

AMD Buys NexGen to Boost x86 Position

AMD's K6 Replaced by Nx686, Will Be Pentium Pin-Compatible

by Michael Slater

In a stunning move that shows how far both companies will go to strengthen their positions against Intel, AMD and NexGen announced a definitive agreement to merge in an all-stock transaction valuing NexGen at \$865 million. The deal will not be formally completed until January or February, but the risk of collapse appears small; ASCII, Compaq, and Olivetti, which control 37% of NexGen's shares, have approved the deal.

Both companies should benefit: NexGen has good designs but is fabless, while AMD has a big new fab but lacks leading-edge processors to build. NexGen was losing money and could have run out of cash unless sales picked up considerably, but this was not the driving force behind the deal; the value of tight coupling with a fab was at the heart of NexGen's motivation.

NexGen will retain its name and will operate as a wholly owned subsidiary of AMD. Atiq Raza will continue to head NexGen and will become a corporate vice president and chief technical officer of AMD.

The two companies will merge their product lines starting with the "sixth-generation" parts. AMD has cancelled its K6 project in favor of NexGen's recently announced Nx686 (see [091401.PDF](#)). NexGen had already demonstrated working silicon of its 686 and said it would begin production of that part in mid-1996. Switching to the AMD fab will cause some delay (although it is possible that initial silicon still will come from IBM); AMD is saying only that it expects to begin production in the second half of 1996.

Even before the K5's recent delays, AMD's K6 was not slated for production until 1997; AMD executives acknowledged that delays in the K5 had pushed out the K6 schedule further. Thus, adopting the Nx686 should give AMD a significant head start on the sixth generation. Because of rapid price declines in the x86 microprocessor market, being able to ship a P6-class product a year earlier could be very valuable.

686 to Become Pentium Pin-Compatible

Shortly after the merger announcement, AMD disclosed that NexGen has been working on a revised version of the 686 that is Pentium pin-compatible. This work was in process even before AMD's involvement. NexGen knew when it disclosed the 686 at the Microprocessor Forum that it would not produce the version it was describing but had decided for competitive reasons to keep the plans for a Pentium pinout secret. The first

686 silicon does have an Nx586-style bus interface, as described in our previous issue, but this version will be used only to debug the microarchitecture. The production version, now to be marketed under the K6 designation, will be Pentium (P54C) pin-compatible.

To mitigate the loss of performance as a result of dropping the dedicated L2 cache interface, the revised chip will boost the instruction cache to 32K, matching the size of the data cache. NexGen says that simulations show no net performance loss, indicating that the L2 cache bus was of little value. The increase in cache size is partially compensated by a reduction in die size from dropping the L2 cache controller; NexGen estimates the net area increase to be only 6%.

NexGen COO to Head K6 & K7 Programs

Vinod Dham, who recently left Intel to join NexGen as COO, will serve as general manager of AMD's sixth- and seventh-generation efforts, with marketing and operations, as well as the design teams, reporting to him. Dham, who led the Pentium design team and then went on to serve as general manager of the Pentium Processor Division at Intel, was reportedly the driving force behind NexGen's shift to a Pentium pinout.

Details of how the design teams will be organized remain to be worked out. Sources at AMD say that the advanced architecture development group, headed by Mike Johnson, remains intact and continues to work on the K7 design. NexGen has its own 786 design in process; the companies have not yet decided which design will survive, or whether some aspects of each will be used. In time, Johnson's team and the NexGen team are likely to work on successive generations, just as Intel overlaps the work of its Santa Clara and Hillsboro groups.

Two Alternatives for Pentium Class

AMD executives say they remain committed to the K5 design, which the company recently admitted is not meeting its performance goals (see [0914MSB.PDF](#)); it won't be until 3Q96 that a revised design, intended to reach the original goal, will be in volume production. By that time, AMD should be able to adapt NexGen's 586 design for AMD's process technology, giving it two options for the Pentium-class market.

If the company can quickly boost the clock speed of the K5 and achieve its targeted improvements in performance per clock cycle, the Nx586 could be obsoleted by the end of next year. On the other hand, if the Nx586 speed can be increased significantly and K5 falls short, it

is possible that the company will focus on the Nx586 as its primary Pentium-class device. The 586 probably will offer a smaller die size and higher performance, but additional engineering would be needed to make it Pentium pin-compatible.

Merger Driven by Fab Leverage

IBM will continue building NexGen's 586 and, at least initially, will build the 686. NexGen will be dependent on IBM until mid-1996 at the earliest, as it will take time to convert the designs for AMD's process. IBM and AMD have both expressed a desire to continue the relationship; this could lead to a partnership between AMD and IBM, possibly extending to process technology.

Much of the benefit of the merger, however, will come from building the chips in AMD's new Austin fab, Fab 25. Access to Fab 25 gives NexGen a high-capacity state-of-the-art manufacturing source that is responsive to its needs; IBM, while a capable manufacturer, isn't likely to tune its process to NexGen's needs or offer priority turnaround.

Slow fab turnaround has been a frequent complaint among IBM foundry customers. In a business as competitive as the x86 market, having a turnaround significantly longer than Intel's can be a major disadvantage, especially when multiple revisions are needed to debug a design. No foundry, however agile, can give a design house the kind of service that an in-house fab can offer.

NexGen's 586 is currently built in IBM's 0.65-micron CMOS-5L process with five layers of metal. The company is testing a version of the chip fabricated in IBM's more advanced CMOS-5S, with a drawn gate length of 0.44 microns, and these chips should hit 120 MHz. A redesign to AMD's 0.35-micron CS-34 process (see [090905.PDF](#)) should improve the speed to 150 MHz or higher while reducing the die size.

AMD currently builds chips with only three layers of metal, but AMD sources say CS-34 has been designed to support more layers, as well as local interconnect as used by IBM, and can be adapted to match NexGen's needs. AMD is already experienced with the chemical-mechanical polishing (CMP) needed to fabricate five metal layers. Its CS-34 metal pitches are tighter than in IBM's CMOS-5S on the critical second and third metal layers, and this should yield a die size decrease of as much as 15–20% relative to IBM's process.

Deal Puts Pressure on Cyrix and IBM

In the long run, AMD is likely to seek to be the sole source for the K6 and K7, leaving IBM in a closer partnership with Cyrix. In fact, there have been rumors—denied by both companies—that IBM is seeking to acquire Cyrix. AMD's merger with NexGen shows the appeal of such a move; should another company—such

as Cyrix's other foundry, SGS-Thomson, or an Asian semiconductor giant—acquire Cyrix, it would leave IBM without a long-term source of x86 designs. It is more likely that IBM will make a minority investment in Cyrix, as IBM did in Intel more than a decade ago, providing some control over Cyrix's future.

As the NexGen/AMD deal illustrates, the existence of independent fabless companies with successful x86 designs may be an unstable economic situation. Having a close coupling with a fab is immensely valuable to such a design house, and the designs are immensely valuable to a company with a fab. It is possible that a partnership that stops short of outright ownership could work, but the fab owner's temptation to absorb the creator of the designs must be intense.

We expect that Intel's competitors together are unlikely to gain more than roughly 30% of the x86 microprocessor market. It is not in Intel's interest to drive prices so low that its competitors can't survive—but Intel does have a great ability to bring price pressure to bear when its core market share is threatened. To the degree that the non-Intel x86 share is limited, any gain on the part of the AMD/NexGen partnership represents a potential loss for Cyrix and IBM.

More Than the Sum of the Parts

In the near term, the AMD/NexGen merger will do little to improve the competitive position of either company. Now that NexGen's 686 is known not to include a 586-style bus interface, any incentive for others to develop chip sets for NexGen's proprietary interface is gone. The deal won't do anything to bring AMD's K5 to market any sooner, leaving AMD scrambling to fill its new fab until the K5 and K6 are ready for production.

In the long run, the merger with NexGen will make AMD a more formidable force in the x86 microprocessor business. AMD has been the clear second-place supplier, but Cyrix's 5x86 and 6x86 offerings, coupled with AMD's K5 delays, threatened to put Cyrix in the lead. The new pairing will give AMD a better chance of maintaining its position and raises a new barrier to Cyrix's and IBM's hope of taking the second-place spot. It also helps, in the long run, to ensure a flow of high-performance processor designs to fill AMD's new Fab 25 with popular and profitable products—but it won't do anything to fill the gap in AMD's portfolio during the first half of 1996.

With AMD's backing, NexGen can continue to increase staffing. AMD's sales, marketing, and distribution leverage should give an additional boost to NexGen's designs. Whether the companies can achieve the theoretical synergy that could result will depend on how well they can integrate the two companies despite their different cultures and competitive design teams. ♦