

To our customers,

---

## Old Company Name in Catalogs and Other Documents

---

On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

## Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
  - “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
  - “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
  - “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

Renesas MCUs

# H8S Family

H8S/Tiny Series



# The MCUs for everyone. **Tiny**



**Renesas Tiny Series MCUs bring enhanced convenience, security, and richness to people's lives.**

### New advances in general purpose MCUs

Renesas offers a wide range of MCU products to match the demands of every aspect of today's modern lifestyle. Of these, the Tiny Series has attracted great attention. These single-chip MCUs each combine a high-performance CPU core with on-chip flash memory. A broad lineup of Tiny Series MCUs is available, allowing users to choose precisely the features and performance that their specific application requires. From specialized high-grade applications to general purpose products, the Tiny Series has your needs covered.

### Low cost, low pin count, small package

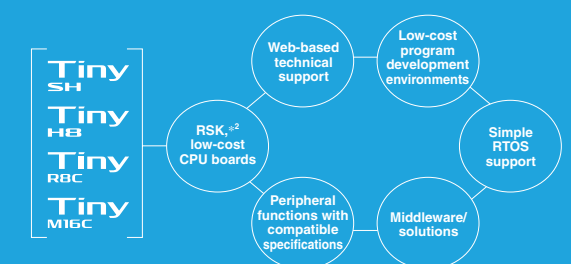
The product concept of the Tiny Series couldn't be simpler. These Renesas MCUs each offer low cost, low pin count, and a small package.

- Low pin count and small package (most 20 to 100 pins), high-performance CPU (16-bit or more).
- Highly reliable on-chip flash memory (factory programming available).<sup>\*1</sup>
- High-performance on-chip peripheral functions for reduced system cost.

### Four personalities, four types of usability

Tiny consists of four product series, each with a different high-performance CPU core. The SH/Tiny Series uses the SuperH™ CPU core. The M16C/Tiny Series uses the M16C CPU core. The R8C/Tiny Series uses the R8C CPU core, which is instruction compatible with the M16C. The H8/Tiny Series uses the H8/300H CPU core. Finally, H8S/Tiny Series uses the H8S/2000 core.

### Common features throughout the series



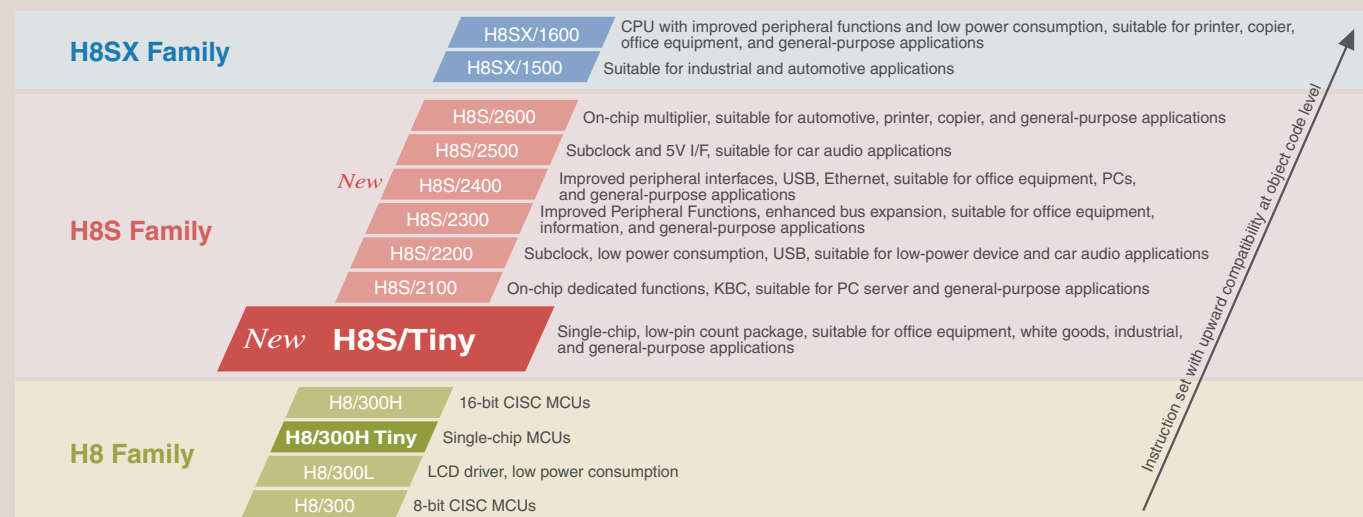
\*1: Applies to R8C/Tiny Series only. \*2: Renesas Starter Kit

# Renesas MCU **Tiny** Series

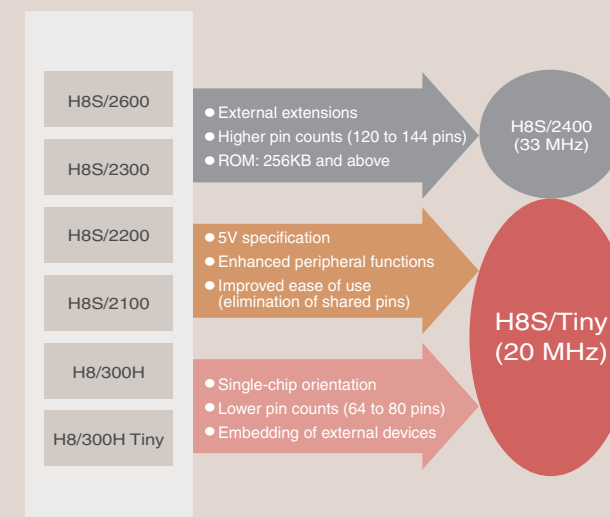


The H8S/Tiny Series adds improved performance to the many advantages of the acclaimed H8/300H Tiny Series.

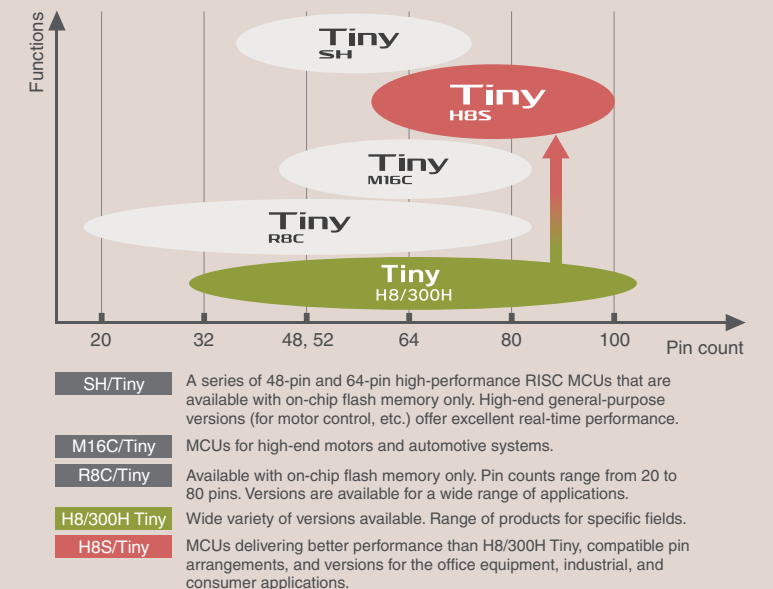
### H8SX, H8S, H8 Lineup



### Advancing to the H8S/Tiny Series



### Tiny Series Roadmap





The H8/Tiny Series of high-performance MCUs are built around the H8S/2000 CPU, which provides object code compatibility with the H8/300H CPU. It is also available in the same packages and retains pin compatibility with earlier MCUs.

**<Enhanced performance>**  
H8S/Tiny

- Further improvement in CPU performance
- New functions such as event link controller (ELC) and peripheral I/O mapping controller (PMC)
- More powerful interrupt controller for reduced software processing load (four priority levels, multiplex interrupts)
- On-chip data transfer controller (DTC) for better data transfer performance
- More A/D converter input channels (16 input channels on 80-pin version)
- Big increase in number of timers

**<Enhanced ease of use>**  
H8/300H Tiny

- High-speed on-chip oscillator with improved accuracy
- Power-on reset (POR) circuit with improved functionality
- Low-voltage detection (LVD) circuit
- Watchdog timer (WDT)
- Serial communication interface (SCI) with built-in noise elimination function

### H8S/Tiny Roadmap

	H8/300H Tiny H8/300H CPU core	H8S/Tiny H8S/2000 CPU core
100-pin	<div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black;">36109</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px;">ROM 128K / RAM 5K</div>	<div style="border: 1px dashed red; width: 60px; height: 30px; margin: 0 auto;"></div>
80-pin	<div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black;">36049</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px;">ROM 96K / RAM 4K</div>	<div style="background-color: #C00000; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px;">H8S/20223</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">ROM 128K / RAM 8K A/D: 10-bit × 16ch</div> <div style="background-color: #C00000; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px;">H8S/20203</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">ROM 128K / RAM 8K A/D: 10-bit × 12ch</div>
64-pin	<div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px;">36077</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">ROM 56K / RAM 4K</div> <div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px; margin-left: 20px;">36079</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; margin-left: 20px;">ROM 128K / RAM 6K</div> <div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px; margin-left: 10px;">36077L</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; margin-left: 10px;">3V ver.</div> <div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px; margin-left: 40px;">36079L</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; margin-left: 40px;">3V ver.</div>	<div style="background-color: #C00000; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px;">H8S/20103</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">ROM 128K / RAM 8K A/D: 10-bit × 8ch</div>
48-pin	<div style="background-color: #0070C0; color: white; padding: 5px; border: 1px solid black; margin-bottom: 5px;">36094</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">ROM 32KB / RAM 2K</div>	

## Peripheral Functions

### New function 1 Event link controller (ELC)

The event link controller (ELC) is a circuit that assigns interrupt signals generated by on-chip functions such as the timers, A/D converters, and the data transfer controller (DTC) as startup sources for other on-chip functions.

**Reduced interrupt processing load**

When on-chip modules are used in combination, event link controller settings enable a reduction in the interrupt processing load.

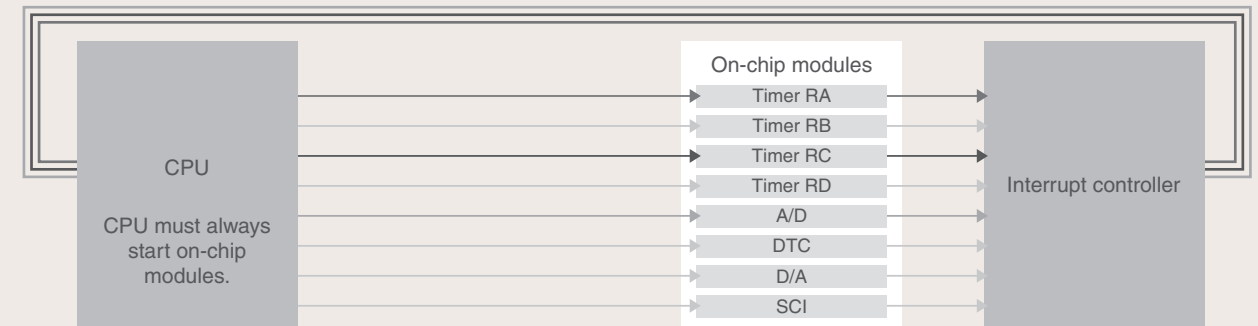
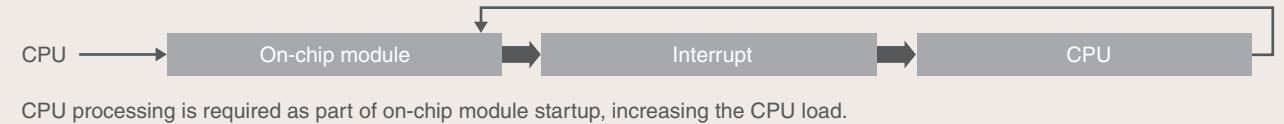
**Improved realtime performance**

Eliminates interrupt transition time, module startup processing within the interrupt handler, and interrupt save time.

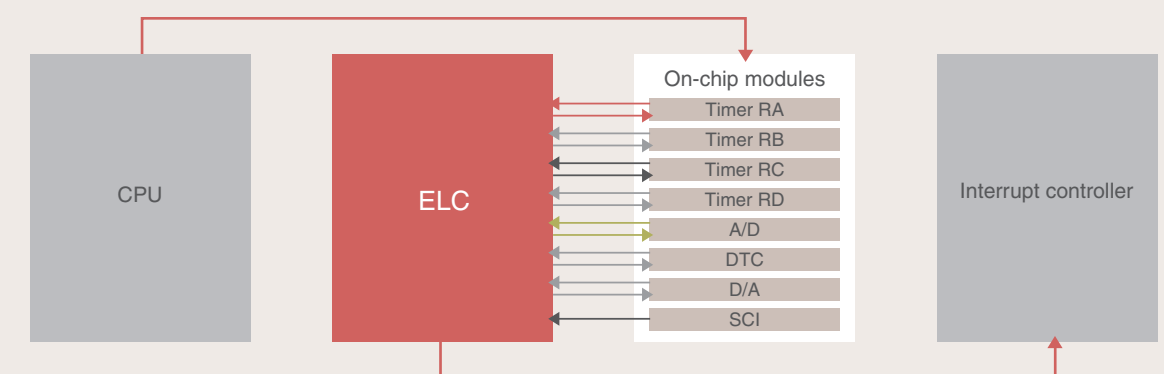
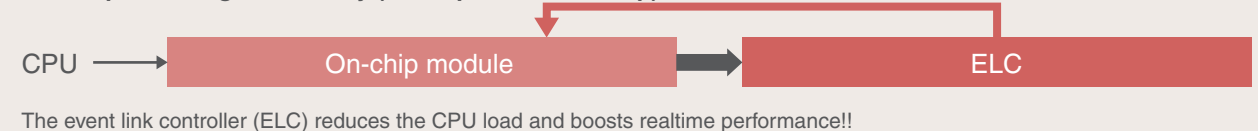
**Reduced program size**

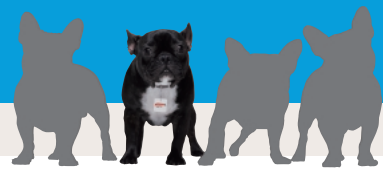
The overall number of interrupts is reduced, making it possible to reduce the size of interrupt handling routines.

#### Conventional processing (on-chip module startup)



#### ELC processing in H8S/Tiny (on-chip module startup)





# Peripheral Functions

## New function 2 Peripheral I/O mapping controller (PMC)

The peripheral I/O mapping controller (PMC) enables changing of the I/O pin assignments of on-chip functions.

**On 64-pin versions 41 pins, and on 80-pin versions 51 pins, can be reassigned to different functions.**

Pins other than system control pins and analog pins can be reassigned to different functions.

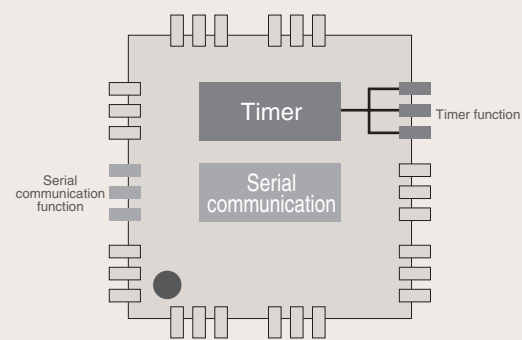
**Selectable among up to six functions per pin.**

Pins can be reassigned to different functions, such as timers and serial communication, by changing register settings.

**More flexibility when designing boards.**

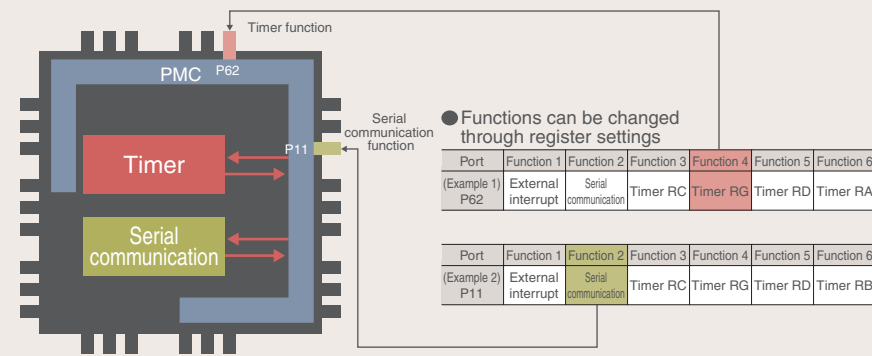
MCU pin functions can be assigned to specific pins to match the layout of the system board, shortening the time needed for board development.

### Conventional MCU



Functions assigned to pins are fixed.

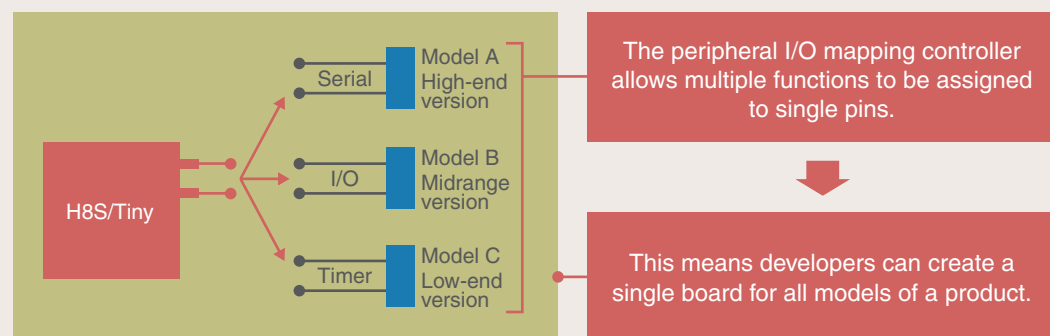
### Using PMC settings on H8S/Tiny



- 64-pin version (H8/20103): 41 pins can be reassigned to different functions.
- 80-pin versions (H8/20203, H8/20223): 51 pins can be reassigned to different functions.

Selectable among up to six functions per pin.

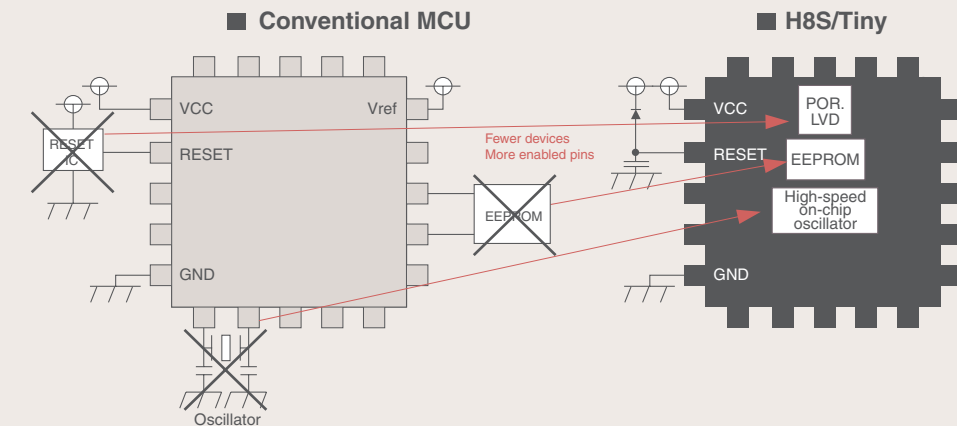
### Usage example



## Big reduction in external devices

In addition to a high-performance CPU and low power consumption, the H8S/Tiny Series provides superior functionality that reduces the number of external devices needed.

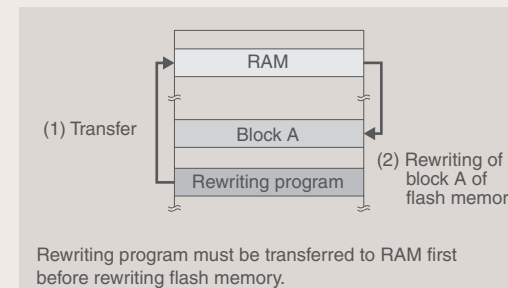
- Fewer external devices: On-chip modules include on-chip oscillator, power-on reset, low-voltage detection, and EEPROM.
- Safe design: Oscillation stop detection, highly functional watchdog timer, ROM protect function, etc.



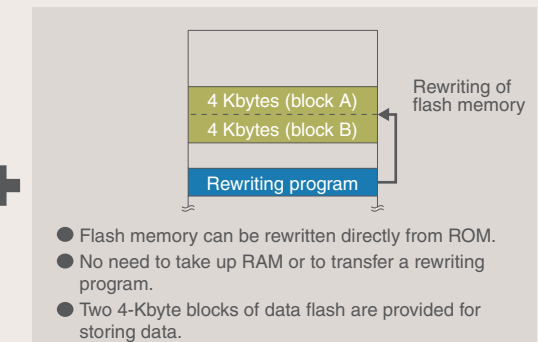
## Data flash

H8S/Tiny MCUs feature on-chip data flash (flash memory for storing data).

### Conventional MCU



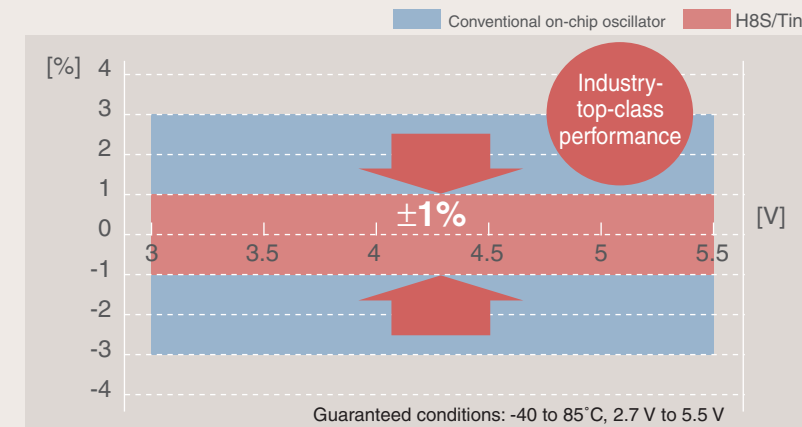
### H8S/Tiny with data flash

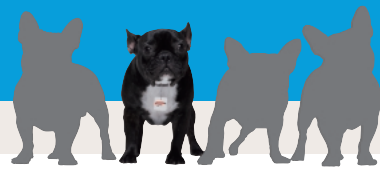


External EEPROM is not needed, helping to reduce costs.

## Highly accurate high-speed on-chip oscillator

The H8S/Tiny Series is equipped with a highly accurate high-speed on-chip oscillator that is at the top of its class in the industry. This eliminates the need for an external oscillator.

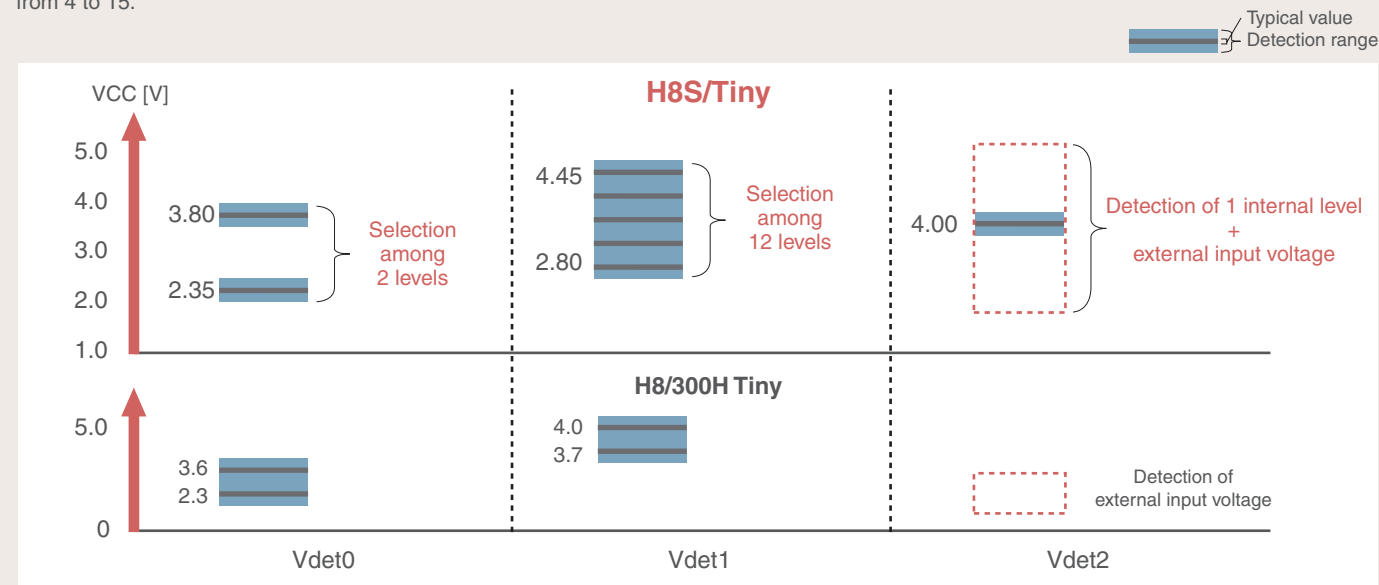




## Peripheral Functions

### More advanced low-voltage detection (LVD) function

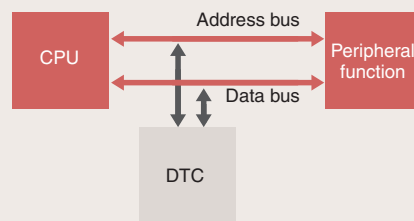
This function monitors the power supply voltage level and generates an internal reset signal or an interrupt when the voltage drops below a designated value. The H8S/Tiny Series has an enhanced low-voltage detection function that increases the available detection voltage levels from 4 to 15.



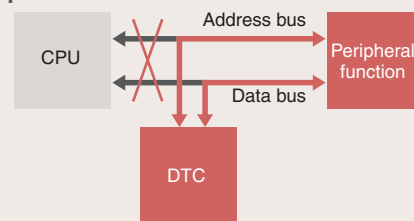
### Data transfer controller (DTC) function

- The data transfer controller (DTC) is a function that transfers data between the memory and registers, bypassing the CPU.
- It is started by interrupts from peripheral functions.
- There are a total of 40 start sources for the 20103 Group, 44 for the 20203 Group, and 46 for the 20223 Group.

#### DTC stopped



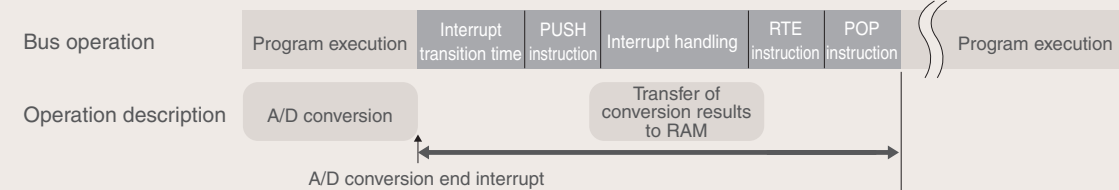
#### DTC startup



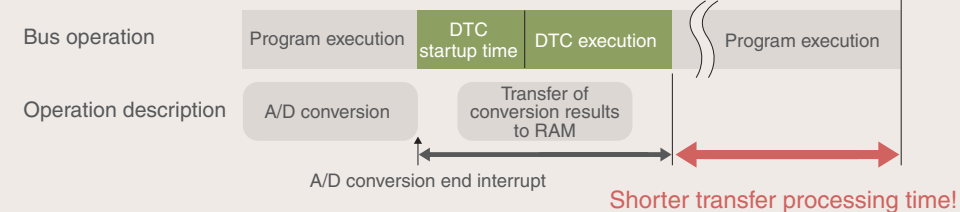
### DTC operation example

Transferring A/D conversion results to RAM

#### Implementation using CPU

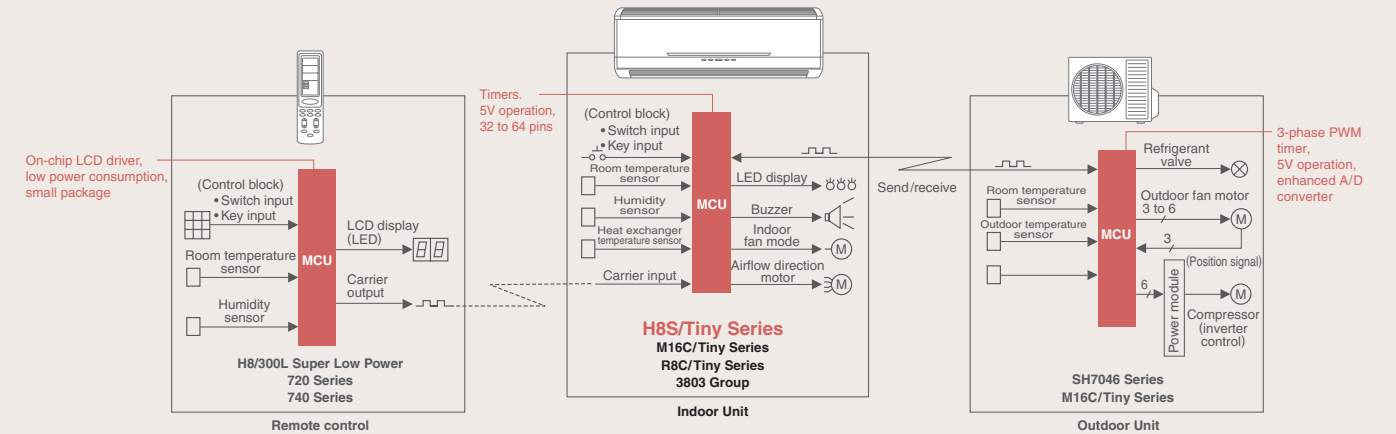


#### Implementation using DTC

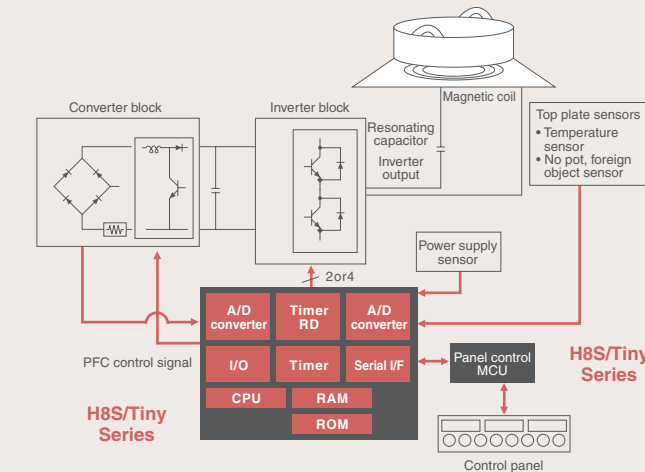


## Application Examples

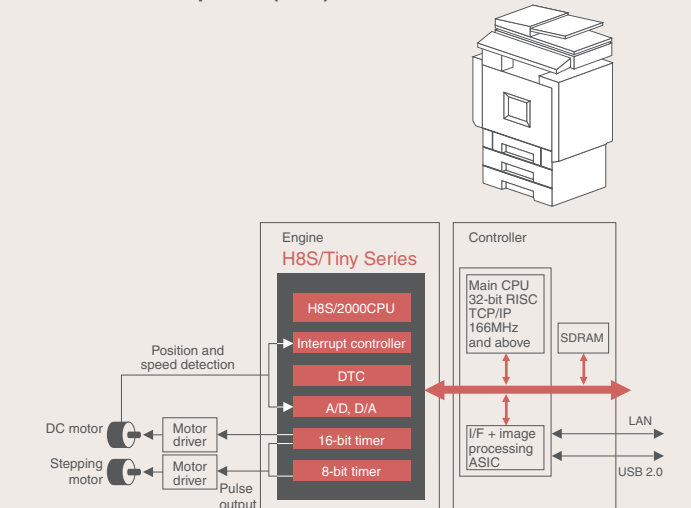
### Air conditioner (system block diagram)



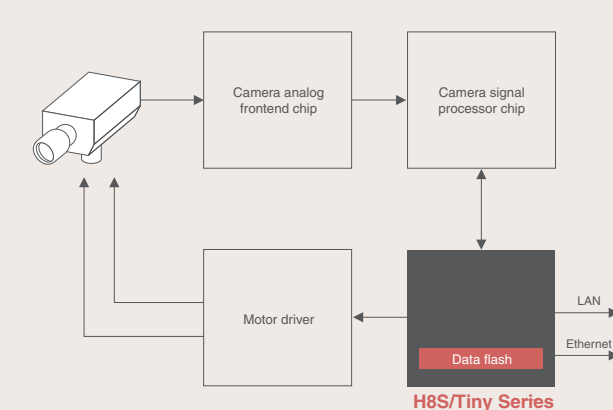
### IH cooking heater system block diagram



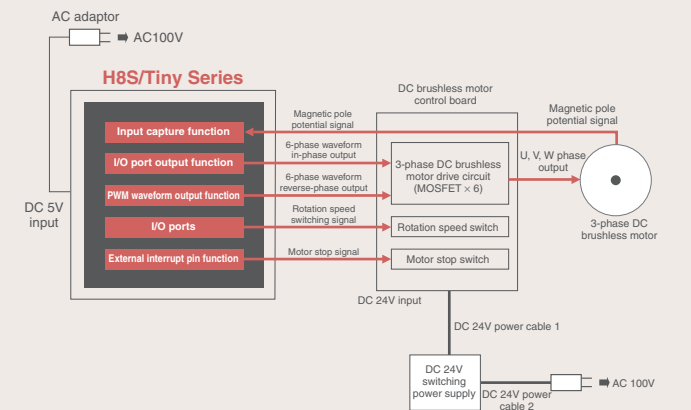
### Multifunction printer (MFP)

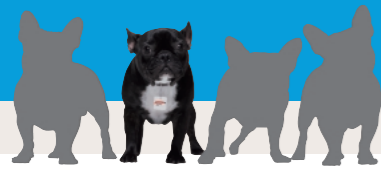


### Home security camera module



### DC brushless motor (control block diagram)





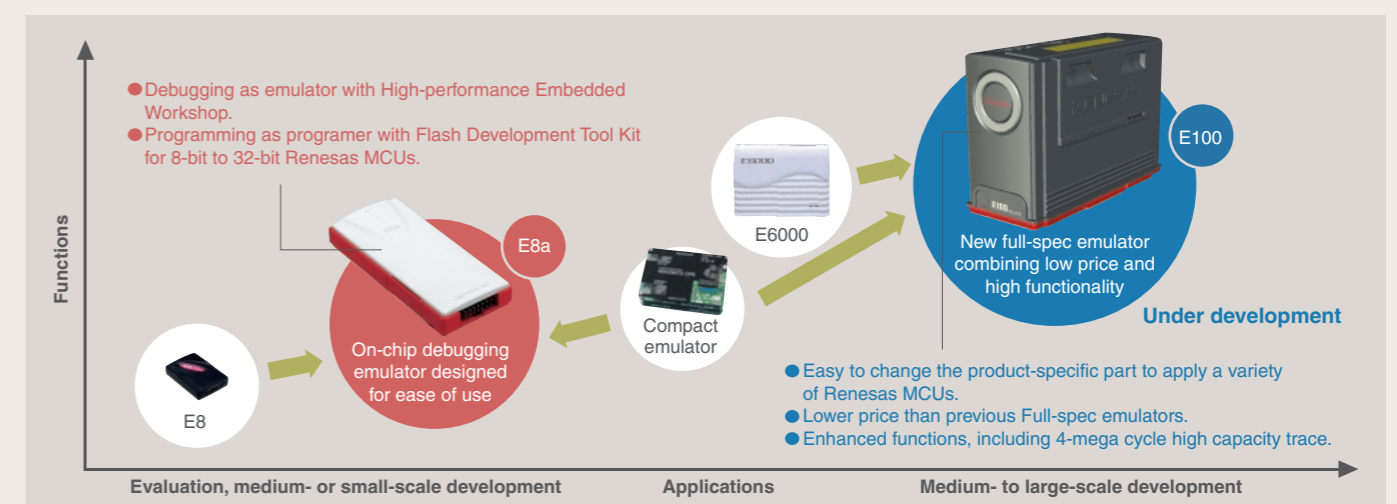
## Specification Table

Pin count	64pin				80pin	
	H8S/20103		H8S/20203		H8S/20223	
Group	H8S/20102		H8S/20103		H8S/20202	
Product name	H8S/20102		H8S/20103		H8S/20202	
ROM (bytes)	96K		128K		96K	
RAM (bytes)	8K		8K		8K	
EEPROM (bytes)	4K x 2 blocks		4K x 2 blocks		4K x 2 blocks	
ROM type	F		F		F	
Program security	●		●		●	
CPU core	H8S/2000 CPU		H8S/2000 CPU		H8S/2000 CPU	
Min. instruction execution time (ns)	50		50		50	
Clock oscillator circuits	4 circuits (system clock, subclock, on-chip oscillators (low speed, high speed))		4 circuits (system clock, subclock, on-chip oscillators (low speed, high speed))		4 circuits (system clock, subclock, on-chip oscillators (low speed, high speed))	
Subclock	●		●		●	
On-chip oscillator	● (High speed, low speed)		● (High speed, low speed)		● (High speed, low speed)	
Oscillation stop detect	●		●		●	
Low-power-consumption configuration	●		●		●	
Power-on reset	●		●		●	
Low voltage detect	●		●		●	
A/D converter	Resolution x channels: 10-bit x 8ch (On-chip comparator mode)		10-bit x 8ch (On-chip comparator mode)		10-bit x 16ch (On-chip comparator mode)	
D/A converter	Resolution x channels: 8-bit x 2ch		8-bit x 2ch		8-bit x 2ch	
RTIC	1		1		1	
Timer RA	1		1		1	
Timer RB	1		1		1	
Timer RC	1		1		1	
Timer RD (16-bit, 2 channels)	1		2		2	
Timer RE	1		1		1	
Timer RG	1		1		1	
Watchdog timer	Selectable internal oscillator		Selectable internal oscillator		Selectable internal oscillator	
Event link controller	●		●		●	
Peripheral I/O mapping controller	●		●		●	
Serial interface	Clock synchronous/asynchronous: 3		3		3	
I <sup>2</sup> C bus	1		1		1	
SSU	1		1		1	
CAN	—		—		—	
COMS I/O	55		55		69	
Large-current drive port	47		47		53	
Pull-up resistors	55		55		69	
Interrupts (sources)	External: 7		7		9	
On-chip debug	●		●		●	
Onboard flash programming	●		●		●	
Packages	10mm x 10mm (0.5mm pitch), 14mm x 14mm (0.8mm pitch)		12mm x 12mm (0.5mm pitch), 14mm x 14mm (0.65mm pitch)		2.7V to 5.5V/4MHz to 20MHz	
Operating frequency/power supply voltage	2.7V to 5.5V/4MHz to 20MHz		2.7V to 5.5V/4MHz to 20MHz		2.7V to 5.5V/4MHz to 20MHz	
Operating temperature (°C)	-20 to 75°C, -40 to 85°C		-20 to 75°C, -40 to 85°C		-20 to 75°C, -40 to 85°C	

Pin count	80pin				64pin			
	H8/36109		H8/36049		H8/36077		H8/36079	
Group	H8/36109		H8/36049		H8/36077		H8/36079	
Product name	H8/36109F		H8/36047		H8/36077F		H8/36079F	
ROM (bytes)	128K		64K		56K		128K	
RAM (bytes)	5K		3K		4K		6K	
EEPROM (bytes)	—		—		—		—	
ROM type	F		M		F		F	
Program security	●		●		●		●	
CPU core	16-bit H8/300H CPU core		16-bit H8/300H CPU core		16-bit H8/300H CPU core		16-bit H8/300H CPU core	
Min. instruction execution time (ns)	100 (@20MHz)		100 (@20MHz)		100 (@20MHz)		100 (@20MHz)	
Clock oscillator circuits	3 circuits (system clock, subclock, on-chip oscillators)		2 circuits (system clock, subclock)		3 circuits (system clock, subclock, on-chip oscillators)		3 circuits (system clock, subclock, on-chip oscillators)	
Subclock	●		●		●		●	
On-chip oscillator	●		●		●		●	
Oscillation stop detect	●		●		●		●	
Low-power-consumption configuration	●		●		●		●	
Power-on reset	● (option)		● (option)		● (option)		● (option)	
Low voltage detect	● (option)		● (option)		● (option)		● (option)	
A/D converter	Resolution x channels: 10-bit x 16ch		10-bit x 8ch		10-bit x 8ch		10-bit x 8ch	
RTIC	1		1		1		1	
Timer A	—		—		—		—	
Timer B1	1		1		1		1	
Timer V	1		1		1		1	
Timer W	—		—		—		—	
Timer Z (16-bit, 2 channels)	—		—		—		—	
Timer RC	1		—		—		—	
Timer RD (16-bit, 2 channels)	2		—		—		—	
Sub-system timer	—		—		—		—	
14-bit PWM	1		1		1		1	
Watchdog timer	Selectable internal oscillator		Selectable internal oscillator		Selectable internal oscillator		Selectable internal oscillator	
Serial interface	Clock synchronous/asynchronous: 3		3		2		2	
I <sup>2</sup> C bus	1		1		1		1	
CAN	—		—		—		—	
Input only	8		8		8		8	
COMS I/O	79		59		47		47	
Large-current drive port	20		13		8		8	
Pull-up resistors	15		13		15		15	
Interrupts (sources)	External: 11		11		●		11	
On-chip debug	●		●		●		●	
Onboard flash programming	●		●		●		●	
Packages	14mm x 20mm (0.65mm pitch), 14mm x 14mm (0.5mm pitch)		14mm x 14mm (0.65mm pitch)		10mm x 10mm (0.5mm pitch), 14mm x 14mm (0.8mm pitch)		14mm x 14mm (0.8mm pitch)	
Operating frequency/power supply voltage	[Without POR/LVD] 4MHz to 10MHz/3.0V to 5.5V, 4MHz to 20MHz/4.5V to 5.5V [With POR/LVD] 4MHz to 16MHz/4.5V to 5.5V		1MHz to 10MHz/2.7V to 5.5V, 1MHz to 20MHz/4.0V to 5.5V		1MHz to 10MHz/2.7V to 5.5V, 3.0V to 5.5V, 1MHz to 20MHz/4.0V to 5.5V, 4.0V to 5.5V		4MHz to 20MHz/4.5V to 5.5V, 4MHz to 16MHz/3.0V to 3.6V	
Operating temperature (°C)	-20 to 75°C, -40 to 85°C		-20 to 75°C, -40 to 85°C		-20 to 75°C, -40 to 85°C		-20 to 75°C, -40 to 85°C	

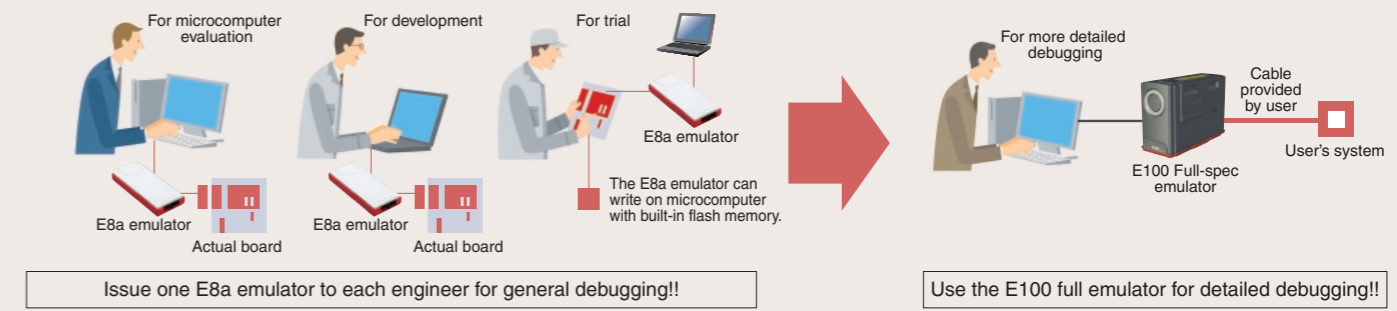
## Development Environment

### New emulator lineup

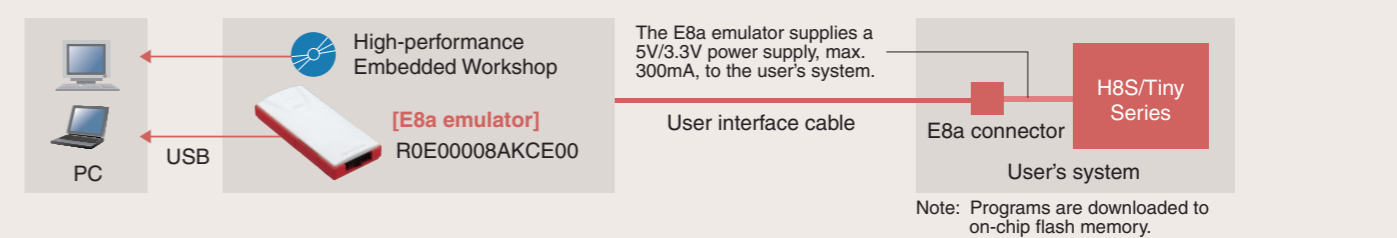


The E8a on-chip debugging emulator is compatible with all products in the H8S/Tiny Series and delivers an excellent performance-to-cost ratio. As it debugs MCUs on the actual boards, it is also optimum to evaluate the analog specific characteristics of MCUs.

The E8a emulator also can function as a flash programmer. Each engineer can be issued an E8a for general debugging tasks, while the development team use two or three E100 full emulators for more detailed debugging in the final stages.

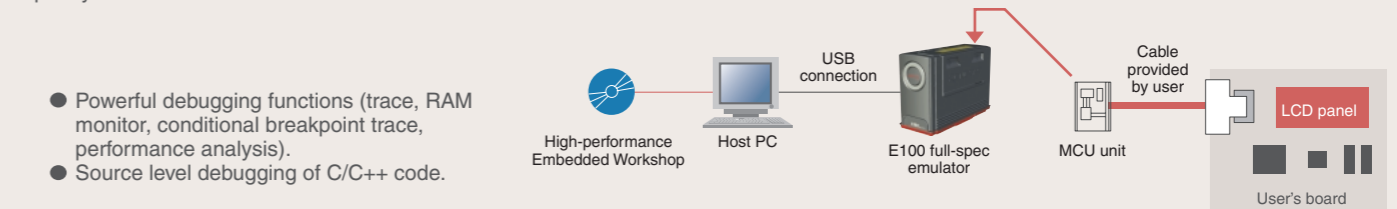


### On-chip debugging emulator



### Full-spec emulator

The E100 full emulator performs at the CPU's maximum operating frequency. When paired with the High-performance Embedded Workshop software package, it provides an easy-to-use environment for debugging programs using a few mouse clicks. The E100 can also be used to quickly download load module files.





**Renesas Technology Corp.** Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

**Notes:**

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
  - (1) artificial life support devices or systems
  - (2) surgical implantations
  - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
  - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



**RENESAS SALES OFFICES**

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

**Renesas Technology America, Inc.**

450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited**

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.  
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

**Renesas Technology (Shanghai) Co., Ltd.**

Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120  
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

**Renesas Technology Hong Kong Ltd.**

7th Fl., North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2377-3473

**Renesas Technology Taiwan Co., Ltd.**

10th Fl., No.99, Fushing North Road, Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

**Renesas Technology Singapore Pte. Ltd.**

1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

**Renesas Technology Korea Co., Ltd.**

Kukje Center Bldg, 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea  
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

**Renesas Technology Malaysia Sdn. Bhd.**

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: <603> 7955-9390, Fax: <603> 7955-9510

