

Intel Boosts Notebook Pentium to 90 MHz

New Notebook Chips Run at 2.9 Volts to Reduce Power

by Linley Gwennap

Aiming to increase the penetration of Pentium in the notebook market, Intel has cut the power dissipation of its 75-MHz Pentium processor and introduced a 90-MHz part for notebook systems. The new parts operate from a 2.9-V supply, reducing power dissipation by about 20% compared with 3.3-V parts. This reduction allows the 90-MHz part to operate within the same thermal range as the original 3.3-V 75-MHz Pentium (*see 081503.PDF*), averting the need for notebook vendors to revamp their mechanical designs.

Intel has coined the phrase "voltage reduction technology (VRT)" for the 2.9-V parts. The VRT parts are available only at 75 and 90 MHz. The new parts use a modified version of Intel's 0.6-micron BiCMOS process that has been tuned to operate at 2.9 V instead of 3.3 V. The P6 also uses a variation of this 2.9-V process.

The VRT parts require both a 2.9-V supply and a 3.3-V supply. The core logic runs at the lower voltage while the pad ring uses the higher value to maintain compatibility with 3.3-V chip sets and cache SRAMs. Thus, vendors can insert the VRT parts into existing Pentium notebook designs simply by producing a 2.9-V supply and routing it to the CPU; the chip set and other motherboard components are not affected.

At 2.9 V, the 90-MHz Pentium typically dissipates 3 W (a maximum of 6.5 W). The reduced voltage almost exactly compensates for the 20% increase in clock speed compared with the original 75-MHz part. The 75-MHz VRT chip dissipates 2.4 W (typical), 20% less than the standard version.

Like the original 75-MHz Pentium, the VRT parts are available in either a PGA package or Intel's TCP (i.e., TAB) package. Intel says that about 75% of its notebook sales are in the TAB package, although many smaller system vendors are using the PGA package. The company does not offer a discount for the TAB version, although the MDR Cost Model projects a \$15 cost reduction for the smaller package.

Both VRT processors are in production now. In 1,000-unit quantities, pricing in either package for the 75-MHz VRT part is \$275, the same as for the standard 75-MHz Pentium. The 90-MHz VRT part lists for \$427, a bit more than the desktop 90-MHz Pentium. Note the 55% jump in price between the 75- and 90-MHz parts, forcing system vendors to pay a stiff premium for the fastest notebook processor. This premium should drop sharply over the next several quarters.

More Notebook Pentiums in Future

About two dozen notebook systems based on the original 75-MHz Pentium have been announced, although most are just now beginning to ship. The processor has been available for six months, but many vendors have found the unusual TAB package and the lack of system-logic chip sets a challenging combination. With only a single notebook Pentium available, system vendors are using Pentium only in high-priced premium notebooks, relying on less expensive 486DX2 and DX4 parts for mainstream products.

Intel's goal is to convert the entire notebook market, top to bottom, to Pentium processors by the end of this year. This aggressive goal requires two changes to the current Pentium lineup: lower prices and a broader family of parts.

The latest announcement addresses the second of these changes. With the addition of a 90-MHz part, notebook makers can move the 75-MHz Pentium into mid-range systems. A faster version, 100 or even 120 MHz, is needed to fill out the line; Intel has promised to deliver a faster part by the end of the year.

A 100-MHz VRT Pentium would increase power dissipation 10% over the already hot notebook Pentiums that are currently available. While some high-end notebook designs probably could accommodate this increase, others might not.

A better solution would be to use Intel's new 0.35-micron BiCMOS process, which should allow chips at speeds up to 120 MHz that do not exceed the heat dissipation of the current parts. In 1996, Intel will probably deploy even faster notebook processors using a 2.5-V CMOS version of its 0.35-micron process, keeping power dissipation at reasonable levels with clock speeds as high as 150 MHz.

To move into the lowest-cost notebooks, where the 486DX2 rules today, the 75-MHz Pentium must undergo significant price cuts. MDR projects that the price of this part will drop below \$200 by the end of this year. A 50-MHz DX2, however, listed for \$102 last quarter, and it is unlikely that Pentium chips will approach that price in the next year. Thus, we see a role for the DX4, which should reach \$100 by late this year, in entry-level notebooks well into 1996.

Even if it doesn't fill the low end, Pentium should dominate mainstream notebooks by early next year. Given Pentium's ongoing sweep of the desktop, the pickings for 486-class chips will be few indeed in 1996. ♦