

Most Significant Bits

K5 Suffers Schedule, Performance Hits

Falling further behind in the Pentium-compatible race, AMD's K5 has suffered another six-month slip, with the company now projecting that volume production will not begin until 3Q96. This delay leaves AMD with a huge gap between the decline of the 486 market and the start of K5 shipments. The company hopes to fill this gap with two products: the X5, a 133-MHz 486 with a 16K write-back cache (see [0912MSB.PDF](#)), and the SS/5, a new product that just appeared on AMD's roadmap. These products are unlikely to be adequate, however, to keep AMD's profits from dipping in the first half of 1996.

The company describes the SS/5 as pin-compatible with Pentium and said it will provide the same performance as Pentium at the same clock rate. AMD confirmed that this chip is based on the K5 design but would not offer further details. As AMD has not had time to design a new CPU core, it seems that the SS/5 is a K5 with some of its advanced features disabled.

The lower performance may stem from one or more serious functional problems found while debugging the current K5. Instead of waiting for a new version that fixes these problems, it appears the company will instead ship the current version with the buggy features disabled. For example, the branch prediction or the out-of-order features could be disabled if they didn't work properly, perhaps reducing performance by the 25% required to put the K5 on the same footing as a Pentium-75.

The new plan also confirms that the K5 is suffering from clock-speed problems. The SS/5 will be built in a 0.35-micron CMOS process but runs at only 75 MHz; AMD had hoped to get to 100–133 MHz with that manufacturing process. The company still hopes to boost frequencies in the future. But as we have pointed out (see [0907MSB.PDF](#)), AMD took a speed risk by cramming the x86 address generation and cache access into a single clock cycle; it appears that this risk did not pay off.

Since the SS/5 will be offered only in a 75-MHz version and offers no performance advantage over a 75-MHz Pentium, AMD will be limited to the very low end of the Pentium market in 1H96. Intel's Pentium-75 price, now \$184, is likely to drop below \$140 by the time the SS/5 is in production. This is close to our estimated production cost for the K5, so profits will be hard to come by.

Samples of the SS/5 are promised for late this year, with limited production in 1Q96 and volume in 2Q96. AMD says the real K5 will follow one quarter behind. The company previously indicated that it would ship more than five million K5 processors in 1996, but it has now revised this estimate to three million "fifth-generation" devices (including the SS/5) in 1996, and five million in the first 12 months of production shipments.

AMD's troubles are great news for Cyrix, which is just about to begin production of its M1. If Cyrix is able to ramp production this year, as the company expects, this will put them about nine months ahead of AMD—a gap big enough to cause some K5 customers to switch to Cyrix. By the time AMD is in production with the 100-MHz K5, Cyrix should be ready with a 133-MHz M1, keeping it well ahead in the performance race.

P6 Becomes Pentium Pro

Protecting its investment in the Pentium brand name, Intel has officially dubbed the forthcoming P6 processor the Pentium Pro. As we pointed out when the P6 was first revealed (see [090201.PDF](#)), Intel and its OEMs have spent hundreds of millions of dollars promoting the Pentium name, and the well-known FDIV problem further increased public recognition of the name. To turn around and promote a new name just two years after the Pentium launch would be expensive, even for Intel.

Sticking with the existing name has its own challenges. PC buyers are drawn to the newest thing, so Intel must convince end users that Pentium Pro is new and different from Pentium. Look for plenty of advertising to accomplish this task. The Pro name does help aim the new processor at its initial target market: professional users of high-performance desktop systems and servers. With its performance problems on Windows 95 (see [091001.PDF](#)), Pentium Pro is not well suited to the consumer market, at least for the next year or so.

Ultimately, Intel must market the Pro to consumers for it to be successful, but this move won't occur until 1997. By that time, the Pro name should be well established, and consumers will want to move up to the new device. With much smaller advertising resources, Intel's competitors will probably stick with variations on the traditional numbering scheme.

World's Fastest Processor Accelerates

Digital Semiconductor today announced a new speed grade of its 21164 processor, setting yet another performance record. The new chip reaches a clock frequency of 330 MHz, a 10% boost over the previous version, and is estimated to deliver 400 SPECint92 and 570 SPECfp92. (The company did not provide SPEC95 performance estimates.) About half of this performance gain comes from the increased clock speed, while the rest comes from compiler enhancements.

The company also announced a faster version of its midrange 21064A chip. Previously limited to 275 MHz, the new 21064A reaches 300 MHz. Digital's performance estimates for this processor are 220 SPECint92 and 300 SPECfp92. Even this midrange chip exceeds the integer

performance of any PowerPC, MIPS, PA-RISC, or Intel processor shipping or sampling today.

The new versions use the same die as existing chips and are functionally identical. The extra speed comes from minor enhancements of Digital's 0.5-micron CMOS process. Both are currently sampling, with volume production expected by the end of this year. Digital did not release pricing for the new chips; the slower 300-MHz 21164 currently lists for a staggering \$2,936, while the old 275-MHz 21064A is just \$644.

These additions position Digital to withstand the onslaught of high-end processors slated to debut in the next six months. In particular, both the PA-8000 and the R10000 are expected to deliver well in excess of 300 SPECint92 and 500 SPECfp92 early next year. These chips could give Digital its first serious competition for the performance lead in years. The faster 21164 should still retain the title on SPECint92. But if HP meets its performance and schedule goals, the higher memory bandwidth of its PA-8000 could propel it past the 21164 on the more robust SPEC95 benchmark.

In a separate announcement, Digital's system arm rolled out a new "personal workstation" for Windows NT users. A version with a 233-MHz Alpha CPU, 512K cache, 32M of memory, 1G hard disk, Matrox video card, 4x CD-ROM, 17" color monitor, and Windows NT lists for \$6,224. Its performance is estimated at 150 SPECint92 and 180 SPECfp92, giving it slightly better price/performance than IBM's 604-based Power Personal systems and putting it well ahead of low-cost workstations from other leading vendors.

Sun Gooses UltraSparc Frequency

With yields better than expected, Sun today announced a 182-MHz (5.5-ns) version of its UltraSparc processor. This speed grade joins 143- and 167-MHz versions on the menu. At the new clock rate, UltraSparc is estimated to deliver 260 SPECint92 and 410 SPECfp92. The latter figure includes a 10% increase found during initial performance testing; this increase also applies to the slower parts. (The company did not release SPEC95 estimates.)

The new version is currently sampling, with volume shipments expected in 1Q95, one quarter later than the slower parts. The 182-MHz UltraSparc is priced at \$1,595 in quantities of 1,000. The improved yields have allowed Sun to ease the prices of the slower parts: the 167-MHz part now lists for \$1,395 while the 143-MHz version is an apparent bargain at \$995.

UltraSparc appears to be in the opposite position of its predecessor: SuperSparc had poor frequency yields and struggled to meet its target clock speed. UltraSparc has exceeded expectations and is poised to become the second of the five major next-generation RISC chips to reach the market. It offers a huge performance upgrade to the SPARC lineup, but once HP's PA-8000 and the

MIPS R10000 debut next year, SPARC could fall toward the back of the pack again.

Hal Launches First Systems

Beating Sun to the punch, Hal Computer has introduced the first SPARC workstations based on a 64-bit processor, using its internally developed Sparc64 chip (see *090301.PDF*). The clock speed, and thus the performance, is much lower than initially expected: instead of reaching speeds of 154 MHz, the fastest system currently available is 118 MHz.

Even at this clock speed, the system is rated at 212 SPECint92 and 271 SPECfp92, making it the fastest SPARC workstation shipping today. In fact, its integer performance surpasses that of any non-Alpha workstation. Systems based on the UltraSparc processor (see previous item) will probably surpass Hal's performance when they begin shipping later this quarter.

A subsidiary of Fujitsu, Hal will sell its systems as the Fujitsu HALstation 300 series. The 100-MHz Model 330 lists for \$23,010, while the faster Model 350 has a base price of \$33,055. Both prices include 2G of disk and 64M of main memory; the Model 330 includes a 17" color monitor, while the 350 comes with a 20" monitor. These prices make the systems competitive with Digital's midrange workstations, but they will probably have to fall as other vendors roll out their next-generation workstations over the next few months.

The new systems run an internally developed 64-bit version of Solaris 2.4, which Hal calls Sparc64/OS 2.4. This is the first 64-bit operating system for SPARC processors. The company claims that all existing 32-bit SPARC applications will run unmodified on the new systems, but new software can take advantage of the 64-bit capabilities of the CPU.

To take advantage of the high-reliability features of its Sparc64 processor, Hal is developing high-end commercial servers, but these systems will not ship for several months. For now, we congratulate Hal for shipping its first systems after a long development cycle. Now comes the hard part: getting a foothold in a crowded and competitive market.

NexGen Launches PCI Chip Set

Taking the first of several steps needed to bolster the company's competitive position, NexGen has announced a PCI chip set that works with its Nx586 microprocessor. Because the NexGen processor has a nonstandard bus interface, it does not work with conventional chip sets and has, until now, been supported only by a VL-Bus chip set from NexGen.

In addition to PCI support, the \$28 chip set supports EDO DRAM and a bus-master IDE interface. The four-chip design is composed of the NxMC memory controller, NxPCI system-logic chip, NxPI PCI/ISA bridge, and

Symphony's Sonata bus-master IDE controller. In addition to the chip set itself, NexGen is producing a baby-AT PCI motherboard. NexGen PCI motherboards are also available from Alaris (U.S.) and HCL Hewlett-Packard (India); NexGen expects Taiwanese vendors DataExpert and A-Trend to be in production later this quarter.

The PCI design should improve NexGen's performance, which has lagged behind Intel's, but it alone won't close the gap. NexGen rates its top-speed 93-MHz processor as a Pentium-100 equivalent, but independent published benchmarks have not supported this rating. Part of the reason is that NexGen's system design had fallen behind Intel's; the new chip set has the potential to resolve this issue. The company has not disclosed any system-level benchmarks with the new chip set.

NexGen also needs higher clock rates, however. The company has completed a shrink to IBM's 0.5-micron CMOS-5S technology, which should enable clock rates around 120 MHz by year end. A further shrink to IBM's 0.35-micron CMOS-5X process is planned for next year; this should boost clock rates to the 150-MHz range. Also missing is a floating-point unit, which NexGen plans to implement as a second chip within the 586 package. Originally promised for midyear, this device is now in beta testing, and NexGen expects it to be in production by year-end. A Comdex announcement seems likely for both the FP version and higher clock rates.

Intel Finally Ships OverDrive for 486DX2-66

The long-awaited 83-MHz P24T has finally started shipping. Formally known as the Pentium OverDrive Processor (PODP), the part is an upgrade for 486 systems with a 33-MHz bus and is the recommended upgrade for 486DX2-66 systems. Originally expected by the end of 1993, the upgrade processor was later delayed for a full year due to a major redesign to boost performance. A 63-MHz version began shipping last January (*see 090101.PDF*), but the faster part was held up by yield problems until "midyear," which turned into September.

Based on Intel's testing, the 83-MHz PODP delivers a performance gain of about 50% over a DX2-66 on typical PC applications. The increase can be much greater for programs with significant amounts of floating-point arithmetic. The PODP comes with a built-in fan (*see 081503.PDF*) to provide adequate cooling in most (but not all) 486 systems.

The PODP is sold through resellers; the suggested list price, in unit quantities, is \$299. The 63-MHz PODP is priced at \$279. Intel provides a guide to which PCs are compatible with the PODP; for more information, check the Web at www.intel.com/procs/ovrdrive.

There have been relatively few sales of OverDrive processors to date. Most PC owners decide to buy a new

system instead of a processor upgrade, as the new CPU does little to improve memory capacity, graphics performance, disk speed, or other critical system aspects.

Intel believes that end users appreciate the opportunity for a low-cost upgrade, even if few take advantage of it. Therefore, it plans to continue the OverDrive line. Pentium systems from 60 to 100 MHz will be upgradable to faster Pentium processors running at 120 to 150 MHz. These upgrade chips will run at either 2× or 2.5× the bus speed. For today's high-end systems, boasting 120- or 133-MHz Pentium CPUs, Intel promises "faster" upgrade chips. These systems may need to be upgraded with a Pentium Pro-based (P6) processor; hopefully, Intel has learned from its P24T nightmare.

Intel/UMC Legal Battle Widens

Following Intel's patent-infringement suits filed against Taiwan-based 486 microprocessor maker United Microelectronics Corp. (*see 0909MSB.PDF*), UMC has now counterattacked. UMC filed in the U.K. to invalidate the three Intel patents that Intel claims UMC's processors infringe. This could turn out to be a critical test case for these patents; despite all of Intel's litigation with AMD and Cyrix, the validity of these patents has never been challenged in court. Some of these patents are different from the U.S. patents, however, so a verdict will not necessarily set a precedent for chips sold in the U.S.

If history is a guide, Intel will seek an out-of-court settlement shortly before trial. If Intel loses a legal challenge, the patents will be lost entirely; if Intel reaches some settlement with UMC, the court documents will be sealed and the patents remain in force.

The significance of this battle goes beyond UMC's 486. A consortium led by the Taiwanese government is reportedly sponsoring the development of Pentium- and Pentium Pro-class processors; the disputed patents—and others—could be limiting factors in these plans. UMC is likely to be deeply involved in such CPU development efforts.

In another UMC-related legal action, Intel has filed a complaint with the International Trade Commission alleging that Eurone, a distributor in Los Angeles, has imported UMC's chips into the U.S. UMC is not named in the complaint, as the company has a stated policy of not distributing chips in the U.S. and the distributor is apparently acting without UMC's authorization.

Erratum: NS486 Memory Speed

Our article on National's 486 chip (*see 091201.PDF*) incorrectly characterized the processor's memory timing. On DRAM page hits, the NS486 can fetch 16-bit data from main memory in a single cycle, the same speed as an on-chip cache would provide. ♦