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The Core Difference in Your Design

RX100 Microcontrollers

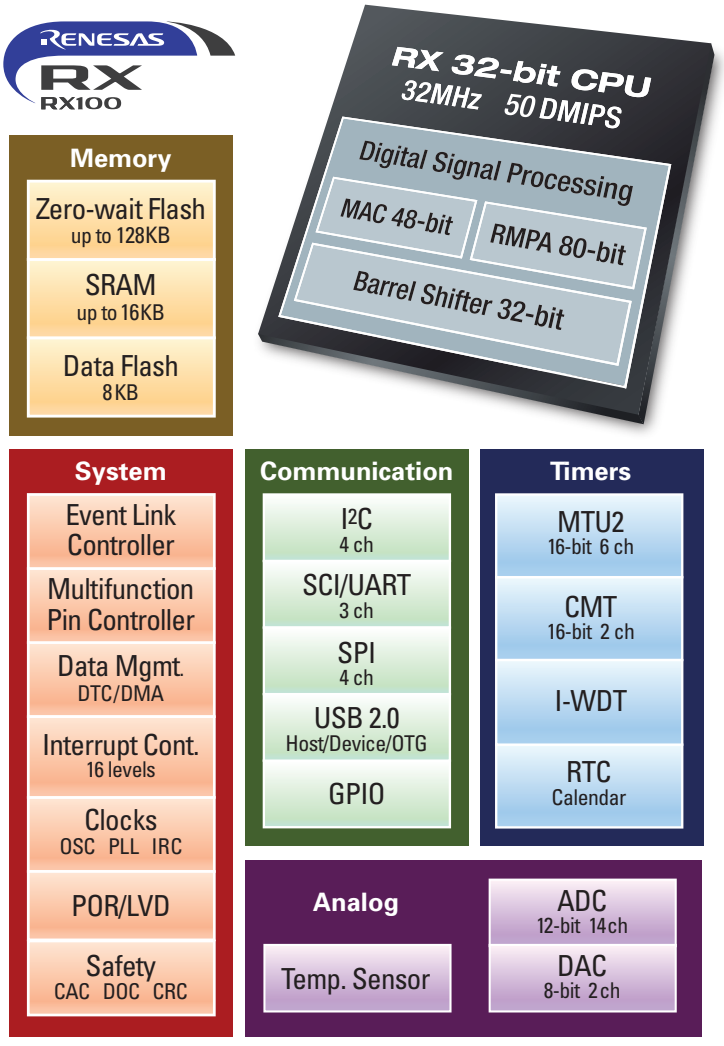
RENESAS RX RX100

Renesas Electronics Singapore
sg.renesas.com

RX100 MCUs for *True Low Power*™, Low Cost, High-performance Applications

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.



Low Power, Fast Wakeup

- 100µA/MHz*
- 350nA standby, 4.8µs wake-up

USB 2.0 Connectivity

- Host, device and OTG

High Performance

- 3.08 CoreMark/MHz
- 1.56 DMIPS/MHz
- 50 DMIPS @ 32MHz

Zero wait-state Flash

- 1KB Block size
- Erase/Write operation down to 1.8V
- BGO Data Flash (programmable while code is executed)

DSP Ready

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

Safety Features

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

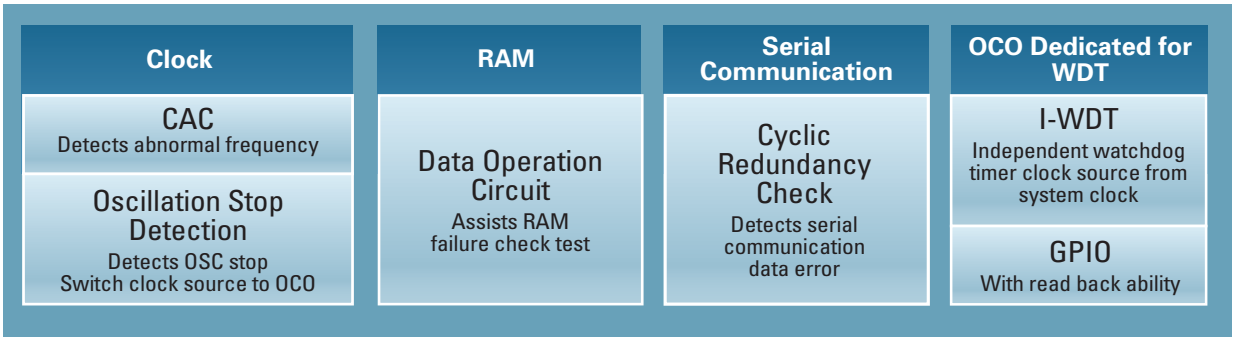
Scalable

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

* All peripherals OFF, running NOP.

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.



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

True Low Power without Compromising Performance

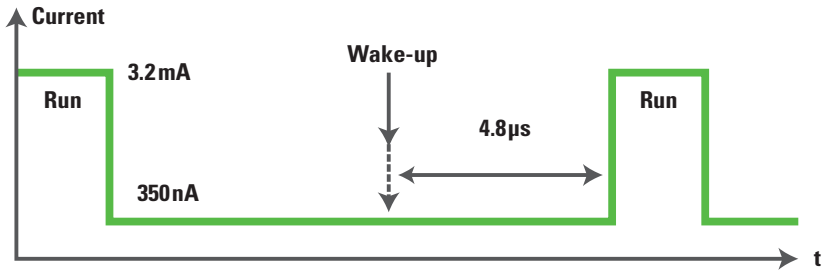
- RX100 MCUs are great design choices for embedded systems that must minimize power consumption by running in sleep mode whenever possible, yet must wake-up quickly whenever there is a need to perform computing or control tasks. Renesas' True Low Power capability offers designers the lowest possible 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 1µs to 4.8µs.

Run Mode	ICLK Frequency	Internal Voltage Regulator Mode
High Speed	8MHz - 32MHz	High Power
Middle Speed	1MHz - 8MHz	Middle Power
Low Speed	32kHz - 1MHz	Low Power

- 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.

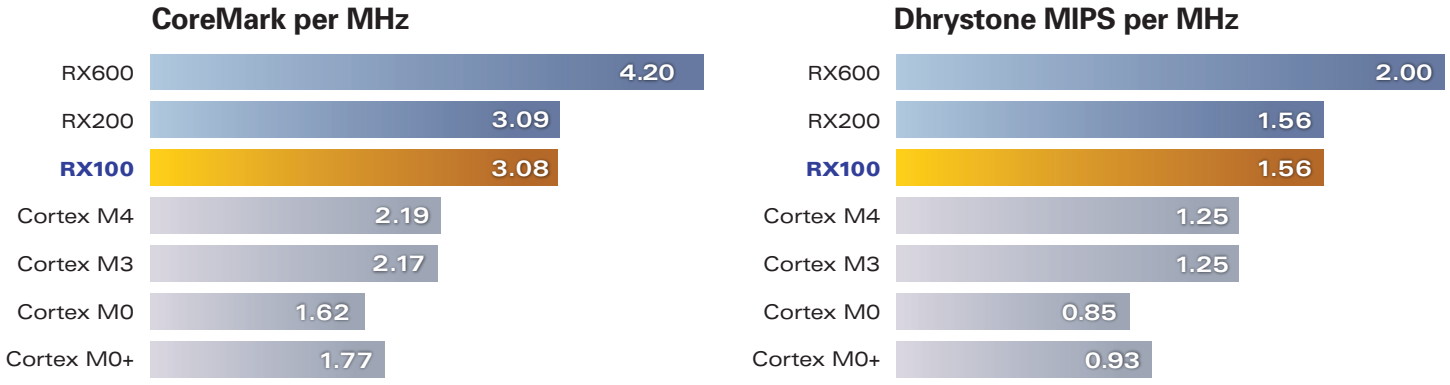
Low Power Consumption, Fast Wake-up

- 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

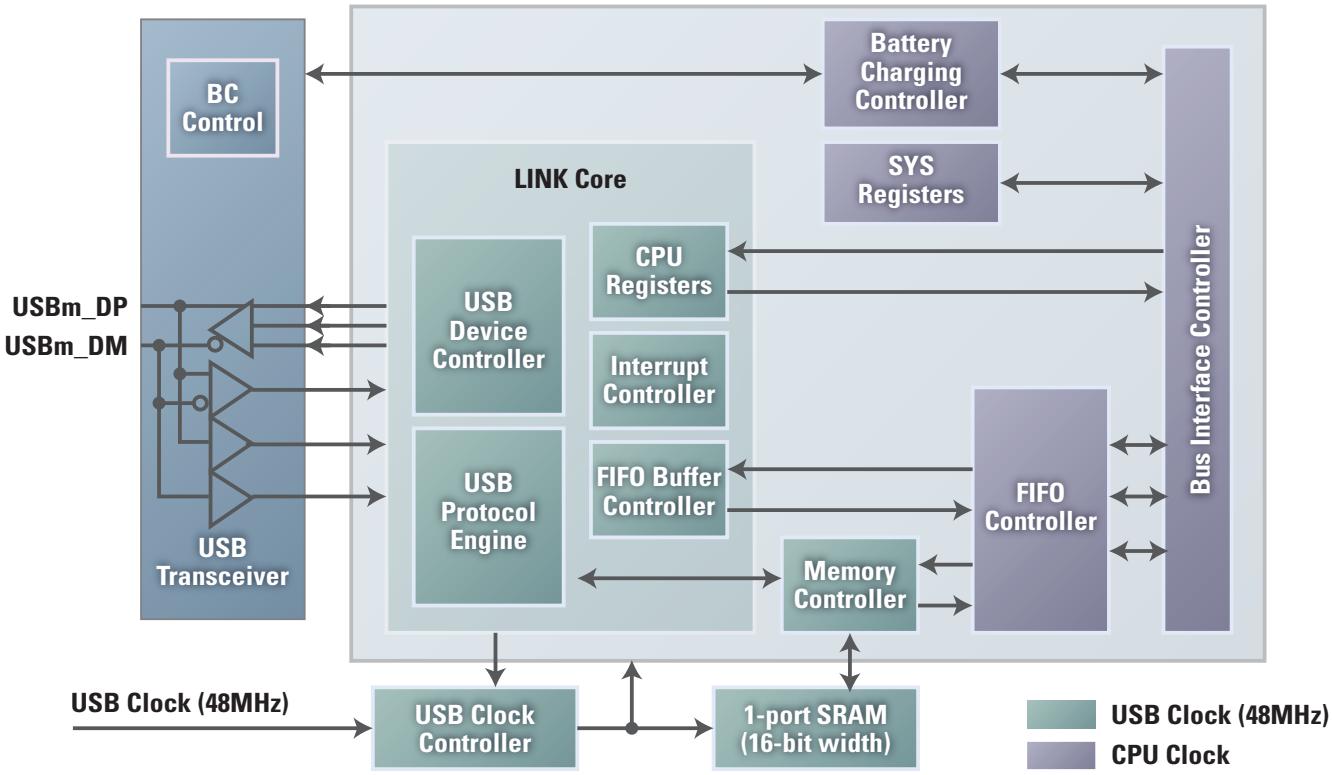
- The RX100 core features 1.56 DMIPS/MHz and 3.08 CoreMark/MHz performance and achieves 50 DMIPS at 32MHz.



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

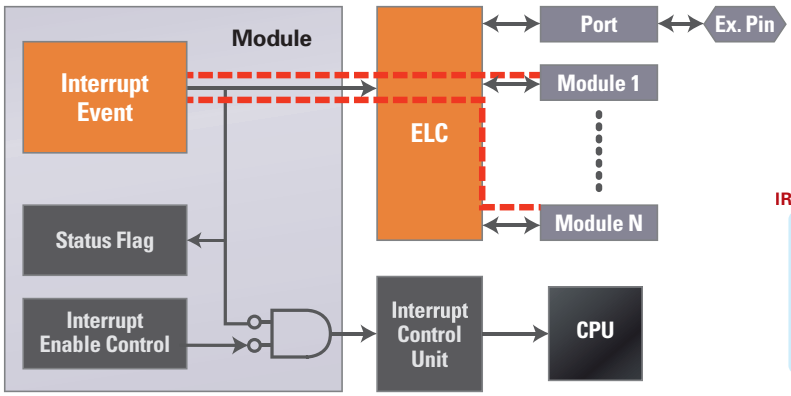
- Devices in the RX111 group incorporate a USB2.0 Host/Function controller and an OTG communication peripheral. Operating as a host, the controller provides full-speed and low-speed data transfers. It also supports battery charging and complies with the battery charging application specification, rev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

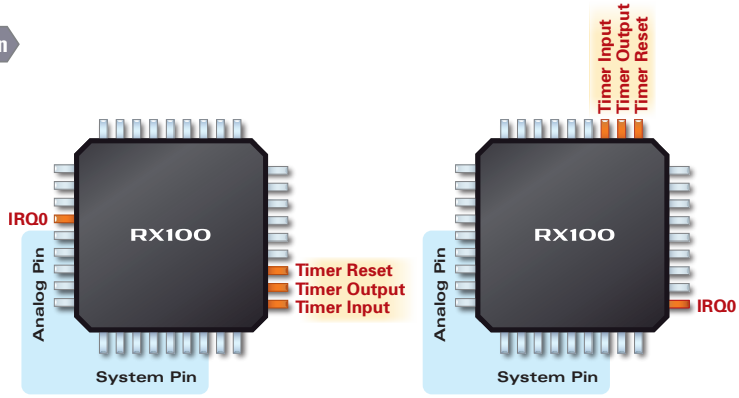


Features Enabling Low Power Consumption and Design Flexibility

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.

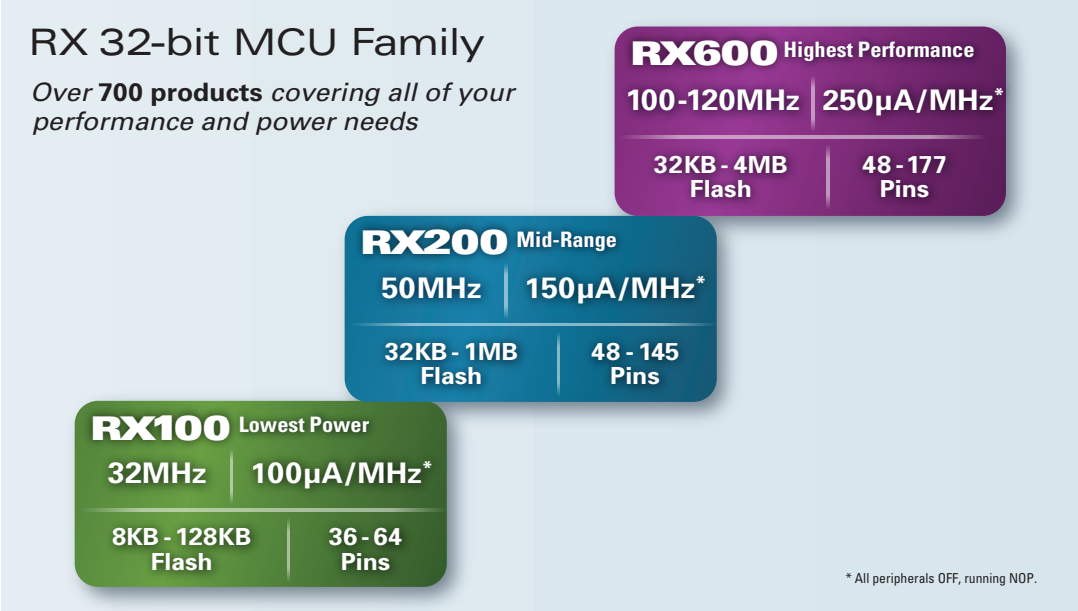




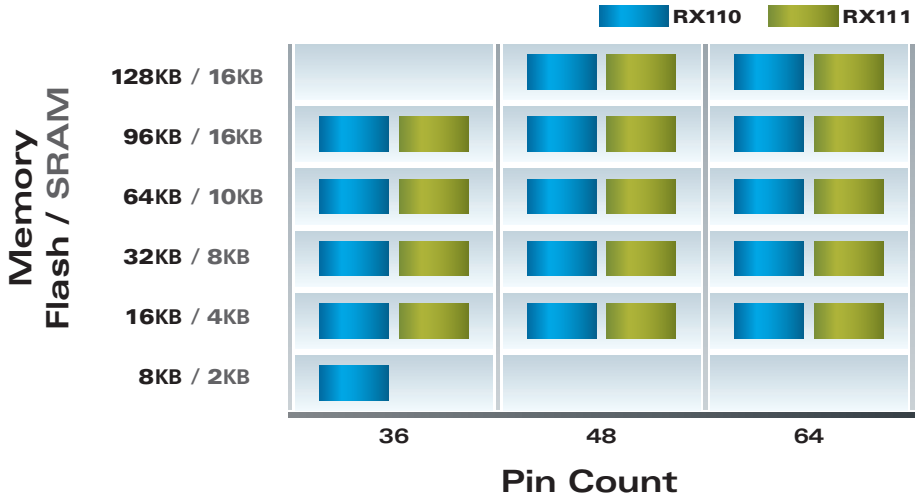
RX Family Performance/Power Consumption Comparison

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 MCU Series Portfolio



	Flash (min)	Flash (max)	SRAM (max)	Data Flash	Safety	MPC	ADC 12-bit	DAC 8-bit	Temp Sensor	MTU2	CMT	I-WDT	RTC	I2C	SCI/UART	SPI	USB 2.0
RX111	16KB	128KB	16KB	8KB	√	√	14	2	√	√	2	√	√	4	4	4	√
RX110	8KB	128KB	16KB	–	√	√	14	–	√	√	2	√	√	3	3	3	–

RX100 Series Devices

	Part Number	MHz	Flash Size (KB)	Data Flash (KB)	VCC (V)	RAM (KB)	16-bit Timers	Watchdog Timers	Motor Control Timer	RTC	A/D 12-bit	DAC	Op-Amps	SCI	SPI	I²C	GPIO	Pin Count/ Package Type	Pin pitch (mm)	Package
RX111 Group	R5F51115ADFM#30	32	128	8	1.8-3.6	16	8	1	1	1	14	2	Y	3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51115ADFK#30										14						44	64-LQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51115ADLF#U0										14						44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51115ADFL#30										10						28	48-LFQFP	0.5	PLQP0048KB-A : 7x7mm
	R5F51115ADNE#V0										10						28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51114ADFM#30	32	96	8	1.8-3.6	16	8	1	1	1	14	2	Y	3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51114ADFK#30										14	2					44	64-LQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51114ADLF#U0										14	2					44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51114ADFL#30										10	–					28	48-LFQFP	0.5	PLQP0048KB-A : 7x7mm
	R5F51114ADNE#V0										10	–					28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51113ADFM#30	32	64	8	1.8-3.6	10	8	1	1	1	14	2	Y	3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51113ADFK#30									1	14	2		3			44	64-LQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51113ADLF#U0									1	14	2		3			44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51113ADFL#30									1	10	–		3			28	48-LFQFP	0.5	PLQP0048KB-A : 7x7mm
	R5F51113ADNE#V0									1	10	–		3			28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51113ADNF#V0									–	8	–		2			22	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm
	R5F51113ADLM#U0									–	7	–		2			18	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
	R5F51111ADFM#30	32	32	8	1.8-3.6	10	8	1	1	1	14	2	Y	3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51111ADFK#30									1	14	2		3	4	4	44	64-LQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51111ADLF#U0									1	14	2		3	4	4	44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51111ADFL#30									1	10	–		3	4	4	28	48-LFQFP	0.5	PLQP0048KB-A : 7x7mm
	R5F51111ADNE#V0									1	10	–		3	4	4	28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51111ADNF#V0									–	8	–		2	3	3	22	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm
	R5F51111ADLM#U0									–	7	–		2	3	3	18	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
	R5F5111JADFM#30	32	16	8	1.8-3.6	8	8	1	1	1	14	2	Y	3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F5111JADFK#30									1	14	2		3	4	4	44	64-LQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F5111JADLF#U0									1	14	2		3	4	4	44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F5111JADFL#30									1	10	–		3	4	4	28	48-LFQFP	0.5	PLQP0048KB-A : 7x7mm
	R5F5111JADNE#V0									1	10	–		3	4	4	28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F5111JADNF#V0									–	8	–		2	3	3	22	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm
	R5F5111JADLM#U0									–	7	–		2	3	3	18	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
RX110 Group	R5F51105ADNE	32	128	–	1.8-3.6	16	2	1	–	1	10	–	Y	3	4	4	28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51105ADFL										10						28	48-LFQP	0.5	PLQP0048KB-A : 7x7mm
	R5F51105ADLF										14						44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51105ADFM										14						44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51105ADFK										14						44	64-LFQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51104ADNE	32	96	–	1.8-3.6	16	2	1	–	1	10	–	Y	3	4	4	28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51104ADFL										10						28	48-LFQP	0.5	PLQP0048KB-A : 7x7mm
	R5F51104ADLF										14						44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51104ADFM										14						44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51104ADFK										14						44	64-LFQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51103ADLM	32	64	–	1.8-3.6	10	2	1	–	–	7	–	Y	2	3	3	22	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
	R5F51103ADNF									–	8			2	3	3	26	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm
	R5F51103ADNE									1	10			3	4	4	28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51103ADFL									1	10			3	4	4	28	48-LFQP	0.5	PLQP0048KB-A : 7x7mm
	R5F51103ADLF									1	14			3	4	4	44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51103ADFM									1	14			3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51103ADFK									1	14			3	4	4	44	64-LFQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F51101ADLM	32	32	–	1.8-3.6	10	2	1	–	–	7	–	Y	2	3	3	22	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
	R5F51101ADNF									–	8			2	3	3	26	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm
	R5F51101ADNE									1	10			3	4	4	28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F51101ADFL									1	10			3	4	4	28	48-LFQP	0.5	PLQP0048KB-A : 7x7mm
	R5F51101ADLF									1	14			3	4	4	44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F51101ADFM									1	14			3	4	4	44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F51101ADFK									1	14			3	4	4	44	64-LFQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F5110JADLM	32	16	–	1.8-3.6	8	2	1	–	–	10	–	Y	3	4	4	22	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
	R5F5110JADNF									–	10						26	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm
	R5F5110JADNE									1	10						28	48-HWQFN	0.5	PWQN0048KB-A : 7x7mm
	R5F5110JADFL									1	10						28	48-LFQP	0.5	PLQP0048KB-A : 7x7mm
	R5F5110JADLF									1	14						44	64-WFLGA	0.5	PWLG0064KA-A : 5x5mm
	R5F5110JADFM									1	14						44	64-LFQFP	0.5	PLQP0064KB-A : 10x10mm
	R5F5110JADFK									1	14						44	64-LFQFP	0.8	PLQP0064GA-A : 14x14mm
	R5F5110HADLM	32	8	–	1.8-3.6	8	2	1	–	–	7	–	Y	2	3	3	22	36-WFLGA	0.5	PWLG0036KA-A : 4x4mm
	R5F5110HADNF										8						26	40-HWQFN	0.5	PWQN0040KC-A : 6x6mm

Selected examples shown here. Please check sg.renesas.com/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

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.

Applilet®

sg.renesas.com/applilet

e² studio – the new Eclipse-based Integrated Development Environment (IDE) from Renesas

Complete development and debug environment based on the popular Eclipse platform and the associated C/C++ Development Tooling (CDT) project.

Basic Features		Advanced Debug Features	
– Connect / Disconnect – Run / Stop (Resume / Suspend) – Software breakpoints – Source step / disassembly step	– Variable and Expression views – Register view – Basic Memory view – Endian selection	– Renesas Debug view with Call Stack – I/O Registers view – Trace view – Eventpoints view	– Real-time Expression view – Real-time Memory view – Real-time Chart view

sg.renesas.com/e2studio

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.

*Also supports the RX110.

RSK Part Number: YR0K505111S000BE
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.

Renesas E1
R0E000010KCE00

Renesas E20
R0E000200KCT00

sg.renesas.com/tools

Third-party Solutions

Compilers

IAR SYSTEMS
www.iar.com/ewrx

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!

KPIT Cummins Infosystems Limited
www.kpitgnutools.com
KPIT GNURX compiler

	Micrium	CMX SYSTEMS	RoweBots	expresslogic	freeRTOS	SEGGER
	www.micrium.com	www.cmx.com	www.rowebots.com	www.expresslogic.com	www.freertos.org	www.segger.com
RTOS	µC/OS-III	CMX-RTX	Unison	ThreadX	FreeRTOS	embOS
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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