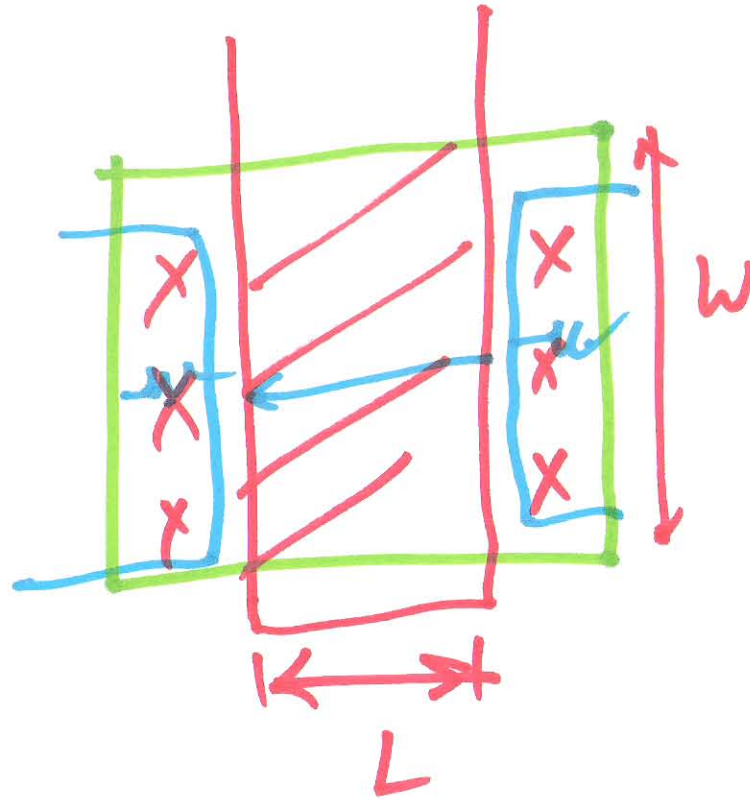


Lecture 10

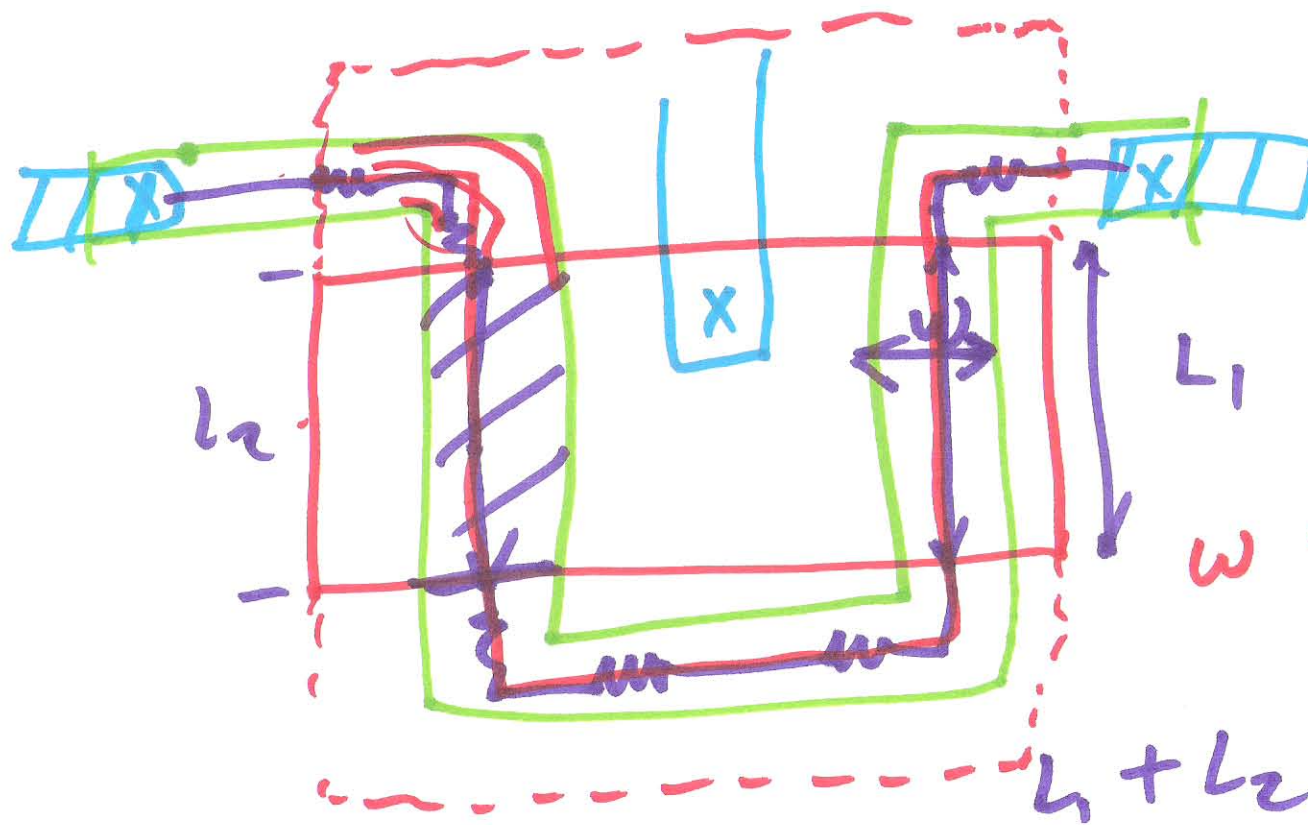
EEH21 / ECG 621

9/28/2015

$L \gg W$

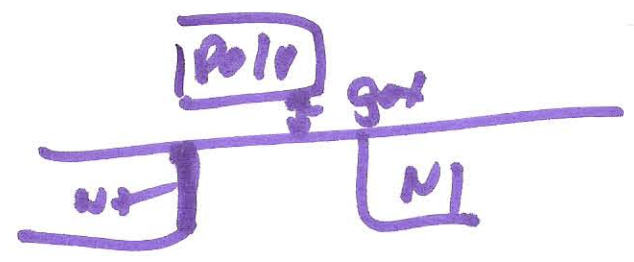


)

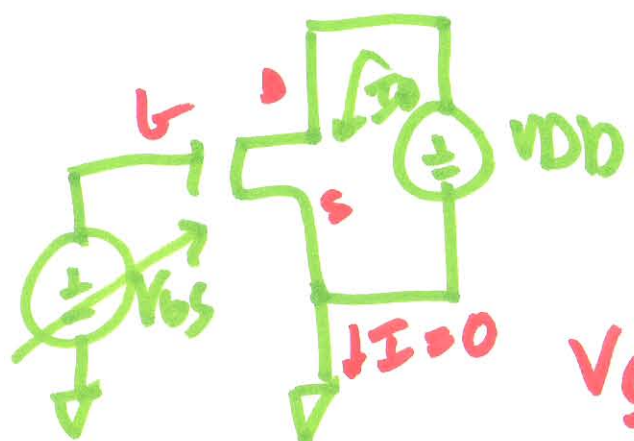
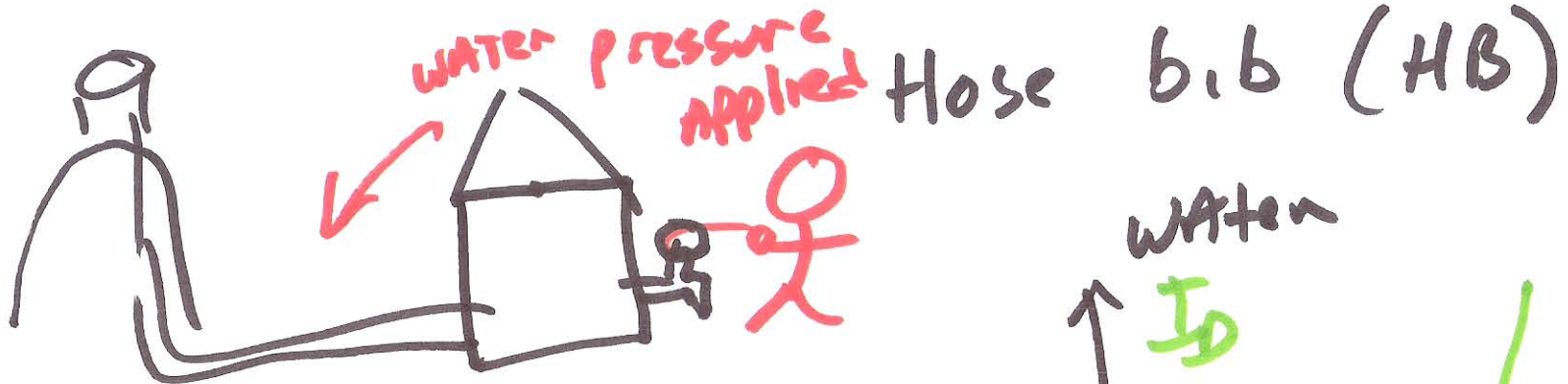


$\frac{w}{L} \ll 1$
 $L \leftarrow L$ is big

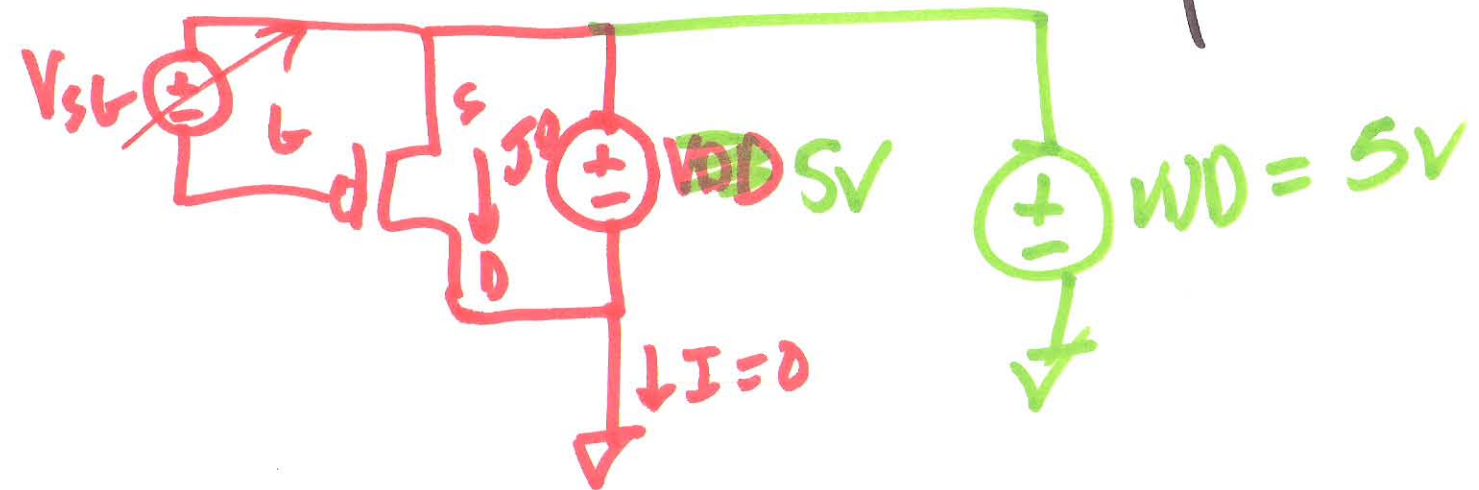
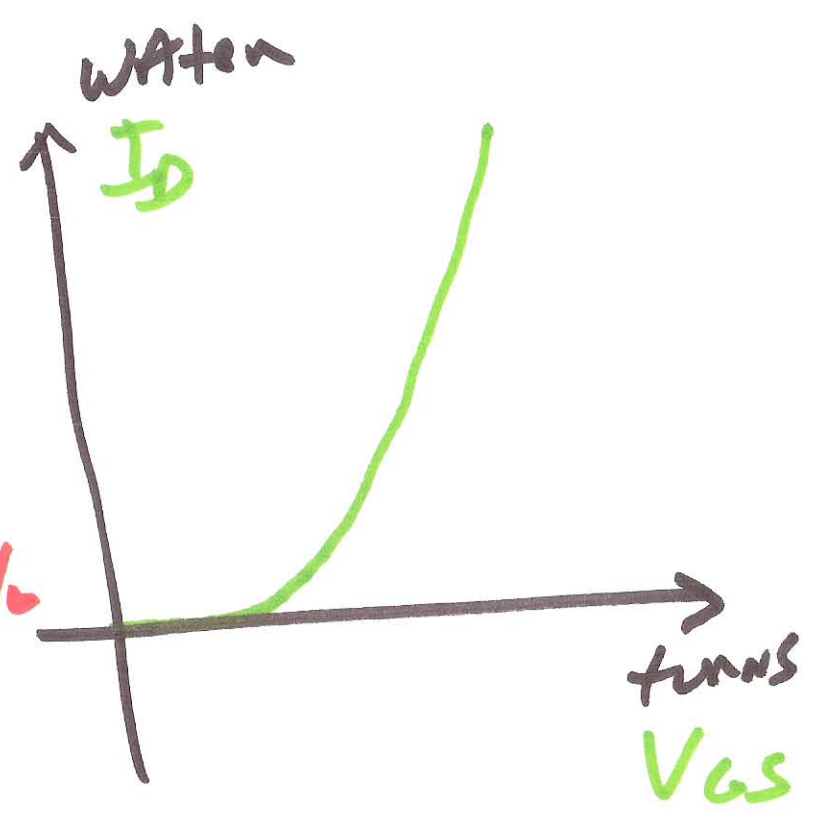
w stays the same



2)



$V_{gs} = V_s - V_b$

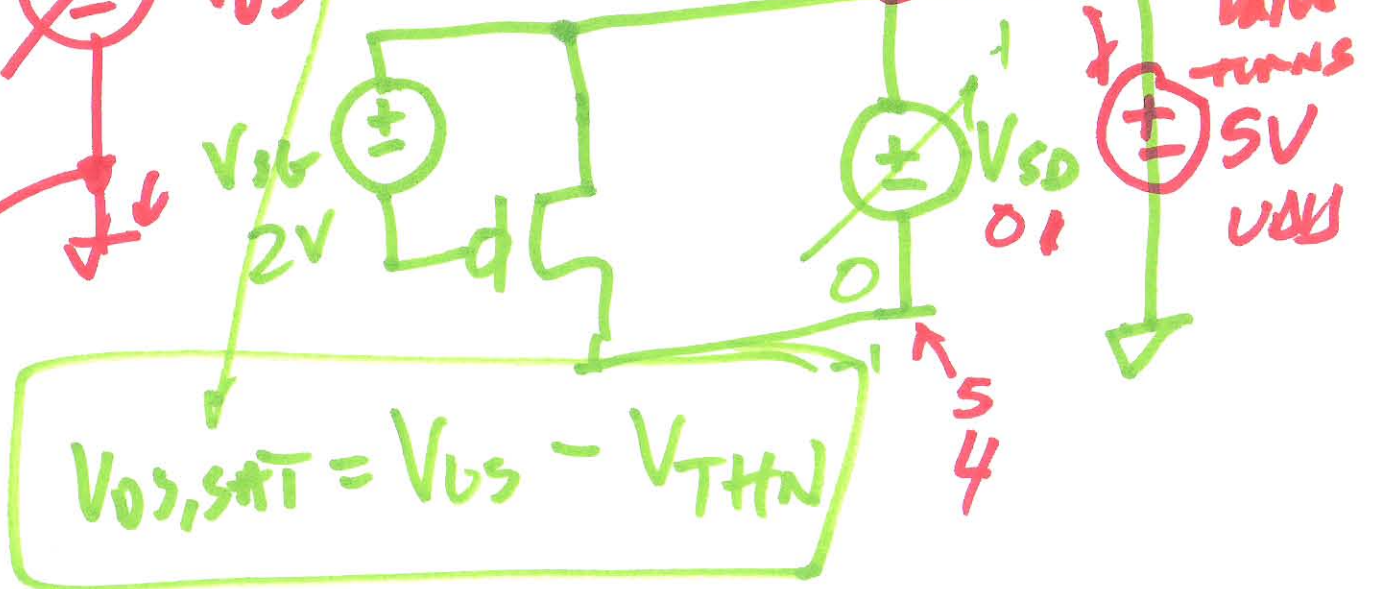
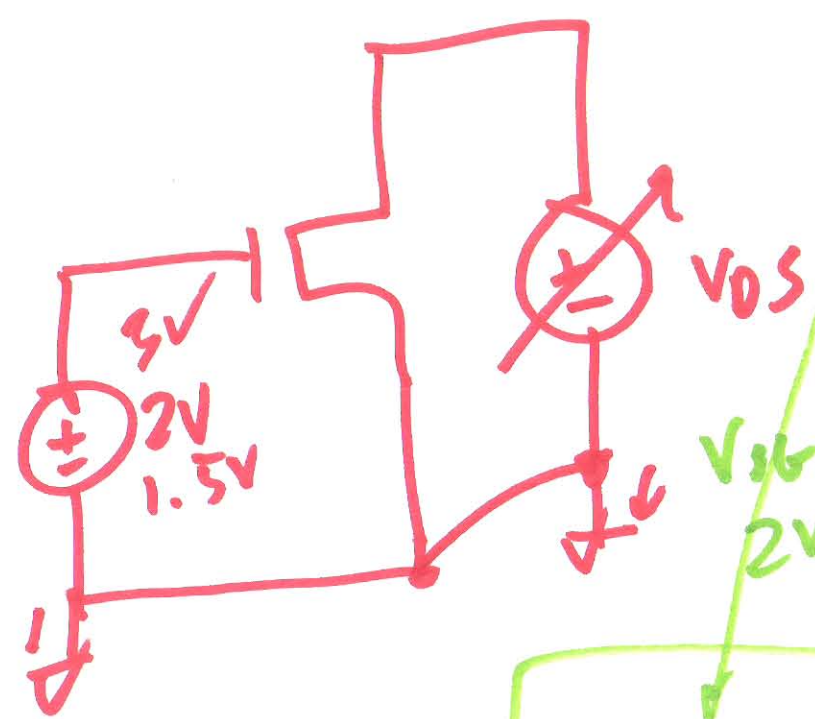
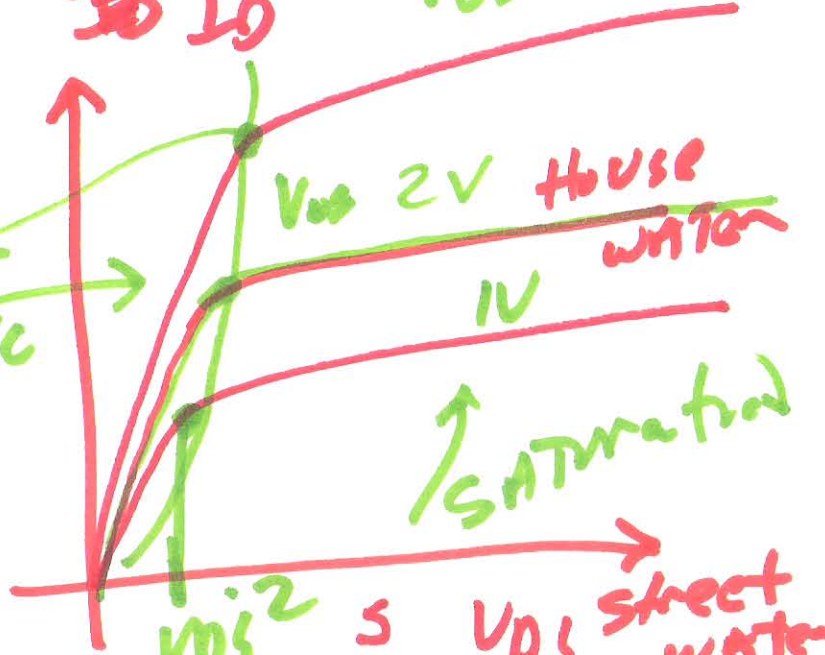


3)



water flow I_D $V_{DS} > V_{THN}$

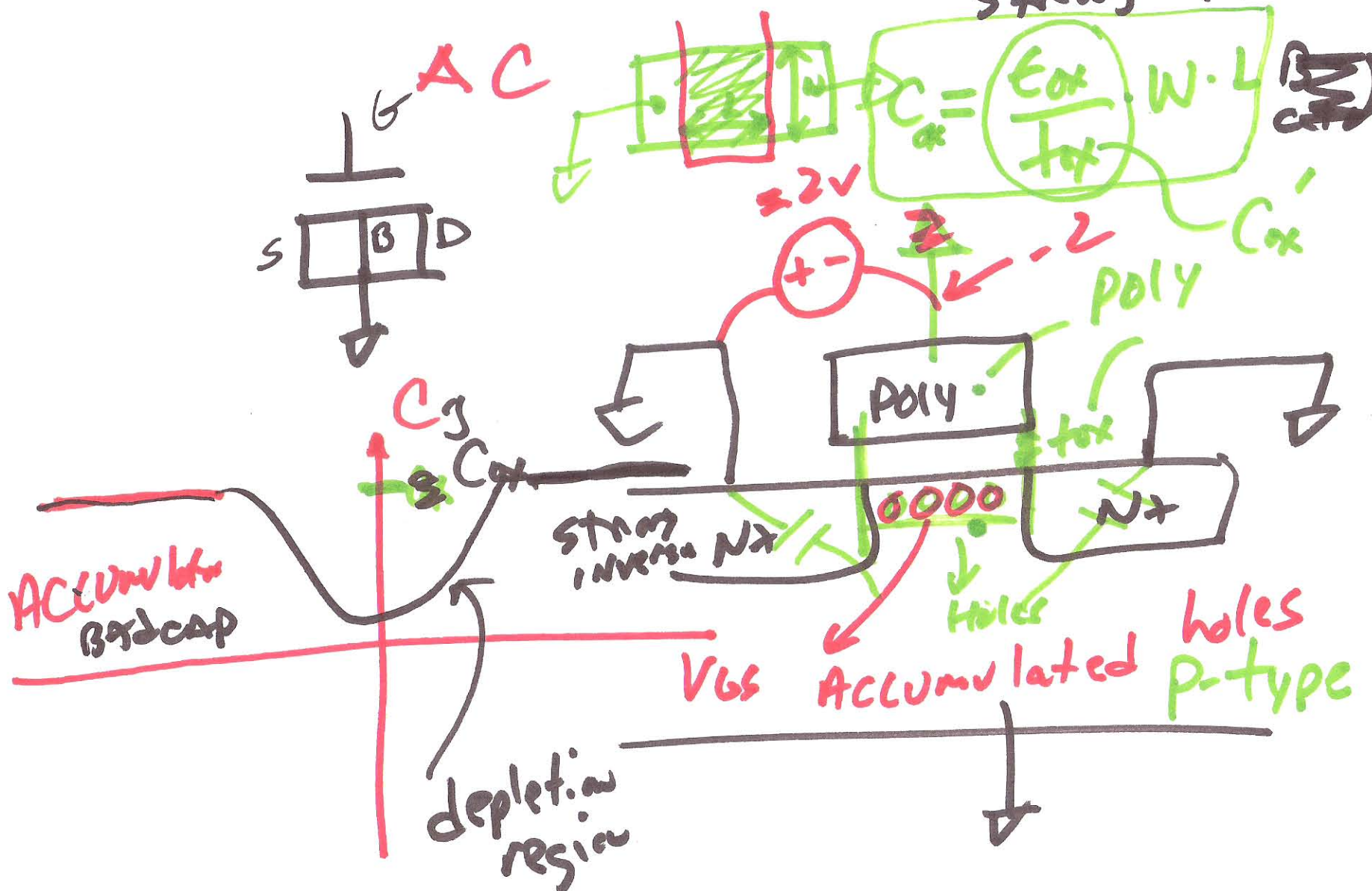
triode linear ohmic



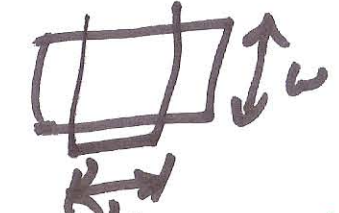
$$V_{DS, SAT} = V_{GS} - V_{THN}$$

4)

Accumulation, Depletion ~~inversion~~ ^{Strong inversion}

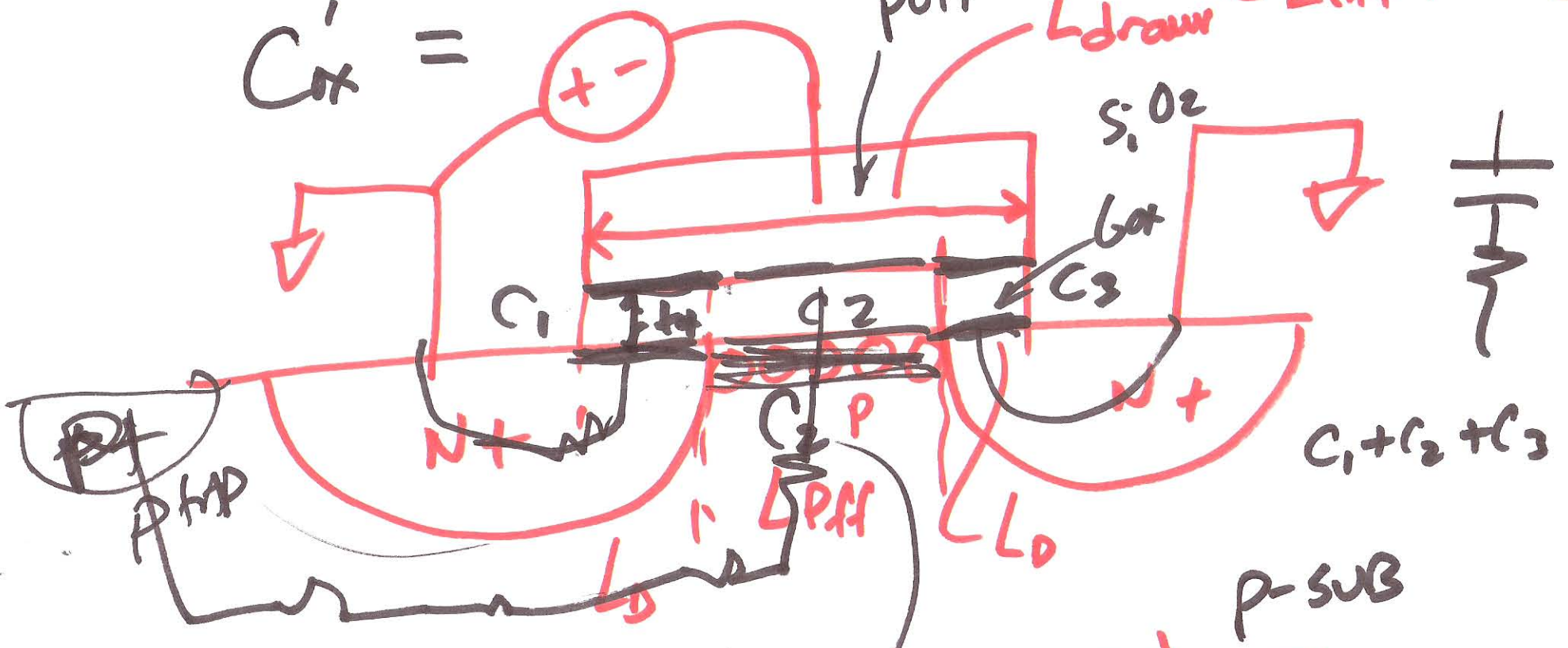


5)

$$C_{ox} = C'_{ox} \cdot w \cdot L = \frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot L$$


$$C'_{ox} = \frac{\epsilon_{ox}}{t_{ox}} \cdot 2V$$

$L_{draw} = L_{eff} + 2L_0$



$$C_3 = C_1 = \frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot L_0$$

$$\rightarrow \frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot (L_{draw} - 2L_0)$$

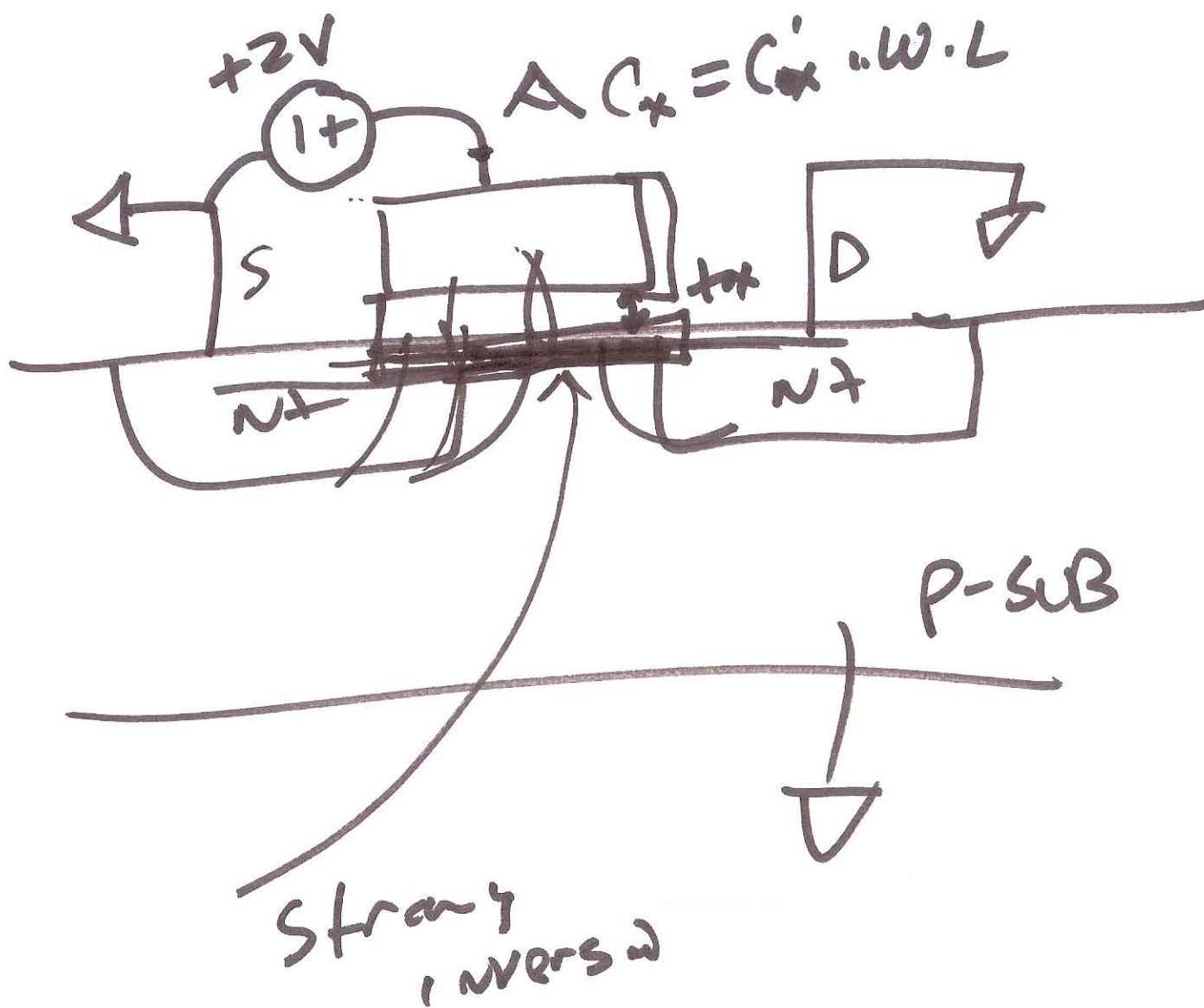
b)

$$C_1 + C_2 + C_3$$

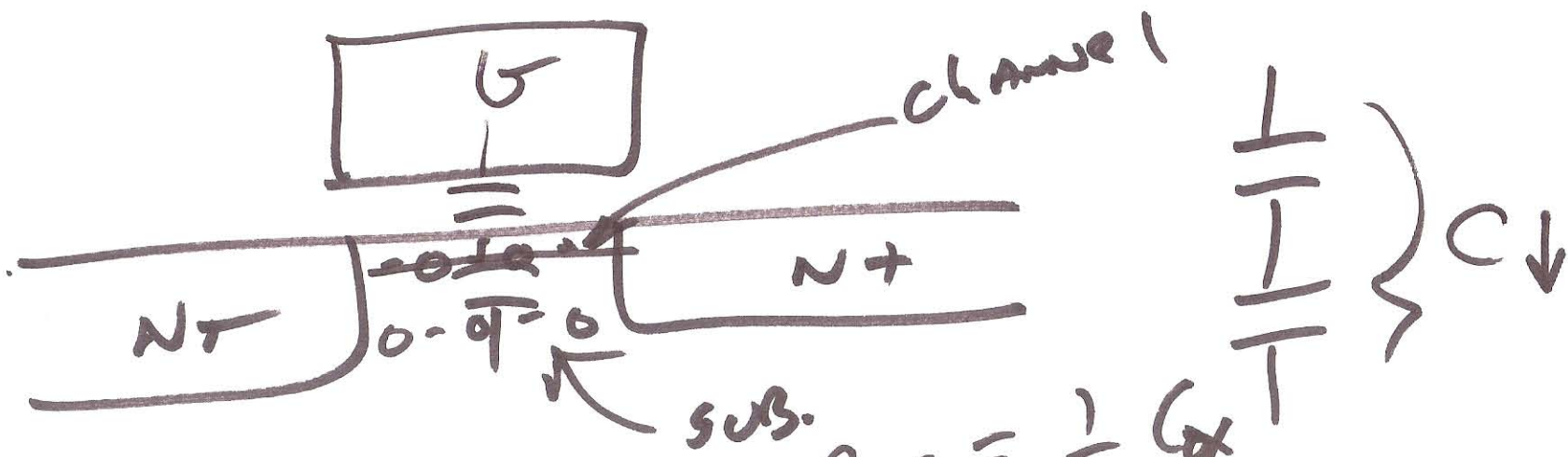
$$\frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot L_0 + \frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot (L_{draw} - 2L_0)$$

$$+ \frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot L_0$$

$$= \frac{\epsilon_{ox}}{t_{ox}} \cdot w \cdot L_{draw} = C_{ox}' \cdot L \cdot w!$$

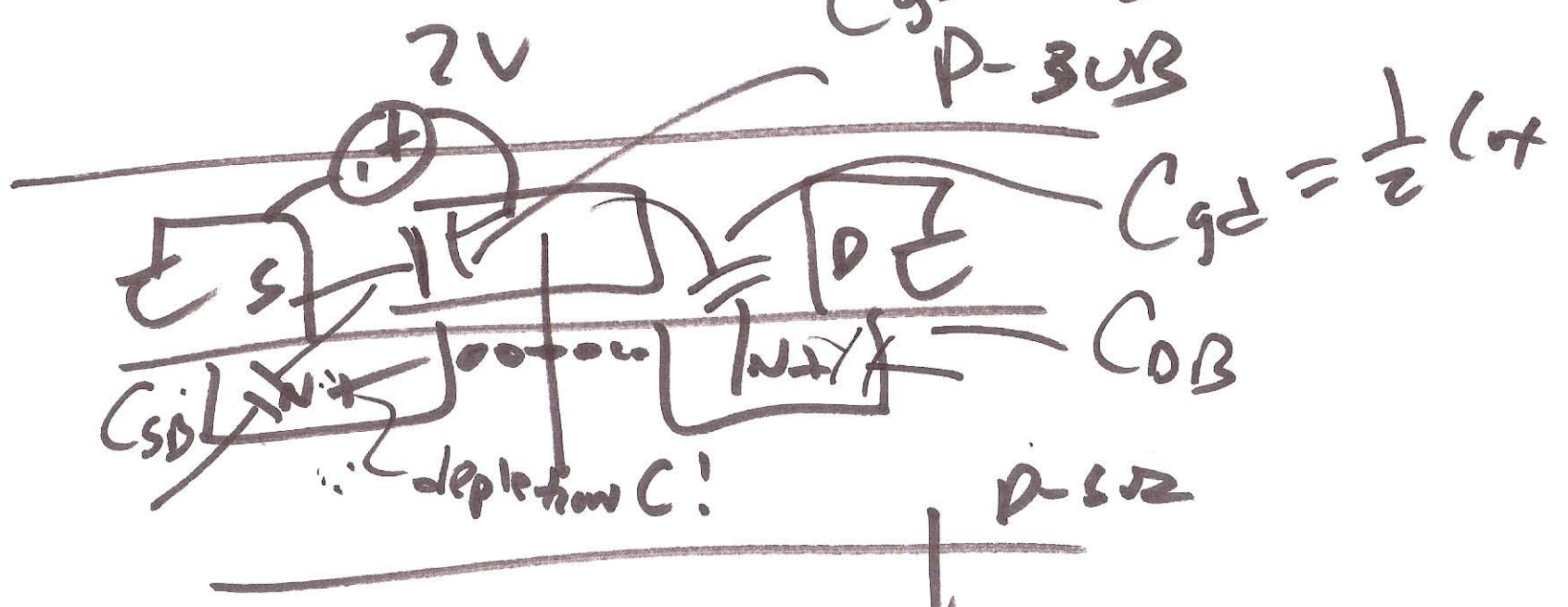


$$A C_x = C_{ox} \cdot W \cdot L$$

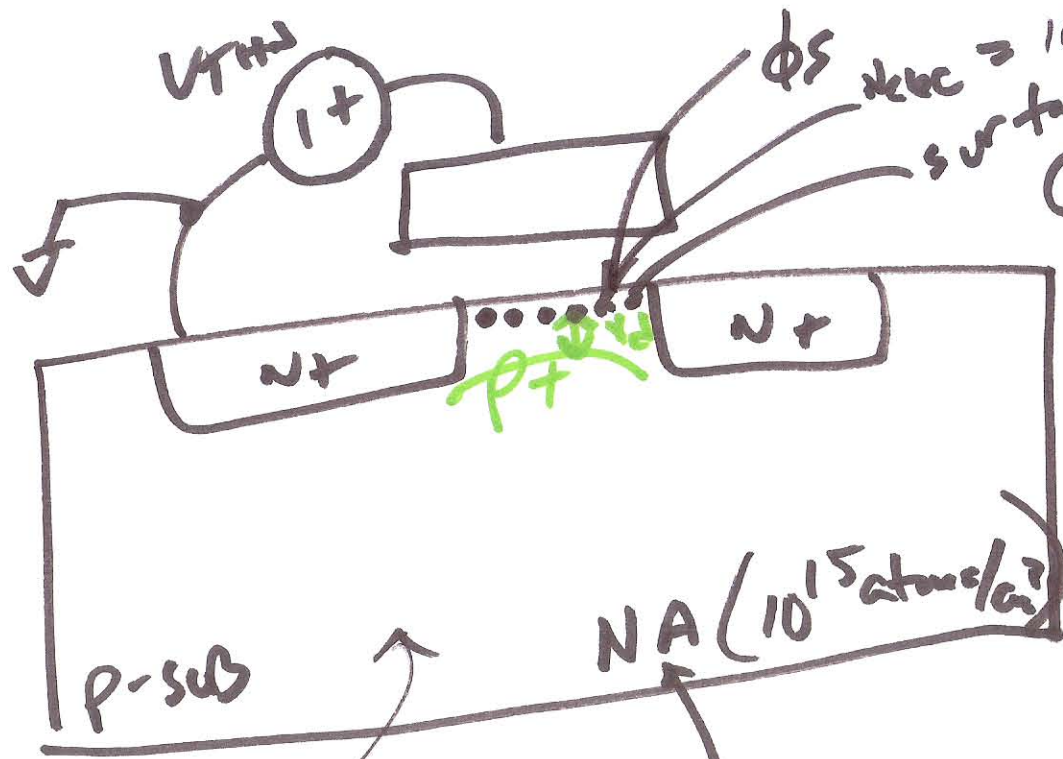


$C_{gs} = \frac{1}{2} C_{ox}$

P-SUB



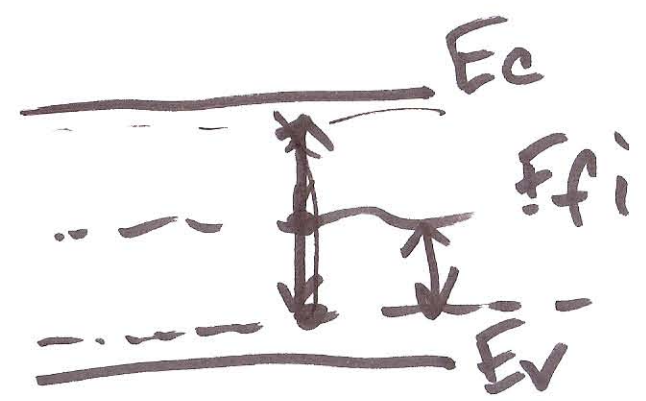
a)



of electrons
 = # of holes
 in substrate
 $V_{GS} = V_{Tth}$

$p = 10^{15} \frac{\text{holes}}{\text{cm}^3}$ # of acceptor atoms (p-type) (Boron)

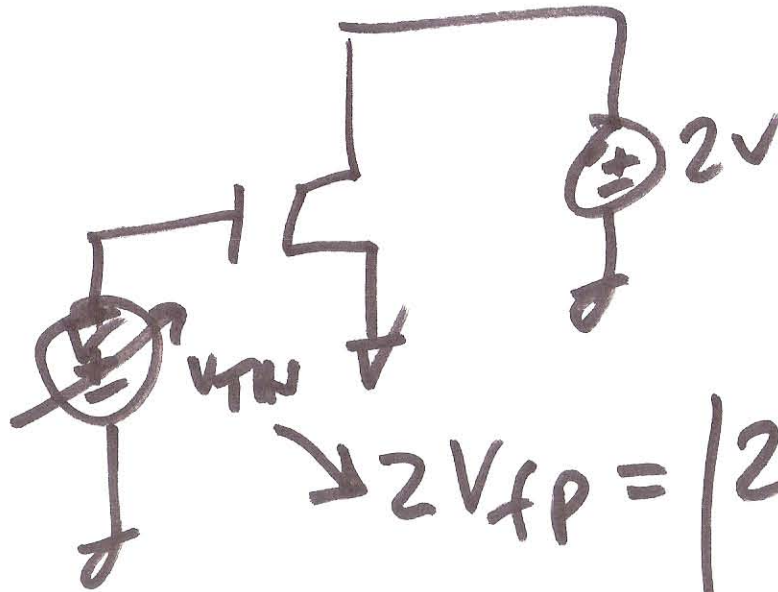
$$2 \frac{KT}{q} \ln \frac{N_i}{NA}$$



$$E_{fp} = -KT \ln \frac{NA}{N_i}$$

$$V_{fp} = \frac{KT}{q} \ln \frac{N_i}{NA}$$

10)



$$2V_{fp} = \left| 2 \cdot \frac{kT}{q} \ln \frac{N_A}{N_D} \right|$$

$$Q'_S = q N_A X_D$$