To our customers,

Old Company Name in Catalogs and Other Documents

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

April 1st, 2010
Renesas Electronics Corporation

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Renesas MCUs
H8S Family H8SX Family
The H8S/H8SX Family meet our customer’s need with the “5S” concept: Speedy, Standard, Special, Select, and Safety.

**Speedy**
- Inheriting the world-renowned H8 architecture, and evolving it even further.
- This 16-bit/32-bit CISC architecture creates a new standard for MCUs.
- The Speedy CISC architecture achieves the world’s fastest access of 1 cycle.
- The H8SX achieves the high performance of 50 MHz, and the H8S achieves 35 MHz.

**Standard**
- These MCUs inherit the world Standard H8 architecture.
- The H8SX adds high-speed multiply and divide instruction, and the H8S adds multiply/multiply and accumulate instructions.
- The basic functions, such as the timer, SCI, and A/D converter units are common to both the H8S and H8SX products.

**Special**
- Users can Select a MCU optimal for their application from the extensive variations available.
- On-chip flash memory MCUs are available in every group, and diverse peripheral functions are available.

**Select**
- Renesas MCUs provide the Safety of knowing that a cumulative total of over one billion units have been shipped.
- A protection function, that prevents important programs from being read out illegally is also available.

Inheriting the world-renowned H8 architecture, and evolving it even further.
This 16-bit/32-bit CISC architecture creates a new standard for MCUs.
The Renesas MCU H8S Family and H8SX Family products are high-performance MCUs that evolve the world standard H8 CISC architecture even further.
These are becoming the de facto standard MCUs and are chosen by our customers due to their high performance and leading edge functionality, extensive product line, rich set of peripheral functions, and other features.
Renesas provides a MCU product line that responds to customer needs based on the “5S” concept: Speedy, Standard, Special, Select, and Safety.

Learn why Renesas MCUs are preferred.
The 32-bit H8SX Family features high performance provided by the CISC architecture. These MCUs take the maximum possible advantage of the merits of the CISC architecture: good code efficiency, low power, ability to make the most effective use of flash memory performance. These MCUs achieve outstanding benchmark performance in automotive, digital home electronics, PC peripherals, and other application areas.

- Internal bus width: 32 bits  • Basic instruction execution states: 1 state  • Number of instructions: 87  • Maximum operating frequency: 50 MHz

High performance

High functionality

Slimmed-down functionality

Lower pin counts

*: H8S/2600 and 2400 Series

Here is where you will find MCUs that perfectly match specific needs: the H8S/H8SX lineup.
Inheriting the respected H8 architecture and improving processing ability and speed.

High-performance CISC architecture
Based on core development focused on compatibility, the H8S Family and H8SX Family also feature upward compatibility in register layout and functionality. This makes reuse of software resources easy. Furthermore, functions that improve ease of use are added to each family.

- Firmware developed for the H8 CPU can be used on the 16-bit H8S CPU and the 32-bit H8SX CPU as well.
- The H8S inherits the whole H8S instruction set.
- The H8SX adds new instructions and new addressing modes to improve ease of use even further. Arithmetic performance is improved greatly by the provision of 32-bit multiply and divide instructions.

Assuring compatibility at the object level
Firmware developed for the H8 CPU can be used on the 16-bit H8S CPU and the 32-bit H8SX CPU as well.

- The H8S/2000-CPU (H8S/2600, H8S/2400 Series) is upward compatible with the 16-bit H8/300L-CPU (H8/300, 300L-CPU).
- Firmware for the 16-bit H8/300, 300L-CPU can be used on the 8-bit absolute address space.
- The SBR (short address base register) function makes it possible to set up a start address for an 8-bit absolute address space.

High-speed 32-bit processing for high performance
These CPUs use a 2-stage pipeline processing plus instruction FIFO structure to achieve high-speed processing at one instruction per clock cycle. Furthermore, by making the internal CPU bus 32 bits wide, the instruction fetch time is reduced significantly from earlier 16-bit MCUs.

The H8S/2000-CPU and H8SX/2000-CPU have approximately 3.5 times more instructions and 4.5 times more instructions respectively than the H8/300H-CPU and H8/300-CPU. The H8SX/1600-CPU has 50 MIPS and is ideal for embedded applications.

VBR reduces the interrupt response time significantly.
These MCUs feature a VBR (vector base register) function that can set up an arbitrary address in a vector table. By allocating the vector in RAM, even ROM-less versions can perform interrupt handling quickly.

SBR creates faster programs.
The SBR (short address base register) function makes it possible to set up a start address for an 8-bit absolute address space at an arbitrary location. Fast and efficient programs can be created by changing the start address of the 8-bit absolute address space.
A rich set of advanced functions that can completely support a wide range of applications.

EXDMAC makes high-speed data transfers possible.
These MCUs include the EXDMAC direct memory access controller that proves its worth in high-speed transfers of data between two external data busses. System performance increases significantly since data is transferred without stopping CPU operation.

New A/D conversion mode that doubles conversion speed.
Conversion speed is effectively doubled since the units can convert at the same time, making high-speed conversion possible. (Units 0 and 1 can operate independently from different external triggers.) Possible. (Units 0 and 1 can operate independently from the same external trigger (ADTRG0).) It is also possible to activate the units independently from different external triggers.

Deep software standby mode
These MCUs provide deep software standby mode, which can suppress standby mode power consumption even further. Power to unneeded modules can be cut with register settings and leakage current can be reduced greatly.

Synchronous serial communications unit that provides high-speed synchronous serial communications
These MCU provide a synchronous serial communications unit that supports both a clock synchronous communications mode and a 4-wire bus communications mode. This unit supports communications with a wide range of devices that have a clock synchronous CSI unit with CSI signal by providing clock polarity reversal. LSB/MSB first selection, conflict error detection and other functions.

HSCI2 allows selection of an optimal transfer clock.
HSCI2 (high-speed serial communications interface 2) allows the selection of an optimal SCI transfer clock without depending on the frequency of an oscillator element. It generates the optimal average transfer rate clock source required for the SCI from the MCU's internal 8-bit timer (TMR unit). This obviates the need to select an oscillator element constrained by the SCI transfer clock, and allows an oscillator element optimal for the system to be selected.

USB boot function that can write to a connected flash memory.
The MCU's internal flash memory can be written directly from a PC using the USB boot function. Since this is a direct USB connection, high-speed writing is possible. Furthermore, on-site maintenance and other operations are quite and easy since no USB/SCI converter or other external circuits are required.
3V series that features a built-in 32-bit multiplier/divider.

Extensive lineup with operating frequencies up to 50 MHz and internal flash memory capacities from 256 KB to 1024 KB.

ROMless products support onboard writing to external flash ROM.*

Built-in functions include a high-precision 16-bit 3Σ/Δ A/D converter and a high-speed 10-bit successive approximation A/D converter.

*The user must provide write and erase programs for the specifications of the flash ROM actually used.

Application Areas

PC peripherals and Da-equipment (PC, storage devices, printers, and scanners),
consumer equipment (digital home electronics), and industrial equipment
(PA equipment, POS peripherals, meters, test equipment, and games).

Features of the H8SX/1600 Series

- Flash/ROM capacities from 256/24 KB to 1024/56 KB
- Improved peripheral functions, including dual TPUPPG units, and high-speed SCI/PC bus units
- Up to three high-speed 10-bit A/D converter units support simultaneous, independent, and continuous conversion.
- Built-in high-precision 16-bit 3Σ/Δ A/D converter
- Support for a wide variety of communication formats including USB 2.0 (full speed) and I2C bus.
- Built-in EXDMAC can operate the internal and external busses independently.
- New standby mode added. Supports even finer-grained control of the power supply
- Available in a variety of miniature packages including BP-176V (13 × 13 mm)

Improved peripheral functions, including dual TPU/PPG units, and high-speed SCI/I2C bus units

Flash/ROM capacities from 256/24 KB to 1024/56 KB

- Large-capacity on-chip flash memory
- High-speed operation and low cost for multi-track recording
- High-speed refresh of flash memory using the on-chip EXDMAC
- Reduced amount of external memory

Large-capacity on-chip flash memory and reduced parts counts.

• The inclusion of a large capacity (up to 1 MB) flash memory on chip allows large application programs to be loaded onto the MCU chip itself.

•末端 conversion function
• Address/data multiplexed
• Support for a data/address multiplexed I/O interface makes direct interface with a DSP possible.

Bus controller performance improvements

- Vector table can be freely located by the user
- An 8-bit absolute address space that the user can set freely
- On-chip multiplier/divider unit for improved calculation speeds
- New instruction set additions for improved code efficiency (83% improvement over earlier CPUs)

CPU performance improvements

- Development frequency improvements to 40 MHz and higher
- New inclusion and additions for improved code efficiency (20% improvement even over earlier CPUs)
- On-chip multiplier/divider and fine-tuned calculation speeds
- An 8-bit absolute address space that the user can set freely
- Instruction latencies can be handled by the user
- Longer clock cycle memory access achieved by on-chip PMM (25 MHz)

Bus controller performance improvements

- Support for a dedicated dual-channel I/O interface enables direct interface with a DSP
- All registers and control signals have been made 32-bit wide
- Large-capacity built-in flash memory
- The inclusion of large capacity up to 1024 KB flash memory on chip allows large application programs to be loaded onto the MCU chip itself.

This means that external memory can be reduced.

 günün işlerini yapmayı başardım! 
 
Daha fazla bilgi için lütfen mutfakta kalacak. 

Bilgi ve sağlıkla başa çıkın. 

Herkesin sağlığına ve mutluluğuna dua ederiz! 

Bilgileri gözden geçirin ve bu konuda daha fazla bilgi alabilirsiniz.
5V series that features a built-in 32-bit multiplier/divider.

Lineup features operating frequencies up to 48 MHz and ASSP products for automotive applications. This is an extensive line with, in addition to a lineup of models with 256 KB to 1024 KB of on-chip flash memory, high quality grade versions for dashboard and airbag systems.

### Application Areas
- Industrial equipment (FA control), HVAC, and vending machines and automotive applications (dashboard and airbag systems).

**Features of the H8SX/1500 Series**
- Built-in PWM modules that provide 16 10-bit channels and 12 16-bit channels
- Extensive set of built-in communications functions, including synchronous serial communications unit, FC bus, and CAN bus
- Sound generator function can produce sine waves in the range 31 Hz to 20 kHz with an accuracy of within 1%
- Multi-signal pulse control can be implemented using up to two 16-bit PPG units with an accuracy of within 1%
- New standby mode added. Supports even finer-grained control of the power supply and continuous conversion.
- High-speed 10-bit A/D converter units support simultaneous, independent, and continuous conversion.

### Airbag System Structure Example

- Special features
  - LED PWM 12 outputs or Stepping Motor (2 gauges)
  - LCD controller

### Dashboard System Structure Example

- Special features
  - 16-bit external bus expansion
  - High-performance 32-bit CPU core

### Compatibility with the Voc < 3.3V H8SX/1500 Series

Even though the operating voltages differ between the H8SX/1500 Series and the H8SX/1600 Series, Renesas has emphasized pin compatibility when developing the products.

Both the H8SX/1500 group and the H8SX/1600 group and the H8SX/1700 group are pin function compatible* products.

In the future, a Renesas customer changes from a Voc = 5.0 V to a Voc = 3.3V power supply system, Renesas provides a product lineup that allows the switch to the H8SX/1600 group or H8SX/1700 group to be made with confidence.

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* The H8SX/1500 group and the H8SX/1600 group do not support external expansion. If a bus clock frequency range is 8 to 46 MHz.
H8S/2600

High-end H8S Family series that features a built-in 16-bit multiplier.
Product lineup includes wide temperature range high-reliability products (-40 to +105°C, -40 to +125°C) for automotive applications. This series features not only special communications functions (PC bus, CAN Bus, and synchronous serial communications units) but also special peripheral functions (including motor control PWM output and LCD controller units).

Application Areas
PC peripherals and IA equipment (printers), industrial equipment (FA control and inverter control), and automotive applications (dashboard, car air conditioning, gateways, EPS, ABS, and body control).

H8S/2500

Low-power 5V series that features a 32 kHz oscillator inherited from the H8S/2200 series. These MCUs include special communications functions (I2C bus, IEBus, and CAN bus) and support both 5V interface and 3V interface systems with a port pin power supply. This series can also support 5V/3V mixed systems by supplying different port pin power supply voltages.

Application Areas
Industrial equipment (FA control and inverter control) and automotive applications (car audio).
New H8S series that provides an extensive set of peripheral functions and a 16-bit multiplier.
Adopts the CPU from the H8S/2600 H8S Family high-end model for powerful arithmetic processing.
New models with built-in USB and Ethernet functions are under development.
This new series features low-voltage operation (3.3V @34 MHz) and a rich set of low-power modes.

**Application Areas**
- PC peripherals and OA equipment (POS terminals, printers, and USB equipment) and industrial equipment (card readers and wireless equipment)

**PHY LSI Connection Example**
- Connection to a physical layer LSI (PHY LSI) makes Ethernet/IEEE 802.3
- Magic packet detection and Wake-On-LAN (WOL) signal output
- Supports both 10 Mbps and 100 Mbps transfers.
- Conforms to the Ethernet/IEEE 802.3 MAC layer (Media Access Control) standards.

**H8S Family standard series that provides optimal support for a wide range of application areas.**
This general-purpose series features the world’s highest level of 16-bit CPU performance (H8S/2378 group: 28.6 ns at 35 MHz),
the smallest package in the H8S Family (TLP-112: 8 x 8 mm), and an extensive memory lineup, from 32 KB/2 KB to 512 KB/32 KB,
and is optimal for a wide range of application areas.

**Application Areas**
- PC peripherals and OA equipment (printers and USB terminals), industrial equipment (and readers and FA control), and consumer products (LCD TVs and electronic musical instruments).

**H8S/2400 Series Product Development Chart**
- Miniature Packages (8mm: TLP-113V / 9mm: TLP-145V)
- On-chip debugging functions
- Built-in SDRAM interface*1
- I2C bus: 2 channels
- Improved peripheral functions
- Low-voltage/high-speed operation
- 3.3V single power supply
- 35 MHz/3.3V

**H8S/2300 Series Product Development Chart**
- Improved communications functions
- Built-in CRC circuit
- Built-in multiplier
- 10bit: 16ch
  - 8bit: 6ch
- Improved communications unit: 1 channel
- SCI with FIFO:
  - 1 channel
  - (256 to 2048 byte)
- BSC
- DTC
- PLL
- A/D oscillator
- I2C bus: 6 channels
- EtherC
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- DTC
- PLL
- A/D oscillator
- I2C bus: 6 channels
- EtherC

**H8S/2472 Group Block Diagram (under development)**

**H8S/2424 Series Product Development Chart**
- Special functions
- I2C bus inclusion
- SDRAM interface
- 10bit: 16ch
  - 8bit: 6ch
- Improved communications unit: 1 channel
- SCI with FIFO:
  - 1 channel
  - (256 to 2048 byte)
- BSC
- DTC
- PLL
- A/D oscillator
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- BSC
- DTC
- PLL
- A/D oscillator
- I2C bus: 6 channels
- EtherC
H8S /2200

H8S series that aims for low power consumption by including a 32 kHz oscillator.

In addition to versions with a lowest guaranteed operating voltage of 2.2V, this series also features powerful communications functions (SCI: 4 channels, PC bus: 2 channels, IEBus, high-speed SCI, and USB 2.0). This is a microcomputer series that aims for low power consumption by providing a 32 kHz oscillator.

Application Areas: PC peripherals and OA equipment (POS terminals, printers, and USB equipment), industrial equipment (card readers and wireless equipment), and consumer products (electronic health-related product).

![H8S/2200 Series Low Power Modes](image)

![H8S/2200 Series Product Development Chart](image)

H8S /2100

16-bit MCU series that inherits the peripheral functions of the H8/300 8-bit microcomputers.

These devices maintain the same pin arrangements as the H8/300 Series to allow smooth replacement and include a wide range of PC-related peripheral functions, such as PC bus, keyboard buffer controller, ISA bus, and LPC units. This series also features an extensive set of memory options (ROM: 32 KB to 1 MB, RAM: 2 KB to 40 KB).

Application Areas: PC peripherals and OA equipment (POS terminals, keyboard controllers, and battery control) and industrial equipment (card readers and meters).

![H8S/2100 Series Product Development Chart](image)
### Function Overview

#### H8S Family

<table>
<thead>
<tr>
<th>Series</th>
<th>Group</th>
<th>Internal memory</th>
<th>CPU</th>
<th>RAM</th>
<th>External bus expansion</th>
<th>Clock and power supply functions</th>
<th>A/D converters</th>
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1. Function that A/D converts two or more analog values at the same time.
2. EXDMAC: Present in the H8SX/1668R and H8SX/1648R.
3. The H8SX/1622 has a 16-bit A/D converter.

#### H8S Super Low Power

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H8S Family and H8SX Family Selection by ROM/RAM  
Capacity

| ROM/RAM | IA | IB | IC | ID | LE | LC | LB | LA | K | J | I | H | G | F | E | D | C | B | A | ROM | RAM |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 256K    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 512K    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1M      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2M      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 4M      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 8M      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 16M     |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

Note: Details of ROM/RAM capacity and other specifications are not fully visible in the provided image. For detailed information, refer to the actual document.
Powerful development environment makes it possible to take maximum advantage of the H8SX and H8S MCU performance.

**Integrated Development Environment**

**High-Performance Embedded Workshop**
This integrated development environment provides the tools needed for application development, including compilers and debuggers (emulator software) and implements the development process from coding through evaluation and verification in a single application.

- Automatic generation of startup programs for each MCU
- Integration and unified management of tools from editor through debugger
- Automatic execution of the compile, assemble, and link sequence
- Source file management in project units
- Windows based easy-to-use GUI
- Registration and startup of external tools
- Network environment project management
- Macro generation support functions: test support functions
- Latest information provided over the internet (network update function for the software tools, document update function)
- Flexible expansion functions that match the environment used (unique GUI environment construction using TCL/TK version 8.4.1, simple connection with external tools using a target server function (COM))
- Collaboration with partner vendors (Linking with CASE tools, linking with version control tools)

This integrated development environment provides the tools needed for application development, including compilers and debuggers (emulator software) and implements the development process from coding through evaluation and verification in a single application.

**Compilers**

**H8SX, H8S, and H8 Family C/C++ Compiler Package**
These compilers include an optimization function that generates compact code while eliciting the maximum possible performance from the MCU.

- Support for Intel, Sun, and H8 Family CPUs
- Support for ANSI/ISO standard C and C++
- ROM capacity is reduced and execution speed improved by the latest optimization technologies and an extensive set of optimization options
- Provision of an extensive set of embedded functions and extended functions to take advantage of the special functions provided by the MCU
- Simulator/debugger for efficient debugging of programs created in either C/C++ or assembler

**Real-Time OS**

The OS allows large-scale complex applications to be implemented simply and with real-time control. It also reduces program development times and promotes reusability and maintainability.

- Conforms to the ITRON 4.0 standard*
- Executes on Intel's x86 processor
- OS that runs in the background without interrupting other processes
- A run-time library is provided
- A standard set of OS debugging functions provided by embedding the Renesas debugger.

**E10A-USB**

**H8S/H8SX Family E10A-USB Emulator**
Ease of use is improved significantly by adopting USB (full speed) as the PC interface.

- The hardware is common, and can support multiple debugging platforms.
- The High-performance Embedded Workshop is adopted as the emulator/debugger, and program construction, building, and debugging are supported in a single window.

- OCD simulator with superb cost-performance characteristics
- Adherence to the ITRON standard for the PC interface

**E6000/E6000H**

**H8S/H8SX Family Full-Spec Emulators: E6000/E6000H**
The E6000/E6000H full-spec emulators implement real-time emulation at the CPUs' top operating frequency. User programs can be debugged using a mouse and GUI with the High-performance Embedded Workshop. Rapid downloading of load module files is also supported.

- Powerful debugging functions (including trace, ROM monitor, conditional break and trace, and performance analysis)
- Source level debugging of C/C++ programs

*Only supports MCUs with on-chip debugging functions.
Renesas Flash Memory Programming Environment

Renesas Software and Tools
Web Page: http://www.renesas.com/tools
This page provides detailed functional overviews of the development tools, trial versions of the software, and other information. It also provides the latest information in a timely manner.

Application Notes
This link displays a page containing application examples and sample program listings.

FAQs
This link displays a page providing answers to questions about the main Renesas tool products in Q&A format.

Downloads
(Upgrades and sample programs)
This link displays a page where customers who have purchased software tools can download upgrades free of charge.

Technical Updates
This link displays a page containing important usage information on Renesas MCUs and tools.

Tool News
This link displays the latest information on Renesas tools, updated twice a month.

Evaluation Software
Evaluation versions of software are provided free of charge to enable customers to assess product functions and performance.

Product Information
These links display pages containing datasheets providing overviews, features, and functions of the main Renesas tool products.

Accessory Information
This link displays a page with information such as patterns for connecting emulators and user systems and details of accessories used to make connections.

Onboard Programmers
If a PROM programmer is used, the appropriate socket adapter must be purchased separately for each MCU used. See the "Renesas Development Environment Products List (Renesas and partner vendor products)", which is a separate document, for details.

Alliance Partner Program
The Alliance program provides tools to increase the synergy between car Customers, 3rd Party Partners, and Renesas. Customers can search our online database to quickly find qualified Design Consultants, Programming Houses, 3rd Party Development Tools, and Manufacturing Companies that provide services or products that support Renesas products and solutions.
Web Site Introduction

The Renesas web site provides comprehensive support for our customers’ development efforts.

H8S Family  http://www.renesas.com/en/h8s  
H8SX Family  http://www.renesas/en/h8sx

- Display limited to related information

Documents
Manuals, datasheets, catalogs, and other documents can be downloaded in .PDF format.

Application Notes
These provide information on the use of internal peripheral functions and application technologies in .PDF format.

Frequently Asked Questions
This section presents questions and their answers in a Q&A format.

Search
Diverse search functions are provided for your use.
- Model name search: Detailed specifications can be verified for specific models.
- Function/feature search: Useful for finding products that match desired specifications.

Inquiries
Renesas accepts technical questions from this section. We also accept inquiries by email.
Email: csc@renesas.com

Series Page
This section presents outlines of the specifications of the different series and the group deployment.

Sample Page
This section presents details specifications of each group with tables of models. You can find sample programs, excellent circuit constants for reference purposes, and other information here.