



# Fun Facts

## Exactly how small (and cool) is 22 Nanometers?

According to Moore's Law, the number of transistors on a chip roughly doubles every two years. As a result the scale gets smaller and transistor count increases at a regular pace to provide improvements in integrated circuit functionality and performance while decreasing costs.

Intel made a radical change in its transistor design in 2011, and then the world's first 22nm 3-D tri-gate silicon transistors entered high volume production in 2012.

Intel 22nm 3-D transistors will deliver an unprecedented combination of performance and energy efficiency in a whole range of computers, from servers to desktops, and from laptops to handheld devices.

Enjoy these facts illustrating the change in transistor size and structure, that are delivering the benefits of Moore's Law to you.



The original transistor built by Bell Labs in 1947 was large enough that it was pieced together by hand. By contrast, more than 100 million 22nm tri-gate transistors could fit onto the head of a pin.<sup>1</sup>



More than 6 million 22nm tri-gate transistors could fit in the period at the end of this sentence.<sup>2</sup>



A 22nm tri-gate transistor's gates are so small you could fit more than 4,000 of them across the width of a human hair.<sup>3</sup>



If a typical house shrunk as transistors have, you would not be able to see a house without a microscope. To see a 22nm feature with the naked eye, you would have to enlarge a chip to be larger than a house.<sup>4</sup>



Compared to Intel's first microprocessor, the 4004, introduced in 1971, a 22nm CPU runs over 4,000 times as fast and each transistor uses about 5,000 times less energy. The price per transistor has dropped by a factor of about 50,000.



A 22nm transistor can switch on and off well over 100 billion times in one second. It would take you around 2,000 years to flick a light switch on and off that many times.<sup>5</sup>



It's one thing to design a tri-gate transistor but quite another to get it into high volume manufacturing. Intel's factories produce over 5 billion transistors every second. That's 150,000,000,000,000 transistors per year, the equivalent of over 20 million transistors for every man, woman and child on earth.



The 3rd Generation Intel® Core™ processor — quad core, contains 1.48 billion transistors. If transistors were people, Intel's chip has more transistors than the population of China at approximately 1.3 billion people.

<sup>1</sup> A pin head is about 1.5 mm in diameter.

<sup>2</sup> A period is estimated to be 1/10 square millimeter in area.

<sup>3</sup> A human hair is about 90 microns in diameter.

<sup>4</sup> The smallest feature visible to the naked eye is 40 microns.

<sup>5</sup> Assumes a person can flick a light switch on and off 150 times per minute.

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