Rapid technological change brings faster and more affordable computers

Computer processing power has steadily risen because of increased transistor counts. As a result, chips become more powerful and also cheaper to produce and therefore more plentiful. Steady improvements in power and cost lead to increased and seamless integration of computers into our daily lives.

Lithography is the technique that uses light to etch transistors onto a chip. The shorter the wavelength of light used, the more detailed and more transistors are etched on the chip. In the quest to squeeze more transistors onto silicon chips, new manufacturing techniques will help to extend the life of Moore’s Law.

Multiple Patterning

Etching a transistor onto a chip involves creating a mask or stencil of the pattern. Light shines through the mask, creating the pattern on the surface of the wafer. Using multiple patterning, the process repeats using additional exposure patterns, often referred to as repeat patterns. This pattern accommodation creates a high density of transistors, with more interconnects, in some cases up to 45 layers.

3D Chip Stacking

Manufacturers pack the third dimension by moving transistors. Chip stacking takes this to a new level, stacking chips vertically and stacking them. The result is a high density of interconnected components that dramatically reduces the size of the chip package and boosts the speed at which data flows.

Extreme UV lithography (EUV)

Lithographic resolution has been improved by moving to even smaller wavelengths. Although EUV lithography has been achieved, absorption of shorter wavelengths restricts the use of reflective materials. A promising solution is the use of reflective optics - reflective projection optics for EUV lithography. EUV lithography uses a reflective mask with a wavelength of 13.8 nm, allowing smaller and more precise features to be created on a chip.

Immersed Lithography

Another way is to increase the density by using immersion lithography. This technique involves filling the space between the lens and the wafer with a liquid to improve resolution. The liquid, usually a mixture of fluorinated hydrocarbons, fills the spaces between the lens and the wafer, improving the resolution and reducing the optical blur. This technique allows for even smaller feature sizes and higher density chip designs.

As Moore's Law continues to hold, imagine the possibilities:

- Real-time natural language translation
- Imagine using cybernetic prosthesis or hearing aid for a country and having your conversation translated in real time.
- Auto-flight: imagine a car that has a virtual windshield and can drive on the road as if it were the least congested mode in the city.

Gordon Moore, co-founder of the company that produced it, in 1965 - an illustration produced by the research department of technology worldwide.