Renesas Technology to Release R8C/33T Group of 16-Bit MCUs with On-Chip Capacitive Touch Sensor Circuit for Products Incorporating Touch Panels

— Suitable for a wide range of applications including white goods and mobile devices; on-chip touch sensor circuit contributes to compact system size, reduced power consumption, and improved noise tolerance —

Tokyo, September 17, 2009 — Renesas Technology Corp. today announced the R8C/33T Group of 16-bit MCUs that are the first from Renesas Technology to feature an on-chip sensor control unit*[1] for capacitive touch sensors, which are used in applications such as switches for white goods such as IH cooking heaters or operation keys for mobile devices such as mobile phones and portable music players. Sample shipments will begin in October 2009 in Japan.

The R8C/33T Group of MCU products is the first to combine the features of Renesas Technology's well-established R8C Family of high-performance, low-power 16-bit MCUs with an on-chip capacitive touch sensor circuit based on sophisticated touch sensor technology from OMRON Corporation. The single-chip implementation contributes to compact system size, reduced power consumption, and improved noise tolerance. It also helps to reduce system development time.

The R8C/33T Group comprises three products, each with a capacitive touch sensor having 18 channels (max. 9 × 9 = 81 channels when matrixed) and up to 32/24/16 KB of on-chip flash memory respectively.

< Product Background >

Nowadays the use of touch panels and touch keys is spreading rapidly in a wide range of product categories, including white goods, AV components, office equipment, game consoles, mobile phones, and portable music players. This trend is expected to continue in the future. At the same time, demand is growing rapidly for more compact size, lower cost, reduced power consumption, and improved performance in such products. Therefore, there is increasing demand for the single-chip implementation between a touch sensor control IC for capacitive touch sensors and an MCU for system control.

The R8C Family forms the core of the Renesas Technology lineup of MCU products, which currently have the world's top market share*[2] in the consumer field. R8C Family products have a wide selection of packages, memory configurations, and advanced on-chip peripheral functions available and are used as system control MCUs in a broad range of applications.

There is strong demand from manufacturers of such products for MCUs with an on-chip sensor control unit for capacitive touch sensors. In response, Renesas Technology is releasing the R8C/33T Group of 16-bit MCUs with an on-chip sensor control unit for capacitive touch sensors.

< Features >

The main features of the R8C/33T Group are summarized below.

(1) Support for more compact and lower cost systems

Integration of an on-chip sensor control unit for a capacitive touch sensor means that system control and touch control can both be handled by a single chip. There is no longer a need for an external touch sensor IC chip, which contributes to greater system compactness. In addition, the R8C/33T Group can connect directly to the sensor electrodes for touch sensing. This eliminates the requirement for resistors and capacitors for each electrode, reduces the total number of parts, lowers the overall system cost, improves reliability, and shortens the development time.

(2) Approximately 1/10 the power consumption of comparable Renesas Technology products for reduced system power consumption overall

The addition of a sensor control unit dramatically reduces the amount of CPU processing time needed for touch detection and cuts the system power consumption to about 1/10 of that when a comparable Renesas Technology MCU is used and touch detection is implemented in software. Also, the sensor control unit operates at a low frequency (4 MHz or 5 MHz), which also helps to reduce power consumption.

Note that during touch detection operation, other system control tasks such as LED illumination and PWM output continue as with a conventional MCU.

(3) Improved touch detection sensitivity

The sensor control unit for capacitive touch sensors employs a series capacitance division comparison system*[3] that provides very rapid and stable touch detection functionality. It also reduces electromagnetic noise emissions by eliminating the need for an external touch sensor IC chip.

< Product Details >

[About the joint development with OMRON]

Renesas Technology is jointly developing capacitance touch sensor solutions with OMRON for responding to demands from manufacturers of products incorporating touch panels and for making a full-scale entry into the touch sensor market. (For reference: on March 12, 2009 an agreement was announced between OMRON Corporation and Renesas Technology to jointly develop capacitance touch sensor solutions.)

OMRON is a world leader in touch sensor technology with its proprietary series capacitance division comparison system, which has an established track record in a broad range of markets.

Renesas and OMRON are creating a hardware version of OMRON's proven touch sensor technology in the form of a touch detection circuit device and integrating it into Renesas' R8C Family of MCU products as a single chip solution.

Fusing the MCU and analog peripheral circuit integration technology for which Renesas is famous with OMRON’s touch sensor technology results in an MCU for touch sensor applications that combines excellent performance, low power consumption, and a superior cost-performance ratio. Renesas Technology plans to follow the initial R8C/33T Group with additional MCU products in future.

[Details of theR8C/33T Group]

The new R8C/33T Group is built around the R8C CPU core and delivers excellent performance and functions along with flexibility of use. The maximum operating frequency is 20 MHz and the operating voltage covers a wide range from 1.8 V to 5.5 V. The many on-chip peripheral functions include the following:

- Power-on reset function: This function resets all the MCU's internal circuits at power-on. This increases flexibility by accommodating cases where the initial power supply voltage rise is gradual.
- Low-voltage detection function: This function issues an internal reset signal and an interrupt when the voltage drops below a designated level. The low-voltage detection function of the R8C/33T Group comprises three internal circuits which can be set, respectively, to four levels, 16 levels, and one level (external input supported), allowing for maximum flexibility.
- Data transfer controller: The R8C/33T Group features an on-chip data transfer controller of the same type that has been well received in Renesas Technology's H8S Family and H8SX Family MCUs. It enables data transfers between the on-chip memory and peripheral function registers to bypass the CPU, reducing the time required for data transfers and reducing the load on the CPU.

Though the R8C/33T Group integrates a capacitive touch sensor circuit, its package is a 32-pin LQFP measuring a compact 7 mm × 7 mm. It is available in two shipment configurations: with the flash memory blank or with the flash memory preprogrammed at the factory.

The E8a emulator, an on-chip debugger with a single-pin interface, is available as a development tool for MCU debugging. Since the connection requires only one pin, all of the MCU's I/O pins remain usable during debugging and program development efficiency is enhanced. In addition to functioning as an emulator, the E8a can also be used as a flash memory programmer.

Furthermore, by using a operation tool called a workbench with a GUI display, essential design tasks such as electrode design, sensitivity adjustment, threshold value setting, and signal monitoring can be performed easily, contributing to a reduction in design man-hours and development costs. Settings can be written to data flash*[4] to allow for fine tuning of individual models. This makes it possible for customers to incorporate highly accurate touch sensor solutions into their products.

Future product development efforts will focus on compact packages, support for multiple touch sensor inputs, lower power consumption, and increased memory size as Renesas Technology extends the R8C Family lineup to meet the requirements of an evolving market and works to supply products that contribute to enhanced functionality, lower-voltage operation, and reduced power consumption.

< Notes >

Notes: 1. Sensor control unit: The capacitive touch sensor circuit integrated into the R8C/33T.

2. Source of sales figures: 2008 WW Microcontroller for Consumer Revenue market share

   Source: Gartner, "Semiconductor Applications Worldwide Annual Market Share: Database" Gerald Van Hoy et al. 2 April 2009

3. Series capacitance division comparison system: The amount of change in the capacitance of a capacitor connected in series to the sensor electrodes is converted into a voltage, and the touch/non-touch state of the panel is determined by measuring the discharge duration. Touch sensors employing this system proposed by OMRON Corporation provide rapid response and a high level of noise tolerance. Renesas Technology and OMRON are developing the R8C/33T Group jointly.

4. Data flash: A proprietary Renesas Technology flash memory used mainly for data storage separate from flash memory normally used for software storage.

< Typical Applications >

- A wide range of fields including consumer products, electrical household appliances, industrial equipment, mobile devices, imaging equipment, and office equipment.

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

N Version (Operating Temperature Range: –20 to 85°C)

Product Name	**Product No.**	**Flash Memory/ RAM**	**Data Flash**	**Package (Size)**	**Sample Price [Tax Included] (Yen)**
R8C/33T Group	R5F21334TNFP	16 KB/1.5 KB	4 KB	32 -pin LQFP (7 mm × 7 mm, 0.80 mm pin pitch)	200 to 300
	R5F21335TNFP	24 KB/2 KB	4 KB		
	R5F21336TNFP	32 KB/2.5 KB	4 KB		

< **Specifications** >

Item	**R8C/33T Group Specifications**		
Product No. (1) 7 mm × 7 mm 32-pin LQFP (operating temperature range)	• R5F21334TNFP (-20 to +85°C) • R5F21334TDFP (-40 to +85°C)	• R5F21335TNFP (-20 to +85°C) • R5F21335TDFP (-40 to +85°C)	• R5F21336TNFP (-20 to +85°C) • R5F21336TDFP (-40 to +85°C)
CPU core	16-bit CPU core: R8C CPU		
Max. Operating frequency/power supply voltage	20 MHz/2.7 V to 5.5 V 5 MHz/1.8 V to 5.5 V		
Operating temperature range	-20 to +85°C (N version) or -40 to +85°C (D version)		
Flash memory	16 KB	24 KB	32 KB
Data flash	1 KB × 4 banks		
RAM	1.5 KB	2 KB	2.5 KB
On-chip peripheral functions	Timers • 16-bit timer: 1 channel (input capture/output compare function) • 8-bit timer: 2 channels		
	Watchdog timer: 14-bit × 1 channel (with prescaler)		
	Data transfer controller: 1 channel		
	Serial interfaces • UART (combined synchronous/asynchronous serial I/O): 2 channels • UART (combined synchronous/asynchronous serial I/O/I^2C mode/ synchronous serial communication unit (SSU) mode): 1 channel		
	LIN interface: 1 channel (using 8-bit timer and UART)		
	Programmable I/O ports • Input-only port: 1 • CMOS I/O ports: 27 (selectable pull-up resistance) • Large-current-drive ports: 27		
	Power-on reset circuit		
	Voltage detection circuits: 3 channels (voltage detection 0 and voltage detection 1 with selectable detection level)		
	Oscillator circuits • Main clock oscillator circuit (with main clock oscillation stop detection function) • High-speed on-chip oscillator • Low-speed on-chip oscillator • Power-down (low-power) modes (standard mode [high-speed clock, high-speed on-chip oscillator, low-speed on-chip oscillator], wait mode, stop mode)		
	Interrupts • Interrupt vectors: 69 • External interrupt inputs: 8 (INT × 4, key input × 4) • Interrupt priority levels: 7		
	10-bit A/D converter × 12 channels, sample-and-hold function, sweep mode		
	Sensor control unit •System channels × 3, electrostatic capacitance detection × 18		
Package	32-pin LQFP (7 mm × 7 mm, 0.80 mm pin pitch)		

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