Intel says building up yields chip gain

By John Markoff


HILLSBORO, Ore. — Intel announced yesterday that it has again found a way to make computer chips that can process information more quickly and with less power in less space.

The transistors on computer chips — whether for PCs or smartphones — have been designed in essentially the same way since 1959 when Robert Noyce, Intel's cofounder, and Jack Kilby of Texas Instruments independently invented the first integrated circuits that became the basic building block of electronic devices in the information age.

These early chips were built on a flat surface. But like a real estate developer building skyscrapers to get more rentable space from a plot of land, Intel is now building up. When the space between the billions of tiny electronic switches on the flat surface of a computer chip is measured in the width of just dozens of atoms, designers needed the third dimension to find more room.

The company has already begun making its microprocessors using a new 3-D transistor design, called a Finfet (for fin field-effect transistor), which is based around a remarkably small pillar, or fin, of silicon that rises above the surface of the chip. Intel, based in Santa Clara, Calif., plans to enter general production based on the new technology some time later this year.

Although the company did not give technical details about its new process in its announcement yesterday, it said that it expected to be able to make chips that run as much as 37 percent faster in low-voltage applications and it would be able to cut power consumption as much as 50 percent.

Intel currently uses a photolithographic process to make a chip, in which the smallest feature on the chip is just 32 nanometers, a level of microscopic manufacture that was reached in 2009. (By comparison a human red blood cell is 7,500 nanometers in width and a strand of DNA is 2.5 nanometers.) “Intel is on track for 22-nanometer manufacturing later this year,” said Mark T. Bohr, an Intel senior fellow and the scientist who has overseen the effort to develop the next generation of transistors.

The company’s engineers said that they now felt confident that they would be able to solve the challenges of making chips through at least the 10-nanometer generation, which is likely to happen in 2015.

But despite its promise and the company’s bold claims, Intel’s 3-D transistor is still a controversial technology within the chip industry. Indeed, a number of the company’s competitors say Intel is taking what could be a disastrous multibillion-dollar gamble on an unproved technology.

There has been industry speculation that Finfet technology will give Intel a clear speed advantage, but possibly less control over power consumption than alternative approaches.

By opting for a technology that emphasizes speed over low power, Intel faces the possibility that it could win the technology battle and yet lose the more important battle in the marketplace. The scope of Intel’s gamble is underscored by the fact that although the company dominates the markets for data center computers, desktops, and laptops, it has largely been locked out of the tablet and smartphone markets, which are growing faster than the traditional PC industry. Those devices use ultra-low-powered chips to conserve battery power and reduce overheating.

Apple, for example, uses Intel’s microprocessors for its desktops and laptops, but for the iPhone and iPad it has chosen to use a rival low-power design, built by others, that Apple helped pioneer in the late 1980s.
Industry executives and analysts have said that Intel is likely to have a lead of a full generation over its rivals in the shift to 3-D transistors.

Other companies, like ST Microelectronics, are wagering that an alternative technology based on placing a remarkably thin insulating layer below traditional transistors will chart a safer course toward the next generation of chip manufacturing. They believe that the insulation approach will excel in low-power applications, and that could be a crucial advantage in consumer-oriented markets where a majority of popular products are both hand-held and battery-powered.

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