

## **Renesas Technology Releases SuperH™ Family Microcontroller, the SH72544R, Featuring 200 MHz Operation and 2.5 Mbytes Large-Capacity On-Chip Flash Memory**

— Optimal for implementing high-precision power-train control, the SH72544R is based on the 400 MIPS real-time processing SH-2A CPU core and features a large-capacity on-chip flash memory —

Tokyo, July 7, 2008 - Renesas Technology Corp. today announced the SH72544R SuperH<sup>\*1</sup> Family microcontroller designed for control of automotive engine and transmission systems. This microcontroller features high-speed operation of up to 200 MHz and a high-speed, large-capacity 2.5 Mbytes on-chip flash memory. Sample shipment will begin on July 8, 2008 in Japan.

In August 2007 Renesas Technology announced the SH72546RFCC software development microcontroller as the industry's first<sup>\*2</sup> on-chip flash memory microcontroller fabricated using a 90 nm process. This device, designed for power train control, operated at 200 MHz, and featured a high-speed, large-capacity 3.75 Mbytes on-chip flash memory.

The SH72544R is the first mass-production version based on the SH72546RFCC and is fully compatible with the SH72546RFCC's functions, package, and pin assignment. This means that users can directly use the system hardware, programs, and other design assets they have developed using the SH72546RFCC. Application of such assets to this product will be quick and seamless.

Furthermore, the SH72544R operates at 200 MHz, the highest speed for on-chip flash memory microcontrollers, and can achieve operation at high-temperature environments of ambient temperatures up to 125°C, desirable for automotive applications. In addition, the 2.5 Mbytes large-capacity on-chip flash memory allows it to implement leading-edge high-precision control.

The SH72544R provides the following features.

- (1) High-performance CPU core operating at 200 MHz can implement high-level real-time control with low power consumption.

This product incorporates the same SH-2A high-performance CPU core as the SH72546RFCC, a core that adopts a superscalar design and Harvard architecture, and achieves the superb performance of 400 MIPS at 200MHz operation. This performance allows the SH72544R to implement even finer-grained high-level real-time control of engine and transmission systems. Despite providing a large-capacity on-chip flash memory made possible by fabrication in a 90 nm process, the SH72544R achieves low power consumption of less than 900mW even when operating at 200 MHz in an environmental temperature of 125°C. This allows it to be useable in the high-temperature environments required by engine and transmission systems, which means it makes system design easier.

(2) Large-capacity 2.5 Mbytes on-chip flash memory supports large-scale applications

This product features a large-capacity 2.5 Mbytes on-chip flash memory. This capacity is 2.5 times of that provided by Renesas' existing SH7058 product, which has a strong track record in engine and transmission system control, and thus can store even larger scale programs required to achieve even finer-grained high-level control.

In addition, the SH72544R also includes 128 Kbytes of flash memory with functions essentially equivalent to those of EEPROM for data storage. Using this on-chip flash memory can obviate the need for external memory and thus contribute to reduced system costs.

Generally, a flash memory has a slower maximum operating speed than a logic circuit due to its operating principle. In addition to using unique Renesas' technologies to increase the speed of the flash memory in this product, the SH72544R also features a low-power cache system to optimize the use of flash memory. In addition to minimizing increases in power consumption, these technologies achieve performance essentially equal to single-cycle access at 200 MHz.

(3) Extensive set of peripheral functions designed for engine and transmission control system

The SH72544R includes a rich set of peripheral functions. In addition to a multifunction timer (ATU-III: Advanced Timer Unit III), which is useful for both engine and transmission control, the SH72544R also features high-speed 12-bit A/D converter, CAN\*<sup>3</sup> interface, and high-speed serial interface functions. The SH72544R can thus implement high-precision real-time control in a small mounting area.

(4) Fully compatible with the SH72546RFCC

The SH72544R is fully compatible, in both functions and package, with the SH72546RFCC, which is designed for software development.

The SH72546RFCC includes a large-capacity emulation RAM\*<sup>4</sup> for efficient debugging and is possible for real time adjustment of control parameters in the application program during microcontroller operation. Therefore users can development application systems efficiently using the SH72546RFCC and then easily switch to end product for mass production by replacing it with the SH72544R.

**< Product Background >**

In recent years, emission regulations have become increasingly strict to protect the environment, which means improved fuel efficiency is strongly desired as well. As a result, even higher precision control is desired in power train control equipment used in engine, transmission control systems. Associated with this requirement, there are increasing needs for further improvements in processing performance and support for large size programs for fine-grained control, that is, larger memory capacities for the on-chip program storage.

Renesas Technology has been mass producing the SH7050 series products for the power train control market. These devices have been widely used and have earned a large share of this market. To support the increasing needs for even higher performance in the future, however, Renesas decided to deploy a line of products that are based on the SH-2A CPU core, which provides superb real-time control performance, that provide both high-speed operation and a large-capacity on-chip flash memory made possible by fabrication in a 90 nm process. Accordingly, Renesas announced the SH72546RFCC, which is designed for software development, in August 2007, and is now releasing the SH72544R as the first mass production product based on the SH72546RFCC.

**< Product Details >**

The SH72544R incorporates the high-performance SH-2A CPU core, which achieves 400 MIPS at 200 MHz and is optimal for real-time processing.

It includes a large-capacity 2.5 Mbytes on-chip flash memory and supports the increasingly large-scale programs required for fine-grained high-level control. In addition, it also includes a 128 KB EEPROM function area that allows data to be rewritten during microcontroller operation. Since this obviates the need for the external EEPROMs that were previously used, it can contribute to reduced costs in application systems.

Furthermore, the SH72544R includes a rich set of peripheral functions that are appropriate for engine control applications and are fully compatible with the SH72546RFCC peripheral functions. The ATU-III provides functions that are effective for use in both engine and transmission control. In particular, it includes 32-bit input capture/output compare, one-shot pulse output, PWM output, and other functions, and can provide up to 106 pulse outputs. The 12-bit A/D converter features 37 input channels and can rapidly convert analog data from a number of sensors. Furthermore, the SH72544R provides an extensive set of communication interfaces, including an automotive network CAN interface and high-speed serial interfaces that can connect to external devices. These peripheral functions and interfaces can reduce component costs.

The SH72544R is provided in a 272-pin P-BGA package (21 × 21 mm) and is fully pin compatible with the SH72546RFCC. The E10A-USB compact on-chip debugging emulator, which is powered from the USB bus and thus requires no external power supply, can be used as a development tool.

At the same time as providing a lineup with various package and flash memory capacity, for example a product with a modified flash memory capacity of 2 Mbytes, Renesas Technology will continue to develop products with higher operating frequencies, improved performance, and increased functionality to meet market needs.

#### < Notes >

- Notes: 1. SuperH™ is a trademark of Renesas Technology Corp.  
 2. At the time the SH72546RFCC was released: August 2007.  
 3. CAN (Controller Area Network): An automotive network specification proposed by Robert Bosch GmbH.  
 4. Emulation RAM is used for adjustments during debugging. The emulation RAM address space is set up to overlap the flash memory area so that data values can be rewritten freely even during microcontroller operation.
- \* Other product names, company names, or brands mentioned are the property of their respective owners.

#### < Typical Applications >

- Automotive systems: Control of the power train, including engine and transmission systems

#### < Prices in Japan > \*For Reference

Product Name (Product No.)	Max. Operating Frequency	Package	Sample Price [Tax Included] (Yen)
SH72544R(R5F72544RKGB)	200 MHz	272-pin P-BGA	9,800

**< Specifications >**

<b>Item</b>	<b>SH72544R Specifications</b>
Product No.	R5F72544RKBG
Power supply voltage	3.3 V/5 V (dual power supply)
Maximum operating frequency	200 MHz
Maximum processing performance	400 MIPS (at 200 MHz operation)
CPU core	SH-2A (double-precision FPU support)
Operating ambient temperature	-40 to +125°C
On-chip flash memory	2.5 Mbytes + 128 Kbytes (EEPROM function)
On-chip RAM	128 Kbytes
On-chip peripheral functions	Advanced Timer Unit III (ATU-III) A/D converter (12-bit resolution) × 37 channels Serial communications interface (SCI) × 5 channels High-speed serial communications interface (High-Speed SCI) × 3 channels Controller area network (RCAN) × 3 channels Compare match timer (CMT) × 2 channels User break controller (UBC) On-chip debugging functions <ul style="list-style-type: none"><li>• Advanced user debugger II (AUD-II)</li><li>• JTAG interface</li><li>• Direct memory access controller (DMAC) × 8 channels</li><li>• Automotive direct memory access controller (A-DMAC) × 66 channels</li></ul> Interrupt controller (INTC) Watchdog timer (WDT) Bus state controller (BSC) Multi-input signature generator (MISG) Clock oscillator (CPG): built-in multiplication PLL
Power-down modes	Sleep mode Hardware standby mode Module standby function
Package	272-pin P-BGA (21 × 21 mm)

Information contained in this news release is current as of the date of the press announcement, but may be subject to change without prior notice.