

## MOORE'S LAW

In computing, Moore's Law is really just an observation and forecast, NOT a physical law, by **Gordon Moore, Intel co-founder**, during the mid-60's and revised in 1975 stating that there is a trend where every two years or so, the amount of transistors packed inside integrated circuits doubles in number, which can be roughly translated into the prediction that computers become twice as powerful every two years.

Moore's law has stopped being true because of

- 1) Heat dissipation problems
- 2) Transistors cannot be made any smaller
- 3) The absolute physical limit on transistor size due to quantum tunneling.
- 4) Leakage happens if you have thin insulators. The smaller you go the thinner the insulators. Leakage can occur.

Transistor density is still increasing but it not the doubling predicted every two years by Moore's Law.

As the transistors become smaller, it gets hard to dissipate the power they use.

If the temperature becomes too high the CPU will melt.

Another problem with small transistors is quantum tunneling - the electronic Pathways have become so small that electrons can tunnel from one pathway to another.

Dynamic power consumption is proportional to capacitance, frequency and the square of voltage swing. So increasing clock rate increases power consumption. Also, clock rate is limited by the speed of light as the signal has to travel between transistors. Voltage swing is the biggest factor in power consumption. With reducing transistor size, voltage swing is scaled down, reducing power consumption. However, it is limited by two factors: it has to be above the transistor activation threshold, and higher than the noise to prevent errors.

In conclusion, Moore's Law no longer holds valid because of several physical limitations in electronics and because of a switch from faster processors to higher number of cores and parallel computing coming from the industry itself. There are some people who think that eventually, if there is a profound shift to a new technology in integrated circuits (e.g. quantum computing), Moore's Law or a similar trend might emerge and hold true once again, at least for a while.