



UNIT: 1 MOS TRANSISTOR PRINCIPLE

1. Define threshold voltage of a MOSFET.

The threshold voltage of a MOSFET is usually defined as the gate voltage where an inversion layer forms the interface between the insulating layer (oxide) and the substrate (body) of the transistor.

2. What is enhancement mode FET?

A type of FET in which there are no charge carriers present in the channel, when the gate voltage is in zero. In these devices, the increasing the gate voltage will increases the current flow from source to drain.

3. What specifications you will consider for selecting a MOSFET?

- Breakdown voltages
- Forward transconductance
- Drain source on resistance (R_{ds})
- Switching characteristics
- Zero gate voltage drain current (I_{dss})
- Input capacitance (C_i)

4. What are the steps performed to achieve lithography friendly design?

- Checking the layout confirming the design rules (spacing, trace width, shorts).
- Check for the less congested areas and increasing the spacing of the nets.

5. State different types of oxidation.

- Dry oxidation
- Wet oxidation

6. Give the major advantages of IC.

- Size is less
- High speed
- Less power dissipation.

7. What are different generations of integration circuits?

- SSI (Small Scale Integration)
- MSI (Medium Scale Integration)
- LSI (Large Scale Integration)
- VLSI (Very Large Scale Integration).

8. Give the variety of integrated circuits (ICs).

- More Specialized Circuits (MSC).
- Application Specific Integrated Circuits (ASICs).
- Systems on Chips (SOC).

9. What are the various silicon wafer preparations?

- Crystal growth and doping
- Ingot trimming and grinding
- Ingot slicing
- Wafer polishing and etching
- Wafer cleaning.



10. What are the different terminals in MOS transistors?

- Drain
- Source
- Gate.

11. What is depletion mode operation MOS?

If the channel is initially doped lightly with p-type impurity a conducting channel exists at zero gate voltage and the device is said to operate in depletion mode.

12. What is enhancement mode operation of MOS?

If the gate field must induce a channel before current can flow and the gate voltage enhances the channel current and such a device is said to the enhancement mode MOS.

13. State the different types of CMOS processes.

- p-well process
- n-well process
- Silicon on insulator process
- Twin tub process.

14. What are the steps involved in twin tub process?

- Tub formation
- Thin oxide construction
- Source and drain implantation
- Contact cut definition
- Metallization.

15. What is latch up?

Latch up is a condition in which the parasitic components give rise to the establishment of low resistance conducting paths between VDD and VSS with disastrous results. Careful control during fabrication is necessary to avoid this problem.

16. What is stick diagram?

It is used to convey information through the use of color code. Also it is the cartoon of a chip layout.

17. What are the uses of stick diagram?

- It can be drawn much easier and faster than a complex layout.
- These are especially important tools for layout built from large cells.

18. Give the various color coding used in stick diagram.

Green	-	n-diffusion
Red	-	Polysilicon
Blue	-	Metal
Yello	-	Implant

19. What are the advantages of silicon on insulator (SOI) process?

- No latch-up
- Due to absence of bulks transistor structures are denser than bulk silicon.

20. State the advantages of CMOS process.

- Low power dissipation
- High packing density
- Bidirectional capability
- Low input impedance
- Low delay sensitivity to load.

21. What are short channel devices?

Transistors with channel length less than 3 - 5 microns are termed as short channel devices. With short channel devices the ratio between the lateral and vertical dimensions are reduced.

22. State the different operating regions for an MOS transistor.

- a. Cut-off region
- b. Non-saturated region
- c. Saturated region.

23. Define threshold voltage of CMOS.

The threshold voltage, V_t for a MOS transistor can be defined as the voltage applied between the gate and the source of the MOS transistor below which the drain to source current, I_{DS} effectively drops to zero.

24. What is body effect?

The threshold voltage V_T is not a constant with respect to the voltage difference between the substrate and the source of MOS transistor. This effect is called substrate-bias effect or body effect.

25. What is channel length modulation?

The current between drain and source terminals is constant and independent of the applied voltage over the terminals. The effective length of the conductive channel is actually modulated by the applied voltage V_{DS} , increasing V_{DS} causes the depletion region at the drain junction to grow, reducing the length of the effective channel.