E-MOSFET

(Enhancement - Metal oxide semiconductor field effect Transistor)

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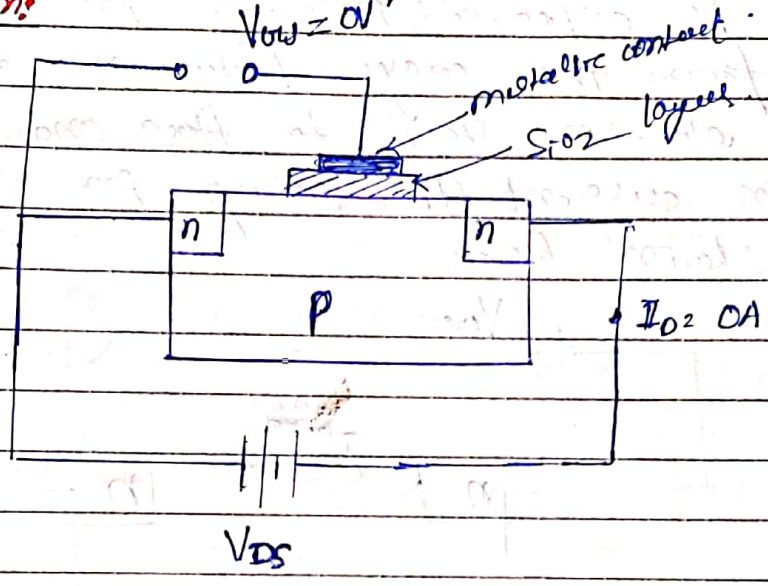
E-MOSFET:- E-MOSFET has no physical channel from source to drain because the substrate extends completely to the SiO_2 layer. E-MOSFET is operated in the enhancement mode and has no depletion mode.

Construction:



It also consists of n-channel but p-type substrate is extended to gate of the device so that there is no direct connection between the source and drain of the device.

The symbol of the E-MOSFET is shown below.

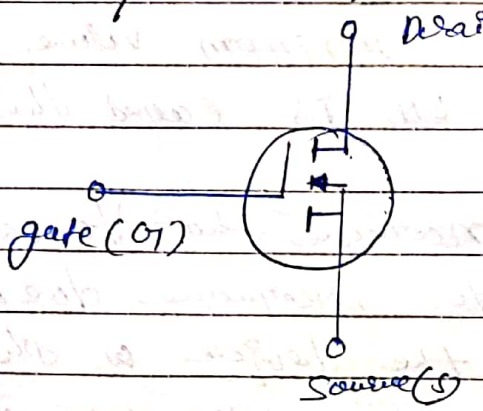


Fig: Symbol of E-MOSFET.

Operation: When $V_{GS} = 0V$, then there is no channel connection between source (S) and drain (D). And hence drain current (I_D) is equal to 0.

For this reason E-MOSFET is off.

II) When $V_{GS} > 0$ then it attracts free electrons into the p-region and combine with holes. If V_{GS} is positive enough a layer of free ions is created (induced) in the p-region and forms the ways between source to drain and electron starts to flow and hence drain current (I_D). setup in the circuit as shown below.

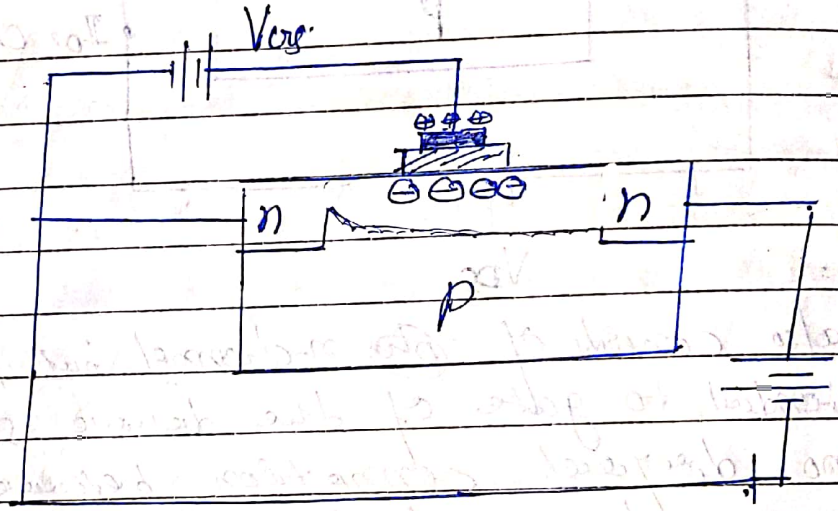
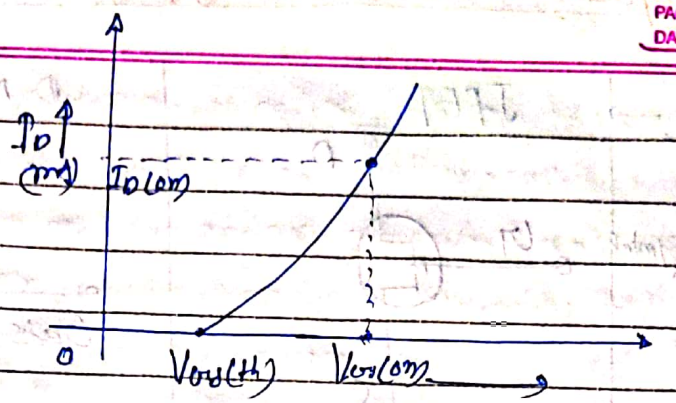


Fig: b Formation of connection b/w Source to drain.

Threshold voltage: The minimum value of V_{GS} that turns the E-MOSFET ON is called threshold voltage $V_{GS(th)}$

If we further increase the V_{GS} drain current starts to increase due to increase in channel width of the device as shown on the overleaf page. The magnitude of drain current for E-MOSFET is given by:

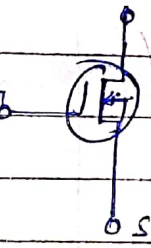
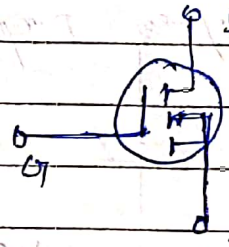
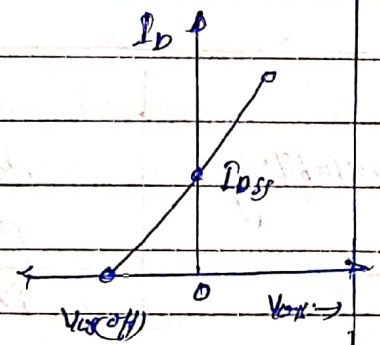
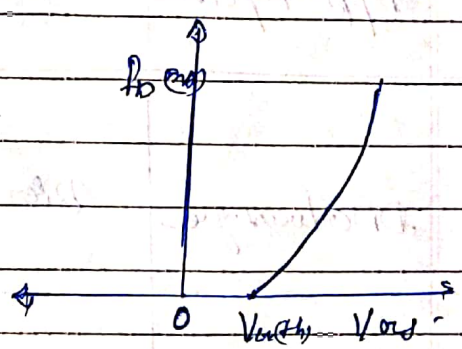
$$I_D = k (V_{GS} - V_{GS(th)})^2$$



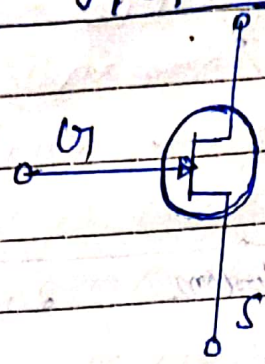
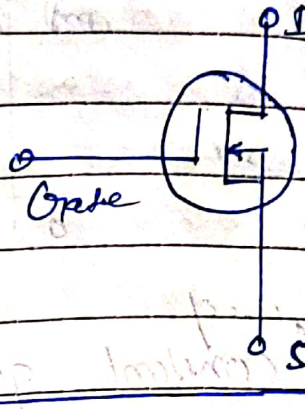
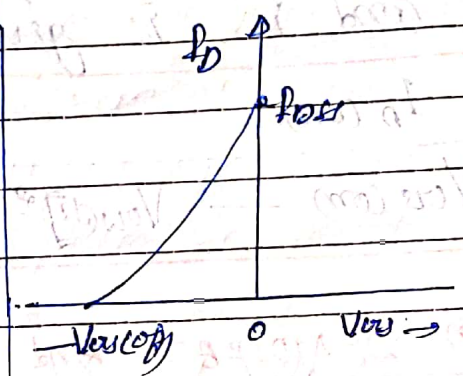
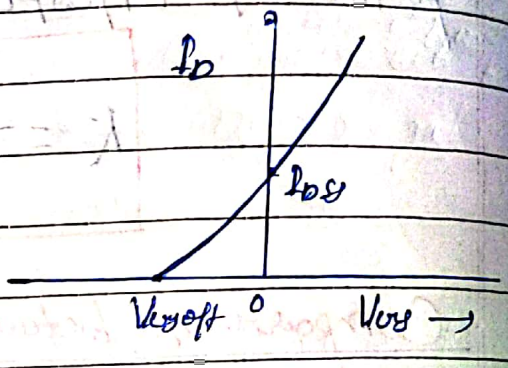
The value of constant quantity (K) depends up the particular particular E-MOSFET, and it is given by,

$$K = \frac{I_{D(on)}}{[V_{GS(on)} - V_{GS(th)}]^2}$$

Comparision between D-MOSFET And E-MOSFET.

Devices	D-MOSFET	E-MOSFET
I) Schematic symbol		
II) Transconductance curve		
III) Modes of operation	Depletion mode and Enhancement mode.	Enhancement mode only.

Comparison between JFET and D-MOSFET.

Devices →	JFET	D-MOSFET.
I) Schematic symbol		
II) Transconductance curves.		
III) Modes of operation	Depletion only	Depletion & enhancement mode only.
IV) I/p impedance	very high	Higher than JFET.
V) Disadvantage	Bias instability	Bias instability & more sensitive to change in temperature.