AMD Tapes Out K6

Sources indicate that AMD has taped out its K6 processor, the key to the company's return to profitability. This device is based on the Nx686 design *(see* **091401.PDF***)* but will include a Pentium pinout, MMX compatibility, and enlarged caches: 32K of instruction cache and 32K of data cache. According to our sources, the initial K6 die measures about 200 mm^2, roughly the size of the P6 CPU chip.

AMD would not confirm any details of the K6 tapeout but continues to expect K6 samples to be available in 4Q96, with production parts in 1H97. Our rule of thumb—one year from tapeout to production—puts K6 shipments into 3Q97. AMD may be able to pull this into 2Q97, however, because the K6 processor core has already been at least partially debugged (in its Nx686 incarnation), reducing the amount of work remaining before full production.

According to financial analysts, AMD's microprocessor revenues have declined by more than 70% over the past five quarters, pulling the entire company into an unprofitable position. This precipitous drop is a function of dual declines in 486 sales and prices; the weak 5K86 (K5) product line has stabilized the situation but offers little relief. If the K6 performs as promised, it should reestablish AMD as a strong x86 competitor. The wait, however, will be painful.

Microsoft Announces Pegasus as Windows CE

Microsoft's long-awaited and much-rumored operating system for portable, handheld, and consumer-electronics devices today received a name: Windows CE. The new OS, to be officially released at Fall Comdex in November, runs on at least two processor architectures, one of which is Hitachi's SuperH. The other is widely expected to be MIPS; a port to x86, the mother of all Windows, is not currently planned.

As the name implies, Windows CE (for "consumer electronics") is a subset of Windows 95/NT and implements some portion of the Win32 APIs. Depending on which APIs are included, a detail Microsoft has not disclosed publicly, applications written for Windows systems may port relatively easily to Windows CE. Apart from a general Windows-like look and feel, few features of the operating system have been revealed. It does include built-in synchronization with desktop machines running Windows and a new real-time kernel, a first for a Microsoft operating system.

Several hardware vendors have been developing handheld organizer-like devices for release in the fall. Among them will be units based on Hitachi's SH7708 processor *(see* **090302.PDF***)*. Hewlett-Packard is expected to be among the companies basing handheld devices on SuperH processors. Hitachi also worked with Microsoft to provide a version of Visual C++ for the SuperH instruction set.

Windows CE follows a number of ill-fated attempts by Microsoft to penetrate the consumer-electronics market. Notable predecessors were Microsoft at Work and WinPad, a stripped-down version of Windows 3.x that was stillborn. Windows CE more closely resembles Microsoft at Work, an embedded OS that was aimed at office automation and communications. Like At Work, Windows CE executes from ROM and is designed to be portable across architectures.

With several hardware vendors developing organizers running Windows CE, the number of electronic organizer makers could double by the end of this year. More important, Windows CE could mark the first time any single standard has prevailed over this heavily fragmented market.

Cyrix Chip Suffers on NT 4.0

Due to a hardware problem in the chip, most current Cyrix 6x86 processors do not deliver the expected level of performance on the new release of Window NT, version 4.0. During stress testing on the final version of NT 4.0, Microsoft found intermittent crashes on 6x86 systems that do not occur on Pentium (or other) processors. Working with Cyrix, Microsoft determined that the crashes disappear if the 6x86's cache is set to write-through mode instead of write-back.

As one might expect, disabling write-back mode causes a significant performance loss. The effect varies from application to application; *Byte* magazine measured the loss at 32% on SYSmark/32. This decrease would make a 6x86-P166+, for example, run NT 4.0 more like a Pentium-100.

Cyrix says it was caught by surprise, as the problem did not appear in earlier beta releases of NT 4.0. The company claims it has not yet isolated the failure to a root cause, but it has discovered that, coincidentally, changes in the most recent stepping apparently eliminate the problem. Cyrix's production is moving to the new stepping, but the company still has a large inventory of older parts that contain the flaw. Cyrix says the production version of NT 4.0 checks the stepping level of the CPU and turns off write-back mode only if it is an older 6x86 processor.

Cyrix believes the impact of the bug will be small, since it does not seem to affect other operating systems and few Cyrix processors are being used with Windows NT today. NT has been most popular in the corporate market, whereas the 6x86 has sold mainly in consumer systems preloaded with Windows 95. For 6x86 system owners who run NT 4.0, Cyrix will offer the choice of a software patch (which at this point simply reenables write-back mode, allowing users to take their chances on a crash) or a new CPU.

The news comes on the heels of other claimed problems with the 6x86. A few users have reported 6x86 systems overheating and crashing. At 22 W, the maximum power consumption of the 6x86-P200 is 20% higher than that of a Pentium-200, so if the chip is placed in a standard Pentium system with little thermal margin, it is possible for the CPU to overheat. Cyrix works with its customers to help them

implement an adequate level of cooling, however, so the overheating is probably isolated to a few poorly designed systems. System vendors working with the 6x86 should be sure to provide adequate cooling.

Cyrix also acknowledges reports that some game programs do not take advantage of the 6x86's performance as they would Pentium's. These programs do not properly interpret the CPU_ID of the 6x86; Pentium features are enabled only if the processor identifies itself as a Pentium, which the 6x86 does not do. Thus, the game runs on the 6x86 as if it were a 486. Cyrix is working with these software vendors on a case-by-case basis to help them fix their code.

None of these problems in itself seems significant. In combination, however, they indicate how hard it is for another vendor to be completely compatible with Pentium. Every minor difference can cause a problem somewhere, and other differences may pop up in the future. Although many of these problems can be chalked up to sloppy work by PC designers and software writers, the write-back cache bug shows Cyrix cannot seem to get its hands around all the required hardware-compatibility issues.

Compaq Enters Workstation Market

The workstation and PC markets continue to collide: Compaq has announced the formation of a workstation division and plans to ship its own workstations by the end of this year. These systems will use Pentium Pro processors and Windows NT 4.0 to compete with RISC-based workstations from current market leaders Sun and Hewlett-Packard. Compaq expects the new systems to sell for $7,000 to $30,000.

The company will keep costs down by leveraging as many components as possible from its high-volume PC business. To deliver workstation-class 3D graphics, however, Compaq will use acceleration hardware from Intergraph, which has its own line of Pentium Pro–based workstations. Compaq also plans to add an upgraded support package to match the extensive customer support available from traditional workstation vendors.

The combination of Pentium Pro and Intergraph's 3D hardware should allow the new systems to match up well with the low-end and midrange workstations on the market today. High-end systems from RISC vendors will offer much better floating-point performance and 3D graphics, but these systems typically have entry prices of $40,000 and up. On the other hand, the SPEC performance of an entry-level Pentium Pro will blow away any RISC workstation now selling for less than $10,000; for applications that take advantage of multiprocessing, a two-processor PPro system will compete well against even a $40,000 workstation.

One drawback is the use of Windows NT. Most workstation shops today use some variant of Unix, and NT has fewer features and fewer technical applications than most Unix systems. Microsoft continues to invest heavily in enhancing NT, however, and most major technical software is either available today or being ported to NT; Compaq's move could accelerate this trend. For many workstation users, an added lure is NT's compatibility with popular business applications.

Compaq's goal is to surpass Digital as the world's third-largest computer vendor; offering a full line of PCs, workstations, and servers is a key strategy. This move will put price pressure on the RISC workstation vendors as Compaq attempts to use its lower manufacturing costs to buy market share. Companies like Compaq and Intergraph are using Pentium Pro to blur the line between PCs and workstations. Once Intel's Merced processor appears, distinguishing the PC and workstation markets will become nearly impossible.

QED to Sell Chips

Quantum Effect Design (QED), best known for its Orion design *(see* **061507.PDF***)*, is reinventing itself as a CPU vendor, expanding its reach beyond design-for-hire services for MIPS suppliers such as NEC, IDT, and Silicon Graphics to provide its customers with development, design, and fabrication services. The QED-labeled devices will be aimed at high-end 32-bit and 64-bit embedded applications, a historical QED strength.

The company recently acquired a MIPS license, allowing it to legally produce microprocessors. It is negotiating with a number of semiconductor vendors for fab capacity, although it has not yet named a supplier. The company is proclaiming architectural independence, focusing on MIPS and "other mainstream instruction sets."

QED's strategy is to fill a perceived hole in the embedded market between traditional embedded CPUs with insufficient performance and desktop processors with excessive power consumption. The company will focus on improving its processors' system-level performance through integration rather than pushing basic processing power through exotic microarchitectural enhancements. At least at the outset, all QED chips will be customer-specific, though some standard parts may also emerge.

IMS Developing Pentium Competitor

Taking another run at the x86 market, International Meta Systems (El Segundo, Calif.) is developing a Pentium-class product it calls the IMS6000. The chip is slated to tape out next February, and the company hopes to make volume shipments by the end of 1997. IMS has released few details about the part but confirmed it will be pin-compatible with Intel's P55C and will implement all the same instructions, including the MMX extensions.

A small design house, IMS will have an unnamed outside foundry fabricate the chips. The company has staffed a new design center in Austin (Texas), near both Motorola and Texas Instruments, two large foundries with Intel patent licenses, a key legal asset for a fledgling x86 vendor.

The company's previous effort, the IMS3250 *(see* **0806MSB.PDF***)*, used a RISC-like core to emulate x86 instructions. IMS claimed 486-class performance but never

documented this performance level or compatibility. The lack of a 486 pinout sealed the product's doom. The company has adjusted its strategy and hopes the IMS6000 will do better. Even if the company can deliver in late 1997, however, it will enter a shrinking Pentium market full of aggressive competitors. IMS will need to move quickly to P6-class performance to have a good shot at profitability.

Consortium Pushes System-on-a-Chip

A newly formed group of 35 ASIC vendors, EDA tool makers, and small design firms, the Virtual Socket Interface (VSI) Alliance is dedicated to creating a standard interchange format for ASIC function blocks. VSIA hopes to increase the amount of design reuse between creators of intellectual property, such as logic-design firms, and semiconductor vendors. The initial version of the VSI specification is expected to be approved within a few weeks.

CPU core vendors MIPS Technologies and ARM are among the founding members, as are EDA tool vendors Cadence, Synopsys, ViewLogic, and Mentor. Representing foundries are Fujitsu, NEC, Toshiba, TI, Hitachi, National, and VLSI Technology. All promised to either deliver or accept functional macrocells under the VSI specification.

Although details of the specification itself are still sketchy and closely guarded, VSI is a superset of hardware-description languages such as Verilog or VHDL. VSI allows a functional block to be described at one of several levels of detail, from an abstract behavioral model to a complete CPU floor plan. Encryption features will allow licensors to distribute VSI models without divulging their internal details. VSI descriptions can be modeled, simulated, and compiled with other VSI models, enabling, the organization hopes, an open market in special-purpose function blocks.

Although VSIA's goals are laudable for their egalitarian approach to ASIC design, it is not clear how many vendors will embrace this business model. Large semiconductor vendors like Motorola and LSI Logic, for example, derive much value from their large and flexible peripheral libraries. While such companies might welcome VSI descriptions from outside, they would presumably be loath to share their own macrocells. This situation could severely limit the number and type of CPU cores available to VSI designers.

On the other hand, smaller design firms such as Virtual Chips and PrairieComm would welcome the opportunity to make their wares more accessible to a greater number of customers and semiconductor vendors. Such a universal interchange format—if VSI does, in fact, become that—would provide a huge boost for smaller companies with a few good ideas hoping to break into the booming market for application-specific devices.

Erratum: ARM First Merchant RISC

Contrary to our microprocessor history *(see* **101002.PDF***)*, the first commercially available RISC processor was the ARM1, which began shipping in 2Q85. Its initial application, however, was in an accelerator card for Acorn PCs; the MIPS R2000-based systems released in 2Q86 were the first commercial systems based on a RISC microprocessor. M