Klamath To Use SEC Daughtercard

After months of speculation (see **1006MSB.PDF**), Intel confirmed that the Klamath processor will be offered on a daughtercard along with the level-two cache data and tag RAM. The card will attach to the motherboard using an edge connector, eliminating the cost of a physical connector on the daughtercard. This solution allows PC makers to easily support a variety of configurations (various CPU clock speeds and cache sizes) with the same basic motherboard. Theoretically, end users could upgrade their systems in the same way, but Intel did not commit to providing such upgrade products.

Although companies such as Apple and HP already use processor daughtercards in their systems, Intel naturally believes it has invented a new packaging technology, which it dubs the SEC (single-edge contact) cartridge. The daughtercard offers essentially the same functions as the current Pentium Pro multichip module ("dual-cavity PGA" in Intel parlance) but reduces cost in several ways: substituting FR4 plastic for the MCM's ceramic substrate, substituting commodity SRAMs for a custom single-die cache, and eliminating the cost of bare-die testing. These changes are also needed to allow production volumes to reach the millions of units per quarter needed for a mainstream PC product.

The daughtercard will probably ship in a metal case that provides for thermal transfer as well as electromagnetic shielding. A heat sink can be mounted to the case, providing adequate cooling for even a 30–40-W processor/cache subsystem. Intel plans to retain a pin-compatible form factor for future P6 processors; we believe this includes Willamette (see **1015MSB.PDF**). Different form factors may be used for servers (with room for more cache) and for notebooks. Intel believes the SEC concept, in various pinouts, could last as long as ten years, taking it through the Merced generation and even beyond.

The daughtercard design allows Intel to optimize the performance of the CPU/cache interface without impacting the motherboard. Klamath will use a half-speed cache starting at 117 MHz, and we expect this speed to move up to 150 MHz by the end of 1997. These high frequencies will not appear on the motherboard, however, simplifying the PC maker's job.

Intel would not disclose whether it will offer standalone Klamath chips to vendors that might want them. We expect the vast majority of PC vendors will be satisfied with the daughtercard strategy, but a few may not want to cede to Intel the ability to buy SRAMs, determine cache configurations, and limit the mechanical design of their products.

Sources indicate that Intel will purchase the Klamath cache RAMs externally rather than fabricate them; the company has been manufacturing the L2 cache chips in its Pentium Pros. The transition to Klamath will leave Intel as by far the largest customer for cache SRAMs in the world, squeezing the profit on these parts to the bare minimum.

The new design retains the convenience of the Pentium Pro package—a single unit containing the CPU and cache—while reducing Intel's costs and improving manufacturability. The change, however, essentially obsoletes all Pentium Pro motherboards, much as the change to the 296-pin P54C package obsoleted boards designed for the original 273-pin P5 Pentium. Once PC vendors make the conversion, they will have a connector they can rely on for years—at least for Intel processors.

This connector is unlikely to be used by Intel's competitors, however. Unfortunately for them, the Klamath pinout connects to the P6 bus, which is generally believed to be legally protected by Intel. Thus, Intel's competitors could offer similarly packaged processor/cache subsystems, but they probably won't offer daughtercards that plug right into a Klamath connector. It may be possible to define a connector that accepts both Intel and non-Intel processors; if not, acceptance of non-Intel chips may be slowed. —*L.G.*

AMD Demos 200-MHz K6 and K5-PR166

At Comdex, AMD privately demonstrated a prototype K6 system running at 200 MHz. When placed next to a 200-MHz Pentium Pro, the K6 ran several Windows NT applications slightly faster. This difference supports AMD's previous claims that the K6 will be a bit faster than Pentium Pro on a cycle-for-cycle basis.

Whether AMD can match Intel's clock speeds remains to be seen. Although the demo was of a single part, the company is confident it will deliver volume quantities of K6 parts at speeds up to 200 MHz by 2Q97. At that time, however, we expect Intel will be shipping Klamath processors at 233 or perhaps 266 MHz.

AMD disclosed that the K6 die size is only 162 mm^2, a bit smaller than our previous estimate and smaller than the lower-performance K5. Both parts are built in similar processes; the K6 gains an advantage from an extra two layers of metal and a local-interconnect layer, but it clearly has a much more efficient design. More important, the K6 is only 15% larger than Intel's P55C and should be significantly smaller than Klamath, giving AMD a reasonable manufacturing cost. With a moderate die size and Fab 25's capacity, AMD will be able to flood the market with parts.

In addition to the private K6 demo, AMD provided a public "technology demonstration" of a K5 processor delivering Pentium-166-class performance. The chip breaks new ground in clock multipliers with a 116.5-MHz internal clock speed—1.75 times the 66-MHz bus clock. The odd clock multiplier allows AMD to avoid using the slower 60-MHz bus while still providing a core CPU speed that delivers performance similar to that of a 166-MHz Pentium.

The 116.5-MHz PR166 delivers performance comparable to a Pentium running at a 42% higher clock speed, while

the 100-MHz PR133 compares to a 33% faster Pentium. This improvement is due in part to enhancements made to the bus-interface logic in the PR166 version. Another factor is the K5's larger L1 instruction cache, which enables the chip to scale more readily with clock speed than does Pentium. If AMD can get sufficient yield at 133 MHz, the K5 should deliver performance comparable to that of a Pentium-200.

Samples of the K5-PR166 are promised for December, with production in 1Q97. Pricing for the new speed grade has not been announced. —*M.S.*

MMX Prevalent at Comdex

Intel has apparently shipped a significant number of P55C processors already, even though the product will not be officially launched until January. Intel's own Comdex booth was a near-generic pitch for multimedia and communication PC applications, with barely a mention of MMX—but P55C processors appeared in systems from dozens of other companies throughout the show. Presumably to minimize the potential negative effect on Christmas sales of P54C systems, Intel did not allow these companies to announce products, so they were all called "technology demonstrations."

Intel has delivered a few Klamath processors to its key OEMs but did not allow them to demonstrate Klamath systems, even under the "technology demonstration" guise. In Andy Grove's keynote speech, however, he demonstrated a system with a "P6-family processor with MMX technology" that was presumably Klamath. Intel would not disclose the clock rate but said it was greater than 200 MHz; we expect Klamath to debut at speeds up to 233 MHz. Grove's demonstration showed the system performing full-speed DVD playback entirely in software. —*M.S.*

3Dfx's Voodoo Rush Improves Integration

Also at Comdex, 3Dfx (*www.3dfx.com*) introduced a new 3D accelerator chip set for personal computers and arcade-game applications. Known as Voodoo Rush, the two-chip set is a derivative of 3Dfx's current Voodoo 3D accelerator (see **100304.PDF**). Unlike its predecessor, Voodoo Rush works with a 2D graphics controller, sharing its bus interface and frame buffer. The interface between the chips was codeveloped by 3Dfx and Alliance Semiconductor, whose ProMotion-AT3D, also announced at the show, is the first controller to support the new interface. Trident, Macronix, and Media Reality are also expected to support this interface.

The new 3Dfx chip set consists of the PCfx triangle-rendering engine, which connects to the Alliance part over the newly-defined "VR Interface," and 3Dfx's standard Texelfx texture-mapping engine, which requires its own local texture memory.

According to 3Dfx, the new chip set offers the same performance as the original Voodoo but enables lower-cost solutions. Instead of two PCI cards, Voodoo graphics can now be put on a single board with 2D support or in a daughterboard upgrade. Even so, Voodoo Rush products will still be limited to the high end of the PC 3D market; three large logic chips and two separate memory arrays are required. 3Dfx is generally considered to offer much better 3D performance and quality than its competitors, supporting its current price premium. Single-board Voodoo Rush solutions will give 3Dfx access to an even wider market.

Voodoo Rush is priced at $45 in 10,000-piece quantities. Samples are available now, with production scheduled for 1Q97. —*P.N.G.*

Digital Shows Chilled 767-MHz Alpha

Pushing clock speeds to new heights, Digital demonstrated at Comdex a prototype workstation running at 767 MHz. This particular 21164 processor, capable of 600 MHz under normal conditions, was able to achieve the higher clock rate because it was cooled to about –40° F. No commitment was made to ever introduce this technology in a product, however.

Chilled processors have been tried in the past but never made it into volume systems. Several past efforts used Peltier-effect coolers, whose thermal efficiency is poor. Digital used a cooler from KryoTech based on conventional phase-change refrigeration technology, using a compressor to liquefy a Freon-like cooling material and an expansion chamber mounted on the processor to replace the heat sink.

KryoTech *(www.kryotech.com)*, a spinoff from NCR formed in April of this year, also showed a 266-MHz Pentium Pro system using Intel's 200-MHz chips. The volume cost of the cooling system is quoted as "under $700."

On a more prosaic level, Digital showed Alpha-based PCs from Enorex *(www.enorex.com)* that achieve lower price points than ever before. Fully configured systems start at just $2,999 with a 366-MHz 21164 processor and rise to $5,599 for a 500-MHz system. Next year, the 21164PC will push these prices down even further. —*M.S.*

Chromatic Taps SGS-Thomson as Third Source

Filling out its roster, Chromatic *(www.mpact.com)* has signed SGS-Thomson as the third licensee for its Mpact media-processor family (see **101501.PDF**). Since existing agreements with partners LG Semicon and Toshiba limit Chromatic to three sources, there will be no new Mpact vendors, at least for a while. The three vendors cover Europe and Asia; Chromatic feels the lack of a U.S. partner won't hurt, because U.S. companies are used to buying foreign components and because Chromatic itself is based in the U.S. SGS presumably sees significant sales prospects for Mpact.

SGS-Thomson is also one of three sources for Cyrix's x86 processor designs, but the European vendor has had problems getting the 6x86 into production. Hopefully, the company will not have as much trouble with the smaller Mpact chips. SGS did not announce product availability, but sources indicate chips should be on the market by mid-1997. A unique possibility would be for SGS to combine the 6x86 and Mpact on a single die, but the vendor must first master the production of the individual components. —*L.G.* M