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INTEL STRIKES BACK AT TRANSMETA

By Keith Diefendorff {7/3/00-02}

Not wishing to see Transmeta gain too strong a foothold in the growing ultrathin portable and Internet appliance markets, Intel has launched a salvo of new Mobile Pentium III and Mobile Celeron processors at the fledgling startup. However, Intel's five new mobile processors are not all that new; they use exactly the same Coppermine die Intel has been shipping to the notebook market for some time, but they broaden Intel's mobile portfolio with higher frequencies, lower voltages, and lower prices. Intel did not change the bus speeds of the new offerings: all Intel Mobile parts clock in with a 100MHz front-side bus.

Taking a page from Transmeta's book, Intel has tossed in a new specification it calls "average power" to make its chips appear more power-competitive with Transmeta's Crusoe chips. Transmeta uses its code-morphing software and LongRun hardware (see *MPR 2/14/00-01*, "Transmeta Breaks X86 Low-Power Barrier") to throttle back the frequency and voltage of the processor when the demand for performance is low. Intel recognized that it could pull almost the same trick with its QuickStart power-saving modes and SpeedStep (see *MPR 2/7/00-05*, "SpeedStep Boosts Mobile Performance"). The trick is less effective for Intel because Transmeta's code-morphing software provides more insight into the current processing demand, and LongRun provides a fine-grain control over voltage and frequency that Intel lacks. Transmeta also has two other factors working in its favor: its processors use far fewer logic transistors, and they include an integrated north bridge whose power scales at the same rate as the processor's. In an Intel system, the nonintegrated north bridge uses a constant amount of power (about 3.3W), regardless of the processor speed.

Nonetheless, Intel's power-modulation techniques allow it to claim substantially lower power, more in line with that of Crusoe. Intel quotes an average power of 2.8W in AC-power mode and 1.6W in battery-optimized-SpeedStep mode for the new 750/600MHz Mobile Pentium III, and 1.6W and 0.8W for the new 600/500MHz version. The power consumption of the 600/500MHz version in battery-optimized mode is so much less, because it operates at a reduced 1.1V, compared with 1.35V for the 750/600MHz part. The new 650MHz and 600MHz Mobile Celerons, which do not implement SpeedStep, burn less than 3W of power, on average, at 1.6V.

Intel's average-power specifications, however, are based on the Ziff-Davis BatteryMark 3.0 benchmark. This benchmark can be misleading, because it presents a very light workload of only about 20% duty cycle. In a more realistic scenario, the power consumption of Intel's new parts would be higher. And OEMs must still design for the even higher TDP (thermal design power) specification of the chips. On AC power, the TDP of the 750/600MHz Mobile Pentium III is 15.8W (19.1W w/82443BX north bridge), and it is 9.5W for the 600/500MHz part. The TDP of the 650MHz Mobile Celeron is about 14W, and it is about 13W for the 600MHz version. The lowest-power version of Intel's new chips is a 500MHz Mobile Celeron that operates at 1.35V and consumes about 7.9W TDP.

By way of comparison, a 667MHz TM5400 Crusoe has a TDP of 5.5W, including north-bridge power. Thus, we expect that in a more realistic battery-benchmark environment, the Crusoe would burn substantially less power than Intel's new parts. For example, Intel says its new Mobile

Pentium IIIs use about 2W while playing a DVD movie; Transmeta claims less than 1W for the same task.

On the other hand, when high performance is needed, there is no doubt that Intel's new parts will clean Transmeta's clock. By Transmeta's own claims, Crusoe at 700MHz will probably perform only about as well as a 500MHz Pentium III. And Transmeta's reluctance to provide benchmarks to substantiate this claim makes us suspicious that the company may be hiding performance that is even worse. Furthermore, the Mobile Pentium III at 500MHz operates at 1.1V, whereas Crusoe at the same voltage will only run at 200MHz.

Intel's new mobile parts are available immediately. List prices in 1,000-unit quantities are $562 and $316 for the 750/600MHz and 600/500MHz Mobile Pentium IIIs; $181 and $134 for the 650MHz and 600MHz Mobile Celerons; and $134 for the 500MHz low-power Mobile Celeron. Intel did not indicate whether the new parts will take advantage of the new C-0 Coppermine die stepping, which reduces die size by about 5%, from 106mm^2 to 100mm^2, but we assume that they will do so—if not initially, then soon. The 750/600MHz Mobile Pentium III and the 650- and 600MHz Mobile Celerons are offered in BGA, microPGA, and mobile-module packages. The low-power 600/500MHz Mobile Pentium III and the 500MHz Mobile Celeron are offered in BGA only.

Although these new mobile processors from Intel do not reach down to the power levels of Transmeta's Crusoe, despite Intel's average-power ruse, they will provide higher performance. So, for customers looking for top performance in their ultrathin notebooks, Intel still looks like the best bet in town. ◇