MOST SIGNIFICANT BITS

Tillamook to Extend P55C

Sources have confirmed that Intel is developing a 0.25-micron version of its P55C processor, as we have speculated *(see* **101404.PDF***)*. The new device, said to be code-named Tillamook after a small town in Oregon, is expected to be a simple optical shrink of the current P55C processor. The P55C is built in Intel's 0.28-micron process, known as P854. We expect Tillamook to appear sometime in 2H97 at 200 MHz and possibly 233 MHz.

The key advantage of the shrink is a significant reduction in power. The 0.25-micron process, known as P856, is designed to run at 1.8 V *(see* **101203.PDF***)*, while the current P55C operates at 2.45 V in notebooks. This voltage change alone will decrease power dissipation by almost 50%. At 200 MHz, the P55C dissipates too much power to fit into a standard notebook design, preventing Intel from offering this part for mobile systems. Tillamook will easily fit into standard notebooks at 200 MHz.

In fact, even a 233-MHz Tillamook would have a maximum power dissipation of about 6 W, no sweat for notebook designers. Since the P55C hits 200 MHz in the current process, the smaller transistors should allow operation at 233 MHz. While a 233-MHz Tillamook would be a boon to notebook users, Intel may wish to push desktop users to the Klamath socket, locking out its x86 competitors. Intel may release the 233-MHz Tillamook only in a mobile module to keep it from appearing on the desktop.

Another advantage is a significantly decreased die size: Tillamook should be about 85 mm^2, just over half the size of the 140-mm^2 P55C. (Despite the 0.28-micron transistors, the P55C uses the equivalent of 0.35-micron metal layers, so the move to 0.25-micron produces a substantial die shrink.) This shrink will reduce manufacturing costs and increase per-wafer output.

Intel engineers will be challenged to provide 3.3-V I/O with the 1.8-V process, originally intended for 2.5-V I/O. Assuming Intel overcomes this challenge and that Tillamook maintains the P55C pinout, the only change required to the motherboard will be for the lower supply voltage.

Pressure from AMD and Cyrix may have helped Intel decide to greenlight the new chip. Tillamook gives Intel a response to the K6 and M2, which both offer increased performance in the P55C socket. The new part also provides some relief to thermally stressed notebook designers while filling a gap between the P55C and the forthcoming Mobile Deschutes, a P6 processor due in 1H98.

If Intel chooses to release a 233-MHz Tillamook for the desktop, it will provide one last performance kicker to the Pentium line before forcing vendors to move to P6 motherboards. As the first Intel processor to go through four full process generations, the Pentium core is proving to have quite a long lifetime. —*L.G.*

Intel Launches MMX, P55C

Capping a nine-month product roll-out, Intel has officially launched the Pentium Processor with MMX Technology, previously known as the P55C *(see* **101404.PDF** *and* **101701.PDF***)*. Intel has been shipping the chip in volume for some time, so both mobile and desktop systems using it are available immediately from a wide range of vendors.

The P55C delivers a modest performance benefit for applications that don't use MMX because of its larger on-chip cache. The 200-MHz chip delivers 6.4 SPECint95 (base) and 3.9 SPECfp95 (base)—an impressive boost of 26% over the non-MMX version *(see* **1101CW.PDF***for full SPEC details)*. On BAPCo's SYSmark32 tests, the 200-MHz P55C shows gains of 12% under Windows 95 and 19% under NT 4.0. These gains are lower than for SPEC because of the greater number of memory and I/O accesses in the application-oriented SYSmark32.

Intel's Media Benchmark—one of few benchmarks that illustrate MMX performance—shows a boost of about 60%. This is not a particularly meaningful number, however, as it is a combination of four widely varying results. On 3D geometry, which does not use MMX, the P55C delivers a trivial 4% increase, mainly due to the larger cache. On image processing, the improvement is a whopping 370%; audio shows a 113% gain, while video is boosted by 78%.

After January 27, pricing (in 1,000s) for the desktop version, which is in a plastic PGA and runs at 2.8 V, is $356 for the 166-MHz part and $539 for the 200-MHz version. The mobile versions are in PGA or TAB packages and operate at 2.45 V; pricing in either package is $539 at 150 MHz and $336 at 166 MHz.

The desktop prices are about $50 higher than those of the non-MMX versions at the same clock speed, while the 150-MHz mobile version carries a larger $122 premium. When one compares performance, on the other hand, the P55C-166 fares well against a Pentium-200 but costs $142 less. If buyers are savvy, this difference will cause the old 200-MHz part to phase out rather quickly.

The initial MMX software offerings are nearly all consumer focused. At the launch event, Intel showed about a dozen applications, including games, photo capture and editing programs, home 3D modeling software, and a software MIDI synthesizer. (See *mmx.com/mmx/software* for a list of applications.) Intel expects about 100 applications supporting MMX to ship by the end of the year.

The early applications are predominantly from smaller companies. To motivate these vendors to support MMX before there is any installed base, Intel has provided cash as prepaid royalties for system-bundling deals. In essence, Intel has guaranteed the software vendors a certain level of success in selling their applications to system makers for bundling, and it has provided the cash up front to help fund

development work. In return, the developers had to commit to implementing a certain level of MMX optimization.

Thanks to its lower supply voltage, the P55C is able to deliver more performance within a thermal envelope similar to the P54C's. The 166-MHz mobile version is rated at 9.5 W maximum, slightly less than the mobile P54C-150. . For the desktop versions, the power dissipation is also similar to that of the P54C: the 200-MHz P55C dissipates a maximum of 15.7 W. (See *developer.intel.com/design/mmx/index.htm* for more information.)

With most information on the P55C previously disclosed, the official launch provided few surprises. We expect the initial midrange pricing for the part to drop substantially by midyear, making the P55C the best-selling PC processor during 2H97. This growth will quickly establish MMX as a requirement in the PC market. —*M.S.*

Apple Offers New OS Strategy

Apple has, at long last, laid out its new operating-system strategy and taken the first step toward implementing that strategy by acquiring Next Software. Apple's plan leads to a modern, object-oriented operating system replete with all the right buzzwords. Unfortunately, the benefits of the new OS will accrue only to applications written for a new application programming interface (API) based on Next's OpenStep API. Macintosh applications will be supported only within a compatibility box that carries with it all of the disadvantages of the current Mac OS.

The new operating system, code-named Rhapsody, will include Next's OpenStep software, extended with a few key Mac APIs, such as QuickTime and OpenDoc, and a version of Mac OS for compatibility with existing applications. An early developer release is promised for the middle of this year, with a limited end-user release by the end of the year. A version with Mac application compatibility and an enhanced Mac-style user interface is promised for mid-1998. This version is expected to be the first of interest to Mac users; the late-'97 version will be used mainly by developers and current users of Next's software.

Next's original product was a full operating system, called NextStep, based on the Mach kernel (used in a version of Unix developed at Carnegie-Mellon). More recently, Next shifted its efforts to OpenStep, a "middleware" product that implements Next's development environment and APIs on top of existing operating systems (including Windows NT and various versions of Unix). Although it has been assumed in many press reports that Rhapsody will use the Mach kernel, Apple says this decision has not been made; the Copland kernel and other options are also being considered.

With the now-abandoned Copland operating system, Apple had hoped to provide a high degree of compatibility with existing Mac applications while replacing the kernel to provide memory protection and pre-emptive multitasking. Because Mac Toolbox routines are not re-entrant, Copland required a nearly complete rewrite of the operating system. Unfortunately, most Mac applications use undocumented features in the system software, such as directly accessing internal data structures. This misuse has made maintaining compatibility extremely difficult.

The new strategy forces existing Mac OS applications to run within a "compatibility box," which is just a copy of Mac OS running as a task under the new operating system. This version of Mac OS will be modified to work through the new kernel instead of communicating directly with the hardware. Apple says application compatibility will be better than it would have been with Copland, and at least 85% of existing applications should run. A key difference from the Copland strategy, however, is that standard Macintosh applications cannot take advantage of the new pre-emptive multitasking and interapplication memory protection.

Apple promises that twice-yearly releases of the existing Mac OS will continue through at least the end of the decade. The Harmony release (Mac OS 7.6), just now shipping, has modest stability and performance enhancements. Due in mid-'97 is the Tempo release, which will include a new multithreaded Finder—finally written in native PowerPC code—that will bring to System 7 some of the user-interface enhancements originally created for the ill-fated Copland. For most Mac users, Tempo and its follow-ons—rather than Rhapsody—will be the most significant developments for at least the next two years. —*M.S.*

AMD Pushes K5 to PR166 Performance

By increasing the K5's core clock speed to 116.5 MHz *(see* **1016MSB.PDF***)*, AMD has announced a new version with performance similar to that of a Pentium-166, according to AMD. The new K5-PR166 is slated for availability by the end of this quarter. AMD is currently shipping K5 processors with performance ratings of up to PR133, using internal clock speeds of up to 100 MHz. The PR166 carries a list price (in 1,000-unit quantities) of $167.

Reaching the PR166 level puts AMD well into the sweet spot of the PC market. Pentium-166 systems were the most popular high-end PC during the recent Christmas season; with the introduction of the P55C, the Pentium-166 will be Intel's midrange processor throughout 1H97. The PR166 lists for 43% less than the Pentium-166, and AMD is likely to offer deeper discounts than Intel.

On the other hand, a large gap in Intel's pricing structure puts the PR166 at about the same price as a 150-MHz Pentium and $33 more than a Pentium-133. OEMs will gain little extra performance by substituting a PR166 for an Intel processor of the same price.

For the first time, AMD has introduced a version of the K5 that matches the performance of an Intel chip priced at more than $200. This success will boost AMD's average selling price and aid in the company's recovery from a financially disastrous 1996. The K5, however, is still far from matching the performance of Intel's fastest parts, a task that falls to the forthcoming K6. —*L.G.* M