THE POWER OF SMALL IMPROVEMENTS

Intel’s Leading-Edge Manufacturing Technology Adds Value to Industrial Equipment
Everyone has heard of Moore’s Law, but few of us have a clear idea of what it can do for high-value industrial, embedded, or communications equipment. The fact is, leveraging this fundamental rule of chip technology is perhaps the single most important part of choosing a leading-edge supplier. Far from being an arcane physics problem, Moore’s Law provides the key to unlock a sustainable competitive advantage.

Intel is the recognized leader in cutting-edge chip design and manufacturing and the home of Moore’s Law, which was named after the company’s cofounder, Gordon Moore. Intel’s consistent investment and development of chip technology pays dividends for its customers, who constantly stay one step ahead of the power, space, and performance curve.

**Good Products Start with Good Manufacturing**

It’s no exaggeration to say that Intel’s chips are among the most complicated devices ever created by humankind. They pack the power of space-program technology into the size of a postage stamp, at prices anyone can afford. That kind of technological leap doesn’t happen by accident.

Each year, Intel invests billions of dollars in its world-class chip-manufacturing capacity. Some of that goes into research and development of tomorrow’s technologies; some in new equipment and personnel; and some into constructing all-new plants (called “fabs”) around the globe. In all, Intel has the largest and most diverse manufacturing network of any chip-making company in the world.

For example, Intel’s recently announced 22nm technology creates chips in 3D, a new technique that aims to increase performance while also reducing power consumption. It’s at least a generation ahead of anything the industry has seen before.

Faster chips mean more performance for Intel’s customers, and reducing power consumption means industrial systems produce less heat. That makes equipment more reliable, cooler, and quieter. Fans can be reduced or eliminated when computers cool themselves, and the cost savings can be significant—sometimes even paying for the chips themselves!

Green building codes may also require more energy-efficient, low-power electronics. That’s not something that can be added or retrofitted to existing equipment. It must be designed-in, using the most efficient chip-making technology.

Every generation of Intel technology moves every Intel customer further ahead of the curve. With its broad range of chips for everything from small, low-cost portable devices all the way up to massively multicore computers and cloud servers, Intel’s continued investment in technology advances the state of the art in several areas at once.

**Cutting Electron Travel Times**

The value of Intel’s leading-edge chip production comes down to basic physics. In short, smaller is better. The billions of electrons moving inside every computer chip must travel from one transistor to another, and like any moving object, the shorter the distance they travel, the sooner they arrive at their destination. Quicker electrons mean faster computers, more-efficient networks, and better wireless connections.

But the advantages go deeper than that. Intel’s advanced production technology also means that fewer electrons have to make the trip. Less electricity is consumed and the entire chip runs more efficiently.

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The third leg of Intel’s technology stool involves heating and cooling. Physics dictates that every electron inside the chip also gives off a bit of heat. The fewer electrons, the less heat. Since Intel’s leading-edge chips don’t consume as much electricity to begin with, they also don’t give off as much excess heat. That means cooling the end product is easier—especially if it’s in a sealed industrial enclosure. Weatherproofing becomes much easier when you’re designing with cooler, more-efficient chips that don’t need a fan.

This is where Moore’s Law comes in. Intel’s former CEO and Chairman predicted (accurately) that his company could pack twice as much electronic circuitry into a chip every 18–24 months. Even though he made his bold pronouncement back in 1965, Dr. Moore was remarkably accurate. Today, Intel’s chips pack up to 2 million times more circuitry into a single chip compared to the company’s first microprocessor in 1971.

To do that, the company invests heavily in leading-edge research and development. It operates nearly a dozen fabs around the world where its chips are
made. That's an enormous competitive advantage that many other chipmakers can't claim. In fact, Intel is one of the few companies that manufactures its own chips in-house.

Other companies, in contrast, outsource their chip production to third parties, often located halfway around the world. Called “foundries,” these independent chip-making plants share their manufacturing capacity with dozens of different (and often competing) clients.

Companies that outsource their chip production to third-party foundries can’t control their own manufacturing processes, nor can they fine-tune the production to suit their needs. Because foundries are shared and must appeal to a broad range of clients, their production equipment is comparatively generic and conservative.

Consequently, foundries are typically one or two generations behind Intel on the technology curve. They simply can’t sustain Intel’s level of investment, nor can they cater to a single customer or market requirement. Their shared business model depends upon satisfying a range of clients with technology that’s “good enough.”

Intel, on the other hand, controls every aspect of its own design, manufacture, and manufacturing. The chip designers always know precisely what manufacturing technology is at their disposal. This allows them to fine-tune each chip to take advantage of the latest Intel technology. No generic half measures or conservative “worst case” design—each Intel chip is created to maximize performance and power efficiency.

**Supply Chain Management**

The other major advantage to owning its own production facilities involves supply-chain management. Intel chips never leave the company until just before they reach the customer’s hands. That means a steady, reliable, and verifiable “chain of custody” for microprocessors and other high-value components. Customers never have to worry about counterfeit chips, or second-rate knockoffs from an untrusted source. Intel and its supply-chain partners know where each batch of components is at all times.

**Announcing 22nm Technology**

The latest advance in Intel’s steady stream of technology improvements is 22nm technology. With 22nm technology, the transistors on the chip “go 3D,” building upwards like skyscrapers on the skyline. This latest improvement makes Intel’s leading-edge devices even faster and more power-efficient than before. And it’s available only at Intel.

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**ABOUT INTEL**

Intel (NASDAQ: INTC) is a world leader in computing innovation. The company designs and builds the essential technologies that serve as the foundation for the world’s computing devices. Additional information about Intel is available at www.intel.com/pressroom and blogs.intel.com.

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1[reference to publicly available CapEx]