Intel Flexes StrongArm With New Chips

Highly Integrated SA-1110 and SA-1111 Support Synchronous Memory

by Tom R. Halfhill

Reaffirming its commitment to the StrongArm architecture cast off by Digital, Intel is introducing a new integrated microprocessor with a companion chip. The new SA-1110 and SA-1111 will strengthen StrongArm's position in the market for highly integrated power-miserly processors. Intel plans to deliver the new chips in 3Q99.

As their lookalike names imply, the SA-1110 and the SA-1111 are closely related to the existing SA-1100 (see MPR 9/15/97, p. 1) and SA-1101 (see MPR 10/26/98, p. 20), which remain in production. Like its predecessor, the SA-1110 adds a useful mix of peripherals to a modified version of the SA-1 core first announced by Digital in 1995. Likewise, the SA-1111 is a spin of the SA-1101 that offers additional peripheral functions for more elaborate embedded systems.

Faster Memory With SDRAM

The SA-1110's most significant improvement over the SA-1100 is superior memory bandwidth—its integrated memory controller adds support for SDRAM and SMROM (synchronous mask ROM). Like the SA-1100, it will also work with EDO RAM, SRAM, mask ROM, and flash. By supporting synchronous memory, the SA-1110 offers 87% more memory bandwidth than the fastest SA-1100, which accesses memory at 55 MHz while using a 4× multiplier to drive the core at 220 MHz.

For various reasons, however, Intel won't offer the new processor at 220 MHz. The only clock multipliers are 2× and 4×, so the memory bus would have to run at 110 MHz or 55 MHz. Intel thinks the faster speed would make system design too difficult and costly for most embedded applications. Instead, Intel will offer the SA-1110 at core frequencies of 206 MHz (1.75 V) and 133 MHz (1.55 V). The memory buses will run at 103 MHz and 66 MHz, respectively. Intel feels that falling SDRAM prices and the general trend away from EDO RAM will lead most customers to choose SDRAM for either bus frequency.

Another key difference between the SA-1110 and its predecessor is the addition of two more chip selects. The SA-1110 has six selects in all, including three with variable latencies. The variable-latency selects can tolerate delayed responses from other chips—such as graphics coprocessors and Ethernet controllers—that may not always respond instantly to a select signal. Intel says it's particularly useful for interfacing to ISA-type devices.

The new SA-1111 companion chip is similar to the existing SA-1101: both have shared memory control, a USB host controller, two PS/2 ports, two pulse-width-modulation outputs for LCDs, and glue for PC Card/Compact Flash slots. The new chip discards the SA-1101's CRT controller, 1284 parallel port, and keypad-matrix interface. Instead, it adds buffers for the PC Card/Compact Flash slots, an AC-Link/I^2S (Inter-IC Sound) audio interface, and a synchronous serial port (SSP).

Intel will manufacture the SA-1110 and SA-1111 in the former Digital fab at Hudson, Mass., which produces other StrongArm parts. That fab still uses Digital's 0.35-micron three-layer-metal CMOS process. The SA-1110's die measures only 75 mm^2—comparable to the SA-1100's and compact for an integrated 2.5-million-transistor chip in this process.

According to Intel, the SA-1110 should consume less than 500 mW at 206 MHz and less than 250 mW at 133 MHz. It will be available in a 256-pin mBGA, though not in the SA-1100's 208-pin TQFP, due to the extra chip-select pins.

A Price-Performance Bargain

Intel's pricing will lure customers toward the faster grade of the SA-1110. The 206-MHz chip costs only 17% more than the 133-MHz part but runs 55% faster and has 56% more memory bandwidth. Although it also consumes twice as much power, 500 mW is still a small price to pay for 206 MHz, which should yield about 230 MIPS. At 133 MHz, the SA-1110 should deliver about 150 MIPS.

Note that those estimates are based on the older processor's performance. The SA-1110 should do much better with real-world applications, because the easily cached Dhrystone 2.1 benchmark doesn't adequately measure the benefits of a faster memory bus.

Likely competitors include Hitachi's Super-H 7708, 7718, and 7750 as well as NEC's VR4121. All support SDRAM, but they lack the useful LCD controller built into the SA-1110. The less-integrated 7750 reaches 200 MHz and 360 MIPS, while the VR4121 peaks at 168 MHz and 224 MIPS. Prices and power requirements roughly track these performance numbers, so the SA-1 StrongArm line remains competitive, despite its aging processor core. M

Price & Availability

Intel says it will sample the SA-1110 in June and the SA-1111 in July. Production is slated for 3Q99. Preliminary pricing for 10,000-unit quantities of the SA-1110 is $28 at 206 MHz and $24 at 133 MHz. The SA-1111 in the same quantities will cost $15. For more information, see *http://developer.intel.com/design/strong/*.