

Renesas Microcomputer

8-bit All Flash

78K0S, 78K0 Microcontrollers

Empower your
creativity



Flash

Shifting to "All Flash"

All of our 8-bit general-purpose microcontrollers employ reliable flash memories.

A new evolution leading to system development success

Answering ever more specific needs, contributing to cost cutting, delivering peace of mind that can be relied on.

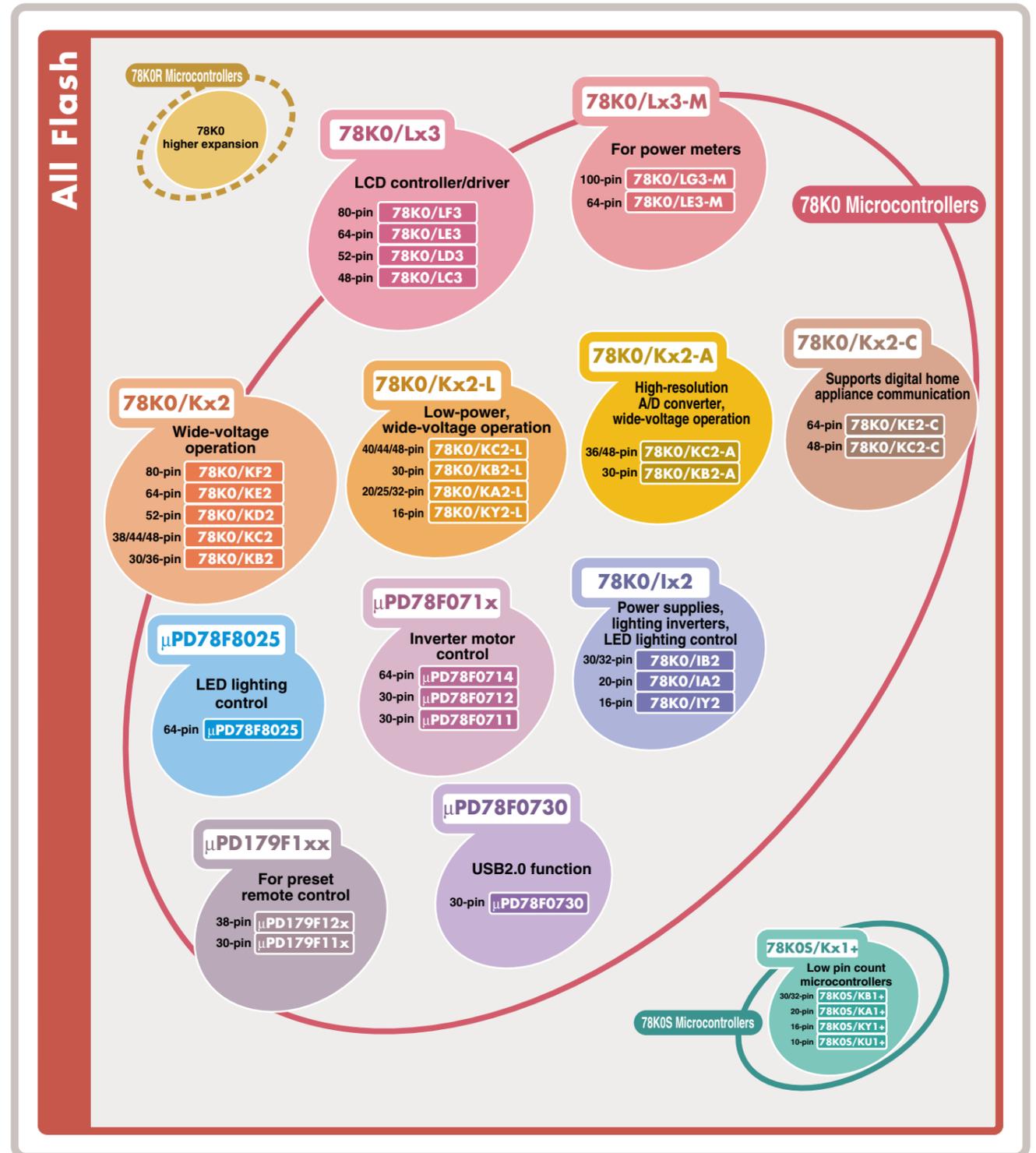
To ensure that our diversified offering of 8-bit microcontrollers designed for many different applications truly empower our customers, which path should we aim for?

Renesas Electronics, which has consistently been tracing the future course of microcontrollers, has come up with an answer, embodied by its shift to All Flash:

To offer a full lineup consisting entirely of flash memory products.

A truly diversified lineup that offers a full range of products, which are available with 10 to 100 pins and ROM capacity of 1 KB to 128 KB; cuts total cost by allowing program changes, the incorporation of peripheral functions, and lower power consumption; as well as providing a full range of development tools that dramatically enhance ease of use.

More than just providing its devices with sophisticated functions, Renesas Electronics has also created an entire infrastructure that ranges from the development of flash microcontrollers to their delivery.



Application examples

All Flash microcontrollers are suitable for various application fields and raise the commercial value of customer systems.



Cameras

Digital still cameras, digital video cameras, SLR cameras



Audio

Portable audio, component stereo systems



Industrial equipment

Industrial motors, control equipment, vending machines, power meters



Portable devices

PDA, IC recorders



Computer peripherals

LBP, PPC, MFP, inkjet printers, scanners, fax machines



Home appliances

Air conditioners, refrigerators, washing machines, microwave ovens



Video and recording equipment

Blu-ray players, Blu-ray recorders, industrial cameras



Remote control

Preset remote control, etc.



Other

Electronic instruments, electric bidets, toys, etc.

Flash microcontrollers can boost the competitiveness of your systems. Based on this concept, we are shifting to "All Flash".

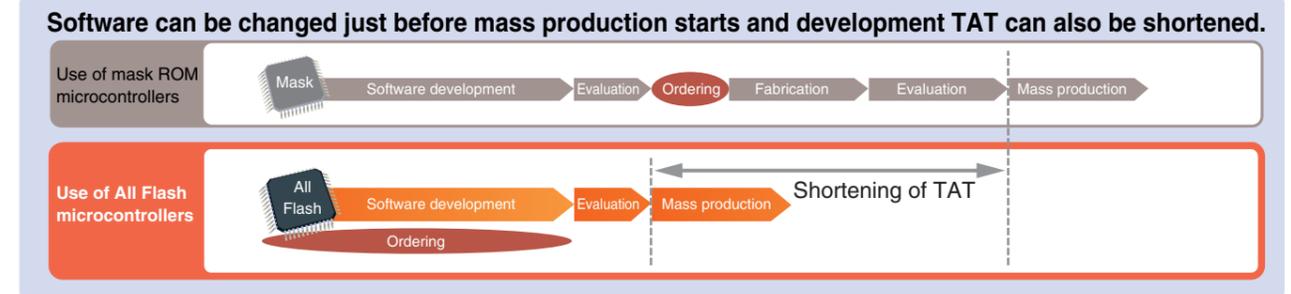


Flash microcontrollers offer overwhelming advantages.

Compared to mask ROM microcontrollers, flash microcontrollers definitely contribute to speeding up system development. Microcontrollers can be ordered before program completion and programs can be written even after the microcontroller has been mounted on the board. Microcontroller order placement and program development can therefore be done concurrently, allowing TAT to be shortened as a result.

In addition, when flash microcontrollers are used for products with many different versions or that are localized for specific regions, the cost of ordering mask ROM microcontrollers is eliminated and purchase and stock management costs can be slashed.

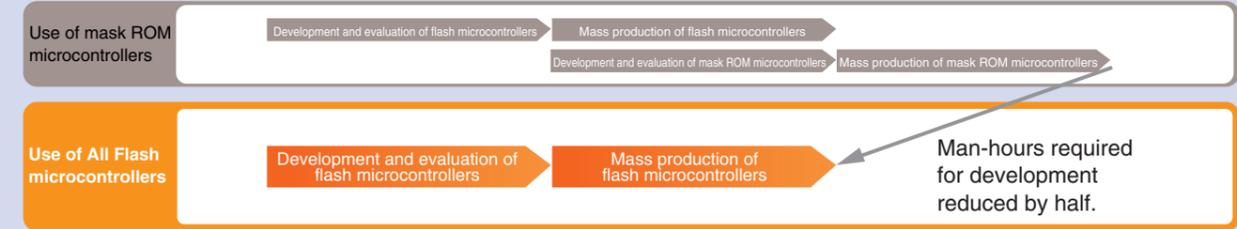
For software designers



Since mask ROM microcontrollers cannot be ordered until their specifications are finalized, last-minute software changes can be problematic. On the other hand, specifications for flash microcontrollers can be changed just prior to the start of mass production. Thus orders for flash microcontrollers can be placed while the software is still being developed, allowing the development TAT to be shortened.

For hardware designers

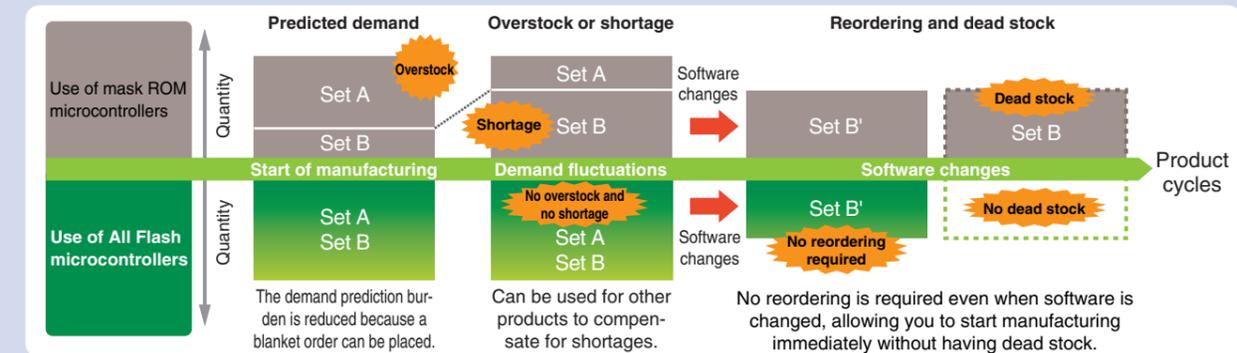
Mass-produced flash microcontrollers require evaluation only once, reducing development man-hours.



In the case of mass-produced mask ROM microcontrollers, evaluations of both flash microcontrollers and mask ROM microcontrollers are required. Since evaluated flash microcontrollers can be directly mass-produced, the man-hours required for development are reduced by half, resulting in greatly shortened development TAT.

For purchasing divisions

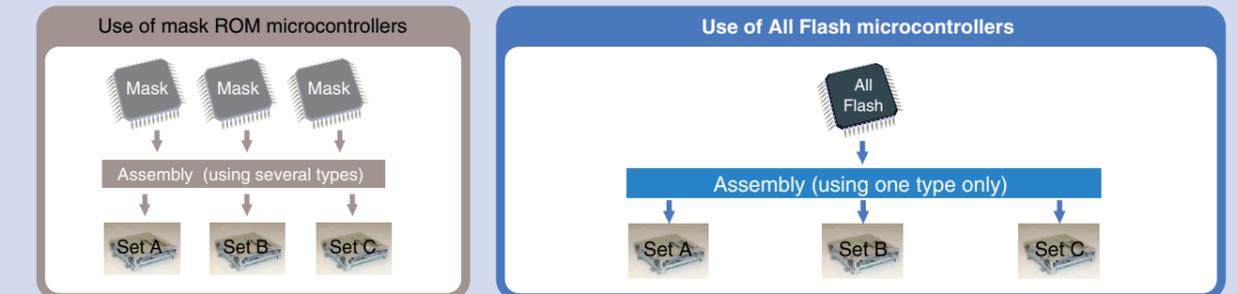
Flash microcontrollers protect you from fluctuations in demand and can reduce dead stock.



Mass-produced mask ROM microcontrollers may become dead stock as the result of changes in software or fluctuations in demand. On the other hand, flash microcontrollers can be mass-produced immediately after software changes and used for other products, resulting in fewer lost opportunities, less dead stock, and lower ordering costs.

For manufacturing divisions

Parts sharing makes production planning easier and boosts production efficiency.



In the case of mass-produced mask ROM microcontrollers, the use of different software for different products necessitates the use of a different microcontroller for each type of product. In contrast, mass-produced flash microcontrollers facilitate the sharing of parts since they can be used for various products by simply rewriting the software.

Unsure about flash microcontrollers? Renesas Electronics can dispel your concerns in flash microcontrollers.



"Reliability" is the concept.

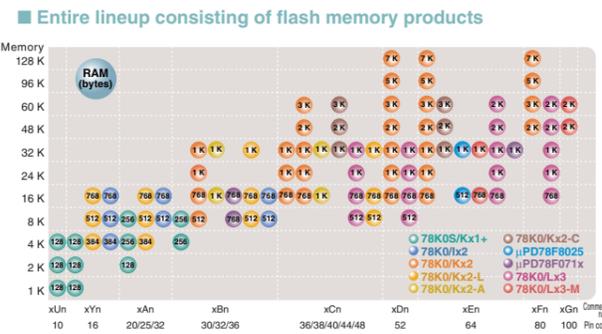
Compared to mask ROM microcontrollers, flash microcontrollers definitely speed up system development. On the other hand, they are often considered as expensive and available in limited configurations. Renesas Electronics

has successfully cleared various hurdles by adapting development, production, sales, and distribution processes specifically for flash microcontrollers, to offer reliable microcontrollers that are attractive in all respects.

Large selection

We offer enhanced 293 products.

To respond to demands for various types of microcontrollers, we offer a range of 293 All Flash 8-bit microcontrollers featuring various pin counts, ROM capacities, packages, etc. Among these, the 78K0/Kx2, 78K0/Kx2-A, μ PD78F8025, and μ PD78F071x feature an operating speed of 20 MHz; the 78K0/Kx2-L, 78K0/Kx2, 78K0/Kx2-A, μ PD78F8025, and 78K0/Lx3 feature a wide power supply range of 1.8 to 5.5 V. The package lineup includes low-pin-count SSOPs (16, 20, and 30 pins), a 32-pin 5 x 5 mm WQFN and a 40-pin 6 x 6 mm WQFN. With these packages, we have achieved a 46% reduction in package thickness and reduction in package size of up to 87% compared with our conventional 8-bit microcontrollers (which come in an 80-pin LQFP with a size of 14 mm x 14 mm), helping you reduce the size of your set. Our large selection allows you to select the best product for your needs.

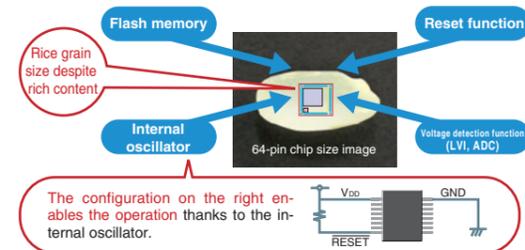


Low cost

Our low prices overturn conventional notions.

We have drastically reduced costs through the application of new processes, etc., overturning the conventional notion that flash microcontrollers are expensive. Our microcontrollers use flash memory instead of EEPROM™, an internal oscillator, a voltage detection function (LVI), a reset function, and various other functions normally provided externally, which translates into considerably lower total system cost for you.

■ Total cost reduction through embedded peripheral IC functions



Low power consumption

About 1/3 that of mask ROM products.

Compared to the 7.6 mA operating current of conventional mask ROM products that run on 5 V/10 MHz (using an external ceramic resonator), the 78K0/Kx2, 78K0/Kx2-L, and 78K0/Kx2-A have a low operating current of 2.3 mA (1.9 mA for the 78K0/Lx3) when running on 10 MHz (using an external ceramic resonator), and just 1.4 mA (1.3 mA for the 78K0/Kx2-L) when running on 8 MHz (using an internal oscillator) under the same operating conditions. Thus lower power consumption than that of conventional mask ROM products can be achieved with our flash microcontrollers.

■ Realization of lower power consumption than mask ROM products

Condition (5 V power supply voltage)	Operating current
Mask ROM products	7.6 mA
Flash memory 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A	2.3 mA
78K0/Lx3	1.9 mA
78K0/Kx2, 78K0/Kx2-A, 78K0/Lx3	1.4 mA
78K0/Kx2-L	1.3 mA

Comparison with Renesas Electronics products

Wide variety of products for specific applications

We offer ideal products for various applications.

Renesas Electronics offers a wide range of products for specific applications, such as the 78K0/Lx2 and μ PD78F8025, provided with an inverter control feature for fluorescent and LED lighting, the 78K0/Kx2-C for digital AV applications, the μ PD179F1xx, ideal for remote control of home electronics devices, the 78K0/Lx3-M for power meters, and μ PD78F071x, ideal for controlling motors. In addition to the basic features, the specialized features of the products are well developed, enabling you to choose the best product for your application.

■ 78K0/Lx2, μ PD78F8025



■ μ PD78F071x

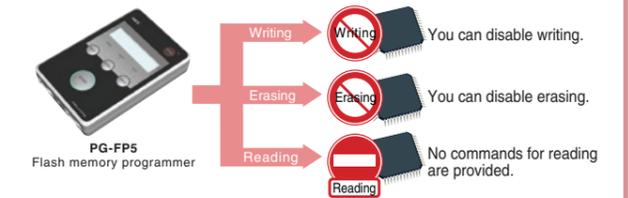


High reliability

Our products incorporate our experience and technology in the automotive field as well as software protection functions.

All our products incorporate the experience we have gained in the process of supplying microcontrollers for over 1,000 types of applications and the technology we developed for flash microcontrollers for the automotive field. Our products also feature functions that disable reading and malicious software rewriting and erasing, thus offering maximum protection of your valuable software.

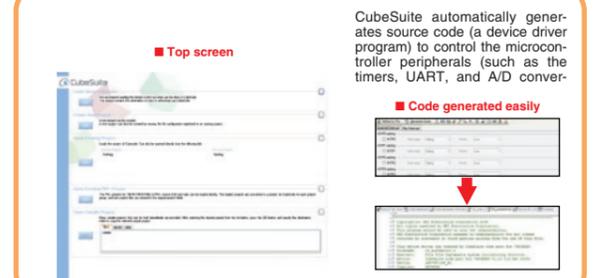
■ Incorporated software protection functions



Rich development environment

We offer inexpensive, easy-to-use, and convenient tools.

Renesas Electronics provides an easy-to-use and convenient development environment, exemplified by our newly released CubeSuite™ integrated development platform. CubeSuite can be used to compile and debug programs, manage pin layouts, generate code for microcontroller peripherals, and execute high-speed building. Add MINICUBE2, an on-chip debug emulator with flash memory programming capability, into the mix and you have a powerful environment that enables fast and accurate system development.



Support for mass production

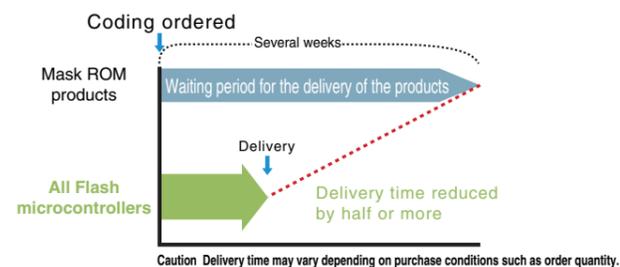
In addition to a large lineup of programming tools, we also offer programming services.

Renesas Electronics and partner manufacturers offer a large number of programming tools, making programming possible in many different settings such as development environments and production lines. Moreover, programming services are also available from partner manufacturers both in Japan and overseas, serving a broad range of needs such as large-volume programming after shipping.

We offer programmed products.

The programmed products are shipped similarly to mask ROM products.

■ Shorter delivery time than that of mask ROM products, even if they are programmed products.



■ Programming environment supporting All Flash products

Flash memory programmers made by Renesas Electronics

PG-FP5 MINICUBE2

Flash memory programmers made by partner manufacturers

Naito Denshi Machida Mfg. Co., Ltd. Yokogawa Digital Computer Corporation Wave Technology Co., Ltd.
FL-PR5 NET IMPRESS Series Y3000-8

TESSERA Technology Inc. Interface Co., Ltd.
Stick GANG Writer StickWriter ITF2000

Programming houses

Matsubara.KK ROIMTEC AVNET Logistics Synchrowatt Corporation
LIBERTY HSC ertec TAKUMI SHOJI CO.,LTD

We offer flash microcontrollers in various packages and ROM or RAM sizes, allowing you to select the best flash microcontroller for your product or application.

Commercial Name	78K0S/KU1+	78K0S/KY1+	78K0S/KA1+	78K0S/KB1+	78K0/KB2	78K0/KC2			78K0/KD2	78K0/KE2	78K0/KF2		
Pin Count	10-pin	16-pin		20-pin	30/32-pin	30/36-pin	38-pin	44-pin	48-pin	52-pin	64-pin	80-pin	
ROM (bytes)	10-pin	16-pin		20-pin	30/32-pin	30/36-pin	38-pin	44-pin	48-pin	52-pin	64-pin	80-pin	
128 K	Product name (RAM (bytes))									μPD78F0527A, μPD78F0527DA ² (7 K)	μPD78F0537A, μPD78F0537DA ² (7 K)	μPD78F0547A, μPD78F0547DA ² (7 K)	
96 K										μPD78F0526A (5 K)	μPD78F0536A (5 K)	μPD78F0546A (5 K)	
60 K									μPD78F0515A, μPD78F0515DA ² (3 K)	μPD78F0525A (3 K)	μPD78F0535A (3 K)	μPD78F0545A (3 K)	
48 K									μPD78F0514A (2 K)	μPD78F0524A (2 K)	μPD78F0534A (2 K)	μPD78F0544A (2 K)	
32 K						μPD78F0503A, μPD78F0503DA ² (1 K)	μPD78F0513A, μPD78F0513DA ² (1 K)	μPD78F0513A, μPD78F0513DA ² (1 K)	μPD78F0513A (1 K)	μPD78F0523A (1 K)	μPD78F0533A (1 K)		
24 K	78K0S/Kx1+ Microcontrollers (Low Pin Count Microcontrollers)					μPD78F0502A (1 K)	μPD78F0512A (1 K)	μPD78F0512A (1 K)	μPD78F0512A (1 K)	μPD78F0522A (1 K)	μPD78F0532A (1 K)		
16 K						μPD78F0501A (768)	μPD78F0511A (768)	μPD78F0511A (768)	μPD78F0511A (768)	μPD78F0521A (768)	μPD78F0531A (768)		
8 K							μPD78F9224 (256)	μPD78F9234 (256)	μPD78F0500A (512)				
4 K	μPD78F9202, μPD78F9502 (128)	μPD78F9212, μPD78F9512 (128)		μPD78F9222 (256)	μPD78F9232 (256)	78K0/Kx2 Microcontrollers							
2 K	μPD78F9201, μPD78F9501 (128)	μPD78F9211, μPD78F9511 (128)		μPD78F9221 (128)									
1 K	μPD78F9200, μPD78F9500 (128)	μPD78F9210, μPD78F9510 (128)											
Package	10-pin SSOP (MA) Thickness: 1.2 mm 5.72 mm (225) Pitch: 0.65 mm 	16-pin SDIP ¹ (CS) Thickness: 2.8 mm 7.62 mm (300) Pitch: 1.778 mm 	16-pin SSOP ¹ (MA) Thickness: 1.5 mm 5.72 mm (225) Pitch: 0.65 mm 	20-pin SDIP (CS) Thickness: 2.8 mm 7.62 mm (300) Pitch: 1.778 mm 	32-pin SDIP (CS) Thickness: 2.8 mm 7.62 mm (300) Pitch: 1.778 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	38-pin SSOP (MC) Thickness: 1.7 mm 7.62 mm (300) Pitch: 0.65 mm 	44-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.8 mm 	48-pin LQFP (GA) Thickness: 1.4 mm 7 × 7 mm Pitch: 0.5 mm 	52-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.65 mm 	64-pin LQFP (GC) Thickness: 1.4 mm 14 × 14 mm Pitch: 0.8 mm 	64-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.65 mm 	80-pin LQFP (GC) Thickness: 1.4 mm 14 × 14 mm Pitch: 0.65 mm 
		16-pin SSOP (GR) Thickness: 1.44 mm 5.72 mm (225) Pitch: 0.65 mm 	16-pin WLPGA ¹ (FH) Thickness: 0.4 mm 2 × 2.3 mm Pitch: 0.5 mm 	20-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	36-pin FLGA (FC) Thickness: 0.91 mm 4 × 4 mm Pitch: 0.5 mm 					64-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.5 mm 	64-pin TQFP (GA) Thickness: 1.0 mm 7 × 7 mm Pitch: 0.4 mm 	80-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.5 mm 
											64-pin FLGA (FC) Thickness: 0.91 mm 5 × 5 mm Pitch: 0.5 mm 	64-pin FPBGA (F1) Thickness: 0.69 mm 4 × 4 mm Pitch: 0.4 mm 	

*1 μPD78F9210, 78F9211, and 78F9212 only *2 Supports on-chip debugging of 78K0/Kx2
Remark The packages are shown in their actual size.

Large selection (2/3)

We offer flash microcontrollers in various packages and ROM or RAM sizes, allowing you to select the best flash microcontroller for your product or application.

Commercial Name	78K0/KY2-L	78K0/KA2-L	78K0/KB2-L	78K0/KC2-L	78K0/KB2-A	78K0/KC2-A	78K0/KC2-C*	78K0/KE2-C*	μPD179F1xx	μPD78F0730	
Pin Count	16-pin	20/25/32-pin	30-pin	40/44/48-pin	30-pin	36/48-pin	48-pin	64-pin	30-pin	38-pin	30-pin
ROM (bytes)	128 K	96 K	60 K	48 K	32 K	24 K	16 K	8 K	4 K	2 K	1 K
Product name (RAM (bytes))											
128 K	Product name (RAM (bytes))										
96 K											
60 K							μPD78F0762 (3 K)	μPD78F0765 (3 K)			
48 K							μPD78F0761 (2 K)	μPD78F0764 (2 K)			
32 K			μPD78F0573, μPD78F0578 (1 K)	μPD78F0583, μPD78F0588 (1 K)	μPD78F0591 (1 K)	μPD78F0593 (1 K)	μPD78F0760 (1 K)	μPD78F0763 (1 K)	μPD179F114 (1 K)	μPD179F124 (1 K)	
24 K									μPD179F113 (1 K)	μPD179F123 (1 K)	
16 K	μPD78F0552, μPD78F0557 (768)	μPD78F0562, μPD78F0567 (768)	μPD78F0572, μPD78F0577 (768)	μPD78F0582, μPD78F0587 (768)	μPD78F0590 (1 K)	μPD78F0592 (1 K)	78K0/Kx2-C Microcontrollers for Digital AV Applications		μPD179F112 (768)	μPD179F122 (768)	μPD78F0730 (3 K)
8 K	μPD78F0551, μPD78F0556 (512)	μPD78F0561, μPD78F0566 (512)	μPD78F0571, μPD78F0576 (512)	μPD78F0581, μPD78F0586 (512)	12-bit A/D Converter				μPD179F111 (512)		
4 K	μPD78F0550, μPD78F0555 (384)	μPD78F0560, μPD78F0565 (384)			78K0/Kx2-A Micro controllers				μPD179F110 (512)		
2 K	78K0/Kx2-L Microcontrollers								Microcontrollers for Preset Remote Control		USB Micro- controllers
1 K	78K0/Kx2-L Microcontrollers								Microcontrollers for Preset Remote Control		USB Micro- controllers
Package	16-pin SSOP (MA) Thickness: 1.5 mm 5.72 mm (225) Pitch: 0.65 mm 	20-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm  32-pin WQFN (K8) Thickness: 0.75 mm 5 × 5 mm Pitch: 0.5 mm  25-pin FLGA* (FC) Thickness: 0.69 mm 3 × 3 mm Pitch: 0.5 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	44-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.8 mm  48-pin LQFP (GA) Thickness: 1.4 mm 7 × 7 mm Pitch: 0.5 mm  40-pin WQFN (K8) Thickness: 0.75 mm 6 × 6 mm Pitch: 0.5 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	48-pin LQFP (GA) Thickness: 1.4 mm 7 × 7 mm Pitch: 0.5 mm  36-pin FLGA* (FC) Thickness: 0.69 mm 4 × 4 mm Pitch: 0.5 mm 	48-pin LQFP (GA) Thickness: 1.4 mm 7 × 7 mm Pitch: 0.5 mm 	64-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.5 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	38-pin SSOP (MC) Thickness: 1.7 mm 7.62 mm (300) Pitch: 0.65 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 

* Under development
Remark The packages are shown in their actual size.

Large selection (3/3)

We offer flash microcontrollers in various packages and ROM or RAM sizes, allowing you to select the best flash microcontroller for your product or application.

Commercial Name	78K0/IY2	78K0/IA2	78K0/IB2	μPD78F8025	μPD 78F071x		78K0/LC3	78K0/LD3	78K0/LE3		78K0/LF3	78K0/LE3-M*1	78K0/LG3-M*1
Pin Count	16-pin	20-pin	30/32-pin	64-pin	30-pin	64-pin	48-pin	52-pin	64-pin		80-pin	64-pin	100-pin
ROM (bytes)													
128 K	Product name (RAM (bytes))												
96 K													
60 K													
48 K	78K0/Lx2												
32 K	Microcontrollers for Power Supplies, Lighting Inverters, and LED Lighting Control												
24 K													
16 K													
8 K													
4 K													
2 K													
1 K													
Package	16-pin SSOP (MA) Thickness: 1.5 mm 5.72 mm (225) Pitch: 0.65 mm 	20-pin SOP (MC) Thickness: 1.7 mm 7.62 mm (300) Pitch: 1.27 mm  20-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm  32-pin WQFN (K8) Thickness: 0.75 mm 5 × 5 mm Pitch: 0.5 mm 	64-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.65 mm 	30-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 	64-pin TQFP (GK) Thickness: 1.0 mm 12 × 12 mm Pitch: 0.65 mm 	48-pin LQFP (GA) Thickness: 1.4 mm 7 × 7 mm Pitch: 0.5 mm 	52-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.65 mm 	64-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.65 mm 	64-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.5 mm 	80-pin LQFP (GC) Thickness: 1.4 mm 14 × 14 mm Pitch: 0.65 mm 	64-pin LQFP (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.5 mm 	100-pin LQFP (GC) Thickness: 1.4 mm 14 × 14 mm Pitch: 0.5 mm 

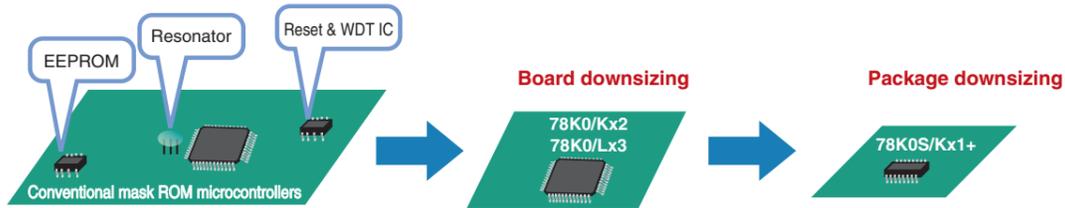
*1. Under development

*2. μPD78F044x and 78F045x only

Remark The packages are shown in their actual size.

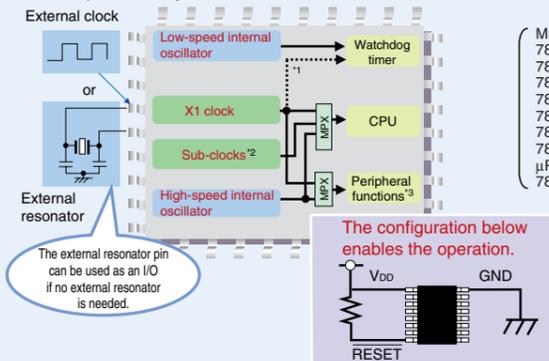
All the required peripheral functions are provided on chip, saving you money and space.

Total cost reduction achieved through the following on-chip peripheral functions



Internal oscillator

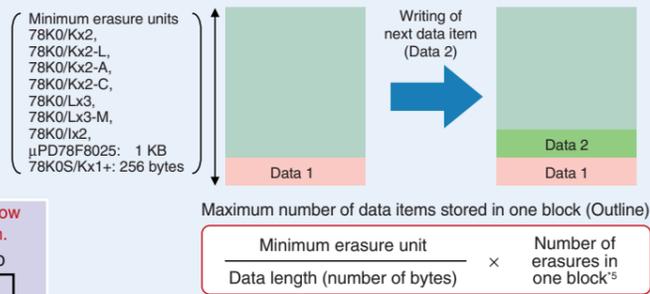
Various oscillators are embedded. The flash microcontroller can operate with just an internal oscillator.



*1 78K0S/Kx1+ and μ PD78F071x only
 *2 Sub-clocks are not provided for the 78K0S/Kx1+, 78K0/KB2, 78K0/KY2-L, 78K0/KA2-L, 78K0/KB2-L, 78K0/KB2-A, 78K0/Lx2, μ PD78F0730, μ PD179F1xx, and μ PD78F8025.
 *3 Use an external resonator or an external input clock when using the USB function incorporated in the μ PD78F0730.
 *4 Except μ PD78F071x, μ PD78F0730, and μ PD179F1xx

EEPROM emulation function⁴

Any block can be used as nonvolatile memory for storing data with the self-programming function of the flash memory.



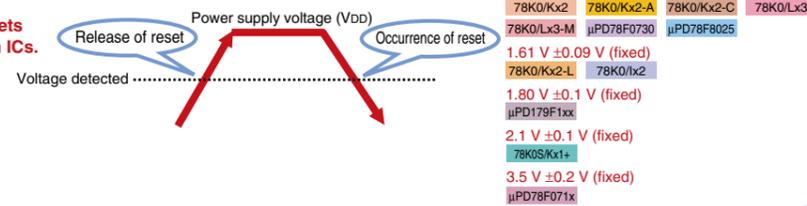
*5 78K0S/Kx1+: 1,000 times, 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, 78K0/Lx3-M, 78K0/Lx2, μ PD78F8025: 10,000 times (4 KB)
 Remark See the user's manual (EEPROM emulation library) for details.

Reset function

Highly accurate and user-friendly voltage detection and reset functions are incorporated.

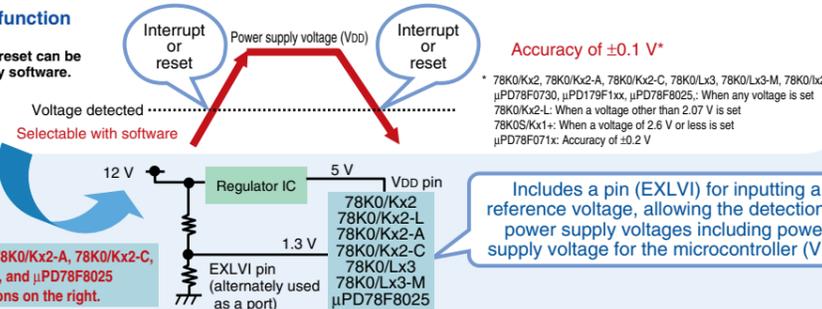
Power-on clear function

Reduces external resets and voltage detection ICs.



Voltage detection function

Interrupt or reset can be selected by software.



Highly reliable watchdog timer

Refer to the watchdog timer description on page 21.

The low power consumption is comparable to that of conventional mask ROM products, allowing you to build more eco-friendly systems.

Low power consumption comparable to that of mask ROM products

Power supply voltage: 5 V

Conventional mask ROM microcontrollers	Operation mode	Resonator	Operating current
		10 MHz	7.6 mA
78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A		10 MHz	2.3 mA (70% reduced)
78K0/Lx3		10 MHz	1.9 mA (75% reduced)
78K0/Kx2, 78K0/Kx2-A, 78K0/Lx3		Internal oscillator 8 MHz	1.4 mA (82% reduced)
78K0/Kx2-L		Internal oscillator 8 MHz	1.3 mA (83% reduced)

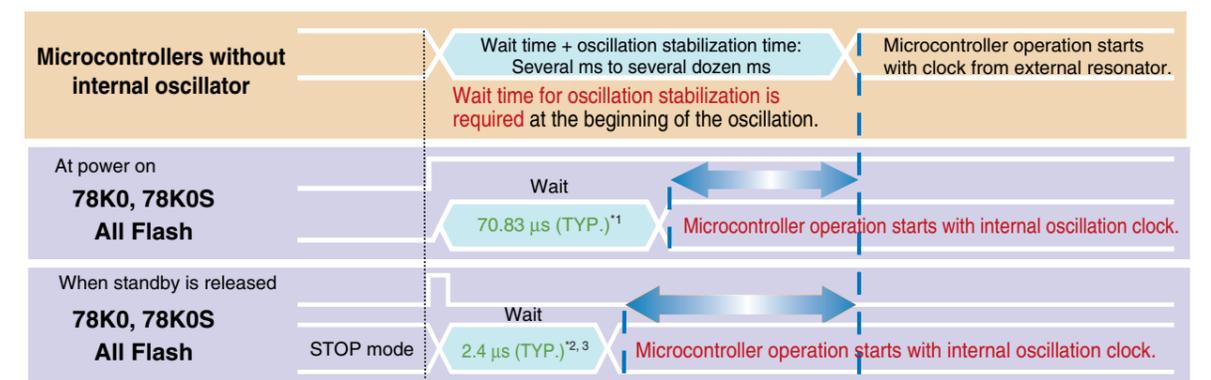
Power supply voltage: 3 V

Conventional mask ROM microcontrollers	HALT mode	Resonator	Standby current
		32.768 kHz	6 μ A
78K0/Kx2		32.768 kHz	3.5 μ A (42% reduced)
78K0/Lx3		32.768 kHz	2.4 μ A (60% reduced)
78K0/Kx2-L		32.768 kHz	1 μ A (73% reduced)
78K0/Kx2, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, μ PD179F1xx	STOP mode	All clocks stop.	1 μ A
78K0/Kx2-L		All clocks stop.	0.3 μ A

Remark The current values are typical values.

The internal oscillator allows fast startup, eliminating the need for oscillation wait time and reducing average power consumption.

Power-consumption reduction achieved by fast startup



Internal oscillators require almost no wait time for oscillation stabilization. The non-productive time intervals indicated by the arrows above are eliminated, which reduces the average power consumption.

*1 In the case of the μ PD78F071x, 78K0S/Kx1+: 544 μ s (TYP.)
 *2 In the case of the 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, μ PD78F8025, 78K0/Lx3, and 78K0/Lx2, μ PD179F1xx: 4.8 μ s, μ PD78F0730: 5 μ s, μ PD78F071x: 70.83 μ s
 *3 78K0/Kx2, 78K0/Kx2-A, 78K0/Kx2-C, μ PD78F8025: When oscillation frequency is 10 MHz or less (AMPH = 0)

Wide variety of products for specific applications (1/2)

We offer ideal products for various applications.
You can choose the optimal product for your needs.

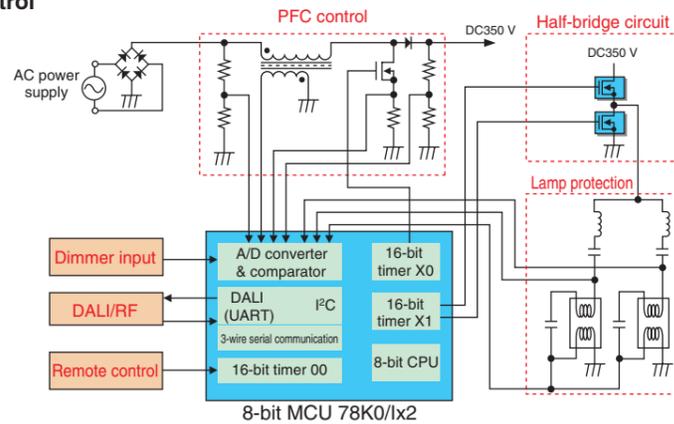
Microcontrollers for power supplies, lighting inverters, and LED lighting control (78K0/lx2), microcontrollers for LED lighting control (μ PD78F8025) (1/2)

Renesas Electronics has developed a dedicated driver capable of independently driving lighting control, which can be used to facilitate system configuration.

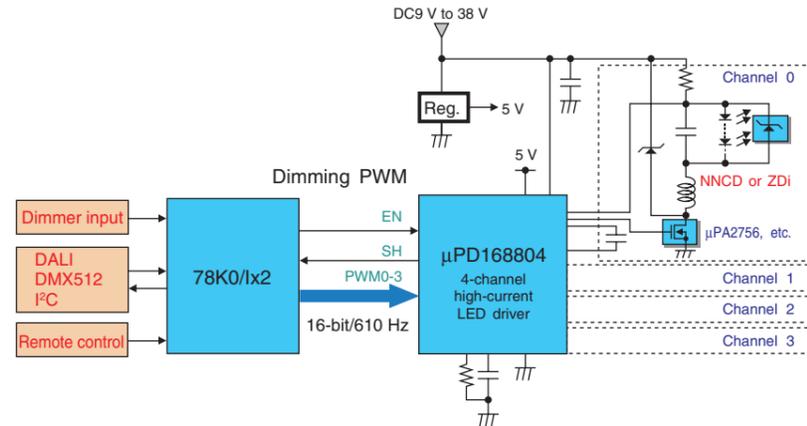
By using the 78K0/lx2, you can achieve low power consumption through PFC/dimmer control and by linking operations with a network.

The μ PD78F8025 allows efficient and reliable control thanks to its switching-type constant current driver and extensive on-chip protection circuits, including circuits to prevent overcurrent and overheating.

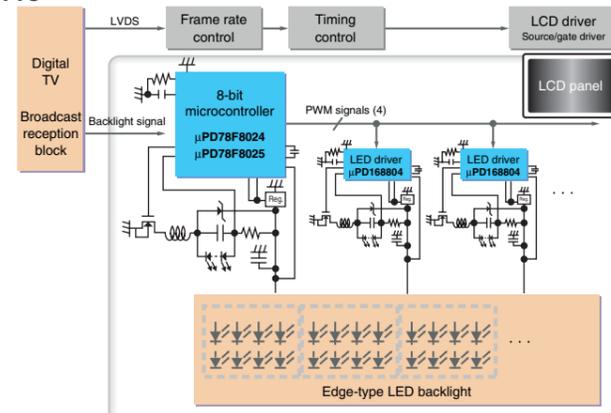
Lighting ballast control



LED lighting



LCD control in digital TVs



Microcontrollers for power supplies, lighting inverters, and LED lighting control (78K0/lx2), microcontrollers for LED lighting control (μ PD78F8025) (2/2)

A wide range of tools to aid the efficient development of high-performance lighting

[Lighting solution evaluation boards]

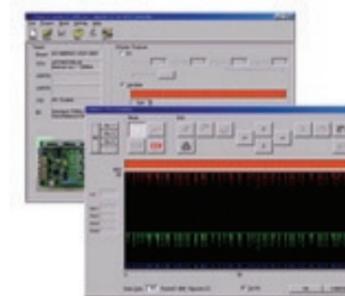
- Renesas Electronics provides evaluation boards dedicated to each lighting application. Everything you need to evaluate your system, including manuals, circuit diagrams, and development tools, can be downloaded from our website, providing you with fine-tuned, comprehensive development support.

Lighting Applications	Illumination Lighting LED Solution			General Lighting Fluorescent Lighting Solution	Lighting Communication Master Evaluation Board
Evaluation board	Microcontroller only 78K0/IB2 HBLEED evaluation board EZ-0005	Microcontroller + driver 78K0/IA2 PWM evaluation board EZ-0006 μPD168804 step-down HBLEED evaluation board EZ-0007		 Ballast (inverter) fluorescent light EZ-BLST-003	 Lighting communication master evaluation board EZ-0008
Mounted device (MCU)	(78K0/lx2)				

- Solution boards can be evaluated separately. When evaluating lights that feature communication capabilities, each solution board can be evaluated separately in combination with a master evaluation board.

[Automatic software generator] Applilet® EZ for HCD

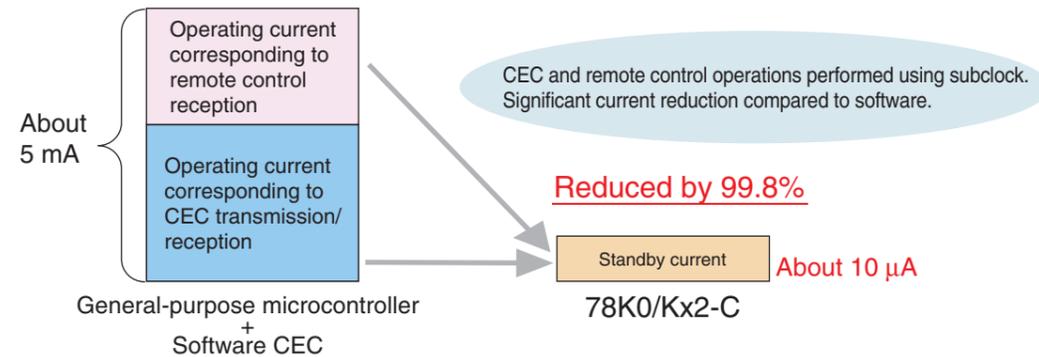
Applilet EZ for HCD automatically generates sample software for LED lighting, which can then be written to the microcontroller on the board. Applilet EZ for HCD is easy to operate even for first-time users, and will lighten your software development load.



Microcontrollers for digital AV applications (78K0/Kx2-C)

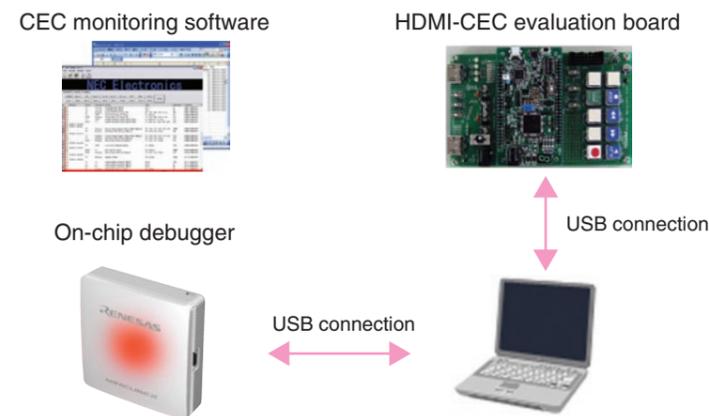
1. Reduction in standby power

The operating current when transmitting and receiving via HDMI™-CEC has been reduced by 99.8%.



2. Reduction in development man-hours

Dedicated software that allows CEC line monitoring (CEC Viewer) is available, in addition to conventional development environment.



3. Example applications



Remark HDMI (High-Definition Multimedia Interface): Standardized digital audio/video I/O interface for home electronics and AV devices.
CEC (Consumer Electronics Control): Control protocol (control method) for device control signals standardized by HDMI.
By using CEC, multiple AV devices can be controlled by using one remote controller.

Microcontrollers for power meters (78K0/Lx3-M)

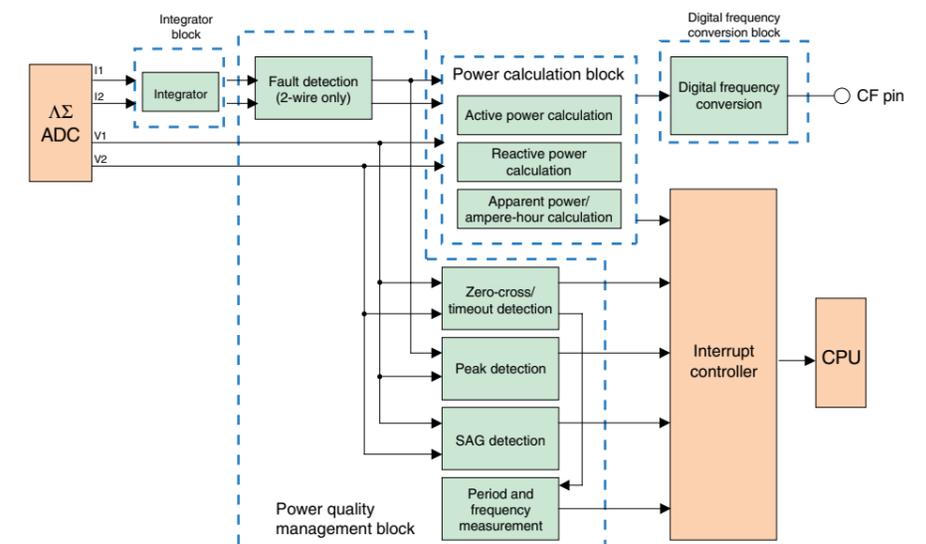
All the features required to realize a single-phase power meter integrated on a single LSI.

Renesas Electronics makes all the features required to realize a single-phase power meter available on a single LSI, helping you reduce the size of your system. Extensive peripherals also mean that the 78K0/Lx3-M can be used for a variety of power meter applications.

[Features]

- 24-bit $\Delta\Sigma$ /A/D converter (4 channels): 2 channels for current and 2 channels for voltage*
 - High-resolution analog-to-digital conversion
 - On-chip phase regulator regulates input signal phase shift caused by external circuits or components
- Precision power metrology
 - Detection of active power, reactive power, apparent power, RMS voltage, and RMS current
 - Active power calculation error: 0.1% (typ.)
 - Reactive power calculation error: 0.5% (typ.)
- Current integration
 - A current integrator can be specified to be used or not used for each current channel, and different sensors can be connected.
- Power quality measurement
 - Anti-tamper (fault detection) feature
 - Peak detection
 - Zero-cross detection
 - SAG detection
 - Period and frequency measurement
- On-chip LCD controller
 - Can be switched between external and internal resistive division
- Remote-control transmitter
 - Remote-control transmission is achieved by using an 8-bit timer (TMH1) and UART.
- Real-time counter
 - The power supplies are separated, allowing the microcontroller to run on the real-time clock even when the power supply is stopped.

Block diagram of power measurement feature



* 2 channels for current and 1 channel for voltage (3 channels in total) in the μ PD78F8052 and 78F8053.

High reliability

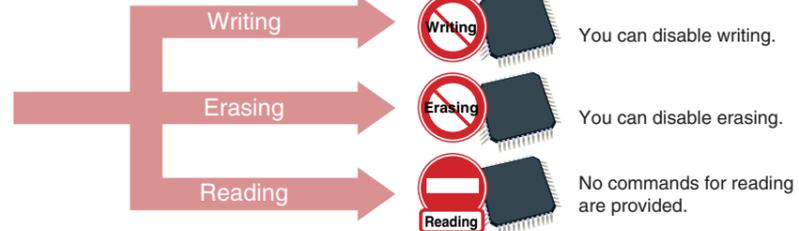
The reliability technologies developed for automotive flash microcontrollers can be found in all our flash microcontrollers, making them a safe choice.

Record of shipment & applications employing our flash microcontrollers



A flash security setting function is provided to protect your software from malicious rewriting and reading.

Software protection function

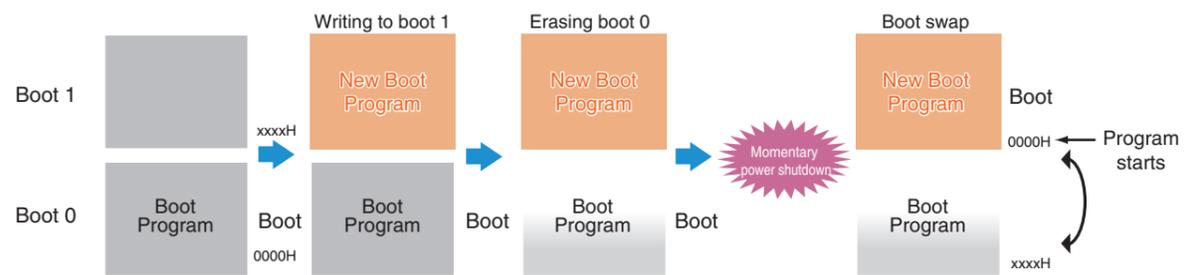


The 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, 78K0/Lx3-M, 78K0/lx2, and μ PD78F8025 include a boot swap feature to protect important programs even when power shuts down during self-programming.

Problems during self-rewriting



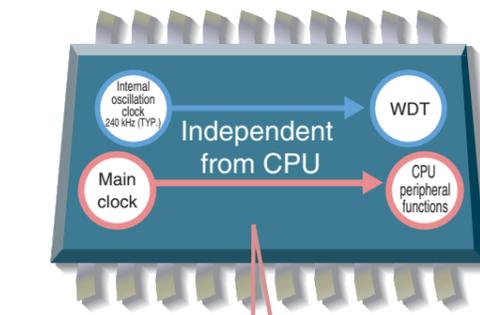
Boot swap function



The microcontroller can start normally even when momentary power shutdown occurs during boot rewriting.

The enhanced watchdog timer (WDT) offers improved reliability and functionality equivalent to that of an external WDT.

WDT independent from CPU



This configuration is the same as that in which an external watchdog timer is connected. The WDT does not stop even if the main clock stops.

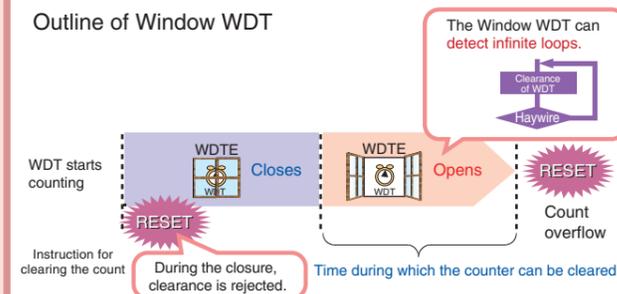
WDT function

	Conventional microcontrollers	78K0/Kx2, 78K0/Lx3, 78K0S/Kx1+, etc.
X1 clock stops	The watchdog timer also stops and the microcontroller haywire cannot be detected.	The watchdog timer does not stop.
Microcontroller haywire	It is doubtful whether the haywire is detected because counts are cleared by 1-bit flags.	No need to worry about haywire because counts are cleared by the byte instruction.

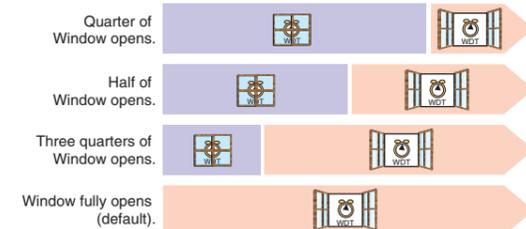
The 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, 78K0/Lx3-M, 78K0/lx2, μ PD179F1xx, and μ PD78F8025 have more reliable functions.

Window WDT

Outline of Window WDT

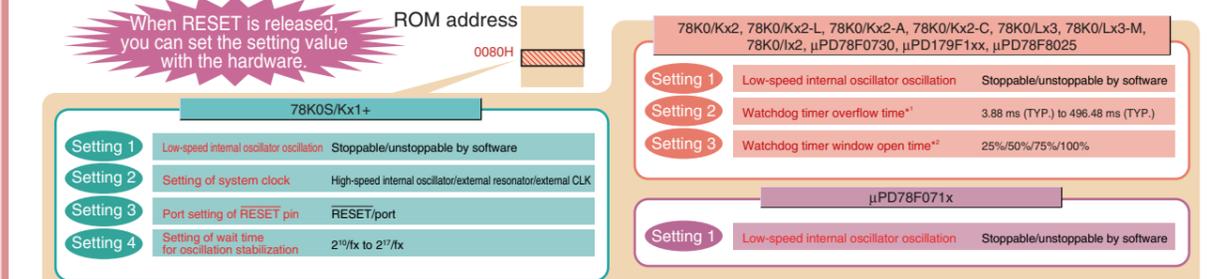


Four types of Window settings can be selected according to the system.



An option byte function is incorporated to enable important system operation settings by hardware, eliminating setting errors caused by inadvertent program loops.

Option byte function



*1 This is 3.88 ms (TYP.) to 3.97 s (TYP.) for the 78K0/Kx2-L and 78K0/lx2.

*2 This can be set to only 100% in the μ PD78F0730.

Rich development environment (1/2)

We provide inexpensive, easy-to-use, and convenient development environments, allowing you to select the best development environment according to the device and development conditions.

Lineup of development environments

	Board supplied with Applilet EZ for simple software creation	Starter kit for quick microcontroller programming	Test boards for MINICUBE2	Pitch conversion board
78K0S	Applilet EZ EZ-0001 Microcontroller training kit ReferSTAR 78K*1	For 20-pin SSOP package EZ-0002 For 20-pin DIP package CT-207*1	For 78K0S/KB1+ QB-78K0SKB1-TB	DIP conversion board FB-78F9222MC*2
78K0	Microcontroller training kit (ReferSTAR 78K upgrade kit*1)	For 78K0/KF2 TK-78K0/KF2*3 For 78K0/KC2-L TK-78K0/KC2L*3 For 78K0/KE2-C TK-78K0/KE2C*3	For 78K0/KF2 QB-78K0KF2-TB For 78K0/IB2 QB-78K0IB2-TB For 78K0/KE2-C QB-78K0KE2C-TB*5 For 78K0/KC2-L QB-78K0KC2L-TB For 78K0/LF3 QB-78K0LF3-TB	

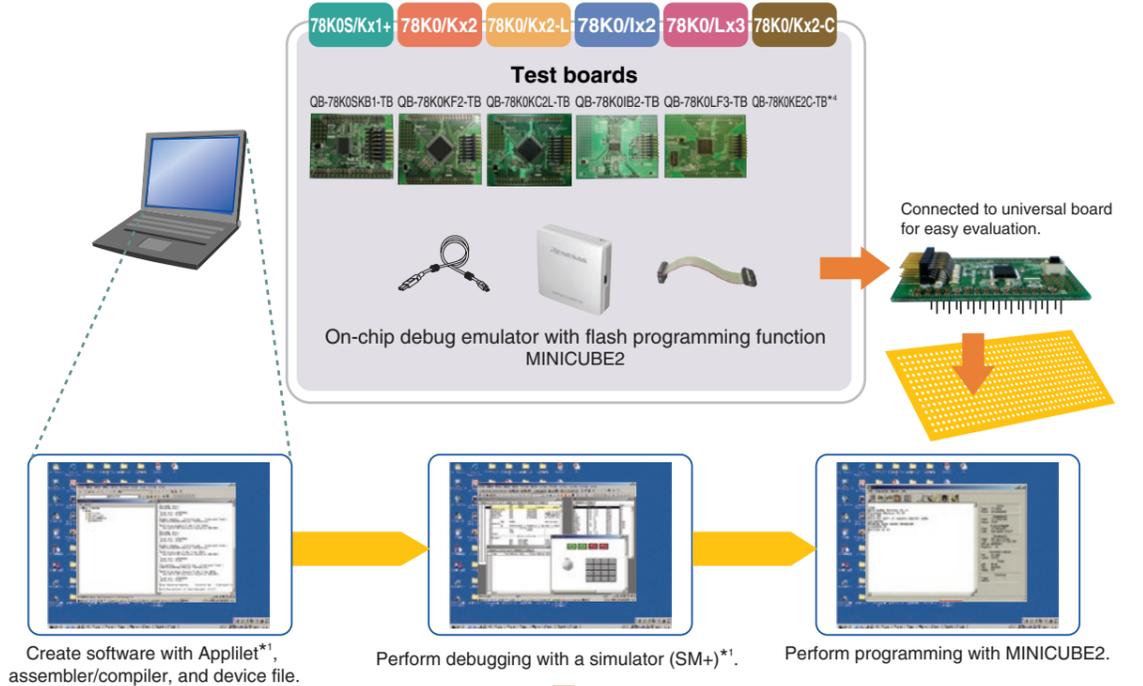
Software development Debugging/verification Programming

	Software development	Debugging/verification	Programming
78K0S	Software package (SP78K0S) Assembler (RA78K0S) (PM+ is included.) Compiler (CC78K0S) Device driver configurator (Applilet2 for 78K0S/Kx1+) Microcontroller integrated development environment (CubeSuite)	Simulator (SM+ for 78K0S/Kx1+) Full-function in-circuit emulator (IECUBE®) On-chip debug emulator with programming function (MINICUBE2) MINICUBE2 wireless option (QB-MINI2-RF)	Flash memory programmer PG-FP5 FL-PR5*2
78K0	Software package (SP78K0) Assembler (RA78K0) (PM+ is included.) Compiler (CC78K0) Device driver configurator (Applilet2 for 78K0/Kx2, Lx3) (Applilet3 for 78K0/Lx2, Kx2-L)	Simulator (SM+ for 78K0/Kx2)*4 Full-function in-circuit emulator (IECUBE) On-chip debug emulator with programming function (MINICUBE2) MINICUBE2 wireless option (QB-MINI2-RF)	Flash memory programmer PG-FP5 FL-PR5*2

*1 Made by Sunhayato Corporation
 *2 Made by Naito Densai Machida Mfg. Co., Ltd.
 *3 Made by TESSERA Technology Inc.
 *4 Not supported by the μPD179F1xx.
 *5 Under development

Development flow

Example of inexpensive development environment



I need software tools.

All the required software is available in one package.

Software packages (SP78K0S, SP78K0)

- The software package includes the following.
- Assembler package
 - Linker
 - Object converter
 - Librarian
 - List converter
 - Structured assembler preprocessor
 - PM+
 - C compiler
 - Integrated debugger*2

System simulators (SM+ for 78K0S/Kx1+, SM+ for 78K0/Kx2)

Remark The assembler package, C compiler, and integrated debugger are also sold separately.



I want to perform debugging with the microcontroller connected to the target board.

A simplified emulator is also available.

MINICUBE2 (On-chip debug emulator with flash programming function)

- QB-MINI2 (78K0S/Kx1+, 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, 78K0/Lx3-M, μPD78F071x, 78K0/Lx2, μPD78F0730, μPD179F1xx supported)



A full-function emulator is also available.

IECUBE (Full-function in-circuit emulator)

- QB-78K0SKX1 (For 78K0S/Kx1+)
- QB-78K0KX2 (For 78K0/Kx2 and μPD78F8025)
- QB-78K0KX2L (For 78K0/Kx2-L)
- QB-78F0593 (For 78K0/Kx2-A)
- QB-78K0KX2C (For 78K0/Kx2-C)
- QB-78K0LX3 (For 78K0/Lx3)
- QB-78K0LX3M (For 78K0/Lx3-M)*4
- QB-780714 (For μPD78F071x)
- QB-78K0IX2 (For 78K0/Lx2)
- QB-780731 (For μPD78F0730)
- QB-179F124 (For μPD179F1xx)



I want a programmer that can be used with all flash microcontrollers.

Programmers suited to your needs are also available.



*1 Not supported by the μPD179F1xx.
 *2 ID78K0S-NS only. The ID78K0S-QB and ID78K0-QB are supplied with an emulator.

*3 Made by Naito Densai Machida Mfg. Co., Ltd.
 *4 Under development

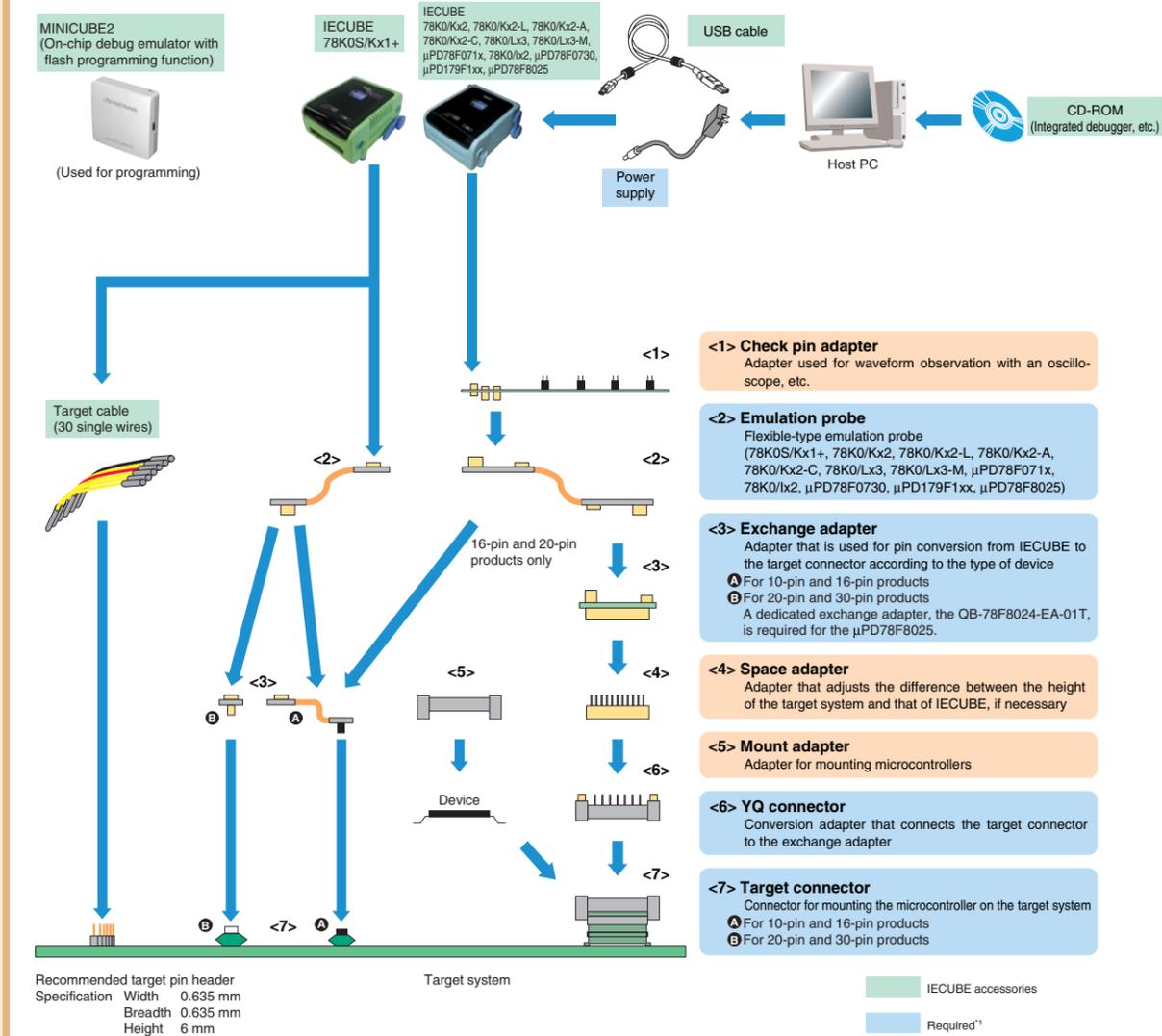
For details on tools, access these URLs. <http://www2.renesas.com/micro/en/freesoft/index.html>

Hardware tool

Full-function emulator

IECUBE (Full-function in-circuit emulator)

System configuration



¹ Options required for connecting target system when using IECUBE for 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, 78K0/Lx3-M, μPD78F071x, 78K0/lx2, μPD78F0730, μPD179F1xx, and μPD78F8025 microcontrollers

Options required for attaching with attachment pad of target device when using 78K0S/Kx1+ microcontroller

² Options required to meet debug application needs when using IECUBE for 78K0/Kx2, 78K0/Kx2-L, 78K0/Kx2-A, 78K0/Kx2-C, 78K0/Lx3, 78K0/Lx3-M, μPD78F071x, 78K0/lx2, μPD78F0730, μPD179F1xx, and μPD78F8025 microcontrollers

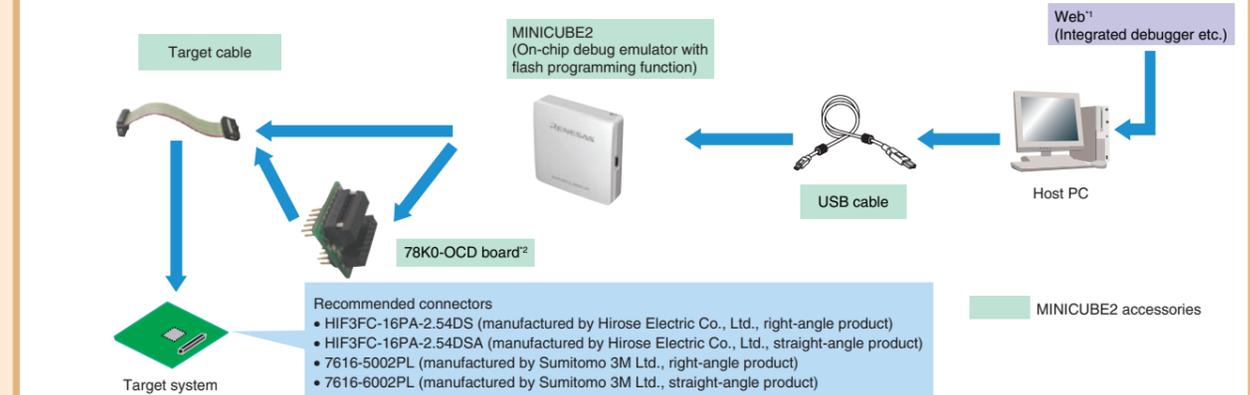
Remark For the device development environment when using IECUBE, see the **Single-Chip Microcontroller Development Tools Selection Guide (U11069E)**.

Flash memory programmer

Product Name	Package Contents
PG-FP5 (flash memory programmer)	PG-FP5 main unit, USB cable, serial cable, target cable, and ground cable (The power supply is sold separately.)

Simplified emulator

MINICUBE2 (On-chip debug emulator with flash programming function)



¹ For more information on MINICUBE2:

<http://www2.renesas.com/micro/en/development/asia/minicube2/minicube2.html>

² MINICUBE2 accessory required for on-chip debugging of 78K0 microcontrollers

Software tool

Commercial Name	Package	Software Package	C Compiler Package	Assembler Package	Integrated Debugger	System Simulator	Device File
78K0S/KU1+	10-pin SSOP (5.72 mm (225)) 16-pin SDIP (7.62 mm (300))	SP78K0S ²	CC78K0S	RA78K0S	ID78K0S-QB	SM+ for 78K0S/Kx1+ ⁴	DF789234
78K0S/KY1+	16-pin SSOP (5.72 mm (225)) 16-pin WLBGA (2x2.3 mm) 20-pin SDIP (7.62 mm (300))						
78K0S/KA1+	20-pin SSOP (7.62 mm (300)) 20-pin SSOP (7.62 mm (300))						
78K0S/KB1+	30-pin SSOP (7.62 mm (300)) 32-pin SDIP (7.62 mm (300))						
78K0/KB2	30-pin SSOP (7.62 mm (300)) 36-pin FLGA (4x4 mm) 38-pin SSOP (7.62 mm (300))	SP78K0 ³	CC78K0	RA78K0	ID78K0-QB	SM+ for 78K0/Kx2	DF780547
78K0/KC2	44-pin LQFP (10x10 mm) 48-pin LQFP (7x7 mm)						
78K0/KD2	52-pin LQFP (10x10 mm) 64-pin LQFP (14x14 mm) 64-pin LQFP (12x12 mm)						
78K0/KE2	64-pin LQFP (10x10 mm) 64-pin TQFP (7x7 mm) 64-pin FLGA (5x5 mm) 64-pin FPBGA (4x4 mm)						
78K0/KF2	80-pin LQFP (14x14 mm) 80-pin LQFP (12x12 mm)						
78K0/KY2-L	16-pin SSOP (5.72 mm (225)) 20-pin SSOP (7.62 mm (300))						
78K0/KA2-L	25-pin LGA (3x3 mm) ¹ 32-pin WQFN (5x5 mm)						
78K0/KB2-L	30-pin SSOP (7.62 mm (300)) 40-pin WQFN (6x6 mm)						
78K0/KC2-L	44-pin LQFP (10x10 mm) 48-pin LQFP (7x7 mm)						
78K0/KB2-A	30-pin SSOP (7.62 mm (300)) 36-pin FLGA (4x4 mm) ¹						
78K0/KC2-A	48-pin LQFP (7x7 mm) 36-pin FLGA (4x4 mm) ¹						
78K0/KC2-C ¹	48-pin LQFP (7x7 mm)						
78K0/KE2-C ¹	64-pin LQFP (10x10 mm)						
mPD179F1xx	30-pin SSOP (7.62 mm (300)) 38-pin SSOP (7.62 mm (300))	SP78K0 ³	CC78K0	RA78K0	ID78K0-QB	SM+ for 78K0/Kx2	DF780588
mPD78F0730	30-pin SSOP (7.62 mm (300))						
mPD78F8025	64-pin LQFP (12x12 mm)						
78K0/IY2	16-pin SSOP (5.72 mm (225)) 20-pin SSOP (7.62 mm (300))						
78K0/IA2	20-pin SSOP (7.62 mm (300)) 20-pin SOP (7.62 mm (300))						
78K0/IB2	30-pin SSOP (7.62 mm (300)) 32-pin WQFN (5x5 mm)						
mPD78F071x	30-pin SSOP (7.62 mm (300)) 64-pin LQFP (12x12 mm)						
78K0/LC3	48-pin LQFP (7x7 mm)						
78K0/LD3	52-pin LQFP (10x10 mm) 64-pin LQFP (12x12 mm)						
78K0/LE3	64-pin LQFP (10x10 mm) 64-pin TQFP (7x7 mm)						
78K0/LF3	80-pin LQFP (14x14 mm) 80-pin LQFP (12x12 mm)						
78K0/LE3-M ¹	64-pin LQFP (10x10 mm)						
78K0/LG3-M ¹	100-pin LQFP (14x14 mm)						
							DF780593
							DF780765
							DF179124
							DF780731 DF788025
							DF780756
							DF780141
							DF780495
							DF788055

¹ Under development ² The CC78K0S and RA78K0S are packaged in the SP78K0S.

³ The CC78K0 and RA78K0 are packaged in the SP78K0. ⁴ The 78K0S/KU1+ is not supported. Support is planned with the next upgrade.

Support for mass production

Mass production support environment for your needs.

You can select the mass production method with the largest merit, according to delivery time or mass production quantity.

Programming by the customer

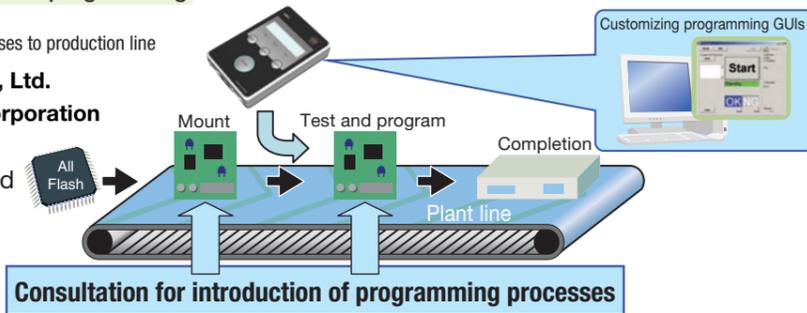
Delivery time^{*1}: Practically none, highly flexible

Support for introducing in-line programming

Support for introducing programming processes to production line

Naito Densai Machida Mfg. Co., Ltd.
Yokogawa Digital Computer Corporation

Unprogrammed products received



Flash memory programmers

Various products selectable for your purposes and price range



Programming by partner companies

Flexible support for small-volume programming and short delivery time

Programming houses

Just ask us about the programming houses in your region

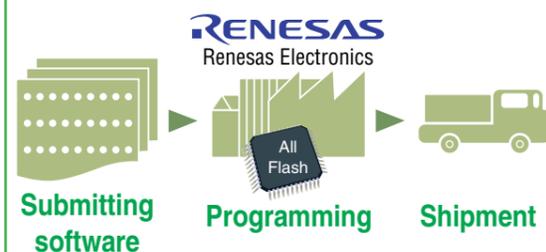


Programmed products

Shipment form same as that of mask ROM microcontrollers

Renesas Electronics

The same way as mask ROM microcontrollers, programmed products can be delivered with a short TAT



Programming houses

Delivery time^{*1}: **Several days**

Renesas Electronics

Delivery time^{*1}: **About 1/2 that of mask ROM²**



*1. Period from completion of software until start of mass production

*2. Delivery time may vary depending on purchase conditions, such as order quantity.

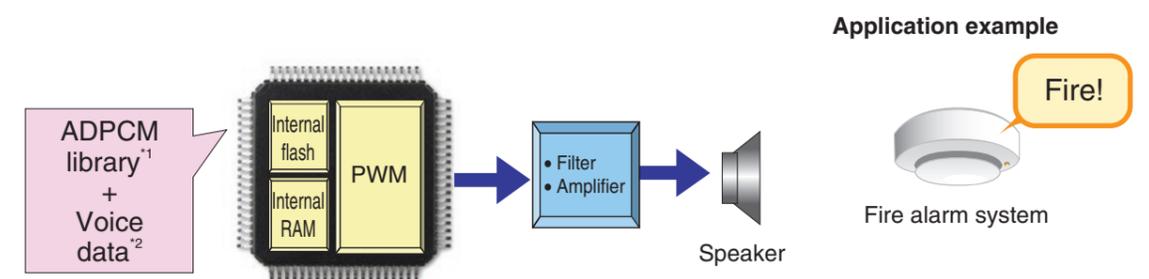
Application examples

Various functions achieved with 78K0 All Flash features and libraries

New functions can be easily constructed. One example is introduced below.

Speaking (ADPCM: Adaptive Differential Pulse Code Modulation)

A voice function can be realized without a dedicated IC! Contributes to reduced costs.



*1. ADPCM library (ADPCM-SP2) features

Library sizes		Extension processing performance (during 20 MHz drive)
ROM	RAM	
600 bytes	8 bytes	17 μ s, max.

Remarks 1. The above processing times are processing times for individual libraries. When mounted in a system, this becomes a total of 40 μ s (during 20 MHz drive), because extra processing time is required for output processing.
2. Processing is necessary every 125 μ s in the case of 8 kHz sampling voice.

*2. Voice data compression can be chosen from 2 patterns.

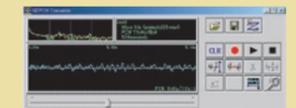
Compression rate	High audio quality ← High compression	
	4 Kbps	2 Kbps

Evaluation environment to support "speaking"



TK-78K0/KF2+Voice
Made by TESSERA Technology Inc.

Voice conversion tool (WAVE→ADPCM)

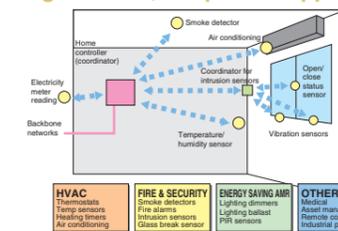


CvADPCM
Made by Renesas Electronics Corporation
Obtained from our Website

Connecting (ZigBee®)

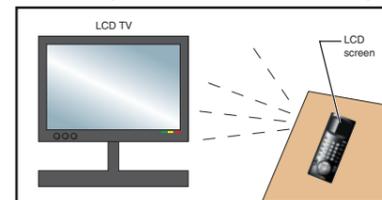
Our All Flash microcontrollers comply with ZigBee PRO, providing total support for low-power wireless network applications. You can start developing your application straight away.

● ZigBee PRO, SimpleNET application



- Build a low-power in-home network
- Supports 8, 16, and 32-bit microcontrollers

● RF4CE (wireless remote control) application



- The remote controller is omnidirectional, so you do not have to point it at the device.
- Bidirectional communication allows the device status to be displayed on the remote controller's screen.

● ZigBee SDK^{Note} (software development kit)



A protocol stack library that enables the establishment of wireless communication, diagnosis, and debugging through the use of Network Viewer, Sniffer, and other tools on your computer is included.

- The kit supports the ZigBee PRO, SimpleNET, and RF4CE standards.

Note Product co-developed by Skyley Networks, Inc. and Renesas Electronics.

Evaluation board lineup

(Boards made by TESSERA Technology Inc.)

TK-78K0R/KG3+UD



16-bit microcontroller
78K0R/KG3 mounted
- Internal ROM: 512 KB
- Internal RAM: 30 KB

TK-RF8058+SB



16-bit microcontroller with
RF receiver μ PD78F8058
mounted
- Internal ROM: 128 KB
- Internal RAM: 8 KB

78K0R UD Stick



16-bit microcontroller
78K0R/KE3 mounted
- Internal ROM: 256 KB
- Internal RAM: 12 KB

Product specifications (1/3)

CPU Core		78K0S								78K0																																									
Commercial name		78K0S/KU1+		78K0S/KY1+				78K0S/KA1+		78K0S/KB1+		78K0/KB2				78K0/KC2				78K0/KD2				78K0/KE2				78K0/KF2																							
Pin count		10-pin		16-pin				20-pin		30/32-pin		30/36-pin				38-pin				44-pin				48-pin				52-pin				64-pin				80-pin															
Product name		μPD78F9200	μPD78F9201	μPD78F9202	μPD78F9500	μPD78F9501	μPD78F9502	μPD78F9210	μPD78F9211	μPD78F9212	μPD78F9510	μPD78F9511	μPD78F9512	μPD78F9221	μPD78F9222	μPD78F9224	μPD78F9232	μPD78F9234	μPD78F0500A	μPD78F0501A	μPD78F0502A	μPD78F0503A	μPD78F0511A	μPD78F0512A	μPD78F0513A	μPD78F0511A	μPD78F0512A	μPD78F0513A	μPD78F0511A	μPD78F0512A	μPD78F0513A	μPD78F0514A	μPD78F0515A	μPD78F0521A	μPD78F0522A	μPD78F0523A	μPD78F0524A	μPD78F0525A	μPD78F0526A	μPD78F0527A	μPD78F0531A	μPD78F0532A	μPD78F0533A	μPD78F0534A	μPD78F0535A	μPD78F0536A	μPD78F0537A	μPD78F0544A	μPD78F0545A	μPD78F0546A	μPD78F0547A
Flash memory (bytes)		1 K	2 K	4 K	1 K	2 K	4 K	1 K	2 K	4 K	1 K	2 K	4 K	2 K	4 K	8 K	4 K	8 K	8 K	16 K	24 K	32 K	16 K	24 K	32 K	16 K	24 K	32 K	16 K	24 K	32 K	48 K	60 K	16 K	24 K	32 K	48 K	60 K	96 K	128 K	16 K	24 K	32 K	48 K	60 K	96 K	128 K	48 K	60 K	96 K	128 K
Bank		-		-				-		-		-				-				-				-				4				6				-				4				6							
RAM (bytes)		128		128				128		256		256		512	768	1 K	1 K	768	1 K	1 K	768	1 K	1 K	768	1 K	1 K	2 K	3 K	768	1 K	1 K	2 K	3 K	5 K	7 K	768	1 K	1 K	2 K	3 K	5 K	7 K	2 K	3 K	5 K	7 K					
Power supply voltage		Normal operation mode								2.0 to 5.5 V								1.8 to 5.5 V																																	
		Flash memory programming mode								2.7 to 5.5 V								2.7 to 5.5 V																																	
Minimum instruction execution time		0.20 μs (10 MHz: V _{DD} = 4.0 to 5.5 V)/0.33 μs (6 MHz: V _{DD} = 3.0 to 5.5 V)/0.40 μs (5 MHz: V _{DD} = 2.7 to 5.5 V)/1.0 μs (2 MHz: V _{DD} = 2.0 to 5.5 V)								0.10 μs (20 MHz: V _{DD} = 4.0 to 5.5 V)/0.20 μs (10 MHz: V _{DD} = 2.7 to 5.5 V)/0.40 μs (5 MHz: V _{DD} = 1.8 to 5.5 V)																																									
Clock		Main clock								Ceramic ¹ /crystal ¹ /external clock: 1 to 10 MHz								Ceramic/crystal/external clock: 1 to 20 MHz																																	
		High-speed system clock								8 MHz ±5%								8 MHz ±5%																																	
		High-speed internal oscillator								Crystal/external clock: 32.768 kHz																																									
		Sub-clock								-																																									
		Low-speed internal oscillator								240 kHz (TYP.) (clock for watchdog timer and 8-bit timer TMH1)																																									
I/O ports		Total		8				14				17		26		23				31				37				41				45				55				71											
		CMOS I/O		7				13				15		24		21				29				33				36				40				50				66											
		CMOS input		1				1				1		1		-				-				-				-				-				-															
		CMOS output		-				-				1		1		-				-				1				1				1				1															
		N-ch open-drain		-				-				-		-		2				4				4				4				4				4															
Timer		16-bit timer (TM0)		Number of channels				1				-		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1							
				Function				Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output								Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output																																			
		16-bit timer (TMx)		Number of channels				-				-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-									
				Function				-								-																																			
		8-bit timer (TMH)		Number of channels				1				1		1		1		2		2		2		2		2		2		2		2		2		2		2		2											
				Function				Interval timer/PWM output/square-wave output								Interval timer/PWM output/carrier generator output/square-wave output																																			
		8-bit timer (TM5)		Number of channels				-				-		-		2		2		2		2		2		2		2		2		2		2		2		2													
				Function				-								Interval timer/external event counter/PWM output/square-wave output																																			
		8-bit timer (TM8)		Number of channels				-				-		1		1		-		-		-		-		-		-		-		-		-		-		-													
				Function				-								Interval timer																																			
		Watchdog timer (WDT)		1				1				1		1		1		1		1		1		1		1		1		1		1		1		1		1													
		Watch timer		-				-				-		-		1		1		1		1		1		1		1		1		1		1		1															
		Real-time counter (RTC)		-				-				-		-		-		-		-		-		-		-		-		-		-		-		-		-													
Serial interface		UART (supporting LIN)		-				-				1		1		1		1		1		1		1		1		1		1		1		1		1		1													
		UART		-				-				-		-		-		-		-		-		-		-		-		-		-		-		-															
		UART/CSI		-				-				-		-		1		1		1		1		1		1		1		1		1		1		1															
		CSI		-				-				-		-		-		-		-		-		-		-		-		-		-		-		-															
		Automatic transmit/receive 3-wire CSI		-				-				-		-		-		-		-		-		-		-		-		-		-		-		-															
		I ² C		-				-				-		-		1		1		1		1		1		1		1		1		1		1																	
A/D converter		Successive approximation		10 bits × 4				-				10 bits × 4		10 bits × 4		10 bits × 4		10 bits × 4		10 bits × 4		10 bits × 6		10 bits × 8		10 bits × 8		10 bits × 8		10 bits × 8		10 bits × 8		10 bits × 8		10 bits × 8															
		ΔΣ		-				-				-		-		-		-		-		-		-		-		-		-		-		-		-															
Interrupt		External		2				2				4		4		6		7		7		8		8		8		8		9		9		9																	
		Internal		5				3				5		4		9		9		14		16		16		16		16		16		19		20																	
Maximum number of segments displayed in LCD		8 commons		-				-				-		-		-		-		-		-		-		-		-		-		-		-																	
		4 commons		-				-				-		-		-		-		-		-		-		-		-		-		-		-																	
On-chip debug (MINICUBE2)		Supported								Supported								Supported								Supported																									
Multiplier/divider		-								-								8-bit × 8-bit		-																															
Low voltage detector (LVI)		2.35/2.6 V ±0.1 V or 2.85/3.1/3.3 V ±0.15 V or 3.5/3.7/3.9/4.1/4.3 V ±0.2 V (Selectable by software)								1.93/2.08/2.24/2.39/2.55/2.70/2.85/3.01/3.16/3.32/3.47/3.62/3.78/3.93/4.09/4.24 V (default) ±0.1 V. The detected voltage can be input to pins. (Selectable by software)																																									
Power-on clear (POC)		2.1 V ±0.1 V								1.59 V ±0.15 V																																									
Other		-								-								Clock output				Clock output				Clock output, buzzer output				Clock output, buzzer output																					
Operating temperature		T _A = -40 to +85°C (model with expanded temperature range)																T _A = -40 to +85°C (model with expanded temperature range)																																	

*1. The μPD78F9500, 78F9501, and 78F9502 cannot connect to a ceramic or crystal resonator.
 *2. Only supported in the μPD78F0503DA, 78F0513DA, 78F0515DA, 78F0527DA, 78F0537DA, and 78F0547DA.

Product specifications (2/3)

CPU Core		78K0																78K0				78K0				78K0				78K0				78K0																																					
Commercial name		78K0/KY2-L				78K0/KA2-L				78K0/KB2-L				78K0/KC2-L				78K0/K B2-A		78K0/KC2-A		78K0/KC2-C*1		78K0/KE2-C*1		μPD179F1xx				μPD78F0730		78K0/IY2				78K0/IA2				78K0/IB2																															
Pin count		16-pin				20/25/32-pin				30-pin				40/44/48-pin				30 -pin		36/48-pin		48-pin		64-pin		30-pin				38-pin		30-pin		16-pin				20-pin				30/32-pin																													
Product name		μPD78F0550	μPD78F0551	μPD78F0552	μPD78F0555	μPD78F0556	μPD78F0557	μPD78F0560	μPD78F0561	μPD78F0562	μPD78F0565	μPD78F0566	μPD78F0567	μPD78F0571	μPD78F0572	μPD78F0573	μPD78F0576	μPD78F0577	μPD78F0578	μPD78F0581	μPD78F0582	μPD78F0583	μPD78F0586	μPD78F0587	μPD78F0588	μPD78F0590	μPD78F0591	μPD78F0592	μPD78F0593	μPD78F0760	μPD78F0761	μPD78F0762	μPD78F0763	μPD78F0764	μPD78F0765	μPD179F110	μPD179F111	μPD179F112	μPD179F113	μPD179F114	μPD179F122	μPD179F123	μPD179F124	μPD78F0730	μPD78F0740	μPD78F0741	μPD78F0742	μPD78F0750	μPD78F0751	μPD78F0752	μPD78F0743	μPD78F0744	μPD78F0753	μPD78F0754	μPD78F0745	μPD78F0746	μPD78F0755	μPD78F0756													
Flash memory (bytes)		4 K	8 K	16 K	4 K	8 K	16 K	4 K	8 K	16 K	4 K	8 K	16 K	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	16 K	32 K	32 K	48 K	60 K	32 K	48 K	60 K	4 K	8 K	16 K	24 K	32 K	16 K	24 K	32 K	16 K	4 K	8 K	16 K	4 K	8 K	16 K	8 K	16 K	8 K	16 K	8 K	16 K	8 K	16 K													
Bank		-																								-				-				-				-				-				-				-				-																	
RAM (bytes)		384	512	768	384	512	768	384	512	768	384	512	768	512	768	1 K	512	768	1 K	512	768	1 K	512	768	1 K	1 K	1 K	1 K	1 K	1 K	2 K	3 K	1 K	2 K	3 K	512	512	768	1 K	1 K	768	1 K	1 K	3 K	384	512	768	384	512	768	512	768	512	768	512	768															
Power supply voltage		Normal operation mode		1.8 to 5.5 V																								1.8 to 5.5 V				1.8 to 3.6 V				1.8 to 3.6 V				4.0 to 5.5 V				2.7 to 5.5 V																											
		Flash memory programming mode		2.0 to 5.5 V																								2.7 to 5.5 V				1.8 to 3.6 V				2.0 to 3.6 V				4.0 to 5.5 V				2.7 to 5.5 V																											
Minimum instruction execution time		0.2 μs (10 MHz: V _{DD} = 2.7 to 5.5 V)/0.4 μs (5 MHz: V _{DD} = 1.8 to 5.5 V)																								0.1 μs (20 MHz: V _{DD} = 2.7 to 5.5 V)/0.4 μs (5 MHz: V _{DD} = 1.8 to 5.5 V)				0.1 μs (20 MHz: V _{DD} = 2.7 to 3.6 V)				0.5 μs (4 MHz: V _{DD} = 2.0 to 3.6 V)/1 μs (2 MHz: V _{DD} = 1.8 to 3.6 V)				0.125 μs (16 MHz: V _{DD} = 4.0 to 5.5 V)				0.2 μs (10 MHz: V _{DD} = 2.7 to 5.5 V)																													
Clock		Main clock		Ceramic/crystal/external clock: 1 to 10 MHz																								Ceramic/crystal/external clock: 1 to 20 MHz				Ceramic/crystal/external clock: 2 to 20 MHz				Ceramic/crystal/external clock: 1 to 4 MHz				*6				Ceramic/crystal/external clock: 1 to 10 MHz																											
		High-speed system clock		4 MHz ±2%, 8 MHz ±3%: Can be changed by using option byte																								8 MHz ±5%				8 MHz ±5%				4 MHz ±2%				16 MHz ±10%				4 MHz ±2%, 8 MHz ±3%: Can be changed by using option byte																											
		High-speed internal oscillator		-																								Crystal/external clock: 32.768 kHz				Crystal: 32.768 kHz				-				-				-																											
		Sub-clock		-																								-				Crystal: 32.768 kHz				-				-				-																											
		Low-speed internal oscillator		30 kHz ±10% (clock for watchdog timer and 8-bit timer TMH1)																								240 kHz ±10% (clock for watchdog timer and 8-bit timer TMH1)				240 kHz (TYP.) (clock for watchdog timer and 8-bit timer TMH1)				*7				30 kHz ±10% (clock for watchdog timer and 8-bit timer TMH1)																															
I/O ports		Total		12				16/21/25				24				34/38/42				22		28/40		41		55		26				34		19		12				16				25 (30-pin)/23 (32-pin)																											
		CMOS I/O		9				13/18/22				21				29/33/37				20		26/38		26		38		25				33		17		9				13				22 (30-pin)/20 (32-pin)																											
		CMOS input		3				3				3				5				-		-		4		4		1				1		-		3				3				3																											
		CMOS output		-				-				-				-				-		-		1		1		-				-		-		-				-				-																											
		N-ch open-drain		-				-				-				-				2		2		10		12		N-ch: 24, P-ch: 1*5				N-ch: 32, P-ch: 1*5		2		-				-				-																											
Timer		16-bit timer (TM0)		1				1				1				1				1		1		3		3		1				1		1		1				1				1																											
		Function		Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output																								Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output				Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output				Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output				Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output				Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output																											
		16-bit timer (TMx)		-				-				-				-				-		-		-		-		-				-		-		2		2				2																													
		Function		-																								-				-				-				-				-				-				-				-				-				-				-			
		8-bit timer (TMH)		1				1				2				2				2		2		2		2		2				1		1		1		1				1				1																									
		Function		Interval timer/PWM output/carrier generator output/square-wave output																								Interval timer/PWM output/carrier generator output/square-wave output				Interval timer/PWM output/carrier generator output/square-wave output				Interval timer/PWM output/carrier generator output/square-wave output				Interval timer/PWM output/carrier generator output/square-wave output				Interval timer/PWM output/carrier generator output/square-wave output																											
		8-bit timer (TM5)		1				1				2				2				2		2		2		2		2				2		2		1		1		1				1																											
		Function		Interval timer/external event counter																								Interval timer/external event counter/PWM output/square-wave output				Interval timer/external event counter/PWM output/square-wave output				Interval timer/external event counter/PWM output/square-wave output				Interval timer/external event counter/PWM output/square-wave output				Interval timer/external event counter/PWM output/square-wave output																											
		8-bit timer (TM8)		-				-				-				-				-		-		-		-		-				-		-		-		-		-				-																											
		Function		-																								-				-				-				-				-				-				-				-				-											
		Watchdog timer (WDT)		1				1				1				1				1		1		1		1		1				1		1		1		1				1																													
		Watch timer		-				-				-				-				-		-		-		-		-				-		-		-		-				-																													
		Real-time counter (RTC)		-				-				-				1				-		1		1		1		-				-		-		-		-				-																													
Serial interface		UART (supporting LIN)		1				1				1				1				1		1		1		1		1				1		1		-		-				-																													
		UART		-				-				-				-				-		-		-		-		1				1		1		-		-				-																													
		UART/CSI		-				-				-				-				-		-		1		1		-				-		-		-		-				-																													
		CSI		-				-/1/1				1				2				1		1		1		1		-				1		1		-		-				1																													
		Automatic transmit/receive 3-wire CSI		-				-				-				-				-		-		-		-		-				-		-		-		-				-																													
		I ² C		1				1				1				1				1		1		3		3		-				-		-		-		1				1																													
A/D converter		Successive approximation		10 bits × 4				10 bits × 6/10 bits × 7/10 bits × 11				10 bits × 7				10 bits × 10/10 bits × 11/10 bits × 11				12 bits × 10		12 bits × 12		10 bits × 8		10 bits × 8		-				-		-		-		10 bits × 5				10 bits × 6				10 bits × 9																									
		ΔΣ		-				-				-				-				-		-		-		-		-				-		-		-		-				-																													
Interrupt		External		2				4/5/5				8				9/10/13				6		8/11		8		8		8				4		7		7		9 (30-pin)/8 (32-pin)																																	
		Internal		10				10/11/11				13				16				14		14/16		25		25		10				14		8		12		13																																	
Maximum number of segments displayed in LCD		8 commons		-				-				-				-				-		-		-		-		-				-		-		-		-																																	
		4 commons		-				-				-				-				-		-		-		-		-				-		-		-		-																																	
On-chip debug (MINICUBE2)		Supported				Supported				Supported				Supported				Supported		Supported		Supported		Supported		Supported				Supported		Supported		Supported		Supported																																			
Multiplier/divider		-				-				-				-				16-bit × 16-bit		16-bit × 16-bit		16-bit × 16-bit		16-bit × 16-bit		16-bit × 16-bit		-				-		-		-		8-bit × 8-bit, 16-bit × 16-bit				8-bit × 8-bit, 16-bit × 16-bit																													
Low voltage detector (LVI)		2.07 V ±0.07 V or 1.91/2.22/2.38/2.53/2.68/2.84/2.99/3.15/3.30/3.45/3.61/3.76/3.92/4.07/4.22 V (default) ±0.1 V (Selectable by software)																								*2				2.85/3.01/3.16/3.32/3.47 V ±0.1 V. The detected voltage can be input to pins. (Selectable by software)				2.08 V ^{+0.07 V} _{-0.08 V} , 1.93 to 3.47 V ±0.1 V. The detected voltage can be input to pins. (Selectable by software)				*8				1.91/2.84/2.99/3.15/3.30/3.45/3.61/3.76/3.92/4.07/4.22 V (default) ±0.1 V (Selectable by software)																													
Power-on clear (POC)		Power-on reset: 1.61 V ±0.09 V, power-down reset: 1.59 V ±0.09 V																								1.59 V ±0.15 V				1.59 V ±0.15 V				1.8 V ±0.1 V				1.59 V ±0.15 V				Power-on reset: 1.61 V ±0.09 V, power-down reset: 1.59 V ±0.09 V																													
Other		-				Operational amplifier: 1 ch				-				Operational amplifier: 1 ch				-				Operational amplifier: 2 ch				Clock output (48-pin only)		Operational amplifier: 3 ch		*3		CEC, clock output, remote control receiver				*4		-		*9		-				Operational amplifier: 1 ch				-				Operational amplifier: 1 ch																	
Operating temperature		T _A = -40 to +85°C																								T _A = -40 to +85°C				T _A = -40 to +85°C				T _A = -40 to +85°C				T _A = -40 to +85°C				T _A = -40 to +105°C																													

*1. Under development
 *2. 1.93/2.08/2.24/2.39/2.55/2.70/2.85/3.01/3.16/3.32/3.47/3.62/3.78/3.93/4.09/4.24 V (default) ±0.1 V. The detected voltage can be input to pins. (Selectable by software)
 *3. Clock output, operational amplifier: 3 ch
 *4. CEC, clock output, buzzer output, remote control receiver
 *5. N-ch open-drain output and P-ch open-drain output are alternatively used as CMOS I/O.
 *6. Ceramic/crystal/external clock: 12/16 MHz
 *7. 240 kHz ±10% (clock for watchdog timer and 8-bit timer TMH1)
 *8. 4.24 V ±0.1 V or 4.09 V ±0.1 V (selectable by software)
 *9. USB2.0 full-speed function controller
 *10. These features are not supported in 32-pin products.
 *11. DALI slave communication can be performed.
Remark The specifications of products still under development or in planning are subject to change without notice.

Product specifications (3/3)

CPU Core		78K0	78K0	78K0																								78K0																																													
Commercial name		μPD78F8025	μPD78F071x	78K0/LC3						78K0/LD3						78K0/LE3						78K0/LF3						78K0/LE3-M [†]	78K0/LG3-M [†]																																												
Pin count		64-pin	30-pin	64-pin	48-pin						52-pin						64-pin						80-pin						64-pin	100-pin																																											
Product name		μPD78F8024	μPD78F8025	μPD78F0711	μPD78F0712	μPD78F0714	μPD78F0400	μPD78F0401	μPD78F0402	μPD78F0403	μPD78F0410	μPD78F0411	μPD78F0412	μPD78F0413	μPD78F0420	μPD78F0421	μPD78F0422	μPD78F0423	μPD78F0430	μPD78F0431	μPD78F0432	μPD78F0433	μPD78F0441	μPD78F0442	μPD78F0443	μPD78F0444	μPD78F0445	μPD78F0451	μPD78F0452	μPD78F0453	μPD78F0454	μPD78F0455	μPD78F0461	μPD78F0462	μPD78F0463	μPD78F0464	μPD78F0465	μPD78F0471	μPD78F0472	μPD78F0473	μPD78F0474	μPD78F0475	μPD78F0481	μPD78F0482	μPD78F0483	μPD78F0484	μPD78F0485	μPD78F0491	μPD78F0492	μPD78F0493	μPD78F0494	μPD78F0495	μPD78F8052	μPD78F8053	μPD78F8054	μPD78F8055																	
Flash memory (bytes)		8 K	32 K	8 K	16 K	32 K	8 K	16 K	24 K	32 K	8 K	16 K	24 K	32 K	8 K	16 K	24 K	32 K	8 K	16 K	24 K	32 K	16 K	24 K	32 K	48 K	60 K	16 K	24 K	32 K	48 K	60 K	16 K	24 K	32 K	48 K	60 K	16 K	24 K	32 K	48 K	60 K	16 K	24 K	32 K	48 K	60 K	16 K	24 K	32 K	48 K	60 K	16 K	32 K	48 K	60 K																	
Bank		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																			
RAM (bytes)		512	1 K	768	768	1 K	512	768	1 K	1 K	512	768	1 K	1 K	512	768	1 K	1 K	512	768	1 K	1 K	768	1 K	1 K	2 K	2 K	768	1 K	1 K	2 K	2 K	768	1 K	1 K	2 K	2 K	768	1 K	1 K	2 K	2 K	768	1 K	1 K	2 K	2 K	768	1 K	1 K	2 K	2 K	768	1 K	2 K	2 K																	
Power supply voltage		Normal operation mode		4.0 to 5.5 V		1.8 to 5.5 V																								1.8 to 3.6 V																																											
		Flash memory programming mode		4.0 to 5.5 V		2.7 to 5.5 V																								2.7 to 3.6 V																																											
Minimum instruction execution time		*3		0.10 μs (20 MHz; V _{DD} = 4.0 to 5.5 V)		0.20 μs (10 MHz; V _{DD} = 2.7 to 5.5 V)/ 0.40 μs (5 MHz; V _{DD} = 1.8 to 5.5 V)																								0.2 μs (10 MHz; V _{DD} = 2.7 to 3.6 V)/ 0.4 μs (5 MHz; V _{DD} = 1.8 to 3.6 V)																																											
Clock		Main clock		Ceramic/crystal/external clock: 5 to 20 MHz		Ceramic/crystal/external clock: 2 to 10 MHz																								Ceramic/crystal/external clock: 2 to 10 MHz																																											
		High-speed system clock		*4		8 MHz ±5%																								8 MHz ±5%																																											
		High-speed internal oscillator		8 MHz ±5%		8 MHz ±5%																								8 MHz ±5%																																											
		Sub-clock		-		Crystal: 32.768 kHz																								Crystal: 32.768 kHz																																											
		Low-speed internal oscillator		*5		240 kHz																								240 kHz ±10% (clock for watchdog timer, 8-bit timer TMH1, and LCD controller/driver)																																											
I/O ports		Total		23		15		48		30						34						46						62						32		65																																					
		CMOS I/O		21		11		40		26						30						42						58						29		62																																					
		CMOS input		-		4		8		4						4						4						4						2		3																																					
		CMOS output		-		-		-		-						-						-						-						1		-																																					
		N-ch open-drain		2		-		-		-						-						-						-						-		-																																					
Timer		16-bit timer (TM0)		Number of channels		1		1		1						1						1						1						1		1																																					
				Function		Interval timer/external event counter/PPG output/pulse width measurement/square-wave output/one-shot pulse output										Interval timer/external event counter/PPG output/measurement/square-wave output/one-shot pulse output ^{*10}												Interval timer/external event counter/pulse width measurement																																													
		16-bit timer (TMx)		Number of channels		-		-		-						-						-						-						-		-																																					
				Function		-		-		-						-						-						-						-		-																																					
		8-bit timer (TMH)		Number of channels		2		-		1		3						3						3						3						3		3																																			
				Function		Interval timer/PWM output/carrier generator output/square-wave output				Interval timer/						PWM output/carrier generator output/square-wave output												Interval timer/PWM output/carrier generator output/square-wave output																																													
		8-bit timer (TM5)		Number of channels		2		2		3						3						3						3						3		3																																					
				Function		Interval timer/external event counter/PWM output/square-wave output				Interval timer/						external event counter/PWM output/square-wave output ^{*10}												Interval timer/external event counter/PWM output/square-wave output																																													
		8-bit timer (TM8)		Number of channels		-		-		-						-						-						-						-		-																																					
				Function		-		-		-						-						-						-						-		-																																					
		Watchdog timer (WDT)		1		1		1						1						1						1						1		1																																							
		Watch timer		-		-		-						-						-						-						-		-																																							
		Real-time counter (RTC)		-		-		1						1						1						1						1		1																																							
Serial interface		UART (supporting LIN)		1		-		1						1						1						1						1		1																																							
		UART		-		1		1						-						-						-						-		-																																							
		UART/CSI		1		-		-						1						1						1						1		1																																							
		CSI		-		-		-						-						-						-						-		-																																							
		Automatic transmit/receive 3-wire CSI		-		-		-						-						-						-						1		-																																							
		I ² C		1		-		-						-						-						-						-		-																																							
A/D converter		Successive approximation		10 bits × 4		10 bits × 4		10 bits × 8		-						10 bits × 6						-						10 bits × 6						-						10 bits × 8		10 bits × 8																															
		ΔΣ		-		-		-						-						-						-						-						16 bits × 3		16 bits × 3																																	
Interrupt		External		6		5		8		5						5						6						7						4		5																																					
		Internal		14		14		20		17						18						19						20						19						20						21						20						21						22						17		17	
Maximum number of segments displayed in LCD		8 commons		-		-		-		144						160						224						224						160						288						288						224						-		-													
		4 commons		-		-		-		88						96						128						128						96						160						160						128						96		160													
On-chip debug (MINICUBE2)		-		Supported		Supported		Supported		Supported						Supported						Supported						Supported						Supported		Supported																																					
Multiplier/divider		-		16-bit × 16-bit		32-bit ÷ 16-bit		-		-						-						-						-						-						-		-																															
Low voltage detector (LVI)		*6		4.3 V ±0.2 V						1.93/2.08/2.24/2.39/2.55/						2.70/2.85/3.01/3.16/3.32/3.47/3.62/3.78/3.93/4.09/4.24 V (default) ±0.1 V.						The detected voltage can be input to pins. (Selectable by software)												*11																																							
Power-on clear (POC)		1.59 V ±0.15 V		3.5 V ±0.2 V						1.59 V ±0.15 V																								1.59 V ±0.15 V																																							
Other		*7		*8		*9		Manchester code generator, buzzer output						Manchester code generator, buzzer output, remote control receiver						Manchester code generator, buzzer output, remote control receiver, clock output						*12																																															
Operating temperature		T _A = -40 to +85°C		T _A = -40 to +85°C						T _A = -40 to						+85°C (model with expanded temperature range planned)												T _A = -40 to +85°C																																													

*1. Under development
 *2. When the constant-current driver is not used
 *3. 0.1 μs (20 MHz; V_{DD} = 2.7 to 5.5 V)/0.4 μs (5 MHz; V_{DD} = 1.8 to 5.5 V) (When the constant-current driver is not used)
 *4. Ceramic/crystal/external clock: 1 to 20 MHz
 *5. 240 kHz ±10% (clock for watchdog timer and 8-bit timer TMH1)
 *6. 1.93/2.08/2.24/2.39/2.55/2.70/2.85/3.01/3.16/3.32/3.47/3.62/3.78/3.93/4.09/4.24 V (default) ±0.1 V. The detected voltage can be input to pins. (Selectable by software)
 *7. Constant-current driver for which stepping up or stepping down can be specified.
 *8. Timer for 10-bit inverter control, real-time output port, Hi-Z output controller
 *9. Timer for 10-bit inverter control, real-time output port, Hi-Z output controller, 16-bit up/down counter, buzzer output
 *10. TM0 and TM5 can be connected in cascade and used as a 24-bit event counter.
 *11. 1.93/2.08/2.24/2.39/2.55/2.70/2.85/3.01/3.16/3.32 V ±0.1 V. The detected voltage can be input to pins. (Selectable by software)
 *12. Power calculation, power quality measurement, digital frequency conversion, buzzer output, remote control transmitter
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Renesas Microcomputer 8-bit All Flash

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