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Empowered by Innovation NEC

8-bit All Flash

78K0 Microcontrollers
78K0S Microcontrollers

ALL FLASH

Empower your creativity
78K
Embedded Controller

Jul. 2008

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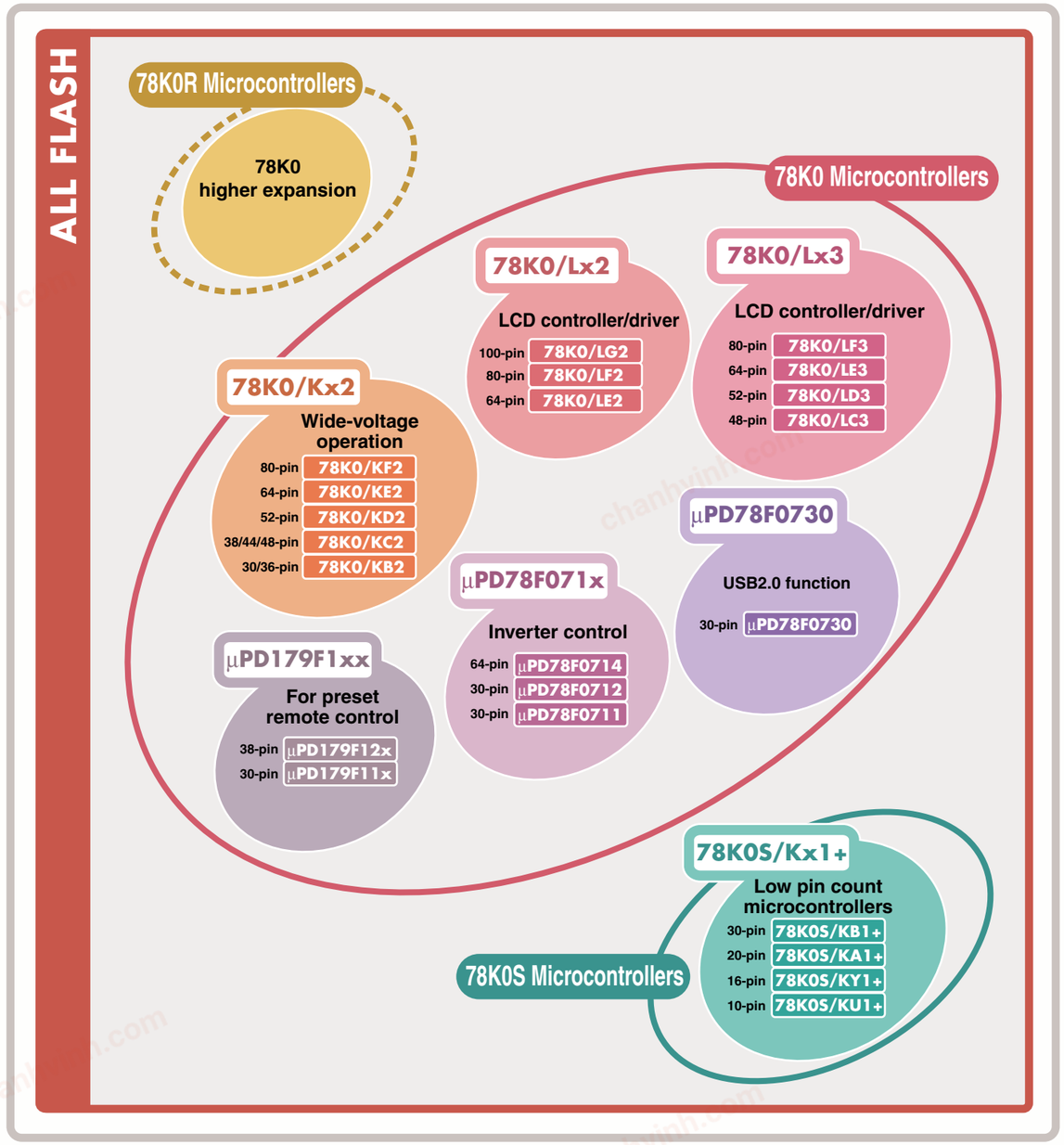
Flash

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?
NEC 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, NEC 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



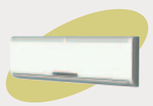
Industrial equipment
Industrial motors, control equipment, vending machines, power meters



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
DVD players, DVD recorder, D-VHS, industrial cameras



Remote control
Preset remote control, etc.



Other
Electronic instruments, electric bidets, toys, etc.

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

Flash microcontrollers offer overwhelming advantages.

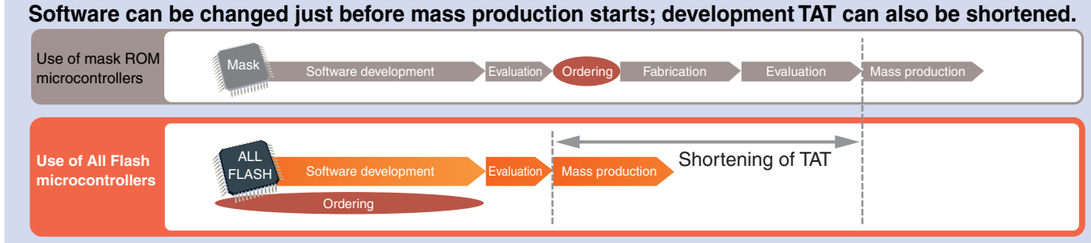
Compared to mask ROM microcontrollers, flash microcontrollers definitely contribute to speeding up system development. Microcontrollers can be ordered before program completion, programs can be written even after the microcontroller has been mounted on the board, and thus microcontroller order placement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

In addition, when flash microcontrollers are used for products with an ample lineup or that are localized for specific regions, ordering costs necessitated by mask ROM microcontrollers can be reduced and purchase and stock management costs can be slashed.

For software designers

Software development | Hardware development | Ordering | Production

Software can be changed just before mass production starts; development TAT can also be shortened.

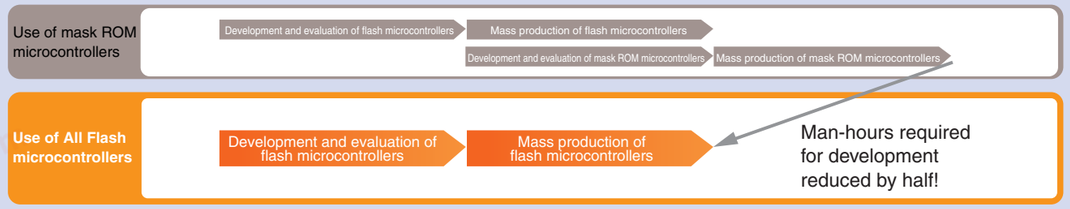


Since mask ROM microcontrollers cannot be ordered until their specifications are finalized, last-minute software changes can be problematic.
On the other hand, specifications for flash microcontrollers can be changed just prior to the start of mass production. Thus orders for flash microcontrollers can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

For hardware designers

Software development | Hardware development | Ordering | Production

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

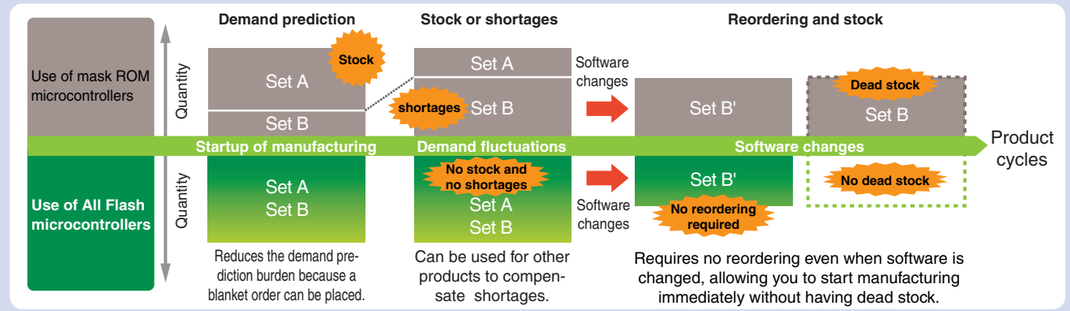


In the case of mass-produced mask ROM microcontrollers, evaluations of both flash microcontrollers and mask ROM microcontrollers are required.
Since evaluated flash microcontrollers can directly be mass-produced, the man-hours required for development are reduced by half, resulting in greatly shortened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

For purchasing divisions

Software development | Hardware development | Ordering | Production

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

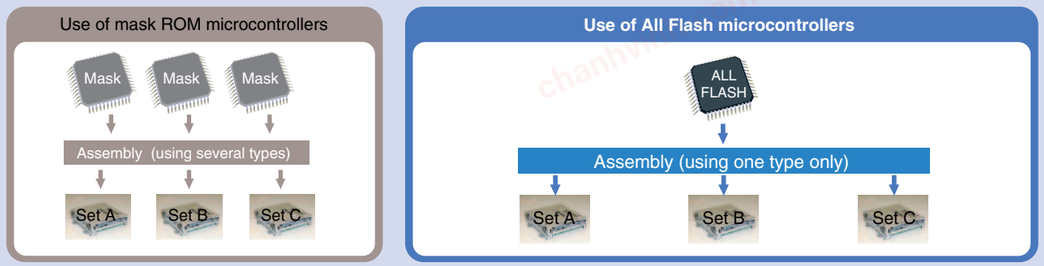


Mass-produced mask ROM microcontrollers may become dead stock as the result of changes in software or fluctuation in demand. On the other hand, flash microcontrollers can be mass-produced immediately after software changes and used for other products, resulting in fewer lost opportunities, less dead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

For manufacturing divisions

Software development | Hardware development | Ordering | Production

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.

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

ALL FLASH

"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. NEC 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.

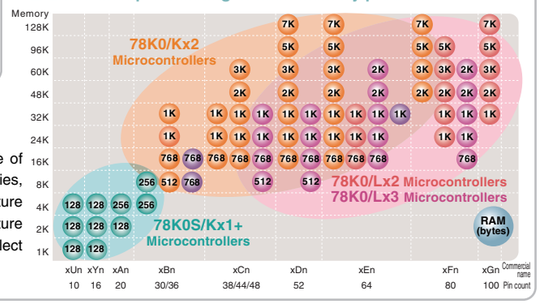
Large selection

Q Isn't the lineup limited?

A **We offer enhanced 216 products**

To respond to demands for various types of microcontrollers, we offer a range of 216 All Flash 8-bit microcontrollers featuring various pin counts, ROM capacities, packages, etc. Among these, the 78K0/Kx2, 78K0/Lx2, and µPD78F071x feature an operation speed of 20 MHz, and the 78K0/Kx2, 78K0/Lx2, and 78K0/Lx3 feature a wide power supply range of 1.8 to 5.5 V. Our large selection allows you to select the best product to suit your needs.

■ Entire lineup consisting of flash memory products



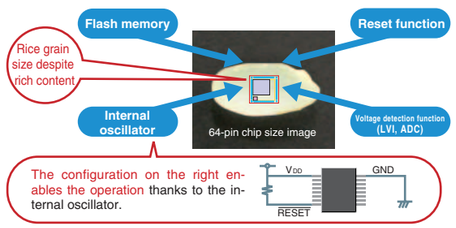
Low cost

Q Are these flash memory products expensive?

A **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

Q Isn't the power consumption large?

A **About 1/3 that of mask ROM products.**

Compared to the 7.6 mA operating current of conventional mask ROM products at 5 V/10 MHz operation (external ceramic resonator), the 78K0/Kx2, 78K0/Lx2, and 78K0/Lx3 products have a low operating current of 2.3 mA at 10 MHz operation (external ceramic resonator), and just 1.4 mA at 8 MHz operation (internal oscillator) under the same 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	External ceramic resonator 10 MHz	7.6 mA
Flash memory (78K0/Kx2, 78K0/Lx2, 78K0/Lx3)	External ceramic resonator 10 MHz	2.3 mA
	Internal oscillator 8 MHz	1.4 mA

Comparison with NEC Electronics products

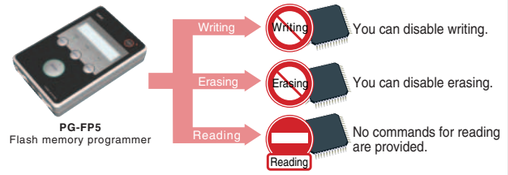
High reliability

Q Isn't the reliability low?

A **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

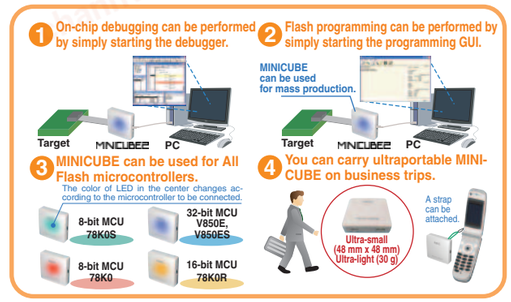


Rich development environment

Q No user-friendly development environment, right?

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

NEC Electronics provides inexpensive, easy-to-use, and convenient development environments. One example is MINICUBE2, an inexpensive on-chip debug emulator with flash programming function. Programming and on-chip debugging can be achieved for not only 78K0S/Kx1+ and 78K0/Kx2 and other 8-bit microcontrollers but also for 16- and 32-bit All Flash microcontrollers. Since the required cables come with MINICUBE and the software such as debuggers and programming GUIs can be downloaded from the website, you can use the debugger right away without having to purchase various accessories. Development environments for various applications are offered at low cost and a lineup of partner manufacturer tools is also available.



Support for mass production

Q Isn't programming cumbersome during mass production?

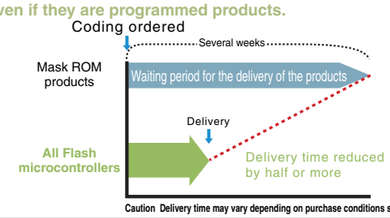
A1 **In addition to a large lineup of programming tools, we also offer programming services.**

NEC 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.

A2 **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.



Caution Delivery time may vary depending on purchase conditions such as order quantity.

■ Programming environment supporting All Flash products



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Large selection (1/2)

78K0S/Kx1+

78K0/Kx2

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 / 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				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 (GR) Thickness: 1.44 mm 5.72 mm (225) Pitch: 0.65 mm 16-pin WLBGA*1 (FH) Thickness: 0.4 mm 2 × 2.3 mm Pitch: 0.5 mm	20-pin SDIP (CS) Thickness: 2.8 mm 7.62 mm (300) Pitch: 1.778 mm 20-pin SSOP (MC) Thickness: 1.2 mm 7.62 mm (300) Pitch: 0.65 mm 20-pin WLBGA*3 (FH) Thickness: 0.4 mm 2.1 × 2.6 mm Pitch: 0.5 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	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	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 (GB) Thickness: 1.4 mm 10 × 10 mm Pitch: 0.5 mm 64-pin FLGA (FC) Thickness: 0.91 mm 5 × 5 mm Pitch: 0.5 mm	64-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.65 mm 64-pin TQFP (GA) Thickness: 1.0 mm 7 × 7 mm Pitch: 0.4 mm 64-pin FPBGA*3 (F1) Thickness: 0.69 mm 4 × 4 mm Pitch: 0.4 mm	80-pin LQFP (GC) Thickness: 1.4 mm 14 × 14 mm Pitch: 0.65 mm 80-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.5 mm

*1 μPD78F9210, 78F9211, and 78F9212 only *2 Supports on-chip debugging of 78K0/Kx2 *3 Under development

Remark The packages are shown in their actual size.

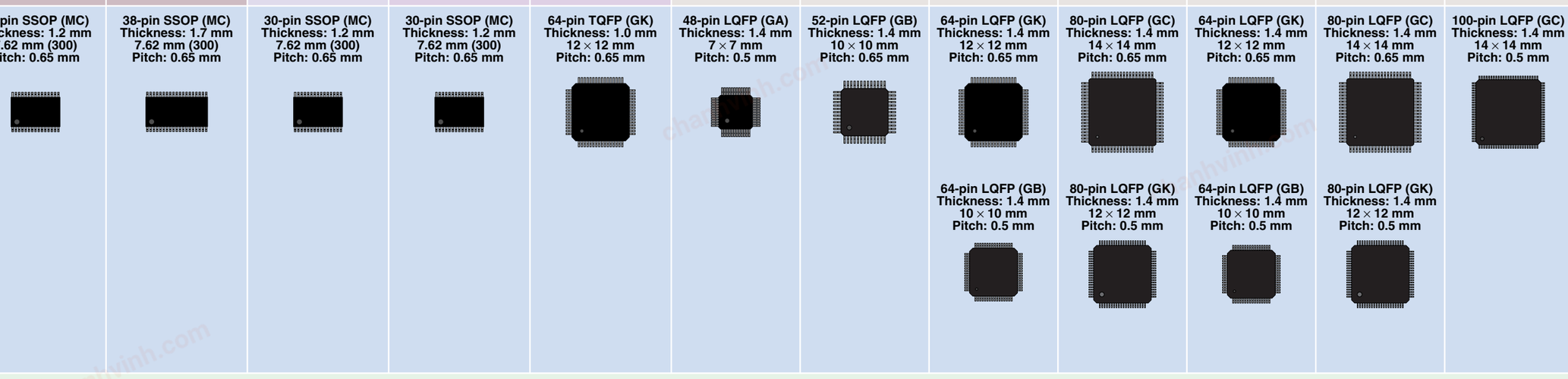
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Large selection (2/2)

78K0/Lx2
78K0/Lx3
μPD78F071x
μPD78F0730
μPD179F1xx

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	μPD179F1xx		μPD78F0730	μPD78F071x		78K0/LC3	78K0/LD3	78K0/LE3	78K0/LF3	78K0/LE2	78K0/LF2	78K0/LG2
Pin Count / ROM (bytes)	30-pin	38-pin	30-pin	30-pin	64-pin	48-pin	52-pin	64-pin	80-pin	64-pin	80-pin	100-pin
128 K	Product name (RAM (bytes))											μPD78F0397, μPD78F0397D*2 (7 K)
96 K											μPD78F0376, μPD78F0386, μPD78F0376D*2, μPD78F0386D*2 (5 K)	μPD78F0396 (5 K)
60 K								μPD78F0445, μPD78F0455, μPD78F0465*1 (2 K)	μPD78F0485, μPD78F0495*1, μPD78F0475 (2 K)		μPD78F0375, μPD78F0385 (3 K)	μPD78F0395 (3 K)
48 K								μPD78F0444, μPD78F0454, μPD78F0464*1 (2 K)	μPD78F0484, μPD78F0494*1, μPD78F0474 (2 K)		μPD78F0374, μPD78F0384 (2 K)	μPD78F0394 (2 K)
32 K	μPD179F114 (1 K)	μPD179F124 (1 K)			μPD78F0714 (1 K)	μPD78F0403, μPD78F0413 (1 K)	μPD78F0423, μPD78F0433 (1 K)	μPD78F0443, μPD78F0453, μPD78F0463*1 (1 K)	μPD78F0483, μPD78F0493*1, μPD78F0473 (1 K)	μPD78F0363, μPD78F0363D*2 (1 K)	μPD78F0373, μPD78F0383 (1 K)	μPD78F0393 (1 K)
24 K	μPD179F113 (1 K)	μPD179F123 (1 K)				μPD78F0402, μPD78F0412 (1 K)	μPD78F0422, μPD78F0432 (1 K)	μPD78F0442, μPD78F0452, μPD78F0462*1 (1 K)	μPD78F0482, μPD78F0492*1, μPD78F0472 (1 K)	μPD78F0362 (1 K)	μPD78F0372, μPD78F0382 (1 K)	
16 K	μPD179F112 (768)	μPD179F122 (768)	μPD78F0730 (3 K)	μPD78F0712 (768)		μPD78F0401, μPD78F0411 (768)	μPD78F0421, μPD78F0431 (768)	μPD78F0441, μPD78F0451, μPD78F0461*1 (768)	μPD78F0481, μPD78F0491*1, μPD78F0471 (768)	μPD78F0361 (768)		
8 K	μPD179F111 (512)			μPD78F0711 (768)		μPD78F0400, μPD78F0410 (512)	μPD78F0420, μPD78F0430 (512)					
4 K	μPD179F110 (512)											
2 K												
1 K												
Package	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	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 80-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.5 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 80-pin LQFP (GK) Thickness: 1.4 mm 12 × 12 mm Pitch: 0.5 mm	100-pin LQFP (GC) Thickness: 1.4 mm 14 × 14 mm Pitch: 0.5 mm



Microcontrollers for Preset Remote Control

USB Micro-controllers

Microcontrollers for Inverter Control

78K0/ Lx3 Microcontrollers

78K0/Lx2 Microcontrollers

*1 Under development
*2 Supports on-chip debugging of the 78K0/Lx2 microcontroller
Remark The packages are shown in their actual size.

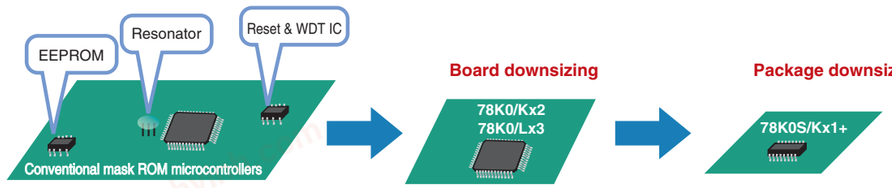
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Low cost

78K0S/Kx1+ | 78K0/Kx2 | 78K0/Lx2 | 78K0/Lx3 | μPD78F071x | μPD78F0730 | μPD179F1xx

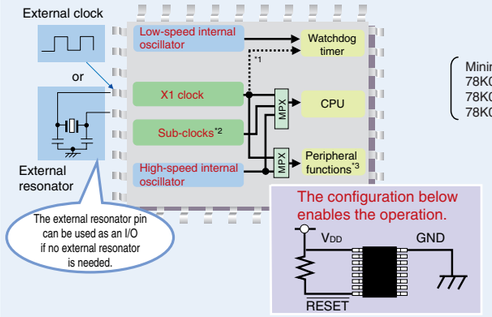
All the required peripheral functions are provided on chip, saving you money and space.

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.



EEPROM emulation function*4

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

Minimum erasure units
78K0/Kx2: 1 KB
78K0/Lx3: 1 KB
78K0S/Kx1+: 256 bytes



Maximum number of data items stored in one block (Outline)

$$\frac{\text{Minimum erasure unit}}{\text{Data length (number of bytes)}} \times \text{Number of erasures in one block}^{*5}$$

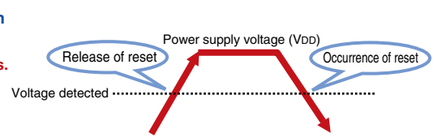
*1 78K0S/Kx1+ and μPD78F071x only
*2 Sub-clocks are not provided for the 78K0/KB2,78K0S/Kx1+, μPD78F0730, and μPD179F1xx.
*3 Use an external resonator or an external input clock when using the USB function incorporated in the μPD78F0730.
*4 Except μPD78F071x, μPD78F0730, and μPD179F1xx
*5 78K0S/Kx1+: 1,000 times, 78K0/Kx2: 10,000 times (4 KB), 78K0/Lx3: 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

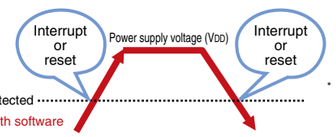
Reduces external resets and voltage detection ICs.



1.59 V ±0.15 V (fixed) — 78K0/Kx2, 78K0/Lx2, 78K0/Lx3, μPD78F0730
1.80 V ±0.1 V (fixed) — μPD179F1xx
2.1 V ±0.1 V (fixed) — 78K0S/Kx1+
3.5 V ±0.2 V (fixed) — μPD78F071x

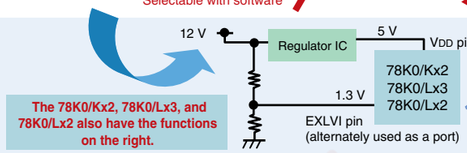
Voltage detection function

Interrupt or reset can be selected by software.



Accuracy of ±0.1 V*

* 78K0/Kx2, 78K0/Lx3, 78K0/Lx2, μPD78F0730, μPD179F1xx: When any voltage is set
78K0S/Kx1+: When a voltage of 2.6 V or less is set
μPD78F071x: Accuracy of ±0.2 V



The 78K0/Kx2, 78K0/Lx3, and 78K0/Lx2 also have the functions on the right.

Includes a pin (EXLVI) for inputting a reference voltage, allowing the detection of power supply voltages including power supply voltage for the microcontroller (VDD)

Highly reliable watchdog timer

Refer to the watchdog timer description on page 15.

Low power consumption

78K0/Kx2 | 78K0/Lx2 | 78K0/Lx3 | μPD179F1xx

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

			Operating current
Conventional mask ROM microcontrollers	Operation mode	Resonator 10 MHz	7.6 mA
78K0/Kx2, 78K0/Lx3, 78K0/Lx2		Resonator 10 MHz	2.3 mA — 70% reduced
		Internal oscillator 8 MHz	1.4 mA — 82% reduced

Power supply voltage: 3 V

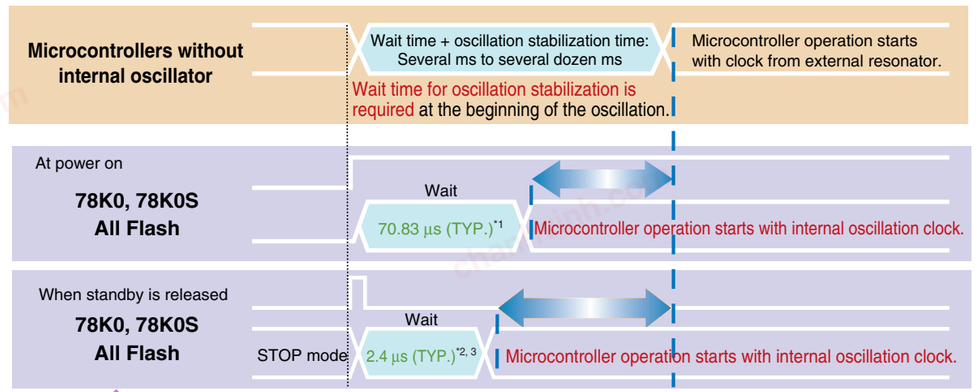
			Standby current
Conventional mask ROM microcontrollers	HALT mode	Resonator 32.768 kHz	6 μA
78K0/Kx2, 78K0/Lx2		Resonator 32.768 kHz	3.5 μA — 42% reduced
78K0/Lx3		Resonator 32.768 kHz	2.4 μA — 60% reduced
78K0/Kx2, 78K0/Lx3, 78K0/Lx2 μPD179F1xx	STOP mode	All clocks stop.	1 μA

Remark The current values are typical values.

μPD78F071x | 78K0S/Kx1+ | μPD78F0730 | 78K0/Kx2 | μPD179F1xx | 78K0/Lx2 | 78K0/Lx3

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 μPD78F071x. 78K0S/Kx1+: 544 μs (TYP.)
*2 In the case of the 78K0/Kx2, 78K0/Lx2, 78K0/Lx3. μPD179F1xx: 4.8 μs, μPD78F0730: 5 μs, μPD78F071x: 70.83 μs
*3 78K0/Kx2, 78K0/Lx2: When oscillation frequency is 10 MHz or less (AMPH = 0)

High reliability

μPD78F0730 78K0S/Kx1+ μPD179F1xx 78K0/Kx2 78K0/Lx2 78K0/Lx3 μPD78F071x

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

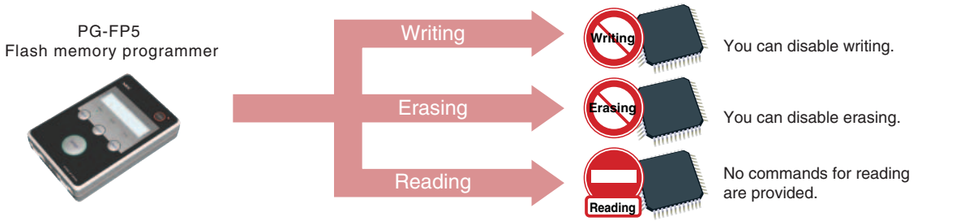
Record of shipment & applications employing our flash microcontrollers



Note As of March, 2008

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

Software protection function



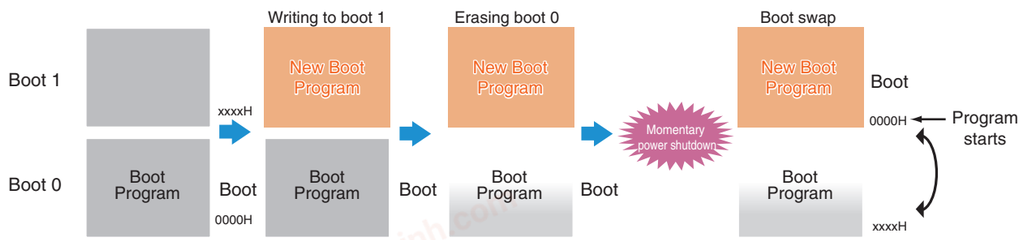
78K0/Kx2 78K0/Lx2 78K0/Lx3

A boot swap function is provided to protect important programs even when power shuts down during self-programming.

Problems during self-rewriting



Boot swap function

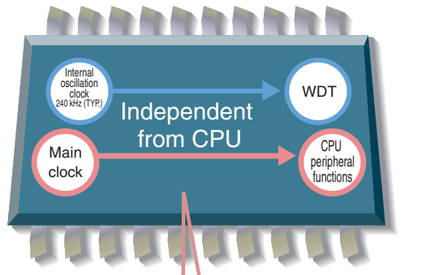


The microcontroller can start normally even when momentary power shutdown occurs during boot rewriting.

μPD78F071x 78K0S/Kx1+ μPD78F0730 78K0/Kx2 μPD179F1xx 78K0/Lx2 78K0/Lx3

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

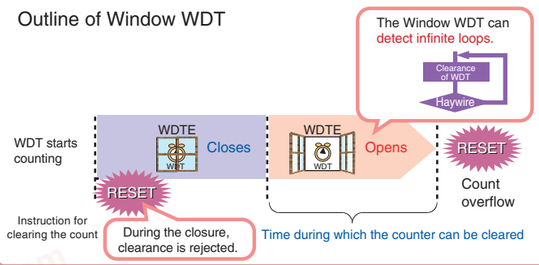
	Conventional microcontrollers	78K0/Kx2, 78K0/Lx2, 78K0/Lx3, and 78K0S/Kx1+
X1 clock stops	The watchdog timer also stops and the microcontroller haywire cannot be detected.	The watchdog timer does not stop.
Microcontroller haywire	It is doubtful whether the haywire is detected because counts are cleared by 1-bit flags.	No need to worry about haywire because counts are cleared by the byte instruction.

μPD179F1xx 78K0/Kx2 78K0/Lx2 78K0/Lx3

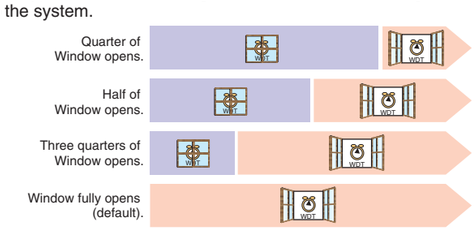
The 78K0/Kx2, 78K0/Lx2, 78K0/Lx3, and μPD179F1xx have more reliable functions.

Window WDT

Outline of Window WDT



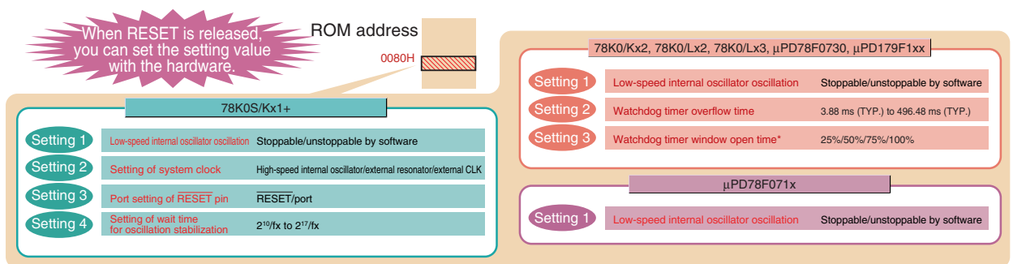
Four types of Window settings can be selected according to the system.



μPD78F071x 78K0S/Kx1+ μPD78F0730 78K0/Kx2 μPD179F1xx 78K0/Lx2 78K0/Lx3

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



* This can be set to only 100% in the μPD78F0730.

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Rich development environment (1/2)

78K0S/Kx1+ | 78K0/Kx2 | 78K0/Lx2 | 78K0/Lx3 | μPD78F071x | μPD78F0730 | μPD179F1xx

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

Test board*4

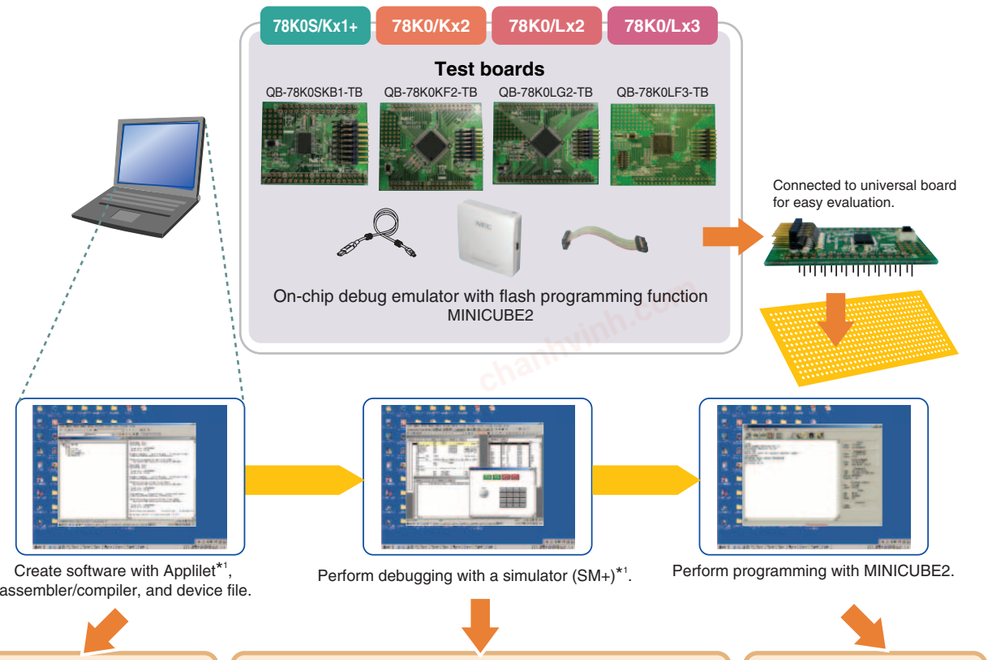
	Board supplied with Applilet® EZ for simple software creation	Starter kit for quick microcontroller programming	Test boards for MINICUBE2	Pitch conversion board
78K0S	Applilet EZ: EZ-0001 Microcontroller training kit: ReferSTAR 78K*1	For 20-pin SSOP package: EZ-0002 For 20-pin DIP package: CT-207*1	For 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/LG2: EZ-0003	For 78K0/KF2: QB-78K0KF2-TB For 78K0/LG2: QB-78K0LG2-TB For 78K0/LF3: QB-78K0LF3-TB	

Development environment	Software development	Debugging/verification	Programming
78K0S	Assembler (RA78K0S) (PM+ is included.) Compiler (CC78K0S) Device driver configurator (Applilet for 78K0S/Kx1+) Software package (SP78K0S)	Simulator (SM+ for 78K0S/Kx1+) Full-function in-circuit emulator (IECUBE®): QB-78K0SKX1 On-chip debug emulator with flash programming function (MINICUBE2): QB-MINI2	Flash memory programmer: PG-FP5 FL-PR5*2
78K0	Assembler (RA78K0) (PM+ is included.) Compiler (CC78K0) Device driver configurator (Applilet2 for 78K0/Kx2) (Applilet2 for 78K0/Lx2) Software package (SP78K0)	Simulator (SM+ for 78K0/Kx2)*4 Full-function in-circuit emulator (IECUBE): QB-78K0KX2, QB-78K0LX2, QB-78K0LX3, QB-780714, QB-780731, QB-179F124 On-chip debug emulator with flash programming function (MINICUBE2): QB-MINI2	Flash memory programmer: PG-FP5 FL-PR5*2

*1 Made by Sunhayato Corporation
*2 Made by Naito Densei Machida Mfg. Co., Ltd.
*3 Made by Application Corporation
*4 Not supported by the μPD179F1xx.

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
  - Assembler
  - 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/Lx2 78K0/Lx3, μPD78F071x, 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)
- QB-78K0LX2 (For 78K0/Lx2)
- QB-78K0LX3 (For 78K0/Lx3)
- QB-780714 (For μPD78F071x)
- 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.

PG-FP5
NEC Electronics

FL-PR5*3
Partner manufacturer

*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 Densei Machida Mfg. Co., Ltd.

For details on tools, access these URLs. **http://www.necel.com/micro/eng/freesoft/index.html**

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Rich development environment (2/2)

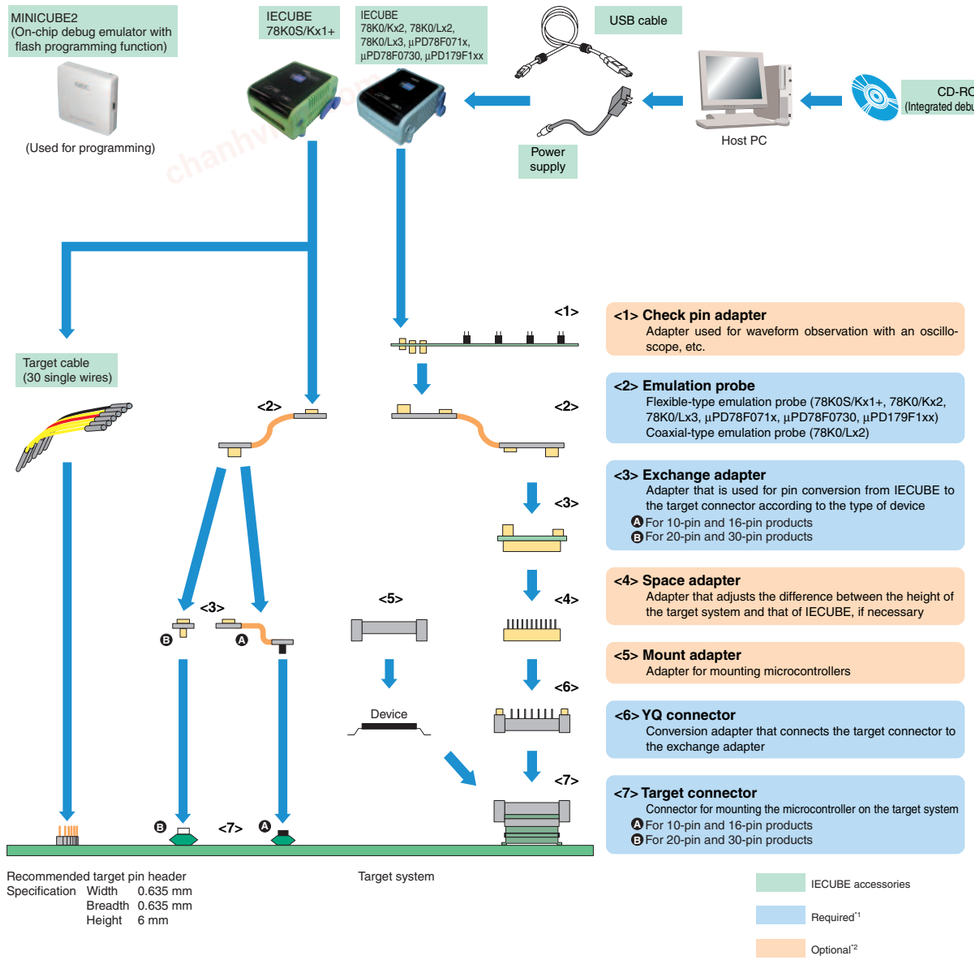
78K0S/Kx1+ | 78K0/Kx2 | 78K0/Lx2 | 78K0/Lx3 | μPD78F071x | μPD78F0730 | μPD179F1xx

Hardware tool

Full-function emulator

IECUBE (Full-function in-circuit emulator)

System configuration



<1> Check pin adapter
Adapter used for waveform observation with an oscilloscope, etc.

<2> Emulation probe
Flexible-type emulation probe (78K0S/Kx1+, 78K0/Kx2, 78K0/Lx3, μPD78F071x, μPD78F0730, μPD179F1xx)
Coaxial-type emulation probe (78K0/Lx2)

<3> Exchange adapter
Adapter that is used for pin conversion from IECUBE to the target connector according to the type of device
Ⓐ For 10-pin and 16-pin products
Ⓑ For 20-pin and 30-pin products

<4> Space adapter
Adapter that adjusts the difference between the height of the target system and that of IECUBE, if necessary

<5> Mount adapter
Adapter for mounting microcontrollers

<6> YQ connector
Conversion adapter that connects the target connector to the exchange adapter

<7> Target connector
Connector for mounting the microcontroller on the target system
Ⓐ For 10-pin and 16-pin products
Ⓑ For 20-pin and 30-pin products

*1 Options required for connecting target system when using IECUBE for 78K0/Kx2, 78K0/Lx2, 78K0/Lx3, μPD78F071x, μPD78F0730, and μPD179F1xx 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/Lx2, 78K0/Lx3, μPD78F071x, μPD78F0730, and μPD179F1xx microcontrollers

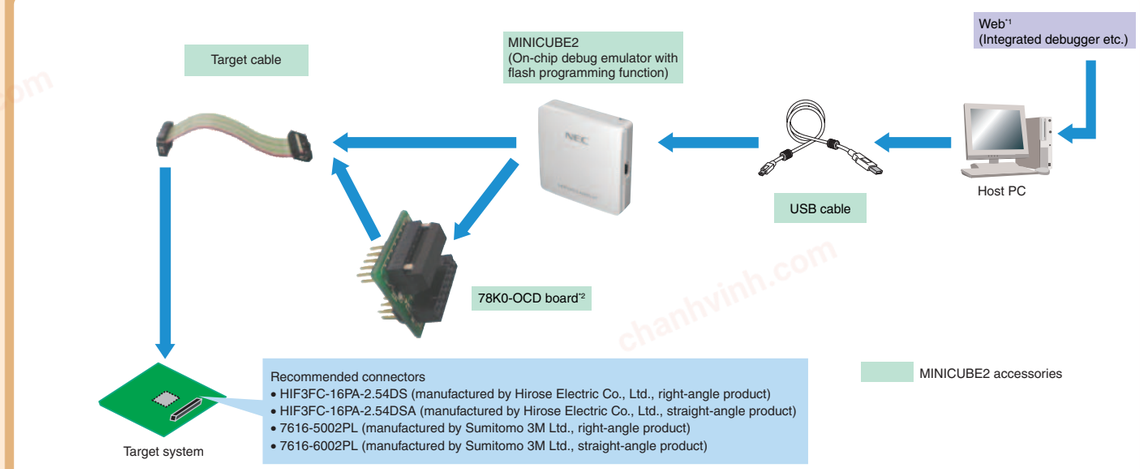
Remark For the device development environment when using IECUBE, see the **Single-Chip Microcontroller Development Tools Selection Guide (U11069E)**.

Flash memory programmer

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

Simplified emulator

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



Recommended connectors
- HIF3FC-16PA-2.54DS (manufactured by Hirose Electric Co., Ltd., right-angle product)
- HIF3FC-16PA-2.54DSA (manufactured by Hirose Electric Co., Ltd., straight-angle product)
- 7616-5002PL (manufactured by Sumitomo 3M Ltd., right-angle product)
- 7616-6002PL (manufactured by Sumitomo 3M Ltd., straight-angle product)

*1 For more information on MINICUBE2:
http://www.necel.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))	SP78K0S*2	CC78K0S	RA78K0S	ID78K0S-QB	SM+ for 78K0S/Kx1+*4	DF789234
78K0S/KY1+	16-pin SDIP (7.62 mm (300)) 16-pin SSOP (5.72 mm (225)) 16-pin WLBGA (2 × 2.3 mm)						
78K0S/KA1+	20-pin SDIP (7.62 mm (300)) 20-pin SSOP (7.62 mm (300)) 20-pin WLBGA (2.1 × 2.6 mm)*1						
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 (4 × 4 mm)	SP78K0*3	CC78K0	RA78K0	ID78K0-QB	SM+ for 78K0/Kx2	DF780547
78K0/KC2	38-pin SSOP (7.62 mm (300)) 44-pin LQFP (10 × 10 mm) 48-pin LQFP (7 × 7 mm)						
78K0/KD2	52-pin LQFP (10 × 10 mm)						
78K0/KE2	64-pin LQFP (14 × 14 mm) 64-pin LQFP (12 × 12 mm) 64-pin LQFP (10 × 10 mm) 64-pin TQFP (7 × 7 mm) 64-pin FLGA (5 × 5 mm) 64-pin FPBGA (4 × 4 mm)*1						
78K0/KF2	80-pin LQFP (14 × 14 mm) 80-pin LQFP (12 × 12 mm)						
μPD179F1xx	30-pin SSOP (7.62 mm (300)) 38-pin SSOP (7.62 mm (300))					–	DF179124
μPD78F0730	30-pin SSOP (7.62 mm (300))						DF780731
μPD78F071x	30-pin SSOP (7.62 mm (300)) 64-pin LQFP (12 × 12 mm)						DF780141
78K0/LE2	64-pin LQFP (12 × 12 mm) 64-pin LQFP (10 × 10 mm)						DF780397
78K0/LF2	80-pin LQFP (14 × 14 mm) 80-pin LQFP (12 × 12 mm)						
78K0/LG2	100-pin LQFP (14 × 14 mm)						
78K0/LC3	48-pin LQFP (7 × 7 mm)						DF780495
78K0/LD3	52-pin LQFP (10 × 10 mm)						
78K0/LE3	64-pin LQFP (12 × 12 mm)*1 64-pin LQFP (10 × 10 mm)*1						
78K0/LF3	80-pin LQFP (14 × 14 mm)*1 80-pin LQFP (12 × 12 mm)*1						

*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.

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Support for mass production

78K0S/Kx1+ | 78K0/Kx2 | 78K0/Lx2 | 78K0/Lx3 | µPD78F071x | µPD78F0730 | µPD179F1xx

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.

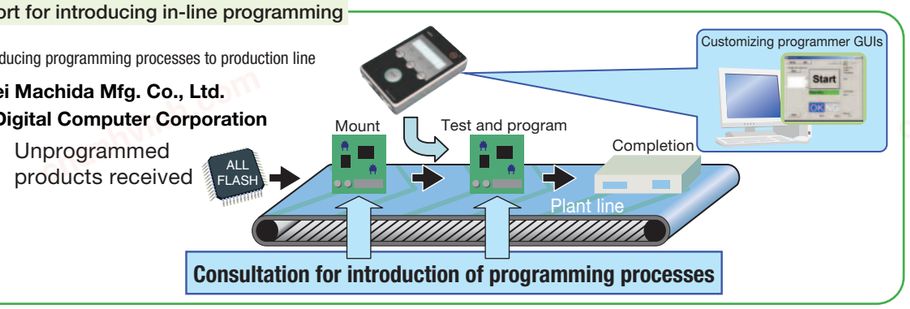
Programming by the customer

Delivery time*1: Practically none, highly flexible

Support for introducing in-line programming

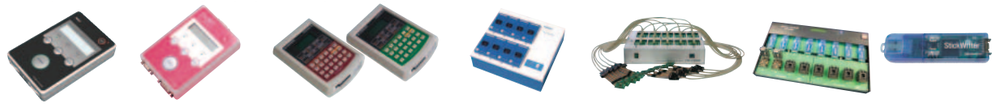
Support for introducing programming processes to production line

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



Flash memory programmers

Various products selectable for your purposes and price range



PG-FP5	FL-PR5	NET IMPRESS series*	Y3000-8*	ITF-2000*	Stick GANG Writer*	StickWriter*
NEC Electronics	Naito Densei Machida Mfg. Co., Ltd.	Yokogawa Digital Computer Corporation	Wave Technology Co., Ltd.	Interface Co., Ltd.	Application Corporation	Application Corporation

* Compatibilities differ according to product.

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

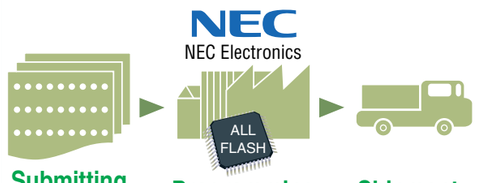


Programmed products

Shipment form same as that of mask ROM microcontrollers

NEC Electronics

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





***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

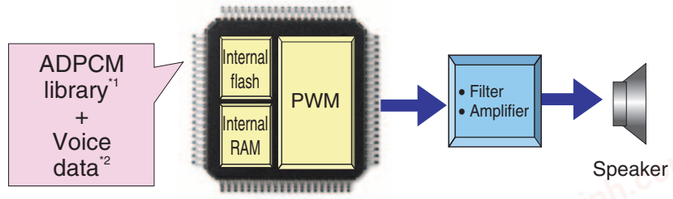
78K0S/Kx1+ | 78K0/Kx2 | 78K0/Lx2 | 78K0/Lx3 | µPD78F071x | µPD78F0730 | µPD179F1xx

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.



Application example



Fire alarm system

***1. ADPCM library (ADPCM-SP2) features**

Software sizes		Extension processing performance (during 20 MHz drive)
ROM	RAM	
600 bytes	8 bytes	17 µs, max.

Cautions 1. The above processing times are processing times for individual libraries. When mounted in a system, this becomes a total of 40 µs (during 20 MHz drive), because extra processing time is required for output processing.
2. Processing is necessary every 125 µs 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 Application Corporation

Voice conversion tool (WAVE→ADPCM)

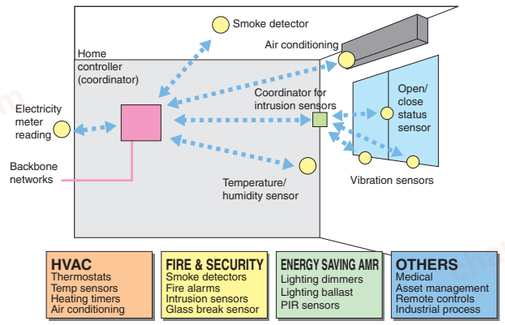


CvADPCM
Made by NEC Electronics Corporation
Obtained from our Website

Connecting (ZigBee®)

The ZigBee 2006 Standard is already applied! Development can start right away.

Network example



TK-850/SG2 + UZ*1 (UZ2400 mounted)



32-bit microcontroller V850ES/SG2 mounted
- Internal ROM: 384 KB
- Internal RAM: 32 KB

TK-78K0R/KG3 + UZ*1 (UZ2400 mounted)



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

TK-78K0/KF2 + UZ*1 (UZ2400 mounted)



8-bit microcontroller 78K0/KF2 mounted
- Internal ROM: 128 KB
- Internal RAM: 7 KB

ZigBee SDK*2 (software development kit)



A protocol stack library that enables peer-to-peer connection by using the GUI on the PC screen, establishment of Mesh net wireless communication, diagnosis, and debugging, is included.
- ZigBee 2006 Standard applied

*1 Made by Application Corporation
*2 Product co-developed by Skyley Networks, Inc. and NEC Electronics.

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Product specifications (1/2)

| CPU Core | | | 78K0S | | | | | | | | | | | | | | | | 78K0 | | | | | | | | | | | | | | | |

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Product specifications (2/2)

| CPU Core | | | 78K0 | | 78K0 | | |

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