

# Trends in IC design: large numbers and small dimensions

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There are several trends that have a large impact on IC design.

- Complexity increase: due to the shrinking feature sizes, the number of transistors that can be integrated on a single die is growing exponentially: Moore's law holds for 40 years now and still the IC complexity doubles every 18 months. We are moving to 250 M transistor designs that can run at several GigaHertz. Universities and other research institutes are dealing with 1 Billion transistor designs and their implications on design technology.
- Minimum feature size decrease: the increase in the number of transistors is made possible, due to the decrease in minimum feature sizes. Within a few years time the minimum feature size will be 65 nanometers. Transistor parameters will show a strong statistical distribution, which will impact the robustness.
- The number of metal layers will increase to 8 in the near future and will even grow to 10 or more. The high packing density of the transistors and the many levels of metal interconnect lead to all kinds of electrical problems that have to be solved. These problems are grouped as deep-submicron problems. Typical examples are: cross talk between neighbouring interconnect lines, parasitic capacitors, resistors and inductors in wires, electro-migration etc. In the past, most of the delay was caused in the logic cells. Today and certainly in the next generation processes, 80% or more of the total delay is due to the interconnect

In the presentation an overview of relevant trends in IC technology and design will be given. Moreover it will be shown that new modelling, design, simulation and verification techniques are needed to cope with the challenges facing us. It will be shown that a multi disciplinary approach is needed to efficiently tackle the IC design and manufacturing challenges. The role of mathematics in this will be highlighted.