Big Changes In the Chip Industry

More functions combine as circuit sizes plunge.

BY JEFFREY ROTHFEDER

It's a classic business irony: Just as semiconductor companies are enjoying arguably their greatest burst of creativity—chiefly, integrating the most complex multimedia, graphics, memory and logic applications into smaller circuits, transistors and chips—their industry's future couldn't be less certain. "Having great integration is good but if we can't make money, we are in trouble," says Nam-Sung Woo, executive vice president at Samsung Electronics. "Semiconductor companies need products that sell 100 million units per year to make money on the chips we put in them. Cell phones so far fit that category. We are desperately looking for something else, but what else is there?"

That question was at the heart of a wide-ranging discussion at a panel entitled "Convergence in Semiconductors." As multiple combinations of telecommunications, audio, video, digital photography, shopping and 3-D gaming increasingly share the same device, chips will be required to deliver greater power in more compact spaces.

There are a host of ideas for achieving that. For instance, a superchip with millions of transistors that can manage an infinite number of applications could be designed. Or perhaps each chip in a series of chips could carry different types of related circuits, such as logic, memory and analog signal processing. Currently, these functions are generally assigned to separate chips. Whichever approach is chosen, chipmakers will have to escalate spending on R&D to produce design breakthroughs. Problem is, there's uncertain return at the end of the development cycle.

An artful analysis of the challenge was provided by Philippe de Marcillac, senior vice president at IDC. De Marcillac noted that the information technology sector is growing at only 6 to 7 percent per year in large markets and a bit more in emerging regions, while the growth rate in telecom is lower still. There are a few product segments, particularly cars and medical equipment, in which the demand for semiconductors will rise, but these are relatively small markets compared to the most promising consumer electronics areas, such as video games.

And while consumer electronics applications are likely to spur chip sales, if history is a guide, any big gains will soon be erased by price erosion and competition, de Marcillac contended. "So we have a slowing core market and a small group of niche markets and yet there is going to have to be big capital investment," he said. "Semiconductor convergence sounds very expensive to me."

Although it may be costly, said Moon S. Song, CEO of Korean handset maker Pantech and Curitel, convergence is nonnegotiable. As Song put it, application integration is "critical in providing the right

LEFT TO RIGHT Philippe de Marcillac, Nam-Sung Woo, Jeffrey Rothfeder, Moon S. Song and Farhad Mafie

features at the right cost" for cell phones, which are by far the most profitable market for semiconductor companies. Annual handset sales were just shy of 800 million units last year compared to about 200 million PCs.

To keep sales of handsets at these levels, in the next 24 months, chip companies are expected to unveil advances in convergence design. Among them: Circuitry on telecom chips will shrink from 130 nanometers to a state-of-the-art 90 nanometers by the second half of this year. And by 2007, the size of circuits is likely to be reduced to 65 nanometers. As the chips become smaller, the applications etched into them will increase. "Today, we still require separate chip processes to handle audio and video signals," but with video via cell phone now appearing, audio and video "will be integrated in the next generation," Song said.

The strategy of many semiconductor companies is simple: Invest in engineering efforts aimed at feeding the evolving requirements of their existing large markets, such as cell phones and PCs, while seeking new revenue channels for these chips or similar ones. There was some disagreement on the panel, but no shortage of suggestions, about what will be the next profitable semiconductor product segments. IDC's de Marcillac suggested that digital TV—high-resolution, interactive television—could fit the bill. He projected that a billion chips will be needed for digital TVs during the next 10 years. That's not quite at the level of cell phone sales, but "digital TVs are less price-sensitive than handsets," so chipmakers should be able to maintain high revenue from lower volume, de Marcillac said.

RFID chips, which emit radio frequency signals to identify the location of an item or person, hold even more promise, argued Farhad Mafie, CEO of Savant Company, an advisor of semiconductor start-ups. Some large retailers, such as Wal-Mart, Target, BestBuy and Metro, have recently begun programs requiring a limited number of suppliers to place RFID chips on palettes and crates in order to track shipments and inventory more efficiently. The Department of Defense is experimenting with a similar plan. And some countries, notably Korea and Japan, are considering installing RFID networks in populous areas of large cities that would allow, for instance, a bookstore or a movie house to send marketing messages to a nearby consumer's RFID-equipped cell phone.

But to make it practical for widespread use on the millions and millions of items in supply chains, the price of each chip would have to drop to below 5 cents from $20 or more currently. "It will be a challenge to make a business case when the chip sells for 2 cents a piece," said Samsung's Woo.

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The bargain-basement price of these chips will be more than made up for by the sheer volume that will have to be produced, Mafie countered. "We are producing chips that are thrown away and need to be replaced each time a new item is made and shipped," he said. "Even a cell phone is used for a year before being replaced, but the whole concept of RFID is that these chips are disposable every day."

That wasn't enough to convince Woo that RFID will ever pay off for semiconductor makers in any significant way. "If you are trying to apply normal manufacturing approaches, it just doesn't cut it," he responded.

A large portion of the discussion was centered on the prospects for the semiconductor industry and the types of companies. There was consensus that the U.S. has the most innovative chip business, despite being counted out more than a decade ago. A majority of the world's most creative design companies—experimenting with new approaches to chip convergence and fresh areas such as biochips and nanotechnology—have launched their businesses in the U.S. because of support from technology-minded universities and access to venture capital. But as industry conditions tighten, it may become harder for these newbies to secure enough funding. "It costs millions of dollars to just buy tools to develop the chips," said Mafie. "Then we have to pay a lot of money to a foundry that will fabricate the chip after design. The cost of entry is becoming extremely difficult."

While Korea is ahead of Japan in commodity memory chips, it lags behind its neighbor and the U.S. in the more strategic and pricey application-specific designs, such as image-processing circuits for digital cameras and high-speed video and graphic sets.

The session's attendees agreed that with the industry facing such tough times, there will likely be a shakeout, accompanied by consolidation, during the next few years. Expected survivors include companies with top-of-the-line products like Intel, Samsung and Texas Instruments, as well as smaller firms with strong patent production for their products in clearly defined areas, such as Qualcomm (cellular telephones), ATI and Nvidia (graphics) and Broadcom (wired and wireless broadband). For chipmakers that don't fit these categories, the future is considerably less clear. ▲