

Hitachi SH7751 Gains a PCI Interface

Sega Dreamcast Chip Redesigned for Less Entertaining Embedded Applications

by Tom R. Halfhill

Hitachi's new SuperH 7751 joins the exclusive club of embedded processors that have an integrated PCI interface.

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It also runs Microsoft's Windows CE and consumes less than half a watt of power, opening up new possibilities for mobile CE-based devices that

could make use of PCI connectivity.

Announced at last month's Embedded Processor Forum by Jim Slager, director of advanced microprocessor core development at Hitachi Semiconductor, the SH7751 is a derivative of the SH7750, the CPU in Sega's Dreamcast video-game console (see MPR 12/29/97, p. 12). The SH7750 was the first chip in Hitachi's SH-4 generation and is by far the most powerful member of the SuperH family. The SH7751 is nearly identical to the SH7750 but has a few differences that make it more suitable for other embedded applications.

The PCI (version 2.1) interface is the most important difference. To make room for it without increasing the pin count, Hitachi trimmed the SH7750's 64-bit data bus down to 32 bits on the SH7751, thus freeing a 32-bit pathway for PCI,

as Figure 1 shows. The SH7751 can access four PCI devices at 33 MHz or one at 66 MHz. It supports host and slave modes and internal or external clocks. A four-channel DMA controller transfers data directly between PCI devices and main memory. The memory bus runs at 83 MHz and gluelessly supports SDRAM, DRAM, SRAM, ROM, or flash memory.

Hitachi reduced the power consumption of the SH7751 by 42% in active mode and by 85% in standby mode compared with the SH7750. To achieve this feat, the SH7751 activates its caches more efficiently, uses smaller transistors in the flip-flops and data paths, and disables the debug unit if it's never used. A process shrink to 0.18 micron helped, too. As a result, the SH7751 typically consumes only 240 mW at 133 MHz (1.5 V) and 400 mW at 167 MHz (1.8 V).

But adding PCI inflated the die size to 55 mm², even after the process shrink. By comparison, the SH7750 measures only 46 mm² in a 0.20-micron process.

Like its sister chip, the SH7751 has prodigious arithmetic capabilities—it can sustain 1.2 GFLOPS at 167 MHz. Instead of applying that math to 3D games, the SH7751

can implement six V.90 soft modems at 56 Kbits/s or handle six voice-over-IP channels simultaneously. For H.263-standard video conferencing, the SH7751 can encode 7–10 frames per second while simultaneously decoding 15 frames per second.

Hitachi plans to sample the SH7751 in July and begin production in December. Priced at \$33 at 133 MHz and \$39 at 167 MHz in 10,000-unit quantities, the SH7751 costs less than comparable embedded chips with PCI. Intel's i960VH, which recently entered production, has PCI, DRAM control, and a two-channel DMA controller; it costs \$45 in 10,000-unit quantities. At 100 MHz, however, it offers less performance (especially for floating-point tasks) than the SH7751.

A closer competitor is Motorola's 8240, which integrates a PowerPC 603e core with PCI, a DRAM controller that supports 100-MHz SDRAM, and two-channel DMA. The 8240 runs faster than the SH7751—200 or 266 MHz—but typically consumes 3 W at 200 MHz. It costs \$55 for 200 MHz or \$82 for 266 MHz, considerably more than the SH7751, and has not yet been certified to run Windows CE.

Although Hitachi designed its sister chip for video games, the SH7751 targets a wider range of embedded applications that need high performance, low power consumption, Windows CE compatibility, and PCI connectivity. □



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Hitachi's Jim Slager speaks at the Embedded Processor Forum.

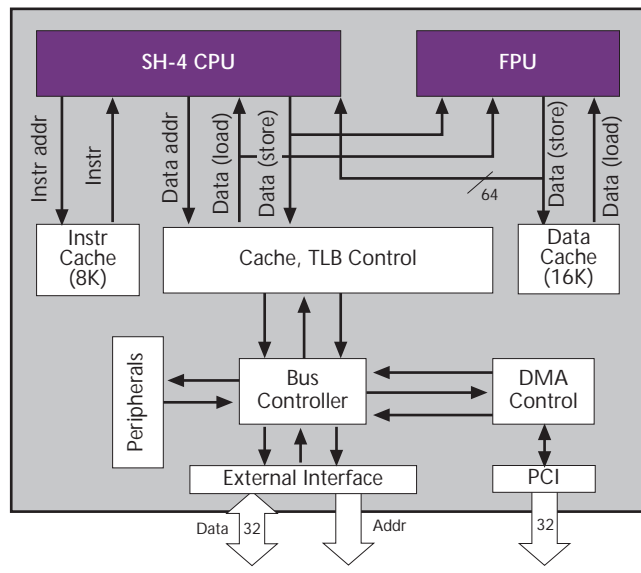


Figure 1. To make room for the PCI interface without increasing the pin count, Hitachi reduced the width of the SH7751's data bus to 32 bits, half the width of the SH7750's bus.