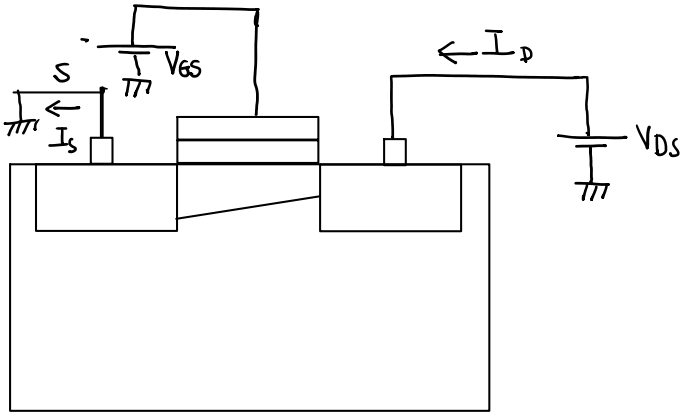
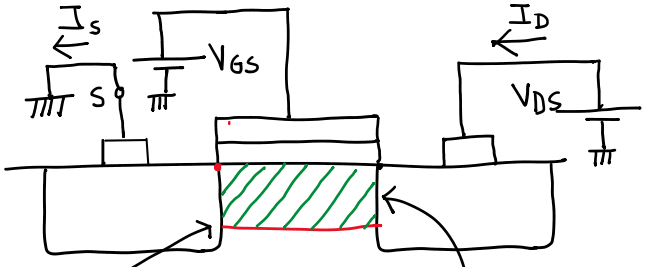
MOSFET Region

Friday, November 15, 2024 9:19 AM

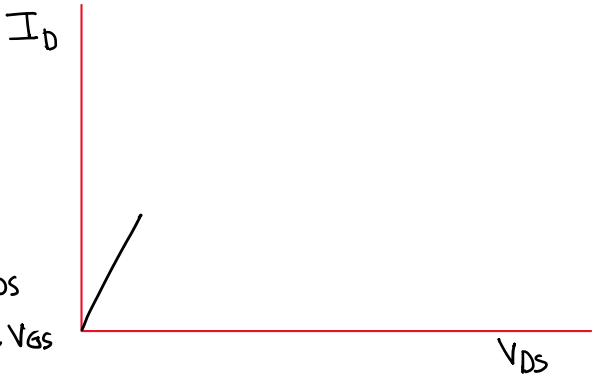


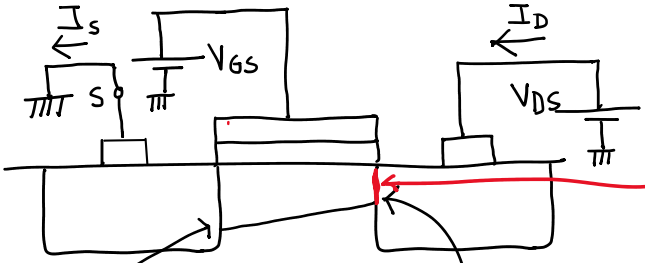


Source end Voltage: V_{GS}

Drain end Voltage: $V_{GS}-V_{DS}$

for small V_{DS}: $V_{GS}-V_{DS} \approx V_{GS}$



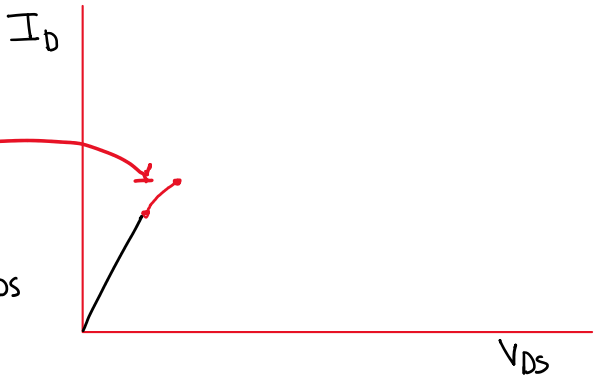


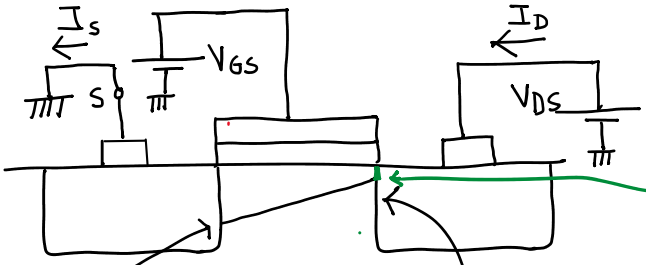
Source end Voltage: V_{GS}

Drain end Voltage: $V_{GS}-V_{DS}$

for increasing V_{DS}:

$V_{GS}-V_{DS} > V_T$

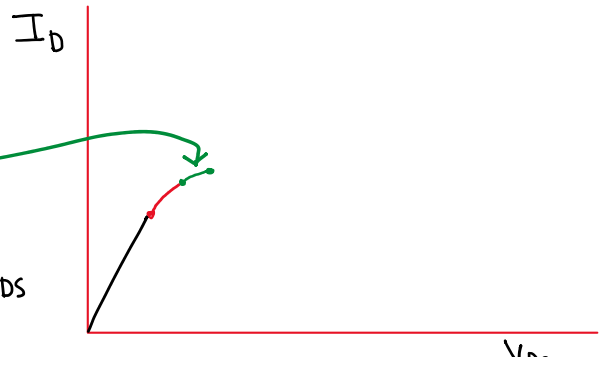




Source end Voltage: V_{GS}

Drain end Voltage: $V_{GS}-V_{DS}$

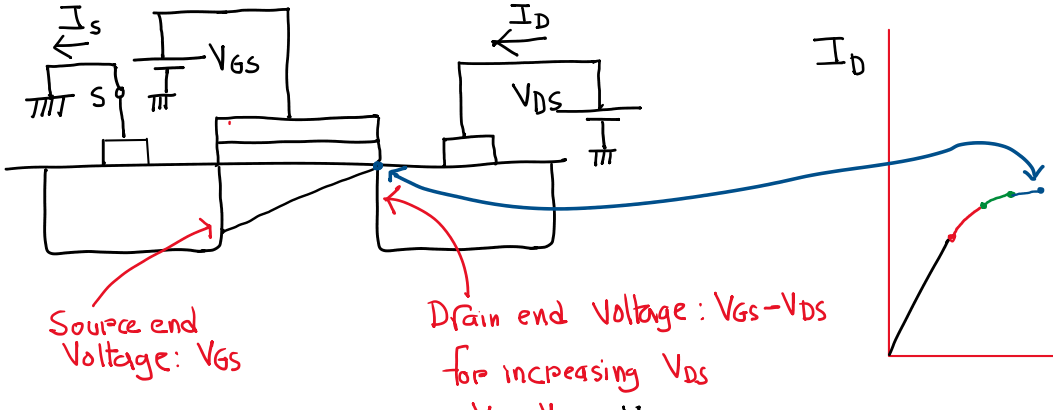
for increasing V_{DS}

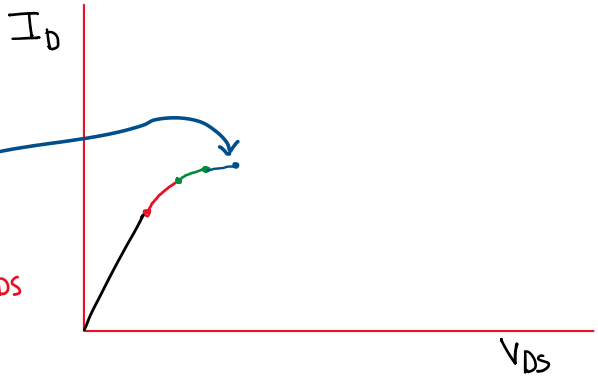


Source end Voltage: V_{GS}

Drain end Voltage: $V_{GS}-V_{DS}$ for increasing V_{DS}

$V_{GS}-V_{DS} > V_T$

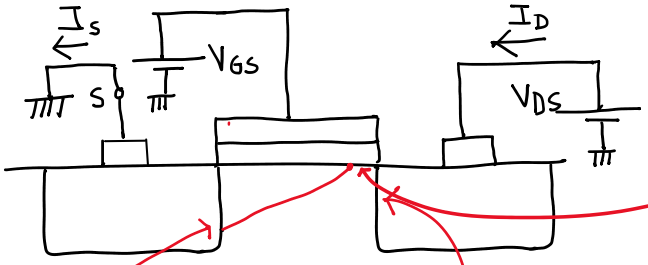


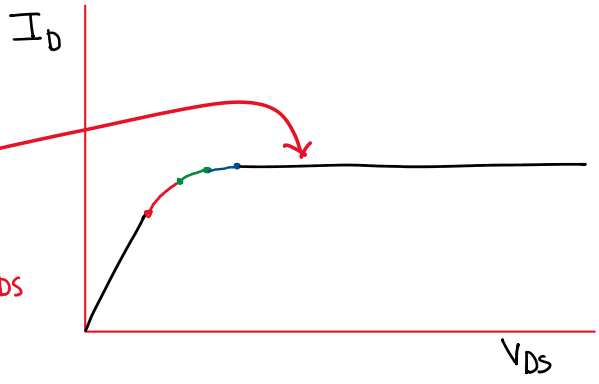


Source end Voltage: V_{GS}

Drain end Voltage: $V_{GS}-V_{DS}$ for increasing V_{DS}

$V_{GS}-V_{DS} = V_T$

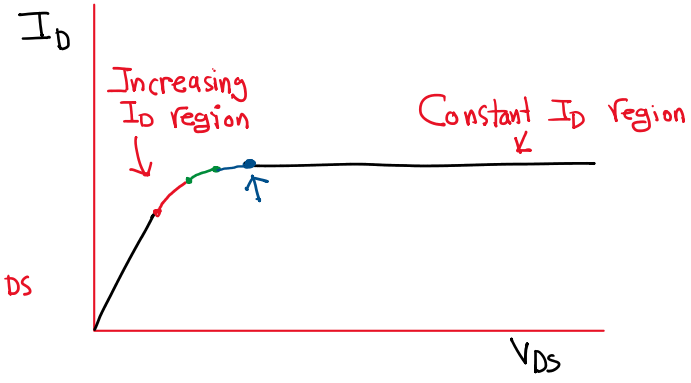




Source end Voltage: V_{GS}

Drain end Voltage: $V_{GS}-V_{DS}$ for increasing V_{DS}

$V_{GS}-V_{DS} < V_T$



Increasing I_D region $\rightarrow$ $V_{GS}-V_{DS} > V_T$ $\rightarrow$ channel exists at drain end

Constant I_D region $\rightarrow$ $V_{GS}-V_{DS} < V_T$ $\rightarrow$ No channel exists at drain end

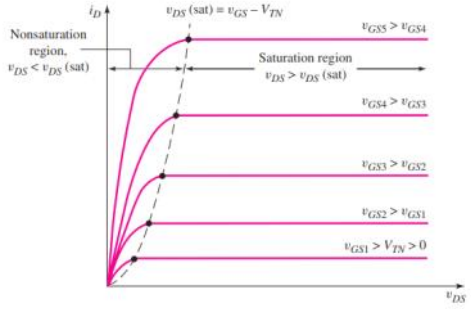


Figure 3.10 Family of i_D versus v_{DS} curves for an n-channel enhancement-mode MOSFET. Note that the $v_{DS}(\text{sat})$ voltage is a single point on each of the curves. This point denotes the transition between the nonsaturation region and the saturation region

$$i_D = K_n\left[2(v_{GS} - V_{TN})v_{DS} - v_{DS}^2\right]$$

$$K_n = \frac{W\mu_n C_{ox}}{2L}$$

$$i_D = K_n(v_{GS} - V_{TN})^2$$