National Unveils "Appliance On a Chip"

Highly Integrated Device Covers Retreat From PC Processor Market

by Tom R. Halfhill

Battered but not beaten by its brief foray onto Intel's turf, National Semiconductor is launching a long-anticipated flank attack—an "information appliance on a chip" designed for non-PC devices in homes and offices. The highly integrated chip, scheduled for delivery next January, is the key to National's post-PC strategy. And it's probably the last chance for National to salvage any value from its costly rental of Cyrix.

Although National plans to reveal more technical details at Microprocessor Forum in October, the company has disclosed the basic architecture of the new system on a chip (SOC), which is called the Geode SC1400. It's the first member of a family of Geode SOCs that National plans to introduce over the next few years.

New Life for Old Cores

As expected, the SC1400 uses an updated version of the MediaGX, which itself was considered a highly integrated chip when first announced by Cyrix (see MPR 7/10/95, p. 1).

In 1996, Compaq adopted it for a line of Presarios that cracked open the market for sub-$1,000 PCs. Although the MediaGX is long gone from the PC market, it ignited a price war that continues to this day. National will retain the rights to an MMX-enhanced version of the MediaGX, known as the GXm, even after selling Cyrix to Via (see MPR 7/12/99, p. 5).

As a stripped-down, scalar version of Cyrix's Pentium-class M1 core, the GXm seems a little geriatric when compared with current PC processors. At its target clock rate of 233 or 266 MHz, the SC1400 will deliver about the same raw performance as a fast Pentium, at a time when sub-$500 PCs will have sixth-generation x86 processors cruising at 400 MHz or higher. And the SC1400 has no 3D acceleration, which makes it unsuitable for running the latest PC games.

But National thinks the SC1400 is fast enough for set-top boxes that will perform a few basic functions of home PCs, such as Web browsing, email, electronic commerce, and online chat. If National finds a ready market for the SC1400, future members of the Geode family will run at higher frequencies and eventually migrate to new cores. That's because, in addition to retaining rights to the MediaGX technology, National is also keeping the original MediaGX design team—about 150 engineers based in Colorado. Instead of using Cyrix's next-generation Jalapeno core, which is included in the sale to Via, the Colorado team will design new cores by extending the x86 technology retained by National.

Higher Integration

The original MediaGX integrated the functions of an SVGA graphics card, a DRAM controller, a PCI controller, and other parts of the core logic. A companion chip, the Cx5510, emulated a 16-bit Sound Blaster card while bridging to the ISA bus, a two-channel IDE bus, and other system devices. As Figure 1 shows, the SC1400 combines these functions and adds considerably more integration, including hardware for MPEG decoding, NTSC/PAL-standard video, USB, and AC97 audio.

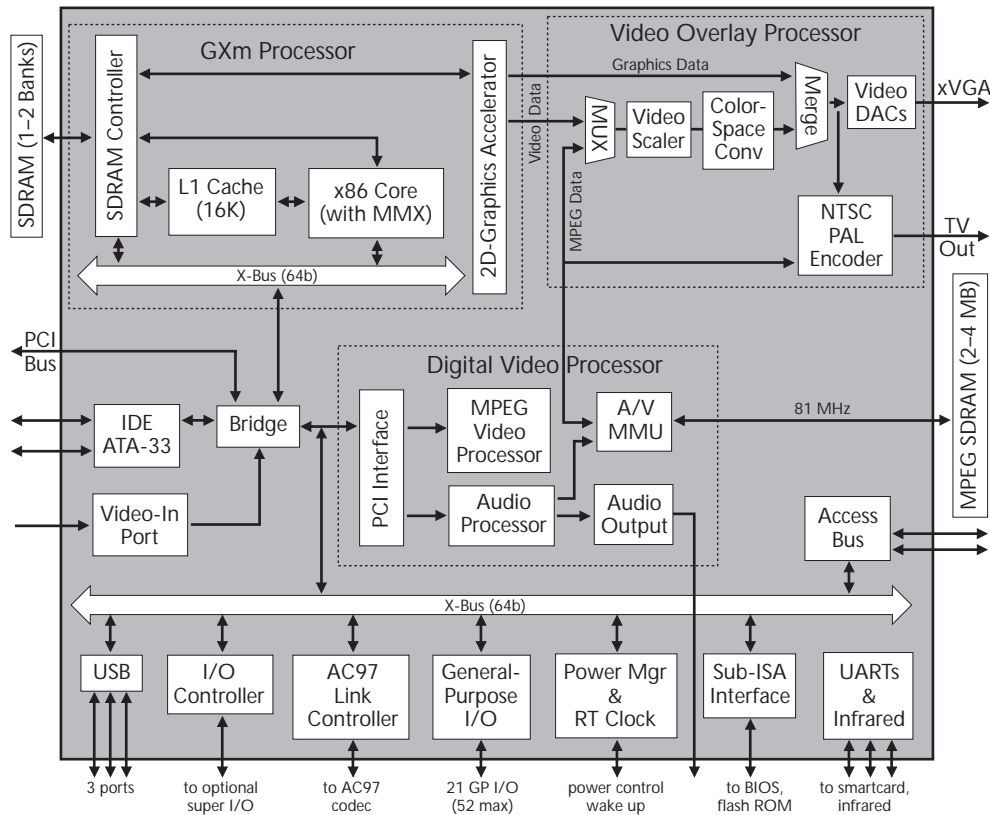The GXm's memory controller supports two banks of

Figure 1. The Geode SC1400 is based on the GXm chip but adds considerably more integration.

66-MHz SDRAM. A second memory interface supports from 2M to 4M of SDRAM at 81 MHz, as a buffer for the on-chip MPEG decoder. National says a future Geode chip will merge the MPEG memory with main memory, just as the SC1400 now stores the SVGA frame buffer in main memory.

A private bus connects the CPU core with the memory controller, PCI controller, MPEG decoder, graphics accelerator, audio interface, and other function blocks. The SC1400 appears to have the ability to overlay computer graphics on video images or to display video inside windows, raising some interesting user-interface possibilities.

National is sampling the SC1400 now and plans to start production in January. In National's 0.25-micron process, the seven-million-transistor SC1400 has a die size of 196 mm^2. National says the chip will cost from $50 to $100 in quantity, hinting that the price will be closer to the lower end of that range—as it should be for this market.

Although National designed the SC1400 for set-top boxes, Geode chips will target other products as well. National says it can easily add or subtract function blocks to customize the chips for Web phones, thin clients, thin servers, wearable PCs, high-end DVD players, and futuristic products such as National's WebPad—a prototype mobile computer that has wireless Internet access.

National is also collaborating with America Online to create a dedicated AOL set-top box known as AOL-TV, which would compete with Microsoft's WebTV. But AOL is still evaluating the SC1400 and may elect to use the GXm chip set instead.

Weighing the Advantages of Integration

Compared with several less-integrated solutions—including National's own GXm—Geode chips will probably be easier to design into systems, and they will use less power than separate components. If their integrated functions closely match a system's requirements, Geode chips could save designers a great deal of work and allow products to reach the market more quickly. The x86 core means that a wide variety of development tools and Web-browser plug-ins are compatible with Geode—two factors that weigh against RISC architectures that are superior in other respects.

When time to market is not the primary consideration, however, a less-integrated approach might deliver more performance and be less expensive for high-volume products. The CPU cores and graphics engines in SOCs are rarely state of the art, and the higher integration is wasted if it doesn't closely match a system's requirements.

Much will depend on National's ability to customize Geode chips for specific applications and customers. The MediaGX briefly made a significant impact on the PC market, and then quickly faded from sight because it didn't keep up with conventional CPUs. Geode will have to evolve more quickly to avoid a similar fate in the emerging and ill-defined market for information appliances. ◫