

Pursuers of flash cash wield higher-density NAND chips

Released By: EETimes, David Lammers

Date: 09/27/04

<http://www.siliconstrategies.com/showArticle.jhtml?articleID=47903000>

Austin, Texas — Since the NAND flash market took off like a rocket several years ago, the race for higher densities has led companies such as Samsung Electronics Co. Ltd. and Toshiba Corp. to devote their most advanced process technologies to this memory type. Now competition is intensifying as heavyweight competitors step into the fray.

Hynix Semiconductor and partner STMicroelectronics; Infineon Technologies, with ally Saifun Semiconductors; Micron Technology; and Renesas Technology are mounting challenges to Samsung and to the Toshiba-SanDisk Corp. alliance. Some believe their entry sets the stage for a bloody market share battle.

"Samsung has 65 per-cent, Toshiba has a large share and then you have all of these big companies saying they want 5 to 10 percent of the market," said Semico Research Corp. analyst Jim Handy. "Everybody is getting tooled up, and that could cause a price crash."

For example, he said, Hynix Semiconductor Inc. "is capable of doing again to the NAND market what it did in DRAMs: add a lot of volume and bomb prices."

Renesas Technology Corp. will announce today that it is sampling a 4-Gbit device with a write time of 10 Mbytes/second. With an eye on the nascent market for cell phones capable of displaying video (see Sept. 20, page 1), Renesas noted that the fast write speed and large capacity would enable a user to put a two-hour movie in MPEG-4 format on a single chip in about two minutes.

Like the leading-edge NAND devices from Toshiba-SanDisk, the Renesas 4-Gbit chip uses multilevel-cell (MLC) technology, which allows two bits to be stored in a single cell. The chip, based on a 90-nanometer process, will move into mass production in the first quarter of 2005, Renesas said, joining 4-Gbit MLC offerings now ramping from Toshiba-SanDisk.

Not to be outdone, Samsung last week announced that its R&D lab had used 60-nm design rules to create the world's first 8-Gbit flash memory, also based on MLC technology. Though analyst Alan Niebel at Web-Foot Research said it may be two years before the 8-Gbit device moves into mass production and 2007 before it becomes "the low-cost leader," he said the announcement shows Samsung's determination to hang onto its lead in the market. The South Korean company said it had NAND revenue of \$2.1 billion last year, controlling 65 percent of total NAND market share. Toshiba has about 30 percent and Renesas the remaining 5 percent.

Samsung is now selling a 2-Gbit NAND device and will enter the 4-Gbit density market next year using a 70-nm process, said Jon Kang, senior vice president of technical marketing. Arguing that code storage and other high-reliability markets require single-level-cell technology, Samsung has largely stayed away from the MLC approach. Its 8-Gbit device will be targeted at audio and image storage, where an MLC architecture with correction technology is well-suited.

"The 8-Gbit density also gives us the possibility of going against the hard-disk-drive vendors. They have a glass ceiling because it is hard to reduce the cost of an HDD below \$80. Flash can go lower than that," Kang said.

With the rising popularity of MP3 players and digital cameras, the NAND market grew from less than \$1 billion in 2001 to \$4.2 billion last year, according to market research firm iSuppli Corp. Now, USB drives are a hot market for flash, particularly the highest-density devices. The USB drives typically hold only two flash chips, so two of the 4-Gbit devices could deliver a cool gigabyte of portable memory storage to the USB drive market next year.

Depending on how quickly video clips and movies come to cell phones, the high-density NAND memory market could see a huge growth spurt in about two years. Semico Research estimates that by 2008, the number of photos that could be stored on an average memory card could rise to about 1,000 — more than most people would want or need. Video has a much greater appetite. Currently, only about 20 minutes of digital video can be stored on a 512-

Mbyte card. And at 9 to 10 cents per megabyte of storage, using NAND-based memory cards to store video is expensive. As densities double and double again in the next few years, and as MPEG-4 quadruples the encoding density, digital video cameras could begin to replace tape with solid-state storage that easily can be moved from camera to PC.

"Video is bound to play a larger role in digital photography," analyst Handy said.

Renesas marketing vice president Sudeep Sharma said he believes the market for video-enabled cell phones will begin to take off at the end of next year, with 2006 as "the major growth year." By Christmas of 2005, the cost of a video-capable phone may drop by half, to about \$500 or \$600, he said, and the storage card needed to hold an hour of "fairly good-quality" video will decline to less than \$100.

"Keeping at the leading edge in terms of densities is the best way to keep ahead of the price-down curve," Sharma said.

Analysts disagree about how quickly the added supply from the new NAND competitors could swamp the market, which has seen prices weaken fast this year. Niebel at Web-Foot said some 40 applications, ranging from PDAs to MP3 players, are driving the demand for NAND chips. By 2006, the demand for NAND chips used largely for data storage will overtake the market for NOR-type flash, used largely for program code storage, as measured by revenues. Intel, AMD and STMicroelectronics are the largest suppliers of NOR parts.

Samsung believes the crossover is imminent, with worldwide NOR revenue crawling upward to \$7.6 billion next year as NAND revenue approaches \$9.9 billion.

Already, NAND accounts for more units than NOR-type flash. And Web-Foot Research forecasts that while bit demand for NOR will increase by about 10 percent a year, in terms of megabytes, demand for NAND will rise by about 300 percent a year for the foreseeable future.

Handy, at Semico Research, was much less bullish. NAND bit demand is slowing from the "surprise" year of 2003, when demand from USB drives and the cards used in camera phones rose much faster than expected, leading to a 250 percent increase in bit consumption. Those two markets "have matured a lot since then, so [NAND bit] growth will be much smaller in the future," Handy said. Semico now sees NAND bit growth of 111 percent for this year, slowing to 64 percent next year. That is far less than the growth seen by Web-Foot Research, which will detail its forecast at its annual flash memory conference this Thursday in Santa Clara, Calif.

Handy said the NAND market is in the midst of a tug-of-war between the established players, such as Samsung, Toshiba-SanDisk and Renesas, and the new entrants, led by Hynix-ST, Infineon-Saifun and Micron Technology Inc. Because of tariffs on Hynix's memory chips in Europe and the United States, Hynix has developed "a fantastic network of sales channels in China, which turns out to be the place where a lot of the flash memory cards and USB flash drives are assembled," Handy said.

Everyone has plans to ramp capacity. Toshiba and SanDisk are building a large 300-mm NAND fab at Yokkaichi, Japan, that will move into production toward the end of next year. Sharma, at Renesas, said that company is expanding investments at its Trecenti 300-mm fab in Japan. Its manufacturing partner, Powerchip Semiconductor, is adding 300-mm capacity for NAND production in Taiwan. Renesas intends to seize 10 percent of the overall NAND market by the end of this year and 15 percent next year, he said.

'Wild card'

"The wild card is what happens in the DRAM market next year, because companies such as Samsung have the ability to switch capacity from DRAMs to NAND," Sharma said.

The race to higher densities will be run on the legs of high-yielding processes and manufacturing skills. Analysts agree that Samsung is the most efficient manufacturer of NAND chips, followed closely by Toshiba. But all of the challengers are experienced high-volume memory manufacturers. Scott Nelson, director of memory marketing at Toshiba, noted that the NAND market has been little affected by the new entrants this year, as both Micron and ST experienced delays in their product introduction plans.

"In 2005, these new competitors have the potential to be a little more visible," Nelson said. That wary anticipation is motivating the big players. Toshiba, for example, expects to announce next month availability of a stacked-dice package that puts two of its 4-Gbit NAND chips together into an 8-Gbit offering. And Toshiba's Yokkaichi 3 fab will open late next year with a 70-nm pilot line for 8-Gbit monolithic production.

With densities doubling at nearly an annual pace and new entrants pouring in, the NAND supply is sure to escalate fast. What is less predictable is the demand, as marketing managers and analysts look toward the huge cell phone market and debate storage needs for photographs and, especially, video.

"People have been surprised in the past," said Handy at Semico. "Markets like MP3 players and USB drives grew very quickly. I think video cameras will be big. And there could be something unknown out there that nobody [envisions] yet."

About Semico

Semico Research Corp is a marketing and engineering research company located in Phoenix, Arizona. Semico was founded in 1994 by a group of semiconductor industry veterans who believed that the validity of semiconductor product forecasts could be greatly improved if the forecasts were based on semiconductor consumption in end-use markets. Semico forecasts, today, are based on that idea. Web: www.semico.com