

Most Significant Bits

PowerPC Prices Continue to Tumble

IBM has cut its prices for the PowerPC 601 for the second time in four months (*see 0803MSB.PDF*). In quantities of 1,000, the 80-MHz 601 now sells for \$360, while the 66-MHz version lists at \$257; both of these prices represent 34% drops from the previous rates. The price of the less popular 50-MHz 601 drops 25% to \$227 in the same volume. IBM has not yet announced pricing for the 100-MHz 601+, due to ship in the fourth quarter.

Intel's rapid reduction in Pentium pricing (*see 080904.PDF*) has left IBM and other RISC vendors (*see next item*) scrambling to reprice their products as well. IBM's drastic price cuts were required to meet the company's objective of matching Pentium performance at half the price. Once Intel's August pricing takes effect (IBM's price cuts are immediate), the 50-, 66-, and 80-MHz 601 prices will be about half of the 60-, 66-, and 90-MHz Pentium prices. Note that Intel has a slight integer performance advantage at both the highest and lowest speed grades.

Motorola has not yet announced new pricing but expects to offer "competitive" pricing for the 601. IBM also announced its pricing for the 603: \$215 for the 66-MHz version and \$254 for the 80-MHz part, both in quantities of 1,000 units. These prices are just slightly higher than Motorola's 603 prices (*see 0807MSB.PDF*).

Unlike Pentium price cuts, which are quickly passed on to the end user, the list pricing for PowerPC has little effect on system buyers, as Apple's prices are negotiated separately and there are few other PowerPC system vendors. It is, however, likely that Apple will trim Power Mac prices to match the drop in Pentium system prices.

IBM also announced that it has shipped one million PowerPC chips since the 601 entered production last fall. Nearly all of these have gone to Apple (we assume IBM isn't counting the ones in key chains), but Apple has so far shipped only a few hundred thousand Power Macs. Apple must be building quite a bit of inventory.

R4600 Hits 150 MHz, Price Falls

Continuing to extend the performance of the R4600, IDT has announced availability of that chip at 150 MHz. The company is now sampling these parts and expects to ship them in volume beginning in September. At this speed, the R4600 will deliver 104 SPECint92 and 81 SPECfp92, based on measurements of a prototype system using a 50-MHz bus and 512K of cache. SPECfp92 figures for the 133-MHz R4600 (*see 0804MSB.PDF*), using a 44-MHz bus, have been revised to 72.

The company said that the new part will list for \$325 in 1,000-unit quantities. IDT also cut the prices of its lower-speed R4600 chips, which are currently in pro-

duction. The 133-MHz part now sells for \$250, and the 100-MHz version costs \$200, a 46% drop from the prices announced earlier. The R4600 now delivers better price/performance than the PowerPC 601 and outperforms Pentium at less than half the price, even with Intel's latest price cuts.

Amazingly, the R4600 has now reached the same clock rate as the "superpipelined" R4400 using the same 0.6-micron CMOS technology. The longer pipeline of the R4400 is supposed to allow higher clock rates to make up for the greater number of pipeline stalls and interlocks. But the R4600 has exceeded the clock speed of all other non-superpipelined processors, and the greater efficiency of its design allows it to exceed the performance of a 150-MHz R4400—and to do so at a much lower cost.

IDT, along with its R4600 partner Toshiba, plans to move the design into the 0.35-micron process used for the 200-MHz R4400 and expects to approach that frequency with the R4600 as well, yielding performance in excess of 130 SPECint92 from a chip with the die size of a 486. After this outstanding technical achievement, the QED team that designed the R4600 is already at work on a next-generation design.

IDT also announced two new products in its burgeoning R30xx family, the R3071 and R3071E. The chips are basically FPU-less versions of the R3081 (*see 060103.PDF*) and are intended for networking and other applications that need the large (20K total) caches of the R3081 but don't require fast floating point. The "E" version includes an MMU. The parts are offered at 33, 40, and 50 MHz; in 10,000-unit quantities, pricing ranges from \$75 to \$118.

Intel Begins Bare-Die Program

Formalizing a pilot program that it started last year, Intel has announced that it will sell most of its processor products as unpackaged die. Under the new SmartDie program, the company is providing bare-die versions of its embedded 386 chips, its 486SX and DX2 parts, the 8xC51SL microcontroller line, and its popular 28F series of flash memory devices. By the middle of next year, the company plans to offer unpackaged versions of its i960, 80C196, and Pentium processors as well.

Intel is responding to increasing demand for chips that use alternative package types (*see 071304.PDF*) to reduce the physical size of portable devices. Trying to cram additional capabilities into cellular telephones, pagers, PDAs, and PCMCIA cards, vendors find it difficult to use standard PQFP chips. By attaching die directly to the board (chip-on-board design), these vendors can reduce board area by a factor of two to three in most cases. Other vendors are using TAB, BGA, or MCM pack-

aging to meet the needs of various applications.

SmartDie products are functionally and electrically identical to standard packaged products and are guaranteed across the same temperature and voltage ranges. Intel performs additional wafer-level tests on these parts and, in some cases, uses temporary chip carriers from MicroModule Systems (Cupertino, Calif.) for burn-in and post-burn-in testing. The company prices SmartDie products at parity with packaged parts, removing the cost penalty traditionally associated with bare die, which require special testing and handling.

For customers that do not have the capability to handle bare die but are interested in alternative packages, Intel has identified several OEMs that will provide this capability. Korean manufacturer Amkor, for example, has a license from Motorola to produce BGA packages and can place Intel processors in these packages. MicroModule has extensive experience with ceramic MCM designs. SMOS (San Jose, Calif.) can provide chip-on-board, TAB, and plastic MCM packaging.

Intel is the first major processor vendor to announce a bare die program. Motorola and others have supplied unpackaged chips to key customers in the past but have not made these devices openly available. SmartDie should increase the use of Intel processors and flash memories in the rapidly growing market for portable consumer electronics. This program sets the standard for similar offerings from other microprocessor vendors.

National and IIT Form R&D Alliance

Integrated Information Technology (IIT) has entered into a research and development alliance with National Semiconductor to develop "key technologies for multimedia communications and personal systems." National purchased an 8% equity position in privately held IIT for an undisclosed sum.

The two companies declined to provide any specifics about products they will jointly develop. National has a strong line of networking and communications chips, while IIT has a programmable video-compression chip as well as a 387-compatible FPU and an accelerated display

controller. IIT is also developing a 486-compatible microprocessor, and this could be part of National's interest: National is the largest semiconductor company without a microprocessor for general-purpose computers. No details of IIT's planned microprocessor have been released.

NVidia Reveals Product Plans

Startup NVidia (Sunnyvale, Calif.) has revealed its general product plans, although the details of its product offering will not be unveiled until the fall. NVidia is targeting the market for home multimedia systems, which it sees as the primary area for PC growth in the next few years, with business PCs as a secondary focus. Although the company is short on specifics, the product apparently will be a single-chip device, compatible with the PCI or VL bus, that implements a "unified media architecture"—providing an interface to the CRT for graphics and video, as well as audio and game port I/O.

NVidia has received "substantial" funding from Sequoia Capital and Sutter Hill Ventures, and from an unnamed technology partner. President Jen-Hsun Huang was formerly with LSI Logic; Curtis Priem and other senior technical staffers came from Sun, where they created Sun's GX graphics system.

NVidia's technology partner is an unnamed semiconductor company that will manufacture the chips in its 0.5-micron, three-layer-metal CMOS fab. NVidia believes that this will give it a substantial advantage over the conventional fabless semiconductor model, in which leading-edge capacity is often hard to obtain and much effort is often diverted to finding new foundries and converting chip designs to different processes.

NVidia is not the only startup chip vendor seeking to ride the multimedia wave. Xenon Microsystems, which has yet to make any public announcements, was founded last year by Rambus founder Mike Farmwald. Earlier this year, Wes Patterson, formerly president of Xilinx, joined the company, which has received \$4.25 million in venture funding. Xenon has said only that it is developing silicon for multimedia systems; it is a fair guess that these chips will work with Rambus DRAMs. ♦