

RL78

The Ultimate Low Power Microcontroller Platform



RL78



RL78 – The Leader In Low Power...

Welcome to the RL78, a new platform family of world's lowest-power microcontrollers from Renesas Electronics. RL78 embeds ultimate intelligence with a perfect combination of lowest power consumption, best in class CPU performance and the highest integration of world leading peripherals.

RL78 – The ultimate embedded intelligence in your system!

A complete platform line-up is on offer with ultimate flexibility of choice in terms of performance, memory, packages, peripherals as well as the world's lowest power consumption in the embedded arena. The general purpose range of RL78 family offers multiple flavours to suit every need:

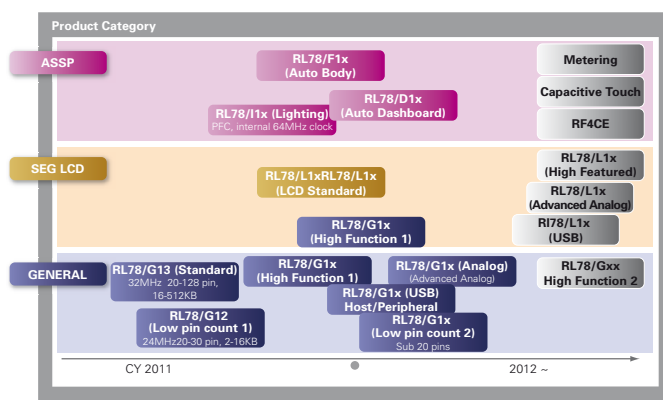
RL78/G12: 24Mhz Low-pin count family from ranging from 20-30pin wide variety of packages

RL78/G13: 32Mhz General purpose family ranging from 20-128pins in a wide variety of packages

RL78 offers the best platform of choice for Industrial, Consumer and Automotive applications.

The Industrial & Consumer portfolio of RL78 family includes widest range of general purpose devices (RL78 G Series) as well as a full roadmap for many application specific lines such as LCD, Lighting, USB, Metering and motor control.

RL78 Roadmap For Your Success



RL78 G Series Portfolio – A Device For Every Need!

302 Products offering Widest Memory & Package Line-up														
ROM														
512 KB								32K	32K	32K	32K	32K	32K	32K
384 KB								24K	24K	24K	24K	24K	24K	24K
256 KB								20K	20K	20K	20K	20K	20K	20K
192 KB							16K	16K	16K	16K	16K	16K	16K	16K
128 KB				12K	12K	12K	12K	12K	12K	12K	12K	12K	12K	12K
96 KB				8K	8K	8K	8K	8K	8K	8K	8K	8K	8K	8K
64 KB	4K	4K	4K	4K	4K	4K	4K	4K	4K	4K	4K	4K	4K	4K
48 KB	3K	3K	3K	3K	3K	3K	3K	3K	3K	3K	3K	3K	3K	3K
32 KB	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K
16 KB	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K
12 KB	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K
8 KB	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K	1K
4 KB	768	768	768	768	768	768	768	768	768	768	768	768	768	768
2 KB	256	256	256	256	256	256	256	256	256	256	256	256	256	256
Pins	20	24	25	30	32	36	40	44	48	52	64	80	100	128
Package	SSOP (300 ml)	QFN (4 4)	LGA (3x3)	SSOP (300 ml)	QFN (5 5)	LGA (4x4)	QFN (6 6)	SSOP (300 ml)	QFP (7x7)	QFP (10x10)	QFP (7x7)(Note)	QFP (12x12, 14x14)	QFP (14x14, 14x20)	QFP (14x20)

Note: 64-pin QFP(7x7) has ROM variation of 32KB - 256KB

RAM w/o Data Flash, RAM w Data Flash

RENEAS

Add Value To Your Application With RL78...

RL78 offers the ideal solution for multiple applications across Industrial, Automotive, Communication and Consumer segments.

Features & Benefits

High Performance

- 1.27DMIPS/MHz
- Max 32MHz operation
- H/W Mul/Div/MAC
- 1.6V to 5.5V operation

Ultimate Low Power

- 70µA @ 32KHz operation
- 0.7µA@ 32KHz HALT with RTC
- “Snooze” mode

Widest Scalability

- 20 to 128pin packages
- Up to 512KB Flash
- Up to 32KB RAM
- ASSP expansion

System Cost Reduction

- Back ground operation data Flash
- 32MHz +/- 1% OCO
- Analog integration

Highest Quality & Safety

- Highest quality Flash
- IEC 60730 safety function
- High EMS robustness
- High temperature support

Ideal choice for any application

Home Appliances

Washers, Dishwashers, Refrigerators, Small Appliances, Induction Cooking, Air Conditioners

Small Appliances

Microwave Ovens, Coffee Machines, Food Processors, Vacuum Cleaner, Fans, Lawn Mowers, Shavers, Hair care, Tooth Brushes

Industrial Control

Sensors, Actuators, Safety Modules, Industrial Drives, other control devices

Metering

Single Phase Electricity Meter, Gas Meter, Water Meter & Heat Cost Meter

Medical

Blood Glucose Meter, ECG Sensor, Blood Pressure Monitor, other home diagnostic monitors

Lighting

Interior Lighting, Architectural Lighting, Stage Lighting, Signage & Back Lighting

Others

Handheld Battery Controlled Devices, Heating Controls, Fire & Security Detectors, Remote Controls, PSU

Lowest Power Consumption @ Highest Performance – No Compromise!

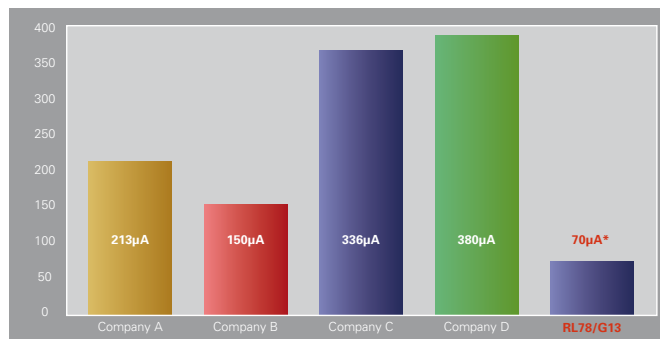
The RL78 family delivers an impressive operating current of **70 $\mu\text{A}/\text{MHz}$** (while running at 32 MHz) and a super low standby current of **0.7 μA** (in sub-halt mode, with the RTC and LVD operating).

All of this is still possible while running the CPU @ 32MHz delivering a mega 40.6 DMIPS (**1.27DMIPS/MHz**) performance without any compromise!

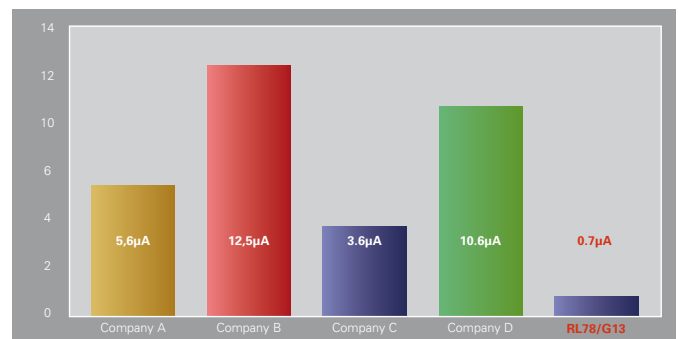
Choose the leader in low power...

Thanks to the latest 130nm process technology, improved internal oscillator configuration and highly optimized internal logic, RL78 stands as an undisputed leader in the competitive landscape.

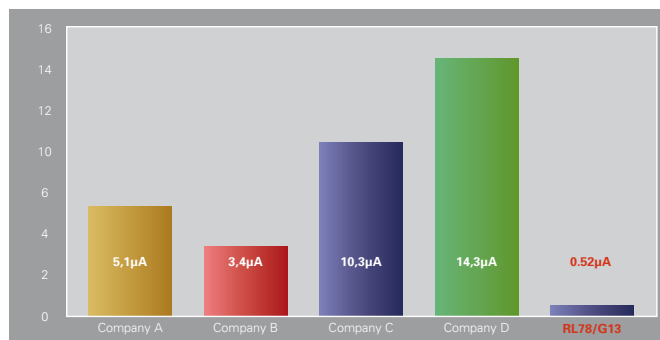
Current consumed during normal operation ($\mu\text{A}/\text{MHz}$)



Current consumed during RTC operation (32.768 kHz, RTC + LVD)

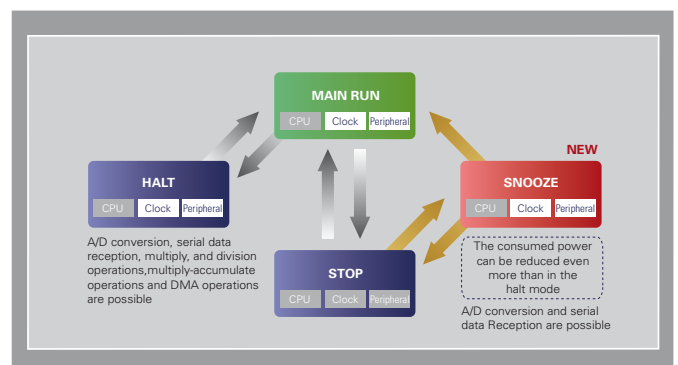


Current consumed in STOP mode (WDT + LVD)



Achieve the ultimate power saving with 'Snooze Mode'

On top the RL78 family offers a very unique power-saving 'snooze mode' in which A/D conversion and serial communication can continue while the CPU is in standby. So no need to wake up the CPU for receiving data. This mode is excellent for battery-powered systems as it greatly increases the battery life.



Source: Comparison made on datasheets
140 μA (all instruction execution)

* operation with nop instruction

RL78 – A Feature Rich Microcontroller

With a complete lineup of products with memory sizes selectable from 2 KB to 512 KB and packages sizes ranging from 20 to 128 pins, RL78 offers the best in class features for any application.

Thanks to all products having been developed using the same platform, it provides ideal compatibility and scalability within and across different families. You can also reuse your existing software assets due to common peripherals coming from the 78K0 and R8C families. To benefit we invite you to select an RL78 family product with the confidence that you can use it for many years to come.

Timers

A complete timer unit is included which, provides choice of 16-bit counter and capture/compare registers for each timer channel. Timers can be operated individually as well as in interlocking units to enable a range of other features such as one-shot pulse & PWM signal outputs.

Serial Interfaces

A single-channel 3-wire serial interface and I²C interface is also included, each of which is provided with a shift register and buffer register. Two full-duplex UART channels are also available.

A/D Converter

The A/D converter can operate from a voltage as low as 1.6 V. The conversion resolution can be selected from 8 or 10 bits. A wide range of conversion modes are available, including scan mode, one-shot conversion mode, and successive conversion mode.

DMAC

Data can be transferred directly between peripheral hardware SFRs and the internal RAM based on interrupts from timers, serial interfaces, or the A/D converter, or based on a software trigger, without going via the CPU.

WDT

The watchdog timer detects a hung program. Three possible WDT window settings are available and can be selected to suit your system.

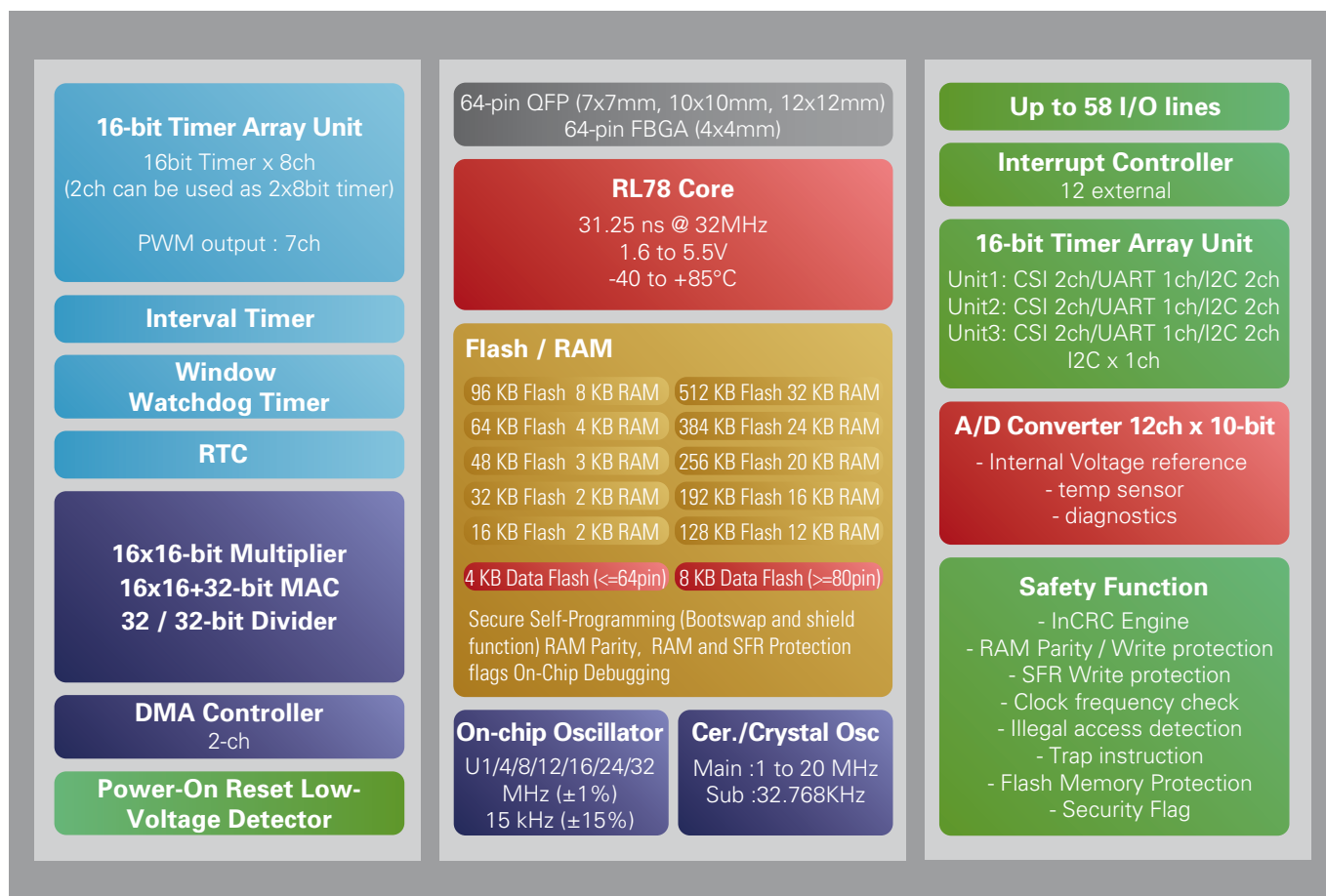
LVD

The LVD monitors the voltage and generates a reset or interrupt signal depending on the current mode. Thanks to a new interrupt and reset mode, the LVD can also initiate data-save processing by generating an interrupt before issuing the reset signal.

RTC

The RTC includes a full calendar feature that enables the clock to be updated automatically up to the year 2099. No need to be awake the CPU from standby mode because it continues operating, helping to reduce power consumption.

RL78/G13: 64-pin Block Diagram



Looking For System Cost Reduction?

Then look no further... Feature rich RL78 family offers the ultimate solution to save overall system cost by integrating the key peripherals inside this all-in-one MCU.

These peripherals include components such as a high precision internal oscillator with an accuracy of 1%. Data Flash memory that can be overwritten 1 million times and that can operate in the background, a temperature sensor, and high current tolerant ports for interfacing with different power supplies. Furthermore a full range of small packages are available to help you reduce the PCB size.

Developed using a new 130nm process, the RL78 family not only reduces system cost, but also helps to reduce the size of your system.

Achieve the highest level of functionality at no extra cost

Full Background Operation Data Flash

- Data access unit 1 byte
- Data Flash size 4 KB (deletion unit: 1 KB)
- Number of overwrites 1 million (Typ.)
- Overwrites/reads 1 million (Typ.)
- Dedicated library further simplifies operation

The Ultimate Security Features

RL78 family is one of the first to offer key critical safety features in hardware to ensure compliance with Europe's International Electrotechnical Commission standards (IEC 60730) as well as help to comply with other internal safety standards for many Consumer and Industrial applications.

The safety Hardware in the RL78 family offers a robust solution for detecting or preventing failures.

Flash memory CRC operations

Flash memory data can be checked through CRC operations, which can be selected according to the usage conditions.

RAM parity error detection

The parity can be automatically checked during RAM access.

Invalid memory error detection

Invalid memory access e.g. access-prohibited areas easily detected.

RAM guarding

Specified RAM areas can be prevented from being overwritten.

SFR guarding

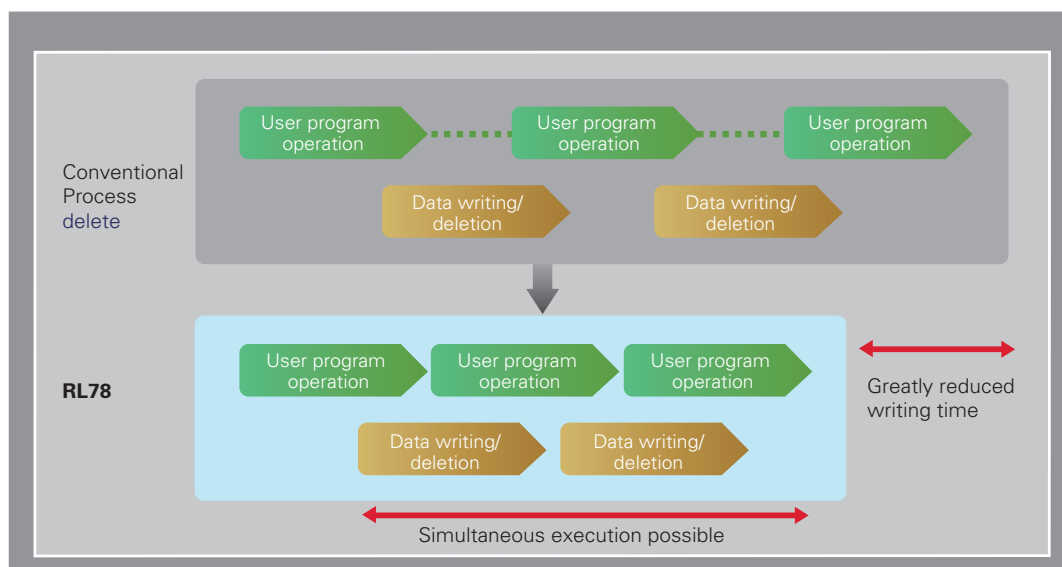
Specific SFRs can be prevented from being overwritten.

Frequency detection

The low-speed internal oscillator (15 kHz) can be used to measure the frequency of the main clock to ensure normal operation.

A/D converter testing

The A/D converter can perform a self-check.



Full Tool Chain For Every Development Stage

RL78 offers the most flexible tool chain for every step of any development. This includes easy to use starter kits for in-depth product evaluation, full IDE, library of middleware software and a range of hardware to help you design easier and faster with RL78. All of this is further supported by a large 3rd party network.

Learning & Evaluation



A USB stick starter kit to quickly learn about RL78 key features, complete with GUI based control, software examples and development environment



A fully featured evaluation platform to enable in-depth testing of RL78 microcontroller. Also enables quick and easy start of your design with RL78. Comes complete with GUI, software examples, application notes and development environment

Development Environment



IAR Embedded Workbench



E1 On-Chip Debugging Emulator - This emulator enables on-chip debugging and flash programming.



Fully functional in-circuit emulator IECUBE® - enables detailed debugging possible through microcontroller-equivalent emulation and the use of functions such as tracing and time measurement.

Programming



E1 On-Chip Debugging Emulator also offering flash programming functionality.



PG-FP5 tool is used is used to delete, write, and verify programs on a target system or via a program adapter.

The Renesas Eco System

Dedicated Website



www.renesas.eu/pr/mcu/rl78

Personalised Content



www.renesas.eu/myrenesas

Engineering Community



www.renesasrulz.com

3rd Party Network



www.renesas.eu/alliance

Online Training



www.renesasinteractive.com

Latest News



www.twitter.com/renesas_europe

Facebook Group



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Video Channel



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

