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SandCraft: Absolutely Fabless

IP Vendor of MIPS Cores to Provide Chips in Addition to Bits

By Steve Leibson {8/28/00-03}

MIPS-compatible processor-core specialist SandCraft has done an about-face and chosen to go fabless. The company now plans to offer chips in addition to its existing line of IP core designs. As recently as 1998, SandCraft publicly stated that it did not plan to offer chips, preferring to emulate ARM and sell IP licenses only. However, time apparently has changed those plans. (And the July 11 announcement of the sale of fabless MIPS processor vendor QED to PMC-Sierra for approximately $2.3 billion in stock may have contributed to the change.)

SandCraft specializes in 64-bit, superscalar, dual-issue versions of MIPS processor cores. Among the company's designs:

- The 250MHz/500-mips 5400 (code-named Genesis), a hand-crafted processor designed for NEC and available as the VR5464 and VR5432 (see *MPR 3/9/98-01*, "NEC VR5400 Makes Media Debut")
- The 400MHz/800-mips/800-MFLOPS SR-1, developed on spec as a hard core for 0.18-micron fab processes
- The 400MHz/800-mips/1.6-GFLOPS SR1-GX, which added multimedia extensions to the SR1 in the form of DSP and SIMD instructions and a vector floating-point unit that can perform two single-precision multiply/adds per cycle (see *MPR 7/12/99-04*, "SandCraft Adds Multimedia Extensions")

The original SandCraft 5400 is a full-custom design for 0.25-micron processes. The SR1 runs on a 0.18-micron process and is also not synthesizable, but at least the designers added the ability to automate porting of the SR1 processor design to new fab processes. The SR1 also acquired critical testability features, such as BIST for the caches and full scan based on the IEEE-1149.1 JTAG specification. The SR1-GX is essentially similar to the SR1, with the substitution of the vector floating-point unit for the SR1's IEEE-754 floating-point math unit. SandCraft calls the SR1 family design its Montage architecture. Montage supports out-of-order dispatch with a peak issue rate of four integer and two floating-point instructions per clock.

Previously, SandCraft provided core designs strictly to existing MIPS licensees, including NEC, LSI Logic (the first SR1-GX customer), and an unnamed third licensee. This prudent approach evaded the unwelcome attention of the MIPS legal machine, which has been focused on unlicensed MIPS core vendor Lexra (see *MPR 12/6/99-03*, "Mips vs. Lexra: Definitely Not Aligned"). However, this approach also resulted in a situation called "double taxation" in the IP business: SandCraft licensees also had to pay for MIPS licenses. SandCraft has now acquired licenses to the MIPS32 and MIPS64 architectures from MIPS, clearing the way for SandCraft to sell silicon based on its IP to all comers and burying all the license fees in the price of the silicon.

SandCraft will now manufacture and distribute semiconductors under its own brand, contracting with wafer foundries, assembly houses, and test facilities for the actual manufacture of the chips. For now, SandCraft plans to manufacture standalone CPUs and application-specific derivatives based strictly on its 64-bit designs—even though it licensed both MIPS64 and MIPS32. Initial production will use a 0.15-micron process at an unannounced fab, with a rapid migration to 0.13-micron technology planned. SandCraft plans to announce the foundry shortly.

SandCraft's founders came from Silicon Graphics and MIPS Technologies. Several of the founders worked on the MIPS VR4300, the processor developed for the Nintendo 64 video-game console that was a spectacular success for MIPS and NEC in the mid-1990s (see *MPR 6/1/98–03*, "Mario Makes Millions for MIPS").