Hitachi Releases 65 MIPS SuperH™ Single-Chip Microcontrollers with 256-Kbyte On-Chip 3.3 V Single-Power-Supply Flash Memory

— 65 MIPS processing performance, approximately double that of previous Hitachi products, plus large-capacity on-chip flash memory suitable for controller applications in digital consumer and OA products and industrial equipment enable high-performance, low-cost end-products to be achieved —

Tokyo, December 17, 2001 — Hitachi, Ltd. (TSE: 6501) today announced the SH7144F and SH7145F F-ZTAT™ version[1] 32-bit single-chip RISC microcontrollers, featuring 65 MIPS high processing performance and 256 Kbytes of on-chip 3.3 V single-power-supply flash memory, for use in digital consumer products such as digital video cameras and video printers, OA equipment such as fax machines and color copiers, and industrial devices such as AC servos and sequencers. Hitachi is also releasing mask ROM versions SH7144 and SH7145. Sample shipments of the SH7144F and SH7145F will begin in February 2002 and Volume production of SH7144 and SH7145 will begin in 4Q 2002 in Japan.

These products incorporate a SuperH™ family[2] SH-2 CPU core, and are successors to the SH7040 Series which has won high acclaim in embedded applications in the consumer, information, OA, and industrial fields. With a finer 0.35 µm process for faster CPU and peripheral module operation, processing performance has been improved to approximately double that of previous Hitachi products. In addition, peripheral module and interface enhancements enable high system performance to be achieved together with low system cost.

The use of 32-bit microcontrollers has recently become widespread in such fields as digital consumer products, OA equipment, and industrial device, enabling higher product performance to be achieved. Hitachi has previously released the SH7034 with an SH-1 CPU core and the SH7040 Series incorporating an SH-2 as products for these markets. However, systems are constantly developing away from simple control functions toward greater functionality and higher performance, including voice and image handling capability, at the same time as prices continue to fall. Previously, voice and image data processing has been handled by dedicated chips or middleware using expensive high-performance microcomputers, presenting a problem in the attainment of lower product costs. There is thus a market need for high-performance devices offering good cost-performance that can solve this problem, as well as a strong demand for devices offering comprehensive peripheral functions that will enable fewer peripheral circuit parts to be used and product costs to be reduced. To meet this market need, Hitachi has developed the SH7144F and SH7145F 32-bit F-ZTAT microcontrollers with on-chip 3.3 V single-power-supply flash memory, offering higher performance and a lower operating voltage, as successors to the highly acclaimed SH7040 Series.

[Product features]
Major features of these products are summarized below.

(1) High processing performance of up to 65 MIPS at 3.3 V low-voltage operation
  A fine 0.35 µm process is used, and the maximum operating frequency has been increased to 50 MHz. This has made possible a processing performance of 65 MIPS, approximately double that of Hitachi's current SH7044 and SH7045. In addition, the reduction in operating voltage to 3.3 V offers lower system power consumption, while the ability to directly connect external flash memory or SRAM makes it possible to reduce the number of external parts such as buffers.

(2) 256-Kbyte on-chip single-power-supply flash memory

These products incorporate 256 Kbytes of 3.3 V single-power-supply flash memory that can be accessed in one cycle. Storing not only a system control program but also middleware for JPEG processing, speech synthesis, speech recognition processing and so forth, and executing this middleware at a high processing speed of 65 MIPS, makes it possible for these products to implement processing previously handled by a high-performance microcomputer or dedicated chip, enabling the number of parts to be cut and end-product cost to be reduced. Moreover, the flash memory allows program amendments and control data rewrites to be carried out with the chip mounted on a board, enabling system development time to be shortened and program modifications and amendments to be carried out by means of program rewrites in the market after delivery. As regards programming and erasing methods, as with current F-ZTAT microcomputers, these products support mass erasing plus a function that allows erasing only of required blocks, with memory divided into 12 large and small blocks, which is useful for such tasks as control data adjustment.

(3) Enhanced peripheral functions, and comprehensive peripheral functions for higher-performance systems.

The on-chip peripheral functions of the current SH7044 and SH7045 have been enhanced in these new models. For example, the number of serial communication interface channels has been increased to four, and connectivity to peripheral I/O modules such as sensors has been improved. In addition, an I^2C bus interface*[3] channel has been introduced, enabling easy connection to EEPROM, audio ICs, and so forth. A multifunction timer pulse unit (MTU*[4]) with a maximum output capability of 16 PWM channels is also included, enabling stepping motor control, pulse counting, and three-phase PWM output for industrial inverter control.

Although these products are single-chip microcontrollers, the external data bus can be extended to a maximum of 32 bits. Combined use of the on-chip DMA controller enables high-speed transfer of large volumes of data without imposing a load on the CPU, a feature useful for large-volume image data transfer for OA equipment such as printers and fax machines, for example. This 32-bit data bus extension function also allows fast execution of programs stored in external memory.

Other features include a reduction in the A/D converter's conversion time from 9.3 μs to 5.4 μs thanks to the faster operating frequency, and a module standby function provided as a power-down mode that enables the clock supply to be halted for unnecessary modules, allowing power consumption to be cut according to application system conditions.

Current cross-software can be used for the development environment, while on the hardware side the E8000S emulator can be used, and the inclusion of on-chip debugging functions (H-UDI and AUD*[5]) allows the use of an E10A PC card-sized emulator, enabling simple connection to a small user system board. The packages used are a 112-pin QFP for the SH7144F and SH7144 and are a 144-pin LQFP for the SH7145F and SH7145, offering pin-compatibility with the current SH7044 and SH7045, respectively.

Hitachi plans to extend the product lineup in the future with models offering higher speed and further enhanced peripheral functions.

Notes: 1 F-ZTAT (Flexible Zero Turn-Around Time) is a microcomputer with on-chip flash memory and is a trademark of Hitachi, Ltd.

2. SuperH is a trademark of Hitachi, Ltd.

3. I^2C bus: Inter-IC bus. An interface specification proposed by Philips Corporation.

4. MTU: Multifunction Timer Pulse Unit. A multifunctional timer unit comprising five 16-bit timers, with a maximum capability of 16 pulse inputs/outputs.

5. On-chip debugging functions (H-UDI: Hitachi User Debug Interface, AUD: Advanced User Debugger): Part of the debugging circuitry previously incorporated in an emulator. Providing these functions on-chip enables simple emulation to be carried out using an actual device during system evaluation.

< Typical Applications >

- Consumer products: Digital video cameras, video printers, DVD applications, etc.

- OA products: Printers, color copiers, PDPs, fax machines, etc.

- Industrial equipment: AC servos, inverters, machine tools, sequencers, etc.

< Prices in Japan > (For Reference)

Product Code		Operating Frequency	ROM/RAM	Unit Price for 10,000 Unit Lot (Yen)
SH7144F	HD64F7144F50	50 MHz	256 KB / 8KB	2,300
SH7145F	HD64F7145F50	50 MHz	256 KB / 8KB	2,400
SH7144 (mask ROM version of SH7144F)	HD6437144F50	50 MHz	256 KB / 8KB	1,550
SH7145 (mask ROM version of SH7145F)	HD6437145F50	50 MHz	256 KB / 8KB	1,600

< Specifications >

Item	SH7144F (HD64F7144)	SH7145F (HD64F7145)	SH7144 (HD6437144)	SH7145 (HD6437145)
	Flash Memory Version (F-ZTAT™)		**Mask ROM Version**	
Power supply	3.0 V to 3.6 V			
Operating frequency	50 MHz (On-chip peripheral modules are 25MHz)			
Processing speed	65 MIPS at 50 MHz operation			
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 (F-ZTAT™ version)	32-bit/1-cycle access, single-power-supply erasing/programming SH7144F, SH7145F: 256 Kbytes			
On-chip ROM — Mask ROM	32-bit/1-cycle access SH7144, SH7145: 256 Kbytes			
On-chip RAM	SH7144F, SH7145F : 8 Kbytes SH7144, SH7145 : 8 Kbytes			
External memory	SRAM and ROM directly connectable by bus state controller			
	SRAM area (4 Mbytes) × 4			
	Provision for idle cycle insertion to prevent bus collisions			
	Data bus width: SH7144F, SH7144: External 8/16 bits. SH7145F, SH7145: External 8/16/32 bits			
On-chip peripheral functions	Multifunction timer pulse unit (MTU)			
	10-bit resolution A/D converter, 4 channels × 2 units = 8 channels			
	Serial communication interface (SCI) × 4 channels (two kinds of serial communication possible: asynchronous and synchronous)			
	I^2C bus interface × 1 channel (option)			
	Compare match timer (CMT) × 2 channels			
	User break controller (UBC)			
	Advanced user debugger (AUD)			
	Hitachi user debug interface (H-UDI)			
	Direct memory access controller (DMAC) × 4 channels			
	Data transfer controller (DTC)			
	Interrupt controller (INTC)			
	Watchdog timer (WDT)			
	Clock pulse generator (CPG): Built-in multiplication PLL			
Power-down modes	Sleep mode			
	Software standby mode			
	Module standby mode			
Packages	SH7144F, SH7144: QFP112 (0.65 mm pitch, 20 mm × 20 mm)			
	SH7145F, SH7145: LQFP144 (0.5 mm pitch, 20 mm × 20 mm)			