The Core Difference in Your Design
RX100 Microcontrollers

True Low Power™
100μA/MHz, 4.8us Wake-up, Lowest Power RX Solution

Advanced On-chip Peripherals
Safety, ADC, USB and More

Superior Architecture
RX CPU Core: 3.08 CoreMark™/MHz, DSP, Upward Compatibility

Renesas Electronics Singapore
sg.renesas.com
The RX100 series is the RX Family’s new entry level 32-bit MCU, extending the RX portfolio to the low end of the spectrum in terms of pin count and flash memory size. This new entrant is a great fit for those who want to benefit from the higher performance RX 32-bit architecture at the lowest possible cost. The RX100 series is the market’s first 32-bit MCU to feature True Low Power, as well as fast wake-up, zero wait-state flash, DSP capabilities and multiple safety functions. The RX111 group is the only entry-level 32-bit MCU that offers integrated USB 2.0 host, device and OTG support.

Designed to support a broad range of markets, the new RX100 series delivers a combination of ultra-low power consumption, on-chip connectivity, an extensive DSP library, and superior performance at attractive price points for low-end 32-bit embedded applications. It consumes only 350nA in sleep mode and snaps into full operation in just 4.8μs. Memory size ranges from 8KB to 128KB, and compact, low-pin-count packages are available starting at 36 pins.
RX 32-bit CPU
32MHz  50 DMIPS

Digital Signal Processing
- MAC 48-bit
- RMPA 80-bit
- Barrel Shifter 32-bit

Memory
- Zero-wait Flash up to 128KB
- SRAM up to 16KB
- Data Flash 8KB

Communication
- I2C 4 ch
- SCI/UART 3 ch
- SPI 4 ch
- USB 2.0 Host/Device/OTG
- GPIO

Timers
- MTU2 16-bit 6 ch
- CMT 16-bit 2 ch
- I-WDT
- RTC Calendar

Analog
- ADC 12-bit 14 ch
- DAC 8-bit 2 ch

System
- Event Link Controller
- Multifunction Pin Controller
- Data Mgmt. DTC/OMA
- Interrupt Cont. 16 levels
- Clocks OSC PLL IRC
- POR/LVD
- Safety CAC DOC CRC

Analogue
- Temp. Sensor

Clock
- CAC: Clock frequency accuracy measurement circuit
- Oscillation Stop Detection: Detects OSC stop
- Switch clock source to OCO

DAC
- 8-bit 2 ch

RAM
- Data Operation Circuit: Assists RAM failure check test

CMT
- 16-bit 6 ch

SCI/UART
- 3 ch

Serial Communication
- Cyclic Redundancy Check: Detects serial communication data error

I-WDT
- Independent watchdog timer clock source from system clock

DAC
- 8-bit 2 ch

POR/LVD
- Safety CAC DOC CRC

USB 2.0 Connectivity
- Host, device and OTG
- 3.08 CoreMark/MHz
- 1.56 DMIPS/MHz
- 50 DMIPS @ 32MHz

High Performance
- Clock Accuracy Control checks that the clock frequency is within a predefined range.
- Oscillation Stop Detection switches the chip’s main clock to an alternative source if the primary one fails.
- Data Operation Circuit continuously performs a SRAM failure test independently of the CPU.
- The Independent Watchdog Timer (I-WDT) uses a reliable internal clock source.

Low Power, Fast Wakeup
- 100μA/MHz
- 350nA standby, 4.8μs wake-up

Safety Features
- Built-in safety features (CAC, DOC, I-WDT, GPIO)
- Temperature sensor

Scalable
- Fully compatible with RX600 and RX200
- Low Pin Count (36–64 pins), 8KB to 128KB
- Multifunction Pin Controller (MPC)

DSP Ready
- Single-cycle Multiply
- Hardware-based Divide
- Extensive DSP Library

RTC
- Calendar

DAC
- 8-bit 2 ch

Safety Functions
RX100 MCUs provide six modular hardware subsystems that help products meet safety standards.

Clock Accuracy Control checks that the clock frequency is within a predefined range. Oscillation Stop Detection switches the chip’s main clock to an alternative source if the primary one fails. Data Operation Circuit continuously performs a SRAM failure test independently of the CPU. The Independent Watchdog Timer (I-WDT) uses a reliable internal clock source.

RX100 Microcontrollers
RX100 MCUs are great design choices for embedded systems that must minimize power consumption by running in sleep mode whenever possible, yet must wake-up quickly whenever there is a need to perform computing or control tasks. Renesas’ True Low Power capability offers designers the lowest possible power consumption across the entire temperature and voltage range, including all peripherals and Flash memory, while also providing maximum flexibility with multiple operational and sleep modes. Four different power-saving modes are available: Run, Sleep, Deep Sleep, and Software Standby. Wake-up time in low-power mode ranges from less than 1μs to 4.8μs.

■ Peripherals that aren’t required can be completely shut down in every mode. A flexible clock system allows peripherals to use a clock frequency from the one driving the CPU to achieve the lowest possible level of power consumption.

■ In run modes, the RX100 MCUs’ three different operating modes can be applied according to the demands of the application at any point in time: high speed, middle speed and low speed.

### Low Power Consumption, Fast Wake-up

- Software standby achieves a power consumption of only 350nA, with a 4.8μs wake-up time. Applications requiring a shorter wake-up can utilize the Sleep and Deep-Sleep modes that reduce the delay to just 1μs.

### Computing Capabilities for Application Performance

- The RX100 core features 1.56 DMIPS/MHz and 3.08 CoreMark/MHz performance and achieves 50 DMIPS at 32MHz.

<table>
<thead>
<tr>
<th>CoreMark per MHz</th>
<th>Dhrystone MIPS per MHz</th>
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<tbody>
<tr>
<td>RX600</td>
<td>RX100</td>
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<tr>
<td>RX200</td>
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<td>Cortex M0+</td>
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<table>
<thead>
<tr>
<th>Run Mode</th>
<th>ICLK Frequency</th>
<th>Internal Voltage Regulator Mode</th>
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</thead>
<tbody>
<tr>
<td>High Speed</td>
<td>8MHz - 32MHz</td>
<td>High Power</td>
</tr>
<tr>
<td>Middle Speed</td>
<td>1MHz - 8MHz</td>
<td>Middle Power</td>
</tr>
<tr>
<td>Low Speed</td>
<td>32kHz - 1MHz</td>
<td>Low Power</td>
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Sources: Cortex M Series CoreMark and DMIPS available on www.arm.com. RX200 and RX100 CoreMark estimates are from Renesas with IAR compiler. RL78 and RX600 CoreMark are published on www.coremark.org. DMIPS/MHz are published on all Renesas brochures for RX and RL families.
USB Connectivity of RX111 MCUs

Devices in the RX111 group incorporate a USB2.0 Host/Function controller and an OTG communication peripheral. Operating as a host, the controller provides full-speed and low-speed data transfers. It also supports battery charging and complies with the battery charging application specification, rev 1.2.

The Event Link Controller (ELC) is an innovative way to reduce CPU load by directly routing interrupt event signals from one peripheral or module to the other; as a result, power consumption, interrupt latency and program size are minimized.

The Multifunction Pin Controller (MPC) allows peripheral input and output signals to be remapped to alternate ports, offering more design layout flexibility. In this example, the ports of the IRQ0 and timer have been moved to a different location of the MCU.

Features Enabling Low Power Consumption and Design Flexibility
RX Family Performance/Power Consumption Comparison

The RX family now contains three series of 32-bit MCUs that are optimized for a vast range of application requirements. The RX100, RX200 and RX600 series are CPU and peripheral compatible and share the same software tools and ecosystem.

MCUs in the top-level RX600 series are ideal for systems that require high-performance, excellent connectivity, LCD drive and motor control capability. By contrast, devices in the RX200 and RX100 series are optimized for ultra-low-power, portable applications, safety functionality and integrated analog interfaces.

RX 32-bit MCU Family

Over 700 products covering all of your performance and power needs

RX600 Highest Performance

100-120MHz | 250µA/MHz*

32KB - 4MB Flash | 48 - 177 Pins

RX200 Mid-Range

50MHz | 150µA/MHz*

32KB - 1MB Flash | 48 - 145 Pins

RX100 Lowest Power

32MHz | 100µA/MHz*

8KB - 128KB Flash | 36 - 64 Pins

* All peripherals OFF, running NOP.

RX Family Performance/Power Consumption Comparison

RX100 MCU Series Portfolio

<table>
<thead>
<tr>
<th>Memory</th>
<th>RX110</th>
<th>RX111</th>
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<tbody>
<tr>
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<td><img src="image2" alt="RX111" /></td>
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<td>96KB / 16KB</td>
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<td>8KB / 2KB</td>
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<td>Safety</td>
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<td>USB 2.0</td>
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RX111:
- Flash (min): 16KB, Flash (max): 128KB, SRAM (max): 16KB, Data Flash: 8KB, Safety: ✓, ADC/DAC: ✓, Timer/Counter: ✓, RTI: ✓, I2C: ✓, SPI: ✓, USB 2.0: ✓

RX110:
### RX100 Series Devices

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<th>MHz</th>
<th>Flash Size (KB)</th>
<th>Data Flash (KB)</th>
<th>VCC (V)</th>
<th>RAM (KB)</th>
<th>12-bit Timers</th>
<th>Motor Control Timer</th>
<th>RTC</th>
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**RX111 Group**

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</table>

Selected examples shown here. Please check sg.renesas.com/rx100 for complete list of available devices.

Note: Support for 105°C available

### RX100 Microcontrollers
Get up and Running with the RX Ecosystem

Renesas makes it easy to launch new system designs. Our comprehensive hardware and software tools – including very low cost and free products – help swiftly advance the product development process from concept stage to final RX-based design.

**Renesas Customizable Software Library**

Applilet is a support tool that makes it easy to generate code optimized for an RX100 MCU. It functions through a simple GUI windows application or via an e² studio plug-in. This tool generates customizable device drivers that compile and work right out of the box.

sg.renesas.com/applilet

**RX111 Renesas Promotion Board (RPB)**

The RPB was designed to showcase RX111 low power modes, featuring Pmod™ and energy harvesting connectors, and comes loaded with software and tools.

- Integrated J-Link debugger
- Power measurement built in
- Applilet
- e² studio toolchain
- USB Demo

RPB Part Number: YRPBRX111
sg.renesas.com/RPBRX111

**RX111 Renesas Starter Kit (RSK)**

This complete RX111-based hardware/software platform for in-depth application design includes the E1 Debugger, e² studio, demonstration firmware, and a trial version of the Renesas RX compiler.

RSK Part Number: YROK505111S000BE
sg.renesas.com/RSKRX111

**Complete Debugging, Emulation, and Programming**

On-chip debugging of an RX-based application is performed via a debug connection to the target and USB connection to the Windows-based IDE. The Renesas E1 and E20 debuggers offer thorough CPU control and visibility.

ON CHIP DEBUGGER

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**Third-party Solutions**

<table>
<thead>
<tr>
<th>Compilers</th>
<th></th>
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<tbody>
<tr>
<td>IAR Systems</td>
<td><a href="http://www.iar.com/ewrx">www.iar.com/ewrx</a></td>
</tr>
</tbody>
</table>

The IAR Embedded Workbench for RX is now available in two editions – The EWRX Standard edition and the new EWRX-BL Baseline edition, which is targeted at developers working with Renesas RX MCUs with smaller memory like the RX100 series. The Baseline edition is limited to a code size of 256KB, but otherwise provides a fully functional IDE, including project manager, editor, compiler, assembler, linker librarian and debugger tools.

NEW: Free 64KB size-limited Kickstart version now also available!

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**RTOS**

-µC/OS-III | CMX-RTX | Unison |ThreadX | FreeRTOS |embOS |

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| USB | | | | | |

Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.

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