Most Significant Bits

Judge Ingram Blocks AMD Use of Intel Microcode
On December 2, a key Intel/AMD legal battle came to a head when Judge Ingram ruled in favor of Intel and blocked AMD's use of Intel's microcode. The ruling stems from a microcode copyright infringement case originally brought by Intel against AMD's 287, but the most recent opinion is in response to AMD's request for the judge to clarify whether the jury's verdict applied only to the 287, or also to the 486 and other microprocessors. The dispute is over whether the 1976 agreement between the two companies covers Intel's microcode copyrights, or only patents and ROM code copyrights.

In a ten-page opinion, Judge Ingram does not address the actual issues of the case; he goes no further than deciding that he has no grounds to modify or extend the jury's verdict. The jury surprised many observers when it ruled in favor of Intel last June, and AMD clearly had hoped for a more positive outcome from the judge. AMD had even sent Intel a required 30-day advance notice that it would begin shipping its 486.

AMD's 386 is not immediately affected by the decision because the arbitration ruling (which is entirely separate from this case) granted AMD a license to make 386 microprocessors, independent of any other agreements. Intel is challenging the arbitrator's right to grant such a license, however. Should Intel succeed in overturning the arbitration ruling, AMD's 386 would be in jeopardy.

AMD demonstrated its 486 chip at Comdex, using Intel's microcode, operating at 50 MHz. AMD appeared ready to begin shipping the chip quickly if Ingram ruled in its favor. Now, the chip will be delayed by about six months while AMD completes and verifies its clean-room version of the microcode. Convincing prospective OEMs that its chip is fully compatible will be considerably more difficult, but—as Cyrix has shown—not impossible.

Although AMD insists that the clean-room microcode project has been fully staffed from the earliest possible date, many observers believe that AMD de-emphasized the clean-room effort because of its confidence in getting a positive outcome in the litigation—a gamble that it now appears will cost AMD six months of 486 revenue. AMD now says that it wouldn't have shipped very many 486s in the first six months anyway, and that the ramp-up in June of the clean-room part will be faster, so the lost revenue is not so great—no more than $100 million, according to AMD. This isn't a huge part of AMD's projected $1.5 billion in 1993 revenue, but it isn't insignificant.

Keeping AMD out of the market for another six months is a windfall for Intel, which will have that much longer before it has to share the 486 market with AMD. The delay in AMD's introduction is also likely to keep Intel's 486DX pricing relatively high.

Cyrix should also benefit. Cyrix plans to begin shipping its first 486-pin-compatible processor, the 486S2/50 (with a 2K on-chip cache and no FPU), early in '93. Cyrix's follow-on, code-named M7, will add an FPU and a full 8K cache. If Cyrix gets the M7 into production before AMD's 486, it could be the first to ship a 486DX-compatible chip.

As for further legal wrangling, AMD will say only that it is reviewing its options. A prepared statement from CEO Jerry Sanders gives a hint of AMD's plans, though: "No verdict and no ruling can change the underlying truth. In 1976 I negotiated in good faith and AMD paid a substantial sum for the rights that AMD is now being denied. There is no acceptable alternative for us other than to continue to fight for justice."

Intel Demonstrates Pentium Systems
Intel did not reveal any new information about the Pentium (P5) microprocessor at Comdex, but it did demonstrate six different prototype systems: one of its own, and one each from system vendors Compaq, Dell, IBM, NCR, and NEC. No performance measurements were provided. An Intel spokesperson said that one of the systems was running at 66 MHz and the others were running at various (slower) speeds. An Intel system demonstrated in a suite was running at 64.1 MHz.

These demonstrations appear to put to rest rumors that Intel is nowhere close to its 66-MHz target clock rate, but it does confirm that getting to 66 MHz is an issue. Of course, demonstrating half a dozen systems is a far cry from full production; chip yield at 66 MHz may be very poor. Intel did reveal that it plans a 60-MHz version as well, indicating that it does expect significantly better yield below 66 MHz.

Some system makers we spoke with said that they did not expect volume production of Pentium chips until mid-year at best, suggesting a slip of another several months. Intel has admitted that the OverDrive version of the Pentium processor (code-named P24T) will not ship until early '94; Intel previously said it would ship in 1993. As for the P5 itself, however, Intel is sticking by its promise to introduce the part and begin ramping up production late in the first quarter. Even if Intel meets this schedule, however, it could be much later in the year before supplies are plentiful, especially for less-favored customers.

Erratum—P5 Not to Provide 36-Bit Addressing
We recently reported *(see **061405.PDF**)* that the P5 would support 36-bit physical addressing. Apparently, our sources were out-of-date; Intel officials tell us that this was in the early specifications but was dropped for lack of customer interest. According to Intel, Pentium is limited to 32-bit addressing.

Intel Launches "OverDrive Ready" Campaign

In an attempt to further raise the profile of its OverDrive processors and reduce confusion over which systems are upgradeable, Intel has launched a new campaign. Working in conjunction with two makers of zero-insertion-force (ZIF) sockets, Intel has developed lower-cost ZIF sockets that are made from a bright blue plastic and stamped "OverDrive Ready." System OEMs that incorporate this socket and meet certain other requirements are licensed to use the OverDrive Ready trademark. The bright blue socket makes it easy for users to spot.

To qualify to use the OverDrive Ready nomenclature, OEMs must show that their systems do not require any hardware changes or BIOS updates to accommodate an OverDrive processor, and the OverDrive socket must be accessible without disassembling the system (although having to remove add-in cards is acceptable). And there is one more requirement—the system must use an Intel microprocessor. Intel hopes that users will look for PCs with OverDrive Ready logos, giving Intel-based machines another marketing edge over the competition.

The low-cost ZIF sockets will benefit OEMs and end users, and encouraging system designers to make the socket easily accessible is also a positive step. It won't eliminate all the confusion, however. Since OverDrive processors are available in a 486DX-pin-compatible version, some system makers prefer to eliminate the second socket, since users can upgrade by removing the original processor. Even if the original processor is in a ZIF socket, such systems won't qualify for the OverDrive Ready slogan. The program also won't cover systems using processors from IBM, AMD, or Cyrix, even though some of those systems will have OverDrive-compatible sockets.

IBM Demonstrates 100-MHz "Blue Lightning"

IBM demonstrated at Comdex a new microprocessor, code-named "Blue Lightning," operating at an internal clock frequency of 100 MHz. The chip has the same CPU core and 16K cache as IBM's 486SLC2, but it has a 386DX-compatible, 32-bit bus interface (the 486SLC2 is 386SX-pin-compatible). It also differs from the 486SLC2 in that it has a clock tripler, instead of a clock doubler, allowing it to plug into a 33-MHz system design while operating internally at 100 MHz.

IBM claims that the chip is the world's fastest 486. IBM's core is roughly comparable to Intel's 486 core, although it is faster on some instructions and slower on others. IBM showed the chip only as a "technology demonstration" and did not make any promises about when it would appear in systems, however, so it is not quite fair to compare it with Intel's chips that are in full production. With twice the cache memory and a 50% higher internal clock rate, it should be comfortably faster than Intel's 486DX2-66. IBM claims that it is not merely a laboratory curiosity, however, as Intel's much touted "100-MHz" 486

described at ISSCC in early 1991 turned out to be.

This chip demonstrates IBM's continued aggressive development of its own x86-family microprocessors. While IBM is barred by its agreement with Intel from marketing the chips alone, IBM is likely to market the "Blue Lightning" chip to system OEMs as part of motherboards and CPU daughtercards.

Digital Shows Alpha PC Running Windows NT

At Comdex, Digital Equipment Corp. showed a number of desktop systems based on its 21064 (Alpha) processor, running a variety of Windows NT applications. Although DEC does not expect to announce these PCs for another six months, it was surprisingly forthcoming with details of the hardware configuration.

The system clocks the Alpha CPU at 125 MHz and has a 512K secondary cache. The secondary cache uses 15-ns SRAMs to keep the cost down, resulting in a four-cycle access time. No specific performance data is currently available. This configuration should perform at about 80% of the low-end Model 400 workstation, which runs at 133 MHz with a 512K, three-cycle secondary cache. One major difference is that the Alpha PCs use EISA as the expansion bus while the workstations use TurboChannel.

Cooling the hot Alpha chip was a major system design issue. Reducing the clock rate keeps the maximum heat dissipation to about 20 watts, but the CPU still requires a finned aluminum heat sink about 3 inches square and about 1 inch tall. The CPU is right next to the fan for maximum airflow. Immediately adjacent to the CPU is another large heat sink for the 3.3V regulator, which dissipates an additional 7 watts worst-case.

The prototypes use a number of programmable logic chips to implement the system-logic functions of a typical PC. The final product will cut costs by integrating these functions into a small number of ASICs. DEC has committed to sell these ASICs along with its processor chips, allowing other companies to clone Alpha PCs, but DEC has so far refused to release design details on these parts. Other areas of the system use standard mass-market parts: SIMMs for memory, EISA expansion cards, etc. The manufacturing cost should be competitive with Pentium-based PCs, and DEC plans to price them aggressively in a bid to establish the Alpha/Windows NT platform.

NEC Plans to Source Hobbit Processor

AT&T and NEC have signed a "memorandum of understanding" regarding alternate sourcing of the Hobbit microprocessor. While final agreements have not been signed and no details have been released, NEC is expected to begin production of Hobbit chips in 1994. NEC is also developing a Hobbit-based personal communicator. *(see 061403.PDF and 061509.PDF)* ◆