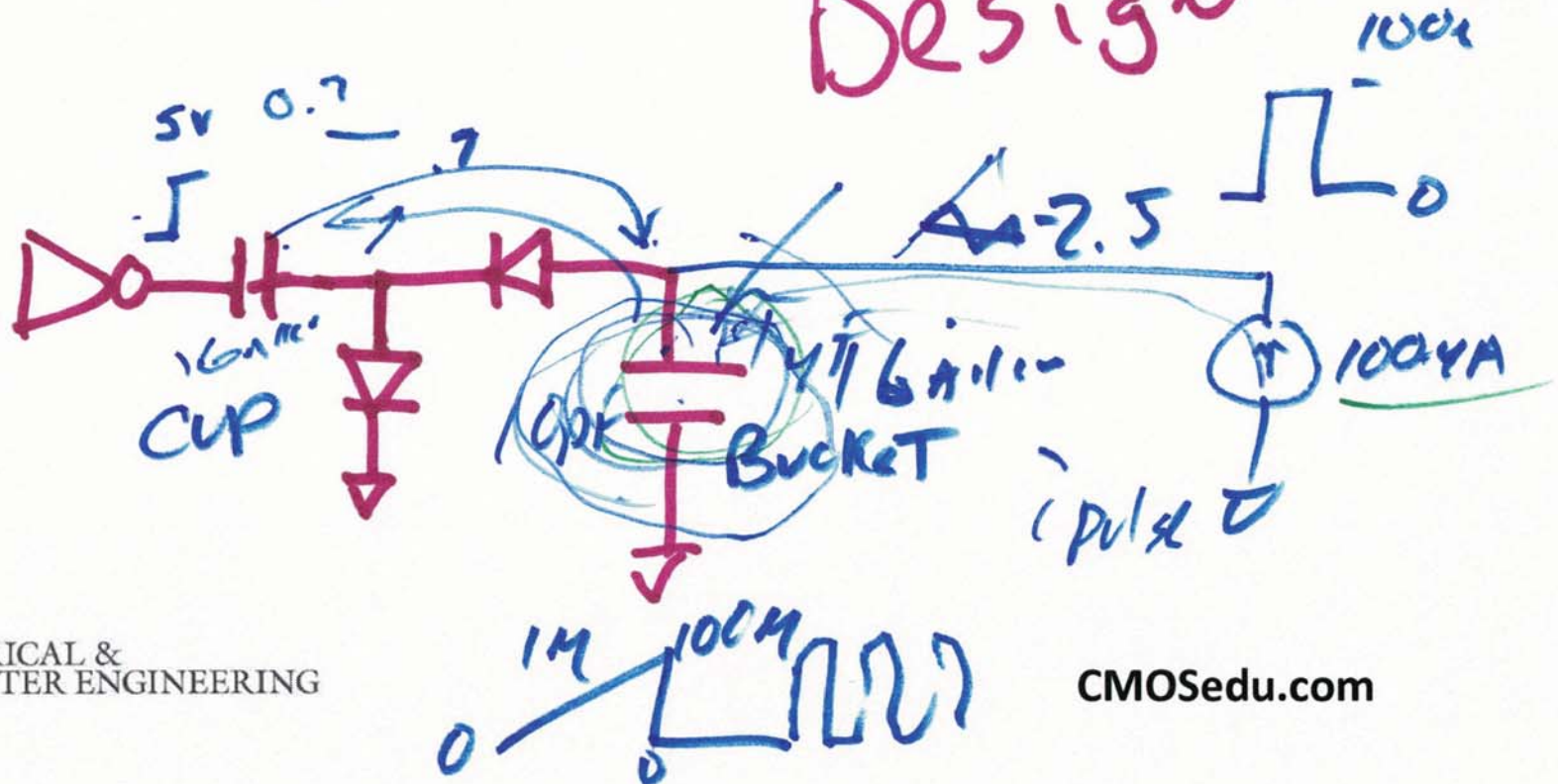


# Lecture 21

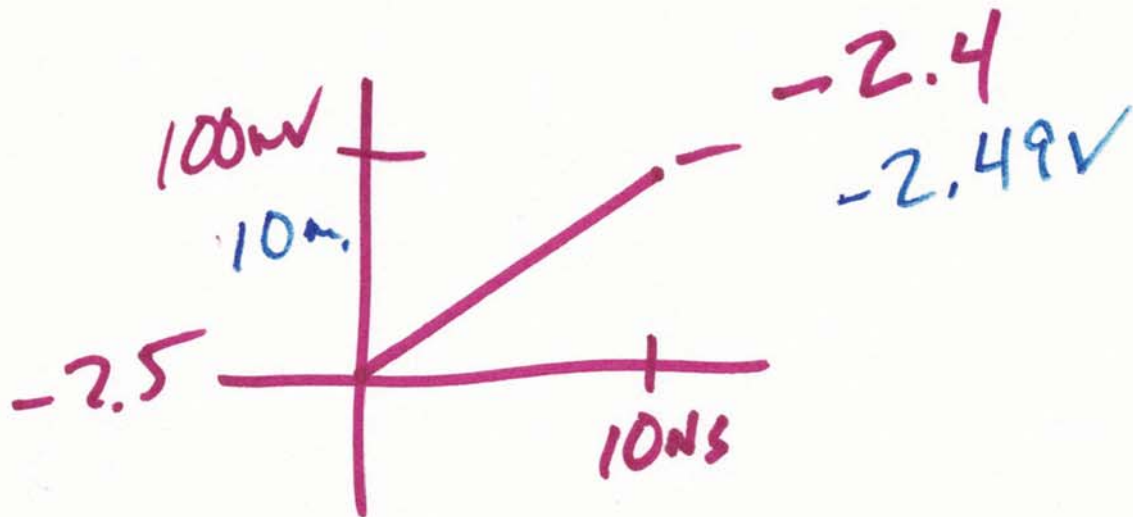
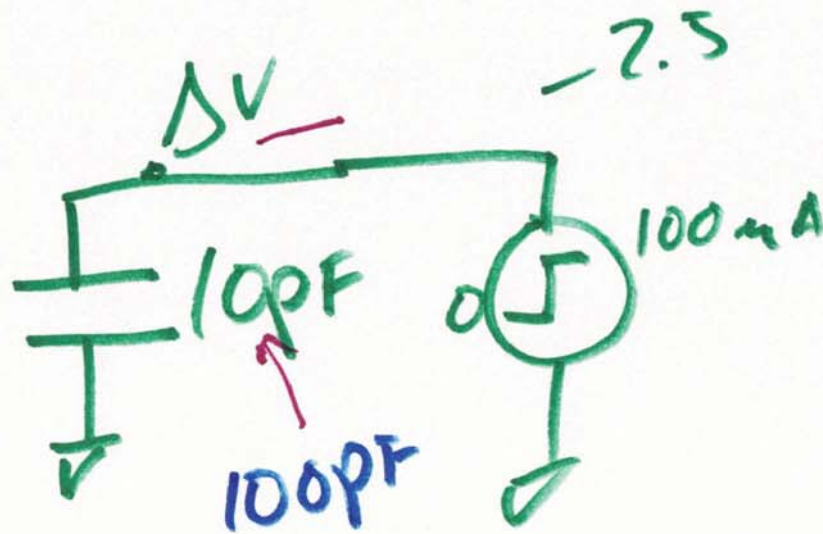
NOV. 9, 2015

EE 421 / ECE 621

# Digital IC Design



17



$$10 \text{ p} = 10^{-11}$$

$$I = C \frac{\Delta V}{\Delta t}$$

$$\frac{100 \text{ mA}}{10 \text{ p}} = \frac{10^{-4}}{10^{-11}} = 10^7$$

$$\frac{10^{-4}}{10^{-10}} = 10^6$$

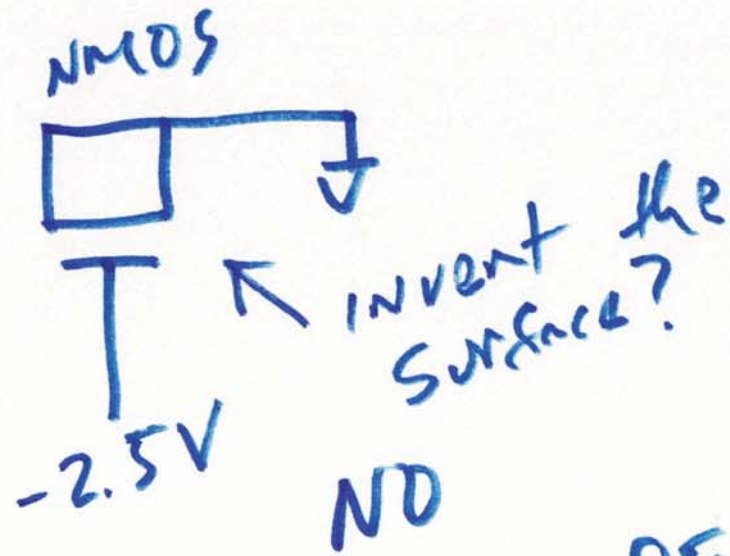
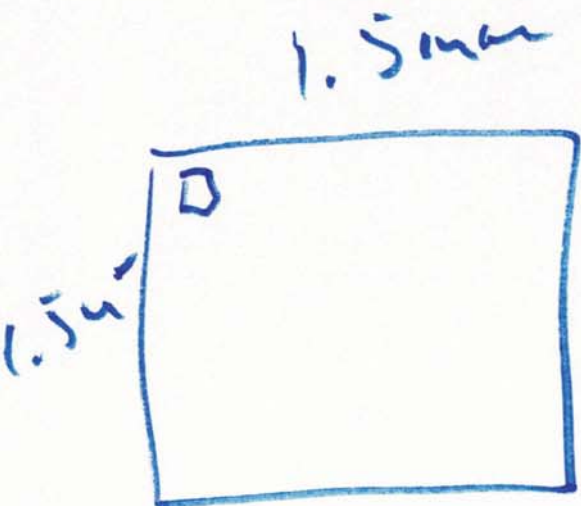
$$10 \frac{\text{V}}{\text{ns}}$$

$$\frac{\Delta V}{\Delta t} = \frac{10 \text{ mV}}{\text{ns}}$$

$$p = 10^{-12}$$

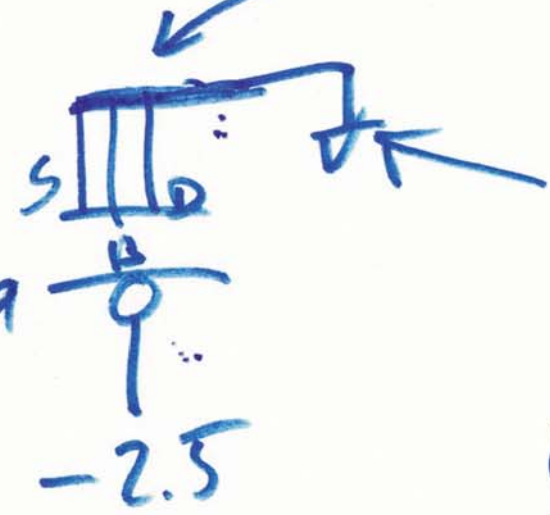
$$10 = 10^1$$

2)



poly1 - poly2  
 $\frac{900 \text{ qF}}{4 \mu\text{m}^2}$

$2.5 \text{ fF}/4 \mu\text{m}^2 = C_{ox}$



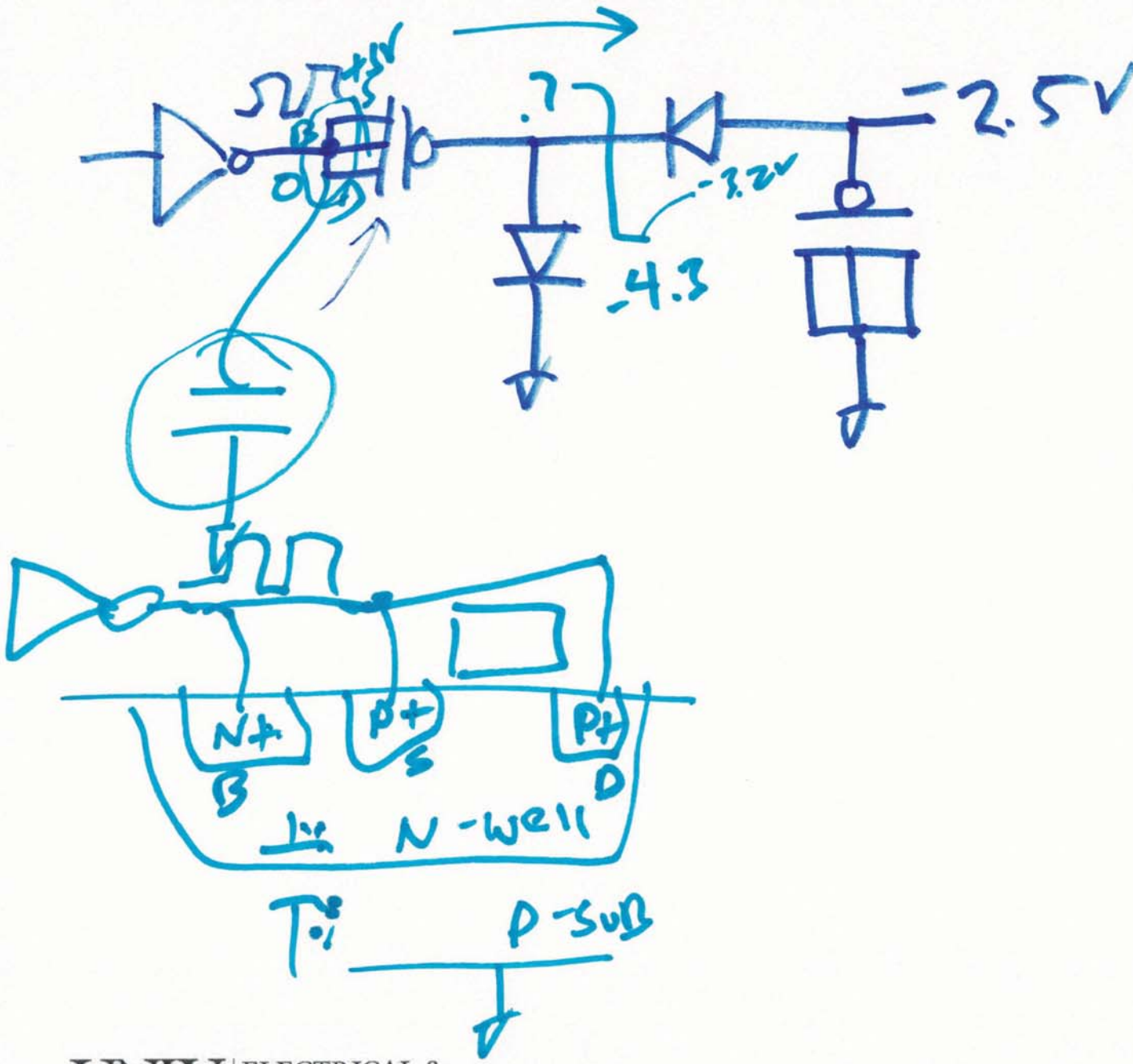
$C_{ox} = 2.5 \text{ fF} \cdot \frac{L \cdot W}{4 \mu\text{m}^2}$

$C_{gate}$

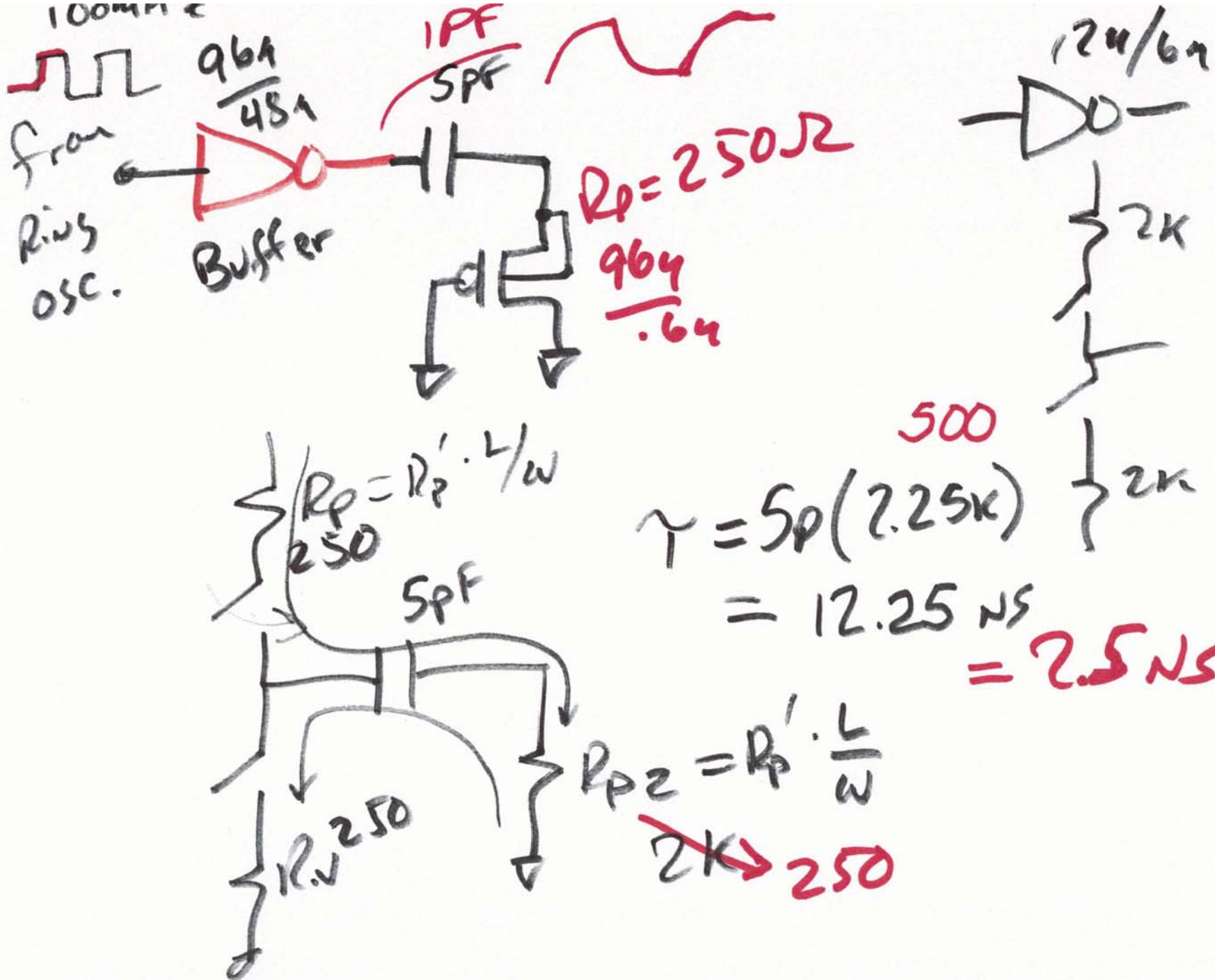
$L = 200$   
 $W = 200$

$\frac{100,000 \text{ fF}}{2.5 \text{ fF}/\mu\text{m}^2} = 40,000 \mu\text{m}^2 = L \cdot W$

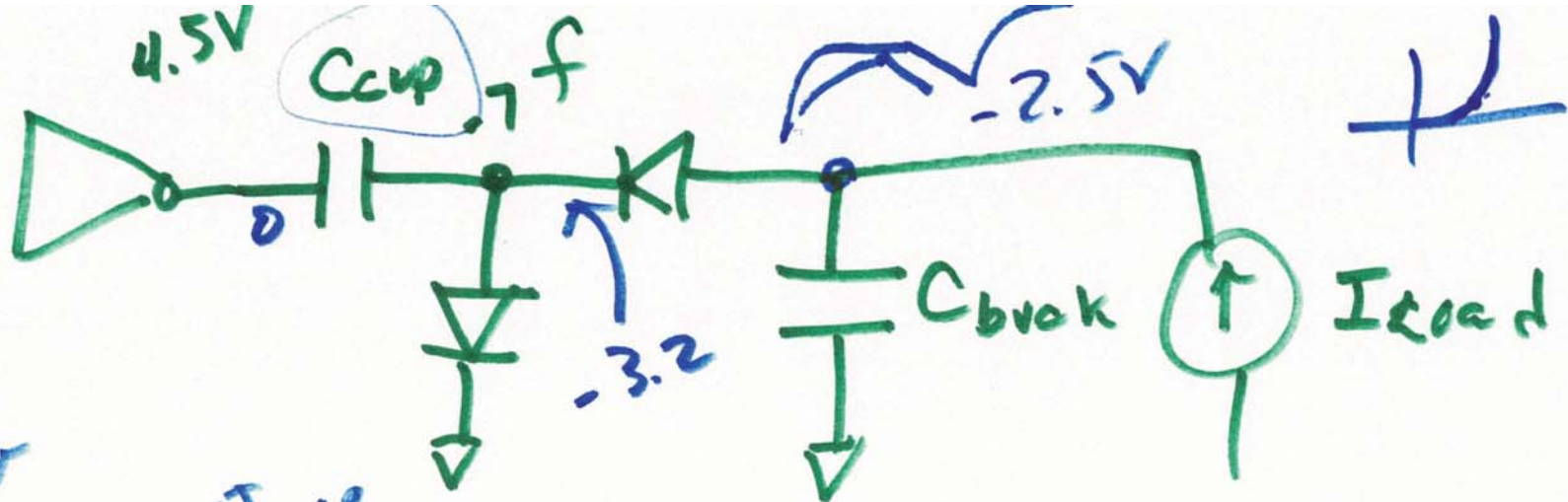
3)



4)



5)



$I_{AVG}$

$$\frac{Q_{chg}}{T_{CLK}}$$

WORST CASE VDD

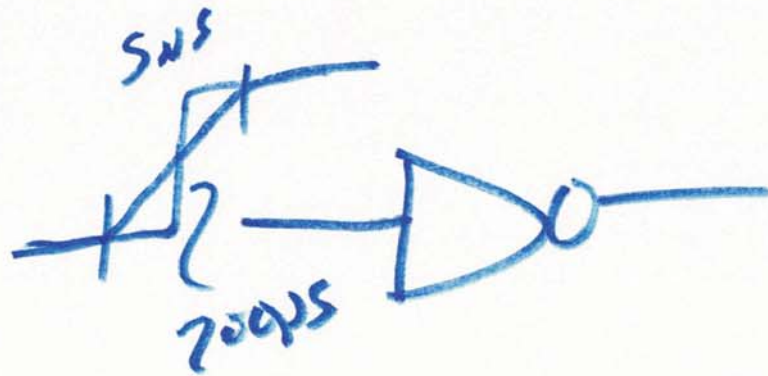
$$\frac{(4.5 - .7)C_{cup} - (0 - (-3.2))C_{cup}}{T_{CLK}}$$

$$= C_{cup} \cdot f_{CLK} \cdot (3.8 - 3.2)$$

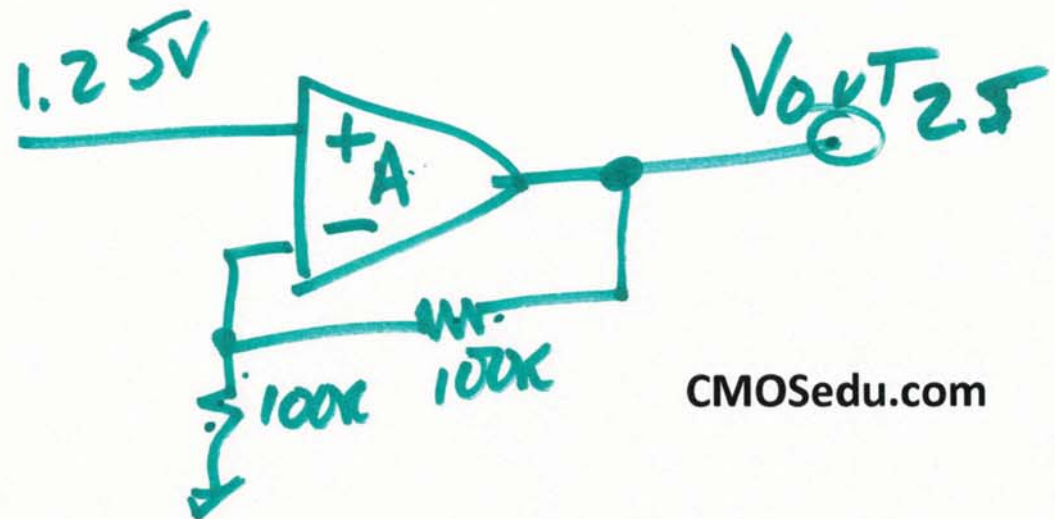
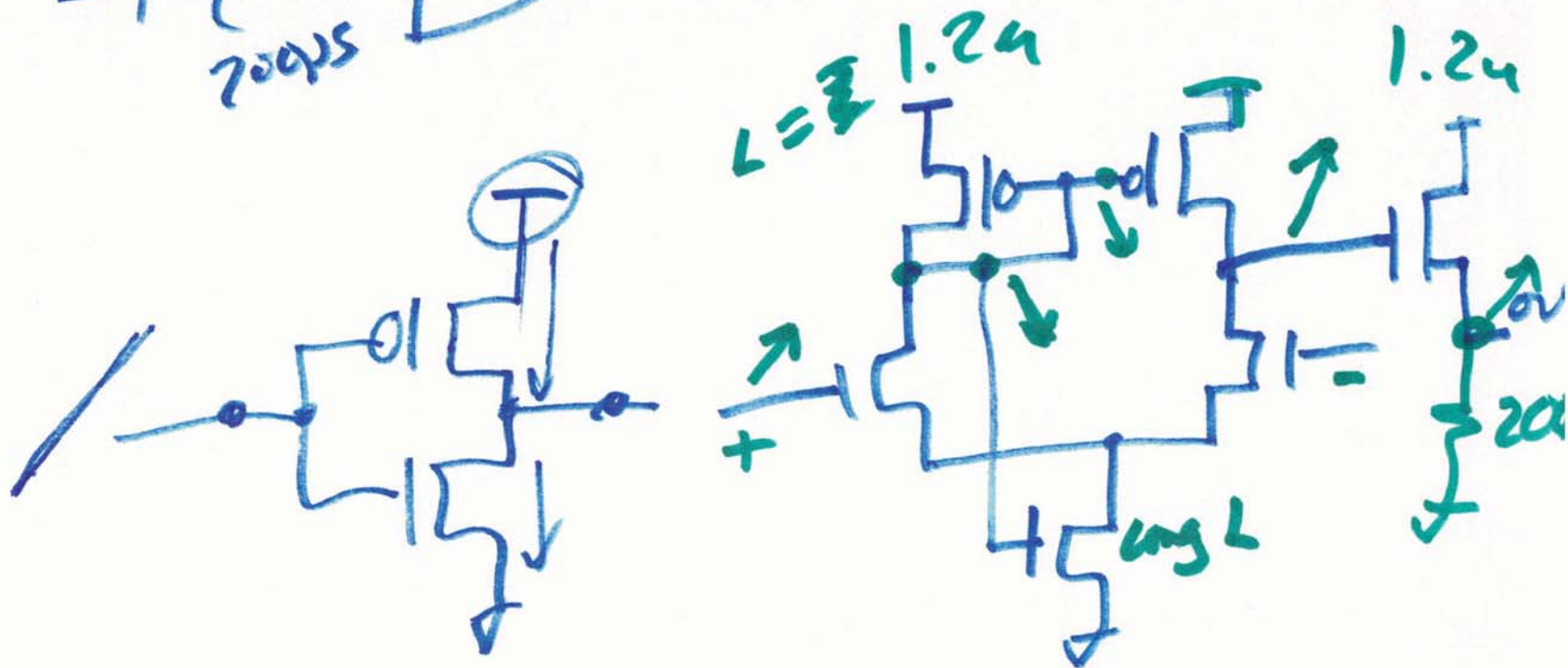
$$= C_{cup} \cdot f_{CLK} \cdot .6 \Rightarrow 1pF \cdot 100MHz \cdot .6$$

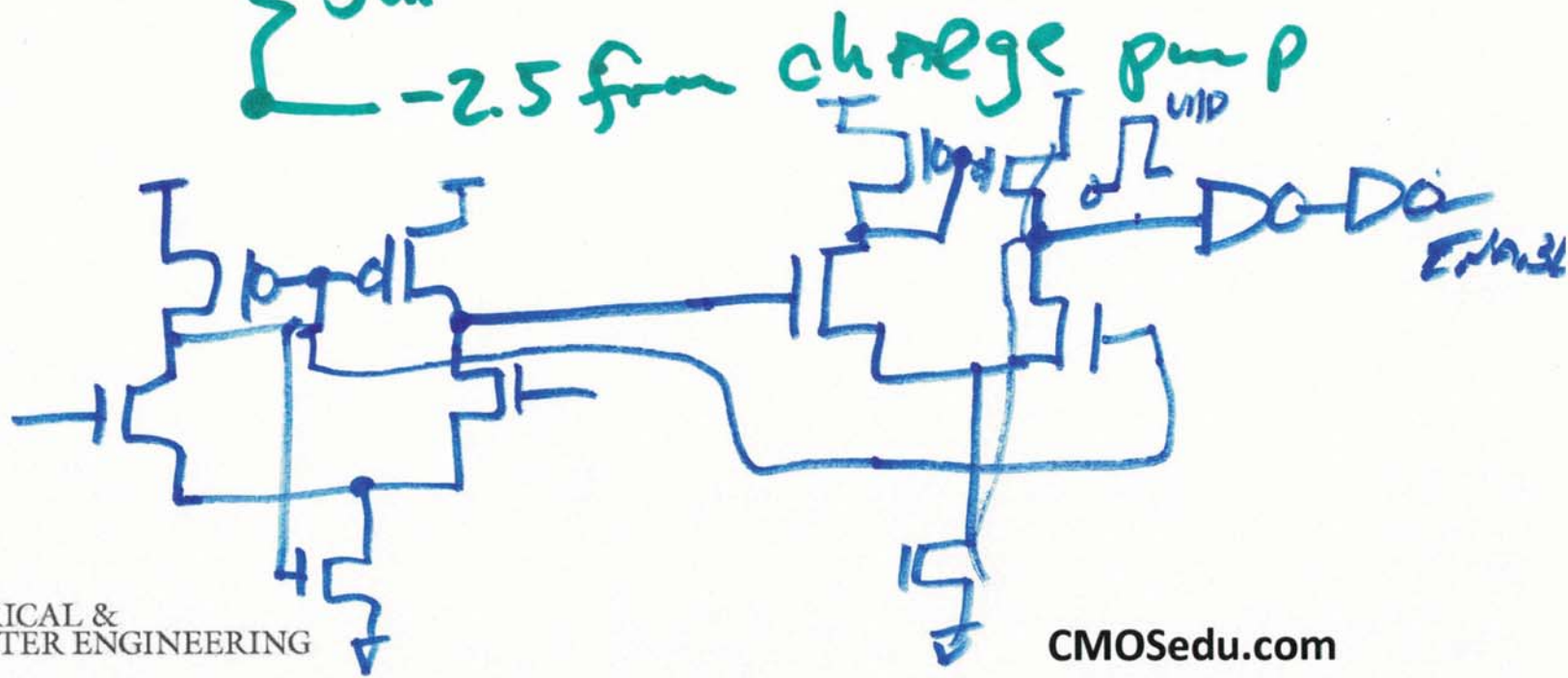
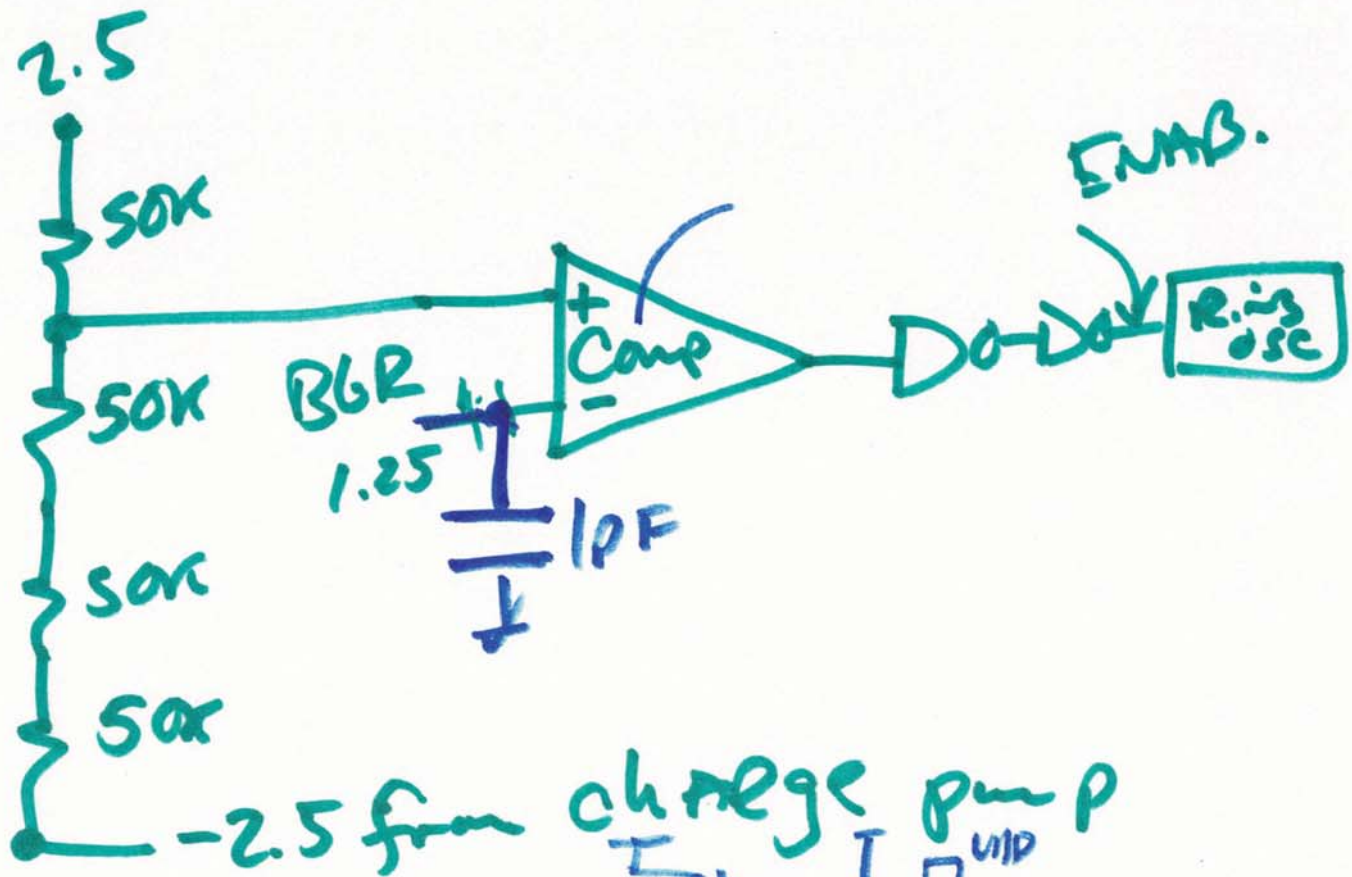
$$.6 \cdot 10^{-4} = 10^{-12} \cdot 10^8 \cdot .6$$

$$60nA = I_{AVG}$$



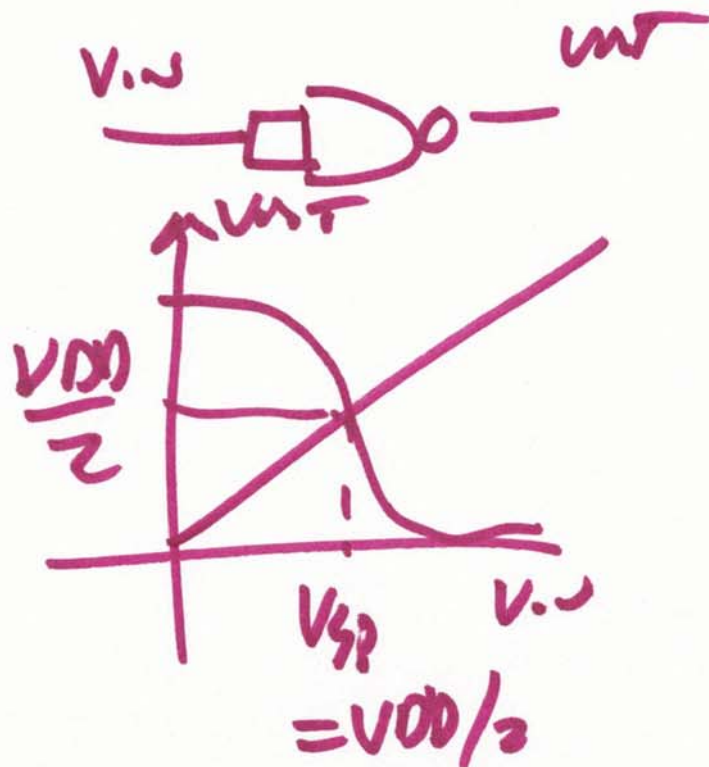
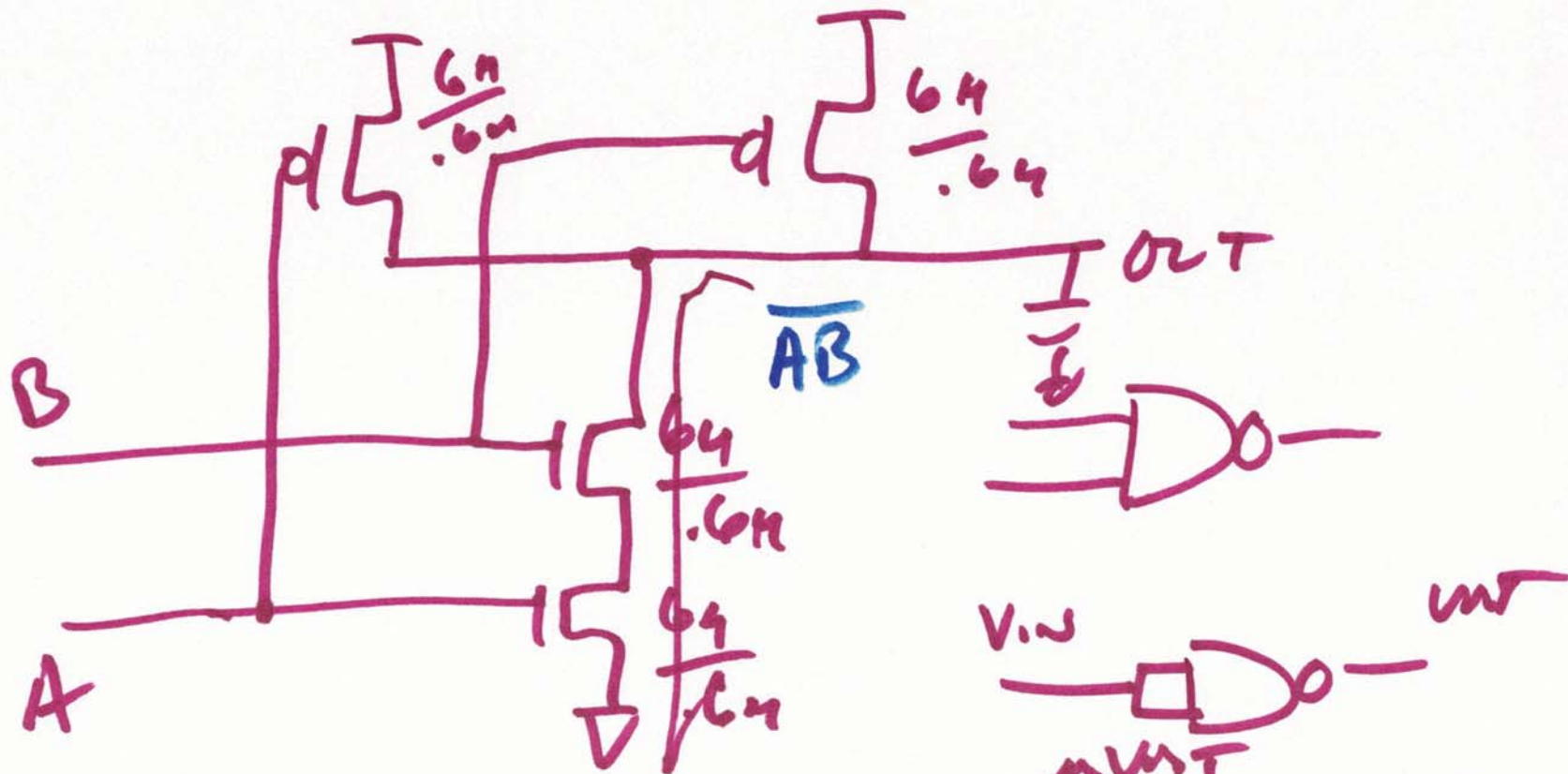
AMP





8)





9)

NOR

