The Core Difference in Your Design
RX100 Microcontrollers
RX100 MCUs for True Low Power, Low Cost, High-performance Applications

The RX100 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 is the market’s first 32-bit MCU to feature True Low Power, as well as fast wake-up, zero wait state flash, multiple safety functions and integrated USB 2.0 host, device and OTG support.

Designed to support a broad range of markets, the new RX111 family delivers a combination of ultra-low-power consumption, on-chip connectivity and superior performance at attractive price points for low-end 32-bit embedded applications, including mobile health care, smart meters, sensors/detectors, and industrial and building automation. It consumes only 350 nA in sleep mode and snaps into full operation in just 4.8 μs. Memory size ranges from 8 KB to 512 KB, and compact, low-pin-count packages are available starting at 36 pins.
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.

CAC: Clock frequency accuracy measurement circuit  
OCO: On-chip oscillator
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.

RX100

- The entry level RX100 series is the lowest cost product line in the RX Family. The RX100 family offers ultra-low-power operation, a fast wake-up time, USB connectivity, 8 KB data Flash, a DAC, and communication channels. Pin counts in the RX100 series are as low as 36 pins. The RX100 is available with flash memory sizes from 8 KB to 512 KB.

RX200

- RX210 MCUs feature memory sizes from 32 KB to 1 MB and provide an integrated 12-bit ADC, analog comparator and temperature sensor. RX220 MCUs aim at price-sensitive designs; they come in smaller packages with as few as 48 pins and offer additional options for smaller memory footprint applications. The RX21A group features advanced analog and security functions such as a 24-bit Delta-Sigma data converter and a Memory Protection Unit.

RX600

- RX62N and RX63N product groups are characterized by advanced connectivity with Ethernet, USB host function, and multiple CAN interfaces; those in the RX62T, RX63T and RX62G groups have features specifically intended for controlling motors and power inverters.

True Low Power without Compromising Performance

- 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 1 μs to 4.8 μs.
- 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 350 nA, with a 4.8 μs wake-up time. Applications requiring a shorter wake-up can utilize the Sleep and Deep-Sleep modes that reduce the delay to just 1 μs.
Computing Capabilities for Application Performance

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

<table>
<thead>
<tr>
<th>CoreMark per MHz</th>
<th>Dhrystone MIPS per MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX600</td>
<td>3.12</td>
</tr>
<tr>
<td>RX200</td>
<td>3.09</td>
</tr>
<tr>
<td>RX100</td>
<td>3.08</td>
</tr>
</tbody>
</table>

| Cortex M4       | 2.19                   |
| Cortex M3       | 2.17                   |
| Cortex M0       | 1.62                   |
| Cortex M0+      | 1.77                   |
| RX600           | 1.65                   |
| RX200           | 1.56                   |
| RX100           | 1.56                   |

| Cortex M4       | 1.25                   |
| Cortex M3       | 1.25                   |
| Cortex M0       | 0.85                   |
| Cortex M0+      | 0.93                   |

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 RX100 MCUs

- Devices in the RX111 and RX113 groups 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.
Comprehensive On-chip Peripherals

Many different combinations of on-chip analog, timer, communication, system and other functions are built into RX100 MCUs to save cost, simplify systems and reduce total power consumption.

### RX100 MCUs

<table>
<thead>
<tr>
<th>Model</th>
<th>Flash (min)</th>
<th>Flash (max)</th>
<th>SRAM (max)</th>
<th>ADC 12-bit</th>
<th>DAC</th>
<th>Temp Sensor</th>
<th>I2C</th>
<th>UART</th>
<th>SPI</th>
<th>USB 2.0</th>
<th>LCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX113</td>
<td>128 KB</td>
<td>512 KB</td>
<td>64 KB</td>
<td>8 KB</td>
<td>17</td>
<td>2 x 12-bit</td>
<td>4</td>
<td>4</td>
<td>9</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>RX111</td>
<td>16 KB</td>
<td>64 KB</td>
<td>8 KB</td>
<td>14</td>
<td>2</td>
<td>2 x 8-bit</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RX110</td>
<td>8 KB</td>
<td>128 KB</td>
<td>16 KB</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Innovative Peripherals

- **12-bit ADC 17 Channels, 1 μs, sample and hold, internal/external voltage reference**
- **12-bit, 2 Channels**
- **12-bit Resolution**
- **16-bit 16 Channels, drives 2 three phase motors**
- **4 x 16-bit Compare/match timer**
- **14-bit Independent watchdog timer**
- **Clock and calendar mode, BCD count, alarms**

#### The Event Link Controller (ELC)

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)

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 IRQO and timer have been moved to a different location of the MCU.

#### Device Features

- Device controller and transceiver included, full-speed (12 Mbps), low-speed (1.5 Mbps), battery charger supported
- Standard, fast, and high-speed (400 KHz), master, slave, multi-master support, digital noise filtering
- Serial communications interface synchronous and asynchronous UART and 9-bit mode, smart card, simple I2C
- I2C Master, slave, multi-master, 400 kbps transfer rate
- Programmable configuration at each pin, options for built-in pull-up and 5 V tolerance, ability to read back output values
- Flexible DMA engine (DTC)
- RAM test, clock abnormally detect, clock stop detect

---

**RX113**

- **128 KB Flash**
- **512 KB Flash**
- **64 KB SRAM**
- **17 Channels ADC**
- **2 x 12-bit DAC**
- **8 KB Temp Sensor**
- **4 x 16-bit Compare/match timer**
- **2 x 12-bit RTC**
- **I2C**
- **UART**
- **SPI**
- **USB 2.0**
- **LCD**

**RX111**

- **16 KB Flash**
- **64 KB Flash**
- **8 KB SRAM**
- **14 Channels ADC**
- **2 x 8-bit DAC**
- **2 x 8-bit Temp Sensor**
- **2 x 16-bit Compare/match timer**
- **8 KB RTC**
- **I2C**
- **SPI**
- **USB 2.0**
- **SPI**

**RX110**

- **8 KB Flash**
- **128 KB Flash**
- **16 KB SRAM**
- **14 Channels ADC**
- **2 x 8-bit DAC**
- **2 x 8-bit Temp Sensor**
- **8 KB RTC**
- **I2C**
- **UART**
- **SPI**
- **USB 2.0**
- **LCD**
RX100 MCU Series Portfolio

RX100 Series Devices

Selected examples shown here. Please check www.renesas.eu/RX100 for complete list of available devices. Note: Support for 105 °C available
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

Application Leading Tool 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 e2studio plug-in. This tool generates customizable device drivers that compiles code and works out of the box.

www.renesas.eu

© 2015 Renesas Electronics Europe. All rights reserved. Printed in Germany.
Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.

RX100 Renesas Promotion Board (RPB)
The board 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
- e2studio toolchain
- USB Demo

RPB Part Number: YRPBRX111
www.renesas.eu/RPBRX111

RX100 Renesas Starter Kits (RSK)
These complete RX111 and RX113 based hardware and software platforms provide a complete development environment for the RX100, including the E1 Debugger, a trial version of the e2studio and the RX compiler and demonstration firmware

RX111 RSK Part Number: YR0K505111S000BE
www.renesas.eu/RSKRX111

RX113 RSK Part Number: YR0K505113S000BE
www.renesas.eu/RSKRX113

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.

Third-party Solutions

<table>
<thead>
<tr>
<th>RTOS</th>
<th>FreeRTOS</th>
<th>embOS</th>
<th>µC/OS-III</th>
<th>CMX-RTX</th>
<th>Unison</th>
<th>ThreadX</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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