

# RL78 FAMILY

Renesas Microcontrollers



**BIG IDEAS**  
FOR EVERY SPACE

# The RL78 Family is the new generation of power-efficient microcontrollers from Renesas.

It enables customers to build compact and energy-efficient systems at lower cost.

The RL78 is a new generation of power-efficient microcontrollers that combine the excellent CPU performance of the 78K0R with the superior on-chip functions of the R8C and 78K. It delivers higher performance and lower power consumption than previous microcontrollers while enabling customers to utilize software resources developed for the R8C and 78K.

## Comprehensive Development Tools

- Integrated development tools for more efficient development
- Support for powerful tools from Renesas partners

## Reliable Safety Functions

- Memory with ECC
- Compliant with Safety Standard for Household Appliances (IEC 60730)
- Support for high operating temperatures (up to 150°C)
- Abnormal operation detection/avoidance function

## Low Power Consumption

- 45.5  $\mu$ A/MHz operation\*1
  - 0.57  $\mu$ A (RTC + LVD)
  - New SNOOZE mode
- Note: 1. Power supply current value during basic RL78/G10 operation

## Reduced System Cost

- 32 MHz  $\pm$ 1% high-precision on-chip oscillator
- On-chip power-on reset, low-voltage detection circuit, temperature sensor, data flash memory, etc.

## Broad Scalability

- 10 to 128 pins/1 to 512 KB
- Extensive product lineup to meet a broad range of requirements
- Pin compatibility
- Ability to reassign peripheral function pins

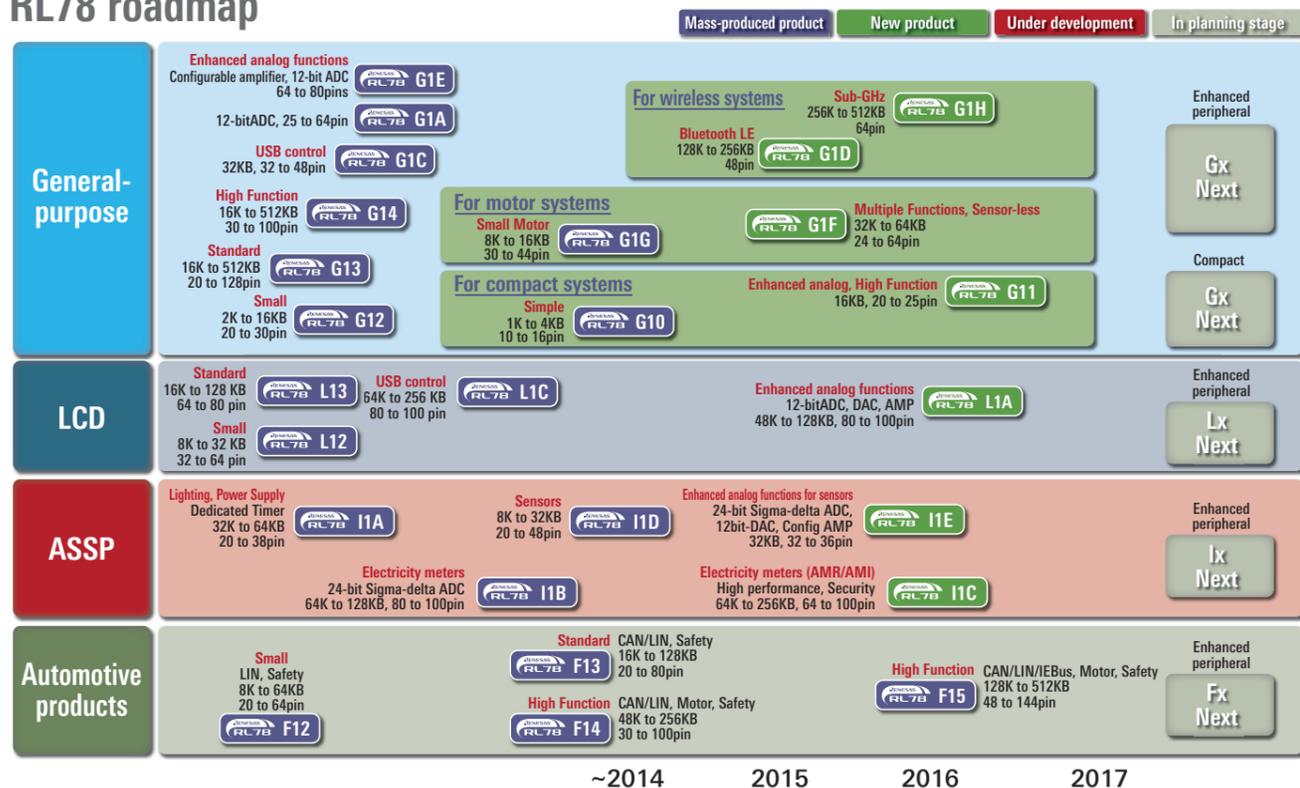
## High Performance

- High processing performance of 1.39 DMIPS/MHz
- Support for power supply voltages from 1.6 to 5.5 V
- Max. 32 MHz operation

RL: Renesas Low power RL products deliver reduced power consumption.

\* Specifications vary depending on the application. Please refer to each product page for details.

## RL78 roadmap



## RL78 application fields

The RL78 Family is utilized in a wide variety of applications.



### Industrial Automation

G14 G11 I1A I1E

- Lineup of microcontrollers for industrial applications requiring high reliability
- Broad array of compact packages
- Operating temperature range of  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , and support available for higher temperatures



### Automotive

F13 F14 F15

- Lineup of highly reliable microcontrollers for automotive applications
- Support for high operating temperatures (up to  $+150^{\circ}\text{C}$ )
- CAN communication, safety functions, etc., for automotive applications



### Consumer Electronics

G13 G12 G10

- Calendar function (RTC) as standard feature
- Serial communication, timers, and on-chip high-speed oscillator as standard features



### White Goods

G13 G12 L13

- Hardware support for European safety standard for household appliances (IEC60730)
- Standard temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , and support available for higher temperatures
- On-chip high-speed on-chip oscillator, power-on reset, etc., ideal for cost-sensitive electric household appliances



### Lighting, Power Supply

I1A G11

- High-resolution PWM output for lighting and power supply control applications
- Easy-to-use Applilet software (free of charge) supporting program development for lighting applications
- Support for DALI, DMX512, PMBus, and SMBus communication



### Detector

I1D G11

- Improved analog functions necessary for detecting very small sensor signals
- Support for power-efficient detection when returning to high-speed operation from STOP mode



### Home Automation

G13 G1D G1H

- Power efficiency among the best in the industry for extended battery life
- Support for low-voltage operation (1.6 V to (G1H: 1.8 V and above))
- Standby function with newly added SNOOZE mode for low power consumption during intermittent operation



### Power Tools

G1F G14

- Proven track record supplying consistently high-quality microcontrollers over the long term
- Ideal microcontroller platform for system development with lineup covering wide range of memory capacities, pin counts, and package options



### Medical/Healthcare

L1A L13 I1E G1D

- Lineup of compact packages
- Proven track record supplying major medical equipment manufacturers
- Active member of Continua Health Alliance



### Metering

I1B I1C L13 G1H

- Standby function that is ideal for low-power applications such as meters and measuring devices
- On-chip analog functions for smartmeters
- Proven track record supplying the meter field for over 30 years



### Motor Control

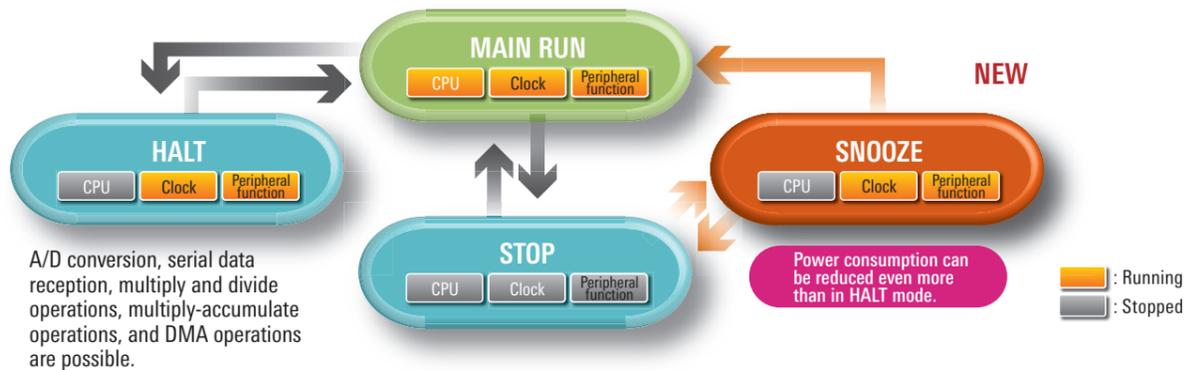
G14 G1F G1G

- On-chip advanced-functionality timers for motor control
- High-speed on-chip oscillator with accuracy of  $\pm 1\%$ , ideal for low-cost, high-precision solutions

# Low Power Consumption

## New SNOOZE mode for more power savings

In SNOOZE mode the CPU is halted while A/D conversion and data reception are enabled. By transitioning from STOP mode (clock stopped) to SNOOZE mode, it is possible to start the on-chip oscillator and operate peripheral functions while the CPU remains inactive.



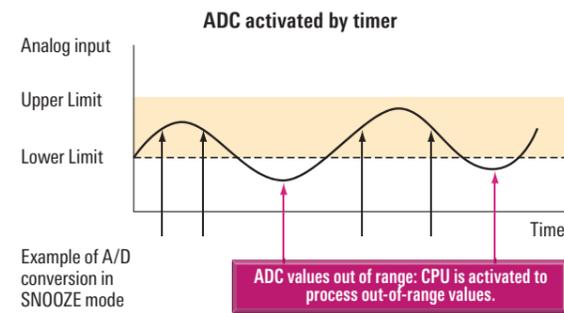
A/D conversion, serial data reception, multiply and divide operations, multiply-accumulate operations, and DMA operations are possible.

### SNOOZE mode

- It is not necessary to activate the CPU for data reception.
- Using the exclusive SNOOZE mode, peripheral functions such as the ADC or UART can operate when in standby mode.
- Power consumption is one-tenth of normal operation.  
SNOOZE mode: 0.5 mA, RUN mode (ADC): 5 mA

### HALT and STOP modes

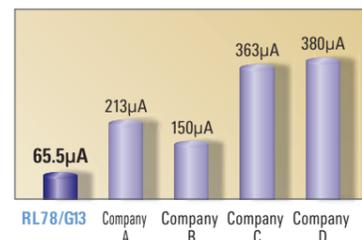
- The standby function stops CPU operation, reducing overall microcontroller current consumption by 80%.
- The STOP mode disables the microcontroller's on-chip functions, reducing power consumption to the lowest level possible.



### Low-power, high-performance products for lower system power consumption overall

In the most common operating modes, the RL78 Family delivers an operating current of 65.5  $\mu$ A/MHz (while operating at 32 MHz) and a standby current of 0.57  $\mu$ A (in SUB-HALT mode, with the RTC and LVD operating). Also, a newly developed SNOOZE mode has been added to the previously implemented HALT and STOP low-power operation modes. In SNOOZE mode the CPU is in the standby state while A/D conversion and serial communication are enabled, and the CPU is activated only when required. This mode is excellent for battery-powered systems as it greatly increases battery life.

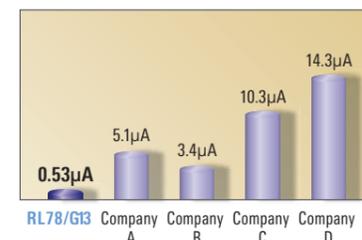
Operating current comparison ( $\mu$ A/MHz)



Operating current comparison during clock operation (32.768 kHz, RTC + LVD)



STOP mode current comparison (WDT + LVD)

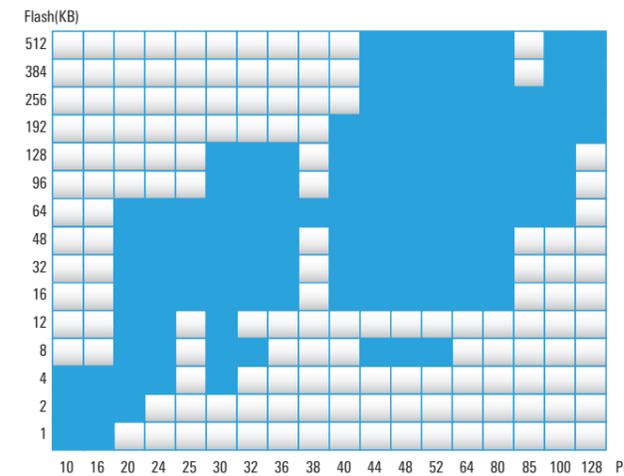


Source: Product data sheets and actual measurement

# Broad Scalability

## Extensive memory size and package options

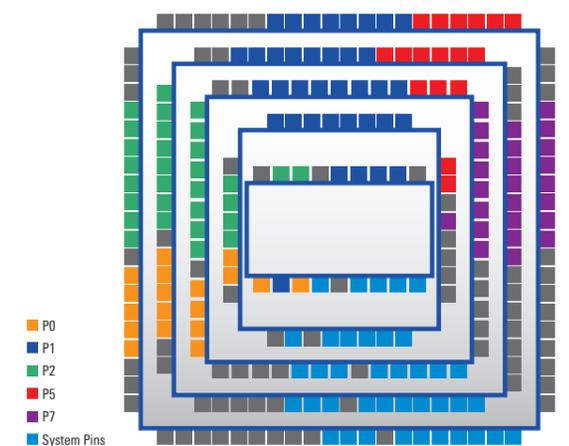
- The extensive lineup includes more than 300 product versions, with memory sizes from 1 KB to 512 KB and package pin counts from 10 pins to 128 pins. This extensive selection provides support for a broad range of application fields, including consumer, automotive, industrial, and communications.
- The wide range of options means that developers are covered if there are changes made to the specifications or more ROM capacity than originally estimated becomes necessary in the middle of the development process.
- Customers can rely on the same microcontroller series when developing product models ranging from the low-end to the high-end. Total development man-hours are reduced.



## Excellent pin compatibility

- Scalability is maintained because the general location of peripheral function pins and input/output pins remains the same even when the pin count changes. Customers can continue to use the RL78 Family of microcontrollers with confidence in the future.
- Customers can use standardized boards for product models ranging from the low-end to the high-end and boost the efficiency of the verification process.

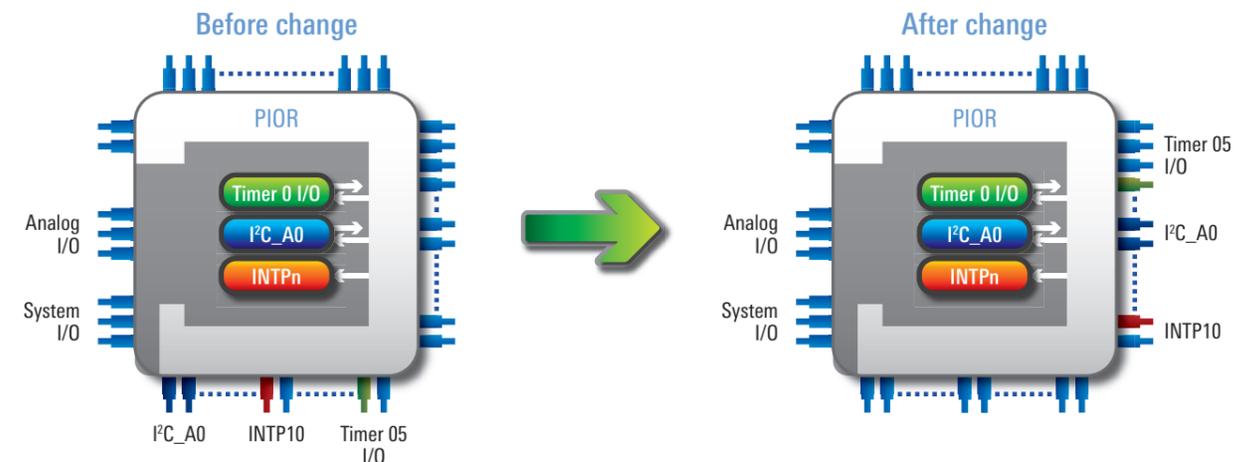
Example of I/O port assignments on RL78/G1x



## Ability to reassign pin functions with PIOR register settings

Pin assignments can be changed for added board layout flexibility. The locations of peripheral function pins can be optimized.

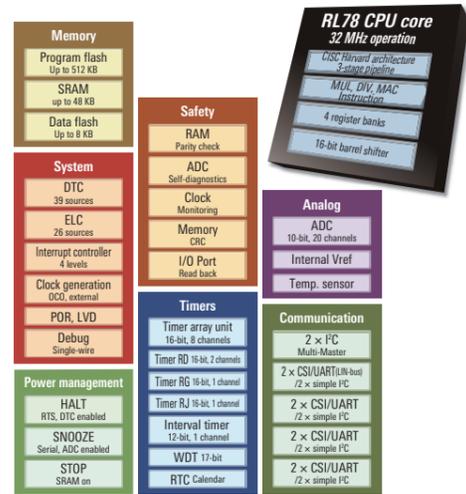
Note: Not all pins can be reassigned.



## High Performance

### RL78 microcontrollers with CPU core employing three-stage pipeline and Harvard architecture

CPU processing performance is substantially improved compared with previous Renesas products.



(Reference) RL78: Block diagram of G14 Group 100-pin product.

#### RL78 CPU Core

- Three-stage pipeline CISC architecture
- Max. operating frequency: 32 MHz
- Support for multiply, divide, and multiply-accumulate instructions

#### Memory

- Support for 1.8 V flash programming and boot swap
- Program flash: 1 KB–512 KB
- SRAM: 2.5 KB–48 KB
- Data flash: 4 KB/8 KB

#### System

- High-speed on-chip oscillator: 32 MHz ±1% (operation supported on timer RD only, 64/48 MHz)

#### Power management

- Operating current: 66 µA/MHz\*1
- HALT current: 0.57 µA (RTC + LVD)\*1
- STOP current: 240 nA (SRAM data retained)\*1
- SNOOZE current: 700 µA (UART), 1.2 mA (ADC)

#### Safety

- Compliant with European safety standard for household appliances (IEC/UL 60730)

#### Timers

- Advanced-functionality timer array unit (TAU)
- Timer RD for three-phase motor control

- Timer RG with two-phase encoder PWM function
- Watchdog timer, real-time clock

#### Analog

- On-chip ADC: 10-bit × 20 channels, conversion time: 2.1 µs
- On-chip DAC: 8-bit × 2 channels, comparator × 2 channels

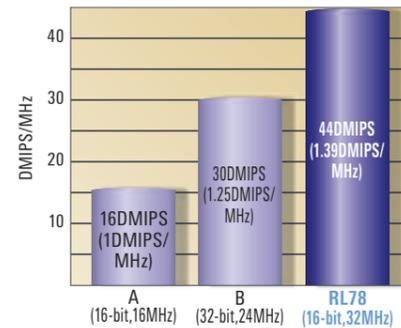
#### Communication

- CSI, UART, I<sup>2</sup>C, Simple I<sup>2</sup>C

#### Package

- 10-pin–144-pin

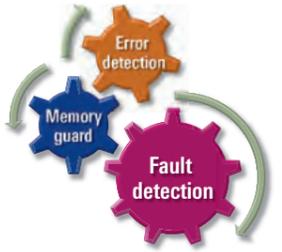
Note: 1. Power supply current for RL78/G14 Group, 64-pin, ROM = 64 KB product.



## Reliable Safety Functions

### Safety functions built into the microcontroller that enhance system reliability

Generally speaking a microcontroller is expected to operate normally even when exposed to noise. The RL78 Family of microcontrollers have a number of safety functions that allow confirmation of normal operation. Customers can use these functions to easily perform self-diagnostics on microcontrollers. The self-diagnostic functions of the RL78 Family contribute to enhanced system reliability.



#### Error detection

These functions check to make sure that the microcontroller's internal CPU and memory are operating properly. When an error is detected, measures such as an internal reset of the microcontroller can help to prevent the system from malfunctioning.

- Watchdog timer (WDT) as standard feature
- Flash memory CRC calculation
- RAM parity error detection
- RAM ECC function\*1
- CPU stack pointer monitoring function\*1
- Illegal memory access detection function\*1

#### Memory guard

This function disables writing to selected addresses in the RAM and SFRs.\*2 It makes it possible to protect settings in RAM and the SFRs, contributing to improved reliability for the customer's system.

- RAM accidental write protection
- SFR accidental write protection

#### Fault detection

This function is for checking the operation of the microcontroller's clock generator circuit, A/D converter, and I/O pins. It simplifies the task of verifying microcontroller operation and makes it easier for customers to ensure safe and reliable operation of their systems.

- Frequency detection
- Simple A/D testing
- I/O power output level detection
- Clock monitoring function\*1

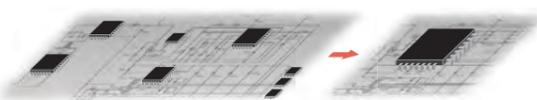
Notes:

1. Available on the RL78/F13 and RL78/F14.
2. SFR (special function register): Registers that store settings related to special functions such as clock control, the low-voltage detection circuit, port control, and interrupts.

## Reduced System Cost

### Helping customers reduce system size and cost

On-chip peripheral functions include a high precision (±1%) high-speed on-chip oscillator, background operation data flash supporting 1 million erase/program cycles, a temperature sensor, and multiple power supply interface ports. The RL78 Family is fabricated using a newly developed 130 nm process that enables customers to achieve reduced system cost and smaller overall system size.

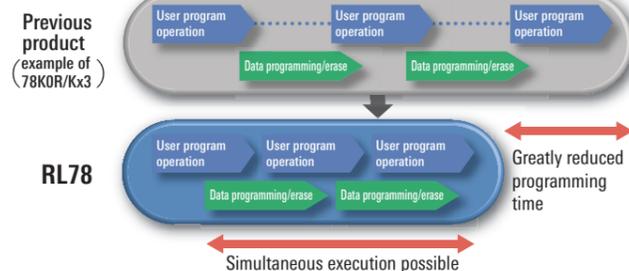


Neat and compact design

## Data flash with advanced functionality

### (background operation) for substantially reduced programming time

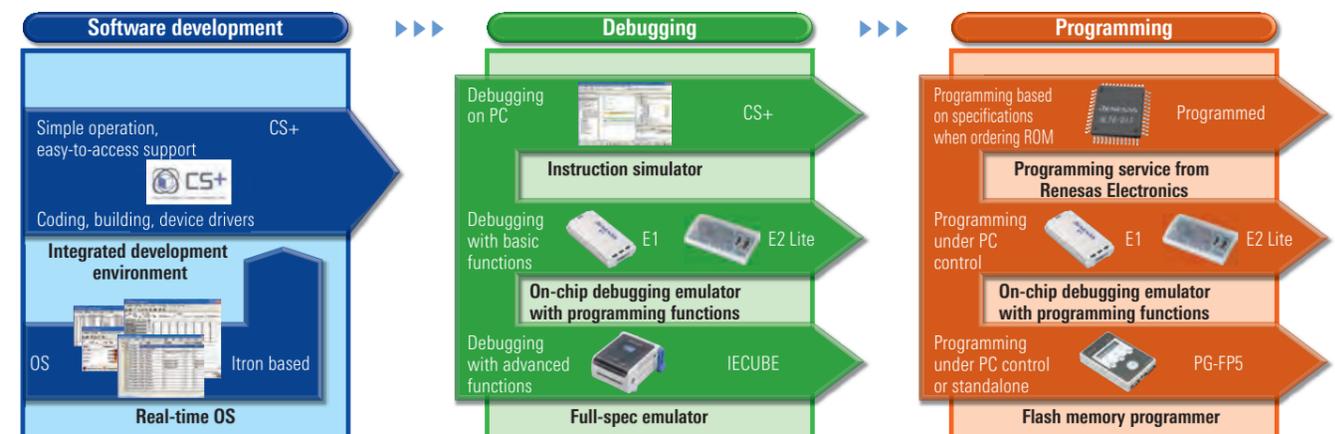
- Data access unit: 1 byte
- Data flash size: 4 KB (erasure unit: 1 KB)
- Number of overwrites: 1 million (typ.) (target)
- Dedicated library: Simplifies operations



## Comprehensive Development Tools

### A full lineup of tools that provides powerful support for efficient development

Renesas provides support for all stages of RL78 application development. The CS+ integrated development environment is easy to use and learn, helping shorten development cycles. A variety of debugging and programming environments are available to meet specific customer needs. Finally, Renesas partner vendors offer a rich array of tools and services covering a broad range of requirements.



# General-purpose, Low-pin-count

## RL78/G10

### RL78/G10 features

#### Ultra-low power consumption

- CPU operation: 46  $\mu$ A /MHz
- STOP mode: 560 nA

#### High-speed on-chip oscillator

- Max. 20 MHz, oscillation accuracy  $\pm 2\%$

#### Lineup of low-pin-count products

- 10 pin: LSSOP (4.4  $\times$  3.6 mm)
- 16 pin: SSOP (4.4  $\times$  5 mm)

#### Other on-chip functions

- ADC
- Timer
- Comparator
- Serial communication
- Selectable power-on reset

	Pins	10	16
ROM			
4 K		512	512
2 K		256	256
1 K		128	128

RAM Size

### Key RL78/G10 specifications

#### RL78 CPU Core

- Three-stage pipeline CISC architecture
- Max. operating frequency: 20 MHz

#### Memory

- Program flash: 1 KB–4 KB
- SRAM: 128 B–512 B

#### System

- High-speed on-chip oscillator: 20 MHz  $\pm 2\%$
- Selectable POR

#### Power management

- Operating current: 46  $\mu$ A/MHz
- HALT current: 290  $\mu$ A
- STOP current: 560 nA (SRAM data retained)

#### Safety

- Internal reset at illegal instruction execution

#### Timers

- Advanced-functionality timer array unit (TAU)
- Watchdog timer

#### Analog

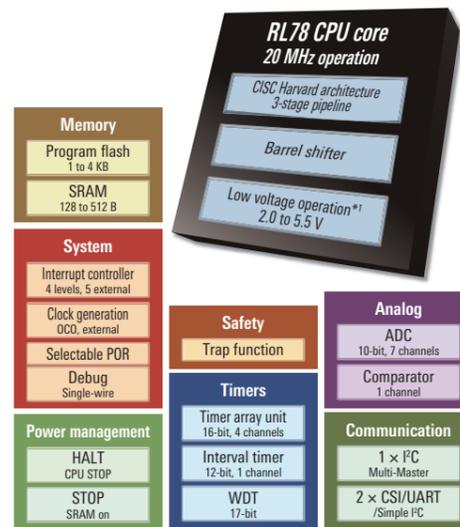
- On-chip ADC, 10-bit  $\times$  7 channels, conversion time: 3.4  $\mu$ s
- On-chip comparator

#### Communication

- CSI, UART, I<sup>2</sup>C, Simple I<sup>2</sup>C

#### Package

- 10-pin/16-pin



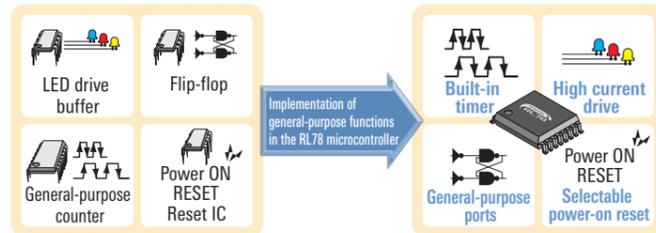
Note: 1. The SPOR detection voltage (VSPOR) must be between 2.25 V and 5.5 V. (Reference) RL78: Block diagram of G10 Group 16-pin product.

(Reference) The power supply voltage range during flash memory programming is 4.5 V to 5.5 V. A low-voltage OCD board is required for debugging at less than 4.5 V.

[https://www.renesas.com/en-us/doc/products/tool/doc/003/r20ut2451ej0100\\_e510y16lvb.pdf](https://www.renesas.com/en-us/doc/products/tool/doc/003/r20ut2451ej0100_e510y16lvb.pdf)

### Lower system cost: Replacement for general-purpose logic ICs

Using general-purpose logic components complicates the design, manufacturing, and testing processes and can lead to malfunctions. Reducing the number of components is a key issue when developing new products.



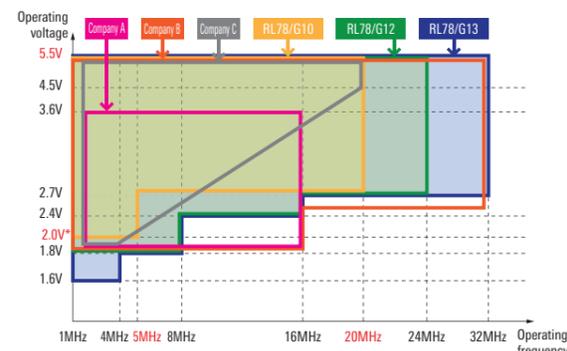
RL78 microcontrollers help simplify the design, manufacturing, and testing processes; reduce malfunctions; and provide numerous other advantages.

- More compact circuit board
- Reduced system cost

## MEMO

### RL78/G10 vs. competing products: Operating voltage/frequency range

Covers the voltage range required by compact electric household appliance applications.



Note: The RL78/G10 includes a SPOR circuit detection voltage (VSPOR), so it should be used within a voltage range of 2.25 V to 5.5 V.

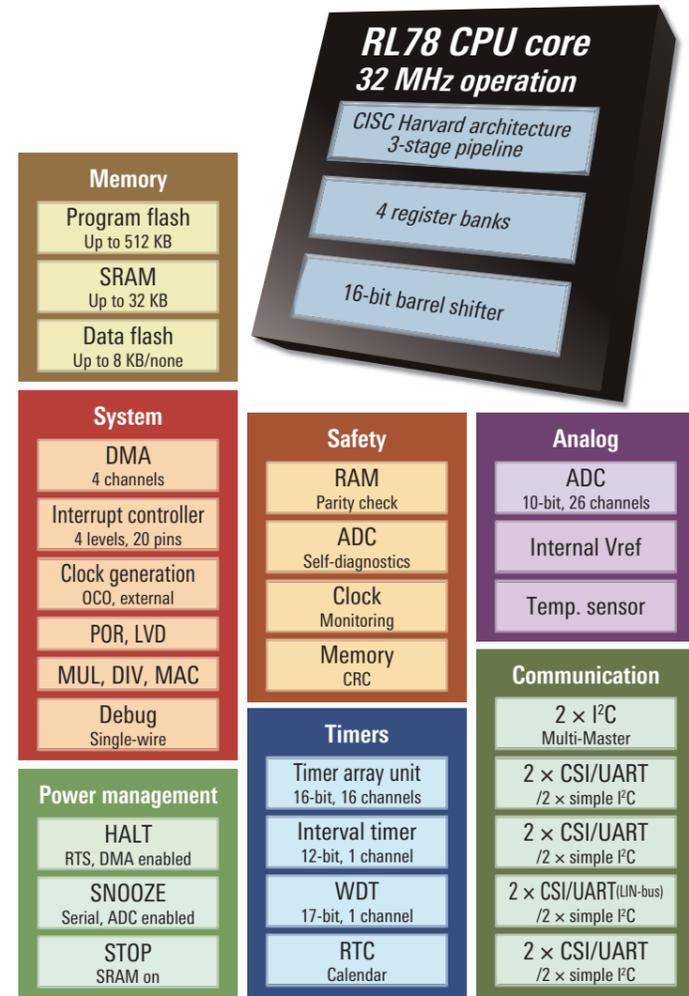
# General-purpose, Standard

## RL78/G12, G13

### Block diagram

- RL78 CPU Core**
  - Three-stage pipeline CISC architecture
  - Max. operating frequency: 32 MHz
- Memory**
  - Support for 1.8 V flash programming and boot swap
  - Program flash: 2 KB–512 KB
  - SRAM: 256 B–32 KB
  - Data flash: 2 KB/4 KB/8 KB/None
- System**
  - High-speed on-chip oscillator: 32 MHz ±1%
  - Library support for multiply/divide and multiply-accumulate operation unit
- Power management**
  - Operating current: 66 µA/MHz\*1
  - HALT current: 0.57 µA (RTC + LVD)\*1
  - STOP current: 230 nA (SRAM data retained)\*1
  - SNOOZE current: 700 µA (UART), 1.2 mA (ADC)
- Safety**
  - Compliant with European safety standard for household appliances (IEC/UL 60730)
  - Illegal memory access detection
- Timers**
  - Advanced-functionality timer array unit (TAU)
  - Watchdog timer, real-time clock
- Analog**
  - 1.6 V (V<sub>DD</sub>) operation
  - On-chip ADC, 10-bit × 26 channels, conversion time: 2.1 µs
  - Internal reference voltage (1.45 V)
- Communication**
  - CSI, UART, I<sup>2</sup>C, Simple I<sup>2</sup>C
- Package**
  - 20-pin–128-pin

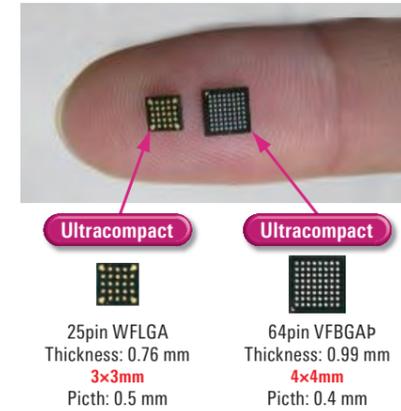
Note: 1. Power supply current RL78/G13 Group product with 64 pins and 64 KB of ROM.



(Reference) RL78: Block diagram of G13 Group 128-pin product.

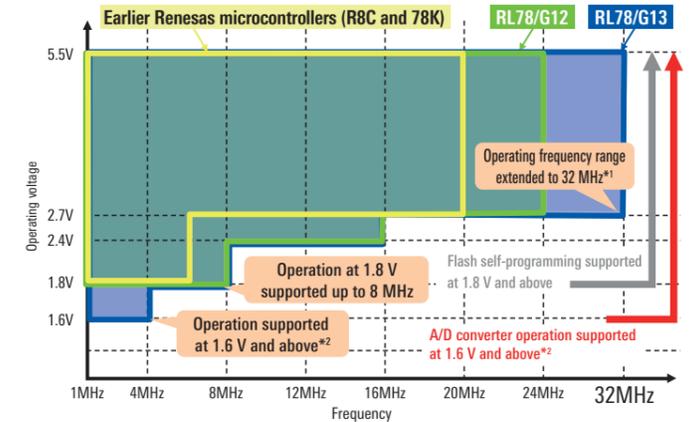
### Extensive lineup: Compact packages

Available compact package options are ideal for miniaturized products.



### High performance: Low-voltage operation

Expanded operating range compared with previous products and support for A/D conversion at voltages from 1.6 V



Notes: 1. 24 MHz (max.) on RL78/G12. 2. Operation supported at 1.8 V and above on RL78/G12

### High performance: Multiply and divide/multiply-accumulate operation unit

On-chip multiply-accumulate operation unit for reduced operation load on CPU

- Completion interrupt generated for divide operations only.
- Multiply-accumulate operation overflow/underflow interrupt generated when the cumulative result of multiply-accumulate operations causes an overflow or underflow.
- Combined-use divide completion interrupt and multiply-accumulate operation overflow/underflow interrupt.
- Whether an overflow or underflow occurred can be determined by referencing a status flag.
- Since the C lacks multiply-accumulate operation instructions, library functions are provided.

### Multiply and divide circuit with support for multiply-accumulate operations

operation	exec cycle
Signed multiply	16 bits×16 bits=32 bits 1 clock
Unsigned multiply	32 bits×32 bits=32 bits ... 32 bits 16 clock
Signed multiply-accumulate	16 bits×16 bits+32 bits=32 bits 2 clock
Unsigned multiply-accumulate	

### Extensive lineup: RL78/G12, G13

Choose with confidence. Extensive lineup of 284 products.

ROM	Pins	20	24	25	30	32	36	40	44	48	52	64	80	100	128
512 KB									32 K						
384 KB									24 K						
256 KB									20 K						
192 KB								16 K							
128 KB					12 K										
96 KB					8 K	8 K	8 K	8 K	8 K	8 K	8 K	8 K	8 K	8 K	8 K
64 KB	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K
48 KB	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K
32 KB	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K
16 KB	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K
12 KB	1.5 K	1.5 K	1.5 K	1.5 K	1 K	1 K									
8 KB	768	768	768	768	768	768									
4 KB	512	512	512	512	512	512									
2 KB	256	256													

RAM No data flash      RAM Equipped with data flash

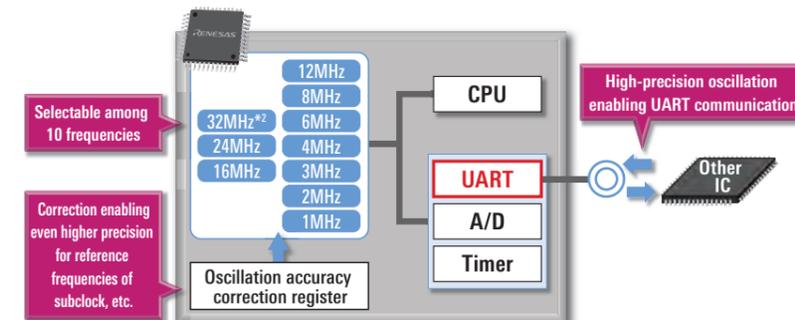
1. For 20-pin packages, the pin spacing of the RL78/G12 is 225 mil and that of the RL78/G13 is 300 mil.  
2. For the 64-pin BGA (4 × 4) package products, the ROM capacity ranges from 32 KB to 256 KB.

### Reduced system cost: On-chip high-precision, high-speed oscillator

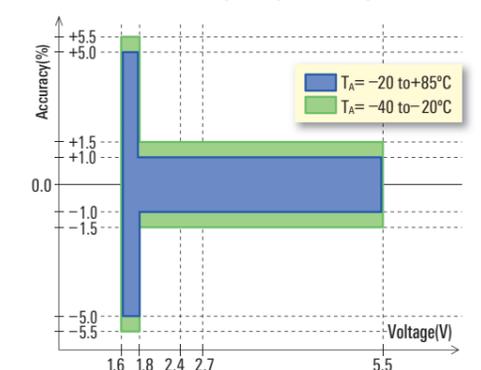
On-chip high-precision, high-speed oscillator to support UART communication

- On-chip high-speed clock generator circuit with precision of ±1%\*1
- Selectable frequencies: 32 MHz,\*2 24 MHz, 16 MHz, 12 MHz, 8 MHz, 6 MHz, 4 MHz, 3 MHz, 2 MHz, and 1 MHz
- Oscillation accuracy correction register for even higher precision

Notes: 1. ±5% on RSF103x. 2. RL78/G13 only



### HOCO oscillation frequency accuracy





## General-purpose, Advanced functionality

**RL78/G14** Ideal for consumer and industrial products such as motor control applications, household appliances, and mobile devices

### CPU core supporting multiply and divide/multiply-accumulate instructions

Added multiply, divide, and multiply-accumulate instructions that enable high-speed operation by direct execution without needing to utilize library functions

#### Overview of multiply, divide, and multiply-accumulate instructions

	operation	exec cycle
Multiply	8 bits×8 bits=16 bits	1 clock
	16 bits×16 bits=32 bits	2 clock
Divide	16 bits / 16 bits=16 bits ... 16 bits	9 clock
	32 bits / 32 bits=32 bits ... 32 bits	17 clock
Multiply-accumulate	16 bits×16 bits+32 bits=32 bits	3 clock

Points of difference from multiply and divide/multiply-accumulate operation unit on RL78/G12 and RL78/G13

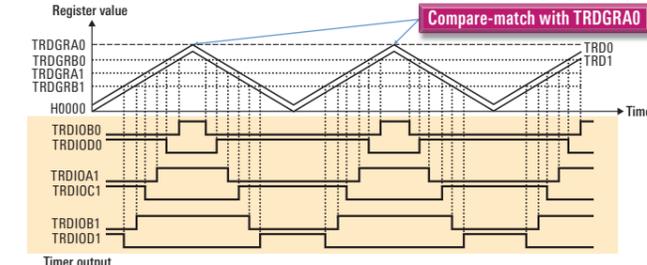
- No interrupts are generated.
- A carry flag is set when the cumulative result of multiply-accumulate operations causes an overflow or underflow.

### Featured function: Timer RD (complementary PWM mode)

High-resolution three-phase complementary PWM output ideal for driving DC brushless motors

- Ability to output three sets of PWM waveforms with no overlap between the forward and reverse phases
- Use of on-chip high-speed oscillator (64 MHz or 48 MHz) as count source supported
  - Ability to operate using multiples of the CPU clock frequency for reduced power consumption

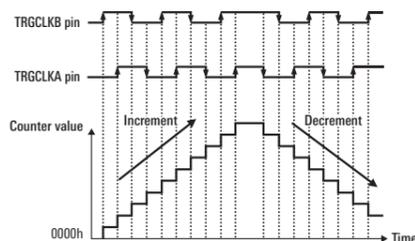
### Complementary PWM mode operation example



### Featured function: Timer RG (phase counting mode)

This function counts (increments or decrements a counter) at both edges when two pulse signals with different phases are input to pins TRGCLKA and TRGCLKB. It is ideal for counting in a two-phase encoder.

TRGCLKB pin		"H"	"L"	"H"	"L"	"H"	"L"	"H"
TRGCLKA pin	"L"		"H"	"L"	"H"	"L"	"H"	"L"
Bits CNTEN7 to CNTEN0 in TRGCNTC register	CNTEN 7	CNTEN 6	CNTEN 5	CNTEN 4	CNTEN 3	CNTEN 2	CNTEN 1	CNTEN 0
Setting value of TRGCNTC register	1	1	1	1	1	1	1	1
Increment/decrement counter	+1	+1	+1	+1	-1	-1	-1	-1



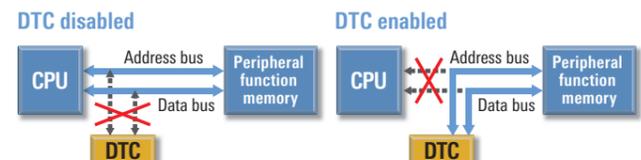
In combination with the TRGCNTC register value, this function performs phase counting by incrementing or decrementing a counter when a user-defined input state occurs.

### Featured function: Data transfer controller (DTC)

The DTC provides functionality to transfer data from one memory location to another, bypassing the CPU.

- Increased number of transfer channels and activation sources for improved flexibility
- Support for data transfers among SFRs, on-chip RAM, and flash memory\*1

Note: 1. The DTC can only read data from flash memory.

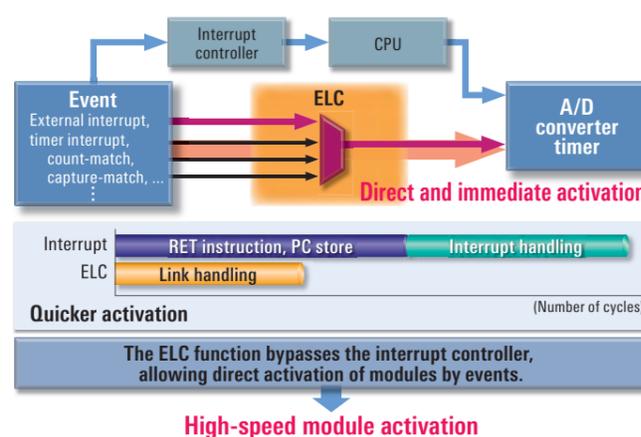


### Comparison of DMA and DTC

	DMA(G13 100pin)	DTC(G14 100pin)
Number of channels	4 channels	24 channels
Transfer address space	4 KB	64 KB
Max. transfer count/block size	1024/1024 bytes	256/512 bytes
Transfer target	SFR ⇄ RAM	SFR ⇄ RAM Flash memory ⇄ SFR, RAM
Number of activation sources	21	39
Other	—	Repeat and chain transfers supported

### Featured function: Event link controller (ELC)

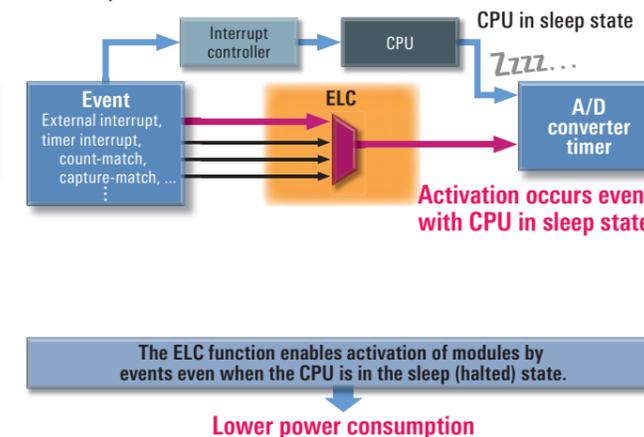
Direct links between hardware modules



The ELC function bypasses the interrupt controller, allowing direct activation of modules by events.

High-speed module activation

No CPU operation needed



The ELC function enables activation of modules by events even when the CPU is in the sleep (halted) state.

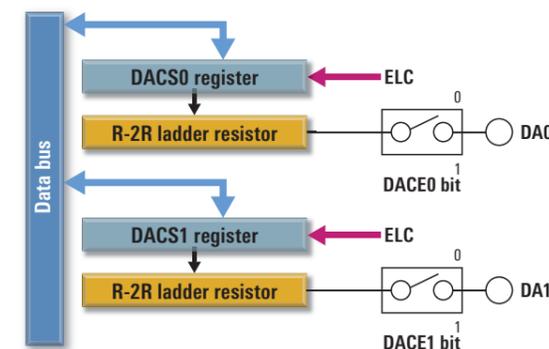
Lower power consumption

### Featured function: D/A converter (products with ROM capacity of 96 KB or more only)

On-chip 8-bit D/A converter (2 channels) that simplifies control of analog output for applications such as audio playback or power supply control

D/A converter operation

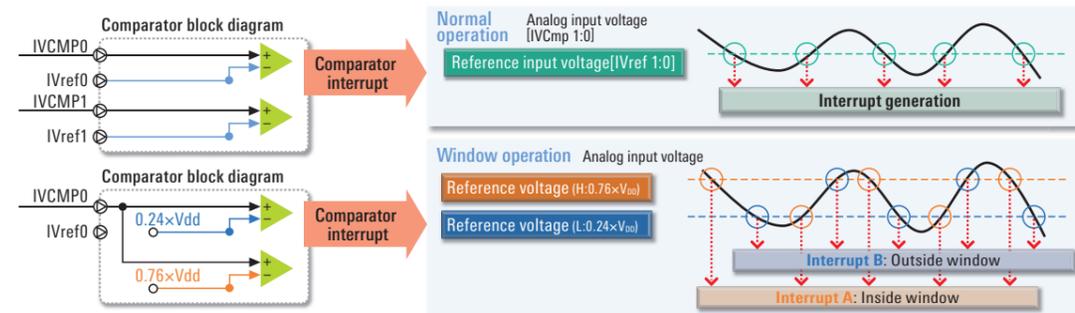
- Normal mode  
D/A conversion is started by a write operation to the DACS<sub>n</sub> (n = 0 or 1) register.
- Real-time output mode  
D/A conversion is started using the real-time output signal input by the ELC as the activation trigger.



### Featured function: Comparator (products with ROM capacity of 96 KB or more only)

Comparator with two channels and support for switching between high-speed and low-speed modes (one channel on 30-pin SOP products)

- High-speed mode: Support for high-speed operation for motor control feedback, etc.
  - Low-speed mode: Support for low power consumption during battery monitoring, etc.
- Ability to use as a window function by combining channels



## General-purpose, Analog

### RL78/G1A

#### RL78/G1A features

##### High-precision A/D converter

- 12-bit A/D converter
  - Total error:  $\pm 1.7$  LSB (typ.)
  - Conversion time: 3.375  $\mu$ s
- Multi-channel analog input
  - 28 analog input channels (max.) to support input from multiple sensors

##### Low power consumption/standby mode

- Low power consumption
  - Carries on the low power consumption of the RL78 Family
  - Operating current: 66  $\mu$ A/MHz
  - STOP current: 0.23  $\mu$ A
- Standby mode
  - Three modes: HALT, SNOOZE, and STOP
  - Reduced average current during intermittent operation

##### Compact package/extensive peripheral functions

- Compact package
  - 3  $\times$  3 mm square : 25-pin LGA package
  - 4  $\times$  4 mm square : 64-pin BGA package
- Extensive peripheral functions
  - Timer (16-bit  $\times$  8 channels)
  - Data flash (nonvolatile memory for data)
  - Serial communication (CSI, UART, I<sup>2</sup>C, etc.)
  - Fault detection (safety functions)

#### Key RL78/G1A specifications

##### RL78 CPU Core

- Three-stage pipeline CISC architecture
- Max. operating frequency: 32 MHz

##### Memory

- Support for 1.8 V flash programming and boot swap
- Program flash: 16 KB–64 KB
- SRAM: 2 KB–4 KB
- Data flash: 4 KB

##### System

- High-speed on-chip oscillator: 32 MHz  $\pm 1\%$
- Library support for multiply/divide and multiply-accumulate operation unit

##### Power management

- Operating current: 66  $\mu$ A/MHz
- HALT current: 0.57  $\mu$ A (SUB + RTC + LVD)
- STOP current: 0.23  $\mu$ A (SRAM data retained)
- SNOOZE current: 700  $\mu$ A (UART), 1020  $\mu$ A (ADC)

##### Safety

- Compliant with European safety standard for household appliances (IEC/UL 60730)
- Illegal memory access detection

##### Timers

- Advanced-functionality timer array unit (TAU)
- Watchdog timer, real-time clock

##### Analog

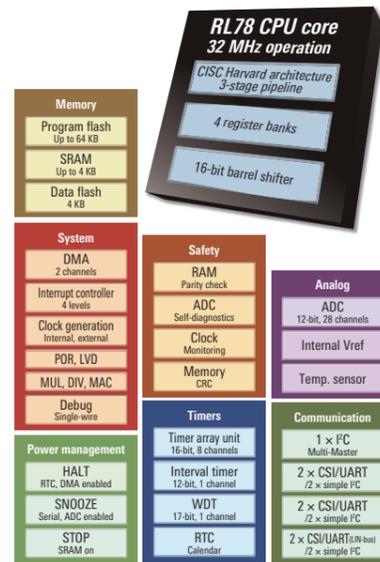
- 1.6 V (V<sub>DD</sub>) operation
- On-chip ADC, 12-bit  $\times$  28 channels, conversion time: 3.375  $\mu$ s
- Internal reference voltage (1.45 V)

##### Communication

- CSI, UART(LIN) I<sup>2</sup>C, Simple I<sup>2</sup>C

##### Package

- 25-pin LGA (3  $\times$  3 mm square)
- 32-pin QFN (5  $\times$  5 mm square)
- 48-pin QFP (7  $\times$  7 mm square)
- 64-pin QFN (7  $\times$  7 mm square)
- 64-pin QFP (10  $\times$  10 mm square)
- BGA (4  $\times$  4 mm square)



(Reference) RL78: Block diagram of G1A Group 64-pin product.

#### Overview of RL78/G1A

Lineup of RL78 Family products with enhanced analog functions

##### Features

- New family RL78 CPU core
  - High-performance 16-bit CPU High-speed 32 MHz operation
  - Low power consumption 66  $\mu$ A/MHz when running 0.57  $\mu$ A/MHz during standby (SUB + RTC + LVD)
- High performance peripheral functions
  - High-resolution 12-bit A/D converter Improved sensing precision, max. 28 channels
  - On-chip high-precision high-speed clock generator Precision:  $\pm 1\%$
  - Data flash: 4 KB Support for background operation
  - Multiply and divide/multiply-accumulate operation unit Reduced CPU load

##### Memory lineup

#### Compact packages and extensive memory capacity options

ROM	Pins	25		32		48		64	
64K	4K	4KB	4KB	4K	4KB	4K	4KB	4K	4KB
48K	3K	4KB	4KB	3K	4KB	3K	4KB	3K	4KB
32K	2K	4KB	4KB	2K	4KB	2K	4KB	2K	4KB
16K	2K	4KB	4KB	2K	4KB	2K	4KB		

RAM Size DATA Flash

##### Support for multiple sensors of various types

Multi-channel analog input support among the best in the industry with 12-bit A/D converter

Infrared sensors, ultrasonic sensors, acceleration sensors, gyro sensors, pressure sensors, thermistors, etc.

## General-purpose, Wireless

### RL78/G1H

#### RL78/G1H features

Power-efficient microcontroller with sub-GHz band transceiver compliant with IEEE 802.15.4g standard

##### Integration of RF peripheral circuits

- RF peripheral balun and filter functions are integrated into the chip. This contributes to a substantial reduction in the design workload and system cost.

##### IEEE 802.15.4e/g-compliant hardware for reduced CPU load

- Generates in hardware wireless frames compliant with IEEE 802.15.4g.
- Provides integrated functionality to automatically distinguish two systems of communication addresses. This reduces the development load, since software it not needed for this processing.
- Supports ACK reply/receive functionality, including the enhanced format required under the Wi-SUN specification, and CSMA-CA functionality in hardware. This reduces the need to implement complicated timing control processing in software.

##### Ultralow current consumption during reception, among the lowest in the industry

- RF reception: 6.3 mA,\*<sup>1</sup> RF reception standby: 5.8 mA\*<sup>1</sup>
  - Reception sensitivity:  $-105$  dBm\*<sup>2</sup>
- Notes: 1. Typ., V<sub>DD</sub> = 3.3 V 2. 2GFSK, 100 kbps, BER < 0.1%

ROM	Pins	64	
512 KB	48 KB	8 KB	
384 KB	32 KB	8 KB	
256 KB	24 KB	8 KB	

RAM Size DATA Flash Size

#### Outline of RL78/G1H specifications

##### RL78 CPU Core

- 3-stage pipeline, CISC architecture
- Max. operating frequency: 32MHz
- Support for multiply, divide, and multiply-and-accumulate instructions

##### Memory

- Support for 1.8 V flash programming and boot swapping
- Program Flash: 256 KB, 384 KB, 512 KB
- SRAM: 24 KB, 32 KB, 48 KB
- Data Flash: 8 KB

##### IEEE802.15.4e/g

- IEEE 802.15.4g compliant sub-GHz band transceiver
- ##### System
- High-speed on-chip oscillator: 32 MHz/24 MHz/16 MHz/12 MHz/8 MHz/6 MHz/4 MHz/3 MHz/2 MHz/1 MHz
  - Data transfer controller
  - Event link controller

##### Power management (target)

- Power-on reset
- Voltage detection circuit

##### Safety

- Compliant with European household safety standard (IEC/UL 60730)

##### Timers

- Advanced-functionality timer array unit (TAU)
- Interval timer
- Watchdog timer, real-time clock

##### Analog

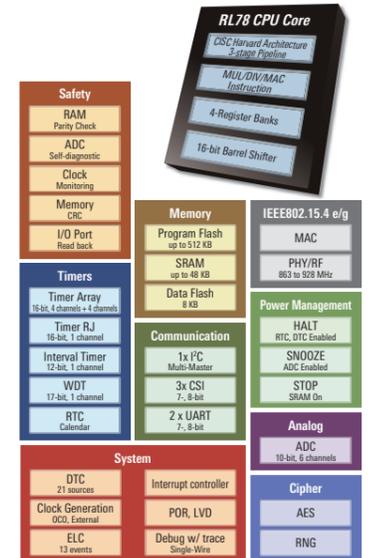
- On-chip ADC, 10-bit  $\times$  6 channels

##### Communication

- CSI $\times 3$ , UART $\times 2$ , I<sup>2</sup>C $\times 2$

##### Package

- HVQFN 9 $\times$ 9mm 64pin, 0.5mm pitch



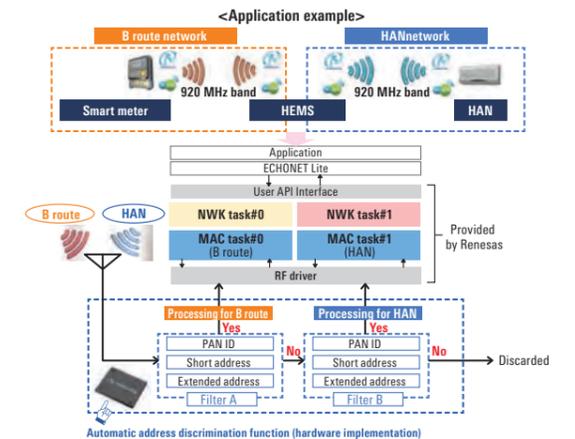
#### Sub-GHz band transceiver

- Compliant with IEEE 802.15.4g specification
- RF frequency range: 863 to 928 MHz
- Modulation method: 2FSK/GFSK, 4FSK/GFSK
- Data rate: 10 to 300 kbps for 2FSK/GFSK, 200/400 kbps for 4FSK/GFSK
- Forward error correction (FEC) function
- RF reception current: 6.9 mA (typ.) at 3.0 V, 100 Kbps, 2FSK/MCU block stop mode
- RF transmission current: 21 mA (typ.) at 3.0 V, 100 Kbps, 2FSK, +10 dBm/MCU block stop mode; 36 mA (typ.) at 3.0 V, 100 Kbps, 2FSK, +13 dBm/MCU block stop mode

#### 2-system address filtering

- Provides integrated hardware functionality to automatically distinguish two systems of communication addresses. This makes it simple to use a single chip to process communications for two networks. It also reduces the development load, since software it not needed for this processing.

- Pass-through data can be selected conditionally based of the following information in receive frames: transmission destination PAN identifier (PAN ID), transmission destination short address, or transmission extended address.



# General-purpose, Wireless

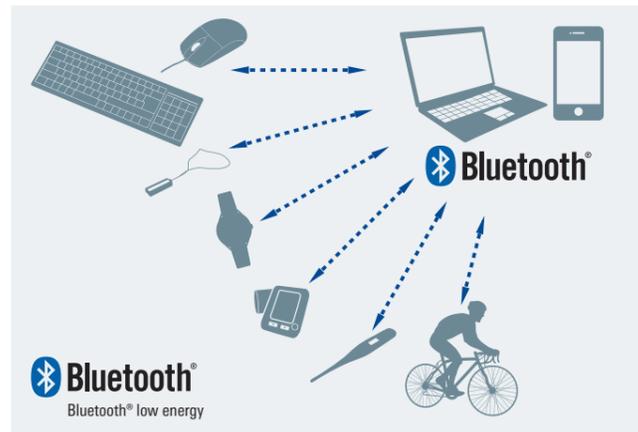
## RL78/G1D

### RL78/G1D features

- Power-efficient low-end microcontrollers with Bluetooth® low energy
  - RF with ultra-low current consumption
    - 4.3 mA during RF transmission, 3.5 mA during RF reception (using on-chip DC-DC converter, 3 V operation)
    - Average current: 9.1 µA (1-second intervals, connection maintained CC-RL compiler)
  - Contributes to reduced system cost and more compact mounting board.
    - Integrates circuit components necessary for antenna connection.
    - Simplifies circuit design and reduces number of external components required. Contributes to smaller mounting area and reduced product cost.
  - Adaptable RF technology
    - Automatic adjustment of transmission output (transmission operating current) to match the communication distance
    - Optimization that prioritizes low current consumption at short distances and prioritizes the communication distance at long distances

### Applications employing Bluetooth® low energy

Applications utilizing Bluetooth® low energy to connect wirelessly with devices such as smartphones while using little power are proliferating rapidly, and include products incorporating wireless tags, such as healthcare and fitness devices, home appliances, and beacons. Renesas provides solutions that support Bluetooth® low energy and enable reliable connections with current consumption levels among the lowest in the industry.



### Key RL78/G1D specifications

- RL78 CPU Core**
  - Three-stage pipeline CISC architecture
  - Max. operating frequency: 32 MHz
- Memory**
  - Support for 1.8 V flash programming and boot swap
  - Program flash: 128 KB, 192 KB, 256 KB
  - SRAM: 12 KB, 16 KB, 20 KB
  - Data flash: 8 KB
- System**
  - High-speed on-chip oscillator: 32 MHz
  - Library support for multiply/divide and multiply-accumulate operation unit
- RF**
  - Bluetooth 4.1 Single mode Master/Slave
  - RF unit power management
  - On-chip oscillator circuit for RF: 32.768 kHz
- Power management**
  - Transmission current (MCU: STOP): 4.3 mA at 3 V
  - Reception current (MCU: STOP): 3.5 mA at 3 V
  - Sleep current (MCU: STOP, RF: DEEP\_SLEEP): 1.4 µA
  - Stop current (MCU: STOP, RF: POWER\_DOWN): 0.3 µA
- Safety**
  - Compliant with European safety standard for household appliances (IEC/UL 60730)
  - Illegal memory access detection
- Timers**
  - Advanced-functionality timer array unit (TAU)
  - Watchdog timer, real-time clock
- Analog**
  - On-chip ADC, 10-bit × 8 channels, conversion time: 2.1 µs
  - Internal reference voltage (1.45 V)
- Communication**
  - CSI × 2, UART × 2, I<sup>2</sup>C × 1, Simple I<sup>2</sup>C × 2
- Package**
  - WQFN 6 × 6 mm 48-pin, 0.4 mm pitch

### RL78/G1D lineup

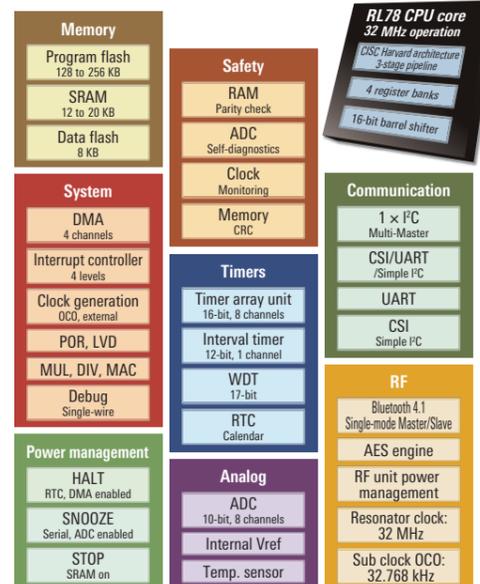
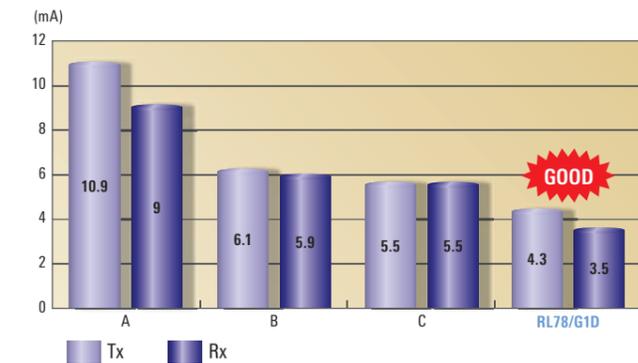
ROM	Pins	
	48	
256 KB	20 K	8 K
192 KB	16 K	8 K
128 KB	12 K	8 K

RAM Size DATA Flash

### 2.4 GHz RF transceiver

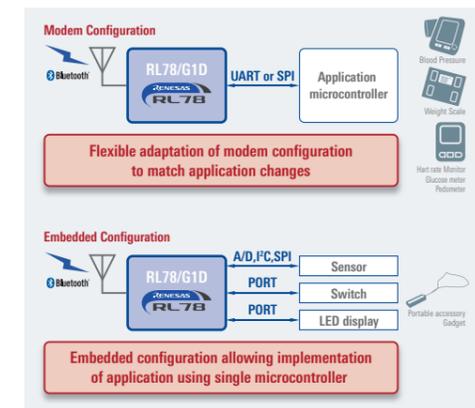
- Compliant with Bluetooth® v4.1 Low Energy (Single Mode, Master/Slave) specification
- Reception sensitivity: -90 dBm
- Max. transmission output power: 0 dBm
- Support for wireless updates
- Software protocol stack provided at no charge

### RF transmit and receive currents among the world's smallest



### RL78/G1D usage configuration examples

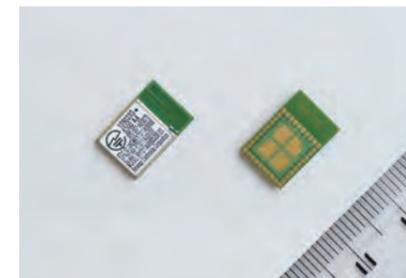
- It is possible to develop a modem configuration in which the RL78/G1D is controlled by the host microcontroller via a serial connection. This provides flexible support for adding wireless capabilities to applications.
- Renesas microcontroller host samples are available. By making use of a host sample, the customer can reduce the development workload.
- It is possible to develop a combined configuration that makes use of the many peripheral functions of the RL78/G1D. Power-efficient applications can be realized using the RL78/G1D alone.



## RL78/G1D module

### RL78/G1D module features

Retains the many function pins of the RL78/G1D. Module is compliant with radio laws and Bluetooth® SIG.



- RL78/G1D (ROM: 256 KB, RAM: 20 KB)
- Convenient compact size (8.95 × 13.35 × 1.7)
- 24 GPIO output pins can be used as microcontroller peripheral function pins.
- Current consumption among the lowest in the industry
- Certified compliant with radio laws of Japan (MIC), Europe (CE), and North America (FCC/IC)
- Bluetooth® SIG certified\*1 QD ID: 82194
- Operating voltage: 1.6 to 3.6 V\*2
- Operating temperature: -25 to +75°C
- Pin count: 42 pins

Notes: 1. It is only necessary to register the final product.  
2. 1.8 to 3.6 V when using on-chip DC/DC converter.

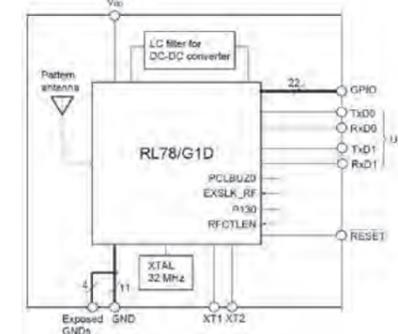
### RL78/G1D module lineup

ROM	Pins	
	48	
256 KB	20 K	8 K

RAM Size DATA Flash

### Block diagram of RL78/G1D module functions

- On-chip antenna, LC for DC/DC converter, and 32 MHz crystal oscillator are ready for immediate use.
- 32.768 kHz supplied as default by on-chip oscillator.
- Lower power consumption can be achieved by using an external 32.768 kHz clock.
  - Supplied by host microcontroller
  - Supplied by an external crystal resonator (XT1 or XT2)

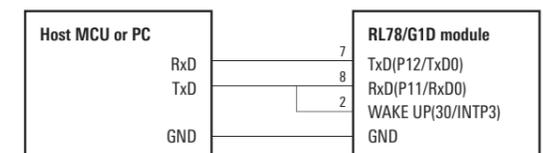


### Software for checking operation

- Software is provided to check the operation of the modem configuration used for control by the host microcontroller via the UART. Multiple profiles are supported. Customers can also use Renesas custom profiles.
- The RL78/G1D module can be used in a combined configuration that makes use of the many peripheral functions of the RL78/G1D. The module provides a good balance between size and the number of function pins, making it easy to use in a combined configuration.

### Supported profiles

- Bluetooth® SIG standard profiles
  - Proximity
  - Heart Rate
  - Alert Notification
  - Health Thermometer
  - Glucose
  - Find Me
  - Time
  - Running Speed and Cadence
  - Blood Pressure
  - Phone Alert Status
- Custom profiles
  - General-purpose bidirectional communication
  - Firmware Update



Connections to the host microcontroller use UART 2-wire branch connection.

# General-purpose, Motor

## RL78/G1F

### RL78/G1F features

Peripheral functions and flexibility have been improved while retaining the same ROM sizes as the RL78/G14. In particular, analog functions have been strengthened, and the on-chip functions are ideal for motor control.

[Main improvements to peripheral functions compared with RL78/G14]

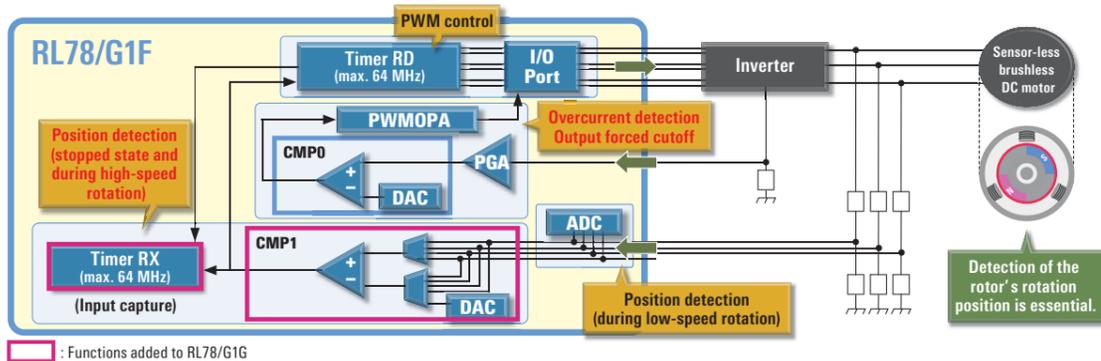
- Input capture timer (timer RX) for motor control
- Programmable-gain amplifier (PGA)
  - High slew rate of 3.0 V/μs (min.) ( $V_{DD} \geq 4.0$  V)
- 2-channel comparator (CMP0 and CMP1)
  - Fast response time of 70 ns (typ.) (1/8 that of RL78/G14)
- D/A converter (1 or 2 channels)
- IrDA communication function
- Debug functions including real-time trace



### Motor control functions of the RL78/G1F

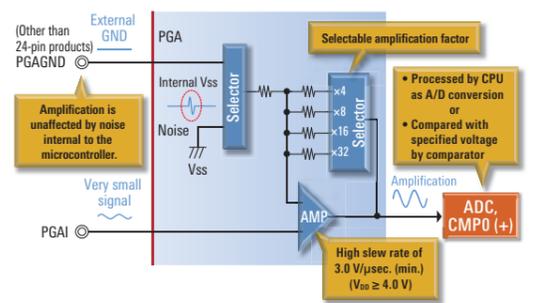
- ① 120-degree conducting control for sensor-less brushless DC motors
  - On-chip 4-input-selectable high-speed comparator (CMP1) and timer RX for rotor position detection without the use of sensors
  - Enables detection of the rotor position when stopped and during high-speed rotation.

- ② Overcurrent detection and forced cutoff of PWM output
  - On-chip high-speed PGA for overcurrent detection + high-speed comparator (CMP0) and control output signal forced cutoff function (PWMOPA)
  - Supports quick detection of overcurrent conditions and immediate cutoff of PWM output.



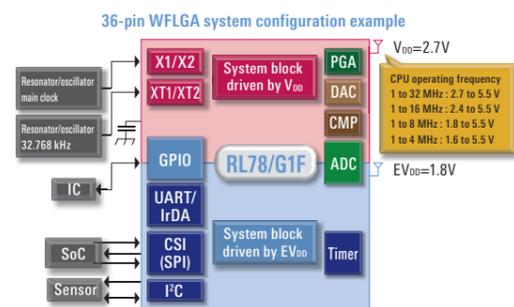
### Programmable-gain amplifier (PGA) for boosting sensor signals

The amplification factor for boosting very small signals is selectable among  $\times 4$ ,  $\times 8$ ,  $\times 16$ , and  $\times 32$ . The slew rate ranges from a minimum of 3.0 V/μsec. (3.5 V/μsec. (min.) at other than  $\times 32$  V ( $V_{DD} \geq 4.0$  V)). The dedicated GND input (PGAGND pin) ensures that amplification is not affected by internal noise.



### 36-pin LGA package (4 x 4 mm) suitable for mobile devices

- Some functions support separate power supplies on 36-pin and 64-pin products. By providing separate power supplies ( $V_{DD}$  and  $EV_{DD}$ ) it is possible to perform communication with an SoC, etc., at low voltage with running the CPU at high speed.
- The 36-pin products allow use of a 32.768 kHz subsystem clock oscillator (XT1) despite low pin count.



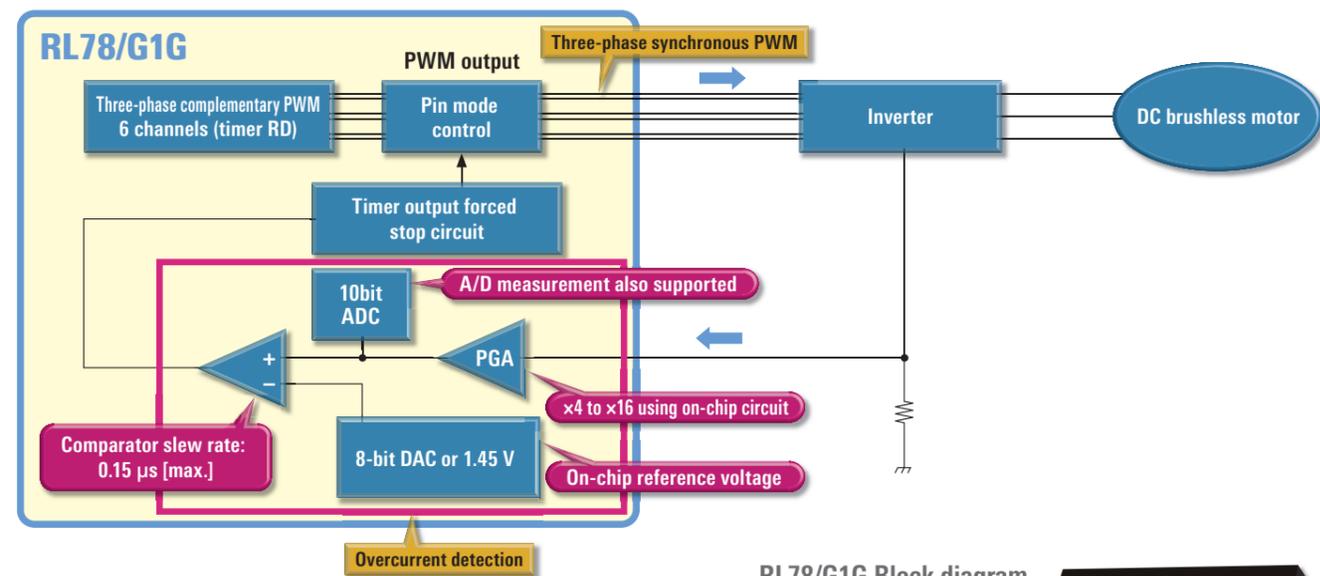
## RL78/G1G

Ideal for DC brushless motor applications **Consumer applications only**  
Support for power-efficient maintenance-free motor operation



		RL78/G1G
Motor control timer	Three-phase complementary PWM	6 channels (48 MHz operation supported)
	Forced shutoff	Supported (Hi-Z, H/L output settings supported)
Overcurrent detection	Programmable-gain amplifier	1 channel (on-chip amplifying resistor)
	Comparator	2 channels (response time: 0.15 μs [max.])
	Comparator reference voltage	8-bit DAC or internal reference voltage of 1.45 V

### Application example: Three-phase synchronous PWM support and overcurrent detection circuit for reduced system cost



### RL78/G1G Block diagram



### Lineup of products with low pin count and small ROM capacity

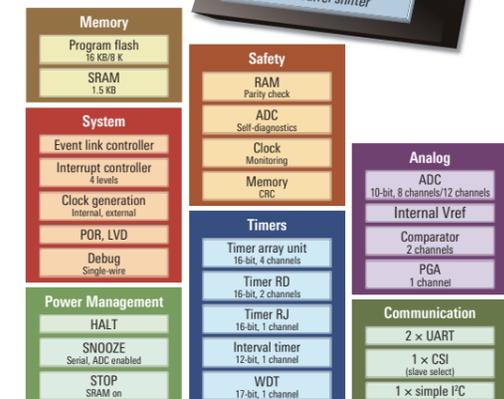
LQFP with 0.8 mm pin pitch for easy mounting using flow soldering

ROM	Pins	30	32	44
16 K		1.5 KB	1.5 KB	1.5 KB
8 K		1.5 KB	1.5 KB	1.5 KB

RAM Size Note: The RL78/G1G is not equipped with data flash.

### Other functions

- Operating current : 75 μA/MHz
- STOP current : 240 nA (SRAM contents retained)
- On-chip oscillator : 24 MHz  $\pm 2\%$  ( $T_a = -40$  to  $+85^\circ\text{C}$ )  
(48 MHz supply by timer RD for motor control supported)
- Compliant with European safety standard for household appliances (IEC/UL 60730)

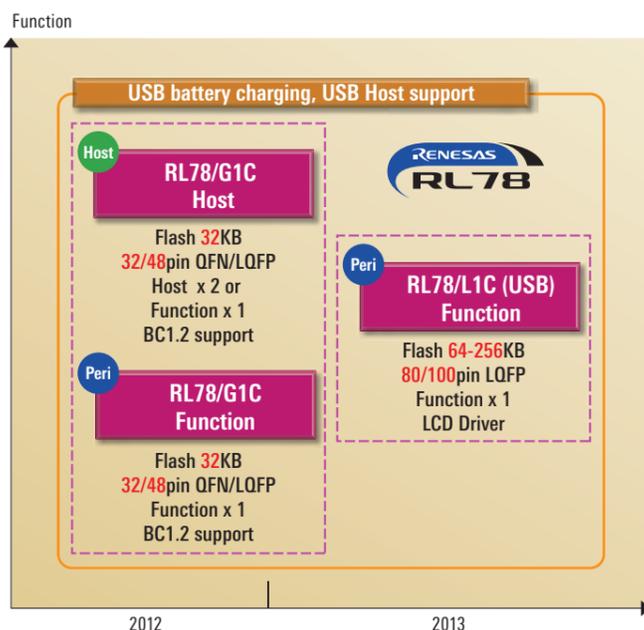


# General-purpose, USB

## Common to RL78/G1C and RL78/L1C

### Low-end USB microcontroller roadmap

RL78 Series next-generation low-end USB microcontrollers



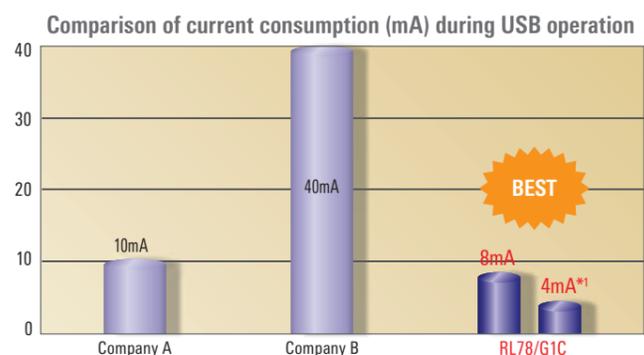
### Product lineup

ROM	Pins		32	48	80	100
256 KB					16 K	16 K
192 KB					16 K	16 K
128 KB					12 K	12 K
96 KB					10 K	10 K
64 KB					8 K	8 K
32 KB	5.5 K	5.5 K	5.5 K	5.5 K		

RL78/G1C : 1 x only Function (green), 2 x Host or 1 x Function (blue)  
 RL78/L1C : 1 x only Function (light blue)

### USB features (low power consumption)

Operating current among world's lowest



Note: 1. Non-communication state when only SOF packets are accepted

## RL78/G1C

### RL78/G1C (USB)

World's first low-end microcontroller with support for USB Battery Charging Specification, Revision 1.2 (BC1.2)

- Support for fast charging and power supply control in addition to USB communication Ability to charge up to 1.5 A using BC1.2 (0.5 A for USB 2.0)
- Low power consumption during USB operation Approx. 65% reduction compared with 78K0R, approx. 20% reduction compared with R8C
- Host x 2 channels, Function x 1 channel Suitable for a broad range of applications

Necessary Functions	Target Applications
BC function	Mobile batteries, USB chargers
Host functionality	Vending machines, Printer, DVD player, Smartphone peripheral accessories, Health devices, Measuring devices, USB memory, Mouse / keyboard, Handheld terminals, Barcode readers, UPS
Function functionality	



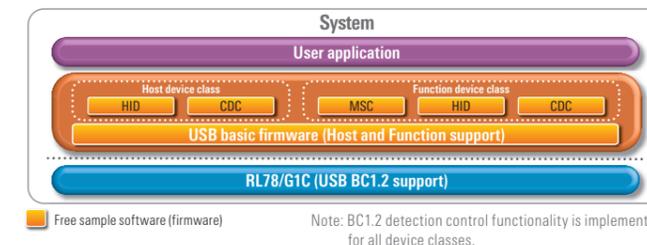
### Overview of USB controller specifications

USB Host and USB BC1.2 support

		RL78/G1C	Reference
USB2.0	Function	1 channel	
	Host	2 channels	Host version only
Transfer speed	LS(1.5Mbps)	○	Host/Function
	FS(12Mbps)	○	Host/Function
	HS(480Mbps)	—	Not supported
Transfer mode	Control	○	FIFO 64 bytes
	Bulk	○	FIFO 64 x 2 bytes, double buffering
	Interrupt	○	FIFO 64 bytes
	Isochronous	—	
On-chip resistors		○	D+ and D- lines, pull-up and pull-down resistors
Supported battery charging classes		○	Support for Host and Function
On-chip PLL		○	External resonator → 48 MHz generation

### USB sample firmware

USB sample firmware is available free of charge. This simplifies system development and reduces the amount of time required.



Note: BC1.2 detection control functionality is implemented for all device classes.

All application notes are available for download on the Renesas website.

### USB sample firmware

USB function	Title	Rev	Memory size[kByte]	
			ROM*1	RAM*2
Host	Basic firmware	2.13	17.9 KB	2.7 KB
	HID (Human Interface Device Class)		17.2 KB	2.0 KB
	CDC (Communication Device Class)		19.5 KB	1.9 KB
Peripheral	Basic firmware	1.00	11.3 KB	1.5 KB
	HID (Human Interface Device Class)		12.0 KB	0.9 KB
	CDC (Communication Device Class)		11.2 KB	1.1 KB
	MS (Mass Storage Device Class)*2		18.2 KB	2.5 KB
AOA	USB Host Android Open Accessory		15.9 KB	1.6 KB
Downloader	USB Peripheral Firmware Update		12.8 KB	3.1 KB

Notes: 1. ROM and RAM sizes for CS+ (V3.00.00) and CA78K0R (V1.71) environments  
 2. Includes EEPROM devices used as media.

## RL78/L1C

### RL78/L1C features

- 100-pin LCD microcontroller with large-capacity ROM
  - ROM: 256 KB, RAM: 16 KB (max.) → Suitable for applications with advanced functionality
  - Low-power LCD microcontroller retaining the features of the RL78 microcontroller family
  - High-performance 16-bit CPU
  - Low power consumption (particularly low LCD drive current due to divided allocation of LCD capacity)
  - Safety functions (compliant with European safety standard for household appliances)
- High-resolution ADC
  - 12-bit ADC to support high-precision sensing → Suitable for sensor measuring devices for consumer and industrial applications
- Full complement of communication functions
  - Compliant with Battery Charging Specification, Revision 1.2 (BC1.2) for USB peripherals → Ability to rapidly charge secondary batteries
  - Variety of serial interface functions
    - CSI/UART/Simple I<sup>2</sup>C x 4
    - I<sup>2</sup>C(Multi-Master) x 1
    - USB Peripheral x 1

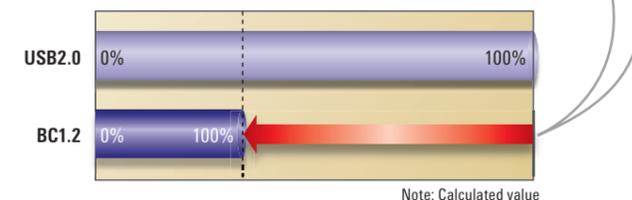
### Overview of USB battery charging standards

- Standards designed to enable rapid battery charging

Current max. value

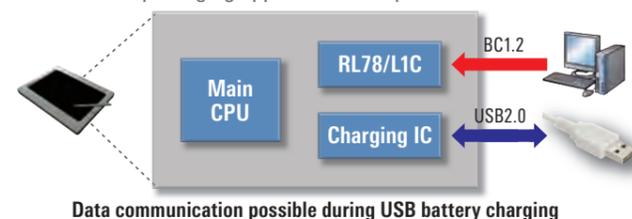
USB 2.0 standard → 500mA

BC1.2 standard → 1500mA



Note: Calculated value

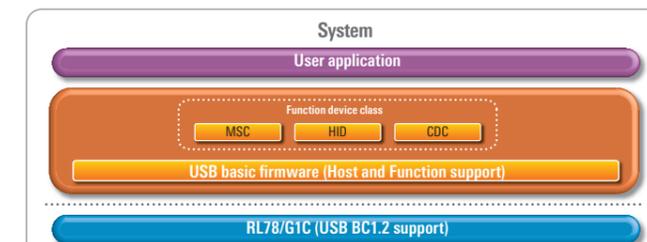
- USB battery charging application example



Data communication possible during USB battery charging

### USB sample firmware

USB sample firmware is available free of charge. This simplifies system development and reduces the amount of time required.



Note: BC1.2 detection control functionality is implemented for all device classes.

All application notes are available for download on the Renesas website.

### USB sample firmware

USB function	Title	Rev	Memory size[kByte]	
			ROM*1	RAM*2
Peripheral	Basic firmware	2.13	11.3 KB	1.5 KB
	HID (Human Interface Device Class)		12.0 KB	0.9 KB
	CDC (Communication Device Class)		11.2 KB	1.1 KB
	MS (Mass Storage Device Class)*2		18.2 KB	2.5 KB
Downloader	USB Peripheral Firmware Update	1.00	12.8 KB	3.1 KB

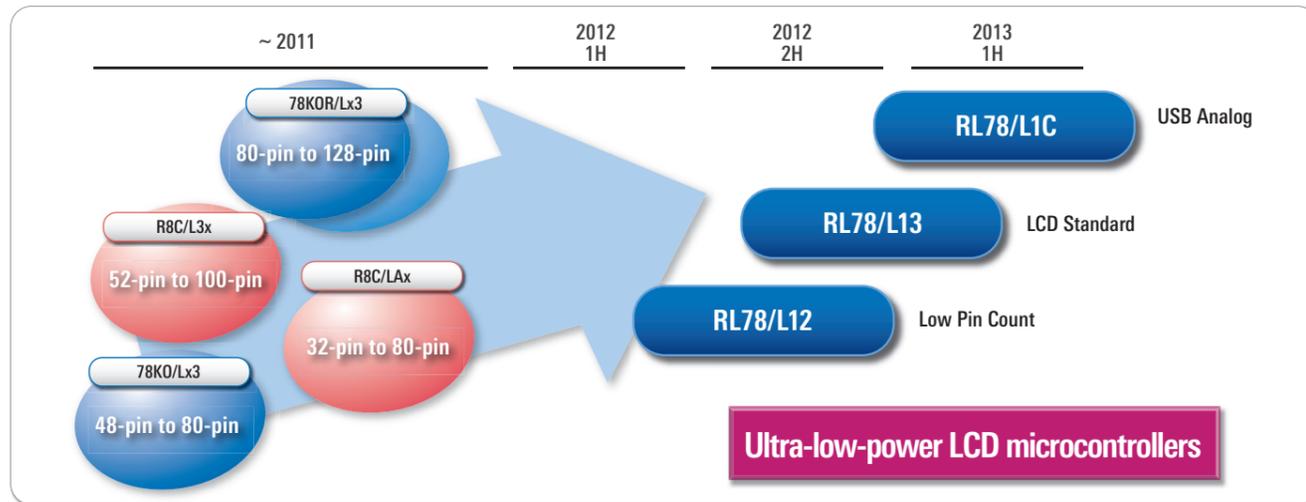
Notes: 1. ROM and RAM sizes for CS+ (V3.00.00) and CA78K0R (V1.71) environments  
 2. Includes EEPROM devices used as media.

# LCD

## RL78/L12, L13, L1C

### LCD microcontroller product roadmap

New successor products combining the features of earlier LCD microcontrollers



### RL78/L12, RL78/L13, and RL78/L1C product concept

- Low-power LCD driver**
  - Capacitor split type for generating LCD drive voltage
  - 89% reduction** in current consumption compared with previous product. Particularly large reduction in LCD drive current
- Support for many segment LCD panel types**
  - Resistance division type** suitable for large panels
  - Voltage boost type** suitable for battery powered systems
  - Capacitor split type** suitable for very small currents
- Return of panels with very large segment counts**
  - Max. display segment count: **416**

		L12	L13	L1C
Healthcare	Blood pressure meters	✓	✓	✓
	Composition meters		✓	✓
	Blood glucose meter			✓
	Pedometers	✓	✓	✓
	Thermometers	✓		
Electric household appliances	Rice cookers		✓	
	Microwave ovens	✓	✓	✓
	Hot water pots		✓	
Compact electric household appliances	LCD remote controls	✓	✓	
	Hot water heaters		✓	
	Telephones	✓	✓	
	Kitchen tools		✓	
Measuring devices	Temperature controllers		✓	✓
	Sensor modules			✓



### RL78/L12, L13, L1C Product lineup

ROM	Pins	32	44	48	52	64	80	100
256 KB							16 K	16 K
192 KB							16 K	16 K
128 KB						8 K	8 K	12 K
96 KB						6 K	6 K	10 K
64 KB						4 K	4 K	8 K
48 KB						2 K	2 K	
32 KB		1.5 K						
16 KB		1 K	1 K	1 K	1 K	1 K	1 K	
8 K		1 K	1 K	1 K	1 K			

RAM RL78/L12: 32-pin - 64-pin    RAM RL78/L13: 64-pin - 80-pin    RAM RL78/L1C: 80-pin - 100-pin

### LCD display seg × com lineup

At each pin count the new products support higher segment counts than earlier products.

Pins	32	48	52	64	80	100	128
50 or more					51	56	54
45 - 49					48		
40 - 44					40	40	
35 - 39				39		40	
30 - 34			30	32	32	31	32
25 - 29		26	24				
20 - 24		22	24	24			
15 - 19							
9 - 14	13	9					

Legend: RL78/L1x (blue), 78KOR/Lx3 (red), 78KO/Lx3 (green), R8C/L3xx (orange), R8C/LAx (purple)

### Ultra-low standby current consumption (clock counter + LCD display)

Capacitor split provides extremely low current consumption when driving LCD panels.

Current during LCD drive <sup>1)</sup>	Resistance division method <sup>2)</sup>	Capacitor split method	Voltage boost method
Renesas RL78/L1x	11.6 μA (typ.)	7.35 μA (typ.)	21.19 μA (typ.)
Company A	11.7 μA (@2.2 V)	Not implemented	24.5 μA
Company B	Not implemented	Not implemented	22.9 μA
Company C	12.0 μA (@1.8 V)	Not implemented	Not implemented
Company D	Not implemented	Not implemented	23.7 μA

Notes: 1. Current value including sub-oscillator, RTC operation, LCD operation and current flow to LCD panel. The calculation assumes an LCD panel drive current of 10 μA when using the resistance division method. (The value differs depending on the drive method.)  
2. Calculated using an external resistance value of 1,000 kΩ for the external resistance division method.

### Supports the three typically used LCD drive methods. Enables LCD circuits with ultra-low power consumption.

	Features/anticipated applications			
<b>Resistance division method</b>	<b>For heavy-duty LCD/AC power supply applications</b> Using resistance division to generate the drive voltage achieves high LCD drive capacity at low cost. External resistors are used for voltage division to generate the LCD drive voltage. The ability to input an external voltage means that external resistors and capacitors can be used to adjust the operating current and drive capacity.			
	<b>High Good</b> Suitable for large LCD panels	<b>Standard</b> 10.4 μA[typ.]*1	<b>Dependent on VDD</b> Display dims as power supply voltage drops.	
<b>Internal voltage boost method</b>	<b>For battery-powered applications</b> The operating current is small and the drive voltage remains constant even when the battery voltage drops, so there is no dimming of the LCD display. The reference voltage is generated internally, and external capacitors are used to boost the voltage. The reference voltage can be adjusted by software in order to modify the LCD contrast. (On the RL78/L12, 18 setting steps are supported.)			
	<b>Standard</b>	<b>Small current Good</b> 0.63 μA[typ.]*	<b>Constant Good</b> No change when power supply voltage from battery, etc., drops, so no dimming of display.	
<b>Capacitor split method</b>	<b>For battery-powered applications</b> This method uses the smallest operating current. The LCD display dims when the battery voltage drops. It can be used without modification in cases where the aim is to dim the display according to the remaining battery capacity. To prevent the display from dimming as the battery voltage drops, the system can switch to the internal voltage boost method when the battery voltage is low. It is also possible to use the internal voltage boost method with the capacitor split method implemented in an external circuit.			
	<b>High Good</b>	<b>Very small current Very Good</b> 0.12 μA[typ.]*1	<b>Dependent on VDD</b> Display dims as power supply voltage drops.	

Note: 1. Drive voltage: 3 V, 1/3 bias, external resistance value: 1,000 kΩ, no LCD panel connected

# LCD, Analog

## RL78/L1A

### RL78/L1A features

**On-chip analog functions, low current consumption, low-voltage analog, on-chip LCD driver**

This power-efficient 16-bit LCD microcontroller is ideal for use in portable healthcare devices such as blood glucose meter.

### World-top-class power efficiency

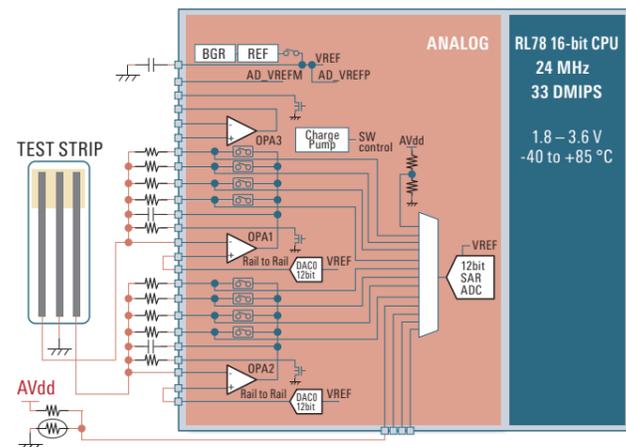
- Current consumption during operation: 66  $\mu$ A/MHz
- In RTC mode: 1  $\mu$ A or less
- Notable analog functions
- On-chip 12-bit ADC and 12-bit DAC that maintain consistent accuracy up to 2.0 V
- Rail-to-rail op-amp with analog switch

### Overview of RL78/L1A specifications

- ROM/RAM: 48KB/5.5KB, 64KB/5.5KB, 96KB/5.5KB, 128KB/5.5KB
- Data flash: 8 KB
- On-chip oscillator circuits: HOCO: 24 MHz, LOCO: 15 kHz
- Main clock: 1 to 20 MHz
- Subclock: 32.768 kHz
- DTC: Data transfer controller (DTC)
- Serial interfaces: 3  $\times$  SCI: Simple SPI/simple I<sup>2</sup>C/UART
- Timers: TAU (timer array unit), 6 channels  $\times$  16-bit, 2 channels  $\times$  16-/8-bit, interval timer: 8-/16-bit timer, RTC (real-time clock)
- Analog: 12-bit A/D converter  $\times$  14 channels, 2-channel 12-bit D/A converter, 2-channel high-precision op-amps (4MUX), 1-channel general-purpose op-amp,

- internal reference voltage (Vref), comparator (CMP)  $\times$  1 channel, TEMPS (temperature sensor)
- Other functions: POR (power-on reset), LVD (low-voltage detection circuit)
- LCD control: 32 seg.  $\times$  4 com. (80-pin), 40 seg.  $\times$  4 com. (100-pin)
- Safety functions: IWDTC (watchdog timer), RAM parity error detection function, ADC test function, frequency detection function, memory CRC, IEC/UL 60730 support

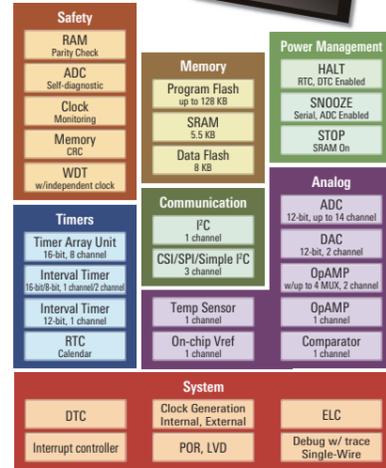
### Analog frontend function configuration Blood glucose meter use case



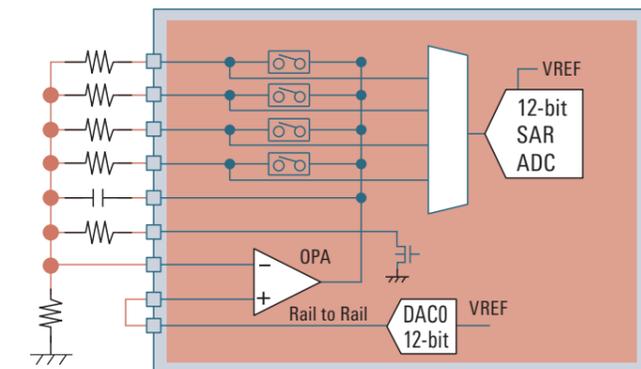
### RL78/L1A lineup

ROM	Pins		80		100	
128 K				5.5 K	8 KB	
96 K	5.5 K	8 KB	5.5 K	5.5 K	8 KB	
64 K	5.5 K	8 KB	5.5 K	5.5 K	8 KB	
48 K	5.5 K	8 KB				

RAM size DATA flash



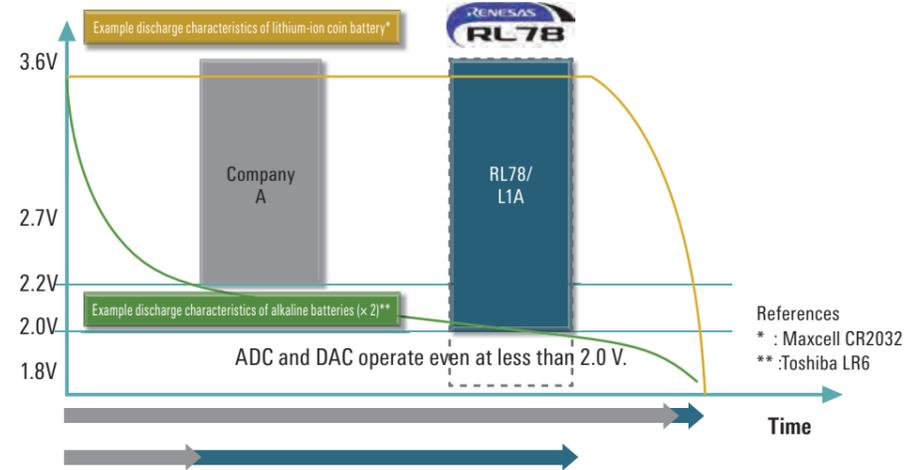
### Features of analog functions I/V conversion Transimpedance amplifier



Switching among the external feedback resistors using analog switches can be accomplished by means of software. It is possible to create a common board design mounted with external resistors for use with multiple product types.

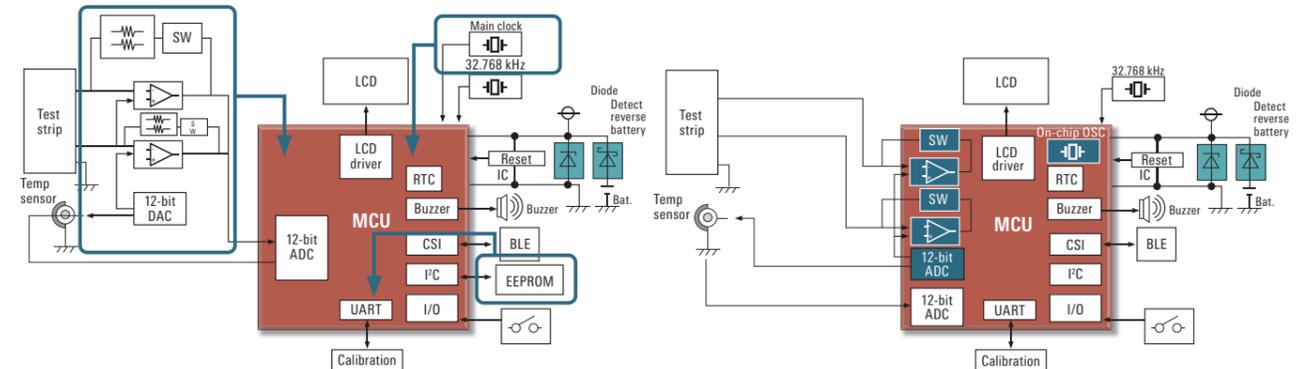
### Low-voltage operation of analog functions

Analog functions maintain accuracy while operating at 2.0 V. Low-voltage operation contributes to extended battery life.



### Enhanced on-chip microcontroller functions to reduce the number of system components

Peripheral functions such as AFE, main clock, and EEPROM are incorporated into the microcontroller. This reduces the number of additional components required.



### RL78/L1A RPBs (Renesas promotion boards)

RL78/L1A RPBs are available for evaluation of various types of products.

#### Features

- Operates on USB power supply.
- Temperature sensor
- Outputs trace data via USB.
- Supports connection of an LCD display.
- Supports connection of an 128  $\times$  128 matrix PMOD.



### RL78/L1A blood glucose meter reference solution

Renesas plans to expand its range of reference solutions and application notes to include a blood glucose meter that utilizes the on-chip functions of the RL78/L1A, such as 12-bit A/D and 12-bit D/A converters and op-amps.

## ASSP, Lighting/Power supply

### RL78/I1A

#### RL78/I1A features

- Basic peripheral functions for lighting and power supply applications
  - Timers for LED control and PFC control
    - 64 MHz source clock, zero current detection, forced output stop function
  - Analog functions for feedback
    - 10-bit A/D converter (2.125  $\mu$ s. conversion), PGA, comparator
  - Support for high temperatures up to 105°C or 125°C
- Current consumption
  - LED power supply control: 3.3 mA (main operation), CPU clock: 16 MHz, timer KB clock: 64 MHz, PLL: on
  - UART (DALI) receive standby: 0.23  $\mu$ A (STOP current)
- Full complement of connectivity functions
  - Communication functions (DALI, PMBus, SMBus, DMX512, UART, I<sup>2</sup>C, CSI)
- Special peripheral functions for "intelligent" operation and improved efficiency
  - Dithering function (0.98 ns pseudo-resolution), software start function, max. frequency limit function, interleaved PFC, standby communication wait

#### RL78/I1A lineup

ROM	Pins	20	30	38
64 KB			4 K	4 K
32 KB		2 K	2 K	

RAM size

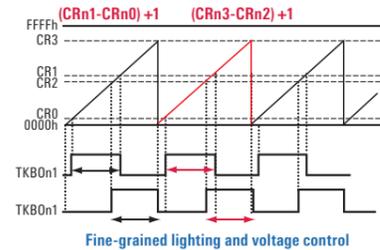
Operating temperature ranges up to 105°C or 125°C supported

#### Main applications

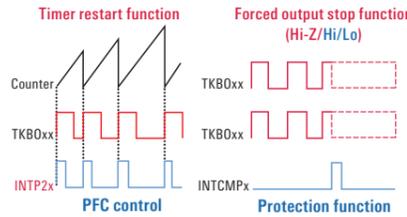
- LED lighting
- Digital power supplies
- Illumination fixtures
- Laser printers
- Microwave ovens
- Vacuum cleaners
- Communication devices

#### Advantages of RL78/I1A

**Dithering function**  
Delivers min. average resolution of 0.98 ns.



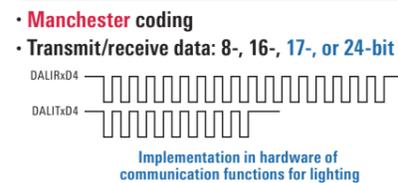
**Linked operation of 16-bit timer KB and INTP comparator**



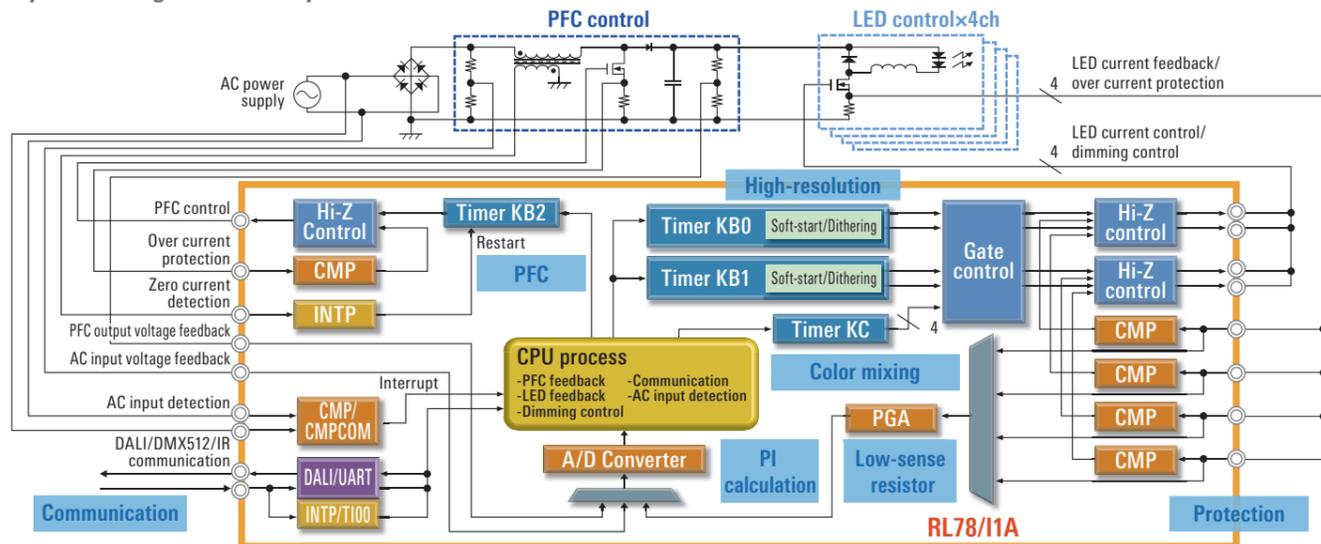
**Support for multiple power supply control methods**

AC/DC (PFC) control circuit	PFC control mode
Boost converter	CRM-PFC control (DCM or CCM also supported)
Flyback converter	
DC/DC control circuit	Constant-current control mode
Buck converter	Average-current control
Boost converter	Peak-current control
Flyback converter	
Half-bridge	
Full-bridge	

**DALI master/slave communication functions**



#### System configuration example: PFC control + LED constant current control



## ASSP, Electricity meter

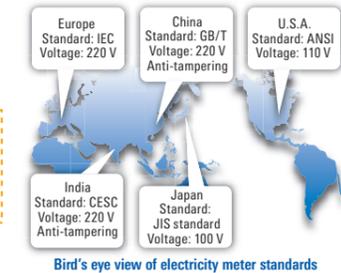
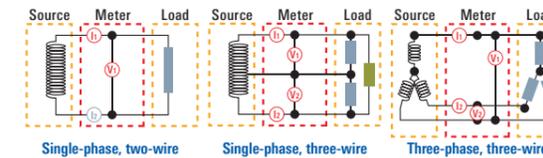
### RL78/I1B

#### Target electricity meter markets of RL78/I1B

##### Electricity meter types

There are various types of meters to match the information required in different countries.

Wiring Type	Main Applications	Main Regions
Single-phase, two-wire	Home	Europe, China, India
Single-phase, three-wire	Home	Japan, U.S.A
Three-phase, three-wire	Commercial/Industrial	Worldwide



#### Product lineup and concept

Product lineup to accommodate various meter types

Four products

ROM	Pins	80	100
128 KB		8 K	8 K
64 KB		6 K	6 K

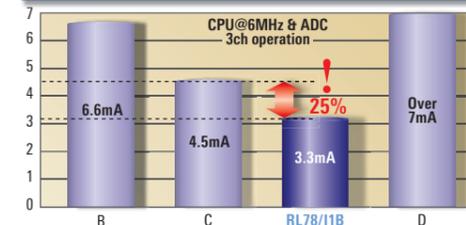
RAM size

#### Aiming for low power consumption

Low power consumption among the best in its class: Power efficient during both calculations and backup operation

- Low power consumption
  - Operating current: 96  $\mu$ A/MHz
  - Standby current: 0.69  $\mu$ A (during RTC or LVD operation)
- Newly developed 24-bit  $\Delta\Sigma$  ADC
  - Current during ADC operation: 0.53 mA/channel

25% lower power consumption than competing products\*1



Note: 1. Based on research by Renesas

#### Lowest power consumption at all operating frequencies

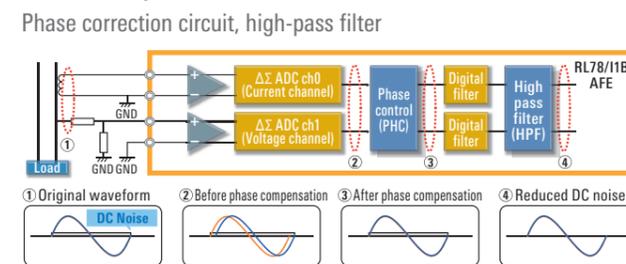


CPU Frequency (MHz)	MCU	RL78/I1B	A	B	C
		64/128 KB	Up to 32 KB	Up to 120 KB	Up to 128 KB
ADC 3-channel operation at each CPU operating frequency (MHz)	3	2.8	4.35	5.1	3.525
	6	3.3	5.55	6.6	4.595
	12	4.2	—	9.6	6.695
	24	6	—	—	10.725

#### $\Delta\Sigma$ ADC with improved functionality for electricity meters

Implementation in hardware of functions essential for power measurement

Phase correction circuit, high-pass filter

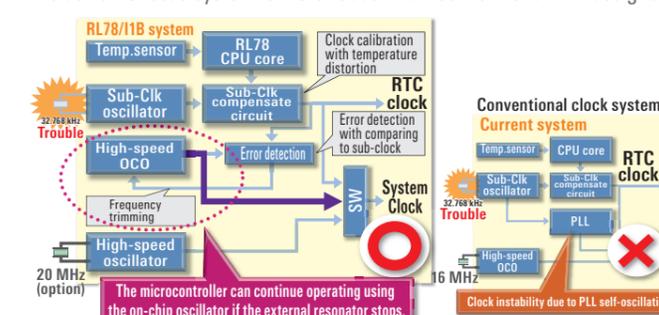


- Newly developed 24-bit ADC
  - Designed for low power consumption
  - Reduced CPU operating frequency that contributes to lower power consumption (on-chip PHC and HPF)
- To further cut power consumption ...
  - Support for multiple sampling frequencies (3.906 kHz and 1.953 kHz)

#### High-speed on-chip oscillator with accuracy of $\pm 0.05\%$

Subclock resonator single-crystal system

Exclusive Renesas system is more robust than conventional PLL designs.



- High-precision clock:  $\pm 0.05\%$  (high-speed on-chip oscillator with correction circuit)
  - Correction of on-chip oscillator by subclock (exclusive Renesas circuit)
- Safety functions: Clock system
  - High-speed on-chip oscillator maintains oscillation at  $\pm 1\%$  accuracy even if external resonator stops operating.

## ASSP, Electricity meter

### RL78/I1C

#### Target electricity meter markets of RL78/I1C

##### Electricity meter types

Wiring Type	Main Applications	Main Regions
Single-phase, two-wire	Home	Europe, China, India
Single-phase, three-wire	Home	Japan, U.S.A
Three-phase, three-wire	Commercial/industrial	Worldwide
Three-phase, four-wire	Commercial/industrial Agriculture/urban housing	Worldwide

#### Product lineup and concept

ROM	Pins	64	80	100
256 KB			16 K	16 K
128 KB		8 K	8 K	8 K
64 KB		6 K	6 K	

RAM Size

#### Improved security functions and arithmetic performance

- First in the industry to implement AES GCM mode in hardware, as required by the DLMS standard.
  - Encryption and decryption are over 20 times faster than the software processing used on previous Renesas products.
- Approx. 30% improvement in arithmetic capacity required for power calculation.
  - On-chip PLL boosts the maximum operating frequency from 24 MHz to 32 MHz.

#### Retaining and improving the power efficiency of the RL78/I1C

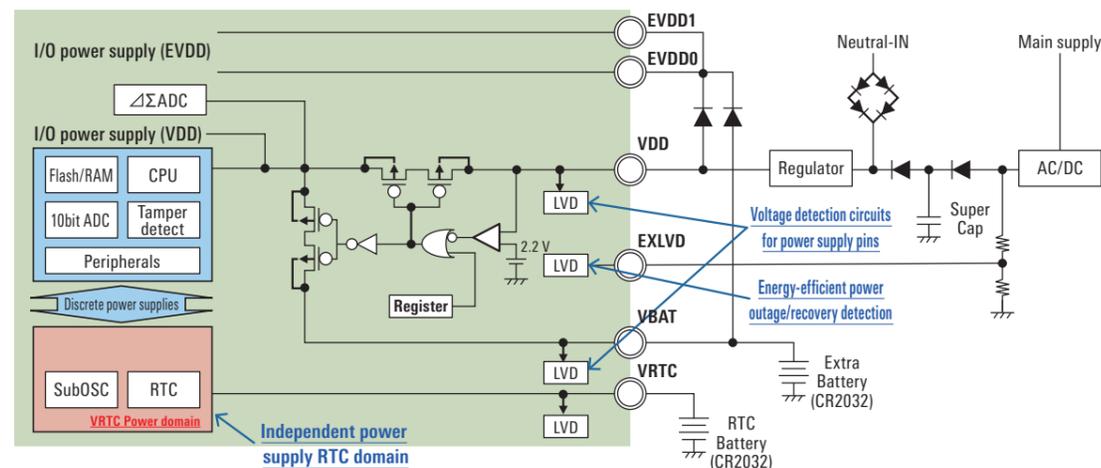
- Independent power supply real-time clock
  - Current consumption of 0.7  $\mu$ A (typ.) during operation

#### Target markets

- Ideal for smart meters, including those using DLMS communication.
- Suitable for a wide variety of power platforms, from single-phase two-wire to three-phase four-wire.

- Available flash memory configurations are 256 KB for DLMS or three-phase meters, 128 KB for single-phase meters or low-end three-phase meters, and 64 KB for low-end single-phase meters.
- Available package pin counts are 100 for three-phase meters or single-phase meters for advanced economies, 80 for single-phase meters for emerging economies, and 64 for applications where space is restricted.
- A total of seven product versions are available.

- 32-bit multiplier/divider and multiply-and accumulate unit dramatically reduce the software burden when performing calculations on 24-bit data converted by the 24-bit  $\Delta\Sigma$  A/D converter.
- Power measurement processing and DLMS processing on a single chip.
  - Ability to handle DLMS communication while power measurement processing is taking place.
  - Approx. 30% reduction in power consumption compared with two-chip solutions combining an earlier meter microcontroller and a dedicated microcontroller for DLMS processing.
  - Contributes to reduced system cost.
- Enhanced power supply monitoring function
  - Low-voltage monitoring of power supply pins using LVD and improved battery backup function to deliver power to the CPU and peripheral functions when power is interrupted.



## ASSP, Detector/Sensor

### RL78/I1D

#### RL78/I1D features

- Low power consumption for extended battery life
  - High-speed recovery from STOP mode in just 3.4  $\mu$ s, and supply of operating current in 124  $\mu$ A when operating at 1 MHz.
  - Ability to operate peripheral circuits (sensor activation, signal amplification, obtaining A/D conversion results) without CPU intervention. Ability to determine whether it is necessary to activate the CPU based on A/D conversion results.
- On-chip analog functions needed for security and emergency applications
  - On-chip general-purpose op-amp, 12-bit A/D converter, and comparator

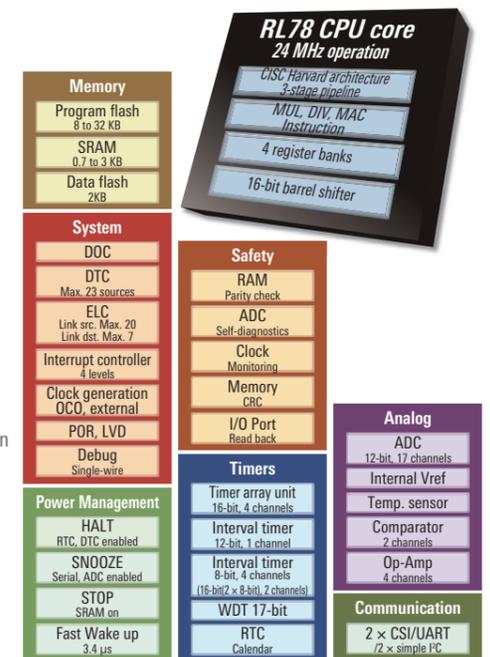
#### Key RL78/I1D specifications

- RL78 CPU Core**
  - Three-stage pipeline CISC architecture
  - Max. operating frequency: 24 MHz
  - Support for multiply, divide, and multiply-accumulate instructions
- Memory**
  - Support for 1.8 V flash programming and boot swap
  - Program flash: 8 KB–32 KB
  - SRAM: 0.7 KB–3 KB
  - Data flash: 2 KB
- System**
  - High-speed on-chip oscillator: 24 MHz  $\pm$ 1%
  - Middle-speed on-chip oscillator: 4 MHz  $\pm$ 12% (support for high-speed wakeup in 3.4  $\mu$ s)
- Power management**
  - Operating current: 58.3  $\mu$ A/MHz
  - HALT current: 0.64  $\mu$ A (RTC + LVD)
  - STOP current: 220 nA (SRAM data retained)
  - SNOOZE current: 700  $\mu$ A (UART), 500  $\mu$ A (ADC)
- Safety**
  - Compliant with European safety standard for household appliances (IEC/UL 60730)
- Timers**
  - Advanced-functionality timer array unit (TAU)
  - 8-bit interval timer (can be used as 16-bit interval timer)
  - Watchdog timer, real-time clock
- Analog**
  - 1.6 V ( $V_{DD}$ ) operation
  - On-chip ADC, 12-bit  $\times$  17 channels, conversion time: 3.375  $\mu$ s
  - Internal reference voltage (1.8 V)
  - Op-amp  $\times$  4 channels (high-speed and low-power modes)
  - Comparator  $\times$  2 channels (window mode support)
- Communication**
  - CSI, UART, Simple I<sup>2</sup>C
- Package**
  - 20-pin, 24-pin, 30-pin, 32-pin, 48-pin

#### RL78/I1D lineup

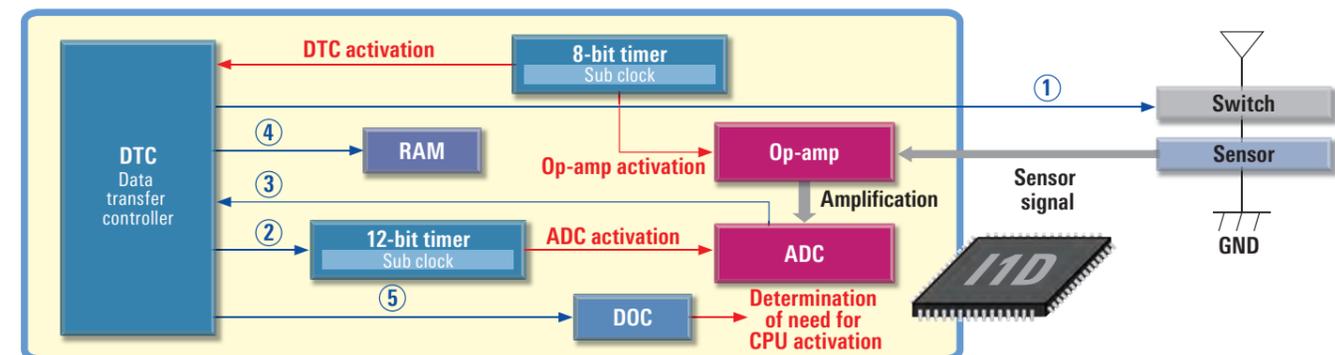
ROM	Pins	20	24	30	32	48
32 KB				3 K	3 K	3 K
16 KB		2 K	2 K	2 K	2 K	2 K
8 KB		0.7 K	0.7 K	0.7 K		

RAM Size



(Reference) RL78: Block diagram of I1D Group 48-pin product.

#### SNOOZE mode operation example



#### Operation procedure

- sensor activation,
- ADC activation,
- obtaining A/D conversion results,
- storing A/D conversion results in RAM,
- transmission of A/D conversion results to DOC (determination of need for CPU activation)



# Smart Analog

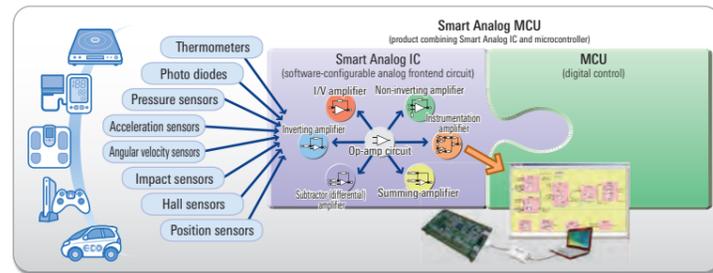
## RL78/G1E

Suitable for products incorporating sensors, such as electric household appliances, industrial equipment, and healthcare devices

### Microcontroller with on-chip analog frontend for sensor applications (and ability to control analog frontend circuit configuration and characteristics from microcontroller)

The RL78/G1E Smart Analog microcontroller is based on the RL78/G1A and incorporates an on-chip analog frontend. It is suitable for a variety of sensor applications and will contribute to the realization of sensor systems that are more compact and lower in cost while also reducing the time required for development.

- Smart Analog products allow you to use *software* to change the circuit configuration or characteristics in order to provide support for multiple types of sensors and drivers. Smart Analog functionality is available on Smart Analog ICs, which contain analog circuits only, and on the RL78/G1E Smart Analog microcontroller, which integrates a Smart Analog IC.



### RL78/G1E features

#### Analog frontend functions essential for sensor control

- Improved analog functions such as configurable amplifier, adjustable-gain amplifier, filters, D/A converter, and temperature sensor

#### 12-bit A/D conversion

- Multiple ADC channels (max. 17 channels) to support input from a variety of sensors
- Support for high-speed, high-precision A/D conversion

#### High-precision, high-speed on-chip oscillator

- On-chip oscillator accuracy of  $\pm 1\%$ , support for UART communication ( $T_A = -20$  to  $+85^\circ\text{C}$ ,  $V_{DD} = 1.8$  to  $5.5$  V)
- Frequency selectable among 32, 24, 16, 12, 8, 6, 4, 3, 2, and 1 MHz

#### Low Power Consumption

- 88.4  $\mu\text{A}/\text{MHz}$  during CPU operation, 0.67  $\mu\text{A}$  during standby
- Even lower power consumption in SNOOZE mode

### RL78/G1E specifications

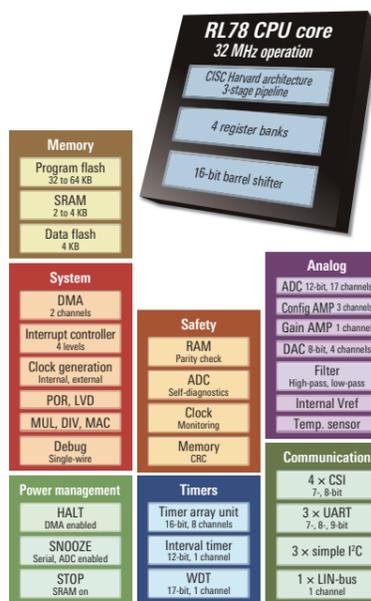
- RL78-S2 CPU Core**
  - Three-stage pipeline CISC architecture
  - Max. operating frequency: 32 MHz
- Memory**
  - Support for 1.8 V flash programming and boot swap
  - Program flash: 32 KB–64 KB
  - SRAM: 2 KB–4 KB
  - Data flash: 4 KB
- System**
  - High-speed on-chip oscillator: 32 MHz  $\pm 1\%$  (target)
  - Library support for multiply/divide and multiply-accumulate operation unit
- Power management**
  - Operating current: 88.4  $\mu\text{A}/\text{MHz}$  (when operating at 32 MHz, configurable amplifier channels 1 to 3 and D/A converter channel 3 operating)
  - HALT current: 145  $\mu\text{A}$  (high-speed on-chip oscillator stopped, AFE stopped)
  - STOP current: 370 nA (SRAM data retained, AFE stopped)

- SNOOZE current: 700  $\mu\text{A}$  (UART operating, AFE stopped), 420  $\mu\text{A}$  (ADC operating, AFE stopped)
- Safety**
  - Compliant with European safety standard for household appliances (IEC/UL 60730)
  - Illegal memory access detection
- Timers**
  - Advanced-functionality timer array unit (TAU)
  - Watchdog timer
- Analog**
  - Power supply voltage range: 3.0 V to 5.5 V (excluding ADC)
  - On-chip ADC, 12-bit  $\times 17$  channels, conversion time: 3.375  $\mu\text{s}$
  - On-chip DAC: 8-bit  $\times 4$  channels
  - Configurable amplifier  $\times 3$  channels, gain amplifier  $\times 1$  channel
  - Low-pass filter, high-pass filter
- Communication**
  - CSI, UART (LIN), Simple I<sup>2</sup>C
- Package**
  - 64-pin/80-pin

### Product lineup

ROM	Pins		64		80	
	64 KB	48 KB	4 K	4 K	4 K	4 K
64 KB	48 KB	32 KB	4 K	4 K	2 K	4 K

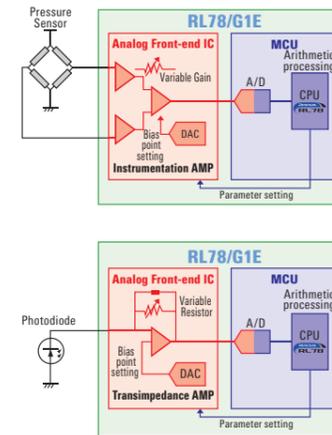
RAM Data Flash



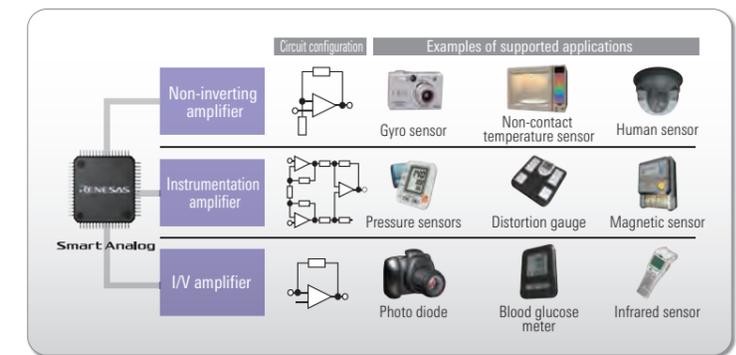
(Reference) RL78: Block diagram of G1E Group 80-pin product.

### Application fields: Suitable for a variety of sensor applications

The RL78/G1E (with variable amplifier circuit configuration) incorporates a configurable amplifier\*1 in its analog frontend circuit block. Using software control it is possible to change the analog circuit configuration and characteristics (adjusting the variable gain, offset and bias voltage, etc.) while the microcontroller is operating. Applications employing multiple sensors are supported by the ability to switch the analog circuit configuration in time-sharing fashion using software. This makes it possible to support a variety of different sensors. The RL78/G1E can be used as a common platform analog frontend IC.



- Setting the analog circuit (configurable amplifier) as an instrumentation amplifier\*2 for use with pressure sensors
- Setting the analog circuit (configurable amplifier) as an I/V amplifier for use with photodiodes

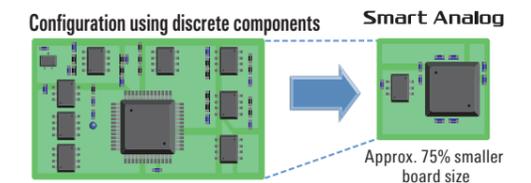


A variety of sensor types can be accommodated by switching the analog circuit configuration

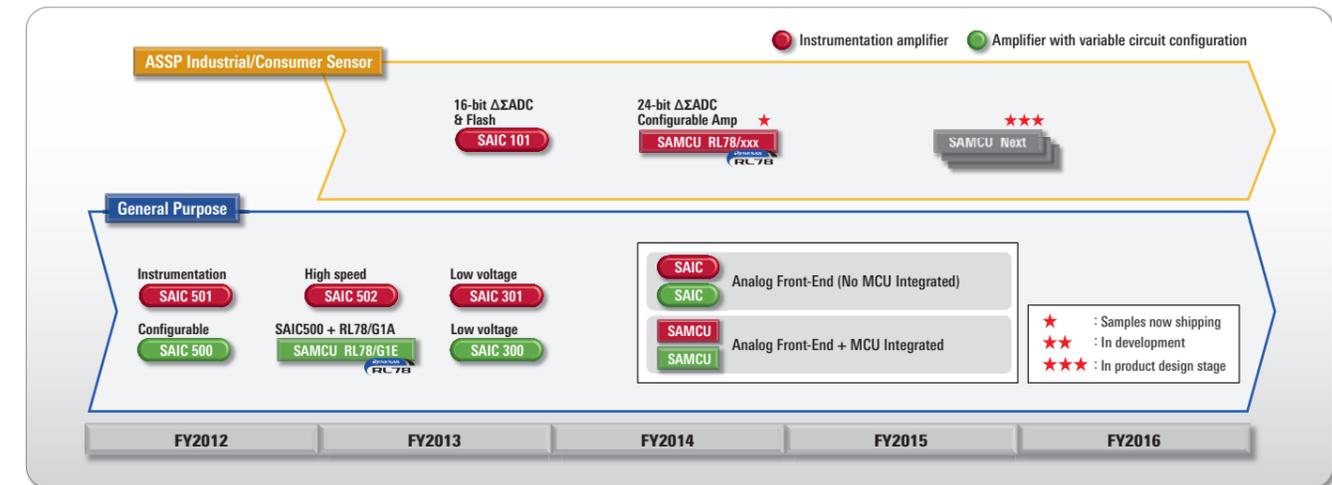
Notes: 1. Selectable among non-inverting amplifier, inverting amplifier, differential amplifier, and I/V conversion amplifier.  
2. The three-channel configurable amplifier is configured as a single-channel instrumentation amplifier operating on multiple channels.

### Making possible more compact and lower cost sensor systems

Integrating the peripheral components on a single chip reduces the component count by 90% and the board size by 75% compared with the use of discrete components for the analog frontend circuit (according to a comparison by Renesas).



### Smart Analog roadmap



Smart Analog website

[https://www.renesas.com/smart\\_analog](https://www.renesas.com/smart_analog)

## Automotive

### RL78/F13, F14, F15

Suitable for automotive applications and for industrial applications as well

The RL78/F1x microcontrollers are the successors to the 78K0R and R8C families. They combine high performance with low power consumption, and features such as CAN/LIN communication functions, advanced-functionality timers, and safety functions make them ideal for both automotive and industrial applications.

#### RL78/F13, F14, F15 lineup

RL78/F13										
ROM	Pins	20	30	32	48	64	80	80	80	80
128 KB			8 K	8 K	8 K	8 K	8 K	8 K	8 K	8 K
96 KB			6 K	6 K	6 K	6 K	6 K	6 K	6 K	6 K
64 KB	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K	4 K
48 KB	3 K	3 K	3 K	3 K	3 K	3 K	3 K	3 K		
32 KB	2 K	2 K	2 K	2 K	2 K	2 K	2 K	2 K		
16 KB	1 K	1 K		1 K		1 K				

RL78/F14							
ROM	Pins	30	32	48	64	80	100
256 KB				20 K	20 K	20 K	20 K
192 KB				16 K	16 K	16 K	16 K
128 KB				10 K	10 K	10 K	10 K
96 KB				8 K	8 K	8 K	8 K
64 KB	6 K	6 K	6 K	6 K	6 K	6 K	6 K
48 KB	4 K	4 K	4 K				

RL78/F15						
ROM	Pins	48	64	80	100	144
512 KB		32 K				
384 KB		26 K				
256 KB					20 K	20 K
152 KB					16 K	16 K
128 KB					10 K	10 K

LIN CAN 1ch CAN 2ch White numbers indicate RAM Size [B]

#### RL78/F13 features

- Lineup of pin counts from 20 to 80 pins and memory from 16 KB to 128 KB
- CAN products and non-CAN products are pin compatible.
- Compatible with RL78/F14 and RL78/F15 for easy migration

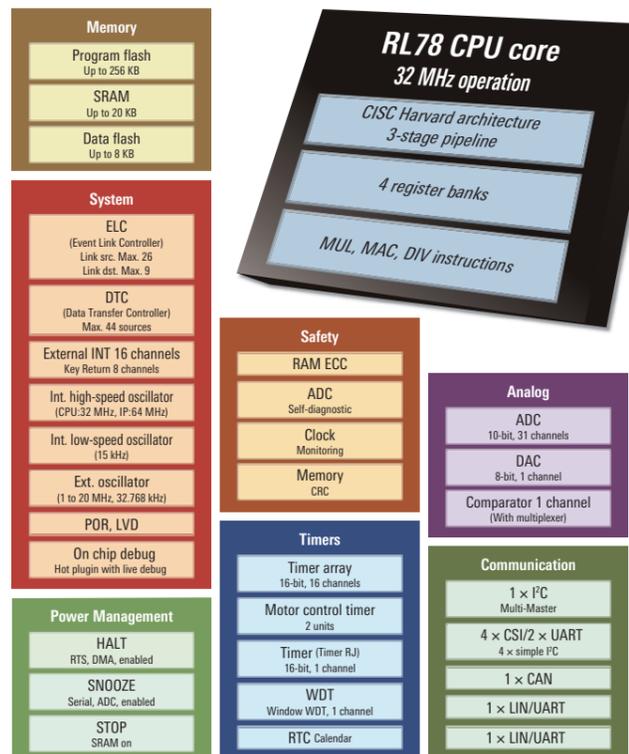
#### RL78/F14 features

- AUTOSAR support  
Renesas is currently an AUTOSAR Alliance Partner.
- Expanded motor functionality  
Comparator and D/A converter can be combined with timer RD for applications such as brushless DC motor control.
- Compatible with RL78/F13 and RL78/F15 for easy migration

#### RL78/F15 features

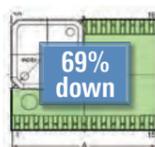
- Compatible with RL78/F13 and RL78/F14 for easy migration
- Expanded number of CAN and LIN channels, on-chip IEBus controller. Enhanced functions suitable for use in automotive gateway products.

#### RL78/F14 block diagram



100-pin product

- More advanced functionality
  - 32 MHz operation (2.7 V to 5.5 V at 105°C)
  - Three-phase waveform output function (timer RD)
  - 4 KB BGO data flash (RL78/F13)
  - 8 KB BGO data flash (RL78/F14)
  - 16 KB BGO data flash (RL78/F15)
  - High-speed on-chip oscillator ( $\pm 2\%$  at  $-40$  to  $+105^\circ\text{C}$ ) CPU: 32 MHz, peripheral:64MHz (timerRD)
  - Advanced on-chip debugging functionality  
Hot plugin  
DTC real-time RAM monitor (RRM) and dynamic memory modification (DMM)  
On-chip trace
- Functional safety support
- Compact package
  - QFN Package lineup  
Ex.32-pin SSOP  $\rightarrow$  32-pin QFN
- High temperature support
  - Operation at  $T_a = 150^\circ\text{C}$  (RL78/F13, F14)



#### CAN module

- Architecture enabling continued utilization of legacy communication software specifications
  - Retains functionality of previous CAN module
- Reduced load for interrupt handling
  - Implementation in hardware of typical interrupt-related functions
  - Reduction of overhead from interrupts at CAN transmit/receive completion
  - Suppression of interrupts at completion of CAN reception of unneeded messages
- Improved self-diagnostic functions
  - Support for read/write testing of RAM used by CAN
- Implementation in hardware of communication control software processing for reduced CPU load
  - Partial implementation in hardware of AUTOSAR-compliant CAN MCAL block and Pdu\_Router
  - Implementation in hardware of ECU self-diagnostic functions (OBD II support functions)



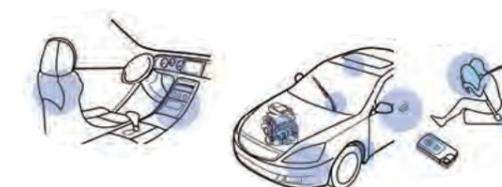
#### RL78/F1x applications

The RL78/F1x Group supports high operating temperatures and offers LIN/CAN communication functionality, making it suitable for a wide range of automotive applications. Some typical applications are listed below.

#### Various types of motor control



#### Various types of body control



- Powertrain (sub-microcontroller)
- Airbags (sub-microcontroller)

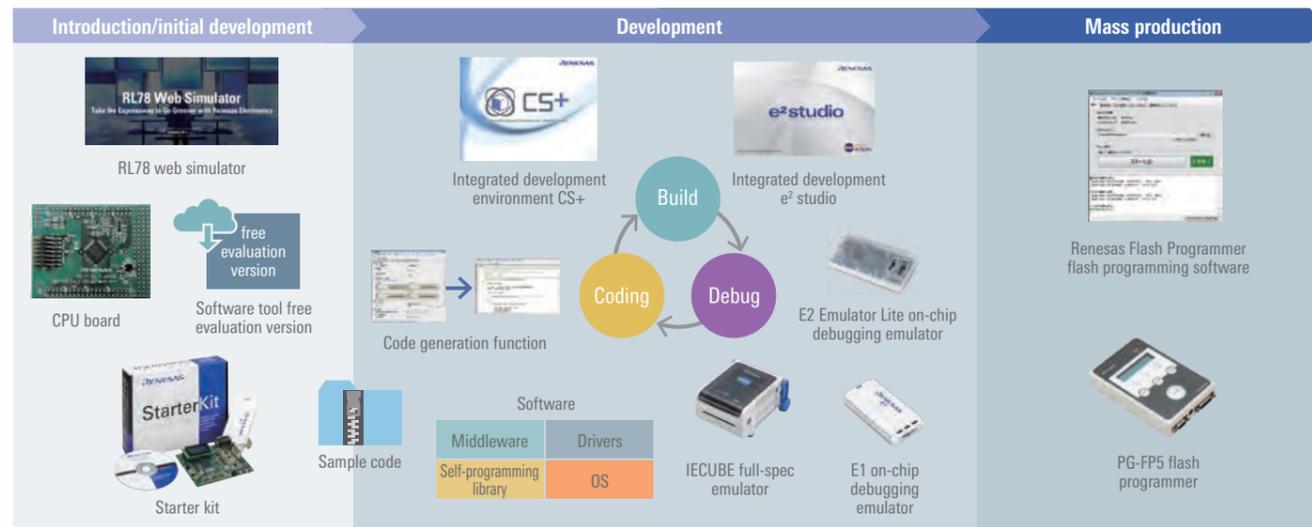
The high reliability required by automotive applications makes these microcontrollers suitable for industrial applications as well.



## RL78 Family development environment

[https://www.renesas.com/rl78\\_tools](https://www.renesas.com/rl78_tools)

Renesas Electronics supports all aspects of application development for the RL78 Family with products such as the integrated development environment CS+, real-time OSes, and programming tools.



### RL78 web simulator

Now you can easily develop prototypes using RL78 microcontrollers and run current consumption simulations without having to purchase developer tools.

[Web http://www.renesas.com/RL78-WebSimulator](http://www.renesas.com/RL78-WebSimulator)

### Current consumption calculation tool

Just enter microcontroller operating settings and this tool instantly calculates the current consumption, including peripheral functions. There is no need to consult the hardware manual or write a program.



### Virtual board and current consumption simulator (e<sup>2</sup> studio)

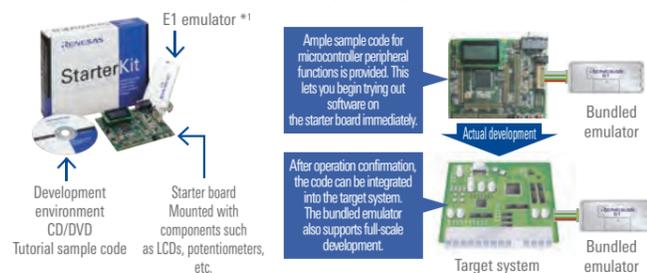
Use the virtual board to check the operation of microcontroller peripheral functions, external switches, LEDs, etc. It is also possible to monitor microcontroller I/O signals and get started with initial evaluation before actually purchasing a board or emulator. The virtual board is useful for everything from analyzing program operation to calculating current consumption with a high degree of accuracy.



### Evaluation boards: Enabling smooth introduction of new microcontrollers

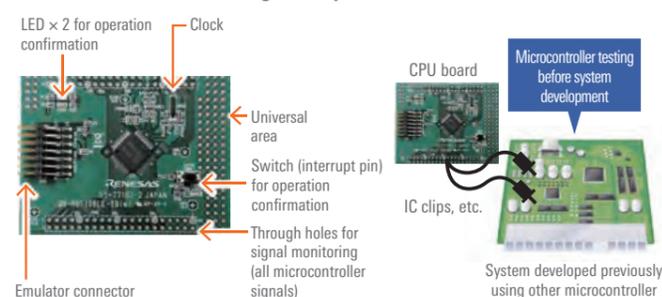
Renesas supplies evaluation boards for a variety of purposes, including microcontroller performance evaluation, initial operation confirmation, evaluation circuit creation, and prototyping of application products.

#### Renesas starter kit features and usage example



Note: 1. An even more affordable package without the E1 is also available.

#### CPU board features and usage example



## Integrated development environments

### CS+

An integrated development environment for 8-bit to 32-bit microcontrollers from Renesas. Even novices will find CS+ simple, convenient, and safe to use. Highly recommended for developers making extensive use of Renesas microcontrollers.

### e<sup>2</sup> studio

Based on the "Eclipse" open-source integrated development environment, e<sup>2</sup> studio supports the Renesas RL78 Family of microcontrollers. Ideal for developers who are familiar with the Eclipse environment or who wish to utilize the many plugins available in the open-source ecosystem.

### Evaluation software tools

Software tools for evaluating product functions and performance are available free of charge.

[Web https://www.renesas.com/tool\\_evaluation](https://www.renesas.com/tool_evaluation)

## RL78 Family self-programming libraries

These custom software libraries for flash programming can be used to write programs or data to microcontrollers that require programming in the field following shipment.

Code flash library

[Web https://www.renesas.com/flash\\_libraries/self\\_prg](https://www.renesas.com/flash_libraries/self_prg)

Data flash library

[Web https://www.renesas.com/flash\\_libraries/data\\_flash](https://www.renesas.com/flash_libraries/data_flash)

- FSL Type01: Library for writing user programs to flash memory
- FDL Type04: Library for writing data to data flash
- EEL Pack01/EEL Pack02: Library for EEPROM emulation\*

\* Allows writing and reading of user data without consideration for the designated location for user data (data flash). Also, since data is appended it is written to scattered locations, and this increases the number of write cycles for EEL target data.

## Emulators

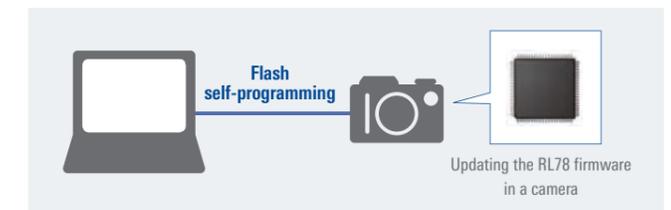
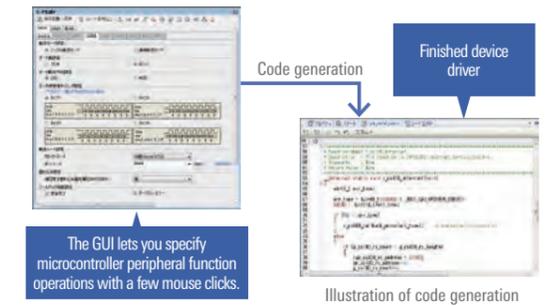
Renesas offers IECUBE, E1 Emulator, and E2 Emulator Lite to meet the debugging requirements of customers.

Lineup	Features	Trace Function	Time Measurement Function	Coverage Function	Flash Programming Function	Device Equivalence
<b>IECUBE</b> Support for powerful debugging functions	Advanced debugging functions including tracing of all instructions, measurement of time between events, and coverage.	Yes	2* <sup>2</sup>	Yes	No	○* <sup>4</sup>
<b>E1 Emulator</b> Basic debugging functions	An on-chip debugging emulator and on-board programmer that supports a wide range of Renesas microcontrollers.	Yes* <sup>1</sup>	1* <sup>3</sup>	No	Yes	◎* <sup>5</sup>
<b>E2 Emulator Lite</b> Convenience for study or hobby use	An affordably priced on-chip debugging emulator and on-board programmer that provides debugging functionality equivalent to the E1 Emulator.					

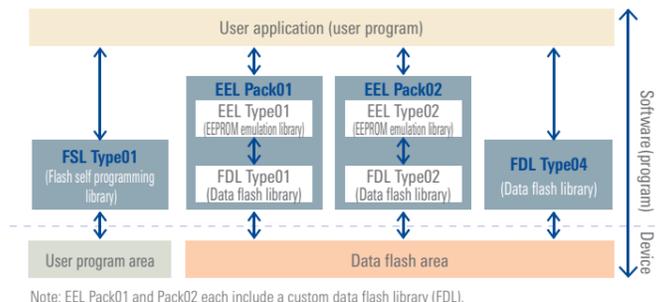
Notes: 1. Microcontrollers with on-chip trace support only 2. Capable of measuring time between events 3. Capable of measuring run-break duration 4. Emulation of device operation for FPGA, etc 5. Actual device operating

### Code generation plugin

Included in CS+ and e<sup>2</sup> studio. It automatically generates code for device drivers, the software that controls microcontroller peripheral functions, based on settings entered via a GUI. A pin table can be displayed to check the settings of multiplexed pins.



### RL78 Family self-programming library correlation chart



## RL78V4 real-time OS compliant with $\mu$ ITRON standard

### A high-quality real-time multitasking environment for embedded systems

- Complies with worldwide standard  $\mu$ ITRON 4.0 specification.
- Compact design suitable for ROM storage
- Full complement of service calls
- Excellent real-time performance (interrupt response time, task switching time)
- Support for convenient functions when used in conjunction with the CS+ integrated development environment (automatic setting of options required to build the OS, display of the state of objects managed by the OS such as tasks and semaphores, graphical display of task operation history and service call issue history)

## Middleware

- Extensive lineup for RL78 applications, including audio, file system, and memory drivers
- Common interface design with flexible support for the entire RL78 Family
- Sample programs included. Highly efficient design process for less time to product completion

### RL78 Family middleware lineup

- Audio
  - ADPCM encoder/decoder
  - Signal processing
  - Digital filters (FIR, IIR)
  - FFT library
  - Security
  - AES library
  - SHA hash function library
  - RSA library\*1
  - File system
  - Open source FAT file system (TFAT)
  - Memory drivers
  - SPI mode MultiMediaCard driver
  - SPI mode MMC/SD memory card driver
  - SPI serial flash driver
  - SPI single master driver
  - Renesas SPI serial EEPROM driver
  - Renesas I<sup>2</sup>C serial EEPROM driver
  - I<sup>2</sup>C single master driver
- Note: 1. Under development

## Three types of debugging environment to match your development style

### Debugging on a PC [CS+ simulator for RL78 Family, 78K0R, and 78K0]

#### Simulator enabling source-level debugging of applications in the CS+ integrated development environment before the target system exists

- Rich break functions and coverage measurement functions
- Ability to evaluate software modules in a manner very similar to evaluation on the actual device



Simulator for CS+

### Debugging with basic functions [E1 on-chip debugging emulator]

#### Basic debugging capabilities at an inexpensive price. This emulator also supports on-chip trace functionality.\*1

- Simple to connect. Allows debugging via a connection to an RL78 microcontroller mounted in the system under development.
- Also functions as a flash programmer.
- Environmentally friendly. All materials from the components to the packaging are RoHS compliant.



Notes: The E20 emulator may be used as well, but the supported debugging functions are equivalent to those of the E1.  
1. On microcontrollers with on-chip trace support only

### Debugging with high-level functions [IECUBE full-spec emulator]

#### A high-performance full-spec emulator with more advanced functions

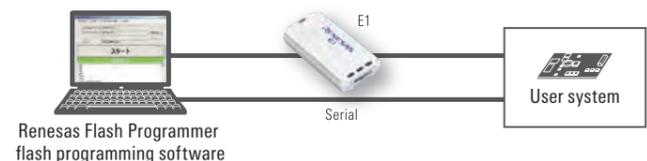
- Trace with time-tag function
- Provides access via a GUI to more powerful debugging capabilities, including a duration measurement function and coverage function.



## Three types of programming environment to match your development goals and circumstances

### Programming controlled by a PC [Renesas Flash Programmer flash programming software]

- Ability to control flash programming from a PC using the E1 or a serial connection
- Two programming operation modes (Basic mode and Full mode)
- Ability to automate programming by running scripts
- Ability to embed unique code



### Programming controlled by a PC or stand-alone programming [PG-FP5 flash programmer]

- Stand-alone programming
- Programming controlled by a PC using a dedicated GUI
- Ability to store settings for up to eight environments
- Ideal for use on the production line (command control, remote control)
- Ability to embed unique code



Note: 1. The portion represented by xx differs depending on the target region.

### Ordering pre-programmed ROM (growing number of products supported)\*1

Pre-programmed flash memory products from Renesas Electronics

Note: 1. The support status differs depending on the product. Please contact a Renesas sales company or agent for details.

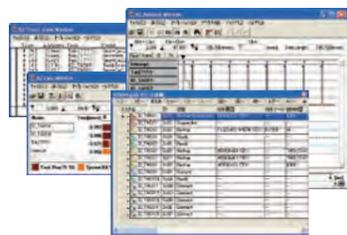


Illustration of function screens in conjunction with CS+

## Application notes and sample code

### Renesas provides sample programs with documentation describing how to use microcontroller peripheral functions as well as system examples.

- Sample code for RL78, constantly expanding lineup
- Extensive sample code including register definition files
- Substantial reduction in time to completion for products incorporating RL78 Family microcontrollers



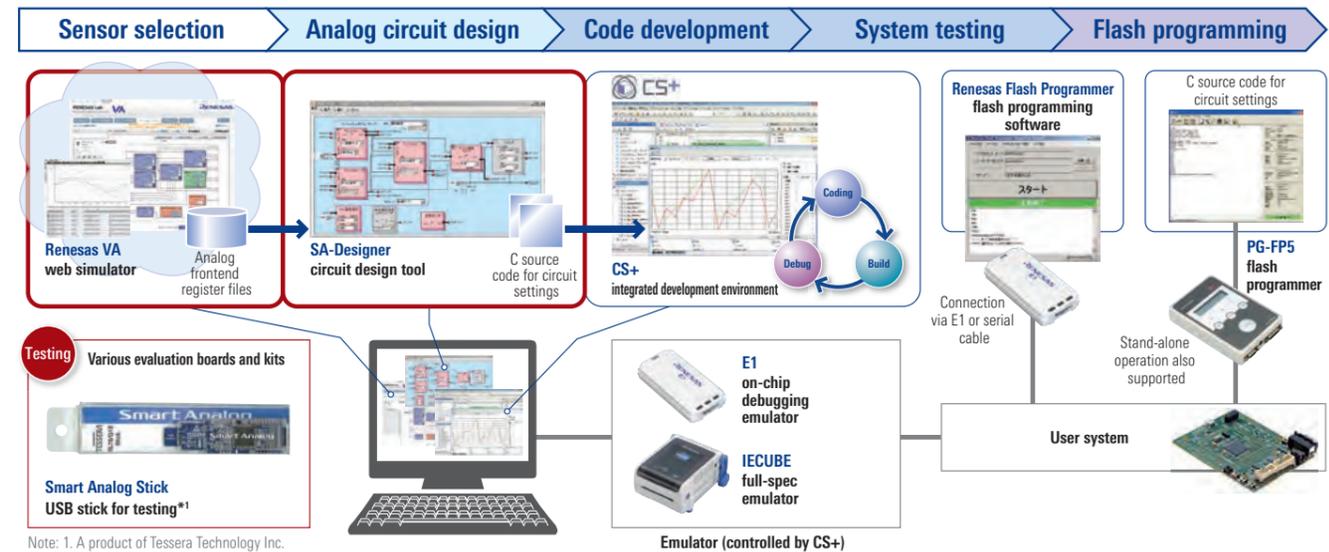
Visit the following URL to download sample code based on the philosophy of "simpler and faster."  
<http://www.renesas.com/software>

## Smart Analog development tools

[https://www.renesas.com/smart\\_analog\\_tools](https://www.renesas.com/smart_analog_tools)

### Lineup of development tools utilizing Smart Analog functions

Smart Analog devices allow you to change the circuit configuration and characteristics by making settings in software, thereby enabling support for multiple types of sensors and drivers. Smart Analog development tools include the standard development tools for RL78 Family microcontrollers as well as Renesas VA, SA-Designer, and evaluation boards and kits.



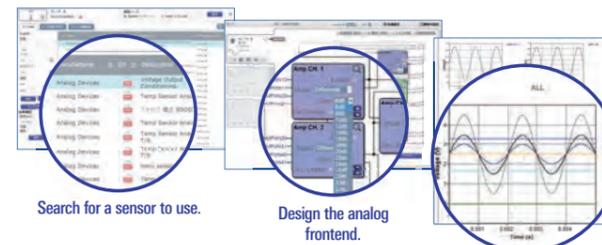
Note: 1. A product of Tesser Technology Inc.

### Sensor selection Free of charge

#### Sensor selection without the actual device: Renesas VA web simulator

This cloud-based tool lets you perform analog circuit design and simulations combining Smart Analog devices and approximately 1,000 varieties of sensors.

Try it now. [Web http://www.renesas.com/renesas\\_va](http://www.renesas.com/renesas_va)



Search for a sensor to use.

Design the analog frontend.

Do signal simulation and download analog frontend register files.

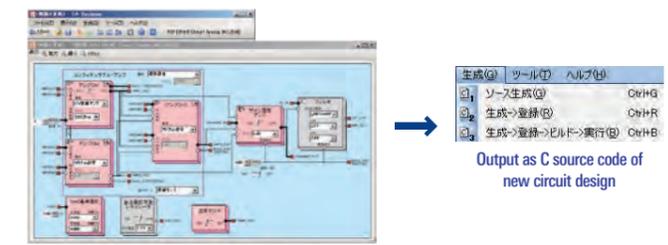
Supported devices  
Smart Analog IC 300 Series  
Smart Analog IC 500 Series  
Smart Analog MCU (RL78/G1E)

### Analog circuit design Free of charge

#### Simple circuit design with a few mouse clicks: SA-Designer

This tool lets you actually design the analog frontend circuit of your Smart Analog product and then outputs the circuit data as C source code.

[Web http://www.renesas.com/sa\\_designer](http://www.renesas.com/sa_designer)



GUI-based circuit design (with ability to import analog frontend register files generated by Renesas VA)

Supported devices  
Smart Analog IC 101 Series  
Smart Analog IC 300 Series  
Smart Analog IC 500 Series  
Smart Analog MCU (RL78/G1E)

### Smart Analog evaluation boards to simplify testing of Smart Analog systems

A selection of starter kits and evaluation boards provide the ideal way to get started with Smart Analog.

[Web https://www.renesas.com/products/smart-analog/evaluation-gui-tools/easystarter.html](https://www.renesas.com/products/smart-analog/evaluation-gui-tools/easystarter.html)

Smart Analog Easy Starter, an GUI-based evaluation tool, lets you do circuit design on analog frontends for sensors and monitor waveforms.

It is possible to connect an option board to a Renesas Starter Kit. The first such product is mounted with the Smart Analog IC101 and sensor elements.



Note: 1. A product of Tesser Technology Inc.

## Alliance partners

A wide variety of products for the RL78 Family, such as compilers, and programmers, are available from Renesas' alliance partners.

Get the latest information here.

[https://www.renesas.com/rl78\\_partners](https://www.renesas.com/rl78_partners)

### Compiler

IAR Systems AB 

### RTOS

CMX Systems, Inc. 

FreeRTOS.org 

Micrium 

SEGGER Microcontroller 

### Programming Services\*1

Falcon Denshi K.K.  
(Exclusive distributor of  
HI-LO SYSTEMS for Japanese  
customers) 

Flash Support Group Company 

### Programmers\*2

Data I/O Corporation 

E-Gloaledge Corporation 

Falcon Denshi K.K. 

Flash Support Group  
Company\*3 

HI-LO System Research  
Co., Ltd.\*3 

HOKUTO DENSHI Co., LTD. 

iFORCOM KYOEI Co., LTD. 

MINATO ELECTRONICS INC. 

NAITO DENSEI MACHIDA  
MFG. CO., LTD. 

SMH Technologies\*3 

SUISEI ELECTRONICS  
SYSTEM CO., LTD. 

TESSERA  
TECHNOLOGY INC. 

Wave Technology Co., Ltd. 

DTS INSIGHT Corporation 

- Notes: 1. Currently supported or support planned.  
2. Contact the manufacturer to determine if use on a mass production line is supported.  
3. Under development or to be developed.

## Development tools for RL78 Family

Get the latest information here.

[https://www.renesas.com/rl78\\_tools](https://www.renesas.com/rl78_tools)

Microcontroller		Starter kit	CPU board	Real-time OS	Integrated development environment (including compiler and simulator)	Software tool	On-chip debugging emulator	Full-spec emulator	Flash memory programming tools	
Series	Group								Flash programming software	Flash memory programmer
RL78/G1x	RL78/G10	—	QB-R5F10Y16-TB*13 or RTE510Y470TGB00000R*13	R178V4*6 (R0R07800TCW01w)*7	CS+	C compiler package (with integrated development environment) for RL78 and 78K Families*8 (R0C07800GSW01D) (R0C07800GSW01N)	E1*9*10 (R0E000010KCE00)	IECUBE*11 (QB-RL78xxx)	Renesas Flash Programmer for E1 (R0C00000F0W12R)*12 or PGFP5 software	E1 or PG-FP5
	RL78/G11	—	YQB-R5F1057A-TB							
	RL78/G12	—	QB-R5F1026A-TB							
	RL78/G13	Renesas Starter Kit for RL78/G13*1 (Part No.: R0K50100LS000BE)	QB-R5F100LE-TB*2 or QB-R5F100SL-TB*2							
		Renesas Starter Kit for RL78/G13 (without E1)*12 (Part No.: R0K50100LS900BE)	—							
	RL78/G14	Renesas Starter Kit for RL78/G14*1 (Part No.: R0K50104PS000BE)	QB-R5F104LE-TB*3 or QB-R5F104PJ-TB*3							
		Renesas Starter Kit for RL78/G14 (without E1)*12 (Part No.: R0K50104PS900BE)	—							
	RL78/G1A	—	QB-R5F10ELE-TB							
	RL78/G1C	Renesas Starter Kit for RL78/G1C*1 (Part No.: R0K5010JGS000BE)	QB-R5F10JGC-TB							
		Renesas Starter Kit for RL78/G1C (without E1)*12 (Part No.: R0K5010JGS900BE)	—							
RL78/G1D	(Evaluation kit available*15)	—								
RL78/G1F	—	YQB-R5F11BLE-TB*16								
RL78/G1G	Renesas Starter Kit for RL78/G1G*1** (Part No.: R0K5011EFS000BE)	Alternative products available*14								
	Renesas Starter Kit for RL78/G1G (without E1)*12** (Part No.: R0K5011EFS900BE)									
RL78/G1E*4	Smart Analog Stick*5	QB-R5F10FME-TB								
RL78/11x	RL78/11A	—	QB-R5F107DE-TB							
	RL78/11B	—	RTE510MPG0TGB00000R							
	RL78/11D	—	RTE5117GC0TGB00000R							
RL78/L1x	RL78/L12	Renesas Starter Kit for RL78/L12*1*** (Part No.: R0K5010RLS000BE)	QB-R5F10RLC-TB							
	RL78/L13	Renesas Starter Kit for RL78/L13*1 (Part No.: R0K5010WMS000BE)	QB-R5F10WMG-TB							
		Renesas Starter Kit for RL78/L13 (without E1)*12 (Part No.: R0K5010WMS900BE)								
RL78/L1C	Renesas Starter Kit for RL78/L1C*1 (Part No.: R0K50110PS000BE)	QB-R5F110PJ-TB								
	Renesas Starter Kit for RL78/L1C (without E1)*12 (Part No.: R0K50110PS900BE)									
RL78/F1x	RL78/F12	—	QB-R5F109GE-TB							
	RL78/F13	—	QB-R5F10BMG-TB							
	RL78/F14	—	QB-R5F10PPJ-TB							
	RL78/F15	—	—							

- Notes: 1. Includes CPU board, E1 on-chip debugging emulator, software (CS+ integrated development environment), and the evaluation version of Renesas Flash Programmer.  
2. The QB-R5F100LE-TB supports the RL78/G13 with 64 KB of flash memory. The QB-R5F100SL-TB supports the RL78/G13 with 512 KB of flash memory.  
3. The QB-R5F104LE-TB supports the RL78/G14 with 64 KB of flash memory. The QB-R5F104PJ-TB supports the RL78/G14 with 256 KB of flash memory.  
4. A board (product number: FB-R5F104PL-TB) that supports the RL78/G14 with 512 KB of flash memory is available from Naito Denshi Machida Mfg. Co., Ltd.  
5. A separate USB cable is required. The custom GUI design software is available for download on the web. (The URL is printed in the product's user's manual.)  
6. Evaluation licenses and mass-production licenses are available.  
7. The lowercase letter w denotes the type of license. It can stand for one of the following numeral and letters:  
1: Evaluation license: The real-time OS can be installed on one host computer.  
A: Evaluation license: The real-time OS can be installed on an unlimited number of host computers.  
K: Mass-production license: The real-time OS can be embedded in up to 3,000 products with the source code closed.  
U: Mass-production license: The real-time OS can be embedded in an unlimited number of products with the source code closed.  
Z: Mass-production license: The real-time OS can be embedded in an unlimited number of products with the source code disclosed.  
8. Product No. R0C07800GSW01D is supplied with install media (DVD), and product No. R0C07800GSW01N does not include install media.

9. The E1 emulator product includes an E1 emulator unit, USB interface cable, target system interface cable, and software CD-ROM.  
10. The E20 emulator may be used as well, but the supported debugging functions are equivalent to those of the E1.  
11. The IECUBE product includes an IECUBE emulator unit, USB interface cable, and software CD-ROM. For details of the system configuration, see "List of constituent products of IECUBE (QB-RL78xxx) full-spec emulator system" below.  
12. In response to requests from many customers who already own the E1 emulator, Renesas now offers a more affordably priced Renesas Starter Kit (without E1) package. The only difference from the standard Renesas Starter Kit package is that the E1 is not included. As with the standard Renesas Starter Kit package, a CPU board, cables, evaluation versions of development tools (compiler, etc.), and manuals are included. These can be used with the customer's own E1 emulator for application prototyping and microcontroller evaluation.  
13. The QB-R5F10Y16-TB supports the 10-pin version of the RL78/G10 with 2 KB of flash memory. The RTE510Y470TGB00000R supports the 16-pin version of the RL78/G10 with 4 KB of flash memory.  
14. Available from RS Components (Product No.: YQB-R5F11EFA-TB)  
15. Evaluation possible using RL78/G10 evaluation board (RTK0EN0001D01001BZ).  
16. Available from RS Components and Digi-Key.  
\* The products (R178V4, CS+, Renesas Flash Programmer, and PG-FP5) require a personal computer running Microsoft Windows\* 7, Microsoft Windows Vista\*, or Microsoft Windows\* XP. Refer to <http://www.renesas.com/ja-jp/windows> for details regarding the operating environment.  
\* See the next and following pages for details on microcontroller production status.  
\*\* Under development

## RL78/L1C HMI solution kit

### Overview

The RL78/L1C HMI solution kit (R0K578L1CD000BR) is a human-machine interface (HMI) solution kit that includes a segment LCD display circuit, audio playback circuit, and capacitive touch key sensor circuit. It simplifies the development and evaluation of products with HMI and USB support, such as electric household appliances and healthcare devices, that are also equipped with communication functions.

### Features

- Segment LCD display, capacitive touch key input, and audio playback circuit  
Simplifies the development and evaluation the products with human-machine interfaces such as electric household appliances and healthcare devices
  - The inclusion of the touch key interface makes it easy to achieve a more attractive design.
  - Includes audio middleware (Sodiack from AREX Corporation) for audio playback and voice speed conversion.
  - The LCD display uses the internal voltage boost method to deliver even lower power consumption.
- Sensor control system for M2M

### Applications

- The USB Function capability and serial flash memory of the RL78/L1C can be used in healthcare devices to store measurement data and transfer or manage data on a smartphone or PC via a USB connection.
- ECHONET Lite can be used to implement communication support. Operation has been confirmed using external modules for 920 MHz (sub-GHz) band communication, ZigBee RF4CE communication, and PLC communication (DSCK).



## RL78/G1C USB charger solution kit

### Overview

The RL78/G1C USB charger solution kit (R0K578G1CD010BR) is an evaluation kit equipped with the RL78/G1C, which integrates USB Host and Peripheral capabilities, a charge control IC, serial EEPROM, character LCDs, and brightness and temperature sensors. It simplifies the development and evaluation of products implementing rapid battery charging using USB Battery Charging Specification, Revision 1.2 (USB BC 1.2) and products with USB support. Users choosing this solution will be able to move quickly from the planning to the design stage of system development and to reduce the number of prototype iterations, thus achieving more efficient development.

### Features

- Enables development of systems utilizing interoperation with smartphones via USB connections (auxiliary batteries, data transfer).
  - The USB Host capability of the RL78/G1C can be used to implement data transfer to a smartphones compatible with Android™ Open Accessory.
  - The USB BC 1.2 detection function can be used to identify whether devices are compatible with USB BC 1.2 or not.
  - The nickel-metal hydride batteries of the solution kit can be used to supply the optimal current to a smartphone.
- Enables development of systems utilizing interoperation with PCs via USB connections (rapid chargers, USB mice, USB storage).
  - The USB Peripheral capability of the RL78/G1C can be used to implement data transfer from serial EEPROM to a PC.
  - USB mouse (HID class) functionality and USB storage (mass storage class) functionality can both be supported at once.
  - The USB BC 1.2 detection function can be used to identify whether PCs are compatible with USB BC 1.2 or not or to identify dedicated chargers.
  - The nickel-metal hydride batteries of the solution kit can be charged rapidly and safely.
- Standalone operation (brightness or temperature sensor, recording of measurement results, clock)
  - Brightness and temperature sensor measurement data can be displayed on the LCD, stored in the serial EEPROM, and time stamped.
  - Support for battery remaining indication and sleep mode.



### Product specifications

Item	Description	Remarks
Product No.	R0K578L1CD000BR	—
Power supply	[1] Size AA batteries (3) [2] USB VBUS	[1] or [2] selectable using jumper
Input voltage	2.6 to 5.5 V	—
Current consumption	Normal operation: Approx. 10 mA, low-power mode: Approx. 0.1 mA	—
Dimensions	Main unit: 120 × 70 × 22 mm, battery box: 70 × 48 × 20 mm	—
Environmental conditions	Operation: 10 to 35°C, storage: -10 to 50°C	No condensation
Microcontroller	RL78/L1C (ROM: 256 KB, RAM: 16 KB, 100-pin)	R5F110PJAFB
External flash memory	M25PX16 (2 MB)	SPI communication
Standard interface	USB micro-B	—
Debugging interface	E1 connector	—
Functions	Brightness measurement (1 digital brightness sensor)	—
	Temperature measurement (1 analog temperature sensor)	Offset setting function
	Display (1 LCD and 2 LEDs)	—
	Key input (4 touch keys, 1 push button, 1 reset button)	—
	Audio output (on-board speaker or external output via earphone jack)	Audio middleware for volume adjustment
	USB-UART conversion	—

### Product specifications

Item	Description	Remarks	
Product No.	R0K578G1CD010BR	—	
Power supply	Nickel-metal hydride batteries: 6 size AAA batteries	—	
Current consumption	Operation: 10 mA, sleep: 0.5 mA	—	
Dimensions	90 × 55 × 28 [mm]	—	
Environmental conditions	Operation: 10 to 35°C, storage: -10 to 50°C	No condensation	
MCU	RL78/G1C (ROM: 32 KB, RAM: 5.5 KB, 48-pin QFP) Main clock: 12.000 MHz, subclock: 32.768 kHz	R5F10JGCAFB —	
EEPROM	R1EX25512ATA00A (64KB)	SPI communication	
USB interface	Standard-A connector	Host	
	micro-B connector	Peripheral	
Charging	USB (input from micro-B connector)	5V	
Supply power	USB (input from standard-A connector)	5V	
Operation functions	When connected to a smartphone	Power to smartphone	—
		Communication with smartphone	Android™ Open Accessory "DemoKit" required.
	When connected to a PC	USB mouse	—
		Reading and writing log records (brightness, temperature, battery voltage, power voltage, charging current)	—
		Charging of main unit	—
Standalone operation	Display and logging of brightness and temperature	—	
	Display of clock or remaining battery, sleep function	—	
Display functions	Brightness	0 to 65,535 lux, 1 lux units	—
	Temperature	0 to 99°C, 1°C units	—
	Battery voltage	0 to 5,000 mV, 1 mV units	—
	Clock	24-hour display, 1 minute units	—
	Charging current	1 to 500 mA, 1 mA units	—
	Supply power current	1 to 1,500 mA, 1 mA units	—
	Other	USB BC 1.2 detection, VID, PID	—

## RL78 lineup

### RL78/G10 (10 to 16 pins)

R5F104AGASP (16 K/8 K) — Top: Product name  
 — Bottom: (RAM/Data flash (bytes))

Series		RL78/G10	
ROM (bytes)	Pin count	10-pin	16-pin
512K			
384K			
256K			
192K			
128K			
96K			
64K			
48K			
32K			
24K			
16K			
8K			
4K		R5F10Y17ASP*1 (512/—)	R5F10Y47ASP*1 (512/—)
2K		R5F10Y16ASP*1 (256/—)	R5F10Y46ASP*1 (256/—)
1K		R5F10Y14ASP*1 (128/—)	R5F10Y44ASP*1 (128/—)
Package		10-pin LSSOP SP thickness: 1.45 mm 4.4 × 3.6 mm Pitch: 0.65 mm 	16-pin SSOP SP thickness: 1.725 mm 4.4 × 5.0 mm Pitch: 0.65 mm 

Note: 1. D version for industrial applications with operating temperature range of -40 to +85°C also available.

### RL78/G12 (20 to 30 pins)

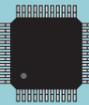
R5F104AGASP (16 K/8 K) — Top: Product name  
 — Bottom: (RAM/Data flash (bytes))

Series		RL78/G12					
ROM (bytes)	Pin count	20-pin	24-pin	30-pin			
512K							
384K							
256K							
192K							
128K							
96K							
64K							
48K							
32K							
16K		R5F1036AASP*1 (1.5K/—)	R5F1026AASP*1 (1.5K/2K)	R5F1037AANA*1 (1.5K/—)	R5F1027AANA*1 (1.5K/2K)	R5F103AAASP*1 (2K/—)	R5F102AAASP*1 (2K/2K)
12K		R5F10369ASP*1 (1K/—)	R5F10269ASP*1 (1K/2K)	R5F10379ANA*1 (1K/—)	R5F10279ANA*1 (1K/2K)	R5F103A9ASP*1 (1K/—)	R5F102A9ASP*1 (1K/2K)
8K		R5F10368ASP*1 (768/—)	R5F10268ASP*1 (768/2K)	R5F10378ANA*1 (768/—)	R5F10278ANA*1 (768/2K)	R5F103A8ASP*1 (768/—)	R5F102A8ASP*1 (768/2K)
4K		R5F10367ASP*1 (512/—)	R5F10267ASP*1 (512/2K)	R5F10377ANA*1 (512/—)	R5F10277ANA*1 (512/2K)	R5F103A7ASP*1 (512/—)	R5F102A7ASP*1 (512/2K)
2K		R5F10366ASP*1 (256/—)	R5F10266ASP*1 (256/2K)				
1K							
Package		20-pin LSSOP SP thickness: 1.45 mm 4.4 × 6.5 mm Pitch: 0.65 mm 	24-pin HWQFN NA thickness: 0.80 mm 4 × 4 mm Pitch: 0.50 mm 	30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 			

Note: 1. D version for industrial applications with operating temperature range of -40 to +85°C and G version (products with data flash only) for industrial applications with operating temperature range of -40 to +105°C also available.

RL78/G13 (20 to 48 pins)

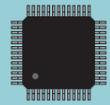
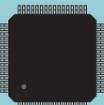
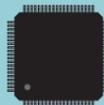
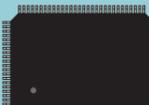
R5F104AGASP — Top: Product name  
(16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G13									
ROM (bytes)	Pin count	20-pin	24-pin	25-pin	30-pin	32-pin	36-pin	40-pin	44-pin	48-pin	
		512K								R5F100FLAFP (32K/8K)*2 R5F101FLAFP (32K/—)*2	R5F100GLAFB (32K/8K)*2 R5F101GLAFB (32K/—)*2
384K								R5F100FKAFP (24K/8K)*2 R5F101FKAFP (24K/—)*2	R5F100GKAFB (24K/8K)*2 R5F101GKAFB (24K/—)*2	R5F100GKANA (24K/8K)*2 R5F101GKANA (24K/—)*2	
256K								R5F100FJAFP (20K/8K)*1 R5F101FJAFP (20K/—)*1	R5F100GJAFB (20K/8K)*1 R5F101GJAFB (20K/—)*1	R5F100GJANA (20K/8K)*1 R5F101GJANA (20K/—)*1	
192K								R5F100EHANA (16K/8K)*1 R5F101EHANA (16K/—)*1	R5F100FHAFP (16K/8K)*1 R5F101FHAFP (16K/—)*1	R5F100GHAFB (16K/8K)*1 R5F101GHAFB (16K/—)*1	R5F100GHANA (16K/8K)*1 R5F101GHANA (16K/—)*1
128K				R5F100AGASP (12K/8K)*1 R5F101AGASP (12K/—)*1	R5F100BGANA (12K/8K)*1 R5F101BGANA (12K/—)*1	R5F100CGALA (12K/8K)*3 R5F101CGALA (12K/—)*3	R5F100EGANA (12K/8K)*1 R5F101EGANA (12K/—)*1	R5F100FGAFP (12K/8K)*1 R5F101FGAFP (12K/—)*1	R5F100GGAFB (12K/8K)*1 R5F101GGAFB (12K/—)*1	R5F100GGANA (12K/8K)*1 R5F101GGANA (12K/—)*1	
96K				R5F100AFASP (8K/8K)*1 R5F101AFASP (8K/—)*1	R5F100BFANA (8K/8K)*1 R5F101BFANA (8K/—)*1	R5F100CFALA (8K/8K)*3 R5F101CFALA (8K/—)*3	R5F100EFANA (8K/8K)*1 R5F101EFANA (8K/—)*1	R5F100FFAFP (8K/8K)*1 R5F101FFAFP (8K/—)*1	R5F100GFAFB (8K/8K)*1 R5F101GFAFB (8K/—)*1	R5F100GFANA (8K/8K)*1 R5F101GFANA (8K/—)*1	
64K	R5F1006EASP (4K/4K)*1 R5F1016EASP (4K/—)*1	R5F1007EANA (4K/4K)*1 R5F1017EANA (4K/—)*1	R5F1008EALA (4K/4K)*3 R5F1018EALA (4K/—)*3	R5F100AEASP (4K/4K)*1 R5F101AEASP (4K/—)*1	R5F100BEANA (4K/4K)*1 R5F101BEANA (4K/—)*1	R5F100CEALA (4K/4K)*3 R5F101CEALA (4K/—)*3	R5F100EEANA (4K/4K)*1 R5F101EEANA (4K/—)*1	R5F100FEAFP (4K/4K)*1 R5F101FEAFP (4K/—)*1	R5F100GEAFB (4K/4K)*1 R5F101GEAFB (4K/—)*1	R5F100GEANA (4K/4K)*1 R5F101GEANA (4K/—)*1	
48K	R5F1006DASP (3K/4K)*1 R5F1016DASP (3K/—)*1	R5F1007DANA (3K/4K)*1 R5F1017DANA (3K/—)*1	R5F1008DALA (3K/4K)*3 R5F1018DALA (3K/—)*3	R5F100ADASP (3K/4K)*1 R5F101ADASP (3K/—)*1	R5F100BDANA (3K/4K)*1 R5F101BDANA (3K/—)*1	R5F100CDALA (3K/4K)*3 R5F101CDALA (3K/—)*3	R5F100EDANA (3K/4K)*1 R5F101EDANA (3K/—)*1	R5F100FDAFP (3K/4K)*1 R5F101FDAFP (3K/—)*1	R5F100GDAFB (3K/4K)*1 R5F101GDAFB (3K/—)*1	R5F100GDANA (3K/4K)*1 R5F101GDANA (3K/—)*1	
32K	R5F1006CASP (2K/4K)*1 R5F1016CASP (2K/—)*1	R5F1007CANA (2K/4K)*1 R5F1017CANA (2K/—)*1	R5F1008CALA (2K/4K)*3 R5F1018CALA (2K/—)*3	R5F100ACASP (2K/4K)*1 R5F101ACASP (2K/—)*1	R5F100BCANA (2K/4K)*1 R5F101BCANA (2K/—)*1	R5F100CCALA (2K/4K)*3 R5F101CCALA (2K/—)*3	R5F100ECANA (2K/4K)*1 R5F101ECANA (2K/—)*1	R5F100FCAFP (2K/4K)*1 R5F101FCAFP (2K/—)*1	R5F100GCAFB (2K/4K)*1 R5F101GCAFB (2K/—)*1	R5F100GCANA (2K/4K)*1 R5F101GCANA (2K/—)*1	
16K	R5F1006AASP (2K/4K)*1 R5F1016AASP (2K/—)*1	R5F1007AANA (2K/4K)*1 R5F1017AANA (2K/—)*1	R5F1008AALA (2K/4K)*3 R5F1018AALA (2K/—)*3	R5F100AAASP (2K/4K)*1 R5F101AAASP (2K/—)*1	R5F100BAANA (2K/4K)*1 R5F101BAANA (2K/—)*1	R5F100CAALA (2K/4K)*3 R5F101CAALA (2K/—)*3	R5F100EAANA (2K/4K)*1 R5F101EAANA (2K/—)*1	R5F100FAAFP (2K/4K)*1 R5F101FAAFP (2K/—)*1	R5F100GAAFB (2K/4K)*1 R5F101GAAFB (2K/—)*1	R5F100GAANA (2K/4K)*1 R5F101GAANA (2K/—)*1	
12K											
8K											
4K											
2K											
1K											
Package	20-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 	24-pin HWQFN NA thickness: 0.80 mm 4 × 4 mm Pitch: 0.50 mm 	25-pin WFLGA LA thickness: 0.76 mm 3 × 3 mm Pitch: 0.50 mm 	30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 	32-pin HWQFN NA thickness: 0.80 mm 5 × 5 mm Pitch: 0.50 mm 	36-pin WFLGA LA thickness: 0.76 mm 4 × 4 mm Pitch: 0.50 mm 	40-pin HWQFN NA thickness: 0.80 mm 6 × 6 mm Pitch: 0.50 mm 	44-pin LQFP FP thickness: 1.60 mm 10 × 10 mm Pitch: 0.80 mm 	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm 	48-pin HWQFN NA thickness: 0.80 mm 7 × 7 mm Pitch: 0.50 mm 	

Notes: 1. D version for industrial applications with operating temperature range of -40 to +85°C and G version for industrial applications with operating temperature range of -40 to +105°C also available.  
2. D version for industrial applications with operating temperature range of -40 to +85°C also available.  
3. G version for industrial applications with operating temperature range of -40 to +105°C also available.

RL78/G13 (52 to 128 pins)

R5F104AGASP — Top: Product name  
(16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G13										
ROM (bytes)	Pin count	52-pin			64-pin			80-pin		100-pin		128-pin
		512K	R5F100JLAFA (32 K/8 K)*2 R5F101JLAFA (32 K/—)*2	R5F100LLAFB (32 K/8 K)*2 R5F101LLAFB (32 K/—)*2	R5F100LLAFA (32 K/8 K)*2 R5F101LLAFA (32 K/—)*2		R5F100MLAFB (32 K/8 K)*2 R5F101MLAFB (32 K/—)*2	R5F100MLAFA (32 K/8 K)*2 R5F101MLAFA (32 K/—)*2	R5F100PLAFB (32 K/8 K)*2 R5F101PLAFB (32 K/—)*2	R5F100PLAFA (32 K/8 K)*2 R5F101PLAFA (32 K/—)*2	R5F100SLAFB (32 K/8 K)*2 R5F101SLAFB (32 K/—)*2	
384K	R5F100JKAFB (24 K/8 K)*2 R5F101JKAFB (24 K/—)*2	R5F100LKAFB (24 K/8 K)*2 R5F101LKAFB (24 K/—)*2	R5F100LKAFB (24 K/8 K)*2 R5F101LKAFB (24 K/—)*2		R5F100MKAFB (24 K/8 K)*2 R5F101MKAFB (24 K/—)*2	R5F100MKAFB (24 K/8 K)*2 R5F101MKAFB (24 K/—)*2	R5F100PKAFB (24 K/8 K)*2 R5F101PKAFB (24 K/—)*2	R5F100PKAFB (24 K/8 K)*2 R5F101PKAFB (24 K/—)*2	R5F100SKAFB (24 K/8 K)*2 R5F101SKAFB (24 K/—)*2			
256K	R5F100JJAFB (20 K/8 K)*1 R5F101JJAFB (20 K/—)*1	R5F100LJAFB (20 K/8 K)*1 R5F101LJAFB (20 K/—)*1	R5F100LJAFB (20 K/8 K)*1 R5F101LJAFB (20 K/—)*1	R5F100LJABG (20 K/8 K)*3 R5F101LJABG (20 K/—)*3	R5F100MJAFB (20 K/8 K)*1 R5F101MJAFB (20 K/—)*1	R5F100MJAFB (20 K/8 K)*1 R5F101MJAFB (20 K/—)*1	R5F100PJAFB (20 K/8 K)*1 R5F101PJAFB (20 K/—)*1	R5F100PJAFB (20 K/8 K)*1 R5F101PJAFB (20 K/—)*1	R5F100SJAFB (20 K/8 K)*2 R5F101SJAFB (20 K/—)*2			
192K	R5F100JHAFB (16 K/8 K)*1 R5F101JHAFB (16 K/—)*1	R5F100LHAFB (16 K/8 K)*1 R5F101LHAFB (16 K/—)*1	R5F100LHAFB (16 K/8 K)*1 R5F101LHAFB (16 K/—)*1	R5F100LHABG (16 K/8 K)*3 R5F101LHABG (16 K/—)*3	R5F100MHAFB (16 K/8 K)*1 R5F101MHAFB (16 K/—)*1	R5F100MHAFB (16 K/8 K)*1 R5F101MHAFB (16 K/—)*1	R5F100PHAFB (16 K/8 K)*1 R5F101PHAFB (16 K/—)*1	R5F100PHAFB (16 K/8 K)*1 R5F101PHAFB (16 K/—)*1	R5F100SHAFB (16 K/8 K)*2 R5F101SHAFB (16 K/—)*2			
128K	R5F100JGAFB (12 K/8 K)*1 R5F101JGAFB (12 K/—)*1	R5F100LGAFB (12 K/8 K)*1 R5F101LGAFB (12 K/—)*1	R5F100LGAFB (12 K/8 K)*1 R5F101LGAFB (12 K/—)*1	R5F100LGABG (12 K/8 K)*3 R5F101LGABG (12 K/—)*3	R5F100MGAFB (12 K/8 K)*1 R5F101MGAFB (12 K/—)*1	R5F100MGAFB (12 K/8 K)*1 R5F101MGAFB (12 K/—)*1	R5F100PGAFB (12 K/8 K)*1 R5F101PGAFB (12 K/—)*1	R5F100PGAFB (12 K/8 K)*1 R5F101PGAFB (12 K/—)*1				
96K	R5F100JFAFB (8 K/8 K)*1 R5F101JFAFB (8 K/—)*1	R5F100LFAFB (8 K/8 K)*1 R5F101LFAFB (8 K/—)*1	R5F100LFAFB (8 K/8 K)*1 R5F101LFAFB (8 K/—)*1	R5F100LFABG (8 K/8 K)*3 R5F101LFABG (8 K/—)*3	R5F100MFAFB (8 K/8 K)*1 R5F101MFAFB (8 K/—)*1	R5F100MFAFB (8 K/8 K)*1 R5F101MFAFB (8 K/—)*1	R5F100PFAFB (8 K/8 K)*1 R5F101PFAFB (8 K/—)*1	R5F100PFAFB (8 K/8 K)*1 R5F101PFAFB (8 K/—)*1				
64K	R5F100JEAFB (4 K/4 K)*1 R5F101JEAFB (4 K/—)*1	R5F100LEAFB (4 K/4 K)*1 R5F101LEAFB (4 K/—)*1	R5F100LEAFB (4 K/4 K)*1 R5F101LEAFB (4 K/—)*1	R5F100LEABG (4 K/4 K)*3 R5F101LEABG (4 K/—)*3								
48K	R5F100JDAFB (3 K/4 K)*1 R5F101JDAFB (3 K/—)*1	R5F100LDAFB (3 K/4 K)*1 R5F101LDAFB (3 K/—)*1	R5F100LDAFB (3 K/4 K)*1 R5F101LDAFB (3 K/—)*1	R5F100LDABG (3 K/4 K)*3 R5F101LDABG (3 K/—)*3								
32K	R5F100JCAFB (2 K/4 K)*1 R5F101JCAFB (2 K/—)*1	R5F100LCAFB (2 K/4 K)*1 R5F101LCAFB (2 K/—)*1	R5F100LCAFB (2 K/4 K)*1 R5F101LCAFB (2 K/—)*1	R5F100LCABG (2 K/4 K)*3 R5F101LCABG (2 K/—)*3								
16K												
12K												
8K												
4K												
2K												
1K												
Package	52-pin LQFP FA thickness: 1.70 mm 10 × 10 mm Pitch: 0.65 mm 	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm 	64-pin LQFP FA thickness: 1.60 mm 12 × 12 mm Pitch: 0.65 mm 	64-pin VFBGA BG thickness: 0.99 mm 4 × 4 mm Pitch: 0.40 mm 	80-pin LFQFP FB thickness: 1.60 mm 12 × 12 mm Pitch: 0.50 mm 	80-pin LQFP FA thickness: 1.70 mm 14 × 14 mm Pitch: 0.65 mm 	100-pin LFQFP FB thickness: 1.60 mm 14 × 14 mm Pitch: 0.50 mm 	100-pin LQFP FA thickness: 1.60 mm 14 × 20 mm Pitch: 0.65 mm 	128-pin LFQFP FB thickness: 1.60 mm 14 × 20 mm Pitch: 0.50 mm 			

Notes: 1. D version for industrial applications with operating temperature range of -40 to +85°C and G version for industrial applications with operating temperature range of -40 to +105°C also available.  
2. D version for industrial applications with operating temperature range of -40 to +85°C also available.  
3. G version for industrial applications with operating temperature range of -40 to +105°C also available.



**RL78/G14 (30 to 100 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash) (bytes)

Series		RL78/G14																		
ROM (bytes)	Pin count	30-pin		32-pin		36-pin	40-pin	44-pin	48-pin		52-pin		64-pin			80-pin		100-pin		
		512K									R5F104GLAFB*2 (48 K/8 K)	R5F104GLANA*2 (48 K/8 K)		R5F104LLAFB*2 (48 K/8 K)	R5F104LLAFA*2 (48 K/8 K)		R5F104LLALA*2 (48 K/8 K)	R5F104MLAFB*2 (48 K/8 K)	R5F104MLAFA*2 (48 K/8 K)	R5F104PLAFB*2 (48 K/8 K)
384K									R5F104GKAFB*2 (32 K/8 K)	R5F104GKANA*2 (32 K/8 K)		R5F104LKAFB*2 (32 K/8 K)	R5F104LKAFB*2 (32 K/8 K)		R5F104LKALA*2 (32 K/8 K)	R5F104MKAFB*2 (32 K/8 K)	R5F104MKAFB*2 (32 K/8 K)	R5F104PKAFB*2 (32 K/8 K)	R5F104PKAFA*2 (32 K/8 K)	
256K								R5F104FJAFP*1 (24 K/8 K)	R5F104GJAFB*1 (24 K/8 K)	R5F104GJANA*1 (24 K/8 K)		R5F104JJAFB*1 (24 K/8 K)	R5F104JJAFB*1 (24 K/8 K)	R5F104JJAFB*1 (24 K/8 K)	R5F104LJAFP*1 (24 K/8 K)	R5F104LJALA*2 (24 K/8 K)	R5F104MJAFB*1 (24 K/8 K)	R5F104MJAFB*1 (24 K/8 K)	R5F104PJAFB*1 (24 K/8 K)	R5F104PJAFB*1 (24 K/8 K)
192K					R5F104EHANA*1 (20 K/8 K)	R5F104FHAFP*1 (20 K/8 K)	R5F104GHAFB*1 (20 K/8 K)	R5F104GHANA*1 (20 K/8 K)		R5F104JHAFB*1 (20 K/8 K)	R5F104LHAFB*1 (20 K/8 K)	R5F104LHAFB*1 (20 K/8 K)	R5F104LHAFB*1 (20 K/8 K)	R5F104LHAFB*1 (20 K/8 K)	R5F104LHALA*2 (20 K/8 K)	R5F104MHAFB*1 (20 K/8 K)	R5F104MHAFB*1 (20 K/8 K)	R5F104PHAFB*1 (20 K/8 K)	R5F104PHAFB*1 (20 K/8 K)	
128K	R5F104AGASP*1 (16 K/8 K)	R5F104BGANA*1 (16 K/8 K)	R5F104BGAFP*1 (16 K/8 K)	R5F104CGALA*2 (16 K/8 K)	R5F104EGANA*1 (16 K/8 K)	R5F104FGAFP*1 (16 K/8 K)	R5F104GGAFB*1 (16 K/8 K)	R5F104GGANA*1 (16 K/8 K)		R5F104JGAFB*1 (16 K/8 K)	R5F104LGAFB*1 (16 K/8 K)	R5F104LGAFB*1 (16 K/8 K)	R5F104LGAFB*1 (16 K/8 K)	R5F104LGAFB*1 (16 K/8 K)	R5F104LGALA*2 (16 K/8 K)	R5F104MGAFB*1 (16 K/8 K)	R5F104MGAFB*1 (16 K/8 K)	R5F104PGAFB*1 (16 K/8 K)	R5F104PGAFB*1 (16 K/8 K)	
96K	R5F104AFASP*1 (12 K/8 K)	R5F104BFANA*1 (12 K/8 K)	R5F104BFAFP*1 (12 K/8 K)	R5F104CFALA*2 (12 K/8 K)	R5F104EFANA*1 (12 K/8 K)	R5F104FFAFP*1 (12 K/8 K)	R5F104GFAFB*1 (12 K/8 K)	R5F104GFANA*1 (12 K/8 K)		R5F104JFAFB*1 (12 K/8 K)	R5F104LFAFB*1 (12 K/8 K)	R5F104LFAFB*1 (12 K/8 K)	R5F104LFAFB*1 (12 K/8 K)	R5F104LFAFB*1 (12 K/8 K)	R5F104LFALA*2 (12 K/8 K)	R5F104MFAFB*1 (12 K/8 K)	R5F104MFAFB*1 (12 K/8 K)	R5F104PFAFB*1 (12 K/8 K)	R5F104PFAFB*1 (12 K/8 K)	
64K	R5F104AEASP*1 (5.5 K/4 K)	R5F104BEANA*1 (5.5 K/4 K)	R5F104BEAFP*1 (5.5 K/4 K)	R5F104CEALA*2 (5.5 K/4 K)	R5F104EEANA*1 (5.5 K/4 K)	R5F104FEAFP*1 (5.5 K/4 K)	R5F104GEAFB*1 (5.5 K/4 K)	R5F104GEANA*1 (5.5 K/4 K)		R5F104JEAFB*1 (5.5 K/4 K)	R5F104LEAFB*1 (5.5 K/4 K)	R5F104LEAFB*1 (5.5 K/4 K)	R5F104LEAFB*1 (5.5 K/4 K)	R5F104LEAFB*1 (5.5 K/4 K)	R5F104LEALA*2 (5.5 K/4 K)					
48K	R5F104ADASP*1 (5.5 K/4 K)	R5F104BDANA*1 (5.5 K/4 K)	R5F104BDAFP*1 (5.5 K/4 K)	R5F104CDALA*2 (5.5 K/4 K)	R5F104EDANA*1 (5.5 K/4 K)	R5F104FDAFP*1 (5.5 K/4 K)	R5F104GDAFB*1 (5.5 K/4 K)	R5F104GDANA*1 (5.5 K/4 K)		R5F104JDAFB*1 (5.5 K/4 K)	R5F104LDAFB*1 (5.5 K/4 K)	R5F104LDAFB*1 (5.5 K/4 K)	R5F104LDAFB*1 (5.5 K/4 K)	R5F104LDAFB*1 (5.5 K/4 K)	R5F104LDALA*2 (5.5 K/4 K)					
32K	R5F104ACASP*1 (4 K/4 K)	R5F104BCANA*1 (4 K/4 K)	R5F104BCAFP*1 (4 K/4 K)	R5F104CCALA*2 (4 K/4 K)	R5F104ECANA*1 (4 K/4 K)	R5F104FCAFP*1 (4 K/4 K)	R5F104GCAFB*1 (4 K/4 K)	R5F104GCANA*1 (4 K/4 K)		R5F104JCAFB*1 (4 K/4 K)	R5F104LCAFB*1 (4 K/4 K)	R5F104LCAFB*1 (4 K/4 K)	R5F104LCAFB*1 (4 K/4 K)	R5F104LCAFB*1 (4 K/4 K)	R5F104LCAFA*2 (4 K/4 K)					
16K	R5F104AAAASP*1 (2.5 K/4 K)	R5F104BAANA*1 (2.5 K/4 K)	R5F104BAAFP*1 (2.5 K/4 K)	R5F104CAALA*2 (2.5 K/4 K)	R5F104EAANA*1 (2.5 K/4 K)	R5F104FAAFP*1 (2.5 K/4 K)	R5F104GAAFB*1 (2.5 K/4 K)	R5F104GAANA*1 (2.5 K/4 K)												
12K																				
8K																				
4K																				
2K																				
1K																				
Package	30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 	32-pin HWQFN NA thickness: 0.80 mm 5 × 5 mm Pitch: 0.50 mm 	32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm 	36-pin WFLGA LA thickness: 0.76 mm 4 × 4 mm Pitch: 0.50 mm 	40-pin HWQFN NA thickness: 0.80 mm 6 × 6 mm Pitch: 0.50 mm 	44-pin LQFP FP thickness: 1.60 mm 10 × 10 mm Pitch: 0.80 mm 	48-pin LFQFP FB thickness: 1.60 mm <sup>3</sup> 7 × 7 mm Pitch: 0.50 mm 	48-pin HWQFN NA thickness: 0.80 mm 7 × 7 mm Pitch: 0.50 mm 	52-pin LQFP FA thickness: 1.70 mm 10 × 10 mm Pitch: 0.65 mm 	64-pin LFQFP FB thickness: 1.60 mm <sup>3</sup> 10 × 10 mm Pitch: 0.50 mm 	64-pin LQFP FA thickness: 1.60 mm 12 × 12 mm Pitch: 0.65 mm 	64-pin LQFP FP thickness: 1.70 mm 14 × 14 mm Pitch: 0.80 mm 	64-pin WFLGA LA thickness: 0.76 mm 5 × 5 mm Pitch: 0.50 mm 	80-pin LFQFP FB thickness: 1.60 mm <sup>3</sup> 12 × 12 mm Pitch: 0.50 mm 	80-pin LQFP FA thickness: 1.70 mm 14 × 14 mm Pitch: 0.65 mm 	100-pin LFQFP FB thickness: 1.60 mm <sup>3</sup> 14 × 14 mm Pitch: 0.50 mm 	100-pin LQFP FA thickness: 1.60 mm 14 × 20 mm Pitch: 0.65 mm 			

Notes: 1. D version for industrial applications with operating temperature range of -40 to +85°C and G version for industrial applications with operating temperature range of -40 to +105°C also available.  
 2. G version for industrial applications with operating temperature range of -40 to +105°C also available.  
 3. Products with 384 KB or 512 KB of ROM are 1.70 mm thick.

**RL78/G1A (25 to 64 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G1A					
ROM (bytes)	Pin count	25-pin	32-pin	48-pin		64-pin	
	512K						
384K							
256K							
192K							
128K							
96K							
64K		R5F10E8EALA*1 (4 K/4 K)	R5F10E8EANA*1 (4 K/4 K)	R5F10EGDAFB*1 (4 K/4 K)	R5F10EGDANA*1 (4 K/4 K)	R5F10ELEAFB*1 (4 K/4 K)	R5F10ELEABG*1 (4 K/4 K)
48K		R5F10E8DALA*1 (3 K/4 K)	R5F10EBDANA*1 (3 K/4 K)	R5F10EGDAFB*1 (3 K/4 K)	R5F10EGDANA*1 (3 K/4 K)	R5F10ELDAFB*1 (3 K/4 K)	R5F10ELDABG*1 (3 K/4 K)
32K		R5F10E8CALA*1 (2 K/4 K)	R5F10EBCANA*1 (2 K/4 K)	R5F10EGCAFB*1 (2 K/4 K)	R5F10EGCANA*1 (2 K/4 K)	R5F10ELCAFB*1 (2 K/4 K)	R5F10ELCABG*1 (2 K/4 K)
16K		R5F10E8AALA*1 (2 K/4 K)	R5F10E8AANA*1 (2 K/4 K)	R5F10EGAAFB*1 (2 K/4 K)	R5F10EGAANA*1 (2 K/4 K)		
12K							
8K							
4K							
2K							
1K							
Package		25-pin WFLGA LA thickness: 0.76 mm 3 × 3 mm Pitch: 0.50 mm	32-pin HWQFN NA thickness: 0.80 mm 5 × 5 mm Pitch: 0.50 mm	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm	48-pin HWQFN NA thickness: 0.80 mm 7 × 7 mm Pitch: 0.50 mm	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm	64-pin VFBGA BG thickness: 0.99 mm 4 × 4 mm Pitch: 0.40 mm

Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.

**RL78/G1H (64 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G1H	
ROM (bytes)	Pin count	64-pin	
	512K		R5F11FLLANA*1 (48 K/8 K)
384K		R5F11FLKANA*1 (32 K/8 K)	
256K		R5F11FLJANA*1 (24 K/8 K)	
192K			
128K			
96K			
64K			
48K			
32K			
24K			
16K			
8K			
4K			
2K			
1K			
Package		64-pin HVQFN NA thickness: 1.00 mm 9 × 9 mm Pitch: 0.50 mm	

Note: 1. D version for industrial applications with operating temperature range of -40 to +85°C also available.

**RL78/G1D (48 pins), RL78/G1D Module (42 pins)**

Series		RL78/G1D
ROM (bytes)	Pin count	48-pin
512K		
384K		
256K		R5F11AGJANB*1 (20 K/8 K)
192K		R5F11AGHANB*1 (16 K/8 K)
128K		R5F11AGGANB*1 (12 K/8 K)
96K		
64K		
48K		
32K		
16K		
12K		
8K		
4K		
2K		
1K		
Package		48-pin HWQFN NA thickness: 0.80mm 6 × 6 mm Pitch: 0.40 mm

Note: 1. D version for industrial applications with operating temperature range of -40 to +85°C also available.

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G1D Module
ROM (bytes)	Pin count	42-pin
512K		
384K		
256K		RY7011A0000DZ00*1 (20 K/8 K)
192K		
128K		
96K		
64K		
48K		
32K		
16K		
12K		
8K		
4K		
2K		
1K		
Package		42-pin LGA Thickness: 1.7 mm 8.95 × 13.35 mm Pitch: 0.85 mm

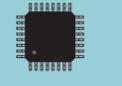
Note: 1. Operating temperature range: -25 to +75°C


**RL78/G1F (24 to 64 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G1F				
ROM (bytes)	Pin count	24-pin	32-pin	36-pin	48-pin	64-pin
512K						
384K						
256K						
192K						
128K						
96K						
64K		R5F11B7EANA*1 (5.5 K/4 K)	R5F11BBEAFP*1 (5.5 K/4 K)	R5F11BCEALA*1 (5.5 K/4 K)	R5F11BGEAFB*1 (5.5 K/4 K)	R5F11BLEAFB*1 (5.5 K/4 K)
48K						
32K		R5F11B7CANA*1 (5.5 K/4 K)	R5F11BBCAFP*1 (5.5 K/4 K)	R5F11BCCALA*1 (5.5 K/4 K)	R5F11BGCAFB*1 (5.5 K/4 K)	R5F11BLCAFB*1 (5.5 K/4 K)
16K						
12K						
8K						
4K						
2K						
1K						
Package		24-pin HWQFN NA thickness: 0.80 mm 4 × 4 mm Pitch: 0.50 mm	32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm	36-pin WFLGA LA thickness: 0.76 mm 4 × 4 mm Pitch: 0.50 mm	48-pin LQFP FB thickness: 1.70 mm 7 × 7 mm Pitch: 0.50 mm	64-pin LQFP FB thickness: 1.70 mm 10 × 10 mm Pitch: 0.50 mm

Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.



**RL78/G1G (30 to 44 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G1G		
ROM (bytes)	Pin count	30-pin	32-pin	44-pin
	512K			
384K				
256K				
192K				
128K				
96K				
64K				
48K				
32K				
16K		R5F11EAAASP (1.5 K/—)	R5F11EBAAFP (1.5 K/—)	R5F11EFAAFP (1.5 K/—)
12K				
8K		R5F11EA8ASP (1.5 K/—)	R5F11EB8AFP (1.5 K/—)	R5F11EF8AFP (1.5 K/—)
4K				
2K				
1K				
Package		30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 	32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm 	44-pin LQFP FP thickness: 1.60 mm 10 × 10 mm Pitch: 0.80 mm 

**RL78/G1C (32 to 48 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/G1C							
ROM (bytes)	Pin count	32-pin				48-pin			
	512K								
384K									
256K									
192K									
128K									
96K									
64K									
48K									
32K		R5F10JBCANA*1 (5.5 K/2 K) Host/Function	R5F10JBCAFP*1 (5.5 K/2 K) Host/Function	R5F10KBCANA*1 (5.5 K/2 K) Function only	R5F10KBCAFP*1 (5.5 K/2 K) Function only	R5F10JGCANA*1 (5.5 K/2 K) Host/Function	R5F10JGCAF*1 (5.5 K/2 K) Host/Function	R5F10KGCANA*1 (5.5 K/2 K) Function only	R5F10KGCAFP*1 (5.5 K/2 K) Function only
24K									
16K									
8K									
4K									
2K									
1K									
Package		32-pin HWQFN NA thickness: 0.80 mm 5 × 5 mm Pitch: 0.50 mm 	32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm 	32-pin HWQFN NA thickness: 0.80 mm 5 × 5 mm Pitch: 0.50 mm 	32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm 	48-pin HWQFN NA thickness: 0.80 mm 7 × 7 mm Pitch: 0.50 mm 	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm 	48-pin HWQFN NA thickness: 0.80 mm 7 × 7 mm Pitch: 0.50 mm 	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm 

Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.

**RL78/L12 (32 to 64 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/L12								
ROM (bytes)	Pin count	32-pin		44-pin	48-pin	52-pin	64-pin			
		512K								
384K										
256K										
192K										
128K										
96K										
64K										
48K										
32K		R5F10RBCAFP*1 (1.5 K/2 K)	R5F10RFCAFP*1 (1.5 K/2 K)	R5F10RGCAFB*1 (1.5 K/2 K)	R5F10RJCAFA*1 (1.5 K/2 K)	R5F10RLCAFB*1 (1.5 K/2 K)	R5F10RLCAFA*1 (1.5 K/2 K)	R5F10RLCANB*1 (1.5 K/2 K)		
24K										
16K		R5F10RBAAFP*1 (1 K/2 K)	R5F10RFAAFP*1 (1 K/2 K)	R5F10RGAAFB*1 (1 K/2 K)	R5F10RJAAFA*1 (1 K/2 K)	R5F10RLAafb*1 (1 K/2 K)	R5F10RLAAFA*1 (1 K/2 K)	R5F10RLAANB*1 (1 K/2 K)		
8K		R5F10RB8AFP*1 (1 K/2 K)	R5F10RF8AFP*1 (1 K/2 K)	R5F10RG8AFB*1 (1 K/2 K)	R5F10RJ8AFA*1 (1 K/2 K)					
4K										
2K										
1K										
Package		32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm	44-pin LQFP FP thickness: 1.60 mm 10 × 10 mm Pitch: 0.80 mm	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm	52-pin LQFP FA thickness: 1.70 mm 10 × 10 mm Pitch: 0.65 mm	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm	64-pin LQFP FA thickness: 1.60 mm 12 × 12 mm Pitch: 0.65 mm	64-pin HWQFN NB thickness: 0.80 mm 8 × 8 mm 0.40 mm		

Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.

**RL78/L13 (64 to 80 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/L13			
ROM (bytes)	Pin count	64-pin		80-pin	
		512K			
384K					
256K					
192K					
128K		R5F10WLGAFB*1 (8 K/4 K)	R5F10WLGAFB*1 (8 K/4 K)	R5F10WMGAFB*1 (8 K/4 K)	R5F10WMGAFB*1 (8 K/4 K)
96K		R5F10WLFafB*1 (6 K/4 K)	R5F10WLFafB*1 (6 K/4 K)	R5F10WMFAFB*1 (6 K/4 K)	R5F10WMFAFB*1 (6 K/4 K)
64K		R5F10WLEAFB*1 (4 K/4 K)	R5F10WLEAFB*1 (4 K/4 K)	R5F10WMEAFB*1 (4 K/4 K)	R5F10WMEAFB*1 (4 K/4 K)
48K		R5F10WLDafB*1 (2 K/4 K)	R5F10WLDafB*1 (2 K/4 K)	R5F10WMDAFB*1 (2 K/4 K)	R5F10WMDAFB*1 (2 K/4 K)
32K		R5F10WLCafB*1 (1.5 K/4 K)	R5F10WLCafB*1 (1.5 K/4 K)	R5F10WMCafB*1 (1.5 K/4 K)	R5F10WMCafB*1 (1.5 K/4 K)
24K					
16K		R5F10WLAafB*1 (1 K/4 K)	R5F10WLAafB*1 (1 K/4 K)	R5F10WMAafB*1 (1 K/4 K)	R5F10WMAafB*1 (1 K/4 K)
8K					
4K					
2K					
1K					
Package		64-pin LFQFP FB thickness: 1.70 mm 10 × 10 mm Pitch: 0.50 mm	64-pin LQFP FA thickness: 1.60 mm 12 × 12 mm Pitch: 0.65 mm	80-pin LFQFP FB thickness: 1.70 mm 12 × 12 mm Pitch: 0.50 mm	80-pin LQFP FA thickness: 1.70 mm 14 × 14 mm Pitch: 0.65 mm

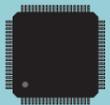
Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.

**RL78/L1C (80 to 100 pins)**

Series		RL78/L1C (USB)		
ROM (bytes)	Pin count	80-pin	85-pin	100-pin
		512K		
384K				
256K		R5F110MJAFB*1 (16 K/8 K)	R5F110NJALA*1 (16 K/8 K)	R5F110PJAFB*1 (16 K/8 K)
192K		R5F110MHAFB*1 (16 K/8 K)	R5F110NHALA*1 (16 K/8 K)	R5F110PHAFB*1 (16 K/8 K)
128K		R5F110MGAFB*1 (12 K/8 K)	R5F110NGALA*1 (12 K/8 K)	R5F110PGAFB*1 (12 K/8 K)
96K		R5F110MFAFB*1 (10 K/8 K)	R5F110NFALA*1 (10 K/8 K)	R5F110PFAFB*1 (10 K/8 K)
64K		R5F110MEAFB*1 (8 K/8 K)	R5F110NEALA*1 (8 K/8 K)	R5F110PEAFB*1 (8 K/8 K)
48K				
32K				
24K				
16K				
8K				
4K				
2K				
1K				
Package		80-pin LQFP FB thickness: 1.70 mm 12 × 12 mm Pitch: 0.50 mm 	85-pin VFLGA LA thickness: 1.00 mm 7 × 7 mm Pitch: 0.65 mm 	100-pin LQFP FB thickness: 1.70 mm 14 × 14 mm Pitch: 0.50 mm 

Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/L1C (no USB)		
ROM (bytes)	Pin count	80-pin	85-pin	100-pin
		512K		
384K				
256K		R5F111MJAFB*1 (16 K/8 K)	R5F111NJALA*1 (16 K/8 K)	R5F111PJAFB (16 K/8 K)
192K		R5F111MHAFB*1 (16 K/8 K)	R5F111NHALA*1 (16 K/8 K)	R5F111PHAFB (16 K/8 K)
128K		R5F111MGAFB*1 (12 K/8 K)	R5F111NGALA*1 (12 K/8 K)	R5F111PGAFB (12 K/8 K)
96K		R5F111MFAFB*1 (10 K/8 K)	R5F111NFALA*1 (10 K/8 K)	R5F111PFAFB (10 K/8 K)
64K		R5F111MEAFB*1 (8 K/8 K)	R5F111NEALA*1 (8 K/8 K)	R5F111PEAFB (8 K/8 K)
48K				
32K				
24K				
16K				
8K				
4K				
2K				
1K				
Package		80-pin LQFP FB thickness: 1.70 mm 12 × 12 mm Pitch: 0.50 mm 	85-pin VFLGA LA thickness: 1.00 mm 7 × 7 mm Pitch: 0.65 mm 	100-pin LQFP FB thickness: 1.70 mm 14 × 14 mm Pitch: 0.50 mm 

Note: 1. G version for industrial applications with operating temperature range of -40 to +105°C also available.

**RL78/L1A (80 to 100 pins)**

Series		RL78/L1A	
ROM (bytes)	Pin count	80-pin	100-pin
		512K	
384K			
256K			
192K			
128K			R5F11MPGAFB (8 KB/5.5 KB)
96K		R5F11MMFAFB (8 KB/5.5 KB)	R5F11MPFAFB (8 KB/5.5 KB)
64K		R5F11MMEAFB (8 KB/5.5 KB)	R5F11MPEAFB (8 KB/5.5 KB)
48K		R5F11MMDAFB (8 KB/5.5 KB)	
32K			
24K			
16K			
8K			
4K			
2K			
1K			
Package		80-pin LQFP FB thickness: 1.60 mm 12 × 12 mm Pitch: 0.50 mm 	100-pin LQFP FB thickness: 1.60 mm 14 × 14 mm Pitch: 0.50 mm 

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

**RL78/I1A (20 to 38 pins)**

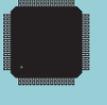
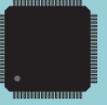
 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/I1A		
ROM (bytes)	Pin count	20-pin	30-pin	38-pin
512K				
384K				
256K				
192K				
128K				
96K				
64K			R5F107AEGSP*1 R5F107AEMSP*2 (4 K/4 K)	R5F107DEGSP*1 R5F107DEMSP*2 (4 K/4 K)
48K				
32K		R5F1076CGSP*1 R5F1076CMSP*2 (2 K/4 K)	R5F107ACGSP*1 R5F107ACMSP*2 (2 K/4 K)	
16K				
12K				
8K				
4K				
2K				
1K				
Package		20-pin LSSOP SP thickness: 1.45 mm 4.4 × 6.5 mm Pitch: 0.65 mm 	30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 	38-pin SSOP SP thickness: 2.00 mm 7.62 mm (300 mil) Pitch: 0.65 mm 

 Notes: 1. Operating temperature range: -40 to +105°C  
 2. Operating temperature range: -40 to +125°C

**RL78/I1B (80 to 100 pins), RL78/I1C (64 to 100 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/I1B		RL78/I1C		
ROM (bytes)	Pin count	80-pin	100-pin	64-pin	80-pin	100-pin
512K						
384K						
256K					R5F10NMJDFB (16 K/2 K)	R5F10NPJDFB (16 K/2 K)
192K						
128K		R5F10MMGDFB (8 K/—)	R5F10MPGDFB (8 K/—)	R5F10NLGDFB (8 K/2 K)	R5F10NMGDFB (8 K/2 K)	R5F10NPGDFB (8 K/2 K)
96K						
64K		R5F10MMEDFB (6 /—)	R5F10MPEDFB (6 K/—)	R5F10NLEDFB (6 K/2 K)	R5F10NMEDFB (6 K/2 K)	
48K						
32K						
24K						
16K						
8K						
4K						
2K						
1K						
Package		80-pin LFQFP FB thickness: 1.70 mm 12 × 12 mm Pitch: 0.50 mm 	100-pin LFQFP FB thickness: 1.70 mm 14 × 14 mm Pitch: 0.50 mm 	64-pin LFQFP FB thickness: 1.70 mm 10 × 10 mm Pitch: 0.50 mm 	80-pin LFQFP FB thickness: 1.70 mm 12 × 12 mm Pitch: 0.50 mm 	100-pin LFQFP FB thickness: 1.70 mm 14 × 14 mm Pitch: 0.50 mm 

**RL78/I1D (20 to 48 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/I1D					
ROM (bytes)	Pin count	20-pin	24-pin	30-pin	32-pin	48-pin	
512K							
384K							
256K							
192K							
128K							
96K							
64K							
48K							
32K				R5F117ACGSP (3 K/2 K)	R5F117BCGNA (3 K/2 K)	R5F117BCGFP (3 K/2 K)	R5F117GCGFB (3 K/2 K)
24K							
16K		R5F1176AGSP (2 K/2 K)	R5F1177AGNA (2 K/2 K)	R5F117AAGSP (2 K/2 K)	R5F117BAGNA (2 K/2 K)	R5F117BAGFP (2 K/2 K)	R5F117GAGFB (2 K/2 K)
8K		R5F11768GSP (0.7 K/2 K)	R5F11778GNA (0.7 K/2 K)	R5F117A8GSP (0.7 K/2 K)			
4K							
2K							
1K							
Package		20-pin LSSOP SP thickness: 1.45 mm 4.4 × 6.5 mm Pitch: 0.65 mm 	24-pin HWQFN NA thickness: 0.80 mm 4 × 4 mm Pitch: 0.50 mm 	30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm 	32-pin HVQFN NA thickness: 0.90 mm 5 × 5 mm Pitch: 0.50 mm 	32-pin LQFP FP thickness: 1.70 mm 7 × 7 mm Pitch: 0.80 mm 	48-pin LFQFP FB thickness: 1.70 mm 7 × 7 mm Pitch: 0.50 mm 

**RL78/I1E (32 to 36 pins)**

 R5F104AGASP — Top: Product name  
 (16 K/8 K) — Bottom: (RAM/Data flash (bytes))

Series		RL78/I1E	
ROM (bytes)	Pin count	32-pin	36-pin
512K			
384K			
256K			
192K			
128K			
96K			
64K			
48K			
32K		R5F11CBCGNA*1 (8 K/4 K)	R5F11CCCGBG*1 (8 K/4 K)
24K			
16K			
8K			
4K			
2K			
1K			
Package		32-pin HVQFN NA thickness: 0.90 mm 5 × 5 mm Pitch: 0.50 mm 	36-pin TFBGA BG thickness: 1.10 mm 4 × 4 mm Pitch: 0.50 mm 

Note: 1. M version for industrial applications with operating temperature range of -40 to +125°C also available.



**RL78/F13 (20 to 80 pins)**

 R5F104AGASP (16 K/8 K) — Top: Product name  
 — Bottom: (RAM/Data flash (bytes))

 R5F104AGASP (16 K/8 K) — Top: Product name  
 — Bottom: (RAM/Data flash (bytes))

Series		RL78/F13 (CAN&LIN)					
ROM (bytes)	Pin count	30-pin	32-pin	48-pin		64-pin	80-pin
		512K					
384K							
256K							
192K							
128K		R5F10BAGLSP*1 (8 K/4 K)	R5F10BBGLNA*1 (8 K/4 K)	R5F10BGGFLFB*1 (8 K/4 K)	R5F10BGGFLNA*1 (8 K/4 K)	R5F10BLGLFB*1 (8 K/4 K)	R5F10BMGLFB*1 (8 K/4 K)
96K		R5F10BAFLSP*1 (6 K/4 K)	R5F10BBFLNA*1 (6 K/4 K)	R5F10BGFLFB*1 (6 K/4 K)	R5F10BGFLNA*1 (6 K/4 K)	R5F10BLFLFB*1 (6 K/4 K)	R5F10BMFLFB*1 (6 K/4 K)
64K		R5F10BAELSP*1 (4 K/4 K)	R5F10BBELNA*1 (4 K/4 K)	R5F10BGELFB*1 (4 K/4 K)	R5F10BGELNA*1 (4 K/4 K)	R5F10BLELFB*1 (4 K/4 K)	R5F10BMELFB*1 (4 K/4 K)
48K		R5F10BADLSP*1 (3 K/4 K)	R5F10BBDLNA*1 (3 K/4 K)	R5F10BGDLFB*1 (3 K/4 K)	R5F10BGDLNA*1 (3 K/4 K)	R5F10BLDLFB*1 (3 K/4 K)	
32K		R5F10BACLSP*1 (2 K/4 K)	R5F10BBCLNA*1 (2 K/4 K)	R5F10BGCLFB*1 (2 K/4 K)	R5F10BGCLNA*1 (2 K/4 K)	R5F10BLCLFB*1 (2 K/4 K)	
24K							
16K							
8K							
4K							
2K							
1K							
Package		30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm	32-pin HVQFN NA thickness: 0.90 mm 5 × 5 mm Pitch: 0.50 mm	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm	48-pin HVQFN NA thickness: 0.90 mm 7 × 7 mm Pitch: 0.50 mm	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm	80-pin LFQFP FB thickness: 1.60 mm 12 × 12 mm Pitch: 0.50 mm

Note: 1. K version for automotive applications with operating temperature range of -40 to +125°C and Y version for automotive applications with operating temperature range of -40 to +150°C also available.

Series		RL78/F13 (LIN)						
ROM (bytes)	Pin count	20-pin	30-pin	32-pin	48-pin		64-pin	80-pin
		512K						
384K								
256K								
192K								
128K					R5F10AGGLFB*1 (8 K/4 K)	R5F10AGGLNA*1 (8 K/4 K)	R5F10ALGLFB*1 (8 K/4 K)	R5F10AMGLFB*1 (8 K/4 K)
96K					R5F10AGFLFB*1 (6 K/4 K)	R5F10AGFLNA*1 (6 K/4 K)	R5F10ALFLFB*1 (6 K/4 K)	R5F10AMFLFB*1 (6 K/4 K)
64K		R5F10A6ELSP*1 (4 K/4 K)	R5F10AAELSP*1 (4 K/4 K)	R5F10ABELNA*1 (4 K/4 K)	R5F10AGELFB*1 (4 K/4 K)	R5F10AGELNA*1 (4 K/4 K)	R5F10ALELFB*1 (4 K/4 K)	R5F10AMELFB*1 (4 K/4 K)
48K		R5F10A6DLS*1 (3 K/4 K)	R5F10AADLS*1 (3 K/4 K)	R5F10ABDLNA*1 (3 K/4 K)	R5F10AGDLFB*1 (3 K/4 K)	R5F10AGDLNA*1 (3 K/4 K)	R5F10ALDLFB*1 (3 K/4 K)	
32K		R5F10A6CLS*1 (2 K/4 K)	R5F10AACLSP*1 (2 K/4 K)	R5F10ABCLNA*1 (2 K/4 K)	R5F10AGCLFB*1 (2 K/4 K)	R5F10AGCLNA*1 (2 K/4 K)	R5F10ALCLFB*1 (2 K/4 K)	
24K								
16K		R5F10A6ALS*1 (1 K/4 K)	R5F10AAALS*1 (1 K/4 K)	R5F10ABALNA*1 (1 K/4 K)	R5F10AGALFB*1 (1 K/4 K)	R5F10AGALNA*1 (1 K/4 K)		
8K								
4K								
2K								
1K								
Package		20-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm	30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm	32-pin HVQFN NA thickness: 0.90 mm 5 × 5 mm Pitch: 0.50 mm	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm	48-pin HVQFN NA thickness: 0.90 mm 7 × 7 mm Pitch: 0.50 mm	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm	80-pin LFQFP FB thickness: 1.60 mm 12 × 12 mm Pitch: 0.50 mm

Note: 1. K version for automotive applications with operating temperature range of -40 to +125°C and Y version for automotive applications with operating temperature range of -40 to +150°C also available.

**RL78/F14 (30 to 100 pins)**

 R5F104AGASP (16 K/8 K) — Top: Product name  
 — Bottom: (RAM/Data flash (bytes))

Series		RL78/F14						
ROM (bytes)	Pin count	30-pin	32-pin	48-pin	64-pin	80-pin	100-pin	
512K								
384K								
256K				R5F10PGJLFB*1 (20 K/8 K)	R5F10PGJLNA*1 (20 K/8 K)	R5F10PLJLFB*1 (20 K/8 K)	R5F10PMJLFB*1 (20 K/8 K)	R5F10PPJLFB*1 (20 K/8 K)
192K				R5F10PGHLFB*1 (16 K/8 K)	R5F10PGHLNA*1 (16 K/8 K)	R5F10PLHLFB*1 (16 K/8 K)	R5F10PMHLFB*1 (16 K/8 K)	R5F10PPHLFB*1 (16 K/8 K)
128K				R5F10PGGLFB*1 (10 K/8 K)	R5F10PGGLNA*1 (10 K/8 K)	R5F10PLGLFB*1 (10 K/8 K)	R5F10PMGLFB*1 (10 K/8 K)	R5F10PPGLFB*1 (10 K/8 K)
96K				R5F10PGFLFB*1 (8 K/4 K)	R5F10PGFLNA*1 (8 K/4 K)	R5F10PLFLFB*1 (8 K/4 K)	R5F10PMFLFB*1 (8 K/4 K)	R5F10PPFLFB*1 (8 K/4 K)
64K		R5F10PAELSP*1 (6 K/4 K)	R5F10PBELNA*1 (6 K/4 K)	R5F10PGELFB*1 (6 K/4 K)	R5F10PGELNA*1 (6 K/4 K)	R5F10PLELFB*1 (6 K/4 K)	R5F10PMELFB*1 (6 K/4 K)	R5F10PELFB*1 (6 K/4 K)
48K		R5F10PADLSP*1 (4 K/4 K)	R5F10PBDLNA*1 (4 K/4 K)	R5F10PGDLFB*1 (4 K/4 K)	R5F10PGDLNA*1 (4 K/4 K)			
32K								
24K								
16K								
8K								
4K								
2K								
1K								
Package		30-pin LSSOP SP thickness: 1.40 mm 7.62 mm (300 mil) Pitch: 0.65 mm	32-pin HVQFN NA thickness: 0.90 mm 5 × 5 mm Pitch: 0.50 mm	48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm	48-pin HVQFN NA thickness: 0.90 mm 7 × 7 mm Pitch: 0.50 mm	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm	80-pin LFQFP FB thickness: 1.60 mm 12 × 12 mm Pitch: 0.50 mm	100-pin LFQFP FB thickness: 1.60 mm 14 × 14 mm Pitch: 0.50 mm

Note: 1. K version for automotive applications with operating temperature range of -40 to +125°C and Y version for automotive applications with operating temperature range of -40 to +150°C also available.

**RL78/F15 (48 to 144 pins)**

 R5F104AGASP (16 K/8 K) — Top: Product name  
 — Bottom: (RAM/Data flash (bytes))

Series		RL78/F15					
ROM (bytes)	Pin count	48-pin	64-pin	80-pin	100-pin	144-pin	
512K		R5F113GLLFB*1 (32 K/16 K)	R5F113GLLNA*1 (32 K/16 K)	R5F113LLLFB*1 (32 K/16 K)	R5F113MLLFB*1 (32 K/16 K)	R5F113PLLFB*1 (32 K/16 K)	R5F113TLLFB*1 (32 K/16 K)
384K		R5F113GKLF*1 (26 K/16 K)	R5F113GKLN*1 (26 K/16 K)	R5F113LKLFB*1 (26 K/16 K)	R5F113MKLFB*1 (26 K/16 K)	R5F113PKLFB*1 (26 K/16 K)	R5F113TKLFB*1 (26 K/16 K)
256K						R5F113PJLFB*1 (20 K/8 K)	R5F113TJLFB*1 (20 K/8 K)
192K						R5F113PHLFB*1 (16 K/8 K)	R5F113THLFB*1 (16 K/8 K)
128K						R5F113PGLFB*1 (10 K/8 K)	R5F113TGLFB*1 (10 K/8 K)
96K							
64K							
48K							
32K							
24K							
16K							
8K							
4K							
2K							
1K							
Package		48-pin LFQFP FB thickness: 1.60 mm 7 × 7 mm Pitch: 0.50 mm	48-pin HVQFN NA thickness: 0.90 mm 7 × 7 mm Pitch: 0.50 mm	64-pin LFQFP FB thickness: 1.60 mm 10 × 10 mm Pitch: 0.50 mm	80-pin LFQFP FB thickness: 1.60 mm 12 × 12 mm Pitch: 0.50 mm	100-pin LFQFP FB thickness: 1.60 mm 14 × 14 mm Pitch: 0.50 mm	144-pin LFQFP FB thickness: 1.60 mm 20 × 20 mm Pitch: 0.50 mm

Note: 1. K version for automotive applications with operating temperature range of -40 to +125°C also available.



**RL78/G12 (20 to 30 pins)**

Series		RL78/G12																											
Pin count		20-pin										24-pin								30-pin									
Product name		R5F10266ASP <sup>*1*</sup>	R5F10267ASP <sup>*1*</sup>	R5F10268ASP <sup>*1*</sup>	R5F10269ASP <sup>*1*</sup>	R5F1026AASP <sup>*1*</sup>	R5F10366ASP <sup>*1</sup>	R5F10367ASP <sup>*1</sup>	R5F10368ASP <sup>*1</sup>	R5F10369ASP <sup>*1</sup>	R5F1036AASP <sup>*1</sup>	R5F10277ANA <sup>*1*</sup>	R5F10278ANA <sup>*1*</sup>	R5F10279ANA <sup>*1*</sup>	R5F1027AANA <sup>*1*</sup>	R5F10377ANA <sup>*1</sup>	R5F10378ANA <sup>*1</sup>	R5F10379ANA <sup>*1</sup>	R5F1037AANA <sup>*1</sup>	R5F1027AASP <sup>*1*</sup>	R5F1027BASP <sup>*1*</sup>	R5F1027CASP <sup>*1*</sup>	R5F1027DASP <sup>*1*</sup>	R5F1037AASP <sup>*1</sup>	R5F1037BASP <sup>*1</sup>	R5F1037CASP <sup>*1</sup>	R5F1037DASP <sup>*1</sup>		
CPU		RL78 CPU core																											
Memory	Flash ROM [bytes]	2 K	4 K	8 K	12 K	16 K	2 K	4 K	8 K	12 K	16 K	4 K	8 K	12 K	16 K	4 K	8 K	12 K	16 K	4 K	8 K	12 K	16 K	4 K	8 K	12 K	16 K		
	Data flash [bytes]	2 K					—					2 K				—				2 K				—					
	RAM [bytes]	256	512	768	1 K	1.5 K	256	512	768	1 K	1.5 K	512	768	1 K	1.5 K	512	768	1 K	1.5 K	512	768	1 K	2 K	512	768	1 K	2 K		
Operating clocks	Maximum operating frequency [Hz]	24 MHz																											
	On-chip oscillator clock	20 MHz																											
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V)																											
	High-speed on-chip oscillator [Hz]	1 to 24 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V)																											
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.8 to 5.5 V)																											
	Subclock (32.768 kHz)	—																											
I/O	I/O ports	18										22								26									
	N-channel open drain (6 V tolerance)	—										2								—									
	N-channel open drain (V <sub>DD</sub> tolerance)	4										5								9									
Timers	16-bit timer TAU [channels]	4, PWM output × 3																											
	Real-time clock (RTC) [channels]	—																											
	Watchdog timer (WDT) [channels]	1																											
	Interval timer [channels]	12-bit × 1																											
Serial interfaces	CSI × 1, UART × 1	—					1					—				1				—				1					
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	1					—					1				—				—									
	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	—										3								—									
	I <sup>2</sup> C × 1	—										1								—									
DMA [channels]	2					—					2				—				2				—						
External interrupt pins [count]	10										14								6										
OCD	On-chip debugging	Yes																											
Peripheral functions	8/10-bit A/D converter [channels]	11																											
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																											
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD),										clock/buzzer output × 1								Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output × 2									
Safety functions	illegal memory access	RAM parity error detection function, detection function, frequency detection function, A/D converter test function																											
	CRC calculation function (general-purpose), RAM guard function, SFR guard function	—					—					CRC calculation function (general-purpose), RAM guard function, SFR guard function				—				CRC calculation function (general-purpose), RAM guard function, SFR guard function				—					
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.8 to 5.5 V																											
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to										+ 85°C (A: Consumer applications, D: Industrial applications) *1								T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *2									
	Package (size [mm])	20-LSSOP (4.4 × 6.5 mm)										24-HWQFN (4 × 4 mm)								30-LSSOP (7.62 mm (300 mil))									

Notes: A dedicated library (approx. 8.1 KB) is required to use the data flash.

- The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F10xxxDxx. For details, see "How to read RL78 Family product numbers" on page 122.
- The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10xxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.
- Figures in parentheses ( ) are when the PDIOR function is used.

**RL78/G13 (20 to 32 pins)**

Series		RL78/G13																																															
Pin count		20-pin								24-pin								25-pin								30-pin								32-pin															
Product name		R5F1006AASP <sup>*2*</sup>	R5F1006CASP <sup>*2*</sup>	R5F1006DASP <sup>*2*</sup>	R5F1006EASP <sup>*2*</sup>	R5F1016AASP <sup>*2</sup>	R5F1016CASP <sup>*2</sup>	R5F1016DASP <sup>*2</sup>	R5F1016EASP <sup>*2</sup>	R5F1007AANA <sup>*2*</sup>	R5F1007CANA <sup>*2*</sup>	R5F1007DANA <sup>*2*</sup>	R5F1007EANA <sup>*2*</sup>	R5F1017AANA <sup>*2</sup>	R5F1017CANA <sup>*2</sup>	R5F1017DANA <sup>*2</sup>	R5F1017EANA <sup>*2</sup>	R5F1008AALA <sup>*3</sup>	R5F1008CALA <sup>*3</sup>	R5F1008DALA <sup>*3</sup>	R5F1008EALA <sup>*3</sup>	R5F1018AALA	R5F1018CALA	R5F1018DALA	R5F1018EALA	R5F100AAASP <sup>*2*</sup>	R5F100ACASP <sup>*2*</sup>	R5F100ADASP <sup>*2*</sup>	R5F100AEASP <sup>*2*</sup>	R5F100AFASP <sup>*2*</sup>	R5F100AGASP <sup>*2*</sup>	R5F101AAASP <sup>*2</sup>	R5F101ACASP <sup>*2</sup>	R5F101ADASP <sup>*2</sup>	R5F101AEASP <sup>*2</sup>	R5F101AFASP <sup>*2</sup>	R5F101AGASP <sup>*2</sup>	R5F100BAANA <sup>*2*</sup>	R5F100BCANA <sup>*2*</sup>	R5F100BDANA <sup>*2*</sup>	R5F100BEANA <sup>*2*</sup>	R5F100BFANA <sup>*2*</sup>	R5F100BGANA <sup>*2*</sup>	R5F101BAANA <sup>*2</sup>	R5F101BCANA <sup>*2</sup>	R5F101BDANA <sup>*2</sup>	R5F101BEANA <sup>*2</sup>	R5F101BFANA <sup>*2</sup>	R5F101BGANA <sup>*2</sup>
CPU		RL78 CPU core																																															
Memory	Flash ROM [bytes]	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	96 K	128 K	16 K	32 K	48 K	64 K	96 K	128 K	16 K	32 K	48 K	64 K	96 K	128 K						
	Data flash [bytes]	4 K				—				4 K				—				4 K				—				4 K				8 K				—				4 K				8 K				—			
	RAM [bytes]	2 K	2 K	3 K	4 K	2 K	2 K	3 K	4 K	2 K	2 K	3 K	4 K	2 K	2 K	3 K	4 K	2 K	2 K	3 K	4 K	2 K	2 K	3 K	4 K	2 K	2 K	3 K	4 K	8 K	12 K	2 K	2 K	3 K	4 K	8 K	12 K	2 K	2 K	3 K	4 K	8 K	12 K	2 K	2 K	3 K	4 K	8 K	12 K
Operating clocks	Maximum operating frequency [Hz]	32 MHz																																															
	On-chip oscillator clock	20 MHz																																															
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),																1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																															
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),																1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																															
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																																															
	Subclock (32.768 kHz)	—																																															
I/O	I/O ports	16								20								21								26								28															
	N-channel open drain (6 V tolerance)	—								—								—								2								3															
	N-channel open drain (V <sub>DD</sub> tolerance)	5								—								6								—								9															
Timers	16-bit timer TAU [channels]	8, PWM output × 2								—								8, PWM output × 3								—								8, PWM output × 3 (7) <sup>**4</sup>															
	Real-time clock (RTC) [channels]	1 <sup>*1</sup>																																															
	Watchdog timer (WDT) [channels]	1																																															
	Interval timer [channels]	12-bit × 1																																															
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	—																2																															
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	—																																															
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	—																1																															
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	—																																															
	I <sup>2</sup> C × 1	—								—								—								1																							
DMA [channels]	—																2																																
External interrupt pins [count]	3								—								5								—								6																
OCD	On-chip debugging	Yes																																															
Peripheral functions	8/10-bit A/D converter [channels]	6																8																															
	Multiplier/divider/multiply-accumulator	—																Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																															
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD)								Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer								output × 1								Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output × 2																							
Safety functions	Flash memory CRC calculation function (high-speed), CRC illegal memory access																calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, detection function, frequency detection function, A/D converter test function																																
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V																																															
	Operating ambient temperature [°C]	T <sub>A</sub> = -40																to +85°C (A: Consumer applications, D: Industrial applications) <sup>**2</sup> T <sub>A</sub> = -40 to +105°C (G: Industrial applications) <sup>**3</sup>																															
	Package (size [mm])	20-LSSOP (7.62 mm (300 mil))								24-HWQFN (4 × 4 mm)								25-WFLGA (3 × 3 mm)								30-LSSOP (7.62 mm (300 mil))								32-HWQFN (5 × 5 mm)															

 Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

- Products with pin counts from 20 to 32 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.
- The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F10xxxDxx. For details, see "How to read RL78 Family product numbers" on page 122.
- The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10xxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.
- Figures in parentheses ( ) are when the PDIOR function is used.

**RL78/G13 (36 to 44 pins)**

Series		RL78/G13																																													
Pin count		36-pin												40-pin								44-pin																									
Product name		R5F100CAALA <sup>*3</sup>	R5F100CCALA <sup>*3</sup>	R5F100CDALA <sup>*3</sup>	R5F100CEALA <sup>*3</sup>	R5F100CFALA <sup>*3</sup>	R5F100CGALA <sup>*3</sup>	R5F101CAALA	R5F101CCALA	R5F101CDALA	R5F101CEALA	R5F101CFALA	R5F101CGALA	R5F100EAANA <sup>**2*3</sup>	R5F100ECANA <sup>**2*3</sup>	R5F100EDANA <sup>**2*3</sup>	R5F100EEANA <sup>**2*3</sup>	R5F100EFANA <sup>**2*3</sup>	R5F100EGANA <sup>**2*3</sup>	R5F100EHANA <sup>**2*3</sup>	R5F101EAANA <sup>*2</sup>	R5F101ECANA <sup>*2</sup>	R5F101EDANA <sup>*2</sup>	R5F101EEANA <sup>*2</sup>	R5F101EFANA <sup>*2</sup>	R5F101EGANA <sup>*2</sup>	R5F101EHANA <sup>*2</sup>	R5F100FAAFP <sup>**2*3</sup>	R5F100FCAFP <sup>**2*3</sup>	R5F100FDAFP <sup>**2*3</sup>	R5F100FEAFP <sup>**2*3</sup>	R5F100FFAFP <sup>**2*3</sup>	R5F100FGAFP <sup>**2*3</sup>	R5F100FHAFP <sup>**2*3</sup>	R5F100FJAFP <sup>**2*3</sup>	R5F100FKAFP <sup>*2</sup>	R5F100FLAFP <sup>*2</sup>	R5F101FAAFP <sup>*2</sup>	R5F101FCAFP <sup>*2</sup>	R5F101FDAFP <sup>*2</sup>	R5F101FEAFP <sup>*2</sup>	R5F101FFAFP <sup>*2</sup>	R5F101FGAFP <sup>*2</sup>	R5F101FHAFP <sup>*2</sup>	R5F101FJAFP <sup>*2</sup>	R5F101FKAFP <sup>*2</sup>	R5F101FLAFP <sup>*2</sup>
CPU		RL78 CPU core																																													
Memory	Flash ROM [bytes]	16 K	32 K	48 K	64 K	96 K	128 K	16 K	32 K	48 K	64 K	96 K	128 K	16 K	32 K	48 K	64 K	96 K	128 K	192 K	16 K	32 K	48 K	64 K	96 K	128 K	192 K	16 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K	16 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K
	Data flash [bytes]	4 K				8 K				—				4 K				8 K				—				4 K				8 K				—													
	RAM [bytes]	2 K	2 K	3 K	4 K	8 K	12 K	2 K	2 K	3 K	4 K	8 K	12 K	2 K	2 K	3 K	4 K	8 K	12 K	16 K	2 K	2 K	3 K	4 K	8 K	12 K	16 K	2 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K	2 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K
Operating clocks	Maximum operating frequency [Hz]	32 MHz																																													
	On-chip oscillator clock	20 MHz																																													
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),																1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																													
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),																1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																													
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																																													
	Subclock (32.768 kHz)	—																32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																													
I/O ports	I/O ports	32												36								40																									
	N-channel open drain (6 V tolerance)	—												3								4																									
	N-channel open drain (V <sub>DD</sub> tolerance)	—												10								—																									
Timers	16-bit timer TAU [channels]	8, PWM output × 3 (7) **4																8, PWM output × 4 (7) **4																													
	Real-time clock (RTC) [channels]	1*1												—								1																									
	Watchdog timer (WDT) [channels]	1																																													
	Interval timer [channels]	12-bit × 1																																													
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	—																2																													
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	—																																													
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	—																—																													
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	—																1																													
	I <sup>2</sup> C × 1	—																1																													
DMA [channels]	—																2																														
External interrupt pins [count]	6												—								10																										
OCD	On-chip debugging	Yes																																													
Peripheral functions	8/10-bit A/D converter [channels]	8												9								10																									
	Multiplier/divider/multiply-accumulator	Library support for																multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned)																													
	Other functions	Power-on reset																accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned) (POR), low-voltage detection circuit (LVD), clock/buzzer output × 2																													
Safety functions	Flash memory CRC calculation function (high-speed), CRC illegal memory access																calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, detection function, frequency detection function, A/D converter test function																														
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V																																													
	Operating ambient temperature [°C]	T <sub>A</sub> = -40																to +85°C (A: Consumer applications, D: Industrial applications) *2 T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *3																													
	Package (size [mm])	36-WFLGA (4 × 4 mm)												40-HWQFN								(6 × 6 mm)												44-LQFP (10 × 10 mm)													

Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

- Products with a pin count of 36 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.
- The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F10xxxDxx. For details, see "How to read RL78 Family product numbers" on page 122.
- The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10xxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.
- Figures in parentheses ( ) are when the PDIR function is used.

RL78/G13 (48 to 52 pins)

Series		RL78/G13																																																			
Pin count		48-pin														52-pin																																					
Product name		①RSF100GAAFB <sup>*1,2</sup>	②RSF100GAANA <sup>*1,2</sup>	①RSF100GCAF <sup>*1,2</sup>	②RSF100GCANA <sup>*1,2</sup>	①RSF100GD <sup>*1,2</sup>	②RSF100GDANA <sup>*1,2</sup>	①RSF100GEAF <sup>*1,2</sup>	②RSF100GEANA <sup>*1,2</sup>	①RSF100GF <sup>*1,2</sup>	②RSF100GFANA <sup>*1,2</sup>	①RSF100GGAF <sup>*1,2</sup>	②RSF100GGANA <sup>*1,2</sup>	①RSF100GHAF <sup>*1,2</sup>	②RSF100GHANA <sup>*1,2</sup>	①RSF100GJAF <sup>*1,2</sup>	②RSF100GJANA <sup>*1,2</sup>	①RSF100GKAF <sup>*1</sup>	②RSF100GKANA <sup>*1</sup>	①RSF100GLAF <sup>*1</sup>	②RSF100GLANA <sup>*1</sup>	①RSF101GEAF <sup>*1</sup>	②RSF101GEANA <sup>*1</sup>	①RSF101GF <sup>*1</sup>	②RSF101GFANA <sup>*1</sup>	①RSF101GGAF <sup>*1</sup>	②RSF101GGANA <sup>*1</sup>	①RSF101GHAF <sup>*1</sup>	②RSF101GHANA <sup>*1</sup>	①RSF101GJAF <sup>*1</sup>	②RSF101GJANA <sup>*1</sup>	①RSF101GKAF <sup>*1</sup>	②RSF101GKANA <sup>*1</sup>	①RSF101GLAF <sup>*1</sup>	②RSF101GLANA <sup>*1</sup>	RSF100JCAFA <sup>*1,2</sup>	RSF100JDAFA <sup>*1,2</sup>	RSF100JEAFA <sup>*1,2</sup>	RSF100JFAFA <sup>*1,2</sup>	RSF100JGAFA <sup>*1,2</sup>	RSF100JHAFA <sup>*1,2</sup>	RSF100JJAFA <sup>*1,2</sup>	RSF100JKAFA <sup>*1</sup>	RSF100JLAFA <sup>*1</sup>	RSF101JCAFA <sup>*1</sup>	RSF101JDAFA <sup>*1</sup>	RSF101JEAFA <sup>*1</sup>	RSF101JFAFA <sup>*1</sup>	RSF101JGAFA <sup>*1</sup>	RSF101JHAFA <sup>*1</sup>	RSF101JJAFA <sup>*1</sup>	RSF101JKAFA <sup>*1</sup>	RSF101JLAFA <sup>*1</sup>
CPU		RL78 CPU core																																																			
Memory	Flash ROM [bytes]	16 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K	16 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K														
	Data flash [bytes]	4 K				8 K				—														4 K				8 K				—																					
	RAM [bytes]	2 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K	2 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K														
Operating clocks	Maximum operating frequency [Hz]	32 MHz																																																			
	On-chip oscillator clock	20 MHz																																																			
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),														1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																																					
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),														1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																																					
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																																																			
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																																																			
I/O ports	I/O ports	44														48																																					
	N-channel open drain (6 V tolerance)	—														4																																					
	N-channel open drain (V <sub>DD</sub> tolerance)	11														13																																					
Timers	16-bit timer TAU [channels]	8, PWM output × 4 (7) <sup>*3</sup>																																																			
	Real-time clock (RTC) [channels]	1																																																			
	Watchdog timer (WDT) [channels]	1																																																			
	Interval timer [channels]	12-bit × 1																																																			
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	1																																																			
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	1																																																			
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	—																																																			
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	1																																																			
	I <sup>2</sup> C × 1	1																																																			
DMA [channels]		2																																																			
External interrupt pins [count]		13														15																																					
OCD	On-chip debugging	Yes																																																			
Peripheral functions	8/10-bit A/D converter [channels]	10														12																																					
	Multiplier/divider/multiplier-accumulator	Library support for														multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																																					
	Other functions	Power-on reset														(POR), low-voltage detection circuit (LVD), clock/buzzer output × 2																																					
Safety functions		Flash memory CRC calculation function (high-speed), CRC illegal memory access														calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, detection function, frequency detection function, A/D converter test function																																					
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V																																																			
	Operating ambient temperature [°C]	T <sub>A</sub> = -40														to +85°C (A: Consumer applications, D: Industrial applications) <sup>*1</sup> T <sub>A</sub> = -40 to +105°C (G: Industrial applications) <sup>*2</sup>																																					
	Package (size [mm])	①48-LFQFP (7 × 7 mm) ②48-HWQFN (7 × 7 mm)														52-LQFP (10 × 10 mm)																																					

Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

1. The version for industrial applications with an operating temperature range of -40 to +85°C is the RSF10xxxDxx. For details, see "How to read RL78 Family product numbers" on page 122.
2. The version for industrial applications with an operating temperature range of -40 to +105°C is the RSF10xxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.
3. Figures in parentheses ( ) are when the PIOR function is used.

**RL78/G13 (64 pins)**

Series		RL78/G13																										
Pin count		64-pin																										
Product name		①.R5F100LCAFA <sup>**2</sup>	②.R5F100LCAFB <sup>**2</sup>	③.R5F100LCABG <sup>*2</sup>	①.R5F100LDAFA <sup>**2</sup>	②.R5F100LDAFB <sup>**2</sup>	③.R5F100LDABG <sup>*2</sup>	①.R5F100LEAFA <sup>**2</sup>	②.R5F100LEAFB <sup>**2</sup>	③.R5F100LEABG <sup>*2</sup>	①.R5F100LFAFA <sup>**2</sup>	②.R5F100LFAFB <sup>**2</sup>	③.R5F100LFABG <sup>*2</sup>	①.R5F100LGAFA <sup>**2</sup>	②.R5F100LGAFB <sup>**2</sup>	③.R5F100LGABG <sup>*2</sup>	①.R5F100LHAFA <sup>**2</sup>	②.R5F100LHAFB <sup>**2</sup>	③.R5F100LHABG <sup>*2</sup>	①.R5F100LJAFA <sup>**2</sup>	②.R5F100LJAFB <sup>**2</sup>	③.R5F100LJABG <sup>*2</sup>	①.R5F100LKAFB <sup>*1</sup>	②.R5F100LKAFB <sup>*1</sup>	③.R5F100LLAFB <sup>*1</sup>	①.R5F100LLAFA <sup>*1</sup>	②.R5F100LLAFA <sup>*1</sup>	③.R5F100LLAFB <sup>*1</sup>
CPU		RL78 CPU core																										
Memory	Flash ROM [bytes]	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K									
	Data flash [bytes]	4 K			8 K																—							
	RAM [bytes]	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K	2 K	3 K	4 K	8 K	12 K	16 K	20 K	24 K	32 K									
Operating clocks	Maximum operating frequency [Hz]	32 MHz																										
	On-chip oscillator clock	20 MHz																										
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																										
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																										
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																										
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																										
I/O ports	I/O ports	58																										
	N-channel open drain (6 V tolerance)	4																										
	N-channel open drain (V <sub>DD</sub> tolerance)	15																										
Timers	16-bit timer TAU [channels]	8, PWM output × 7																										
	Real-time clock (RTC) [channels]	1																										
	Watchdog timer (WDT) [channels]	1																										
	Interval timer [channels]	12-bit × 1																										
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	—																										
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	2																										
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	—																										
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	1																										
	I <sup>2</sup> C × 1	1																										
DMA [channels]		2																										
External interrupt pins [count]		16 (18) *3																										
OCD	On-chip debugging	Yes																										
Peripheral functions	8/10-bit A/D converter [channels]	12																										
	Multiplier/divider/multiply-accumulator	Library support for	multiply/divide/multiply-accumulate operations (equipped with functional unit)																	Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned)	Divide: 32-bit ÷ 32-bit = 32-bit (unsigned)							
	Other functions	Multiply-	accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																	Power-on reset	(POR), low-voltage detection circuit (LVD), clock/buzzer output × 2							
Safety functions		Flash memory CRC calculation function (high-speed), CRC illegal memory access	calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, detection function, frequency detection function, A/D converter test function																									
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V																										
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications, D: Industrial applications) *1 T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *2																										
	Package (size [mm])	① 64-LQFP (12 × 12 mm)	② 64-LFQFP (10 × 10 mm)	③ 64-VFBGA (4 × 4 mm)																								

Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

1. The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F10xxxDxx. For details, see "How to read RL78 Family product numbers" on page 122.
2. The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10xxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.
3. Figures in parentheses ( ) are when the PIOR function is used.







**RL78/G14 (52 to 100 pins)**

Series		RL78/G14																															
Pin count		52-pin								64-pin								80-pin								100-pin							
Product name		R5F104JCAF <sup>*1,2</sup>	R5F104JDAFA <sup>*1,2</sup>	R5F104JEFA <sup>*1,2</sup>	R5F104JFAFA <sup>*1,2</sup>	R5F104JGFA <sup>*1,2</sup>	R5F104JHFA <sup>*1,2</sup>	R5F104JJAFA <sup>*1,2</sup>	R5F104LCAF <sup>*1,2</sup>	R5F104LDAFA <sup>*1,2</sup>	R5F104LEFA <sup>*1,2</sup>	R5F104LFAFA <sup>*1,2</sup>	R5F104LGAFA <sup>*1,2</sup>	R5F104LHFA <sup>*1,2</sup>	R5F104LJFA <sup>*1,2</sup>	R5F104LLFA <sup>*1,2</sup>	R5F104MCAF <sup>*1,2</sup>	R5F104MDAFA <sup>*1,2</sup>	R5F104MEFA <sup>*1,2</sup>	R5F104MFAFA <sup>*1,2</sup>	R5F104MHFA <sup>*1,2</sup>	R5F104MJFA <sup>*1,2</sup>	R5F104MLFA <sup>*1,2</sup>	R5F104MKAFA <sup>*1,2</sup>	R5F104MLAFA <sup>*1,2</sup>	R5F104MPLAFA <sup>*1,2</sup>	R5F104PKAFA <sup>*1,2</sup>	R5F104PLAFA <sup>*1,2</sup>					
CPU		RL78 CPU core																															
Memory	Flash ROM [bytes]	32 K	48 K	64 K	96 K	128 K	192 K	256 K	32 K	48 K	64 K	96 K	128 K	192 K	256 K	384 K	512 K	96 K	128 K	192 K	256 K	384 K	512 K	96 K	128 K	192 K	256 K	384 K	512 K				
	Data flash [bytes]	4 K				8 K				4 K				8 K				12 K				16 K				20 K				24 K			
	RAM [bytes]	4 K	5.5 K	12 K	16 K	20 K	24 K	4 K	5.5 K				12 K	16 K	20 K	24 K	32 K	48 K	12 K	16 K	20 K	24 K	32 K	48 K	12 K	16 K	20 K	24 K	32 K	48 K			
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		32 MHz																													
		External resonator		20 MHz																													
		Timer RD clock		64 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																													
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)																															
	High-speed on-chip oscillator [Hz]	1 to 64 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V) *Timer RD only, operation at 48 or 64 MHz supported																															
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																															
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)																															
I/O	I/O ports	48								58								74				92											
	N-channel open drain (6 V tolerance)									16								25				28											
	N-channel open drain (V <sub>DD</sub> tolerance)	14																															
Timers	16-bit timer TAU [channels]	4, PWM output × 3																															
	16-bit timer RJ [channels]	1																															
	16-bit timer RD [channels]	2, PWM output × 6																															
	16-bit timer RG [channels]	1, PWM output × 1																															
	Real-time clock (RTC) [channels]	1																															
	Watchdog timer (WDT) [channels]	1																															
	Interval timer [channels]	12-bit × 1																															
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	1								2								3															
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	1																															
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	—																															
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	1																															
	I <sup>2</sup> C × 1	1																															
DTC (sources)		30	32	31	33	39																											
ELC (inputs/trigger outputs)		20/7	22/9	20/7	22/9	26/9																											
External interrupt pins [count]		15				15 (19) *3				15 (19) *3				16 (20) *3																			
OCD	On-chip debugging	Yes																															
Peripheral functions	8/10-bit A/D converter [channels]	12																															
	8-bit D/A converter [channels]	—				2				—				2																			
	Multiplier/divider/multiply-accumulator	Multiply/divide/ multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																															
	Comparator	—				2				—				2																			
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output × 2																															
Safety functions		Flash memory CRC calculation function (high-speed), CRC illegal memory access detection function, calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, frequency detection function, A/D converter test function, I/O power output signal level detection function																															
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V																															
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications, D: Industrial applications) *1, T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *2																															
	Package (size [mm])	52-LQFP (10 × 10 mm)				①64-LQFP (10 × 10 mm) ②64-LQFP (12 × 12 mm) ③64-LQFP (14 × 14 mm)				②64-WFLGA (5 × 5 mm)				①80-LQFP (12 × 12 mm) ②80-LQFP (14 × 14 mm)				①100-LQFP (14 × 14 mm) ②100-LQFP (14 × 20 mm)															

Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

- The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F104xxDxx. For details, see "How to read RL78 Family product numbers" on page 122.
- The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F104xxGxx. For details, see "How to read RL78 Family product numbers" on page 122.
- Figures in parentheses ( ) are when the PDIOR function is used.

**RL78/G1A (25 to 64 pins)**

Series		RL78/G1A																					
Pin count		25-pin				32-pin				48-pin				64-pin									
Product name		R5F10E8AALA <sup>#2</sup>	R5F10E8CALA <sup>#2</sup>	R5F10E8DALA <sup>#2</sup>	R5F10E8EALA <sup>#2</sup>	R5F10E8AANA <sup>#2</sup>	R5F10E8CANA <sup>#2</sup>	R5F10E8DANA <sup>#2</sup>	R5F10E8EANA <sup>#2</sup>	①R5F10EGAAFB <sup>#2</sup>	②R5F10EGAAVA <sup>#2</sup>	①R5F10EGCAF <sup>#2</sup>	②R5F10EGCAN <sup>#2</sup>	①R5F10EGDAFB <sup>#2</sup>	②R5F10EGDANA <sup>#2</sup>	①R5F10EGEAF <sup>#2</sup>	②R5F10EGEANA <sup>#2</sup>	①R5F10ELCAF <sup>#2</sup>	②R5F10ELCABG <sup>#2</sup>	①R5F10ELDADF <sup>#2</sup>	②R5F10ELDABG <sup>#2</sup>	①R5F10ELEAF <sup>#2</sup>	②R5F10ELEABG <sup>#2</sup>
CPU		RL78 CPU core																					
Memory	Flash ROM [bytes]	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	32 K	48 K	64 K	32 K	48 K	64 K	32 K	48 K	64 K	
	Data flash [bytes]	4 K																					
	RAM [bytes]	2 K	3 K	4 K	2 K	3 K	4 K	2 K	3 K	4 K	2 K	3 K	4 K	2 K	3 K	4 K							
Operating clocks	Maximum operating frequency [Hz]	32 MHz																					
	On-chip oscillator clock	32 MHz																					
	External resonator	20 MHz																					
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)																					
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)																					
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)																					
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)																					
I/O	I/O ports	19				26				42				56									
	N-channel open drain (6 V tolerance)	2				3				4				12									
	N-channel open drain (V <sub>DD</sub> tolerance)	6				9				11				12									
Timers	16-bit timer TAU [channels]	8, PWM output × 1				8, PWM output × 3				8, PWM output × 6													
	Real-time clock (RTC) [channels]	1*1																					
	Watchdog timer (WDT) [channels]	1																					
	Interval timer [channels]	12-bit × 1																					
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	2				1				—													
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	—				1				2													
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	—				1				—													
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	—				1				—													
	I <sup>2</sup> C × 1	1																					
DMA [channels]	2																						
External interrupts	6				10				13														
OCD	On-chip debugging	Yes																					
Peripheral functions	8/12-bit A/D converter [channels]	13				18				24				28									
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																					
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD)																					
Safety functions	Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function																						
	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 3.6 V																					
Other	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications), T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *2																					
	Package (size [mm])	25-WFLGA (3 × 3 mm)				32-HWQFN (5 × 5 mm)				①48-LFQFP (7 × 7 mm) ②48-HWQFN (7 × 7 mm)				①64-LFQFP (10 × 10 mm) ②64-VFBGA (4 × 4 mm)									

Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

- Products with pin counts from 25 or 32 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.
- The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10ExxGxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/G1H (64 pins)**

Series		RL78/G1H		
Pin count		64-pin		
Product name		R5F11FLJANA <sup>#1</sup>	R5F11FLKANA <sup>#1</sup>	R5F11FLLANA <sup>#1</sup>
CPU		RL78 CPU core		
Memory	Flash ROM [bytes]	256 KB	384 KB	512 KB
	Data flash [bytes]	8 KB		
	RAM [bytes]	24 KB	32 KB	48 KB
Main system clocks	High-speed system clock	X1 (crystal/ceramic) oscillator, external main system clock input (EXCLK), HS (high-speed main) mode: 1 to 32 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), HS (high-speed main) mode: 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), LS (low-speed main) mode: 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V)		
	High-speed on-chip oscillator clock	HS (high-speed main) mode: 1 to 32 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), HS (high-speed main) mode: 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), LS (low-speed main) mode: 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V)		
Subclock (32.768 kHz)	XT1 (crystal) oscillator, external subsystem clock input (EXCLKS)			
Low-speed on-chip oscillator [Hz]	15 kHz (TYP.)			
RF reference clock	48 MHz (TYP.)			
General-purpose registers	8-bit × 32 registers (8-bit × 8 registers × 4 bank)			
Min. instruction execution time	0.03125μs (high-speed on-chip oscillator clock: fIH = 32 MHz operation)			
	0.05μs (high-speed system clock: fMX = 20 MHz operation)			
	30.5μs (subsystem clock: fSUB = 32.768 kHz operation)			
Instruction set	• Data transfer (8-/16-bit), • Add/subtract or logical operation (8-/16-bit), • Multiply (8-bit × 8-bit, 16-bit × 16-bit), divide (16-bit ÷ 16-bit, 32-bit ÷ 32-bit), • Multiply accumulator (16-bit × 16-bit + 32-bit), • Rotate, barrel shift, bit manipulation (set, reset, test, Boolean), etc.			
I/O ports	Total	41		
	CMOS I/O	26		
	CMOS input	5		
	CMOS output	1		
	N-channel O.D. I/O (6 V tolerance)	4		
	GPIO (RF block)	5		
Sub-GHz RF transceiver	Operating frequency band	863 to 928 MHz		
	Modulation method/data rate (kbps)	2FSK/GFSK: 10/20/40/50/100/150/200/300, 4FSK/GFSK: 200/400		
	Current consumption (RF block)	V <sub>CC</sub> = 3.3 V, typ., reception: 6.3 mA, reception standby: 5.8 mA/transmission: 20 mA (+10 dBm)		
	Reception sensitivity	-114 dBm (GFSK 10Kbps, BER<0.1%), -104 dBm (GFSK 100Kbps, BER<0.1%)		
	IEEE 802.15.4g/4e-compliant hardware functions	Support for function to automatically distinguish two systems of addresses, function to automatically generate transmit frames (preamble length: 4 to 1,000 bytes, selectable), and automatic ACK return/receive function		
Timers	16-bit timer [channels]	9		
	Watchdog timer (WDT) [channels]	1		
	Real-time clock (RTC) [channels]	1		
	12-bit Interval timer [channels]	1		
	Timer output	1		
Serial interface	• CSI/UART: 2 channels • CSI: 2 channels (of which 1 channel used for internal communication between microcontroller and RF transceiver)			
	I <sup>2</sup> C bus	2 channels		
DTC (sources)	21			
Vector interrupt sources	Internal	26		
	External	7		
OCD	On-chip debugging	Yes		
Peripheral functions	10-bit resolution A/D converter	6 channels		
	Multiplier/divider/multiply-accumulator	Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)		
	Reset	• Reset by RESET# pin • Internal reset by watchdog timer • Internal reset by power-on reset • Internal reset by voltage detection circuit • Internal reset at execution of illegal instruction • Internal reset at RAM parity error • Internal reset at illegal memory access		
	Power-on reset	• Power-on reset: 1.51 (typ.) • Power-down reset: 1.50 (typ.)		
	Voltage detection circuit	• Rise: 1.88 to 3.13 V (10 stages) • Fall: 1.84 to 3.06 V (10 stages)		
	Clock output/buzzer output	2		
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.8 to 3.6 V		
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications, D: Industrial applications)		
	Package (size [mm])	64-HVQFN (9 × 9 mm)		

Note: 1. The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F11FLxDNA.

**RL78/G1D (48 pins)**

Series		RL78/G1D		
Pin count		48-pin		
Product name		R5F11AGGAMB <sup>*1</sup>	R5F11AGHAMB <sup>*1</sup>	R5F11AGJAMB <sup>*1</sup>
CPU		RL78 CPU core		
Memory	Flash ROM [bytes]	128 K	192 K	256 K
	Data flash [bytes]	8 K		
	RAM [bytes]	12 K	16 K	20 K
Operating clocks	Maximum operating frequency [Hz]	32 MHz		
	On-chip oscillator clock	20 MHz		
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)		
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (2.7 to 3.6 V), 1 to 16 MHz (2.4 to 3.6 V), 1 to 8 MHz (1.8 to 3.6 V), 1 to 4 MHz (1.6 to 3.6 V)		
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)		
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)		
	Crystal resonator for RF [Hz]	32 MHz		
	Low-speed on-chip oscillator for RF	32.768 kHz (with calibration)		
I/O	I/O ports	32		
	N-channel open drain (6 V tolerance)	2		
	N-channel open drain (V <sub>DD</sub> tolerance)	9		
	Timers	8, PWM output × 7		
Timers	16-bit timer TAU [channels]	8, PWM output × 7		
	Real-time clock (RTC) [channels]	1		
	Watchdog timer (WDT) [channels]	1		
	12-bit Interval timer [channels]	12-bit × 1		
8-/10-bit resolution A/D converter		8		
Serial interfaces	CSI, simplified I <sup>2</sup> C, UART	1		
	CSI, simplified I <sup>2</sup> C	1		
	UART	1		
	I <sup>2</sup> C bus	1		
DMA [channels]		4		
External interrupts [channels]		4 (When using RF, this includes connections between the MCU and the RF transceiver via pins externally connected on the board by the user.)		
OCD	On-chip debugging	Yes		
Peripheral functions	8-/10-bit A/D converter [channels]	8		
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)		
	2.4 GHz RF transceiver	Bluetooth v4.1 specification (single mode) supported 2.4 GHz ISM band, GFSK modulation, TDMA/TDD frequency hopping (on-chip AES encryption circuit), adapter function (during slave operation only)		
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output × 1		
Safety functions		WDT, TRAP instruction, flash memory CRC calculation, RAM parity error detection, illegal memory access detection function, frequency detection function, RAM guard function, SFR guard function, A/D test		
Other	Power supply voltage [V]	1.6 to 3.6 V (V <sub>DD</sub> = 1.8 to 3.6 V: using DC-DC converter)		
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C		
	Package (size [mm])	48-HWQFN (6 × 6 mm)		

Note: 1. The version for industrial applications with an operating temperature range of -40 to +85°C is the R5F11AxxDxx.

**RL78/G1D module (42 pins)**

Series		RL78/G1 (module 42 pins)	
Pin count		42-pin	
Product name		RY7011A000DZ00	
CPU		RL78 CPU core	
Memory	Flash ROM [bytes]	256 K	
	Data flash [bytes]	8 K	
	RAM [bytes]	20 K	
Operating clocks	Maximum operating frequency [Hz]	32 MHz	
	On-chip oscillator clock	20 MHz	
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 Hz (V <sub>DD</sub> = 1.6 to 3.6 V)	
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (2.7 to 3.6 V), 1 to 16 MHz (2.4 to 3.6 V), 1 to 8 MHz (1.8 to 3.6 V), 1 to 4 Hz (1.6 to 3.6 V)	
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)	
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)	
	Crystal resonator for RF [Hz]	32 MHz	
	Low-speed on-chip oscillator for RF [Hz]	32.768 kHz (with calibration)	
I/O ports	I/O ports	24	
	N-channel open drain (6 V tolerance)	2	
	N-channel open drain (V <sub>DD</sub> tolerance)	9	
Timers	16-bit timer TAU [channels]	8, PWM output × 7	
	Real-time clock (RTC) [channels]	1	
	Watchdog timer (WDT) [channels]	1	
	12-bit Interval timer [channels]	12-bit × 1	
Serial interfaces	CSI, simplified I <sup>2</sup> C, UART	1	
	CSI, simplified I <sup>2</sup> C	1	
	UART	1	
	I <sup>2</sup> C bus	1	
DMA [channels]		4	
External interrupts [channels]		3	
On-chip debugging		Yes	
Peripheral functions	8-/10-bit A/D converter [channels]	8	
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)	
	2.4 GHz RF transceiver	Bluetooth v4.1 specification (single mode) supported 2.4 GHz ISM band, GFSK modulation, TDMA/TDD frequency hopping (on-chip AES encryption circuit), adapter function (during slave operation only), transmission output: 0 dBm, reception sensitivity: -90 dBm	
Other functions		Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output × 1	
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function	
Other	Power supply voltage [V]	1.6 to 3.6 V (V <sub>DD</sub> = 1.8 to 3.6 V: using DC-DC converter)	
	Receive/transmit peak current	Receive: 3.5 mA, transmit: 4.3 mA (voltage: 3.0 V)	
	Operating ambient temperature [°C]	T <sub>A</sub> = -25 to +75°C	
	Radio law compliance	Japan (MIC), Europe (CE), U.S.A. (FCC), Canada (IC)	
	Product order number	RY7011A000DZ00#001: 2500 pcs (1 reel), RY7011A000DZ00#002: 100 pcs (1 reel)	
Package (size [mm])		42-LGA (8.95 × 13.35 mm)	
Default software	Supplied software	Software for checking operation of modem configuration for control by host microcontroller via UART	
	Supplied profiles	Proximity profile, find me profile, heart rate profile, time profile, alert notification profile, running speed and cadence profile, health thermometer profile, blood pressure profile, glucose profile, phone alert status profile, general-purpose bidirectional communication, firmware update	

Note: A dedicated library is required to use the data flash.

**RL78/G1F (24 to 64 pins)**

Series		RL78/G1F										
Pin count		24-pin		32-pin		36-pin		48-pin		64-pin		
Product name		R5F11B7CANA <sup>*2</sup>	R5F11B7EANA <sup>*2</sup>	R5F11BB8AFP <sup>*2</sup>	R5F11BBEAFP <sup>*2</sup>	R5F11BCCALA <sup>*2</sup>	R5F11BCEALA <sup>*2</sup>	R5F11BGCAF <sup>*2</sup>	R5F11BGEAF <sup>*2</sup>	R5F11BLCAF <sup>*2</sup>	R5F11BLEAF <sup>*2</sup>	
CPU		RL78 CPU core										
Memory	Flash ROM [bytes]	32 K	64 K	32 K	64 K	32 K	64 K	32 K	64 K	32 K	64 K	
	Data flash [bytes]	4 K										
	RAM [bytes]	5.5 K										
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock										
		External resonator										
	On-chip oscillator clock	32 MHz										
Clock generator circuit	External resonator	20 MHz										
	On-chip oscillator clock	64 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)										
	External resonator	20 MHz										
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4Hz (V <sub>DD</sub> = 1.6 to 5.5 V)										
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4Hz (V <sub>DD</sub> = 1.6 to 5.5 V) *Timer RD, RX only, operation at 48 or 64 MHz supported										
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)										
	Subclock (32.768 kHz)	—		32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)								
I/O	I/O ports	20	28	31	44	58						
	N-channel open drain (6 V tolerance)	—	—	2	4	4						
	N-channel open drain (V <sub>DD</sub> tolerance)	10	12	10	12	16						
Timers	16-bit timer TAU [channels]	4, PWM output × 3										
	16-bit timer RJ [channels]	1										
	16-bit timer RD [channels]	2, PWM output × 6										
	16-bit timer RG [channels]	1, PWM output × 1										
	16-bit timer RX [channels]	1										
	Real-time clock (RTC) [channels]	1*1										
	Watchdog timer (WDT) [channels]	1										
	Interval timer [channels]	12-bit × 1										
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	2 (including 1 UART with IrDA support)				1		—				
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	—				1 (including 1 UART with IrDA support)		2 (including 1 UART with IrDA support)				
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	1				—		—				
	CSI × 2, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 2	—				1		—				
	I <sup>2</sup> C × 1	1										
DTC (sources)	30	32	31	32	33							
ELC (inputs/trigger outputs)	21											
External interrupt pins [count]	9	11	10	16	20							
OCD	On-chip debugging	Yes										
Peripheral functions	8/10-bit A/D converter [channels]	8	13	15	17	17						
	8-bit D/A converter [channels]	1	2									
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)										
	Comparator	2										
	Programmable-gain amplifier	1										
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output (48-pin: 1 channel, 64-pin: 2 channels)										
Safety functions	Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function											
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V		V <sub>DD</sub> = 1.6 to 5.5 V (EV <sub>DD</sub> support)		V <sub>DD</sub> = 1.6 to 5.5 V		V <sub>DD</sub> = 1.6 to 5.5 V (EV <sub>DD</sub> support)				
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications), T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *2										
	Package (size [mm])	24-HWQFN (4 × 4 mm)	32-LQFP (7 × 7 mm)	36-WFLGA (4 × 4 mm)	48-LFQFP (7 × 7 mm)	64-LFQFP (10 × 10 mm)						

Notes: A dedicated library is required to use the data flash.

- Products with pin counts from 24 or 32 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.
- The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F11BxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/G1G (30 to 44 pins)**

Series		RL78/G1G					
Pin count		30-pin		32-pin		44-pin	
Product name		R5F11E48ASP	R5F11E4AASP	R5F11E88AFP	R5F11E8AAFP	R5F11EFAAFP	R5F11EFAAFP
CPU		RL78 CPU core					
Memory	Flash ROM [bytes]	8 K	16 K	8 K	16 K	8 K	16 K
	Data flash [bytes]	—					
	RAM [bytes]	1.5 K					
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock					
		External resonator					
	On-chip oscillator clock	24 MHz					
Clock generator circuit	External resonator	20 MHz					
	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)					
	High-speed on-chip oscillator [Hz]	1 to 24 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)					
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)					
I/O	Subclock (32.768 kHz)	—					
	I/O ports	26	28	40			
	N-channel open drain (6 V tolerance)	—					
Timers	N-channel open drain (V <sub>DD</sub> tolerance)	7					
	16-bit timer TAU [channels]	4, PWM output × 3					
	16-bit timer RJ [channels]	1					
	16-bit timer RD [channels]	2, PWM output × 6					
	Real-time clock (RTC) [channels]	—					
	Watchdog timer (WDT) [channels]	1					
	Interval timer [channels]	12-bit × 1					
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	1		—			
	UART × 1	1		—			
ELC (inputs/trigger outputs)	18/6			19/6			
External interrupts [channels]	6			7			
OCD	On-chip debugging	Yes					
Peripheral functions	8/10-bit A/D converter [channels]	8		12			
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)					
	Comparator [channels]	2					
	Programmable-gain amplifier	1					
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output					
Safety functions	Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function						
Other	Power supply voltage [V]	V <sub>DD</sub> = 2.7 to 5.5 V					
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications)					
	Package (size [mm])	30-LSSOP (7.62 mm)	32-LQFP (7 × 7 mm)	44-LQFP (10 × 10 mm)			

**RL78/G1C (32 to 48 pins)**

Series		RL78/G1C			
Pin count		32-pin		48-pin	
Product name		①R5F10JBCANA*1 ②R5F10JBCAFP*1	①R5F10KBCANA*1 ②R5F10KBCAFP*1	①R5F10JGCANA*1 ②R5F10JGCAPB*1	①R5F10KGCANA*1 ②R5F10KGCAPB*1
CPU		RL78 CPU core			
Memory	Flash ROM [bytes]	32 K			
	Data flash [bytes]	2 K			
	RAM [bytes]	5.5 K			
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock	24 MHz		
		External resonator	20 MHz		
		USB clock	48 MHz		
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V)			
	High-speed on-chip oscillator [Hz]	1 to 48 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)			
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 2.4 to 5.5 V)			
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 2.4 to 5.5 V)			
I/O	Total I/O ports and dedicated USB pins	28*2	26*3	44*2	42*3
	I/O ports	22		38	
		N-channel open drain (6 V tolerance)	3		4
Timers	16-bit timer TAU [channels]	4			
	Real-time clock (RTC) [channels]	1			
	Watchdog timer (WDT) [channels]	1			
	Interval timer [channels]	12-bit × 1			
Serial interfaces	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	1			
	I <sup>2</sup> C × 1	1			
USB	Host [channels]	2	—	2	—
	Function [channels]	1			
DMA [channels]		2			
External interrupts [channels]		8		10	
OCD	On-chip debugging	Yes			
Peripheral functions	8/10-bit A/D converter [channels]	8		9	
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)			
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output × 2		RTC output (1Hz) × 1	
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function			
Other	Power supply voltage [V]	V <sub>DD</sub> = 2.4 to 5.5 V			
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications), T <sub>A</sub> = -40 to +105°C (G: Industrial applications)*1			
	Package (size [mm])	①32-HWQFN (5 × 5 mm) ②32-LQFP (7 × 7 mm)	①48-HWQFN (7 × 7 mm) ②48-LQFP (7 × 7 mm)		

Notes: 1. The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10xxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.

2. USB uses pins UV<sub>BUS</sub>, UV<sub>DD</sub>, UDPO, UDMO, UDP1, and UDM1.

3. USB uses pins UV<sub>BUS</sub>, UV<sub>DD</sub>, UDPO, and UDMO.

**RL78/L12 (32 to 64 pins)**

Series		RL78/L12														
Pin count		32-pin			44-pin			48-pin			52-pin			64-pin		
Product name		R5F10R8BAFP*4	R5F10R8BAAFP*4	R5F10R8CAFP*4	R5F10R8BAFP*4	R5F10R8FAAFP*4	R5F10R8CAFP*4	R5F10R8BAFB*4	R5F10R8GAABF*4	R5F10R8CAFB*4	R5F10R8BAFA*4	R5F10R8JAFA*4	R5F10R8CAFA*4	①R5F10R8LAABF*4 ②R5F10R8LAFA*4 ③R5F10R8LANB*4	①R5F10R8LCAFB*4 ②R5F10R8LCAFA*4 ③R5F10R8LCANB*4	
CPU		RL78 CPU core														
Memory	Flash ROM [bytes]	8 K	16 K	32 K	8 K	16 K	32 K	8 K	16 K	32 K	8 K	16 K	32 K	16 K	32 K	
	Data flash [bytes]	2 K														
	RAM [bytes]*1	1 K	1 K	1.5 K	1 K	1 K	1.5 K	1 K	1 K	1.5 K	1 K	1 K	1.5 K	1 K	1.5 K	
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		24 MHz												
		External resonator		20 MHz												
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)														
	High-speed on-chip oscillator [Hz]	1 to 24 MHz (V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)														
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)														
	Subclock (32.768 kHz)	—			32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)											
I/O	Total I/O ports and LCD pins (SEG and COM)	28			40			44			48			58		
	I/O ports	20			29			33			37			47		
		N-channel open drain (E <sub>VDD</sub> tolerance)		2												
LCD controller/Driver		Selectable among internal voltage boost, capacitor split, and external resistance division														
	Segment signal outputs	13			22 (18)*2			26 (22)*2			30 (26)*2			39 (35)*2		
	Common signal outputs	4			4 (8)*2											
Timers	16-bit timer TAU [channels]	4, PWM output × 3			5, PWM output × 4			6, PWM output × 5			8, PWM output × 7					
	Real-time clock (RTC) [channels]	1*3														
	Watchdog timer (WDT) [channels]	1														
	Interval timer [channels]	1														
Serial interfaces	CSI × 2, UART (LIN bus support) × 1	1														
	I <sup>2</sup> C × 1	1														
DMA [channels]		2														
External interrupts [channels]		4			6			7			9					
OCD	On-chip debugging	Yes														
Peripheral functions	8/10-bit A/D converter [channels]	4			7			9			10					
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)														
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output, Remote control carrier wave output × 1														
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function														
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V														
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications) T <sub>A</sub> = -40 to +105°C (G: Industrial applications)*4														
	Package (size [mm])	32-LQFP (7 × 7 mm)			44-LQFP (10 × 10 mm)			48-LQFP (7 × 7 mm)			52-LQFP (10 × 10 mm)			①64-LQFP (10 × 10 mm) ②64-LQFP (12 × 12 mm) ③64-HWQFN (8 × 8 mm)		①64-LQFP (10 × 10 mm) ②64-LQFP (12 × 12 mm) ③64-HWQFN (8 × 8 mm)

Notes: 1. 630 bytes when using self-programming function and data flash function.

2. Figure in parentheses ( ) is number of signal lines when using 8 COM.

3. Products with a pin count of 32 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.

4. The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F10RxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/L13 (64 to 80 pins)**

Series		RL78/L13											
Pin count		64-pin						80-pin					
Product name		①RSF10WLAAFB ②RSF10WLAFA	①RSF10WLCAFB ②RSF10WLCAFA	①RSF10WLDAFB ②RSF10WLDAFA	①RSF10WLEAFB ②RSF10WLEAFA	①RSF10WLFABF ②RSF10WLFafa	①RSF10WLGAFB ②RSF10WLGafa	①RSF10WMAAFB ②RSF10WMAAFA	①RSF10WMCACB ②RSF10WMCACA	①RSF10WMDAFB ②RSF10WMDAFA	①RSF10WMEAFB ②RSF10WMEAFA	①RSF10WMAFBF ②RSF10WMAFAFA	①RSF10WMGAFB ②RSF10WMGafa
CPU		RL78 CPU core											
Memory	Flash ROM [bytes]	16 K	32 K	48 K	64 K	96 K	128 K	16 K	32 K	48 K	64 K	96 K	128 K
	Data flash [bytes]	4 K											
	RAM [bytes]	1 K	1.5 K	2 K	4 K	6 K	8 K	1 K	1.5 K	2 K	4 K	6 K	8 K
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock											
		External resonator											
		Timer KB20 clock											
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V),						1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)					
	High-speed on-chip oscillator [Hz]	1 to 24 MHz 1 to 8 MHz						(V <sub>DD</sub> = 2.7 to 5.5 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 5.5 V), (V <sub>DD</sub> = 1.8 to 5.5 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 5.5 V)					
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)											
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 5.5 V)											
I/O	Total I/O ports and LCD pins (SEG and COM)	57						73					
	I/O ports	49						65					
	N-channel open drain (6 V tolerance)	2											
LCD controller	LCD drive voltage generation method	Selectable among						internal voltage boost, capacitor split, and external resistance division					
	Segment signal outputs	36 (32) *1						51 (47) *1					
	Common signal outputs	4 (8) *1											
Timers	16-bit timer TAU [channels]	8, PWM output × 7											
	16-bit timer KB20 [channels]	1, PWM output × 2											
	Real-time clock2 (RTC2) [channels]	1 (0.96 ppm minimum resolution)											
	Watchdog timer (WDT) [channels]	1											
	Interval timer [channels]	12-bit × 1											
Serial interfaces	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	1						1					
	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	1						1					
	UART × 1	1						2					
	I <sup>2</sup> C × 1	1						1					
DMA [channels]		4											
External interrupts [channels]		9											
OCD	On-chip debugging	Yes											
Peripheral functions	8/10-bit A/D converter [channels]	9						12					
	Comparator [channels]	2											
	Multiplier/divider/multiply-accumulator	Library support for						multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)					
	Other functions	Power-on reset (POR), low-voltage detection						circuit (LVD), RTC output (1 Hz) × 1, clock/buzzer output × 2, remote control carrier wave output × 1					
Safety functions		Flash memory CRC calculation function (high-speed), CRC illegal memory access detection function,						calculation function (general-purpose), RAM parity error detection function, SFR guard function, frequency detection function, A/D converter test function, I/O power output signal level detection function					
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 5.5 V											
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +85°C (A: Consumer applications) T <sub>A</sub> = -40 to +105°C (G: Industrial applications) *2											
	Package (size [mm])	①64-LQFP (10 × 10 mm) ②64-LQFP (12 × 12 mm)						①80-LQFP (12 × 12 mm) ②80-LQFP (14 × 14 mm)					

Notes: 1. Figure in parentheses ( ) is number of signal lines when using 8 COM.

2. The version for industrial applications with an operating temperature range of -40 to +105°C is the RSF10WxxGxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/L1C (80 to 100 pins)**

Series		RL78/L1C (USB)														
Pin count		80-pin					85-pin					100-pin				
Product name		R5F110MEAFB <sup>#2</sup>	R5F110MFAB <sup>#2</sup>	R5F110NGAFB <sup>#2</sup>	R5F110MHAFB <sup>#2</sup>	R5F110MJAFB <sup>#2</sup>	R5F110NEALA <sup>#2</sup>	R5F110NFALA <sup>#2</sup>	R5F110NGALA <sup>#2</sup>	R5F110NHALA <sup>#2</sup>	R5F110NJALA <sup>#2</sup>	R5F110PEAFB <sup>#2</sup>	R5F110PFAB <sup>#2</sup>	R5F110PGAFB <sup>#2</sup>	R5F110PHAFB <sup>#2</sup>	R5F110PJAFB <sup>#2</sup>
CPU		RL78 CPU core														
Memory	Flash ROM [bytes]	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K
	Data flash [bytes]	8 K														
	RAM [bytes]	8 K	10 K	12 K	16 K	16 K	8 K	10 K	12 K	16 K	16 K	8 K	10 K	12 K	16 K	16 K
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		24 MHz												
		External resonator		20 MHz												
		Timer KB2 clock, USB clock		48 MHz (V <sub>DD</sub> = 2.7 to 3.6 V)												
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
	High-speed on-chip oscillator [Hz]	1 to 48 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
I/O	Total I/O ports and LCD and USB pins <sup>#3</sup>		71					89								
	I/O ports		59					77								
	N-channel open drain (6 V tolerance)		2													
LCD controller	LCD drive voltage generation method		Selectable among internal voltage boost, capacitor split, and external resistance division													
	Segment signal outputs		44 (40) <sup>*1</sup>					56 (52) <sup>*1</sup>								
	Common signal outputs		4 (8) <sup>*1</sup>													
Timers	16-bit timer TAU [channels]		8 (PWM output × 7)													
	16-bit timer KB20 [channels]		3 (PWM output × 6)													
	Real-time clock2 (RTC2) [channels]		1 (0.96 ppm accuracy correction)													
	Watchdog timer (WDT) [channels]		1													
	Interval timer [channels]		12-bit × 1													
Serial interfaces	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1		1													
	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1		3													
	I <sup>2</sup> C × 1		1													
USB	Function [channels]		1													
DTC (sources)		32					33									
ELC (inputs/trigger outputs)		30					31									
External interrupts [channels]		9					9									
OCD	On-chip debugging		Yes													
Peripheral functions	8/12-bit A/D converter [channels]		9					13								
	8-bit D/A converter [channels]		2													
	Comparator [channels]		1					2								
	Multiplier/divider/multiply-accumulator		Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)													
	Other functions		Power-on reset (POR), low-voltage detection circuit (LVD), RTC output (1 Hz) × 1, clock/buzzer output × 2, remote control carrier wave output × 1													
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function														
Other	Power supply voltage [V]		V <sub>DD</sub> = 1.6 to 3.6 V													
	Operating ambient temperature [°C]		T <sub>A</sub> = -40 to +85°C (A: Consumer applications), T <sub>A</sub> = -40 to +105°C (G: Industrial applications) <sup>#2</sup>													
	Package (size [mm])		80-LFQFP (12 × 12 mm)					85-VFLGA (7 × 7 mm)					100-LFQFP (14 × 14 mm)			

Notes: 1. Figure in parentheses ( ) is number of signal lines when using 8 COM.  
 2. The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F110xxGxx. For details, see "How to read RL78 Family product numbers" on page 122.  
 3. LCD uses SEG pins and COM pins. USB uses UV<sub>BUS</sub>, U<sub>BEC</sub>, UDP, and UDM pins.

**RL78/L1C (80 to 100 pins)**

Series		RL78/L1C (no USB)														
Pin count		80-pin					85-pin					100-pin				
Product name		R5F111MEAFB <sup>#2</sup>	R5F111MFAB <sup>#2</sup>	R5F111NGAFB <sup>#2</sup>	R5F111MHAFB <sup>#2</sup>	R5F111MJAFB <sup>#2</sup>	R5F111NEALA <sup>#2</sup>	R5F111NFALA <sup>#2</sup>	R5F111NGALA <sup>#2</sup>	R5F111NHALA <sup>#2</sup>	R5F111NJALA <sup>#2</sup>	R5F111PEAFB <sup>#2</sup>	R5F111PFAB <sup>#2</sup>	R5F111PGAFB <sup>#2</sup>	R5F111PHAFB <sup>#2</sup>	R5F111PJAFB <sup>#2</sup>
CPU		RL78 CPU core														
Memory	Flash ROM [bytes]	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K
	Data flash [bytes]	8 K														
	RAM [bytes]	8 K	10 K	12 K	16 K	16 K	8 K	10 K	12 K	16 K	16 K	8 K	10 K	12 K	16 K	16 K
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		24 MHz												
		External resonator		20 MHz												
		Timer KB2 clock, USB clock		48 MHz (V <sub>DD</sub> = 2.7 to 3.6 V)												
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
	High-speed on-chip oscillator [Hz]	1 to 48 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
	Low-speed on-chip oscillator [Hz]	15 kHz (TYP.): V <sub>DD</sub> = 1.6 to 3.6 V														
	Subclock (32.768 kHz)	32.768 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)														
I/O	Total I/O ports and LCD pins (SEG and COM)		71					89								
	I/O ports		63					81								
	N-channel open drain (6 V tolerance)		2													
LCD controller	LCD drive voltage generation method		Selectable among internal voltage boost, capacitor split, and external resistance division													
	Segment signal outputs		44 (40) <sup>*1</sup>					56 (52) <sup>*1</sup>								
	Common signal outputs		4 (8) <sup>*1</sup>													
Timers	16-bit timer TAU [channels]		8 (PWM output × 7)													
	16-bit timer KB20 [channels]		3 (PWM output × 6)													
	Real-time clock2 (RTC2) [channels]		1 (0.96 ppm accuracy correction)													
	Watchdog timer (WDT) [channels]		1													
	Interval timer [channels]		12-bit × 1													
Serial interfaces	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1		1													
	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1		3													
	I <sup>2</sup> C × 1		1													
DTC (sources)		30					31									
ELC (inputs/trigger outputs)		30					31									
External interrupts [channels]		9					9									
OCD	On-chip debugging		Yes													
Peripheral functions	8/12-bit A/D converter [channels]		11					13								
	8-bit D/A converter [channels]		2													
	Comparator [channels]		1					2								
	Multiplier/divider/multiply-accumulator		Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)													
	Other functions		Power-on reset (POR), low-voltage detection circuit (LVD), RTC output (1 Hz) × 1, clock/buzzer output × 2, remote control carrier wave output × 1													
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function														
Other	Power supply voltage [V]		V <sub>DD</sub> = 1.6 to 3.6 V													
	Operating ambient temperature [°C]		T <sub>A</sub> = -40 to +85°C (A: Consumer applications), T <sub>A</sub> = -40 to +105°C (G: Industrial applications) <sup>#2</sup>													
	Package (size [mm])		80-LFQFP (12 × 12 mm)					85-VFLGA (7 × 7 mm)					100-LFQFP (14 × 14 mm)			

Notes: 1. Figure in parentheses ( ) is number of signal lines when using 8 COM.  
 2. The version for industrial applications with an operating temperature range of -40 to +105°C is the R5F111xxGxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/L1A (80 to 100 pins)**

Series		RL78/L1A					
Pin count		80-pin			100-pin		
Product name		R5F11MMDAFB	R5F11MMEAFB	R5F11MMFAFB	R5F11MPEAFB	R5F11MPFAFB	R5F11MPGAFB
CPU		RL78 CPU core					
Memory	Flash ROM [bytes]	48 K	64 K	96 K	64 K	96 K	128 K
	Data flash [bytes]	8 K					
	RAM [bytes]	5.5 K					
Operating clocks	Maximum operating frequency [Hz]	24 MHz					
	On-chip oscillator clock	20 MHz					
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz: $V_{DD} = 2.7$ to 3.6V, 1 to 8 MHz: $V_{DD} = 1.8$ to 2.7 V					
	High-speed on-chip oscillator [Hz]	1 to 24 MHz ( $V_{DD} = 2.7$ to 3.6V), 1 to 16 MHz ( $V_{DD} = 2.4$ to 3.6 V), 1 to 8MHz ( $V_{DD} = 1.8$ to 3.6 V)					
	Low-speed on-chip oscillator [Hz]	15 kHz ( $V_{DD} = 1.8$ to 3.6 V)					
	Subclock (32.768 kHz)	32.768 kHz ( $V_{DD} = 1.8$ to 3.6 V)					
I/O	I/O ports, Total I/O ports and CD pins	59			79		
LCD controller	LCD drive voltage generation method	Selectable among internal voltage boost, capacitor split, and external resistance division					
	Segment signal outputs	32 (28) *1			45 (41) *1		
	Common signal outputs	4 (8) *1					
Timers	16-bit timer TAU [channels]	8 (Timer output × 8, PWM output × 7)					
	8/16-bit interval timer [channels]	2 (8-bit)/1 (16-bit)					
	Real-time clock2 (RTC2) [channels]	1					
	Watchdog timer (WDT) [channels]	1					
Serial interfaces	12-bit interval timer [channels]	1					
	CSI × 1, UART (LIN bus support) × 1, simplified I <sup>2</sup> C × 1	1					
	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	3					
DTC (sources)	I <sup>2</sup> C × 1	1					
	DTC (sources)	30					
ELC (inputs/trigger outputs)		Event inputs: 22, event outputs: 8					
External interrupts [channels]		8					
OCD		On-chip debugging: Yes					
Peripheral functions	8/12-bit A/D converter [channels]	10			14		
	12-bit D/A converter [channels]	3			3		
	Op-amp [channels]	3 (of which, 2 channels have 2 I/O switches)			3 (of which, 2 channels have 4 I/O switches)		
	Reference voltage	2.5/2.048/1.8/1.5 V					
	Comparator [channels]	1					
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)					
Safety functions	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), RTC output (1 Hz) × 1, clock/buzzer output × 2					
	Safety functions	Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function					
Other	Power supply voltage [V]	$V_{DD} = 1.8$ to 3.6 V					
	Operating ambient temperature [°C]	$T_A = -40$ to +85°C (A: Consumer applications)					
	Package (size [mm])	80-LQFP (12 × 12 mm)			100-LQFP (14 × 14 mm)		

Notes: 1. Figure in parentheses ( ) is number of signal lines when using 8 COM.

**RL78/I1A (20 to 38 pins)**

Series		RL78/I1A					
Pin count		20-pin		30-pin		38-pin	
Product name		① R5F1076CGSP ② R5F1076CMSP	① R5F107ACGSP ② R5F107ACMSP	① R5F107AEGSP ② R5F107AEMSP	① R5F107DEGSP ② R5F107DEMSP		
CPU		RL78 CPU core					
Memory	Flash ROM [bytes]	32 K		64 K			
	Data flash [bytes]	4 K					
	RAM [bytes]	2 K		4 K			
Operating clocks	Maximum operating frequency [Hz]	32 MHz ( $T_A = -40$ to +105°C), 16 MHz ( $T_A = 105$ to 125°C)					
	On-chip oscillator clock	20 MHz					
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz ( $V_{DD} = 2.7$ to 5.5 V)					
	High-speed on-chip oscillator [Hz]	1 to 32 MHz ( $V_{DD} = 2.7$ to 5.5 V), 1 to 8 MHz ( $V_{DD} = 2.7$ to 5.5 V)					
	Low-speed on-chip oscillator [Hz]	15 kHz ( $V_{DD} = 2.7$ to 5.5 V)					
	Subclock (32.768 kHz)	—				32.768 kHz ( $V_{DD} = 2.7$ to 5.5 V)	
I/O	I/O ports	16		26		34	
	N-channel open drain (6 V tolerance)	—					
	N-channel open drain ( $V_{DD}$ tolerance)	6		10		11	
Timers	16-bit timer TAU [channels]	8		8, PWM output × 1		8, PWM output × 3	
	16-bit timer KB	2, PWM output × 4		3, PWM output × 6		3, PWM output × 6	
	16-bit timer KC	1, PWM output × 3		1, PWM output × 6		1, PWM output × 6	
	Real-time clock (RTC) [channels]	1*1					
	Watchdog timer (WDT) [channels]	1					
	Interval timer [channels]	12-bit × 1					
Serial interfaces	UART × 1	—		1			
	CSI × 1, UART (LIN bus and DMX512 support) × 1	—				1	
	UART (LIN bus and DMX512 support) × 1*2	1		—			
	UART (DALI communication support) × 1*2	—		1			
DMA [channels]	I <sup>2</sup> C × 1	—		1			
	DMA [channels]	—		2			
External interrupts [channels]		7		10		11	
OCD		On-chip debugging: Yes					
Peripheral functions	8/10-bit A/D converter [channels]	6		11			
	Comparator [channels]	4		6			
	PGA [channels]	1					
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)					
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD)					
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function					
Other	Power supply voltage [V]	$V_{DD} = 2.7$ to 5.5 V					
	Operating ambient temperature [°C]	① $T_A = -40$ to +105°C (G: Industrial applications), ② $T_A = -40$ to +125°C (M: Industrial applications)					
	Package (size [mm])	20-LSSOP (4.4 × 6.5 mm)		30-LSSOP (7.62 mm (300 mil))		38-SSOP (7.62 mm (300 mil))	

 Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

- Products with pin counts from 20 or 30 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.
- The same pin is used for both functions on 20-pin products, so only one function may be used at any given time.

**RL78/I1B (80 to 100 pins)**

Series		RL78/I1B			
Pin count		80-pin		100-pin	
Product name		R5F10MMEDFB	R5F10MMGDFB	R5F10MPEDFB	R5F10MPGDFB
CPU		RL78 CPU core			
Memory	Flash ROM [bytes]	64 K	128 K	64 K	128 K
	Data flash [bytes]	—			
	RAM [bytes]	6 K	8 K	6 K	8 K
Operating clocks	Maximum operating frequency [Hz]	24 MHz			
	On-chip oscillator clock	24 MHz			
	External resonator	20 MHz			
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz ( $V_{DD} = 2.7$ to 5.5 V), 1 to 8 MHz ( $V_{DD} = 1.9$ to 5.5 V)			
	High-speed on-chip oscillator [Hz]	24/12/6/3 MHz ( $V_{DD} = 2.7$ to 5.5 V), 12/6/3 MHz ( $V_{DD} = 2.4$ to 5.5 V), 6/3 MHz ( $V_{DD} = 1.9$ to 5.5 V)			
	Low-speed on-chip oscillator [Hz]	15 kHz ( $V_{DD} = 1.9$ to 5.5 V)			
	Subclock (32.768 kHz)	32.768 kHz ( $V_{DD} = 1.9$ to 5.5 V)			
I/O	Total I/O ports and LCD pins (SEG and COM)	61		77	
	I/O ports	53		69	
	N-channel open drain (6 V tolerance)	3			
Timers	16-bit timer TAU [channels]	8, PWM output $\times 7$			
	Real-time clock (RTC) [channels]	1 (high-precision, 0.96 ppm minimum resolution)			
	Watchdog timer (WDT) [channels]	1			
	Interval timer [channels]	12-bit $\times 1$ , 8-bit $\times 4$			
Serial interfaces	CSI $\times 1$ , UART $\times 1$ , simplified I <sup>2</sup> C $\times 1$	1			
	UART $\times 1$ , simplified I <sup>2</sup> C $\times 1$	1			
	UART $\times 1$ , IrDA $\times 1$	1			
	I <sup>2</sup> C $\times 1$	1			
LCD controller	LCD drive voltage generation method	Selectable among internal voltage boost, capacitor split, and external resistance division			
	Segment signal outputs	34 (30) *1		42 (38) *1	
	Common signal outputs	4 (8) *1			
DTC (sources)		30			
External interrupts [channels]		10			
OCD	On-chip debugging	Yes			
Peripheral functions	8/10-bit A/D converter [channels]	4		6	
	24-bit $\Delta\Sigma$ A/D converter [channels]	3		4	
	Comparator [channels]	2			
	PGA [channels]	1			
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit $\times$ 16-bit = 32-bit (signed/unsigned) Divide: 32-bit $\div$ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit $\times$ 16-bit + 32-bit = 32-bit (signed/unsigned)			
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), battery backup function, RTC output (1 Hz) $\times 1$			
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function			
Other	Power supply voltage [V]	$V_{DD} = 1.9$ to 5.5 V			
	Operating ambient temperature [°C]	$T_A = -40$ to +85°C (D: Industrial applications)			
	Package (size [mm])	80-LFQFP (12 $\times$ 12 mm)		100-LFQFP (14 $\times$ 14 mm)	

Notes: 1. Figure in parentheses ( ) is number of signal lines when using 8 COM.

**RL78/I1C (64 to 100 pins)**

Series		RL78/I1C			
Pin count		64-pin	80-pin		100-pin
Product name		R5F10NLE/G	R5F10NME/G	R5F10NMJ	R5F10NPJ/G
Code flash [bytes]		64 to 128 K	64 to 128 K	256 K	128 to 256 K
Date flash [bytes]		2 K			
RAM [bytes]		6 to 8 K	6 to 8 K	16 K	8 to 16 K
System clocks	External	High-speed clock 1 to 20 MHz, Low-speed clock 32.768 kHz			
	On-chip oscillator clock	High-speed 1.5 to 24 MHz, Middle-speed 1 to 4 MHz, Low-speed 15 kHz			
	PLL clock	—		32 MHz	
High-speed on-chip oscillator clock frequency correction function		Yes			
24-bit $\Delta\Sigma$ A/D converter	Input channels	4	3	3	4
	SNDR	to 80dB (gain $\times 1$ )			
	Sampling frequency	3.906 kHz/1.953 kHz			
	PGA	$\times 1, \times 2, \times 4, \times 8, \times 16, (\times 32)$			
	Internal reference voltage (temperature coefficient)	0.8 V (10 ppm/°C)			
	Zero-cross detection	HW Zero-cross detection			
8/10-bit A/D converter		4 channels			6 channels
32-bit multiply-and accumulate circuit		Yes			
LCD controller	Segment/common signal combinations	15/8, 9/4	30/8, 34/4	30/8, 34/4	38/8, 42/4
	Drive voltage generation method	Selectable among internal voltage boost, capacitor split, and external resistance division			
Timer functions		16-bit timer array unit: 8 ch 12-bit Interval timer: 1 ch 8-bit Interval timer: 4 ch			
RTC with independent power supply		1 ch			
Serial interfaces	CSI, UART0, simplified I <sup>2</sup> C0	1 ch			
	CSI1, UART1, simplified I <sup>2</sup> C1	1 ch			
	UART2, IrDA	—		1 ch	
	CSI3, UART3, simple I <sup>2</sup> C3	—		1 ch	
	MultiMaster I <sup>2</sup> C	1 ch			
DTC (sources)		29	31		
ELC		22 event generation sources, 5 selectable event output destinations			
Battery backup functions	CPU	VDD/VBAT			
	24-bit $\Delta\Sigma$ A/D converter	VDD/VBAT			
	RTC	VRTC (independent power supply)			
Low-voltage detection circuit (LVD)		Internal VDD, VDD pin, VBAT pin, VRTC pin, external pin			
AES HW		Encryption mode: GCM/ECB/CBC, encryption key length: 128/192/256-bit			
Key interrupts		5 pins	8 pins		
Other peripheral functions		Watchdog timer, power-on reset (POR), safety function			
Power supply voltage [V]		1.7 to 5.5 V			
Operating ambient temperature [°C]		-40 to +85°C			
Package (size [mm])		64-LFQFP (10 $\times$ 10 mm)	80-LFQFP (12 $\times$ 12 mm)		100-LFQFP (14 $\times$ 14 mm)

**RL78/I1D (20 to 48 pins)**

Series		RL78/I1D												
Pin count		20-pin		24-pin		30-pin		32-pin				48-pin		
Product name		R5F11768GSP	R5F1176AGSP	R5F11778GNA	R5F1177AGNA	R5F117A8GSP	R5F117AAGSP	R5F117ACGSP	R5F117BAGNA	R5F117BCGNA	R5F117BAGFP	R5F117BCGFP	R5F117GAGFB	R5F117GCGFB
CPU		RL78 CPU core												
Memory	Flash ROM [bytes]	8 K	16 K	8 K	16 K	8 K	16 K	32 K	16 K	32 K	16 K	32 K	16 K	32 K
	Data flash [bytes]	2 K												
	RAM [bytes]	0.7 K	2 K	0.7 K	2 K	0.7 K	2 K	3 K	2 K	3 K	2 K	3 K	2 K	3 K
Operating clocks	Maximum operating frequency [Hz]	24 MHz												
	On-chip oscillator clock External resonator	20 MHz												
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 2.7 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 1.8 V)												
	High-speed on-chip oscillator [Hz]	1 to 24 MHz (V <sub>DD</sub> = 2.7 to 3.6 V), 1 to 16 MHz (V <sub>DD</sub> = 2.4 to 3.6 V), 1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V), 1 MHz (V <sub>DD</sub> = 1.8 to 3.6 V)												
	Middle-speed on-chip oscillator [Hz]	1 to 8 MHz (V <sub>DD</sub> = 1.8 to 3.6 V), 1 to 4 MHz (V <sub>DD</sub> = 1.6 to 3.6 V), 1 MHz (V <sub>DD</sub> = 1.8 to 3.6 V)												
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)												
	Subclock (32.768 kHz)	—		32.768 kHz (V <sub>DD</sub> = 1.6 to 3.6 V)										
I/O	I/O ports	14	18	24	26	42								
	N-channel open drain (6 V tolerance)	—	—	—	—	4								
	N-channel open drain (V <sub>DD</sub> tolerance)	—												
Timers	16-bit timer TAU [channels]	4												
	Real-time clock (RTC) [channels]	1*												
	Watchdog timer (WDT) [channels]	1												
	Interval timer [channels]	8-bit × 4 (or 16-bit × 2), 12-bit × 1												
Serial interfaces	CSI × 1, UART × 1, simplified I <sup>2</sup> C × 1	1	—	1	—	—								
	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	—	1	—	1	1								
DTC (sources)		16	20	19	20	23								
ELC (inputs/trigger outputs)		13/5	17/5	16/7	17/7	20/7								
External interrupt pins [count]		3	—	5	—	8								
OCD	On-chip debugging	Yes												
Peripheral functions	12-bit A/D converter [channels]	6		12				17						
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)												
	Op-amp [channels]	2		4										
	Comparator [channels]	2												
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), clock/buzzer output, data operation circuit (DOC)												
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function												
Other	Power supply voltage [V]	V <sub>DD</sub> = 1.6 to 3.6												
	Operating ambient temperature [°C]	-40 to +105°C (G: Industrial applications)												
	Package (size [mm])	20-LSSOP (4.4 × 6.5 mm)	24-HWQFN (4 × 4 mm)	30-LSSOP (7.62 mm (300 mil))	32-HVQFN (5 × 5 mm)	32-LQFP (7 × 7 mm)	48-LFQFP (7 × 7 mm)							

Notes: A dedicated library is required to overwrite the data flash. Refer to [Development Environments] – [Flash Programming Tools] – [Self-Programming Library] on the Renesas website. [https://www.renesas.com/flash\\_libraries](https://www.renesas.com/flash_libraries)

1. Products with pin counts from 20 or 24 pins are not equipped with a subsystem clock, so only the fixed-cycle interrupt function using the low-speed on-chip oscillator clock (15 kHz) is available for use.

**RL78/I1E (32 to 36 pins)**

Series		RL78/I1E							
Pin count		32-pin				36-pin			
Product name		R5F11C8GNA	R5F11C8MNA	R5F11C88BG	R5F11C8MBG				
CPU		RL78 CPU core							
Memory	Flash ROM [bytes]	32 K							
	Data flash [bytes]	4 K							
	RAM [bytes]	8 K							
Operating clocks	Maximum operating frequency [Hz]	32 MHz							
	On-chip oscillator clock External resonator	20 MHz							
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (2.7 to 5.5 V), 1 to 16 MHz (2.4 to 2.7 V)							
	High-speed on-chip oscillator [Hz]	1 to 32 MHz (2.7 to 5.5 V)	1 to 24 MHz (2.7 to 5.5 V)	1 to 32 MHz (2.7 to 5.5 V)	1 to 24 MHz (2.7 to 5.5 V)				
	Middle-speed on-chip oscillator [Hz]	1 to 16 MHz (2.4 to 2.7 V)							
	Low-speed on-chip oscillator [Hz]	15 kHz							
	Subclock (32.768 kHz)	—							
I/O	I/O ports	10				14			
	N-channel open drain (6 V tolerance)	—							
	N-channel open drain (V <sub>DD</sub> tolerance)	6							
Timers	16-bit timer TAU [channels]	6							
	16-bit timer RJ [channels]	1							
	16-bit timer RG [channels]	1							
	Real-time clock (RTC) [channels]	1							
	Watchdog timer (WDT) [channels]	1							
	Interval timer [channels]	15-bit × 1							
	Serial interfaces	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	1						
	UART × 1	1							
DTC (sources)		23							
ELC (inputs/trigger outputs)		16/7							
External interrupt pins [count]		7				8			
OCD	On-chip debugging	Yes							
Peripheral functions	Instrumentation amplifier + 24-bit ΔΣ A/D converter [channels]	3				4			
	8/10-bit A/D converter [channels]	8				10			
	12-bit D/A converter [channels]	1							
	Configurable amplifier [channels]	3							
	Multiplier/divider/multiply-accumulator	Library support for multiply/divide/multiply-accumulate operations (equipped with functional unit) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)							
Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), temperature sensor, reference voltage generation circuit								
Safety functions		Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), RAM parity error detection function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function							
Other	Power supply voltage [V]	V <sub>CC</sub> = 2.4 to 5.5 V							
	Operating ambient temperature [°C]	Ta = -40 to +105°C (G: Industrial applications)	Ta = -40 to +125°C (M: Industrial applications)	Ta = -40 to +105°C (G: Industrial applications)	Ta = -40 to +125°C (M: Industrial applications)				
	Package (size [mm])	32-HVQFN (5 × 5 mm)				36-TFBGA (4 × 4 mm)			



**RL78/F13 (20 to 80 pins)**

Series		RL78/F13 (CAN and LIN versions)																																		
Pin count		30-pin						32-pin						48-pin						64-pin						80-pin										
Product name		R5F10BACLSP <sup>*1</sup>	R5F10BADLSP <sup>*1</sup>	R5F10BAELSP <sup>*1</sup>	R5F10BAFLSP <sup>*1</sup>	R5F10BAGLSP <sup>*1</sup>	R5F10BBCLNA <sup>*1</sup>	R5F10BBDLNA <sup>*1</sup>	R5F10BBELNA <sup>*1</sup>	R5F10BBFLNA <sup>*1</sup>	R5F10BBGLNA <sup>*1</sup>	①R5F10BGCFLFB <sup>*1</sup> ②R5F10BCCINA <sup>*1</sup>	①R5F10BGDLFB <sup>*1</sup> ②R5F10BGDINA <sup>*1</sup>	①R5F10BCELFB <sup>*1</sup> ②R5F10BCELNA <sup>*1</sup>	①R5F10BGLFLFB <sup>*1</sup> ②R5F10BGLFLNA <sup>*1</sup>	①R5F10BGGFLFB <sup>*1</sup> ②R5F10BGGINA <sup>*1</sup>	R5F10BCLCLFB <sup>*1</sup>	R5F10BCLDLFB <sup>*1</sup>	R5F10BLELFB <sup>*1</sup>	R5F10BLFLFB <sup>*1</sup>	R5F10BLGLFB <sup>*1</sup>	R5F10BMLFLFB <sup>*1</sup>	R5F10BMFLFB <sup>*1</sup>	R5F10BMLGLFB <sup>*1</sup>	R5F10BMGLFB <sup>*1</sup>											
CPU		RL78 CPU core																																		
Memory	Flash ROM [bytes]	32 K	48 K	64 K	96 K	128 K	32 K	48 K	64 K	96 K	128 K	32 K	48 K	64 K	96 K	128 K	32 K	48 K	64 K	96 K	128 K	32 K	48 K	64 K	96 K	128 K										
	Data flash [bytes]	4 K						4 K						4 K						4 K																
	RAM [bytes]	2 K	3 K	4 K	6 K	8 K	2 K	3 K	4 K	6 K	8 K	2 K	3 K	4 K	6 K	8 K	2 K	3 K	4 K	6 K	8 K	2 K	3 K	4 K	6 K	8 K										
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		32 MHz (automotive applications, T <sub>A</sub> = -40 to +105°C), 24 MHz (automotive applications, T <sub>A</sub> = -40 to +125°C)																																
		External resonator		20 MHz																																
		Timer RD clock		64 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																																
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																																		
	High-speed on-chip oscillator [Hz]	64 MHz (±2%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +105°C), 48 MHz (±3%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +125°C)																																		
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																																		
	Subclock (32.768 kHz)	—												32.768 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																						
	PLL	Multiplication factors: ×3, ×4, ×6, ×8																																		
I/O	I/O ports	23						25						38						52						68										
	N-channel open drain (6 V tolerance)	—																																		
	N-channel open drain (E <sub>VDD</sub> tolerance)	9						13						16						—						—										
Timers	16-bit timer TAU [channels]	16																																		
	Timer RJ	1																																		
	Timer RD	2																																		
	Real-time clock (RTC) [channels]	1																																		
	Watchdog timer (WDT) [channels]	1																																		
Serial interfaces	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	1						—						—						—																
	CSI × 4, UART × 2, simplified I <sup>2</sup> C × 4	—						—						1						—																
	UART × 1, LIN (RLIN3) × 1	—						—						1						—																
	CAN (RS-CAN lite) × 1	—						—						1						—																
	Multi-master I <sup>2</sup> C × 1	—						—						1						—																
DTC (sources)	36						—						37						—																	
External interrupts [channels]	9						—						13						14																	
OCD	On-chip debugging	Supported (hot plugin, trace)																																		
Peripheral functions	8/10-bit A/D converter [channels]	12						10						15						19						20										
	8-bit D/A converter [channels]	—																																		
	Comparator [channels]	—																																		
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																																		
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), RTC output (1 Hz) × 1												—												clock/buzzer output × 1										
Safety functions	Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), SRAM ECC function, CPU stack pointer monitor function, clock monitor function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function																																			
Other	Power supply voltage [V]	V <sub>DD</sub> = 2.7 to 5.5 V																																		
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +105°C (L: automotive applications), T <sub>A</sub> = -40 to +125°C (K: automotive applications) <sup>*1</sup>																																		
	Package (size [mm])	30-LSSOP (6.1 × 9.85 mm)						32-HVQFN (5 × 5 mm)						①48-LFQFP (7 × 7 mm) ②48-HVQFN (7 × 7 mm)						64-LFQFP (10 × 10 mm)						80-LFQFP (12 × 12 mm)										

Note: 1. The K version for industrial applications with an operating temperature range of -40 to +125°C is the R5F10BxxKxx, and the Y version for industrial applications with an operating temperature range of -40 to +150°C is the R5F10BxxYxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/F13 (20 to 80 pins)**

Series		RL78/F13 (LIN version)																																		
Pin count		20-pin				30-pin				32-pin				48-pin				64-pin				80-pin														
Product name		R5F10AGALS <sup>*1</sup>	R5F10AGCLS <sup>*1</sup>	R5F10AGDLS <sup>*1</sup>	R5F10AGELS <sup>*1</sup>	R5F10AAALS <sup>*1</sup>	R5F10AACLS <sup>*1</sup>	R5F10AADLS <sup>*1</sup>	R5F10AAELS <sup>*1</sup>	R5F10ABALNA <sup>*1</sup>	R5F10ABCLNA <sup>*1</sup>	R5F10ABDLNA <sup>*1</sup>	R5F10ABELNA <sup>*1</sup>	①R5F10AGALFB <sup>*1</sup> ②R5F10AGALNA <sup>*1</sup>	①R5F10AGCLFB <sup>*1</sup> ②R5F10AGCLNA <sup>*1</sup>	①R5F10AGDLFB <sup>*1</sup> ②R5F10AGDLNA <sup>*1</sup>	①R5F10AGELFB <sup>*1</sup> ②R5F10AGELNA <sup>*1</sup>	①R5F10AALFLFB <sup>*1</sup> ②R5F10AALFLNA <sup>*1</sup>	①R5F10AACLFLFB <sup>*1</sup> ②R5F10AACLFLNA <sup>*1</sup>	①R5F10AADLFLFB <sup>*1</sup> ②R5F10AADLFLNA <sup>*1</sup>	①R5F10AAELFLFB <sup>*1</sup> ②R5F10AAELFLNA <sup>*1</sup>	①R5F10ABALFLFB <sup>*1</sup> ②R5F10ABALFLNA <sup>*1</sup>	①R5F10ABCLFLFB <sup>*1</sup> ②R5F10ABCLFLNA <sup>*1</sup>	①R5F10ABDLFLFB <sup>*1</sup> ②R5F10ABDLFLNA <sup>*1</sup>	①R5F10ABELFLFB <sup>*1</sup> ②R5F10ABELFLNA <sup>*1</sup>	①R5F10ALCLFLFB <sup>*1</sup> ②R5F10ALCLFLNA <sup>*1</sup>	①R5F10ALDLFLFB <sup>*1</sup> ②R5F10ALDLFLNA <sup>*1</sup>	①R5F10ALELFLFB <sup>*1</sup> ②R5F10ALELFLNA <sup>*1</sup>	①R5F10ALFLFLFB <sup>*1</sup> ②R5F10ALFLFLNA <sup>*1</sup>	①R5F10ALGLFLFB <sup>*1</sup> ②R5F10ALGLFLNA <sup>*1</sup>						
CPU		RL78 CPU core																																		
Memory	Flash ROM [bytes]	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K	16 K	32 K	48 K	64 K							
	Data flash [bytes]	4 K				4 K				4 K				4 K				4 K																		
	RAM [bytes]	1 K	2 K	3 K	4 K	1 K	2 K	3 K	4 K	1 K	2 K	3 K	4 K	1 K	2 K	3 K	4 K	1 K	2 K	3 K	4 K	1 K	2 K	3 K	4 K	1 K	2 K	3 K	4 K							
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		32 MHz (automotive applications, T <sub>A</sub> = -40 to +105°C), 24 MHz (automotive applications, T <sub>A</sub> = -40 to +125°C)																																
		External resonator		20 MHz																																
		Timer RD clock		64 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																																
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																																		
	High-speed on-chip oscillator [Hz]	64 MHz (±2%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +105°C), 48 MHz (±3%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +125°C)																																		
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																																		
	Subclock (32.768 kHz)	—												32.768 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																						
	PLL	Multiplication factors: ×3, ×4, ×6, ×8																																		
I/O	I/O ports	13				23				25				38				52				68														
	N-channel open drain (6 V tolerance)	—																																		
	N-channel open drain (E <sub>VDD</sub> tolerance)	6				10				16/13				16/13				16																		
Timers	16-bit timer TAU [channels]	—				8				—				12				8				12														
	Timer RJ	—				—				1				—				—																		
	Timer RD	—				—				2				—				—																		
	Real-time clock (RTC) [channels]	—				—				1				—				—																		
	Watchdog timer (WDT) [channels]	—				—				1				—				—																		
Serial interfaces	CSI × 2, UART × 1, simplified I <sup>2</sup> C × 2	—				—				1				—				1																		
	CSI × 4, UART × 2, simplified I <sup>2</sup> C × 4	—				—				—				1				—																		
	UART × 1, LIN (RLIN3) × 1	—				—				1				—				—																		
	CAN (RS-CAN lite) × 1	—				—				—				—				—																		
	Multi-master I <sup>2</sup> C × 1	—				—				1				—				1																		
DTC (sources)	28				29				30				36				30				36															
External interrupts [channels]	7				8				10				12				10				13															
OCD	On-chip debugging	Supported (hot plugin, trace)																																		
Peripheral functions	8/10-bit A/D converter [channels]	4				10				8				12				15				12				19				20						
	8-bit D/A converter [channels]	—																																		
	Comparator [channels]	—																																		
	Multiplier/divider/multiply-accumulator	Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) Multiply-accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																																		
	Other functions	Power-on reset (POR), low-voltage detection circuit (LVD), RTC output (1 Hz) × 1												—												clock/buzzer output × 1										
Safety functions	Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), SRAM ECC function, CPU stack pointer monitor function, clock monitor function, RAM guard function, SFR guard function, illegal memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function																																			
Other	Power supply voltage [V]	V <sub>DD</sub> = 2.7 to 5.5 V																																		
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +105°C (L: automotive applications), T <sub>A</sub> = -40 to +125°C (K: automotive applications) <sup>*1</sup>																																		
	Package (size [mm])	20-LSSOP (6.1 × 6.65 mm)				30-LSSOP (6.1 × 9.85 mm)				32-HVQFN (5 × 5 mm)				①48-LFQFP (7 × 7 mm) ②48-HVQFN (7 × 7 mm)				64-LFQFP (10 × 10 mm)				80-LFQFP (12 × 12 mm)														

Note: 1. The K version for industrial applications with an operating temperature range of -40 to +125°C is the R5F10AxxKxx, and the Y version for industrial applications with an operating temperature range of -40 to +150°C is the R5F10AxxYxx. For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/F14 (30 to 100 pins)**

Series		RL78/F14																											
Pin count		30-pin				32-pin				48-pin								64-pin				80-pin				100-pin			
Product name		R5F10PADLSP <sup>*1</sup>	R5F10PAELSP <sup>*1</sup>	R5F10PBDLMA <sup>*1</sup>	R5F10PBELMA <sup>*1</sup>	① R5F10PGDLFB <sup>*1</sup> ② R5F10PGDLNA <sup>*1</sup>	① R5F10PGELFB <sup>*1</sup> ② R5F10PGELMA <sup>*1</sup>	① R5F10PGFLFB <sup>*1</sup> ② R5F10PGFLMA <sup>*1</sup>	① R5F10PGGLFB <sup>*1</sup> ② R5F10PGGLNA <sup>*1</sup>	① R5F10PGHLFB <sup>*1</sup> ② R5F10PGHLMA <sup>*1</sup>	① R5F10PGJLFB <sup>*1</sup> ② R5F10PGJLNA <sup>*1</sup>	R5F10PLELFB <sup>*1</sup>	R5F10PLFLFB <sup>*1</sup>	R5F10PLGLFB <sup>*1</sup>	R5F10PLHLFB <sup>*1</sup>	R5F10PLJLFB <sup>*1</sup>	R5F10PMELFB <sup>*1</sup>	R5F10PMFLFB <sup>*1</sup>	R5F10PMGLFB <sup>*1</sup>	R5F10PMHLFB <sup>*1</sup>	R5F10PMJLFB <sup>*1</sup>	R5F10PPELFB <sup>*1</sup>	R5F10PPFLFB <sup>*1</sup>	R5F10PPGLFB <sup>*1</sup>	R5F10PPHLFB <sup>*1</sup>	R5F10PPJLFB <sup>*1</sup>			
CPU		RL78 CPU core																											
Memory	Flash ROM [bytes]	48 K	64 K	48 K	64 K	48 K	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K	64 K	96 K	128 K	192 K	256 K			
	Data flash [bytes]	4 K		4 K		4 K				8 K								4 K		8 K				4 K		8 K			
	RAM [bytes]	4 K	6 K	4 K	6 K	4 K	6 K	8 K	10 K	16 K	20 K	6 K	8 K	10 K	16 K	20 K	6 K	8 K	10 K	16 K	20 K	6 K	8 K	10 K	16 K	20 K			
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		32 MHz (automotive applications, T <sub>A</sub> = -40 to +105°C), 24 MHz (automotive applications, T <sub>A</sub> = -40 to +125°C), 24 MHz (automotive applications, T <sub>A</sub> = -40 to +150°C)																									
		External resonator		20 MHz																									
		Timer RD clock		64 MHz																									
Clock generator circuit	Crystal/ceramic oscillator [Hz]	1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																											
	High-speed on-chip oscillator [Hz]	64 MHz (±2%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +105°C), 48 MHz (±3%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +150°C)												V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +125°C), 48 MHz (±5%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +150°C)															
	Low-speed on-chip oscillator [Hz]	15 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																											
	Subclock (32.768 kHz)	—				32.768 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																							
	PLL	Multiplication factors: ×3, ×4, ×6, ×8																											
I/O	I/O ports	23	25	38								52				68				86									
	N-channel open drain (6 V tolerance)	—																											
	N-channel open drain (E <sub>VDD</sub> tolerance)	9	13	16								16				16				16									
Timers	16-bit timer TAU [channels]	12				16 or 12								16				16											
	16-bit timer RJ [channels]	1																											
	16-bit timer RD [channels]	2																											
	Real-time clock (RTC) [channels]	1																											
	Watchdog timer (WDT) [channels]	1																											
Serial interfaces	CSI × 3, UART × 2, simplified I <sup>2</sup> C × 3	1				—								—				—											
	CSI × 4, UART × 2, simplified I <sup>2</sup> C × 4	—				1								1				1											
	UART × 1, LIN (RLIN3) × 1	1				2 or 1								2				2											
	CAN (RS-CAN lite) × 1	1																											
	Multi-master I <sup>2</sup> C × 1	—				1								1				1											
DTC (sources)	37				44/38								44				44												
ELC (inputs/trigger outputs)	20/7				26 (20) /9 (7)								26				26/9												
External interrupts [channels]	9				14 or 13								15 or 14				16 or 14												
OCD	On-chip debugging	Supported (hot plugin, trace)																											
Peripheral functions	8/10-bit A/D converter [channels]	10	8	13								17 or 16				18 or 16				24									
	8-bit D/A converter [channels]	1																											
	Comparator [channels]	1																											
	Multiplier/divider/multiply-accumulator	Multiply/divide/								multiply-accumulate instructions supported (included in CPU instruction set)																			
	Other functions	Multiply-								accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																			
Safety functions	Power-on reset (POR),								Flash memory CRC calculation function (high-speed), CRC calculation function illegal memory access detection function, (general-purpose), SRAM ECC function, CPU stack pointer monitor function, clock monitor function, RAM guard function, SFR guard function, frequency detection function, A/D converter test function, I/O power output signal level detection function																				
Other	Power supply voltage [V]	V <sub>DD</sub> = 2.7 to 5.5 V																											
	Operating ambient temperature [°C]	T <sub>A</sub> = -40 to +105°C (L: automotive applications),												T <sub>A</sub> = -40 to +125°C (K: automotive applications), T <sub>A</sub> = -40 to +150°C (Y: automotive applications) <sup>*1</sup>															
	Package (size [mm])	30-LSSOP (6.1 × 9.85 mm)	32-HVQFN (5 × 5 mm)	① 48-LFQFP (7 × 7 mm) ② 48-HVQFN (7 × 7 mm)								64-LFQFP (10 × 10 mm)				80-LFQFP (12 × 12 mm)				100-LFQFP (14 × 14 mm)									

Note: 1. The K version for industrial applications with an operating temperature range of -40 to +125°C is the R5F10PxxKxx, and the Y version for industrial applications with an operating temperature range of -40 to +150°C is the R5F10PxxYxx.

For details, see "How to read RL78 Family product numbers" on page 122.

**RL78/F15 (48 to 144 pins)**

Series		RL78/F15																			
Pin count		48-pin				64-pin		80-pin		100-pin					144-pin						
Product name		RF113GKLF <sup>*1</sup>	RF113GLLF <sup>*1</sup>	RF113GKLN <sup>*1</sup>	RF113GLLN <sup>*1</sup>	RF113JKLF <sup>*1</sup>	RF113LLLF <sup>*1</sup>	RF113MKLF <sup>*1</sup>	RF113MLLF <sup>*1</sup>	RF113PGLF <sup>*1</sup>	RF113PHLF <sup>*1</sup>	RF113PJLF <sup>*1</sup>	RF113PKLF <sup>*1</sup>	RF113PLLF <sup>*1</sup>	RF113TGLF <sup>*1</sup>	RF113THLF <sup>*1</sup>	RF113TJLF <sup>*1</sup>	RF113TKLF <sup>*1</sup>	RF113TLLF <sup>*1</sup>		
CPU		RL78 CPU core																			
Memory	Flash ROM [bytes]	384 K	512 K	384 K	512 K	384 K	512 K	384 K	512 K	128 K	192 K	256 K	384 K	512 K	128 K	192 K	256 K	384 K	512 K		
	Data flash [bytes]	16 K								8 K			16 K			8 K			16 K		
	RAM [bytes]	26 K	32 K	26 K	32 K	26 K	32 K	26 K	32 K	10 K	16 K	20 K	26 K	32 K	10 K	16 K	20 K	26 K	32 K		
Operating clocks	Maximum operating frequency [Hz]	On-chip oscillator clock		32 MHz (automotive applications, T <sub>A</sub> = -40 to +105°C), 24 MHz (automotive applications, T <sub>A</sub> = -40 to +125°C)																	
		External resonator		20 MHz																	
		Timer RD clock		64 MHz																	
Clock generator circuit	Crystal/ceramic oscillator [Hz]		1 to 20 MHz (V <sub>DD</sub> = 2.7 to 5.5 V)																		
	High-speed on-chip oscillator [Hz]		64 MHz (±2%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +105°C), 48 MHz (±3%): V <sub>DD</sub> = 2.7 to 5.5 V (automotive applications/T <sub>A</sub> = -40 to +125°C)																		
	Low-speed on-chip oscillator [Hz]		15 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																		
	Subclock (32.768 kHz)		32.768 kHz (V <sub>DD</sub> = 2.7 to 5.5 V)																		
	PLL		Multiplication factors: ×3, ×4, ×6, ×8																		
I/O	I/O ports		38				52		68		86					130					
	N-channel open drain (6 V tolerance)		—																		
	N-channel open drain (E <sub>VDD</sub> tolerance)		16																		
Timers	16-bit timer TAU [channels]		16																		
	16-bit timer RJ [channels]		1																		
	16-bit timer RD [channels]		2																		
	Real-time clock (RTC) [channels]		1																		
	Watchdog timer (WDT) [channels]		1																		
Serial interfaces	CSI × 6, UART × 3, simplified I <sup>2</sup> C × 4		1																		
	CSI × 3, UART × 2, simplified I <sup>2</sup> C × 3		—																		
	CSI × 4, UART × 2, simplified I <sup>2</sup> C × 4		1																		
	UART × 1, LIN (RLIN3) × 1		2																		
	CAN (RS-CAN lite) × 1		2																		
	IEBus controller		1																		
	Multi-master I <sup>2</sup> C × 1		1																		
DTC (sources)		46				50					52										
ELC (inputs/trigger outputs)		26/9																			
External interrupts [channels]		15				18		19		20					22						
OCD	On-chip debugging		Supported (hot plugin, trace)																		
Peripheral functions	8/10-bit A/D converter [channels]		13				17		18		24										
	8-bit D/A converter [channels]		1																		
	Comparator [channels]		1																		
	Multiplier/divider/multiply-accumulator		Multiply/divide/multiply-accumulate instructions supported (included in CPU instruction set) Multiply: 16-bit × 16-bit = 32-bit (signed/unsigned) Divide: 32-bit ÷ 32-bit = 32-bit (unsigned) accumulate: 16-bit × 16-bit + 32-bit = 32-bit (signed/unsigned)																		
Safety functions	Other functions		Power-on reset (POR), low-voltage detection circuit (LVD), RTC output (1 Hz) × 1, clock/buzzer output × 2																		
			Flash memory CRC calculation function (high-speed), CRC calculation function (general-purpose), SRAM ECC function, CPU stack pointer monitor function, clock monitor function, RAM guard function, memory access detection function, frequency detection function, A/D converter test function, I/O power output signal level detection function																		
Other	Power supply voltage [V]		V <sub>DD</sub> = 2.7 to 5.5 V																		
	Operating ambient temperature [°C]		T <sub>A</sub> = -40 to +105°C (L: automotive applications), T <sub>A</sub> = -40 to +125°C (K: automotive applications)																		
	Package (size [mm])		48-LFQFP (7 × 7 mm)		48-HVQFN (7 × 7 mm)		64-LFQFP (10 × 10 mm)		80-LFQFP (12 × 12 mm)		100-LFQFP (14 × 14 mm)					144-LFQFP (20 × 20 mm)					

Note: 1. K version for automotive applications with operating temperature range of -40 to +125°C also available.

# RL78 Family Package lineup

**LQFP**

<b>32-LQFP</b> (7 × 7 mm)	<b>44-LQFP</b> (10 × 10 mm)	<b>52-LQFP</b> (10 × 10 mm)	<b>64-LQFP</b> (12 × 12 mm)
Pitch: 0.80 mm Thickness (max.): 1.70 mm Used by: RL78/G14, G1C, G1F, G1G, I1D, L12	Pitch: 0.80 mm Thickness (max.): 1.60 mm Used by: RL78/G13, G14, G1G, L12	Pitch: 0.65 mm Thickness (max.): 1.70 mm Used by: RL78/G13, G14, L12	Pitch: 0.65 mm Thickness (max.): 1.60 mm Used by: RL78/G13, G14, L12, L13

**LFQFP**

<b>64-LFQFP</b> (14 × 14 mm)	<b>80-LFQFP</b> (14 × 14 mm)	<b>100-LFQFP</b> (14 × 20 mm)	<b>48-LFQFP</b> (7 × 7 mm)
Pitch: 0.80 mm Thickness (max.): 1.70 mm Used by: RL78/G14	Pitch: 0.65 mm Thickness (max.): 1.70 mm Used by: RL78/G13, G14, L13	Pitch: 0.65 mm Thickness (max.): 1.60 mm Used by: RL78/G13, G14	Pitch: 0.50 mm Thickness (max.): 1.70 mm Used by: RL78/G13, G14, G1A, G1C, L12, F13, F14

<b>64-LQFP</b> (10 × 10 mm)	<b>80-LQFP</b> (12 × 12 mm)	<b>100-LQFP</b> (14 × 14 mm)	<b>128-LQFP</b> (14 × 20 mm)	<b>144-LQFP</b> (20 × 20 mm)
Pitch: 0.50 mm Thickness (max.): 1.60 mm Used by: RL78/G13, G14, G1A, L12, F13, F14	Pitch: 0.50 mm Thickness (max.): 1.70 mm Used by: RL78/G13, G14, RL78/G14, I1B, I1C, L13, L14	Pitch: 0.50 mm Thickness (max.): 1.70 mm Used by: RL78/G13, G14, RL78/G14, I1B, I1C, L1C	Pitch: 0.50 mm Thickness (max.): 1.60 mm Used by: RL78/G13	Pitch: 0.50 mm Thickness (max.): 1.60 mm Used by: RL78/F15

**SSOP**

<b>16-SSOP</b> (4.4 × 5 mm)	<b>38-SSOP</b> (7.62 mm(300 mil))	<b>10-LSSOP</b> (4.4 × 3.6 mm)	<b>20-LSSOP</b> (4.4 × 6.5 mm)	<b>20-LSSOP</b> (7.62 mm(300 mil))	<b>30-LSSOP</b> (7.62 mm(300 mil))
Pitch: 0.65 mm Thickness (max.): 1.725 mm Used by: RL78/G10	Pitch: 0.65 mm Thickness (max.): 2.00 mm Used by: RL78/I1A	Pitch: 0.65 mm Thickness (max.): 1.45 mm Used by: RL78/G10	Pitch: 0.65 mm Thickness (max.): 1.45 mm Used by: RL78/G11, G12, I1A, I1D	Pitch: 0.65 mm Thickness (max.): 1.40 mm Used by: RL78/G13, F13	Pitch: 0.65 mm Thickness (max.): 1.40 mm Used by: RL78/G12, G13, G14, G16, I1A, I1D, F13, F14

**LSSOP**

**HWQFN**

<b>32-HWQFN</b> (5 × 5 mm)	<b>48-HWQFN</b> (7 × 7 mm)	<b>64-HWQFN</b> (9 × 9 mm)	<b>24-HWQFN</b> (4 × 4 mm)	<b>32-HWQFN</b> (5 × 5 mm)
Pitch: 0.50 mm Thickness (max.): 0.90 mm Used by: RL78/I1D, I1E, F13, F14	Pitch: 0.50 mm Thickness (max.): 0.90 mm Used by: RL78/F13, F14	Pitch: 0.50 mm Thickness (max.): 1.00 mm Used by: RL78/G1H	Pitch: 0.50 mm Thickness (max.): 0.80 mm Used by: RL78/G11, G12, G13, G1F, I1D	Pitch: 0.50 mm Thickness (max.): 0.80 mm Used by: RL78/G13, G14, G1A, G1C

<b>40-HWQFN</b> (6 × 6 mm)	<b>48-HWQFN</b> (6 × 6 mm)	<b>48-HWQFN</b> (7 × 7 mm)	<b>64-HWQFN</b> (8 × 8 mm)	<b>64-HWQFN</b> (9 × 9 mm)
Pitch: 0.50 mm Thickness (max.): 0.80 mm Used by: RL78/G13, G14	Pitch: 0.40 mm Thickness (max.): 0.80 mm Used by: RL78/G1D	Pitch: 0.50 mm Thickness (max.): 0.80 mm Used by: RL78/G13, G14, G1A, G1C	Pitch: 0.40 mm Thickness (max.): 0.80 mm Used by: RL78/L12	Pitch: 0.50 mm Thickness (max.): 0.80 mm Used by: RL78/G1E

**TFBGA**

<b>36-TFBGA</b> (4 × 4 mm)
Pitch: 0.50 mm Thickness (max.): 1.10 mm Used by: RL78/I1E

**VFBGA**

<b>64-VFBGA</b> (4 × 4 mm)
Pitch: 0.40 mm Thickness (max.): 0.99 mm Used by: RL78/G13, G1A

**VFLGA**

<b>85-VFLGA</b> (7 × 7 mm)
Pitch: 0.65 mm Thickness (max.): 1.00 mm Used by: RL78/L1C

**WFLGA**

<b>25-WFLGA</b> (3 × 3 mm)	<b>36-WFLGA</b> (4 × 4 mm)	<b>64-WFLGA</b> (5 × 5 mm)
Pitch: 0.50 mm Thickness (max.): 0.76 mm Used by: RL78/G11, G13, G1A	Pitch: 0.50 mm Thickness (max.): 0.76 mm Used by: RL78/G13, G14, G1F	Pitch: 0.50 mm Thickness (max.): 0.76 mm Used by: RL78/G14

## How to read RL78 Family product numbers

**R5 F 1 00 6 E A SP #V0**

**R5** Renesas MCU  
**F** ROM Type  
**F:** Flash  
**1** RL78 Series  
**00** Pin count  
**6** ROM capacity (KB)  
**E** Package type  
**A** Application category  
**SP** Packing specification  
**#V0** Packing specification

Product group	
00	G13 Data flash
01	No data flash
02	G12 Data flash
03	No data flash
04	G14
05	G11
07	I1A
09	F12
0A	F13 LIN
0B	F13 LIN & CAN
0E	G1A
0F	G1E
0J	G1C USB host & function
0K	G1C USB function
0M	I1B
0N	I1C
0P	F14
0R	L12
0W	L13
0Y	G10
10	L1C LCD & USB function
11	L1C LCD
13	F15
17	I1D
1A	G1D
1B	G1F
1C	I1E
1E	G1G
1F	G1H
1M	L1A

Pin count	
1	10
4	16
6	20
7	24
8	25
A	30
B	32
C	36
D	38
E	40
F	44
G	48
J	52
L	64
M	80
P	100
S	128
T	144

ROM capacity (KB)	
4	1
6	2
8	8
9	12
A	16
C	32
D	48
F	96
G	128
H	192
J	256
K	384
L	512

Packing specification	
#U, #2	Tray (HWQFN, HVQFN, VFBGA, WFLGA, VFBGA)
#V, #3	Tray*1 (LFQFP, LQFP, LSSOP, SSOP)
#W, #4	Embossed Tape (HWQFN, HVQFN, VFBGA, WFLGA, VFBGA)
#X, #5	Embossed Tape (LFQFP, LQFP, LSSOP, SSOP)

Package type	
SP	SSOP 0.65 mm
SP	LSSOP 0.65 mm
NA	HWQFN 0.5 mm
NA	HVQFN 0.5 mm
NB	HWQFN 0.65 mm
NB	HWQFN 0.4 mm
LA	WFLGA 0.5 mm
LA	VFLGA 0.65 mm
BG	VFBGA 0.4 mm
BG	TFBGA 0.5mm
FA	LQFP 0.65 mm
FB	LFQFP 0.5 mm
FP	LQFP 0.8 mm

Application category	
A	-40°C to 85°C Consumer
D	-40°C to 85°C Industrial
G	-40°C to 105°C Industrial
M	-40°C to 125°C Industrial
J	-40°C to 85°C Automotive
L	-40°C to 105°C Automotive
K	-40°C to 125°C Automotive
Y	-40°C to 150°C Automotive

Notes: Product information for the RL78/G13 (20-pin) with product number R5F1006EASP#V0 is shown as an example.  
1. For 20-pin RL78/G12 and RL78/I1A LSSOP products only the package specification is tube.

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