MOST SIGNIFICANT BITS

■ Intel Cancels Fall Price Cut for Pentium...

Intel has canceled its price cut previously scheduled for November 1, leaving current prices effective for a six-month period. This price strategy is very unusual for Intel, which regularly adjusts its prices to drive faster processors into the mainstream and keep pricing pressure on its competitors.

Intel said the impetus for the change came from consumer PC makers, who objected to having a price cut so close to the holiday buying season. Last year, PC vendors tried to wait until November to buy their CPUs, taking advantage of the price change but leaving too little time to get systems into the stores by Thanksgiving. In previous years, Intel had cut its prices on October 1, providing more time.

It seems unusual for a manufacturer to reject a price cut from a supplier, but the PC market is atypical. All the major manufacturers buy their parts from the same company at about the same price, so whether Intel cuts its prices or not, the relative position of these system competitors is constant. From the PC maker's viewpoint, Intel's price cuts simply allow it to offer a faster processor for the same price; the overall business model doesn't change.

Conversely, the relatively higher prices may not improve Intel's financial position. Instead of buying the same number of processors at the higher prices, PC makers will probably adjust their purchase patterns so Intel's average selling price (ASP) stays roughly the same. In fact, since Intel is offering less value to its customers, and ultimately to end users, PC sales may be reduced by this pricing action.

Any effect on the end-user market is likely to be small, however. Because the CPU is a fraction of the overall system cost, Intel's forsaking a 20% price cut means the system price will be only a few percent higher than it would have been otherwise. Few buyers will notice the difference.

If Intel slows its pace of price reductions over the long term, PCs buyers will wait longer before upgrading their systems, slowing market growth. Intel does not want to see this happen and insists the next round of price cuts, set for February 1997, will bring prices back to where they would have been. In addition, Intel plans to reduce Pentium Pro prices in the fourth quarter as scheduled, because these parts do not go into the consumer market. We expect these PPro price cuts, however, to be fairly small.

Intel can skip a price cut because of its market dominance. AMD has little to offer PC makers except at the very low end, and Intel has successfully kept Cyrix out of major accounts (see **1008ED.PDF**). Intel has not yet decided how often or when it will cut prices next year; we believe the company will return to its strategy of rapid and consistent price cuts to ensure continued growth in PC sales. With new products and manufacturing process improvements on tap for 1997, Intel will have the tools to deliver major improvements in the price/performance of its processors.

■ ...After Reducing Prices for Summer

Intel cut its prices as scheduled on July 29. The company said, due to the cancellation of the fall price cut, the latest prices were trimmed a bit from previous plans, but not significantly. The new prices (see **1010CW.PDF**) represent a fairly typical 20–25% quarterly reduction, with a few exceptions.

In the Pentium line, the 90- and 100-MHz parts are now at price parity with the 75-MHz Pentium at $106, officially making the Pentium-100 the entry point into Intel's lineup. This processor is quickly becoming standard in low-cost PCs. At $134, the Pentium-120 received the biggest decrease, 29%, positioning it to become the new low-end processor in the next round of price cuts. At the high end, the Pentium-200 price dropped 15% to $509 amid rumors of yield problems and missed deliveries. Intel reports it is meeting customer commitments for the Pentium-200.

On the mobile side, the low-voltage Pentium-120 and -133 maintain a slight price premium over the desktop parts, while the slower Pentiums carry the same price in notebook and desktop versions. The new Mobile Pentium-150 (see below) tops the scale at $341.

The price of the 180- and 200-MHz Pentium Pro/256K parts dropped by 20%. The PPro-180 is now at $482, below the price of the PPro-150, which was left unchanged. As we expected, now that yields are up on the 0.35-micron PPros, Intel is phasing out the 0.5-micron PPro-150. The price of the 512K PPros, intended mainly for servers, fell by a relatively small 12–18%.

■ Mobile Pentium-150 Pushes Thermal Envelope

To keep notebook users only two steps behind the 200-MHz desktop Pentium, Intel rolled out a Mobile Pentium that runs at 150 MHz. The chip offers only a minor performance bump from the 133-MHz part, however, because of its slower (60-MHz) system bus, reflecting the limitations of the 150-MHz desktop Pentium.

Intel couldn't reach the higher clock speed with the 2.9-V supply used by other Mobile Pentiums; instead, the new part requires a core voltage of 3.1 V. This increase, combined with the higher clock speed, pushes the typical power dissipation to 3.8 W, compared with a rated 3.3 W for the Pentium-133 and 3.0 W for other Mobile Pentiums.

Although the power equation (see **1010ED.PDF**) tells us the new part should consume 30% more power than its predecessor, the rated increase is only 15%. Although the slower system bus accounts for a small part of the difference, Intel admits its ratings on earlier Mobile Pentiums have been somewhat generous and that it has tightened the spec for the 150-MHz part. By moving to a new stepping with better speed yield, the company hopes to deploy a 2.9-V version of the part by year-end, bringing typical power consumption back down to 3.3 W.

In either case, moving to the 150-MHz part will reduce battery life with almost no increase in system performance. Notebook vendors will also need to ensure their designs can handle the extra heat dissipation of the faster part. We expect some notebook makers won't be able to support the 150-MHz part, instead waiting for the cooler P55C due late this year. Several major vendors will offer 150-MHz notebooks in the interim. In the long run, notebook makers must learn to cope with hotter CPUs; we expect the Mobile P6, due in 1H98, to further expand the thermal envelope.

■ MicroUnity Idles Fab, Seeks Chip Partners

Seeking to cut expenses and realign its efforts for a changing business and technology environment, MicroUnity has largely idled its BiCMOS fab and is seeking semiconductor makers with an interest in the facility or in the company's unique process technology and media-processor design *(see 091402.PDF)*. The company, which peaked at over 250 employees, has laid off most of the 100-person fab staff and continues to cut back in areas unrelated to its core business.

MicroUnity's first chip designs were derailed in 1993 when BiCMOS foundry capacity dried up; as a result, the company built its own fab. By the time the exotic process (using gold metallization and optional air-bridging) was ready early this year, however, the market had changed.

Last year, MicroUnity's major investors—four of the five largest cable companies—shifted their priorities from set-top boxes to cable modems and other Internet-related products that don't need the very high speeds or mixed-signal capabilities of BiCMOS. Then, earlier this year, 0.35-micron CMOS became available from foundries, and the fab became an unnecessary burden for the seven-year-old startup that has, so far, generated revenue only from licensing.

Founder John Moussouris is now seeking to make MicroUnity a sustainable processor and software licensing organization, focused on cable modems and other broadband applications. A low-power CMOS processor is in development, and a major semiconductor company has recently licensed the architecture, boosting its chances for survival.

■ PowerPC 604e Hits 225 MHz

Good news is rolling in on PowerPC for a change. IBM is now shipping the 604e *(see 100703.PDF)* at clock speeds of up to 225 MHz, faster than the 200-MHz parts announced a few months ago. The company had at the time committed to delivering the 604e sometime in 2H96, so the July shipments were a pleasant surprise. Motorola has not yet announced 604e shipments nor committed to delivering 225-MHz parts, but both are expected soon.

The first system to use the 225-MHz 604e is the Power-Tower Pro from Power Computing (Round Rock, Texas). In the past, it could take months for a new PowerPC processor to appear in systems from IBM or Apple; with small, aggressive vendors such as Power Computing, new systems are available concurrent with the release of a new CPU, much as

in the x86 PC world. This change helps close the gap in perceived performance between PowerPC and x86.

IBM claims the 225-MHz 604e will deliver 8.5 SPECint95 and 7.4 SPECfp95 (base), but as usual it did not supply measured SPEC results on a shipping system to support these values. The drawback of using Power Computing as the lead PowerPC vendor is that its systems support Mac OS but not Unix, and so they cannot run the SPEC benchmarks. Based on IBM's claims, the 604e delivers about as much performance as the 200-MHz Pentium Pro with 512K of cache.

IBM prices the 225-MHz part at $594 in quantities of 1,000. This puts it slightly above the 200-MHz Pentium Pro in its 256K version, but the Intel price includes the L2 cache, while the IBM price does not. IBM also announced 1,000-piece prices for other 604e versions: $523 at 200 MHz, $424 at 180 MHz, and $375 at 166 MHz. These latter parts are priced comparably with high-end Pentium chips but offer significantly better performance.

IBM's ability to match Intel's 0.35-micron process, combined with surprisingly good clock speed, has enabled PowerPC's performance to catch up with Pentium Pro's. Intel plans to move its P6 core to 0.25-micron CMOS in 1H97, which could reopen the performance gap. IBM hopes it can keep pace with its own advanced CMOS processes while offering better price/performance. The new 604e, backed by aggressive system makers like Power Computing, is a boon to Macintosh users wanting to keep up with the Intel world.

■ Mitsubishi, IBM Strike PowerPC Deal

IBM Microelectronics and Mitsubishi Electric Corporation have signed an agreement allowing Mitsubishi to design and market embedded PowerPC microprocessors built by IBM. The deal gives Mitsubishi immediate access to IBM's entire line of embedded PowerPC products, including the 401GF, three 403Gx parts, and the 602. The deal also gives Mitsubishi access to new 400-series CPU cores developed during the two-year contract period, including the planned 405. High-performance desktop processors in the 600 series, such as the 604 and 603e, are not included.

Mitsubishi can market PowerPC devices worldwide under its own name or, if it chooses, with IBM markings. For future products, Mitsubishi is free to design new microprocessors around the IBM cores, which IBM will then manufacture at its Vermont facility and resell to Mitsubishi. IBM has turned over VHDL descriptions, simulation models, and all the necessary design tools to allow Mitsubishi to design derivative products. Mitsubishi also gains access to IBM's entire ASIC peripheral library. The only restrictions are that Mitsubishi cannot modify the CPU cores and that all parts must be built by IBM.

Technically, the deal does not give Mitsubishi a license to PowerPC, since it cannot design new cores nor manufacture chips. So far, only IBM, Motorola, and startup Exponential can claim those distinctions.

The teaming improves IBM's chances of penetrating the

lucrative consumer-electronics market, which is dominated by Japanese vendors like Mitsubishi. Mitsubishi gains a viable 32-bit embedded microprocessor line. The move is an apparent slap at Digital's Alpha processors, which Mitsubishi has unsuccessfully tried to sell into embedded applications for years *(see* **0704MSB.PDF***)*.

■ HP Licenses Motorola's ColdFire

Motorola has granted a license to Hewlett-Packard, a long-time customer, for its ColdFire and low-end 68K microprocessor cores. The nonexclusive agreement allows HP's Integrated Circuit Business Division (ICBD) to design and manufacture its own 68K-based microprocessors for internal consumption within HP. The agreement encompasses Motorola's 68000, 68020, 68030, and ColdFire CPU cores but does not include the higher-end '040 or '060 designs.

HP and Motorola have quietly cooperated on special-purpose 68K-based chips for the past few years; the agreement simply makes the relationship public and adds ColdFire to the mix. HP had been a major consumer of 68K processors with its popular LaserJet 2 and LaserJet 3 printers but switched to Intel's i960 family almost exclusively for the LaserJet 4 series. So far, all new members of the LaserJet 5 line use ColdFire processors, again putting a Motorola architecture into the thick of the laser-printer market.

HP's ICBD and Motorola's embedded CPU division will now compete for HP printer design wins. As a company, HP gains a potential second source for 68K chips (albeit an internal one), while Motorola frees up fab capacity to pursue different customers. The company also collects royalties from HP's internal efforts and can flaunt its victory over rival Intel for HP's affections. Ⓜ