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Renesas' New Generation of R8C/Tiny Series MCUs Adds 1.8V Support and Co-processing With Background Operation to Enable Low-cost Innovative Designs

SAN JOSE, Calif. — November 6, 2007 — Renesas Technology America, Inc. today announced a new generation of R8C/Tiny series microcontrollers (MCUs) that are based on the latest process technology tailored for low-end devices. Built on a powerful 16-bit CPU core, the R8C/3x MCUs with on-chip flash have an extended operating voltage range of 1.8V to 5.5V and incorporate new and enhanced analog functions, including level-only-sensitive power-on reset circuits, digital-to-analog converters and analog comparators. In addition, their overall performance has been boosted by the addition of a data transfer controller (DTC) and a background operation (BGO) function for flash memory rewriting.

The new devices are in three product groups: the 52-pin package MCUs in the R8C/35A group, the 32-pin package chips in the R8C/33A group, and the 20-pin package devices in the R8C/32A group. All of the new MCUs maintain compatibility with existing R8C/Tiny products, allowing customers to add new features to their current products quickly, reducing time to market. Primary applications include home appliances, sensor networks, power management equipment and building automation products.

“The new devices within the R8C/Tiny series of MCUs have features that allow engineers to design smarter, lower power and more reliable systems at lower cost,” said Ritesh Tyagi, director, system LSI business unit, Renesas Technology America, Inc. “Over the last four years, our R8C/Tiny series has established itself as a high-performance solution for 8-bit applications. We are raising the bar once again by adding features — especially, a data transfer controller (DTC) for efficient data movement and a background operation (BGO) function for flash rewrite operations without CPU intervention. These specialized hardware blocks manage complex operations automatically, freeing up the CPU to execute extra functions and thereby enabling end systems that are more feature-rich and robust.”

Tyagi added, “This form of ‘co-processing’ capability is typically found only in high-end MCUs that are too expensive for cost-sensitive applications. The new R8C/Tiny series devices incorporate the enhanced features in devices as small as 20 pins with 4KB of flash memory. Customers can use them to expand features for any application without impacting cost.”

Summary of key features of new R8C/Tiny series MCUs

- **1.8V to 5.5V operation** — By supporting an extended operating voltage range, the new R8C/Tiny series MCUs give system designers more options for configuring their power supplies, potentially reducing system cost by eliminating unnecessary components. Additionally, their 1.8V operation allows the devices to serve battery-operated applications more efficiently by reducing power usage.

- **Enhanced data flash with background operation** — Data flash is a type of high-endurance on-chip flash memory intended specifically for data storage. It is available exclusively from Renesas Technology. The data flash in the new R8C/3x MCUs has a BGO function that allows the CPU to execute instructions while data is being written to or erased from the data flash. This makes program development much easier because no special consideration needs to be given to the timing of data flash write and erase operations. Additionally, the capacity of the data flash memory has been increased to a total of 4KBytes (four blocks of 1KByte each), twice that of earlier R8C/Tiny series chips, so more information can be stored.

- **Data transfer controller** — All of the new R8C/Tiny groups, even the 20-pin devices, incorporate a DTC that performs functions similar to those of a direct memory access controller. The DTC unit manages data transfers from memory to memory, or memory to peripherals, without CPU intervention. While the DTC is handling the data transfers automatically, the CPU can perform other operations, so overall system performance can increase. Moreover, the DTC is tightly coupled to the peripherals so that any hardware interrupt event can trigger the DTC to move data from one location to another in memory automatically for fast response. This capability is useful in many situations. For example, a frequent operation in embedded systems is a transfer of consecutive analog-to-digital (A/D) conversion results to RAM. When the DTC is used to move data from the A/D to RAM, it eliminates interrupt processing through the CPU, reducing this operation's execution time significantly.

Highly accurate high-speed on-chip oscillator — The new R8C/Tiny series devices provide a high-speed on-chip oscillator that provides precise clock signals at 40MHz, 36.864MHz, or 32MHz. Frequency accuracy ranks in the industry's top class, with variation limited to $\pm 1\%$ in a temperature range of -20 to 85°C and over the full power supply range of 1.8V to 5.5V. This high-speed internal clock makes it possible to eliminate the use of an external resonator, reducing system overall costs. The oscillator's output can be fed directly to drive 16-bit timer units, enabling the implementation of high-speed PWM (pulse width modulation) control.

- **Extensive analog functions** — R8C/3x devices have more on-chip peripherals than previous models in the R8C/Tiny series, for higher levels of integration and functionality. Among the new functions available in all devices are multiple analog comparator circuits, a power-on reset controller that supports slow-rising power supplies, and an A/D unit with multiple conversion-result registers. Moreover, the members of the 32-pin R8C/33A group and 52-pin R8C/35A group also include a digital-to-analog converter (DAC). The analog features of R8C/Tiny MCUs make the devices good choices for sensor applications.

Hardware/software tools

Renesas offers comprehensive system development support for the R8C/Tiny series MCUs. The E8a universal low-cost on-chip debugging emulator aids system development and can also be used as in-system flash memory programmer. The Renesas High-performance Embedded Workshop (HEW) integrated development and debugging environment includes a complete C/C++ compiler toolchain. (A version of HEW that can generate up to 64KB of application code is available at no charge.) Also, the E100 emulator is in development. This powerful in-circuit emulator will have extensive debugging capabilities and will provide a unified emulation platform for all Renesas MCUs. Its advanced features, such as drag-and-drop setting of complex hardware event points and instant filtering of trace data, will be operated via powerful, yet user-friendly graphical debugging interfaces.

Price and Availability

Product Name		Flash Memory/RAM	Package (Size)	Price/Availability
R8C/35A Group	R5F21354ANFP	16 KB + 4 KB/1.5 KB	52-pin LQFP (10 mm × 10 mm)	\$1.60 to 2.50/ Q1 2008
	R5F21355ANFP	24 KB + 4 KB/2 KB		
	R5F21356ANFP	32 KB + 4 KB/2.5 KB		
	R5F21354ADFP	16 KB + 4 KB/1.5 KB		
	R5F21355ADFP	24 KB + 4 KB/2 KB		
	R5F21356ADFP	32 KB + 4 KB/2.5 KB		
R8C/33A Group	R5F21331ANFP	4 KB + 4 KB/512 B	32-pin LQFP (7 mm × 7 mm)	
	R5F21332ANFP	8 KB + 4 KB/1 KB		
	R5F21334ANFP	16 KB + 4 KB/1.5 KB		
	R5F21335ANFP	24 KB + 4 KB/2 KB		
	R5F21336ANFP	32 KB + 4 KB/2.5 KB		
	R5F21331ADFP	4 KB + 4 KB/512 B		
	R5F21332ADFP	8 KB + 4 KB/1 KB		
	R5F21334ADFP	16 KB + 4 KB/1.5 KB		
	R5F21335ADFP	24 KB + 4 KB/2 KB		
	R5F21336ADFP	32 KB + 4 KB/2.5KB		
R8C/32A Group	R5F21321ANSP	4 KB + 4 KB/512 B	20-pin LSSOP (6.5 mm × 4.4 mm)	
	R5F21322ANSP	8 KB + 4 KB/1 K B		
	R5F21324ANSP	16 KB + 4 KB/1.5 KB		
	R5F21321ADSP	4 KB + 4 KB/512 B		
	R5F21322ADSP	8 KB + 4 KB/1 K B		
	R5F21324ADSP	16 KB + 4 KB/1.5 KB		

About Renesas Technology Corp.

Renesas Technology Corp. is one of the world's leading semiconductor system solutions providers for mobile, automotive and PC/AV (Audio Visual) markets and the world's No.1 supplier of microcontrollers. It is also a leading provider of LCD Driver ICs, Smart Card microcontrollers, RF-ICs, High Power Amplifiers, Mixed Signal ICs, System-on-Chip (SoC), System-in-Package (SiP) and more. Established in 2003 as a joint venture between Hitachi, Ltd. (TSE:6501, NYSE:HIT) and Mitsubishi Electric Corporation (TSE:6503), Renesas Technology achieved consolidated revenue of 953billion JPY in FY2006 (end of March 2007). Renesas Technology is based in Tokyo, Japan and has a global network of manufacturing, design and sales operations in around 20 countries with about 26,500 employees worldwide. For further information, please visit <http://www.renesas.com>

* Names of products, companies, and brands mentioned in this document are the trademarks or registered trademarks of their respective owners.

< Specifications >

(1) R8C/35A Group Specifications

Item	R8C/35A Group Specifications					
Product name	R5F21354 ANFP	R5F21355 ANFP	R5F21356 ANFP	R5F21354 ADFP	R5F21355 ADFP	R5F21356 ADFP
CPU core	16-bit CPU core: R8C CPU					
Maximum operating frequency/power supply voltage	20 MHz/3.0 to 5.5 V					
	10 MHz/2.7 to 5.5 V					
	5 MHz/2.2 to 5.5 V					
	2 MHz/1.8 to 5.5 V					
Operating temperature range	-20 to 85°C			-40 to 85°C		
Flash memory	16 KB	24 KB	32 KB	16 KB	24 KB	32 KB
Data flash	1 KB × 4 blocks					
RAM	1.5 KB	2 KB	2.5 KB	1.5 KB	2 KB	2.5 KB
On-chip peripheral functions	Multifunction timers					
	<ul style="list-style-type: none"> • 16-bit timer: 3 channels (input capture/output compare function) • 8-bit timer: 3 channels 					
	Watchdog timer: 1 channel (hardware reset supported)					
	Data transfer controller: 1 channel					
	Serial interfaces					
	<ul style="list-style-type: none"> • Clock synchronous/UART: 2 channels • Clock synchronous/UART/I²C/IE Bus*: 1 channels • I²C bus interface/synchronous serial communication unit: 1 channel 					
	LIN interface: 1 channel (using one 8-bit timer channel and one clock synchronous/UART channel)					
	10-bit A/D converter: 12 channels					
	8-bit D/A converter: 2 channels					
	General-purpose ports					
	<ul style="list-style-type: none"> • Programmable I/O ports: 47 • Input-only port: 1 					
	LED drive ports: 47					
	Pull-up resistance: Settable for all ports (except input-only port) in 4-bit units					
	Power-on reset circuit					
	Voltage detection circuits: 3 channels (selectable levels for channels 0 and 1)					
	Comparator A: Uses 2 voltage detection circuit channels					
	Comparator B: 2 channels					
Oscillation circuits	Main clock oscillation circuit (with built-in oscillation-stop detection function)					
	Subclock oscillation circuit (32 KHz)					
	High-speed on-chip oscillator					
	Low-speed on-chip oscillator					
Package	52-pin LQFP (10 mm × 10 mm, 0.65 mm pin pitch)					

* IE Bus (Inter Equipment Bus) is a trademark of NEC Electronics Corporation.

(2) R8C/33A Group Specifications

Item	R8C/33A Group Specifications					
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Product name	R5F 21331 ANFP	R5F 21332 ANFP	R5F 21334 ANFP	R5F 21335 ANFP	R5F 21336 ANFP	R5F 21331 ADFP	R5F 21332 ADFP	R5F 21334 ADFP	R5F 21335 ADFP	R5F 21336 ADFP
CPU core	16-bit CPU core: R8C CPU									
Maximum operating frequency/ power supply voltage	20 MHz/3.0 to 5.5 V 10 MHz/2.7 to 5.5 V 5 MHz/2.2 to 5.5 V 2 MHz/1.8 to 5.5 V									
Operating temperature range	-20 to 85°C					-40 to 85°C				
Flash memory	4 KB	8 KB	16 KB	24 KB	32 KB	4 KB	8 KB	16 KB	24 KB	32 KB
Data flash	1 KB × 4 blocks									
RAM	512 B	1 KB	1.5 KB	2 KB	2.5 KB	512 B	1 KB	1.5 KB	2 KB	2.5 KB
On-chip peripheral functions	<p>Multifunction timers</p> <ul style="list-style-type: none"> • 16-bit timer: 1 channels (input capture/output compare function) • 8-bit timer: 3 channels <hr/> <p>Watchdog timer: 1 channel (hardware reset supported)</p> <hr/> <p>Data transfer controller: 1 channel</p> <hr/> <p>Serial interfaces</p> <ul style="list-style-type: none"> • Clock synchronous/UART: 2 channels • Clock synchronous/UART/I²C/IE Bus: 1 channels • I²C bus interface/synchronous serial communication unit: 1 channel <hr/> <p>LIN interface: 1 channel (using one 8-bit timer channel and one clock synchronous/UART channel)</p> <hr/> <p>10-bit A/D converter: 12 channels</p> <hr/> <p>8-bit D/A converter: 2 channels</p> <hr/> <p>General-purpose ports</p> <ul style="list-style-type: none"> • Programmable I/O ports: 27 • Input-only port: 1 <hr/> <p>LED drive ports: 27</p> <hr/> <p>Pull-up resistance: Settable for all ports (except input-only port) in 4-bit units</p> <hr/> <p>Power-on reset circuit</p> <hr/> <p>Voltage detection circuits: 3 channels (selectable levels for channels 0 and 1)</p> <hr/> <p>Comparator A: Uses 2 voltage detection circuit channels</p> <hr/> <p>Comparator B: 2 channels</p>									
Oscillation circuits	<p>Main clock oscillation circuit (with built-in oscillation-stop detection function)</p> <hr/> <p>Subclock oscillation circuit (32 KHz)</p> <hr/> <p>High-speed on-chip oscillator</p> <hr/> <p>Low-speed on-chip oscillator</p>									
Package	32-pin LQFP (7 mm × 7 mm, 0.8 mm pin pitch)									

(3) R8C/32A Group Specifications

Item	R8C/32A Group Specifications					
Product name	R5F21321 ANSP	R5F21322 ANSP	R5F21324 ANSP	R5F21321 ADSP	R5F21322 ADSP	R5F21324 ADSP
CPU core	16-bit CPU core: R8C CPU					
Maximum operating frequency/power supply voltage	20 MHz/3.0 to 5.5 V					
	10 MHz/2.7 to 5.5 V					
	5 MHz/2.2 to 5.5 V					
	2 MHz/1.8 to 5.5 V					
Operating temperature range	-20 to 85°C			-40 to 85°C		
	Flash memory	4KB	8 KB	16 KB	4 KB	8 KB
Data flash	1 KB × 4 blocks					
RAM	512 B	1 KB	1.5 KB	512 B	1 KB	1.5 KB
On-chip peripheral functions	Multifunction timers					
	<ul style="list-style-type: none"> • 16-bit timer: 1 channels (input capture/output compare function) • 8-bit timer: 3 channels 					
	Watchdog timer: 1 channel (hardware reset supported)					
	Data transfer controller: 1 channel					
	Serial interfaces					
	<ul style="list-style-type: none"> • Clock synchronous/UART: 1 channels • Clock synchronous/UART/I²C/IE Bus: 1 channels • I²C bus interface/synchronous serial communication unit: 1 channel 					
	LIN interface: 1 channel (using one 8-bit timer channel and one clock synchronous/UART channel)					
	10-bit A/D converter: 4 channels					
	General-purpose ports					
	<ul style="list-style-type: none"> • Programmable I/O ports: 15 • Input-only port: 1 					
	LED drive ports: 15					
	Pull-up resistance: Settable for all ports (except input-only port) in 4-bit units					
	Power-on reset circuit					
	Voltage detection circuits: 3 channels (selectable levels for channels 0 and 1)					
	Comparator A: Uses 2 voltage detection circuit channels					
	Comparator B: 2 channels					
	Oscillation circuits	Main clock oscillation circuit (with built-in oscillation-stop detection function)				
Subclock oscillation circuit (32 KHz)						
High-speed on-chip oscillator						
Low-speed on-chip oscillator						
Package	20-pin LSSOP (6.5 mm × 4.4 mm, 0.65 mm pin pitch)					