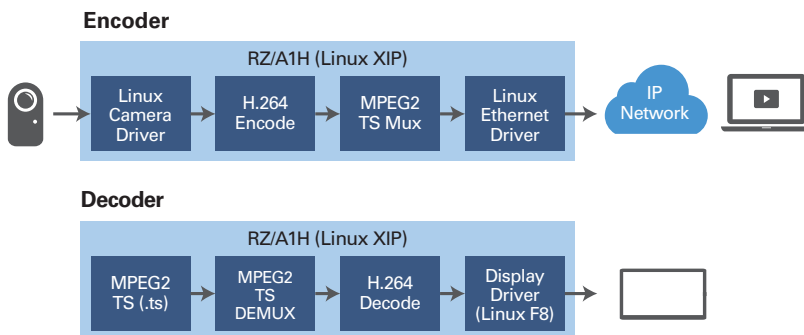802.11 a/b/g/n plus Bluetooth® SDIO Radio Card
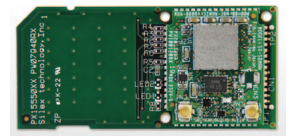
This proven connectivity solution has an SD-card form factor that implements a vendor-independent form factor

**silex** technology

- Offers IEEE 802.11a/b/g/n conformity (2.4 & 5 GHz)
- Applies single-stream 1x1 SISO technology and 40 MHz bandwidth mode for 5 GHz connectivity
- Supports IEEE 802.11e, IEEE 802.11h and IEEE 802.11i
- Supports SDIO 2.0 as host IF of wireless LAN
- Supports Bluetooth 4.0 + LE dual mode

## H.264 Solution Enabled for XIP Linux

**Encoder**

RZ/A1H (Linux XIP)

Linux Camera Driver → H.264 Encode → MPEG2 TS Mux → Linux Ethernet Driver → IP Network

**Decoder**

RZ/A1H (Linux XIP)

MPEG2 TS (.ts) → MPEG2 TS DEMUX → H.264 Decode → Display Driver (Linux F8)

**CONSILIENT TECHNOLOGIES**

www.consilient-tech.com

## Graphics Support Packages for XIP Linux

Accelerates embedded UI development

**Crank** software inc.

Crank Storyboard™ Suite
www.cranksoftware.com

**Qt**

www.qt.io

# Speed up your development with the RZ/A1 ecosystem

## Integrated Software Development Environments

### IAR Embedded Workbench®

- Integrated development environment and optimized compiler for RZ/A1 MPUs
- Project management tools and editor
- Configuration files for all RZ devices
- Emulator debugger support
- Run-time libraries

### ARM

- The ARM DS-5™ Development Studio, Renesas RZ Edition, is a complete software development environment for systems that use RZ/A1 MPUs.
- This IDE provides the DS-5's code editor, compiler, debugger and performance analyzer. These tools seamlessly generate, debug and optimize code for the powerful ARM Cortex-A9 CPU built into RZ/A1 series chips.

### Renesas e² studio

- Based on the popular Eclipse open-source environment
- Complete IDE supports IAR and free GNU compilers
- Powerful project management
- Download free at: am.renesas.com/e2studio

### Green Hills Software

- Green Hills Software supports Renesas RZ/A1 MPUs with its MULTI® IDE, C/C++ optimizing compilers, Probe debugger, and many other development tools. These products let system engineers generate fast, compact code, quickly find and fix bugs, and make sense of complex systems.

## Real-Time Operating Systems

**expresslogic**
ThreadX®
www.expresslogic.com

**Micriµm**
µC/OS-III®
www.micrium.com

**free RTOS**
FreeRTOS
www.freertos.com

**Linux**
Linux BSP
oss.renesas.com

**KEIL Tools by ARM**
RTX
www.keil.com

**SEGGER**
embOS®
www.segger.com

**µd Micro Digital**
SMX® RTOS
www.smxrtos.com

**RoweBots**
Unison RTOS
www.rowebots.com

## Graphics Packages

**expresslogic**
GUIX™
www.expresslogic.com

**Serious**
SHIPTide
www.seriousintegrated.com

**Crank software inc.**
Crank Storyboard™ Suite
www.cranksoftware.com

**SEGGER**
emWin™
www.segger.com

**MICROEJ**
MicroEJ®
www.microej.com

**altia**
DeepScreen®
www.altia.com

**Qt**
www.qt.io

## Wi-Fi Solutions

**GainSpan®**
www.gainspan.com

**silex technology**
www.silexamerica.com

**muRata INNOVATOR IN ELECTRONICS**
www.murata.com

## H.264 Solution

**Consilient Technologies**
www.consilient-tech.com

## Linux Solution

**timesys®** — Embedded Linux from a Trusted Source
www.timesys.com

## ARM Ecosystem

**ARM® mbed™**
www.mbed.com

# Fast track your success with RZ Express!

Design your next embedded microprocessor system with Renesas RZ/A1 MPUs and receive Express Logic X-Ware Platform™ and IAR Embedded Workbench® for ARM® *at no cost!\**

**Renesas**, **Express Logic** and **IAR Systems** have teamed up to bring you the RZ Express promotion! This is a chance for qualified production customers of the Renesas RZ/A1 microprocessor (MPU) to apply to receive a single-product license of Express Logic's ThreadX® real-time operating system (RTOS) and middleware stack, including NetX™, GUIX™, FileX® and USBX™, which are all components of the X-Ware Platform, at no cost. Customers who are chosen to receive this valuable single-product license free of charge will also enjoy free software support from Express Logic for 90 days, plus one free IAR Embedded Workbench® for ARM® IDE (Integrated Development Environment) seat. *The RZ Express promotion is available for a limited time, so apply today!*

See website for more details on this offer:

## renesas.com/rzexpress

*RENESAS RZ*  *THREADX*  *IAR Embedded Workbench®*

*RENESAS | expresslogic | IAR SYSTEMS*

## RZ Express Benefits

- Pay no royalties! No licensing fees!
- Speed your time to revenue with X-Ware™ by Express Logic and the IAR Systems' Embedded Workbench® for ARM IDE
- Differentiate your product with RZ/A1 ARM® Cortex-A9 MPUs by Renesas
- Use the Express Logic RTOS and middleware, including GUIX™, to quickly and effectively build differentiated HMI solutions on top of the Renesas RZ/A1 hardware platform

*RZ EXPRESS*
*TAKE THE FAST TRACK*

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# Renesas Ecosystem

**RENESAS PARTNER Alliance**

> The Alliance Partner Program allows you to connect instantly with hundreds of qualified design consulting and contracting professionals.
> am.renesas.com/Alliance

**RenesasRulz.com**

> A forum and community site to share technical information, questions and opinions with others who use Renesas MCUs and MPUs.
> www.RenesasRulz.com

**Renesas INTERACTIVE**

> Gain the technical knowledge you need. Evaluate, research and learn at your own pace, where you want, when you want, for free.
> www.RenesasInteractive.com

**RENESAS UNIVERSITY PROGRAM**

> For educators and students. Teach with professional grade tools. Learn MCUs with a modern architecture.
> www.RenesasUniversity.com

**My Renesas**

> Customize your data retrieval needs on the Renesas web site. You'll receive updates on the products you're interested in.
> am.renesas.com/MyRenesas

**Software Library – *Free SW***
am.renesas.com/softwarelibrary

**Free Samples**
am.renesas.com/samples

**Technical Support**
am.renesas.com/tech_support

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For additional information, please visit **am.renesas.com/RZA**

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