ENHANCEMENT MODE TRANSISTOR ACTION

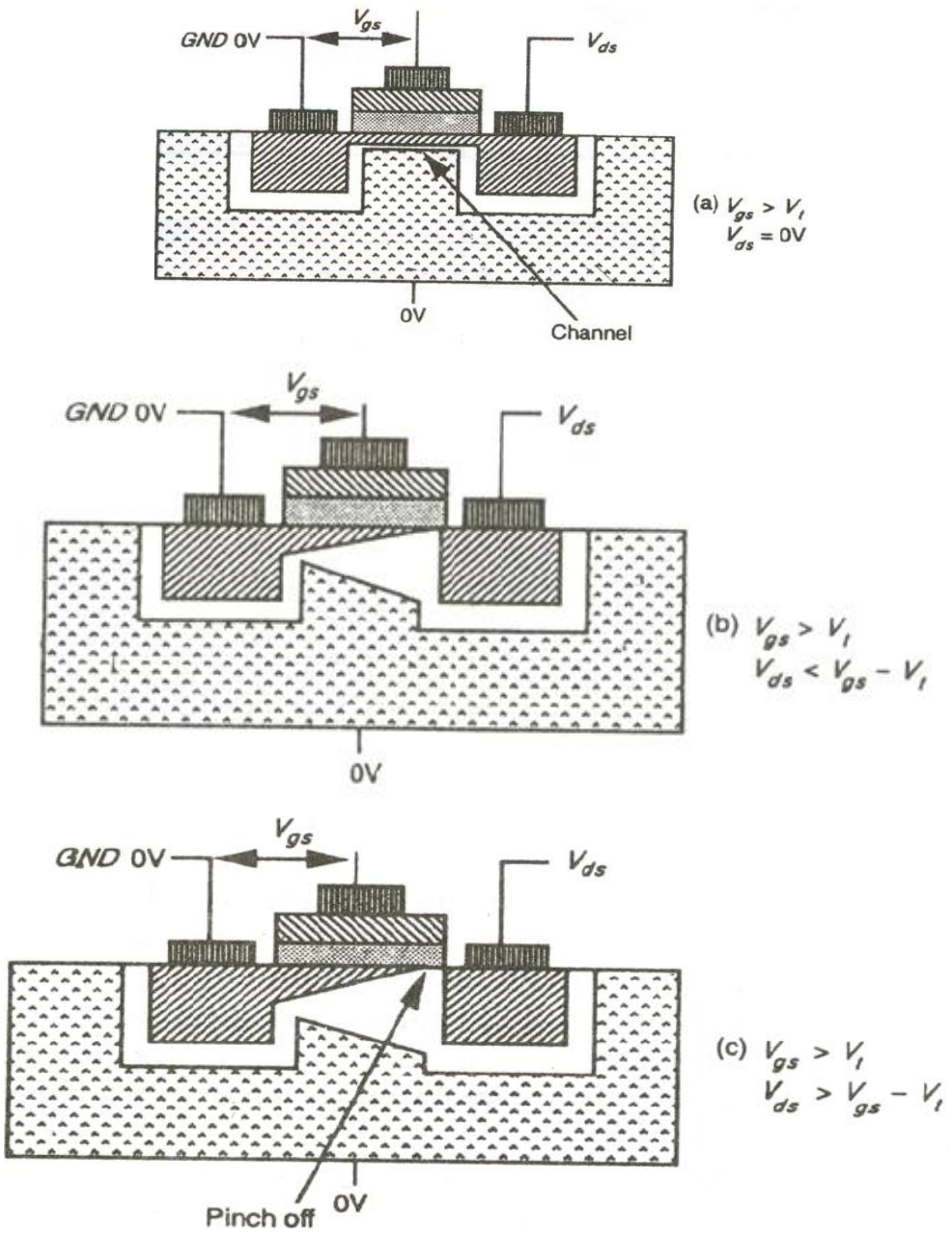

Figure7. (a)(b)(c) Enhancement mode transistor with different Vds values

To establish the channel between the source and the drain a minimum voltage (Vt) must be applied between gate and source. This minimum voltage is called as “Threshold Voltage”. The complete working of enhancement mode transistor can be explained with the help of diagram a, b and c.

a) Vgs > Vt
Vds = 0

Since Vgs > Vt and Vds = 0 the channel is formed but no current flows between drain and source.

b) Vgs > Vt

Vds < Vgs - Vt

This region is called the non-saturation Region or linear region where the drain current increases linearly with Vds. When Vds is increased the drain side becomes more reverse biased (hence more depletion region towards the drain end) and the channel starts to pinch. This is called as the pinch off point.

c) Vgs > Vt

Vds > Vgs - Vt

This region is called Saturation Region where the drain current remains almost constant. As the drain voltage is increased further beyond (Vgs-Vt) the pinch off point starts to move from the drain end to the source end. Even if the Vds is increased more and more, the increased voltage gets dropped in the depletion region leading to a constant current. The typical threshold voltage for an enhancement mode transistor is given by Vt = 0.2 * Vdd.

Depletion mode Transistor action

We can explain the working of depletion mode transistor in the same manner, as that of the enhancement mode transistor only difference is, channel is established due to the implant even when Vgs = 0 and the channel can be cut off by applying a –ve voltage between the gate and source. Threshold voltage of depletion mode transistor is around 0.8*Vdd.

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