

BASIC MOS TECHNOLOGY

Integrated circuits era, enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication, Thermal aspects of processing, BiCMOS technology, production of E-beam masks.

MOS transistor theory

Introduction, MOS device design equations, the complementary CMOS inverter-DC characteristics, static load MOS inverters, the differential inverter, the transmission gate, tristate inverter.

1.1 Integrated circuits era

Transistor was first invented by William.B.Shockley, Walter Brattain and John Bardeen of Bell laboratories. In 1961, first IC was introduced.

Levels of Integration:-

- i) SSI: - (10-100) transistors => Example: Logic gates
- ii) MSI: - (100-1000) => Example: counters
- iii) LSI: - (1000-20000) => Example: 8-bit chip
- iv) VLSI: - (20000-1000000) => Example: 16 & 32 bit up
- v) ULSI: - (1000000-10000000) => Example: Special processors, virtual reality machines, smart sensors.

Moore's Law:-

“The number of transistors embedded on the chip doubles after every one and a half years.” The number of transistors is taken on the y-axis and the years in taken on the x-axis. The diagram also shows the speed in MHz. the graph given in figure also shows the variation of speed of the chip in MHz.

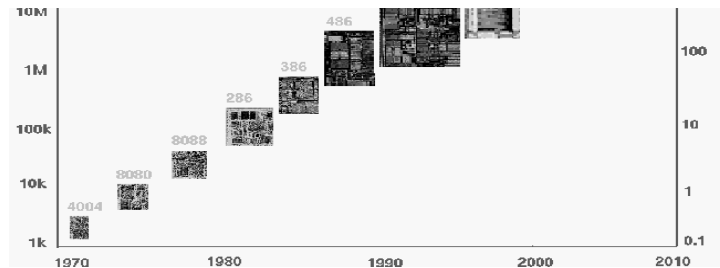


Figure 1. Moore's law.

The graph in figure2 compares the various technologies available in ICs.

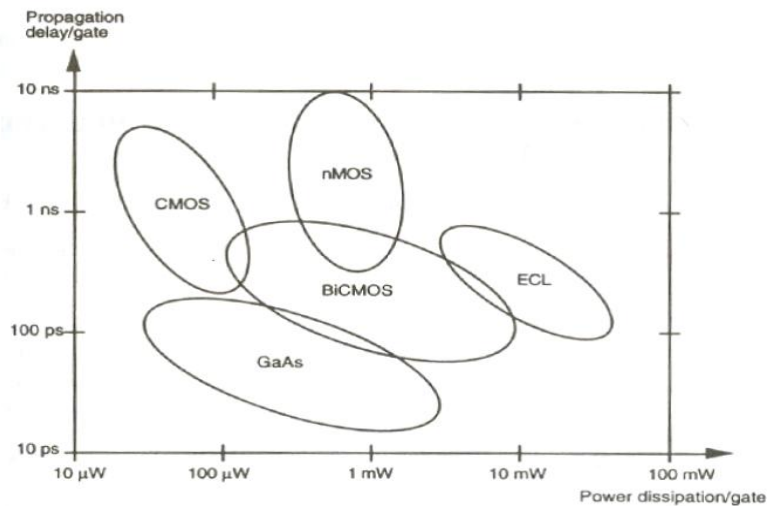


Figure 2. Comparison of available technologies.

From the graph we can conclude that GaAs technology is better but still it is not used because of growing difficulties of GaAs crystal. CMOS looks to be a better option compared to nMOS since it consumes a lesser power. BiCMOS technology is also used in places where high

driving capability is required and from the graph it confirms that, BiCMOS consumes more power compared to CMOS.

Levels of Integration:-

- i) Small Scale Integration:- (10-100) transistors => Example: Logic gates
- ii) Medium Scale Integration:- (100-1000) => Example: counters
- iii) Large Scale Integration:- (1000-20000) => Example:8-bit chip
- iv) Very Large Scale Integration:- (20000-1000000) => Example:16 & 32 bit up
- v) Ultra Large Scale Integration:- (1000000-10000000) => Example: Special processors, virtual reality machines, smart sensors

Source : <http://elearningatria.files.wordpress.com/2013/10/ece-v-fundamentals-of-cmos-vlsi-10ec56-notes.pdf>