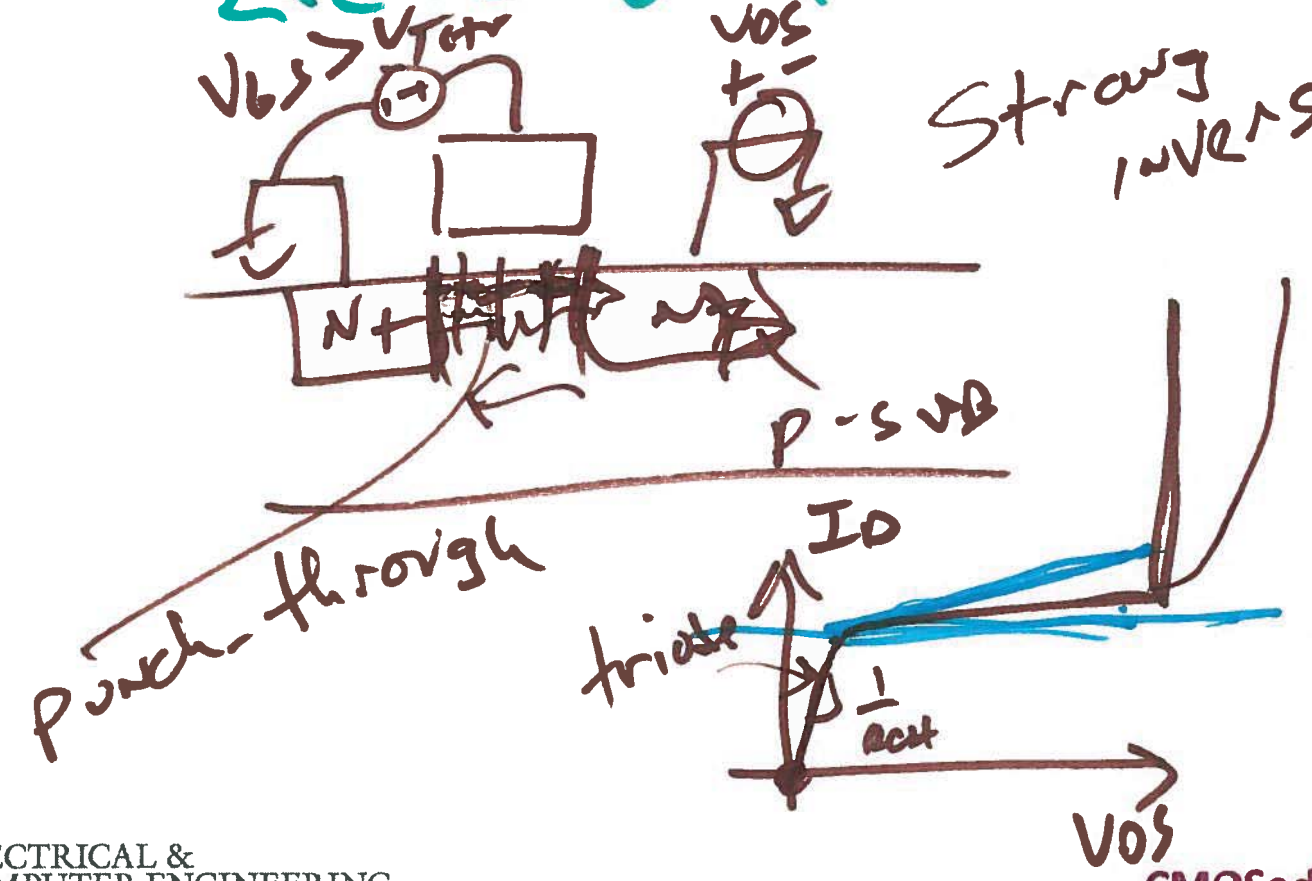
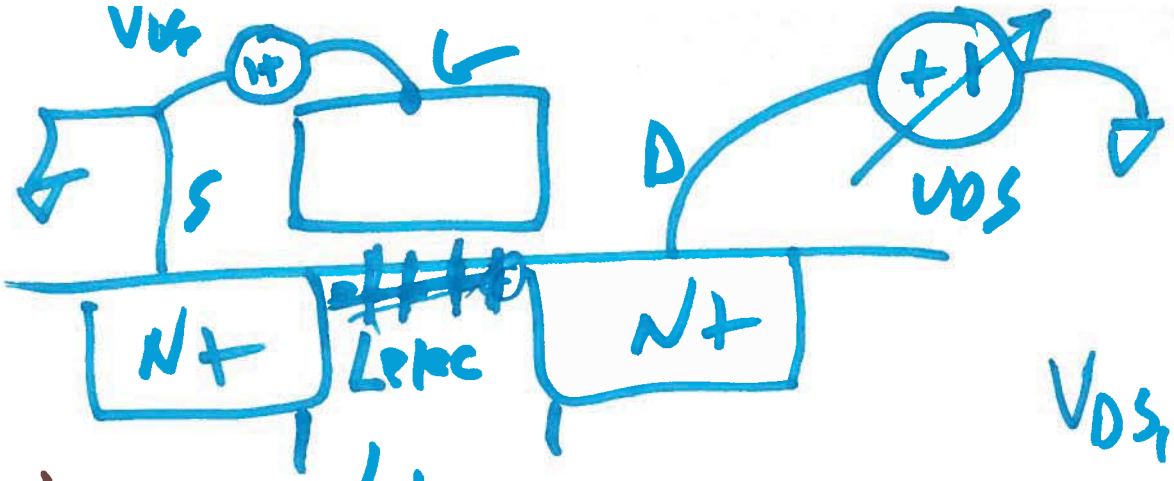
EE 421/ECG 621

Oct. 10, 2016

$$R_{CH} = \int_0^L dR$$

Lecture 12





L_{drawn}

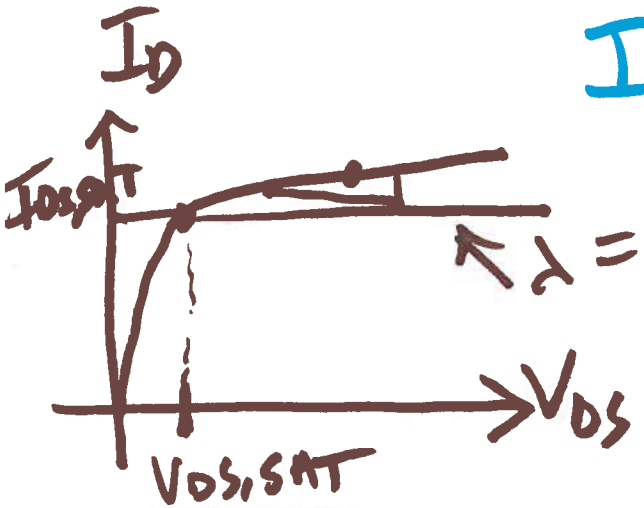
$L_{eff,n} = L_{drawn} - 2L_D$

λ = channel length modulation parameter $[V^{-1}]$

k_n' = transconductance parameter $[\mu A/V^2]$

$V_{DS,SAT} = V_{GS} - V_{THN}$

$$I_D = \frac{k_n'}{2} \cdot \frac{W}{L_{eff,n}} (V_{GS} - V_{THN})^2$$

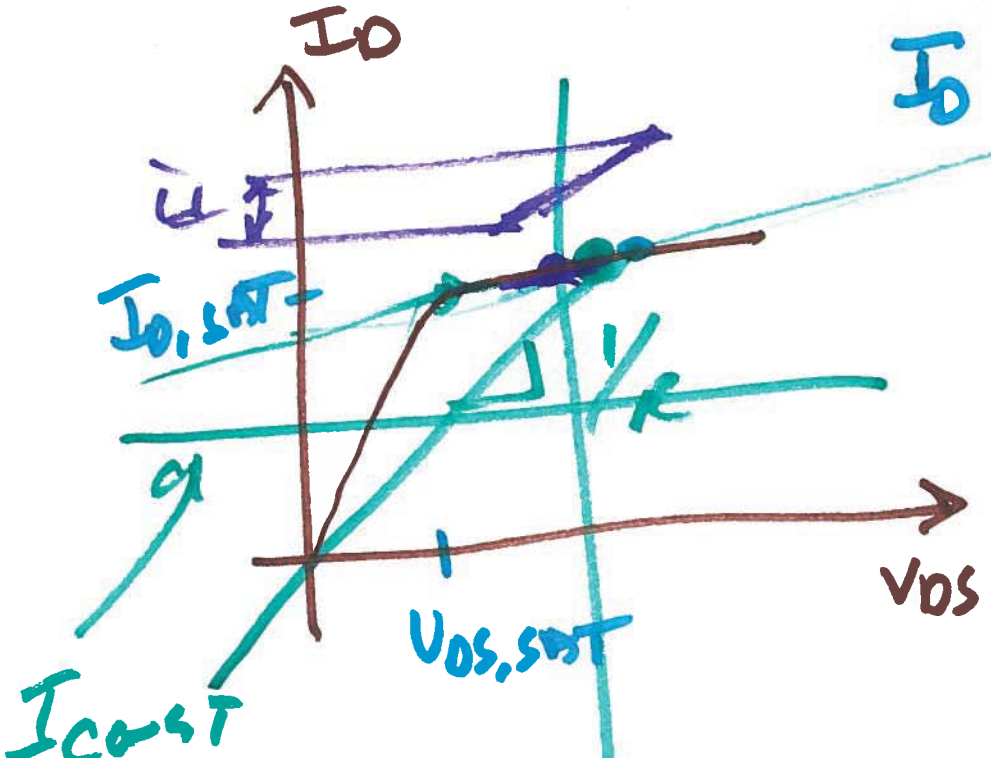


$$I_D = \frac{k_n'}{2} \cdot \frac{W}{L} (V_{GS} - V_{THN})^2 (1 + \lambda (V_{DS} - V_{DS,SAT}))$$

$I_{DS,SAT}$

$V_{DS} > V_{DS,SAT} = V_{GS} - V_{THN}$

$V_{GS} > V_{THN}$

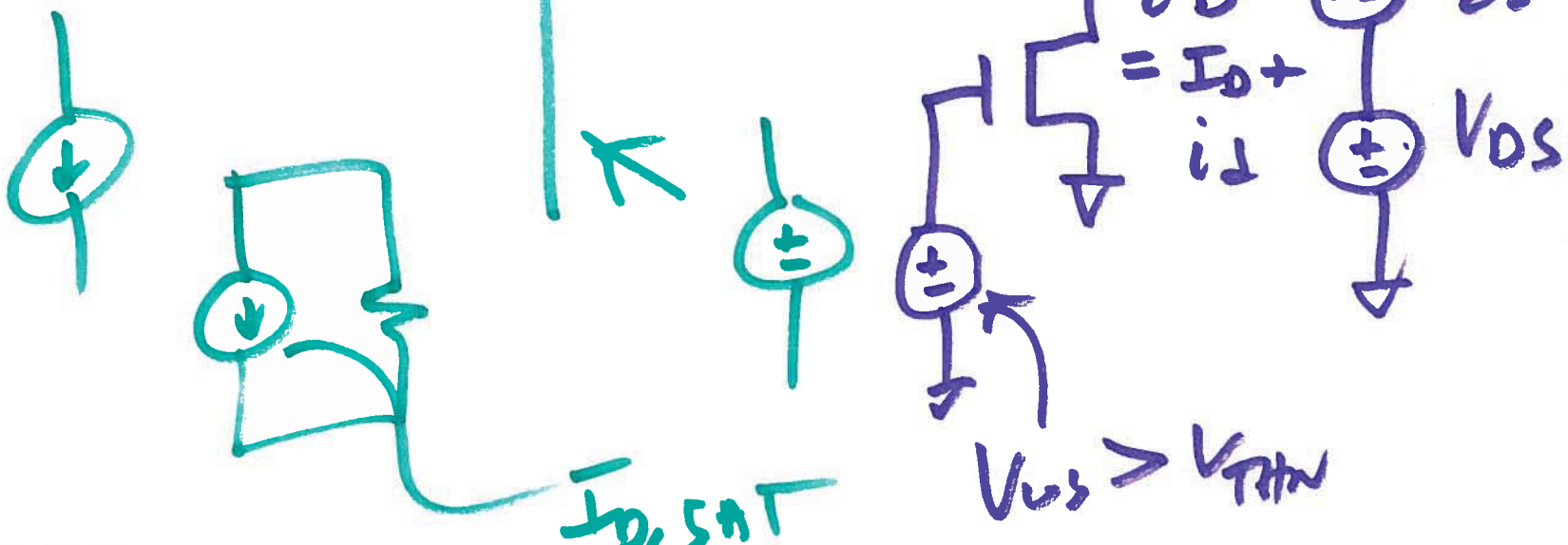


$$I_D = \frac{k'_n}{2}\frac{W}{L}(V_{GS}-V_{THN})^2 \cdot (1+\lambda(V_{DS}-V_{DS,SAT}))$$

$$= I_{D,SAT} \cdot (1+\lambda(V_{DS}-V_{DS,SAT}))$$

$$v_{DS} = v_{ds} + V_{DS}$$

AC DC

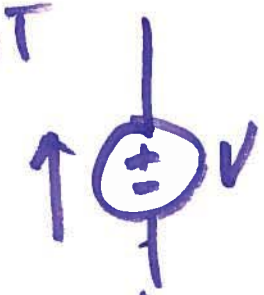


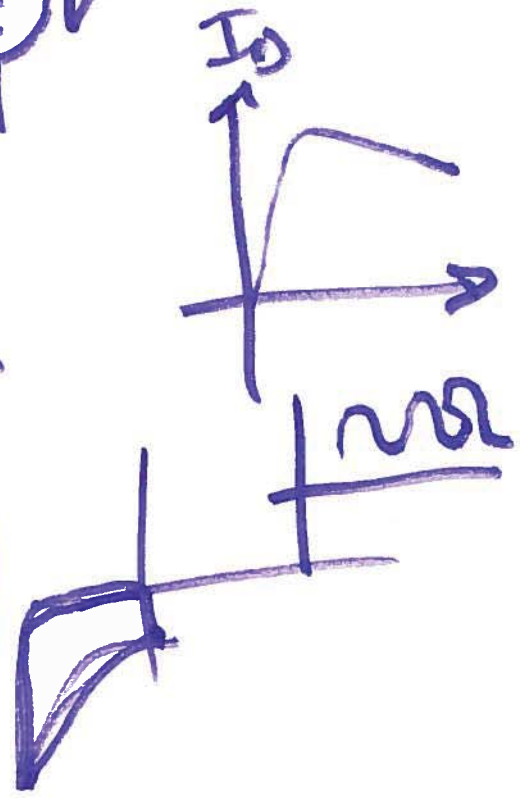
$$\frac{1}{r_o} = \frac{\delta i_D}{\delta v_{DS}}\Bigg|_{\substack{I_D=CNST \\ V_{DS}=CNST}} = \frac{\delta}{\delta v_{DS}}\left[\frac{K_P}{2}\cdot\frac{W}{L}\left(V_{GS}-V_{THN}\right)^2\cdot\left(1+\lambda\left(v_{DS}+V_{DS}-V_{THN}\right)\right)\right]$$

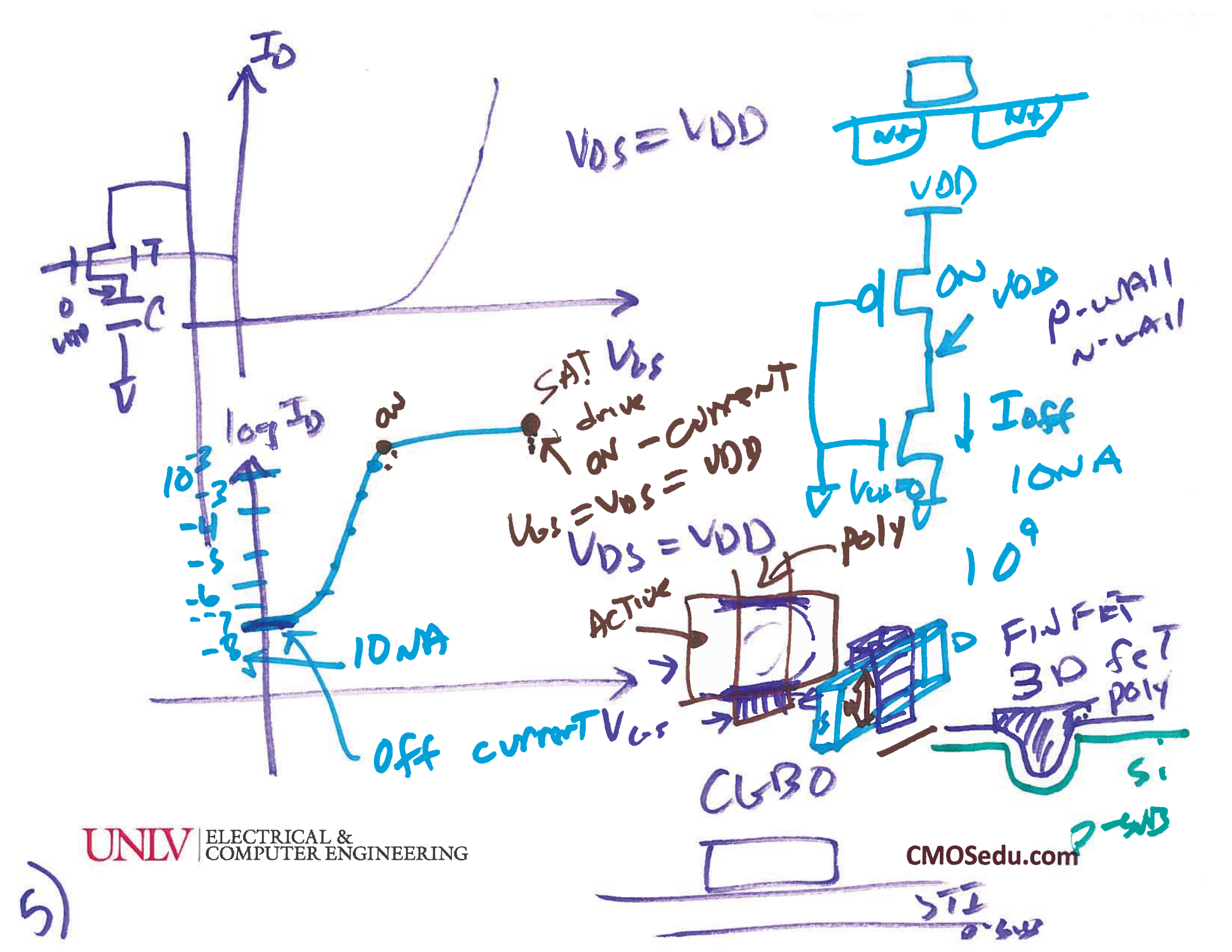
$$= I_{D,SAT}\cdot\lambda\frac{\delta v_{DS}}{\delta v_{DS}}$$

$$r_o = \frac{1}{\lambda I_{D,SAT}}$$

OUTPUT RESISTANCE







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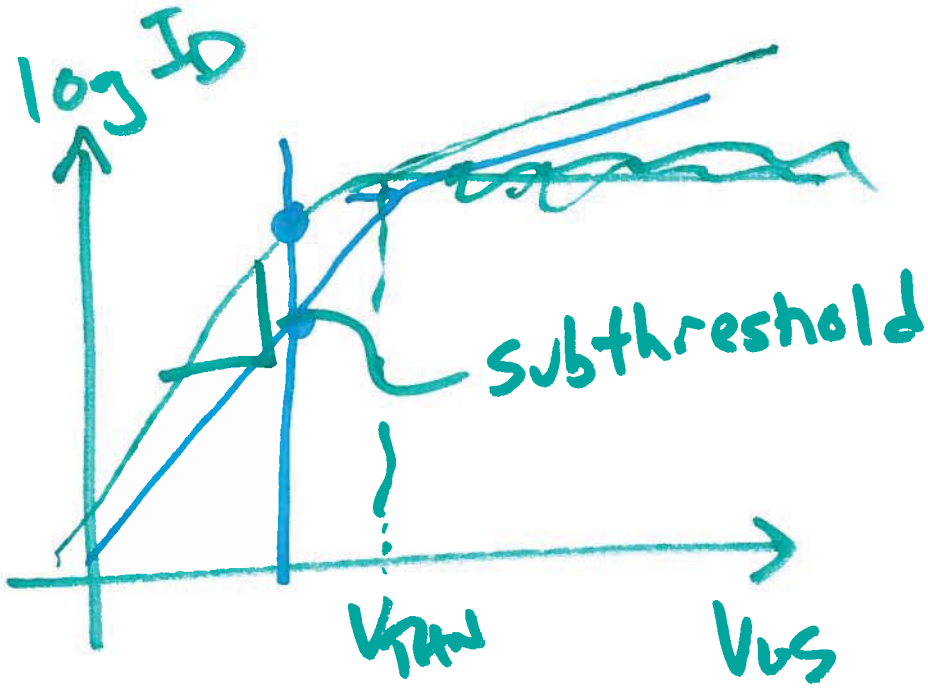
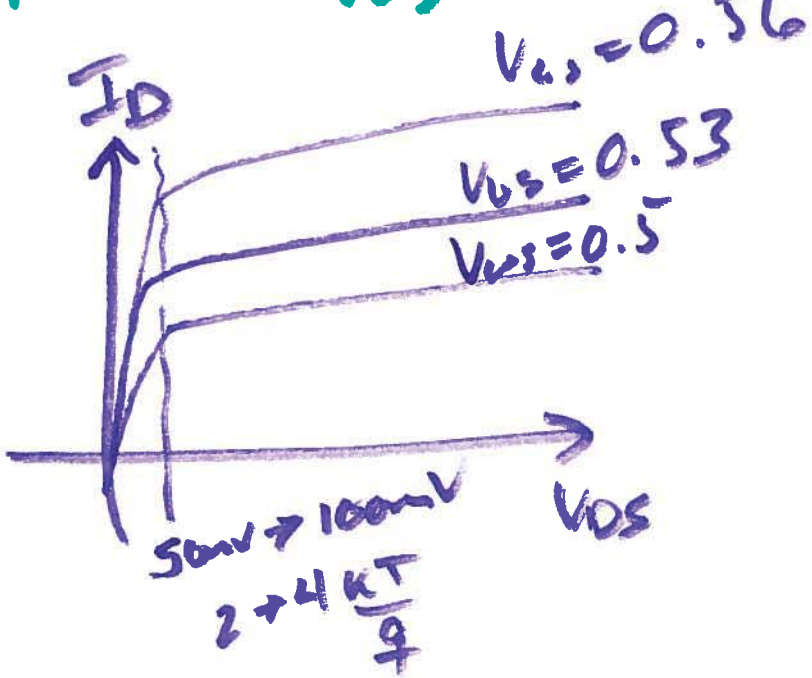
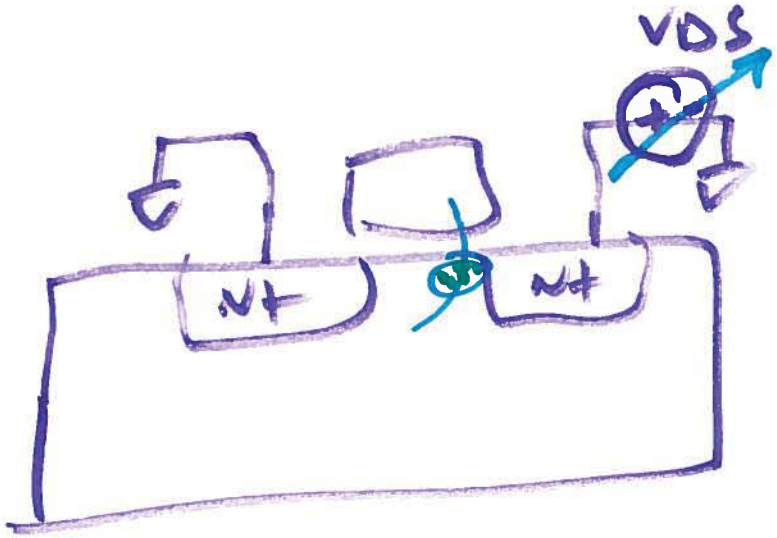
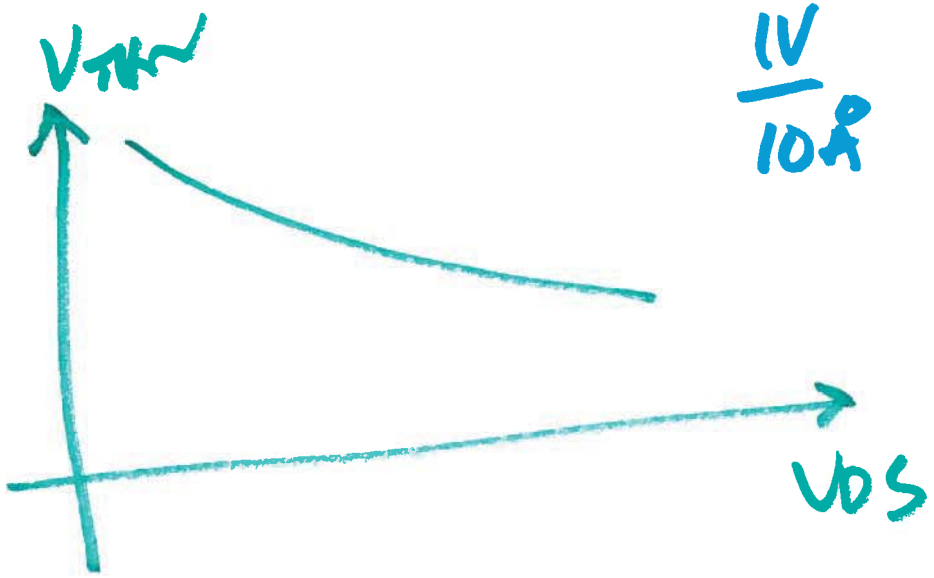


$$I_D = I_{00} e^{V_{GS}/nV_T}$$





Drain-Induced barrier lowering (DIBL)



$\frac{1V}{10A}$