Hitachi Releases 65 MIPS SuperH™ Microcontrollers with 256-kbyte On-Chip Single-Power-Supply Flash Memory

—On-chip SH-2 CPU core (65 MIPS at 50 MHz operating frequency) and motor control timer for single-chip implementation of high-precision motor control and highly efficient system control —

Tokyo, April 5, 2001—Hitachi, Ltd. (TSE: 6501) today announced the SH7046F and SH7047F, 32-bit single-chip RISC microcontrollers, featuring 65 MIPS processing performance and 256 kbytes of on-chip 5 V single-power-supply flash memory, for motor control devices in the white-goods, industrial, and automotive fields. Sample shipments will begin in May 2001 in Japan. Hitachi is also releasing mask ROM versions SH7148 and SH7049, with sample shipments beginning in the 4th quarter of 2001 in Japan.

These products incorporate a SuperH™ family*[1] SH-2 CPU core, and as successors to the highly acclaimed SH7040 Series for embedded applications in the consumer, OA, and industrial fields, comprise the first phase of 0.35 um products. The finer process provides faster CPU and peripheral module operation in a more compact form, making it possible to improve the performance and reduce the cost of high-precision motor control systems.

Recently, in the field of white goods such as air conditioners and washing machines, there has been a growing demand not only for lower prices through the integration of motor control and system control but also for improvement on precision of controlling motors, energy-saving design, and quieter operations. Meanwhile, in the industrial field, including AC servos and inverters of which high performance and functionality are required, and automotive applications such as airbags and ABS, there is an increasing demand for more precise motor control as a way of reducing fuel consumption and protecting the environment. The trend in microcomputers for controlling devices is shifting to 32-bit models from 8-bit and 16-bit models which is the current mainstream.

Hitachi has previously released 16-bit models H8/3032 Series and H8/3039 Series with an on-chip motor control timer (ITU*[2]) for the white goods market, which is subject to constant pressure on price-reduction. Hitachi has also released 32-bit SH7040 Series with an on-chip motor control timer (MTU*[3]) for industrial applications which demands higher functionality and performance. Now, Hitachi is releasing the F-ZTAT™*[4] version SH7046F and SH7047F with on-chip flash memory, and the mask ROM version SH7148 and SH7049, to further strengthen the company's lineup of microcontrollers for motor control.

This product series features an on-chip MTU and MMT*[5] as motor control timers, enabling single-chip control of two motors that previously required two microcontroller chips. In addition, the 65 MIPS processing performance enables high-precision motor control and highly efficient system control to be achieved with a single chip, making it possible to create smaller, lower-priced systems. The two power supply systems of previous products (5 V for the I/O ports and 3 V for the internal logic circuitry) have been replaced by a single 5 V power supply through the use of an on-chip step-down circuit, simplifying system construction. With the internal logic circuits operating on a low stepped-down voltage, both power consumption and noise have been reduced.

The SH7046F and SH7047F feature a large on-chip flash memory capacity of 256 kbytes, while the SH7148 and SH7049 have 64 and 128 kbytes, respectively, of on-chip mask ROM. These products are also equipped with a comprehensive selection of peripheral functions for application areas that demand high-precision control and integrated processing of various kinds of control. The SH7046F and SH7148, for example, has three A/D converter units, each comprising four channels, with all three units capable of operating simultaneously, making it possible to speed up the feedback control essential to high-precision motor control. Moreover, the A/D conversion speed per unit is approximately double that of the SH7040 Series. As a communication function, the SH7047F and SH7049 incorporate an HCAN2*[6], compatible with the CAN*[7] used in in-vehicle LANs and device networks. The HCAN2 enables setting of up to 32 message buffers in one channel, for fast and highly reliable communication. This series also includes a module standby function as a power-down mode that enables the clock supply to be stopped for unnecessary modules, making it possible to implement power-down operation according to the application.

As a development environment, the E8000S emulator can be used. The SH7047F also incorporates H-UDI and AUD on-chip debug functions, enabling simple emulation by using the E10A PC card emulator development tool. The packages used are an 80-pin QFP for the SH7046F and SH7148, and a 100-pin QFP for the SH7047F and SH7049.

Hitachi plans to further extend the product lineup in the future with models offering even higher speed and functionality.

Notes: 1. SuperH is a trademark of Hitachi, Ltd.

2. ITU: Integrated Timer Pulse Unit. A multifunctional timer comprising five 16-bit timer channels, and capable of processing a maximum of 12 pulse outputs or 10 pulse inputs.
3. MTU: Multifunction Timer Pulse Unit. A multifunctional timer comprising five 16-bit timer channels, with a maximum capability of 16 pulse inputs/outputs.
4. F-ZTAT (Flexible Zero Turn-Around Time) is a trademark of Hitachi, Ltd.
5. MMT: Motor Management Timer. Capable of 6-phase non-overlap-time PWM output.
6. HCAN2: Hitachi Controller Area Network. A CAN compliant with the Bosch CAN Ver. 2.0B active specification, featuring full CAN support and a 32-message buffer.
7. CAN: Controller Area Network. A network specification for use in vehicles, proposed by Robert Bosch Gmbh of Germany.

< Typical Applications >

- Automotive: Electric power-steering, airbags, ABS, EV, etc.
- White goods: Air conditioners, washing machines, refrigerators, etc.
- Industrial: AC servos, inverters, uninterruptible power supplies (UPS), FA, sequencers, measuring instruments, etc.

< Prices in Japan > (For Reference)

Product Code	**Model**	**ROM/RAM**	**Price in 10,000-unit quantities (Yen)**
SH7046F (F-ZTAT version)	HD64F7046F50	256kB/12kB	2,500
SH7047F (F-ZTAT version)	HD64F7047F50	256kB/12kB	2,650
SH7148 (mask ROM version of SH7046F)	HD6437148F50	64kB/4kB	1,100
SH7049 (mask ROM version of SH7047F)	HD6437049F50	128kB/8kB	1,200

[Supplementary Material]

< Specifications >

Item		SH7046F SH7047F Flash Memory Version (F-ZTAT™)	SH7148 SH7049 Mask ROM Version
Power supply voltage		4.0 V to 5.5 V	
Operating frequency		50MHz	
Processing speed		65MIPS/50MHz	
CPU core		SH-2 core	
CPU instructions		62 types (all 16-bit fixed-length instructions)	
DSP functions		32 bits × 32 bits → 64 bits :2 to 4 cycles	
		32 bits × 32 bits + 64 bits → 64 bits :2 to 4 cycles	
		16 bits × 16 bits → 32 bits :1 to 3 cycles	
		16 bits × 16 bits + 64 bits → 64 bits :2 to 3 cycles	
On-chip ROM	Flash memory	32-bit/1-cycle access, single-power-supply erasing/programming SH7046F, SH7047F: 256 kbytes	
	Mask ROM	32-bit/1-cycle access SH7148: 64 kbytes SH7049: 128 kbytes	
On-chip RAM		SH7046F, SH7047F: 12 kbytes SH7148: 4 kbytes SH7049: 8 kbytes	
External memory (SH7047F, SH7049)		- SRAM and ROM directly connectable by bus state controller - SRAM area (256 kbytes) × 1 - Provision for idle cycle insertion to prevent bus collisions - Data bus width: External 8 bits	
On-chip peripheral functions		Multifunction timer pulse unit (MTU)	
		Motor management timer (MMT)	
		10-bit resolution A/D converter SH7046F, SH7148: (3 units) × 4 ch SH7047F, SH7049: (2 units) × 8 ch	
		Serial communication interface (SCI) SH7046F, SH7148: × 2 ch SH7047F, SH7049: × 3 ch	
		SH7047F, SH7049: Hitachi controller area network (HCAN2)	
		Compare match timer (CMT) × 2 ch	
		Watchdog timer (WDT)	
		Interrupt controller (INTC)	
		SH7046F, SH7047F: User break controller (UBC)	
		Data transfer controller (DTC)	
		Clock pulse generator (CPG): Built-in multiplication PLL	

< **Specifications** > (cont)

Item	**SH7046F**	**SH7047F**	**SH7148**	**SH7049**
	Flash Memory Version (F-ZTAT™)		**Mask ROM Version**	
On-chip peripheral functions	SH7047F - Advanced user debugger (AUD) - Hitachi user debug interface (H-UDI)			
Power-down modes	Sleep mode			
	Software standby mode			
	Module standby mode			
	SH7047F, SH7049: Hardware standby mode			
Package	SH7046F, SH7148: 80-pin QFP (0.65 mm pitch, 14 mm × 14 mm) SH7047F, SH7049: 100-pin QFP (0.5 mm pitch, 14 mm × 14 mm)			