Hitachi Releases SH7058F SuperH™ Microcontroller Featuring Industry's Fastest Operating Frequency of 80 MHz and 1-Mbyte Large-Capacity On-Chip Flash Memory In The In-Vehicle Control Equipment Field

── 80MHz high-speed operation and large-capacity on-chip flash memory enabling one-cycle access for automobile engine control and sophisticated high-performance control systems in FA and similar industrial equipment ──

Tokyo, September 24, 2002— Hitachi, Ltd. (TSE: 6501) today announced the SH7058F 32-bit single-chip RISC microcontroller, featuring the industry's fastest operating frequency of 80 MHz and the industry's largest class on-chip flash memory capacity of 1 Mbyte, for use in power-train control fields such as automobile engine control, and FA and similar industrial equipment control. Sample shipments will begin in December 2002 in Japan.

The SH7058F is a successor to the F-ZTAT^{TM}*[1] microcontroller with on-chip flash memory SH7055F, incorporating a high-performance RISC microcomputer SuperH™*[2] family SH-2 CPU core. Employing a 0.18μm process, the SH7058F the 80MHz operating frequency and the 1-Mbyte on-chip flash memory enabling one-cycle access. These are twice frequency and memory capacity of current SH7055F. The resulting high-speed operation capability and ability to store large programs for complex control makes it possible to implement sophisticated high-performance control systems requiring more precise and finely tuned control in such fields as engine control.

In such fields as automobile engine control, the kinds of control handled are becoming more and more complex, ranging from simple fuel injection control to control for improving fuel consumption, for example. And there has been a trend in recent years toward increasingly complex forms of control such as those related to environmental conservation. There is a consequent demand for the ability to implement sophisticated, high-precision, high-speed control and handle ever larger control programs, together with an urgent need for microcontrollers that make it possible to shorten system development times by enabling control programs and equipment control programs to be modified on-board.

Hitachi has previously released the SH7055F for use in such fields as engine control, featuring a SuperH family equipment-control-oriented SH-2 CPU core together with 40 MHz operation and 512-Kbyte on-chip flash memory. Now, to meet the market need for larger and faster programs, Hitachi has developed the SH7058F featuring the industry's largest class on-chip flash memory capacity of 1 Mbyte, and the industry's fastest operating speed of 80 MHz.

The SH7058F employs a 0.18μm process and incorporates the same SH-2 CPU core as its predecessor. The main features of the SH7058F are summarized below.

< Features >

1. Ability to implement sophisticated, high-precision control systems provided by 104 MIPS high processing performance resulting from a fast 80 MHz operating frequency, together with 1-Mbyte large-capacity on-chip flash memory with single-cycle access capability

At 80 MHz, the maximum operating frequency of the SH7058F is twice that of the current SH7055F, enabling a high processing performance level of 104 MIPS to be achieved. 1-Mbyte on-chip flash memory--the industry's largest class of on-chip flash memory capacity--is capable of one-cycle access operation at 80 MHz, further contributing to a higher processing speed, and an on-chip flash memory write/erase program eliminates the need for the write/erase program previously provided by the user. Flash memory modes comprise the conventional write/erase mode plus a new user boot mode. This mode allows the user to write the boot operation program following powering-on of the system, enabling the user to implement original boot operation. The high-speed operation, large-capacity flash memory, and the new mode enable high-performance, high-functionality systems to be implemented. SH7058F operation temperature is wide range of -40°C to 125°C and this enables to support the severe used environment such as placement of control equipment near to engine room.

2. System reliability improved through use of new oscillation halt detection function
    The SH7058F features a new oscillation halt detection function not provided in the SH7055F. This function can be enabled or disabled by software according to the requirements of the system. When enabled, self-oscillation is started if halt or abnormality of the LSI's oscillation is detected. For example, if oscillation stops or becomes abnormal due to detachment of a crystal oscillator, after the abnormality is detected, processing that halts the system in an orderly fashion can be executed, improving system reliability.

3. Various peripheral functions for implementation of a high-functionality system
    The SH7058F includes a comprehensive set of on-chip peripheral functions, including an Advanced Timer Unit-II (ATU-II) comprising ten free-running counters, 16 down-counters, and eight PWM (Pulse Width Modulation) counters etc., a watchdog timer channel that can be used as an interval timer, and two compare match timer channels. A 10-bit resolution A/D converter achieves a conversion precision of ±2LSB and is provided with 32 input channels, enabling processing of a large number of analog signals carrying sensor information and the like. And the addition of a multi-trigger A/D function that initiates conversion using a compare match as a trigger enables efficient acquisition of sensor information with more precise timing.

4. "CAN" in-vehicle LAN support for fast and reliable data communication
    CAN[3] (in-vehicle LAN standard) support is provided by two HCAN-II[4] channels. Each channel can use 32 message buffers (one for reception only, and 31 settable for transmission or reception) and uses an independent 16-bit timer, enabling the use of a time trigger transmission function that allows communication to be carried out at high speed and with high reliability.

The package used is a 256-pin QFP. SH7058F is upward compatible SH7055F and programs for the current SH7055F can also be used with easy changes. In addition, the SH7058F includes an on-chip debugging function and the E10A compact emulator or high-functionality E6000 emulator for on-chip debugger use can be used as a development environment, as with the SH7055F.

Hitachi plans to further extend the product lineup with higher-performance models for engine control and other in-vehicle and industrial systems.

Notes: 1. F-ZTAT (Flexible Zero Turn-Around Time) is a trademark of Hitachi, Ltd.
       2. SuperH is a trademark of Hitachi, Ltd.
       3. CAN: Controller Area Network. A network specification for use in vehicles, proposed by Robert Bosch GmbH of Germany.
       4. HCAN-II: Hitachi Controller Area Network. A CAN compliant with the Bosch CAN Ver. 2.0B active specification, featuring full CAN support and 32 message buffers.

< Typical Applications >
- In-vehicle control equipment: Engine control, AT control, suspension control
- Industrial equipment: FA, sequencers, NC

Product Code	Package	Unit Price for 1,000-Unit Lot(Yen)
SH7058F (HD64F7058F80)	256-pin QFP	6,000

< Specifications >

Item	Specifications
Power supply voltage	• 3.3 V ±0.3 V: Internal logical, bus interface • 5.0 V ±0.5 V: Peripheral I/O
Operating frequency	80 MHz
Processing speed	104 MIPS
Temperature range	-40°C to 125°C
Process	0.18-μm CMOS process
CPU core	SH-2 core
CPU instructions	79 types (all 16-bit fixed-length instructions)
Multiplier	32 bits $\times$ 32 bits -> 64 bits: 2 to 4 cycles 32 bits $\times$ 32 bits + 64 bits -> 64 bits: 2 to 4 cycles
Floating-point processor	Single-precision floating-point operations Supports subset of data types specified by IEEE standard
On-chip flash memory	1 Mbyte Flash programming modes: 4 kinds (boot mode, user program mode, user boot mode, writer mode)
On-chip RAM	48 Kbytes
External memory	SRAM and ROM directly connectable by bus state controller External address space $\times$ 4 areas: Bus width and number of wait cycles settable individually Data bus width: 8 or 16 bits Provision for idle cycle insertion to prevent bus collisions
On-chip peripheral functions	Advanced timer unit-II (ATU-II) configuration: 10 free-running counters, 16 down-counters, 8 PWM counters, 6 event counters
	Advanced pulse controller (APC): 8
	Compare match timer (CMT) $\times$ 2 channels
	A/D converter $\times$ 3, analog input $\times$ 32 channels [10-bit resolution, ±2LSB conversion precision, multi-trigger A/D (MTAD)]
	Direct memory access controller (DMAC) $\times$ 4 channels
	Serial communication interface (SCI) $\times$ 5 channels
	Hitachi Controller Area Network-II (HCAN-II) $\times$ 2 channels (Compliant with Bosch CAN Ver. 2.0B active specification: FULL CAN support, 32 message buffers)
	Watchdog timer (WDT)
	Interrupt controller (INTC): 9 external sources, 115 internal sources
	User break controller (UBC)
	User debug interface (H-UDI)
	Advanced user debugger (AUD)
	I/O ports: 149
	Clock pulse generator: Built-in multiplication ($\times$4, $\times$8) PLL Built-in crystal oscillation halt detection function
Power-down modes	3kinds: • Sleep mode • Hardware standby mode • Software standby mode Other power-down functions: Module standby function
Package	256-pin QFP (28 mm $\times$ 40 mm, 0.5 mm pitch)