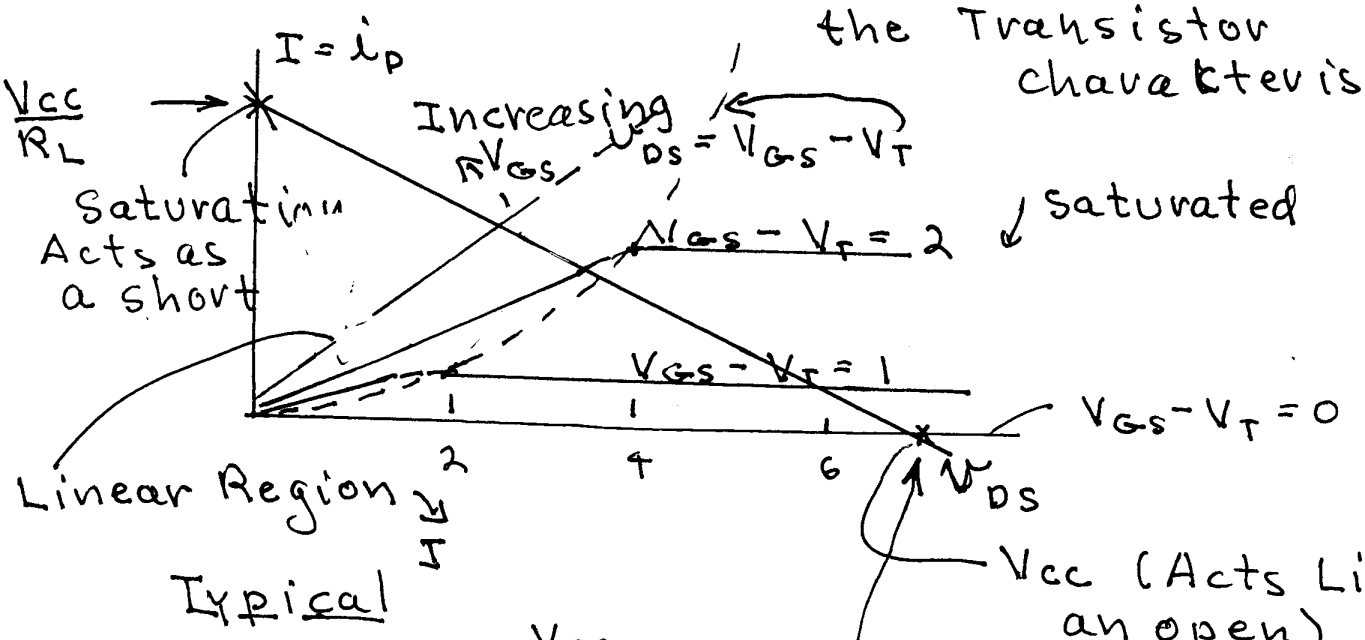
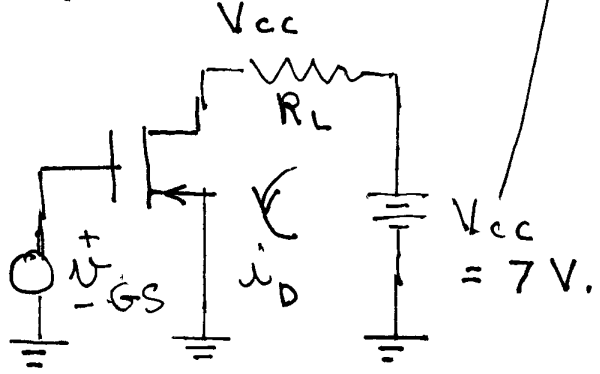
Nos Inverter
Passive Load

Thevenin of Load on the Transistor Characteristic





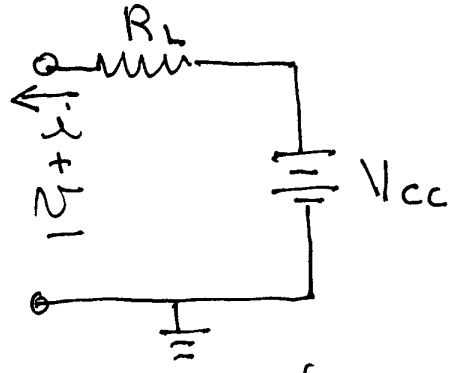
KVL

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

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}

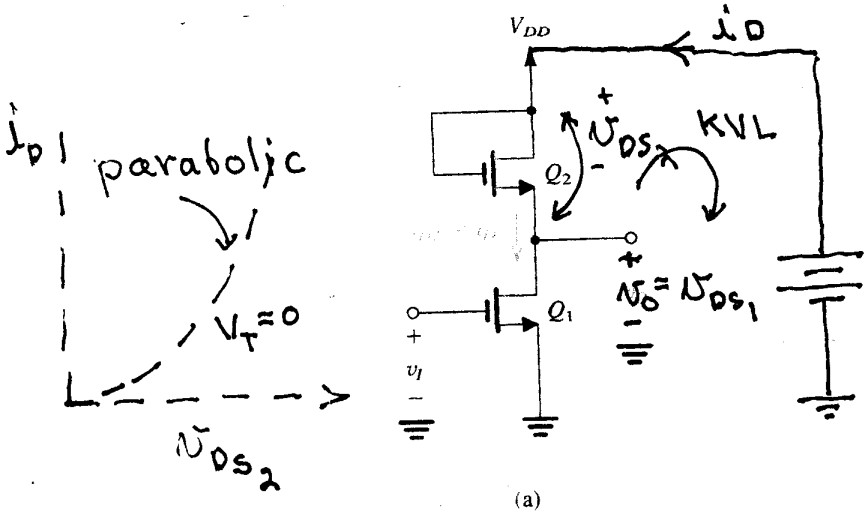
MOS Inverter With Active Load

Connecting gate to drain $\Rightarrow v_{ds} = v_{gs}$

Thus $i_D = 2K\left[(v_{GS_2} - V_{T_2})v_{DS_2} - \frac{1}{2}v_{DS_2}^2\right]$

Saturation $v_{DS} = v_{GS_2} - V_{T_2}$; $i_D = K(v_{GS_2} - V_T)^2$

with gate tied to drain $v_{DS_2} = v_{GS_2}$ so for $V_T > 0$ always saturated



(a)

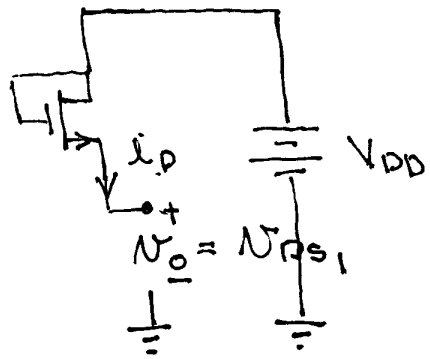
$v_{DS_1} + v_{DS_2} = V_{DD}$

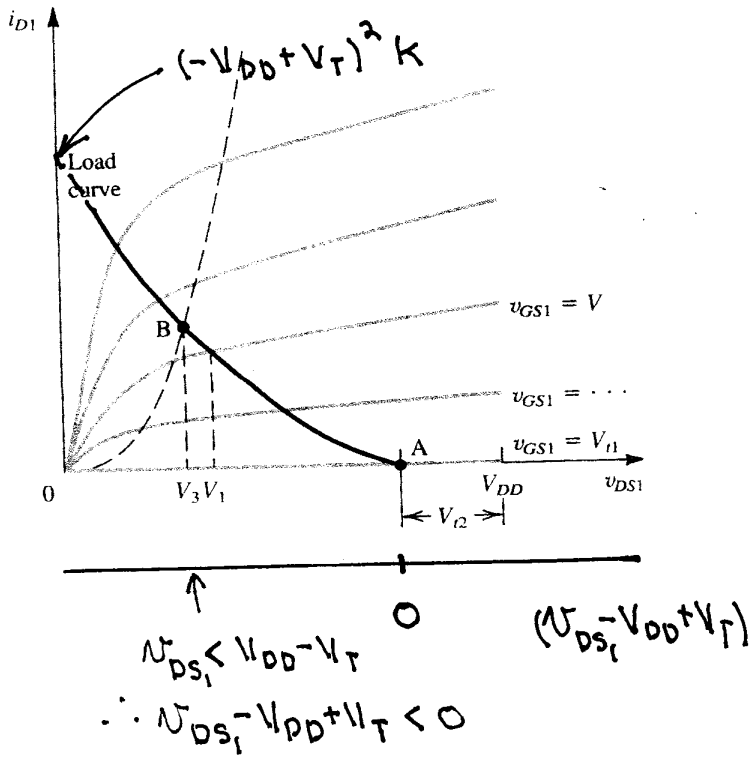
when $v_{GS_1} = V_{T_1}$; $i_D = 0$

$v_{DS_1} = V_{DD} - V_{T_2}$

$v_{DS_2} = V_{T_2} = v_{GS_2}$ to satisfy KVL

Thevenin of





$v_O = V_{DD} - v_{GS_1}$

$v_{DS_1} = V_{DD} - \left(\sqrt{\frac{i_D}{K}} + V_T\right)$

$i_D = (v_{DS_1} - V_{DD} + V_T)^2 K$