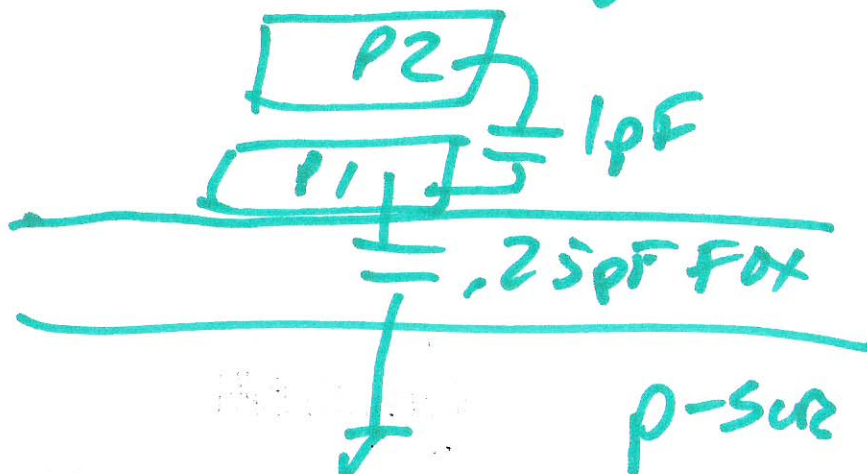
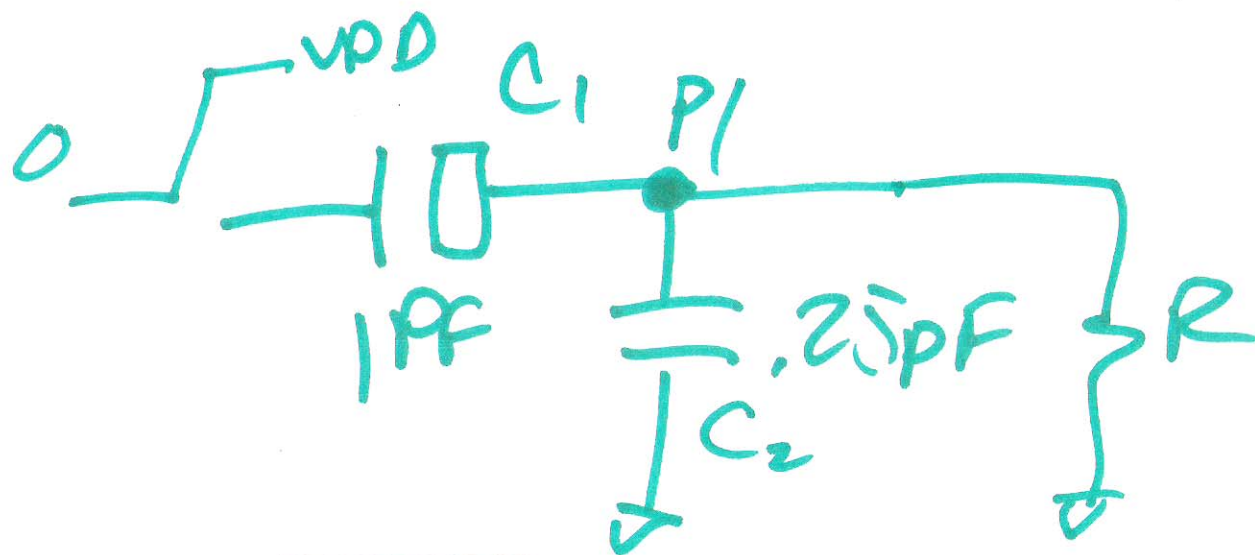


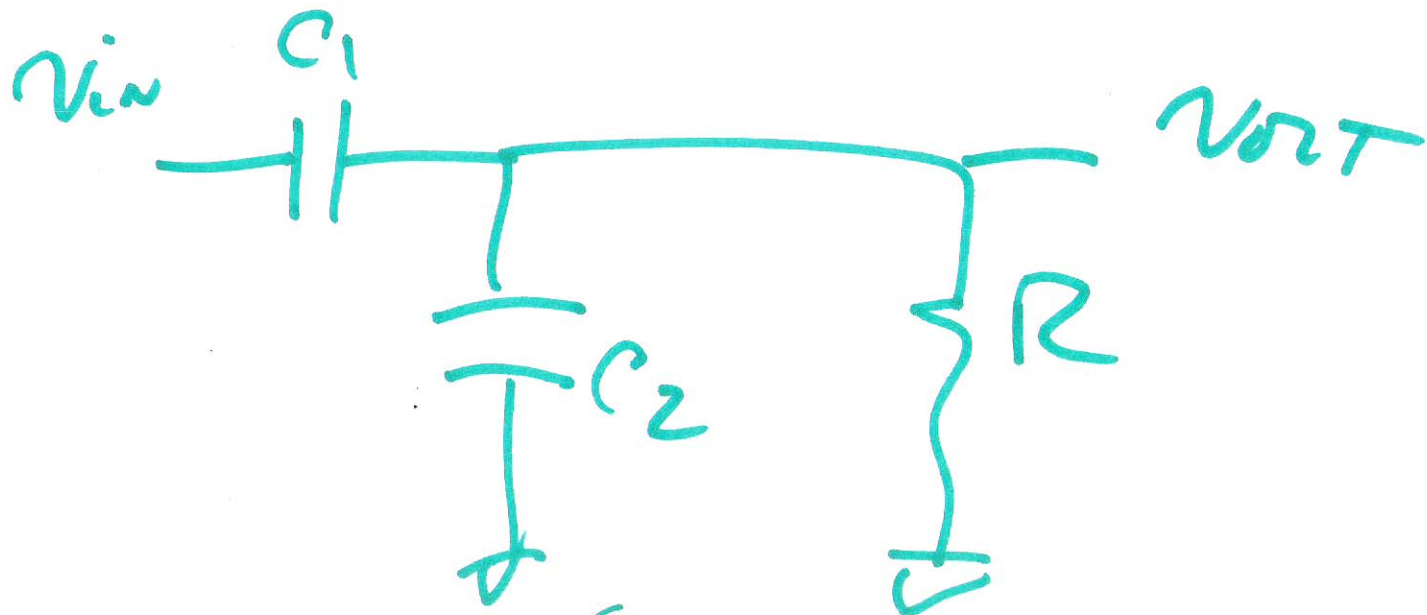
Oct. 8 Lecture 13

MOXP MOSFET CAPACITANCES



$$\frac{0 + j\omega RC_1}{1 + j\omega R(C_1 + C_2)}$$

11



$$v_{out} = \frac{Z}{Z + \frac{1}{j\omega C_1}} \cdot v_{in} = \frac{R \cdot \frac{1}{j\omega C_2}}{R + \frac{1}{j\omega C_2}} = Z = \frac{R}{1 + j\omega R C_2}$$

$$\frac{v_{out}}{v_{in}} = \frac{j\omega C_1 R}{j\omega C_1 R + 1 + j\omega R C_2} = \frac{j\omega C_1 R}{j\omega C_1 R + 1 + j\omega R C_2}$$

2)

$$\frac{1}{4} = \left| \frac{v_{out}}{v_{in}} \right| = \frac{\sqrt{0^2 + (2\pi f \cdot R C_1)^2}}{\sqrt{1^2 + (2\pi f \cdot R(C_1 + C_2))^2}}$$

$$\angle \frac{v_{out}}{v_{in}} = \tan^{-1} \frac{2\pi f R C_1}{0} - \tan^{-1} \frac{2\pi f R(C_1 + C_2)}{1}$$

90°

study → old quizzes 1 → 5

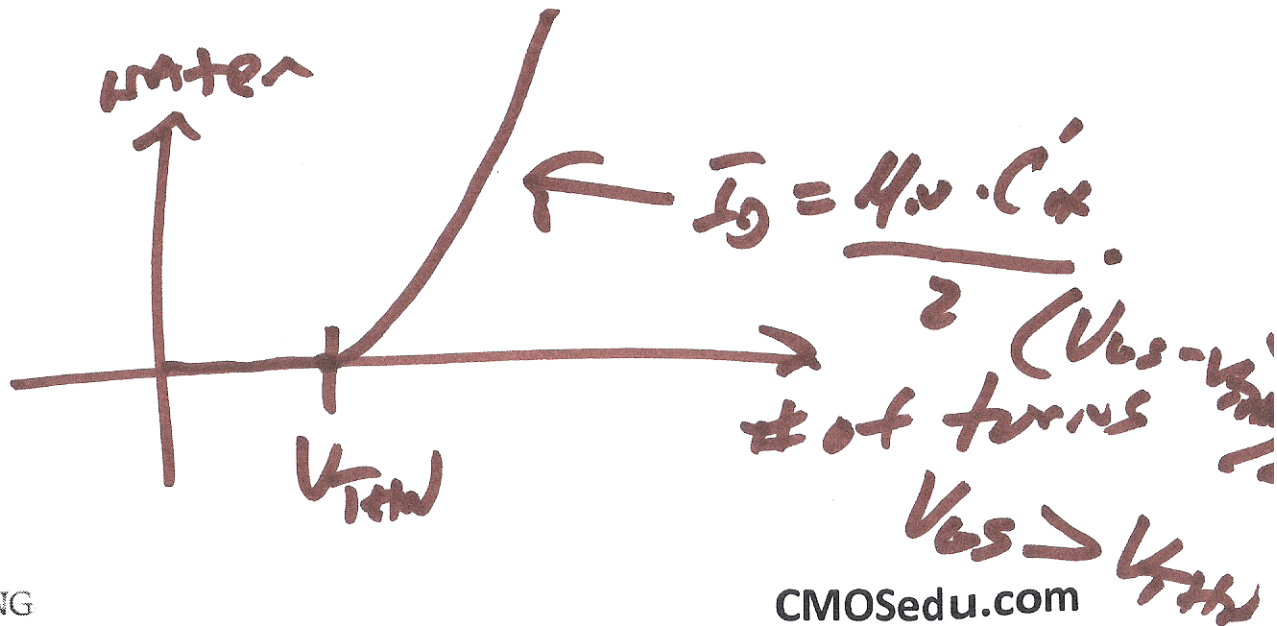
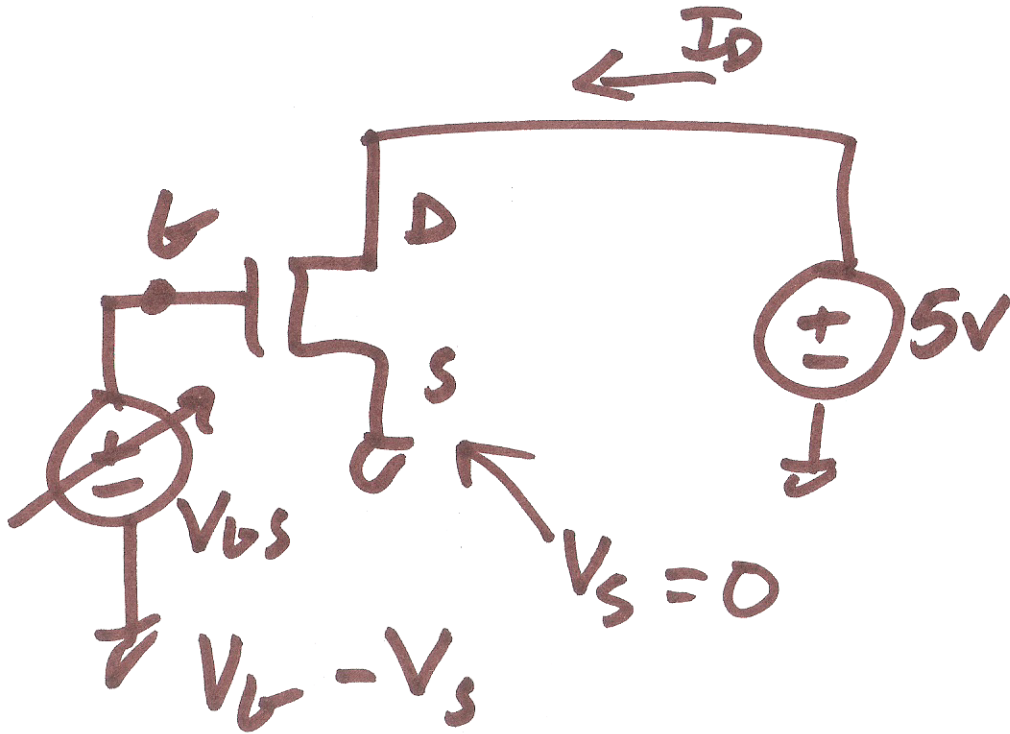
H.W.

END of chapter

MOSFETC

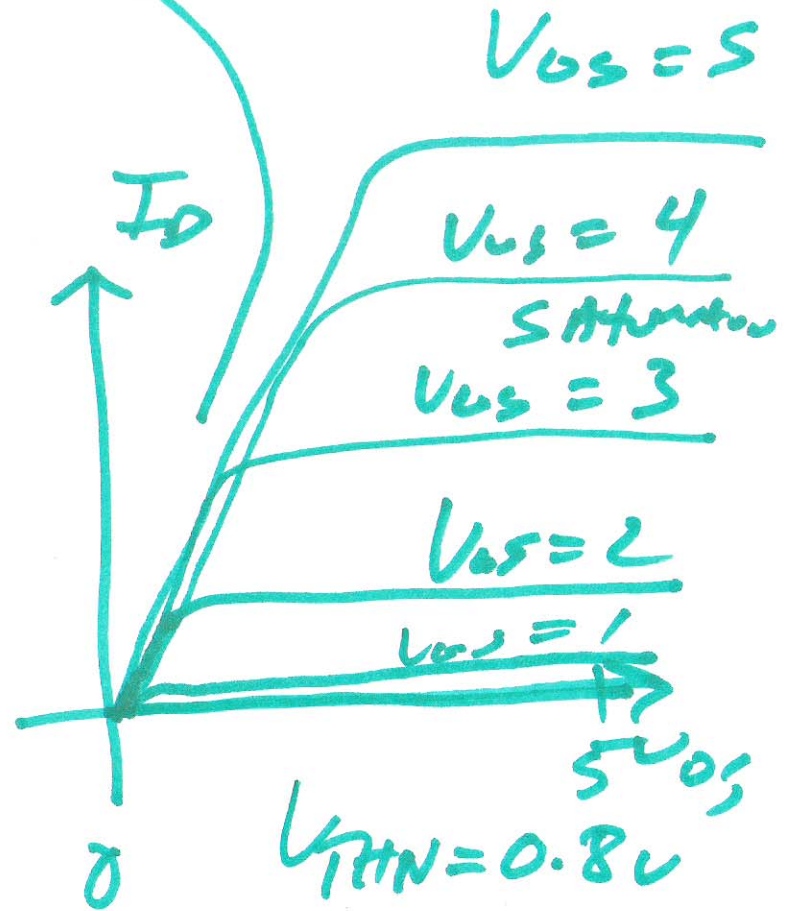
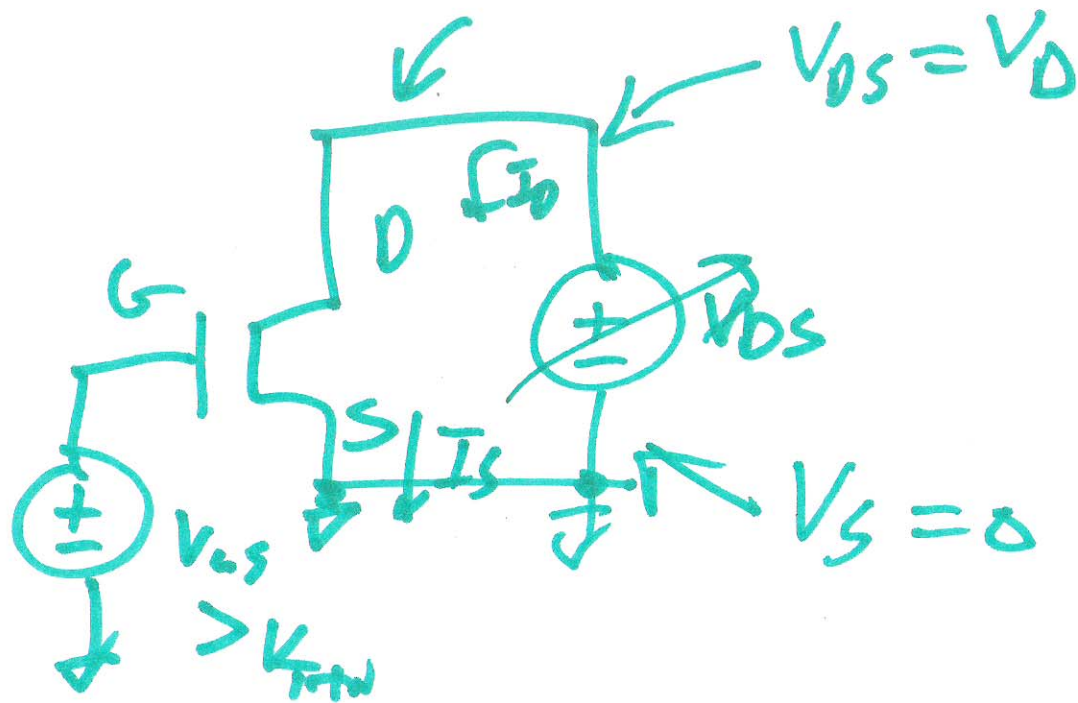
IV

3)

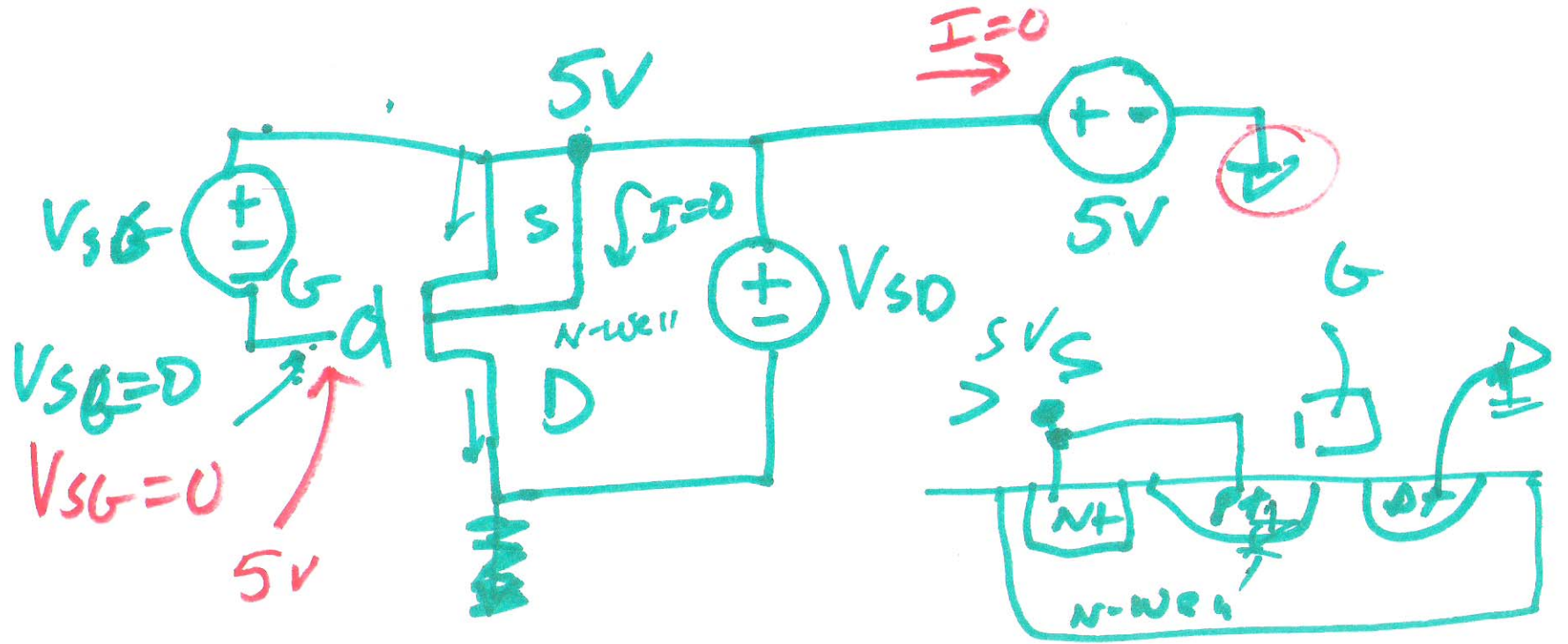




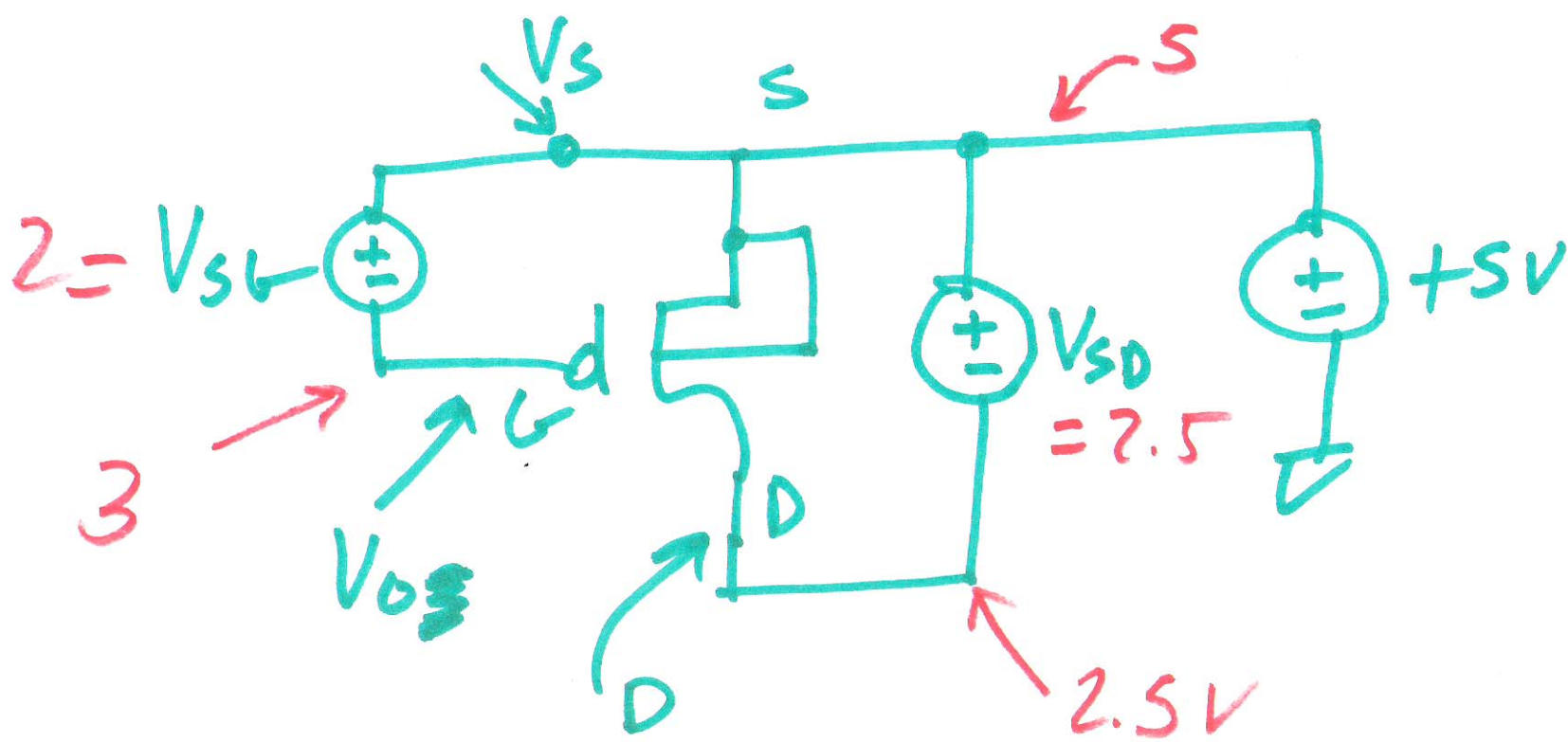
triode, ohmic, linear



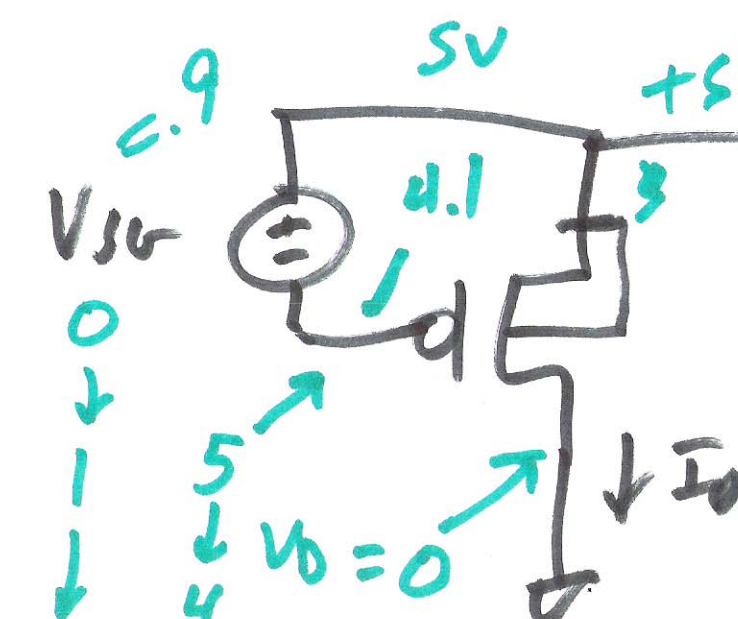
5)



6)



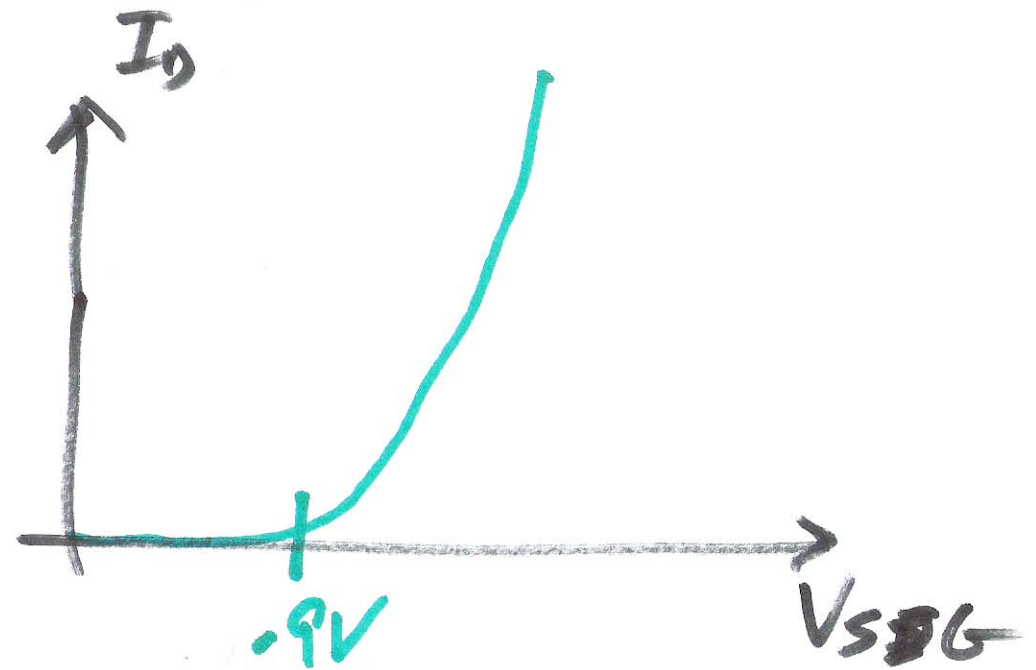
7)



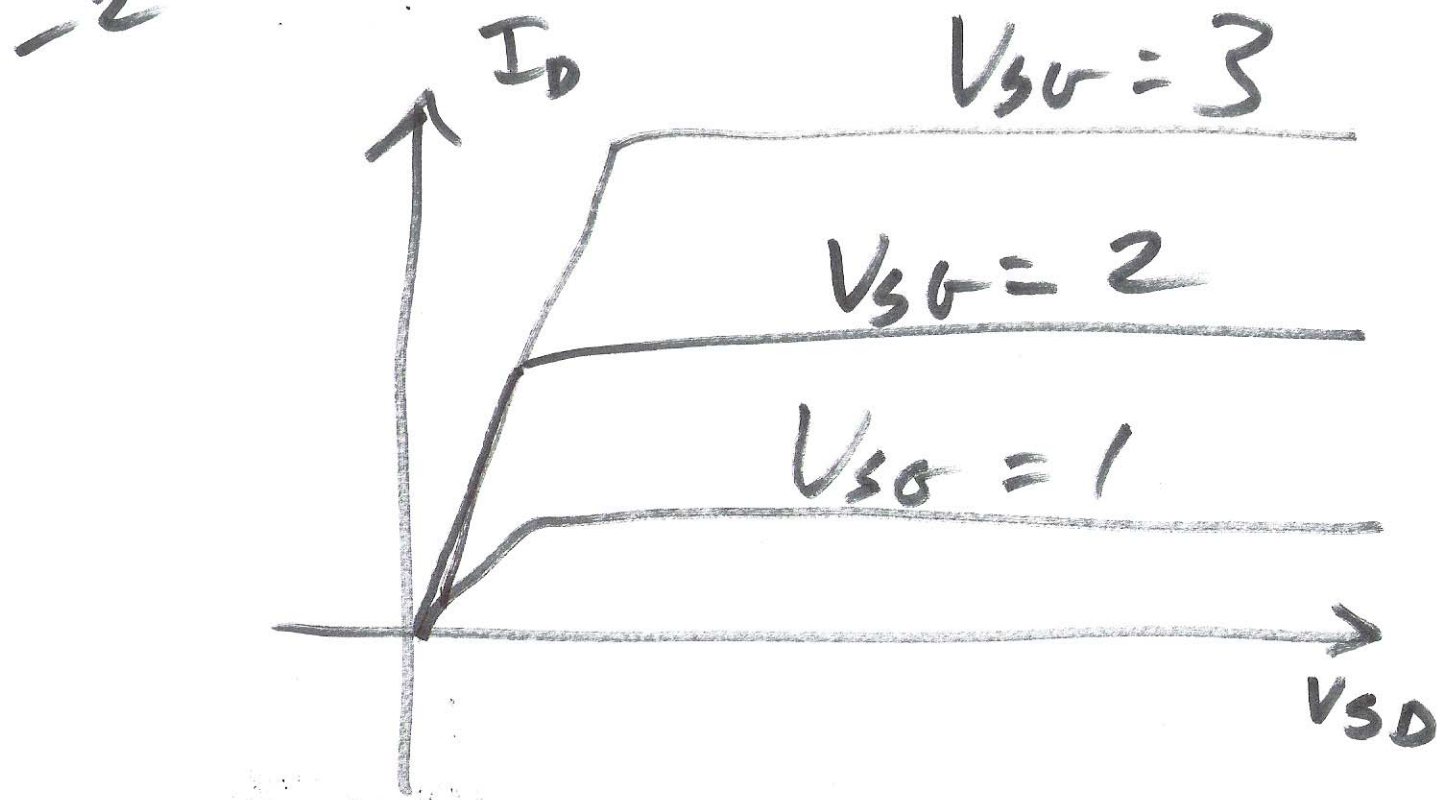
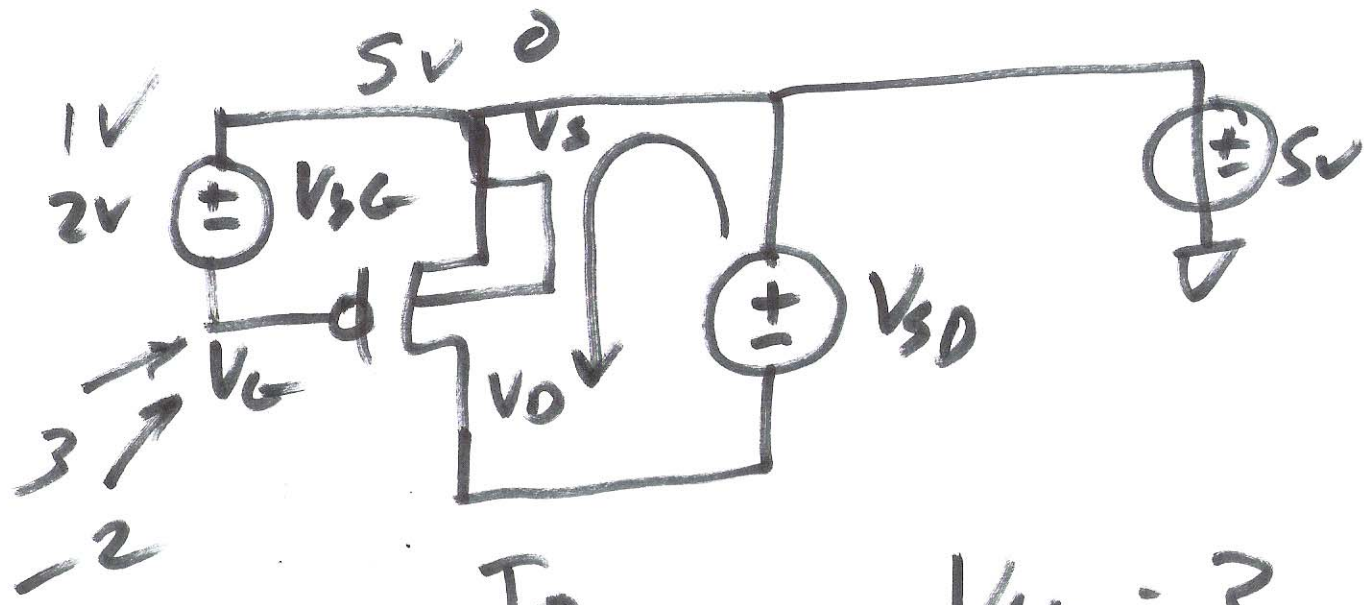
$$V_S - V_D = V_{SD} = 5 - 0 = 5V$$

$$V_{SD} = 5V$$

- $V_{GS} = 0$
- 1
- 2
- 3
- 5
- 4
- 3
- 2
- 1



5)



9)

MOSFETS

NMOS

PMOS

$$C_{ox}' = \frac{\epsilon_{ox}}{t_{ox}}$$

$$\mu_n \cdot C_{ox}' = K_{PN}$$

$$I_D = \frac{K_{PN} \cdot C_{ox}' \cdot W}{2 \cdot L} \left(V_{GS}^{SG} - V_{THP} \right)^2 \quad (\text{SAT})$$

$$\frac{K_{PN} W}{2 L}$$

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

$$SD > V_{SD} - V_{THP}$$

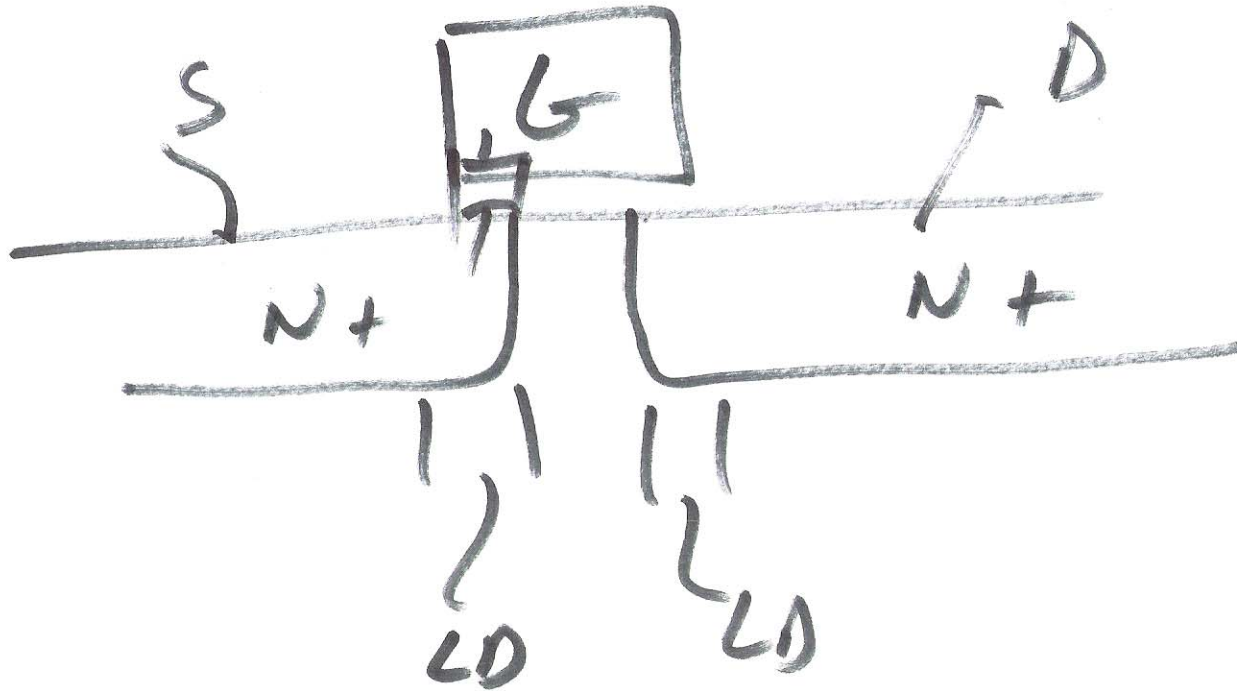
$$I_D = \mu_n C_{ox}' \frac{W}{L} \left((V_{GS}^{SG} - V_{THP}) V_{DS} - \frac{V_{DS}^2}{2} \right) \quad (\text{triode})$$

$$V_{SG} > V_{THP}$$

$$V_{GS} > V_{THN}$$

$$K_{PN} = C_{ox}' \cdot \mu_n$$

$$\beta_N = K_{PN} \frac{W}{L} = C_{ox}' \cdot \mu_n \frac{W}{L}$$



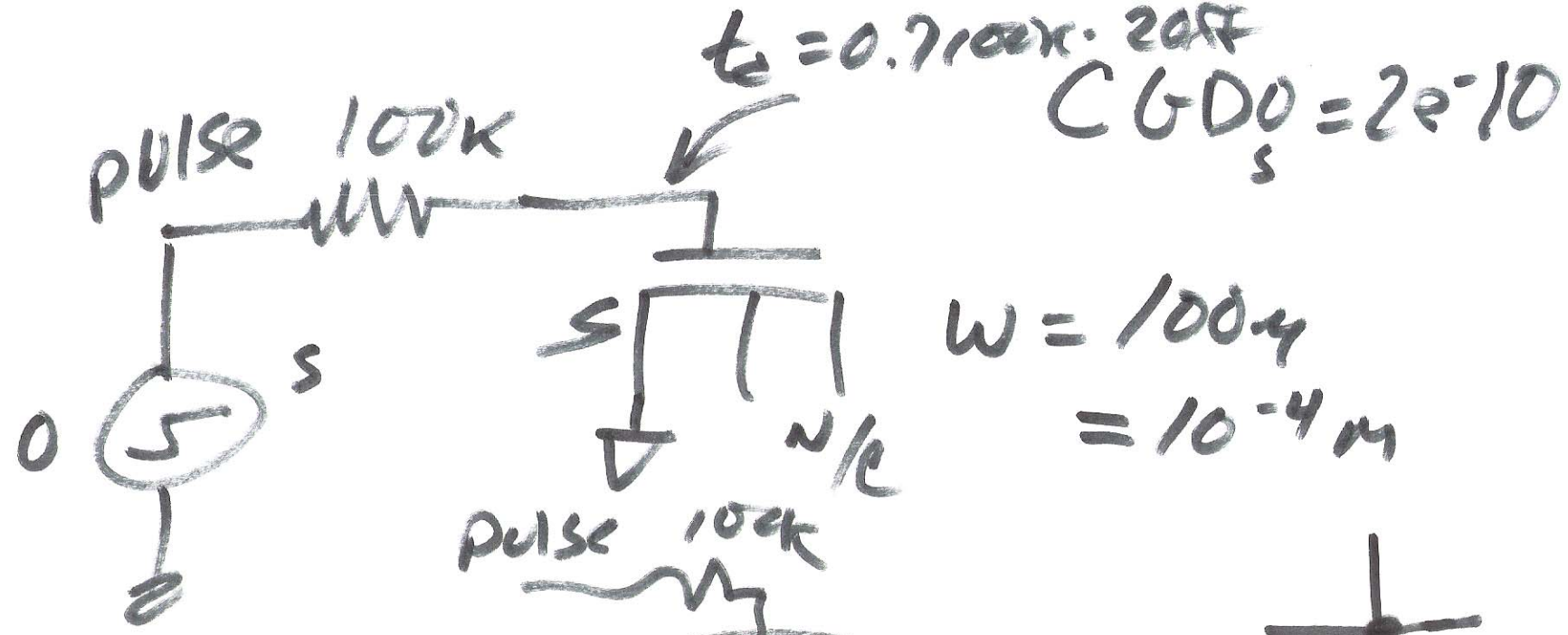
$$C_{SD, overlap} = C_{ox}' \cdot LO \cdot W = \frac{\epsilon_{ox} \cdot LO \cdot W}{t_{ox}}$$

$$C_{over} = C_{GDO} \cdot W + C_{GSO} \cdot W$$

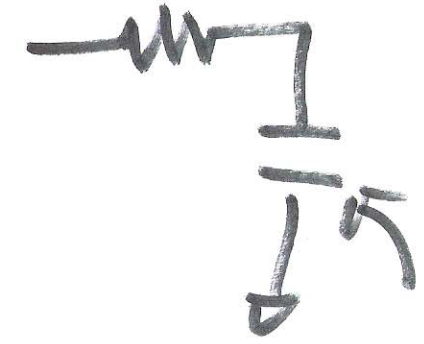
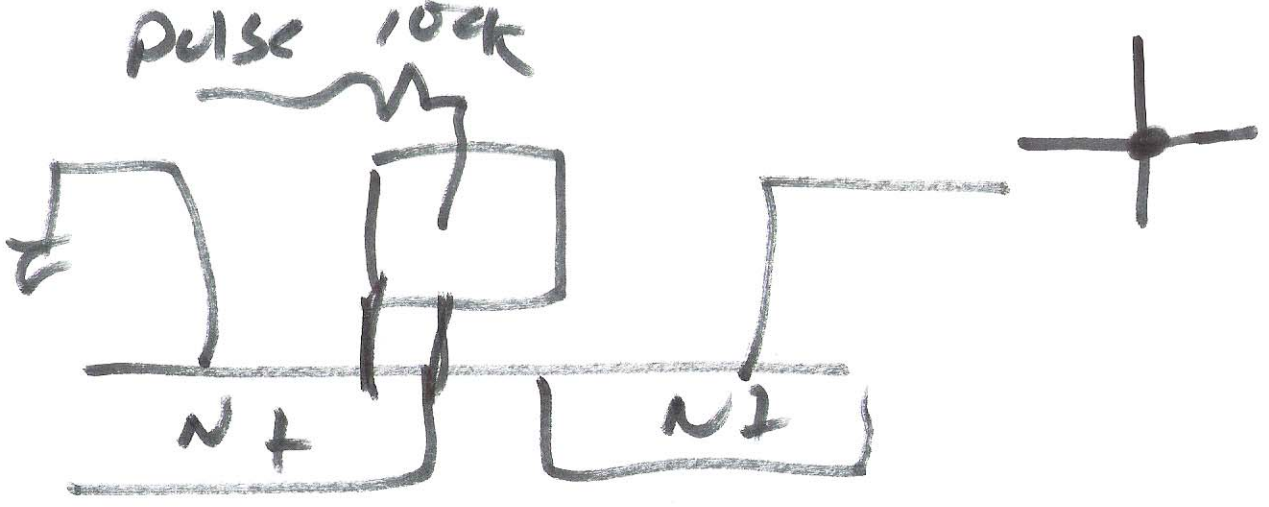
overlap

ZP-10

11)

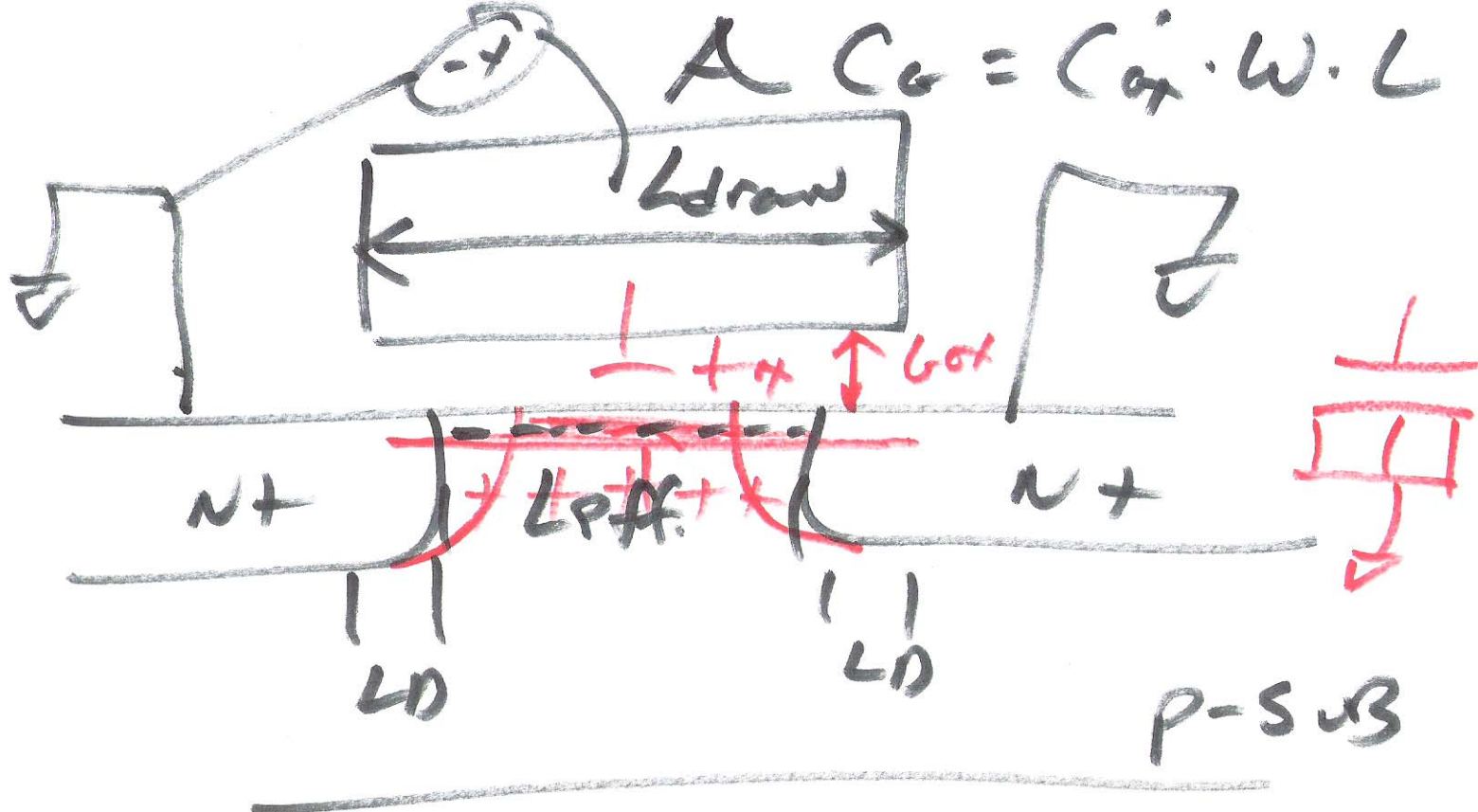


$W = 100 \mu$
 $= 10^{-4} \text{ m}$

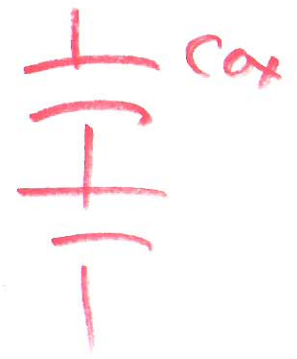


$2 \times 10^{-10} \frac{\text{F}}{\text{m}} \cdot 10^{-4} \text{ m}$
 $= 2 \times 10^{-14} \text{ F} = 20 \text{ fF}$

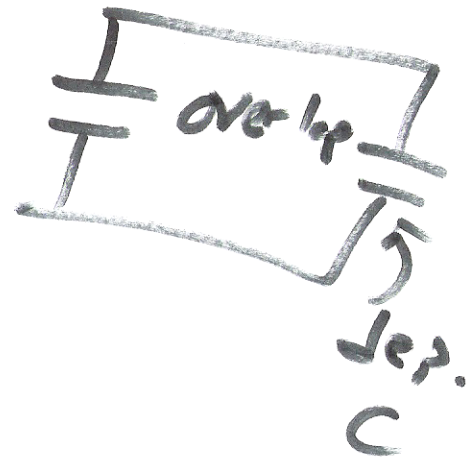
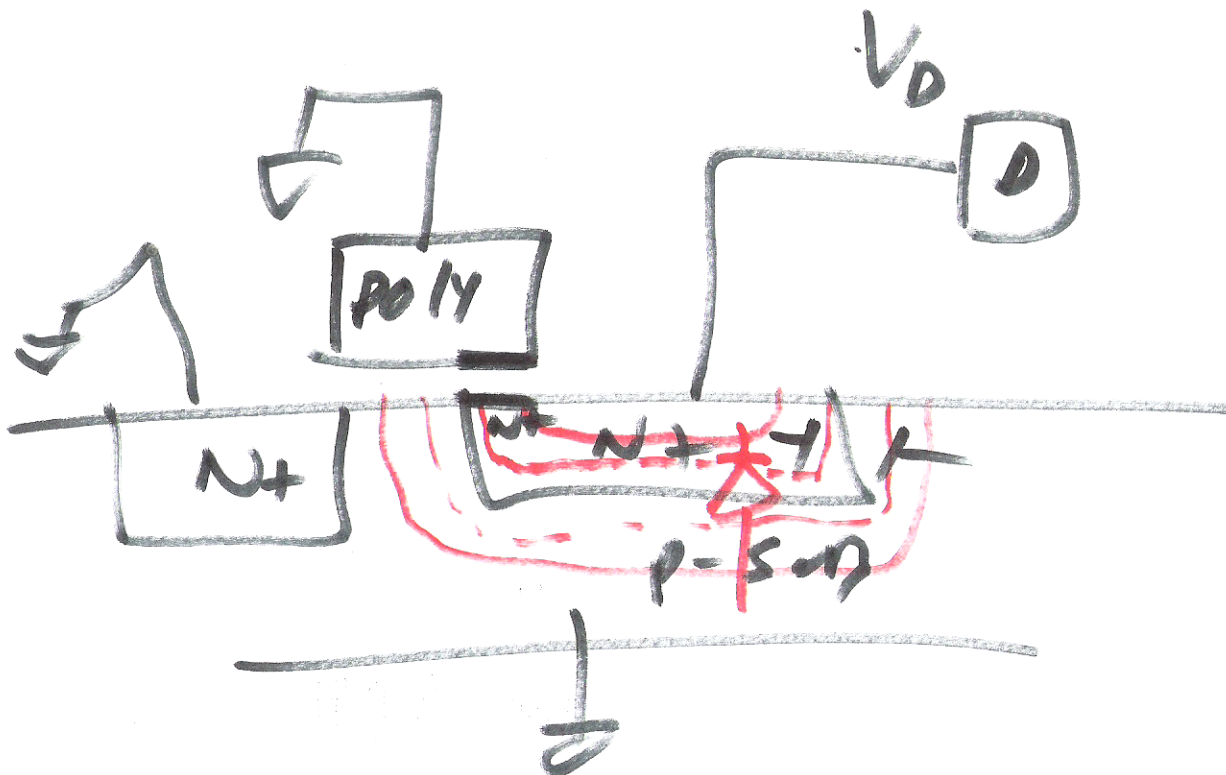
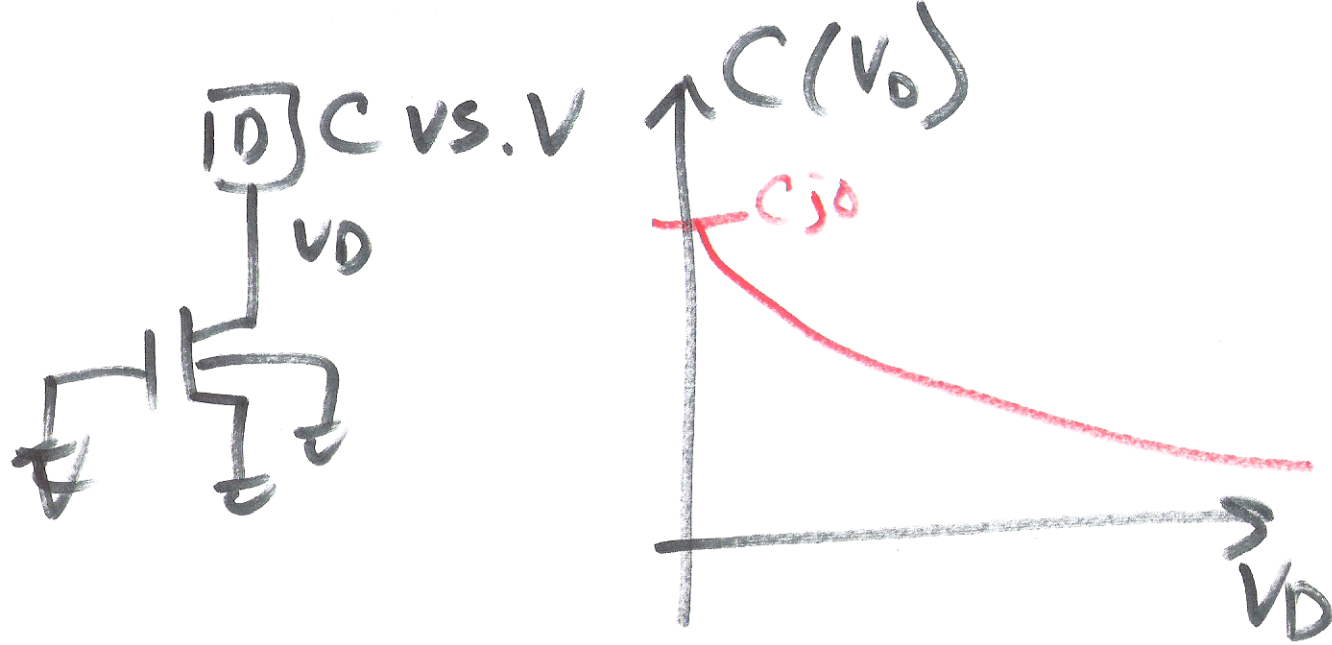
12)



$$DL = 2 \cdot LD$$



(3)



14)