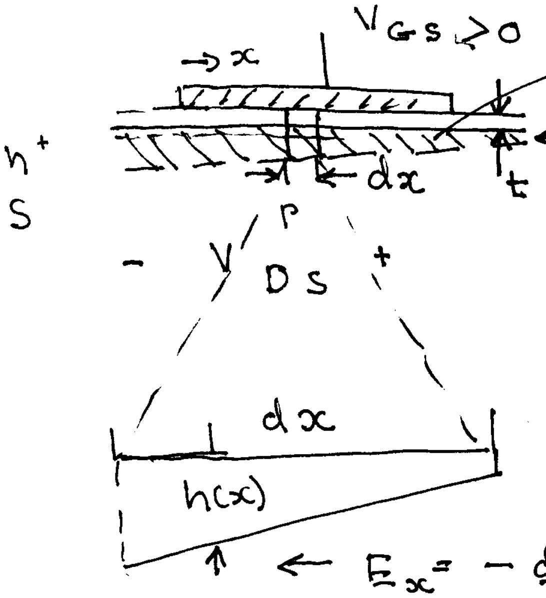
FET

$- \leftarrow$ V_{DS} $\longrightarrow + \leftarrow$ want to attract electrons



$\rightarrow x$ W = width out of paper plane

$$V(x) = (V_{GS} - v(x) - V_t)$$

$\leftarrow E_x = -\frac{dV}{dx}$

$$dC = \frac{\epsilon\, d(\overbrace{\text{Area}}^{W\,dx})}{t} \quad \left\{ \begin{array}{l} \epsilon \hat{=} 12. \times \epsilon_0 \\ = 12 \times 8.85 \times 10^{-12} \text{ F/m} \end{array} \right.$$

$$dq = -(\overbrace{C_{ox} W\, dx}) V(x) \qquad C_{ox} = \frac{\epsilon}{t} \; [\text{F/m}^2]$$

called mobility $(m^2/(V\,sec))$

$v = -\mu E_x = +\mu_n \frac{dV}{dx}$ — just frictional result since force $= qE_x$

$$\text{Current}\left(\frac{\text{Coul}}{\text{sec}}\right) = \frac{dq}{d\text{Volume} = W\,dx\,t}\,(\overbrace{d\,\text{Area}}^{Wt})\,\text{speed} = -C_{ox} W V(x) \mu_n \frac{dV}{dx}$$

$$\therefore\; i_D = +C_{ox} W V(x) \mu_n \frac{dV}{dx} = \textbf{const} \text{ (same anywhere in channel)}$$

Multiply by dx and Integrate to find $V(x)$ — Hambley = $2KL$

$$\int_0^L i_D\, dx = i_D L = +C_{ox} W \mu_n \left[(V_{GS} - V_t) v_{DS} - \frac{1}{2} v_{DS}^2\right]$$

<u>Saturation</u> $v_{DS} = (V_{GS} - V_t)$ - <u>defining curve</u>

Hambley = K_P

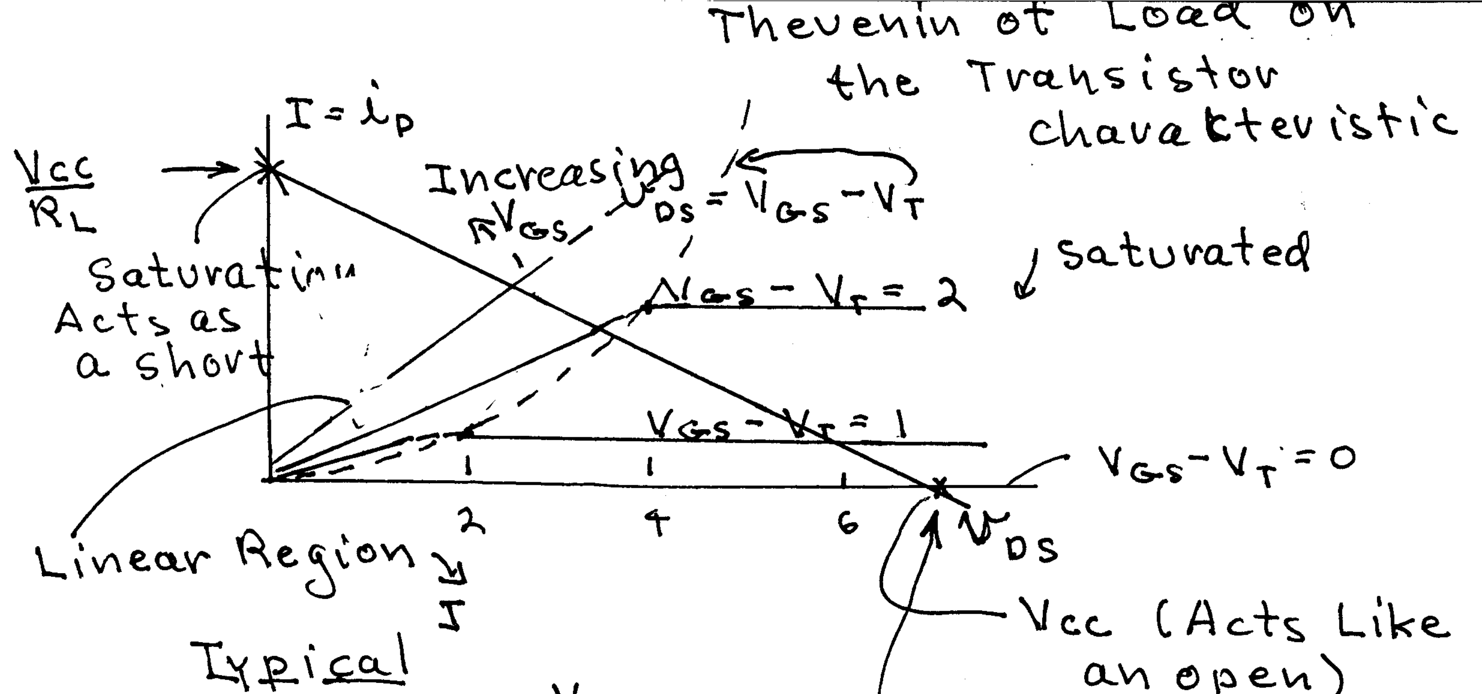
$$i_D = +C_{ox} \frac{W}{L} \mu_n \frac{1}{2} (V_{GS} - V_T)^2$$

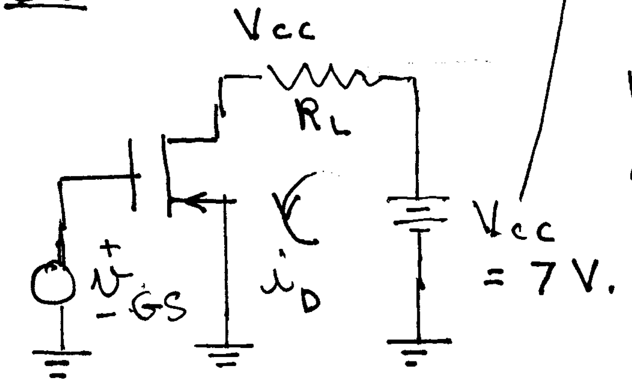
<u>Linear Region</u> $v_{DS} \ll (V_{GS} - V_T)$

$$i_D \simeq +C_{ox} \frac{W}{L} \frac{\mu_n}{2} 2(V_{GS} - V_T) v_{DS}$$

Design Parameters

$$\text{Hambley's } K = \frac{W}{L} \frac{K_P}{2}$$





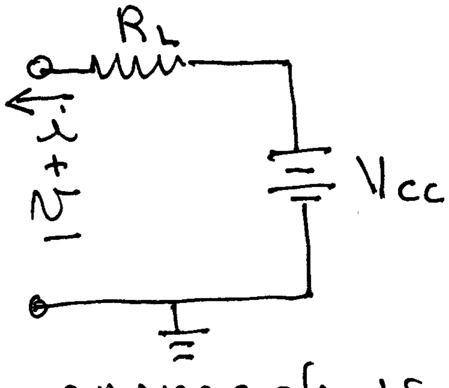
KVL

$v_{DS} = -R_L i_D + V_{CC}$

when $v_{DS} = 0$

$i_D = \frac{V_{CC}}{R_L}$

The line, which is the Thevenin equivalent of the load circuit is called the "load line". Its simply this



The negative slope is simply the opposite reference for current

The solution approach is the same as for the diode but we can now "move" the solution with v_{GS}