

# Lecture 7

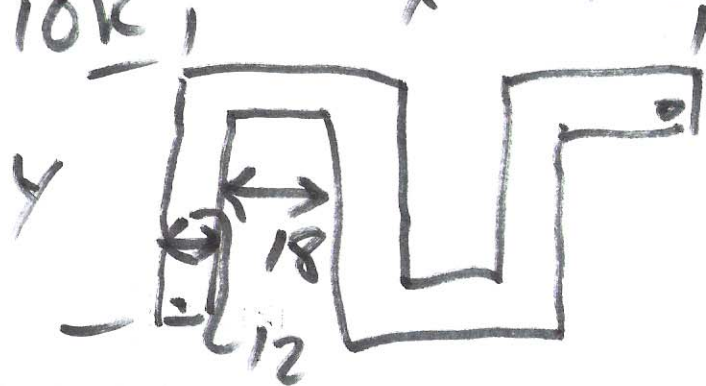
## EE 421 / ECG 621

3.2

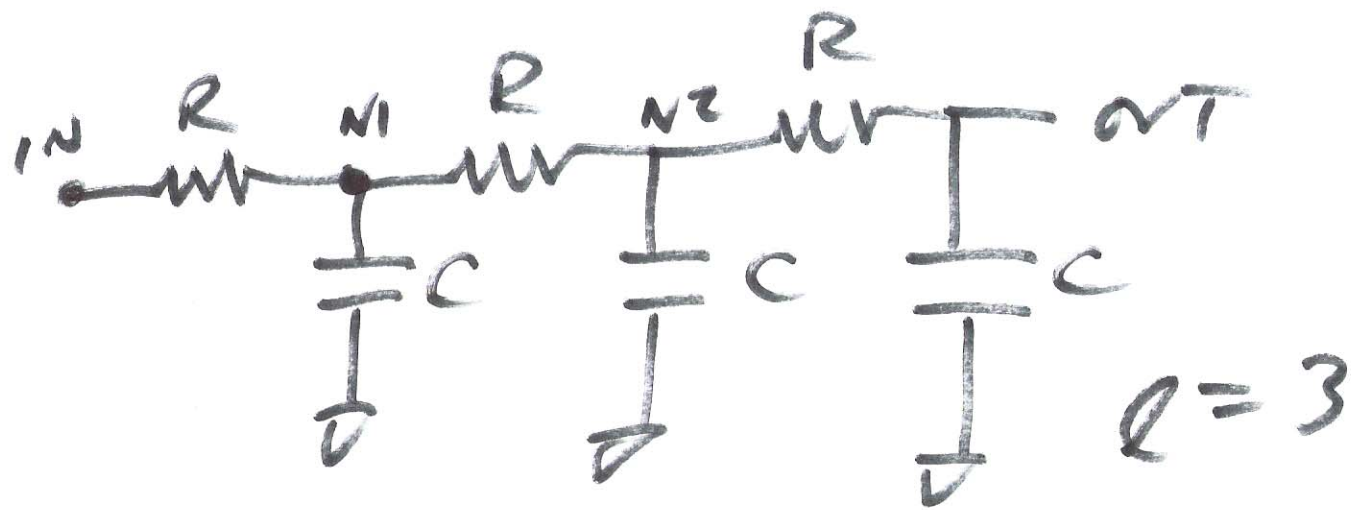
Design and

$R_D = 1.5k$  layout using

$R = 10k$ , the metal layers



1)



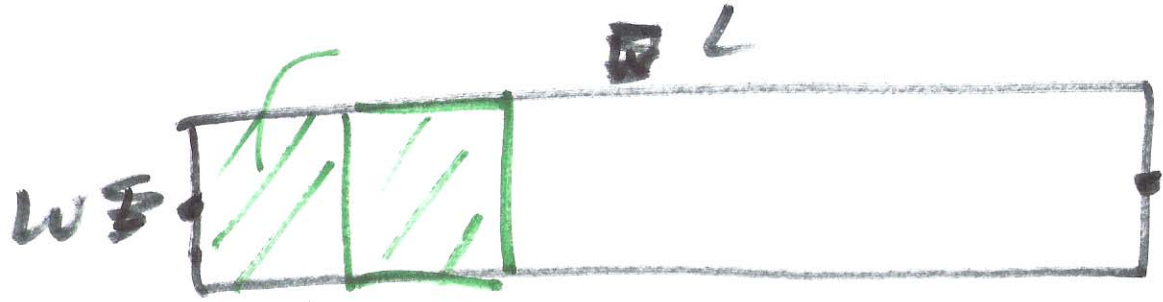
$$t_d = 0.7 RC + 0.7(R+R)C$$

$$0.7(R+R+R)C$$

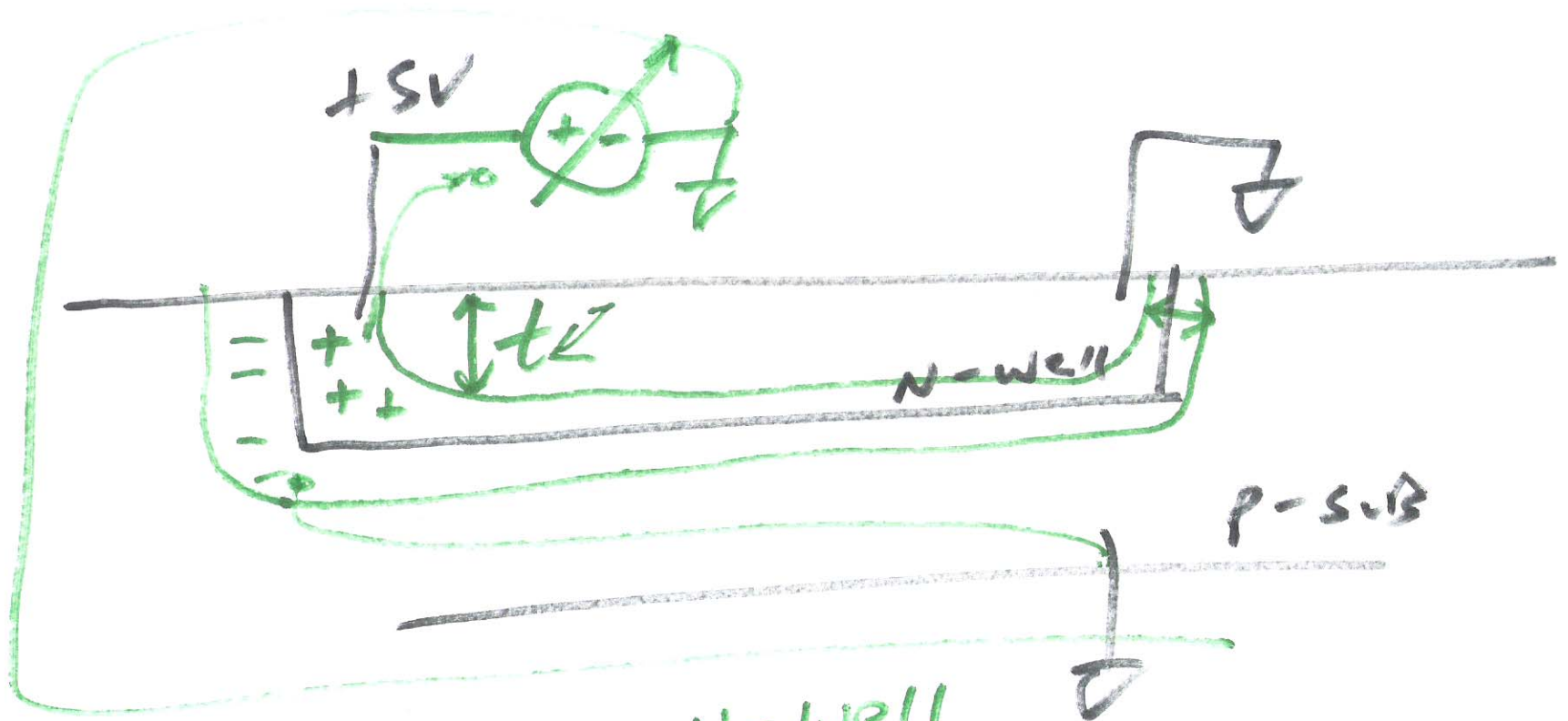
$$= 0.7 RC \frac{l(l+1)}{2}$$

$$= 0.35 RC \cdot 3 \cdot 4$$

2)

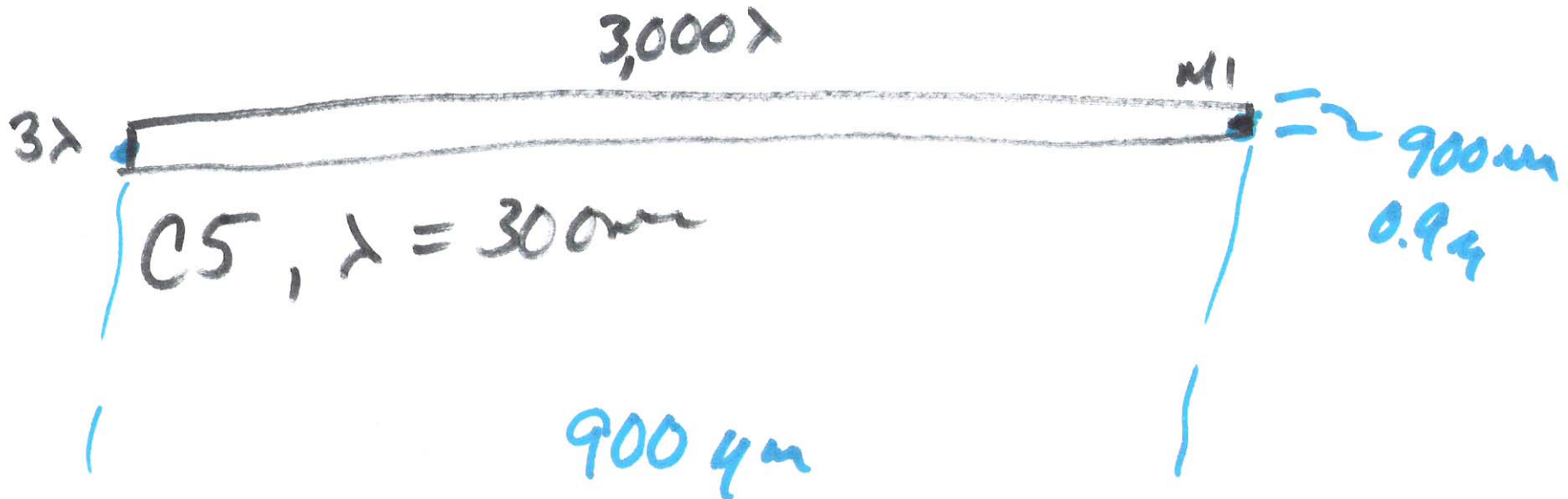


$$R = \frac{\rho L}{AW}$$



- N-well
- M3
- M2
- M1
- VIA 2
- VIA
- Glass

3)



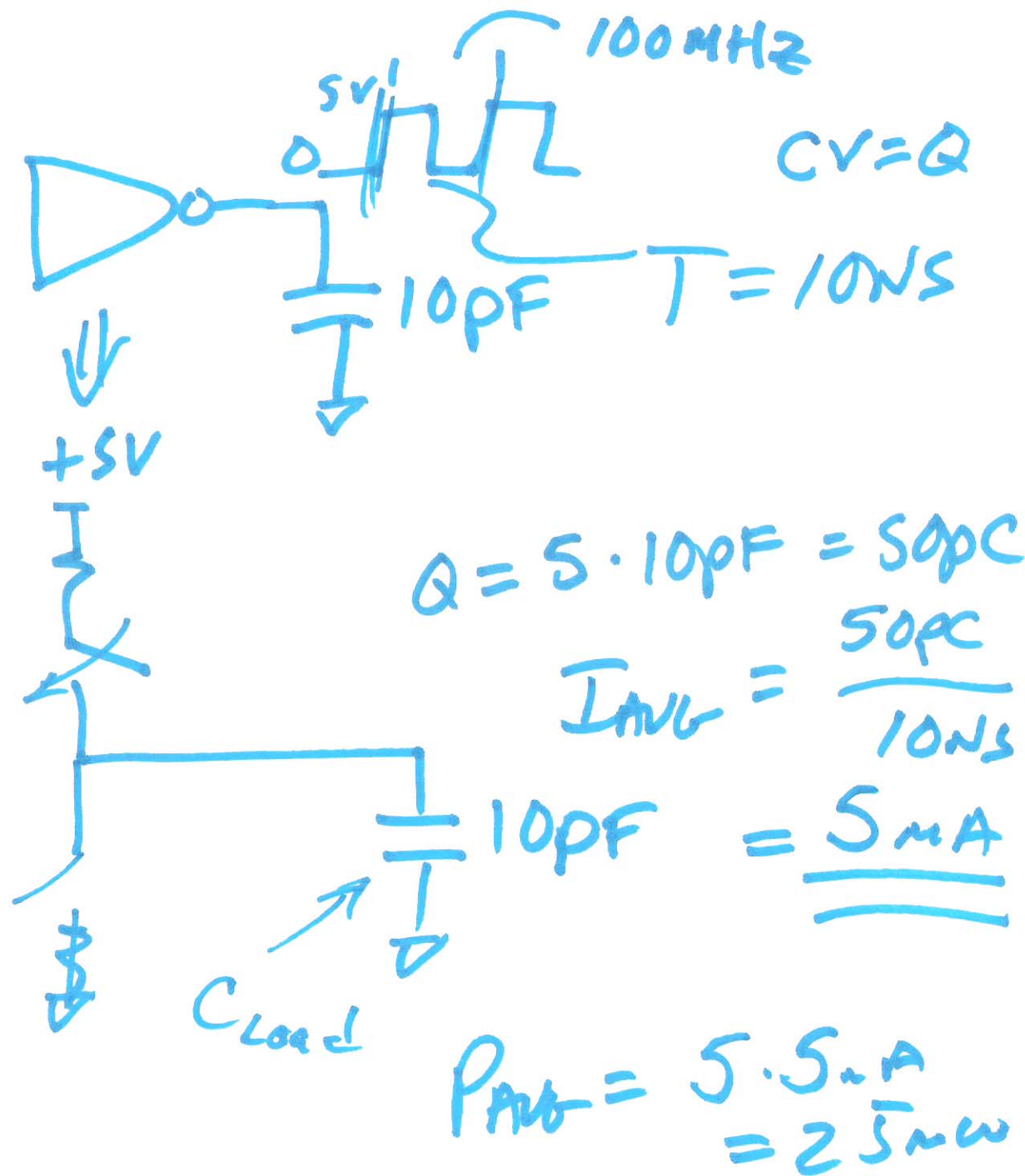
$$R = 0.09 \cdot \frac{3,000}{3} = \underline{\underline{90 \Omega}}$$

$$C = \underbrace{30aF}_{\mu m} \cdot 0.9 \mu m \cdot 900 \mu m = 25 \text{ fF}$$

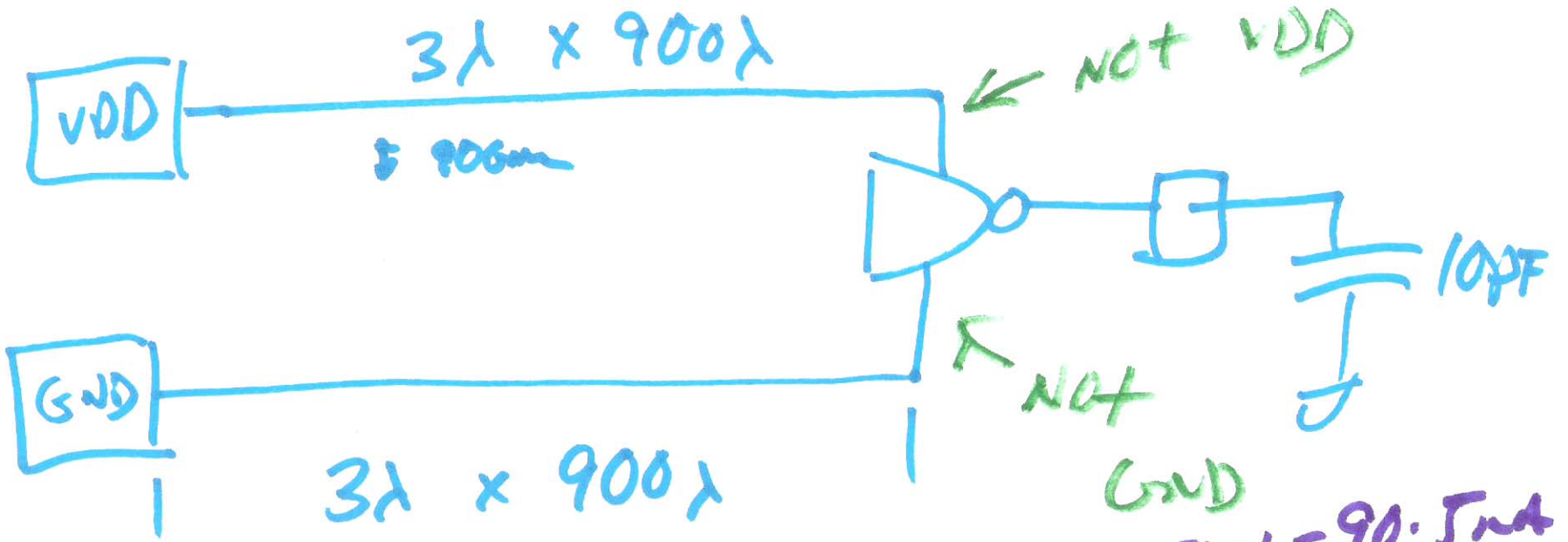
$$t_d \approx 90 \cdot 25 \text{ fF} = 2 \text{ ps}$$

27000  $\mu s$   
 27 fF  
 too fast

4)

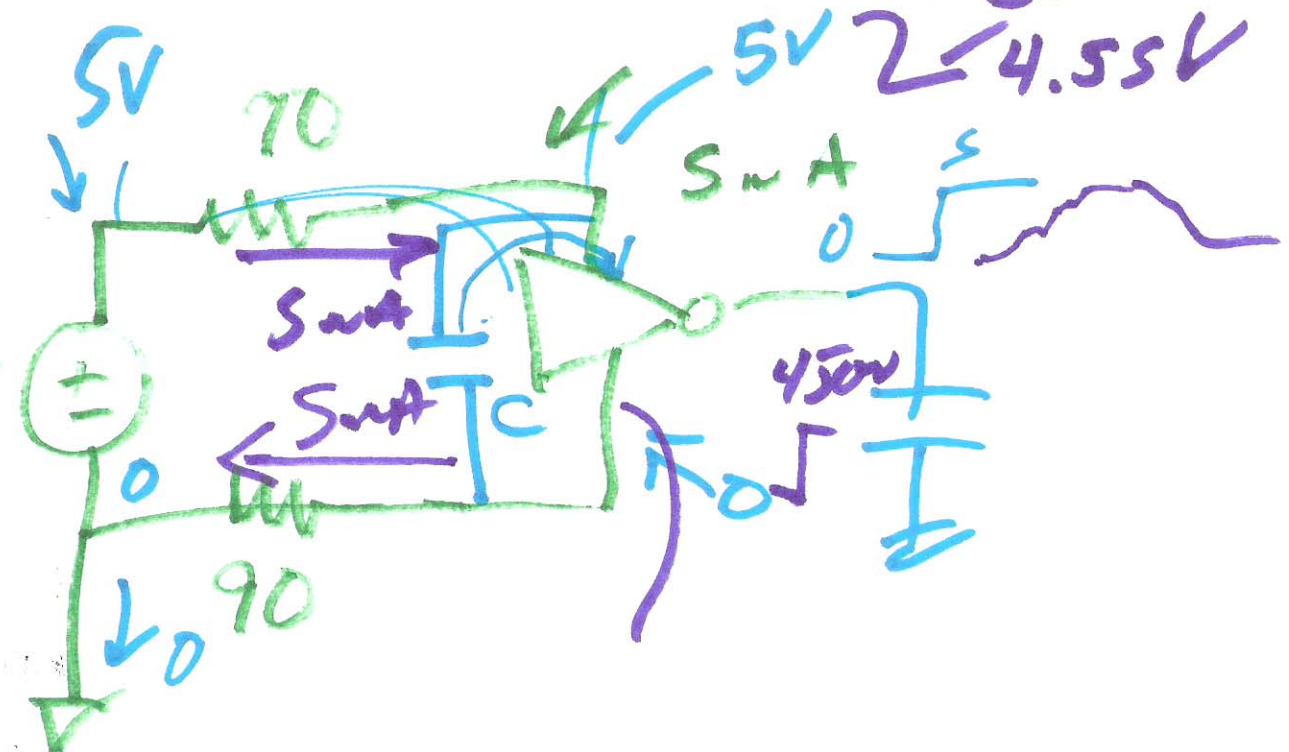


s)



$\tau_{NOT} = 90.5 \text{ ns}$

- 1) Decrease distance
- 2) Increase width
- 3)



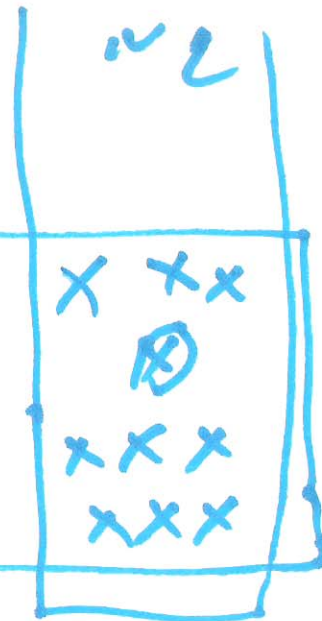
6)

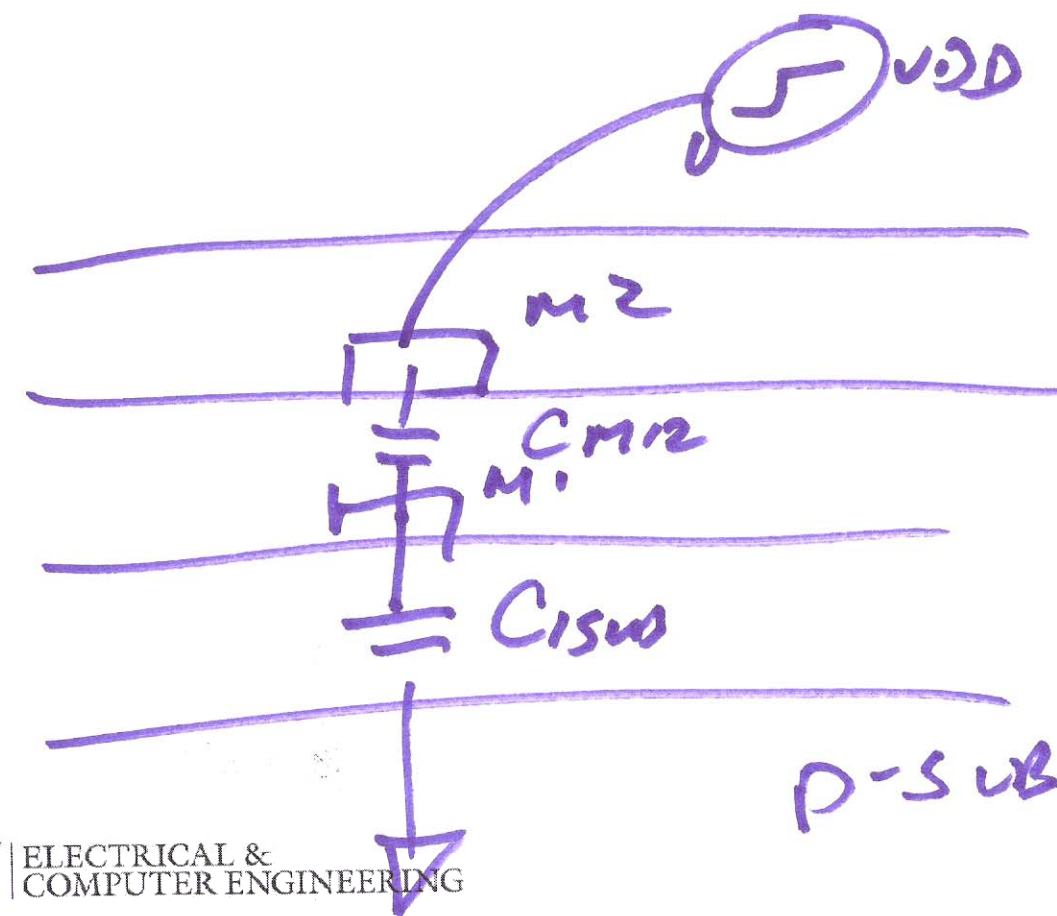
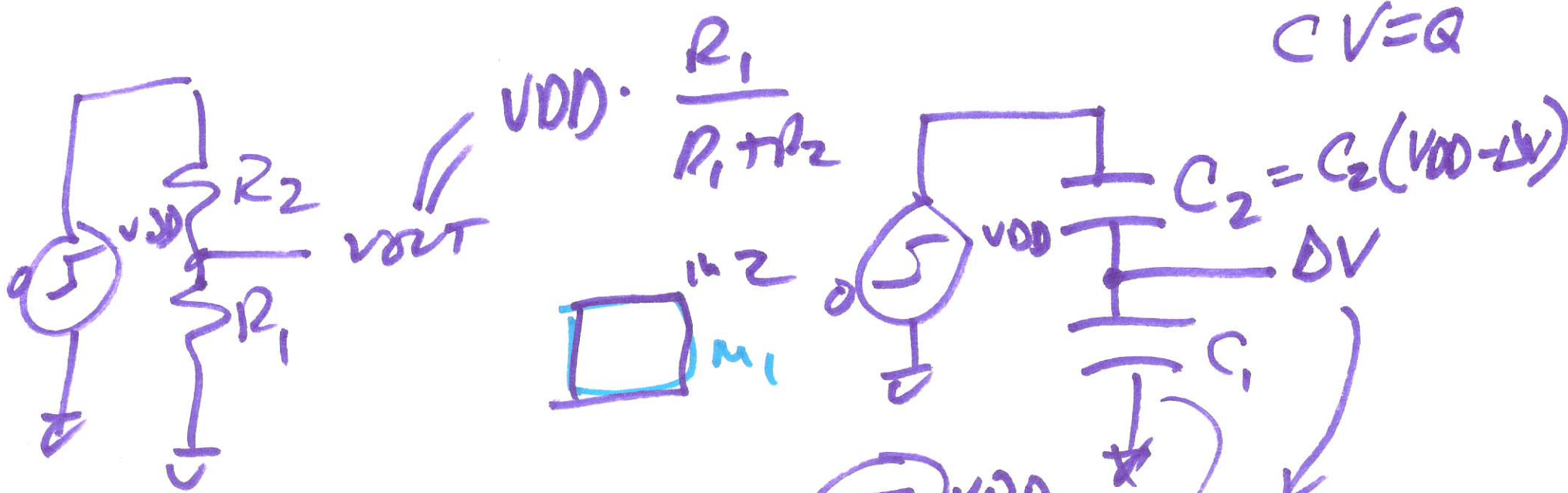
# Electromigration

$$J_{al} = I_{max} / 4m$$

$$I_{max} = 94m \cdot \frac{I_{crit}}{4m} = 900 \mu A$$

$$\frac{0.1 \mu A}{V \cdot A}$$





$\Delta V = V_{DD} \cdot \frac{C_2}{C_1 + C_2}$   
 $\Delta V \cdot C_1$

$CV = Q$

8)