

PowerPC 603e, 604e Hit 200 MHz

Performance Surges as Motorola, IBM Deploy Array of New Parts

by Linley Gwennap

Surpassing expectations, Motorola and IBM have announced they are now sampling PowerPC 603e and 604e processors at speeds up to 200 MHz. The companies had originally planned 166-MHz versions of each device using 0.35-micron CMOS, but better than expected yields allowed the higher speed grades. At these speeds, the 603e should match up well with Intel's forthcoming 200-MHz Pentium, while the 604e takes on Intel's 200-MHz Pentium Pro.

The announcement, made at Apple's Worldwide Developers Conference, lacked any specific details as to when the new parts will ship in volume or what their prices will be. Motorola separately announced pricing for the fast 603e parts, which it plans to ship in June; IBM would not divulge its specific plans. Apple, by far the largest PowerPC customer, would say only that it plans to ship systems using the new processors "before the end of 1996." Smaller PowerPC vendors may utilize the parts in a more timely fashion.

Motorola Begins 0.35-Micron Production

The fast 603e chips are the first production silicon from Motorola's new 0.35-micron fab in Austin (Texas). The company reaches 0.35-micron production more than a year after Intel and IBM, making its parts much more competitive in cost and performance than in the past.

The 0.35-micron 603e ([see 0912MSB.PDF](#)) is functionally identical to the current 603e, retaining the same 16K/16K caches. The 2.5-V core voltage is new, however, keeping power dissipation to a maximum of 5 W at 200 MHz. Typical power dissipation is below 4 W, putting the chips within the range of notebook system designs.

The 604e ([see 0914MSB.PDF](#)) contains several enhancements over the current 604, the most significant being its enlarged caches, which are 32K/32K in the new design. Like other 0.35-micron PowerPC parts, the 604e uses a 2.5-V core with 3.3-V I/O. Power dissipation is 14 W (typical) at 200 MHz, about half of Pentium Pro's power.

Because the 0.35-micron process uses metal layers similar to those of the vendor's 0.5-micron process, neither the die size nor the manufacturing cost of the new versions is significantly reduced. At 79 mm², the new 603e carries an estimated manufacturing cost of \$30, about 25% less than that of Intel's Pentium. The larger 604e, at 148 mm², costs about \$60 to build, less than half the build cost of a Pentium Pro, although the Pentium Pro includes its own L2 cache, which the 604e does not. These lower manufacturing costs should allow IBM and Motorola to offer aggressive pricing compared with Intel's.

Performance Close to Intel's

No measured SPEC95 results are available for the 200-MHz PowerPC parts. The companies estimate the 603e, at its top speed, will deliver 5.1 SPECint95 and 3.7 SPECfp95 (base) in a high-end configuration with 1M of cache and synchronous DRAM memory. These scores exceed those of the fastest Pentium shipping today and should be similar to those of the 200-MHz Pentium, which should be shipping at about the same time as the 200-MHz 603e.

The vendors expect a 200-MHz 604e to reach 7.8 SPECint95 and 6.5 SPECfp95 (base) in a similar high-end configuration, putting the chip slightly behind Pentium Pro on the integer side and slightly ahead for floating point. Assuming the actual chips bear out these estimates, the 603e is a good clock-for-clock match with Pentium, while the 604e will roughly match a Pentium Pro at the same clock speed.

Based on this rule of thumb, 603e pricing (see sidebar) is just 50–60% of Intel's for similar performance. It also obsoletes 604 parts at 150 MHz or slower. Although IBM is now shipping 604 chips at 166 and 180 MHz ([see 1006MSB.PDF](#)), these parts will likely be superseded by the 604e when it begins shipping. Thus, the new parts will provide a nearly complete makeover for the PowerPC lineup, improving performance and reducing cost.

Future cost and performance increases will come with a shrink to IBM's 0.27-micron CMOS-6S process ([see 090905.PDF](#)), which Motorola will presumably adopt as well. While this move will benefit the 603e, the 604e's performance is becoming limited by its bus bandwidth, which is similar to Pentium's. To boost performance, the 604e will ultimately be forced to adopt a new bus interface (perhaps the 620's) or at least add a second bus to handle the L2 cache. Assuming such enhancements, the 604e should be able to track the performance of Intel's P6 family well into 1997. □

Price & Availability

Both IBM and Motorola are now sampling the 603e and 604e at speeds up to 200 MHz. Motorola expects volume production of the 603e in June at 1,000-piece list prices of \$224, \$256, and \$360 for speed grades of 166, 180, and 200 MHz, respectively. IBM has not announced pricing for the 603e at these speeds, and neither vendor has announced pricing or availability for the 604e.

Contact Motorola at 800.845.6686 or check the Web at www.mot.com/powerpc. Contact IBM Microelectronics at 800.POWERPC or www.chips.ibm.com/product/ppc.