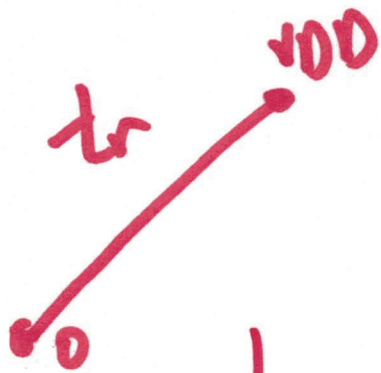


EE 421 / ECG 621

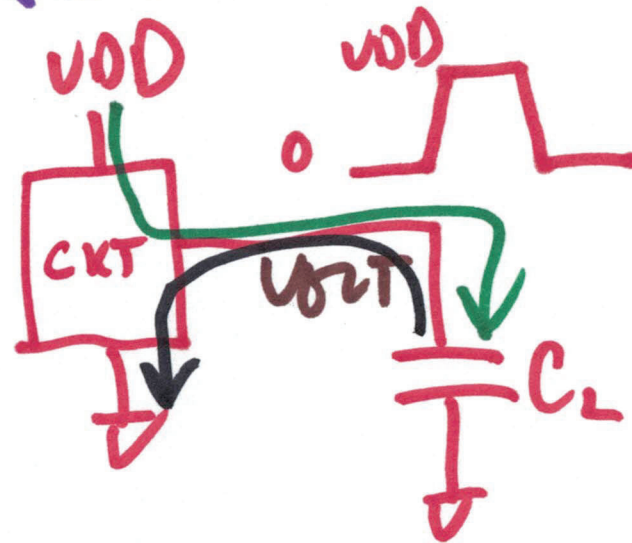
# Digital IC Design

Sept. 13, 2021

Lecture 6

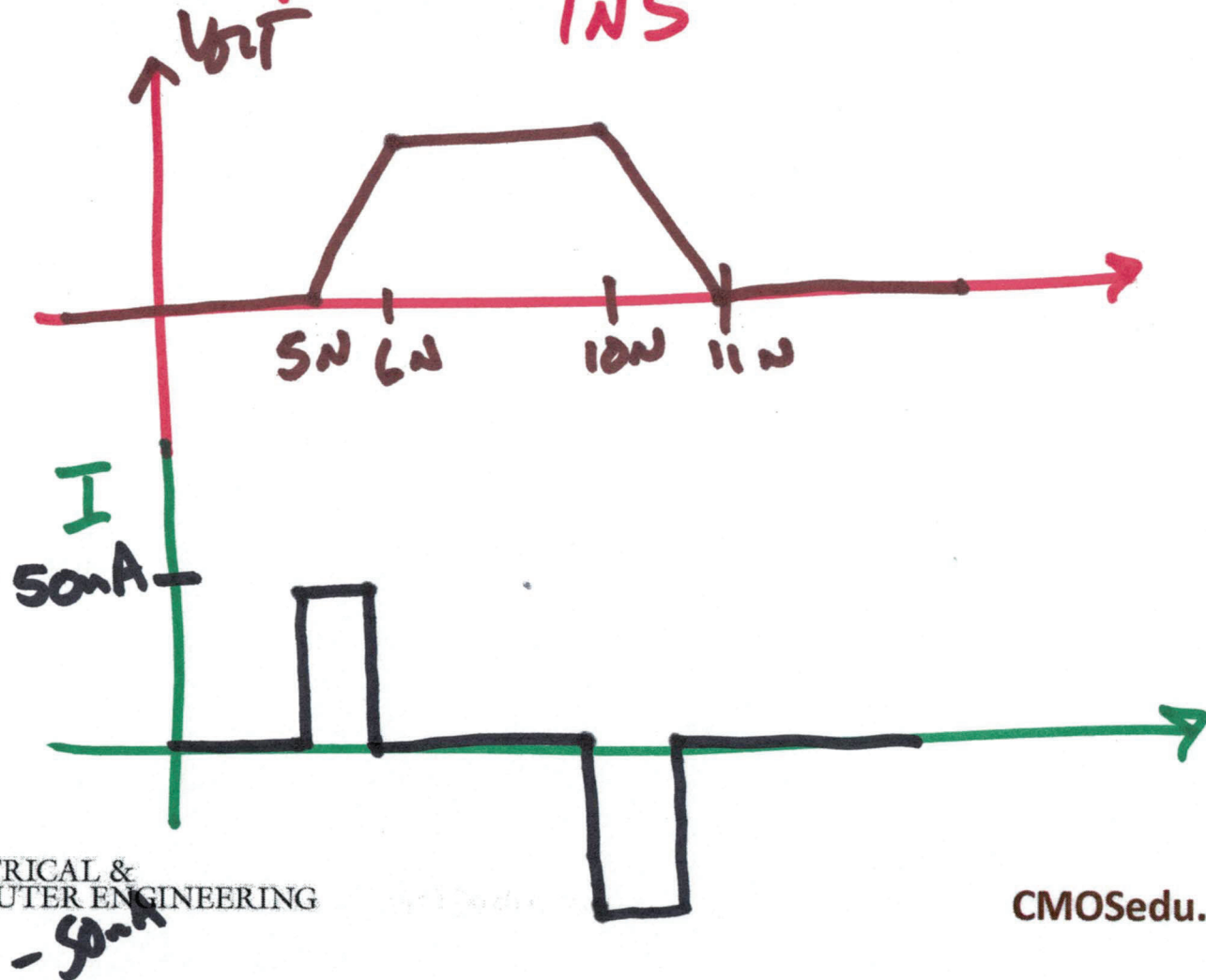


$$I = C_L \cdot \frac{V_{DD}}{t_r}$$

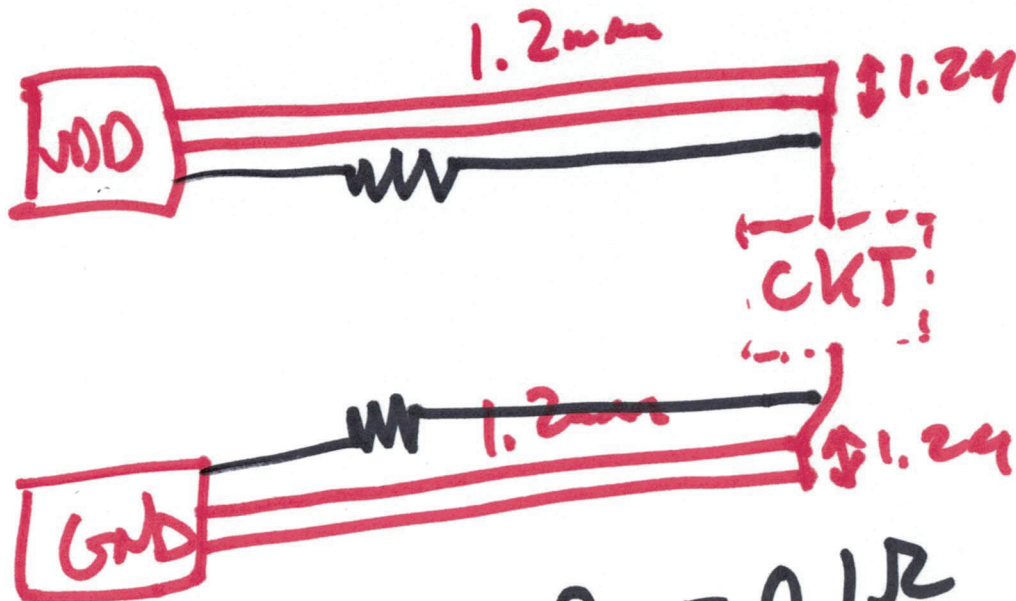


$$I = C_L \cdot \frac{V_{DD}}{t_r}$$

$$= 10 \text{ pF} \cdot \frac{5}{1 \text{ ns}} = 50 \text{ nA}$$



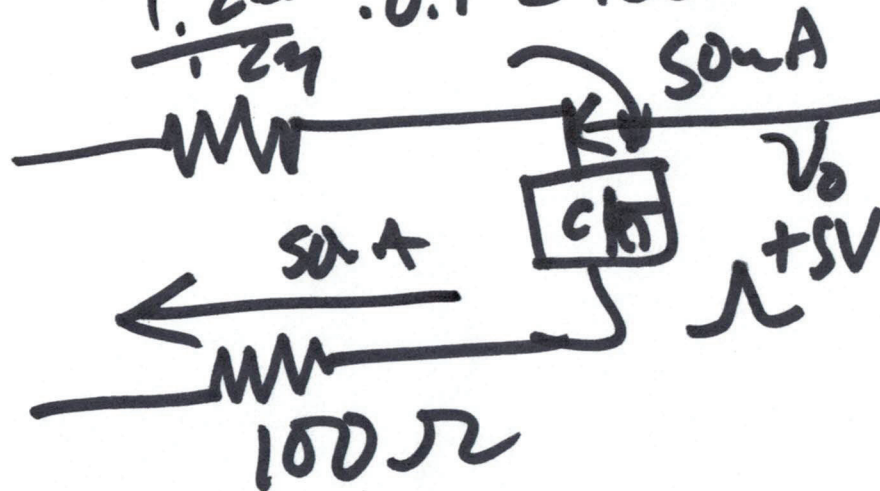
2)



pulses  
50nA

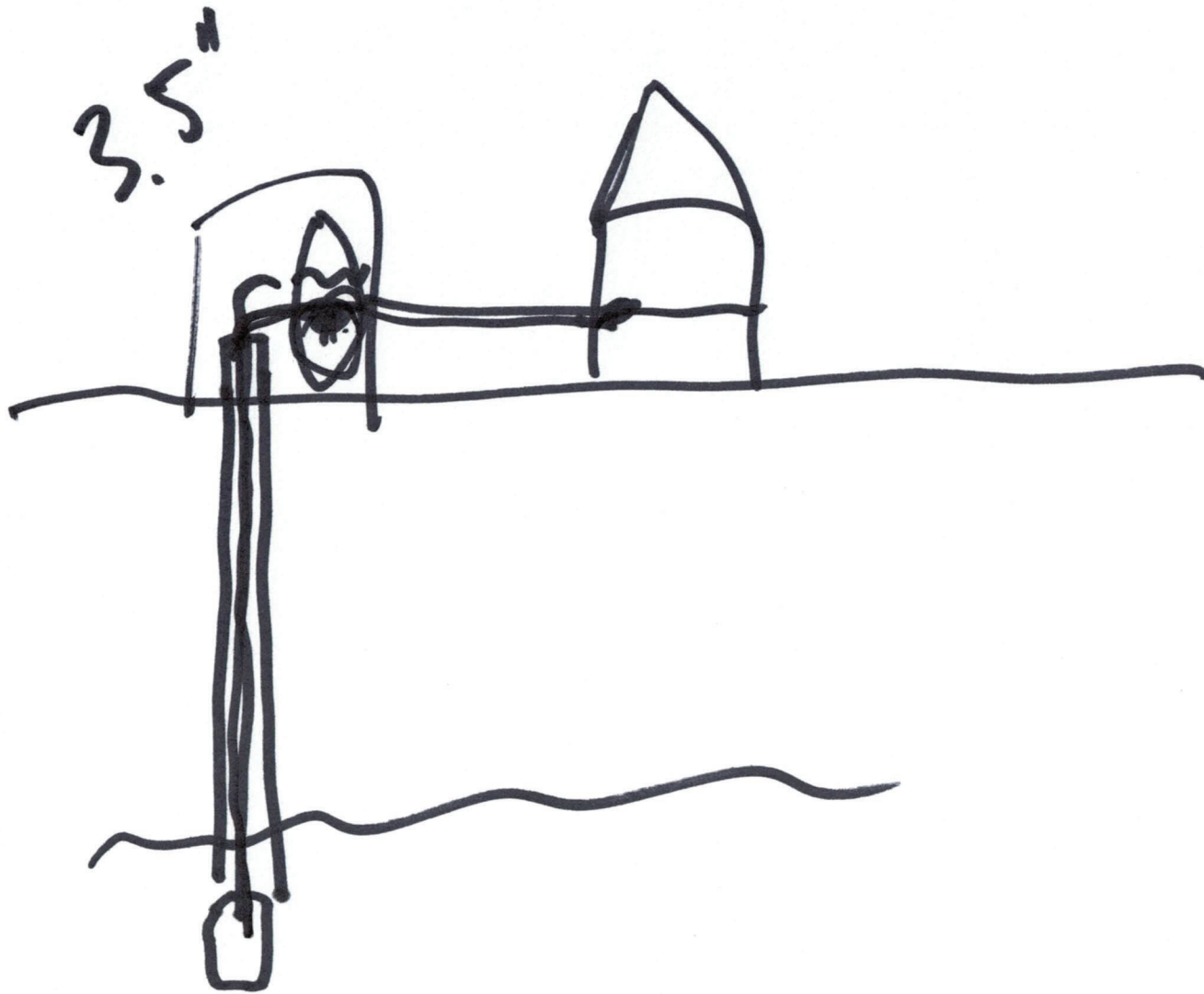
$$R_{\square} = 0.1 \frac{\Omega}{\square}$$

$$\frac{1.2 \mu\text{m}}{1.2 \mu\text{m}} \cdot 0.1 = 100 \Omega$$



$$5 - 50\text{nA} \cdot 100 = 0\text{V}$$

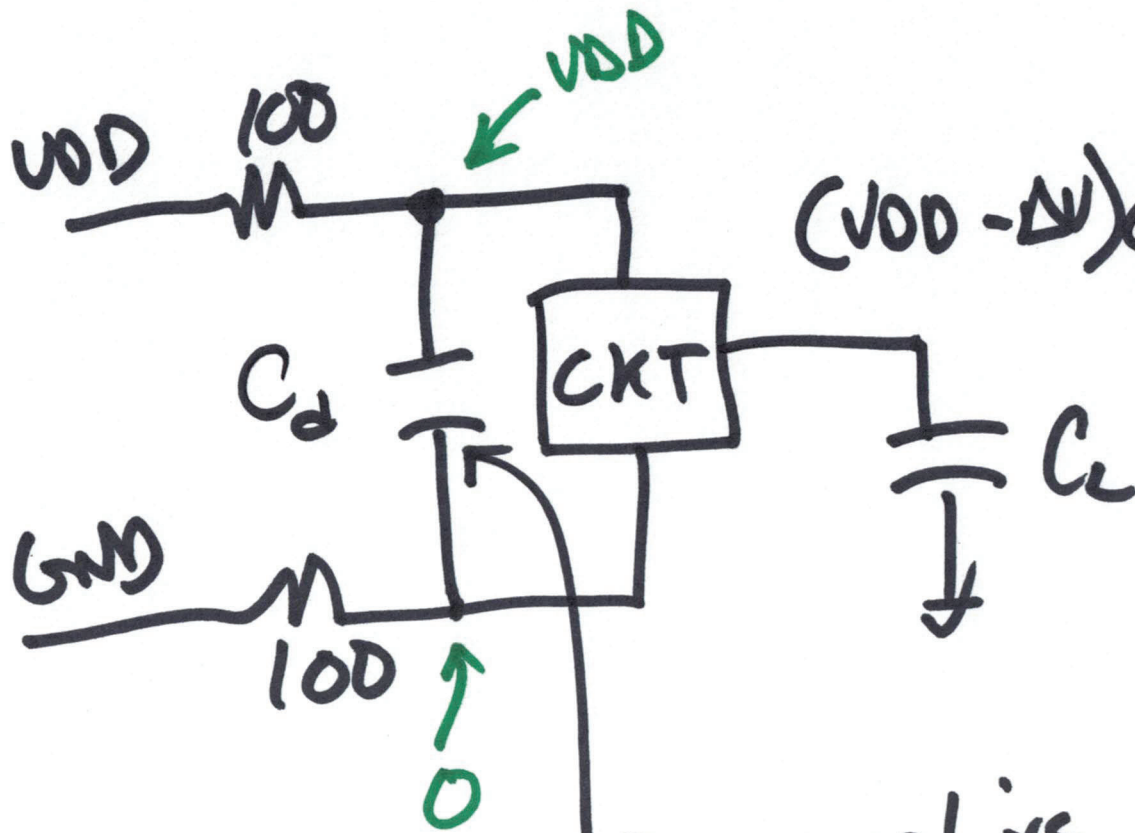
3)



3.5"

a)

$$Q = CV$$



$$(VDD - \Delta V)C_d = VDD \cdot C_L$$

$$C_d = \frac{VDD \cdot C_L}{VDD - \Delta V}$$

Decoupling capacitor

$$VDD = 5$$

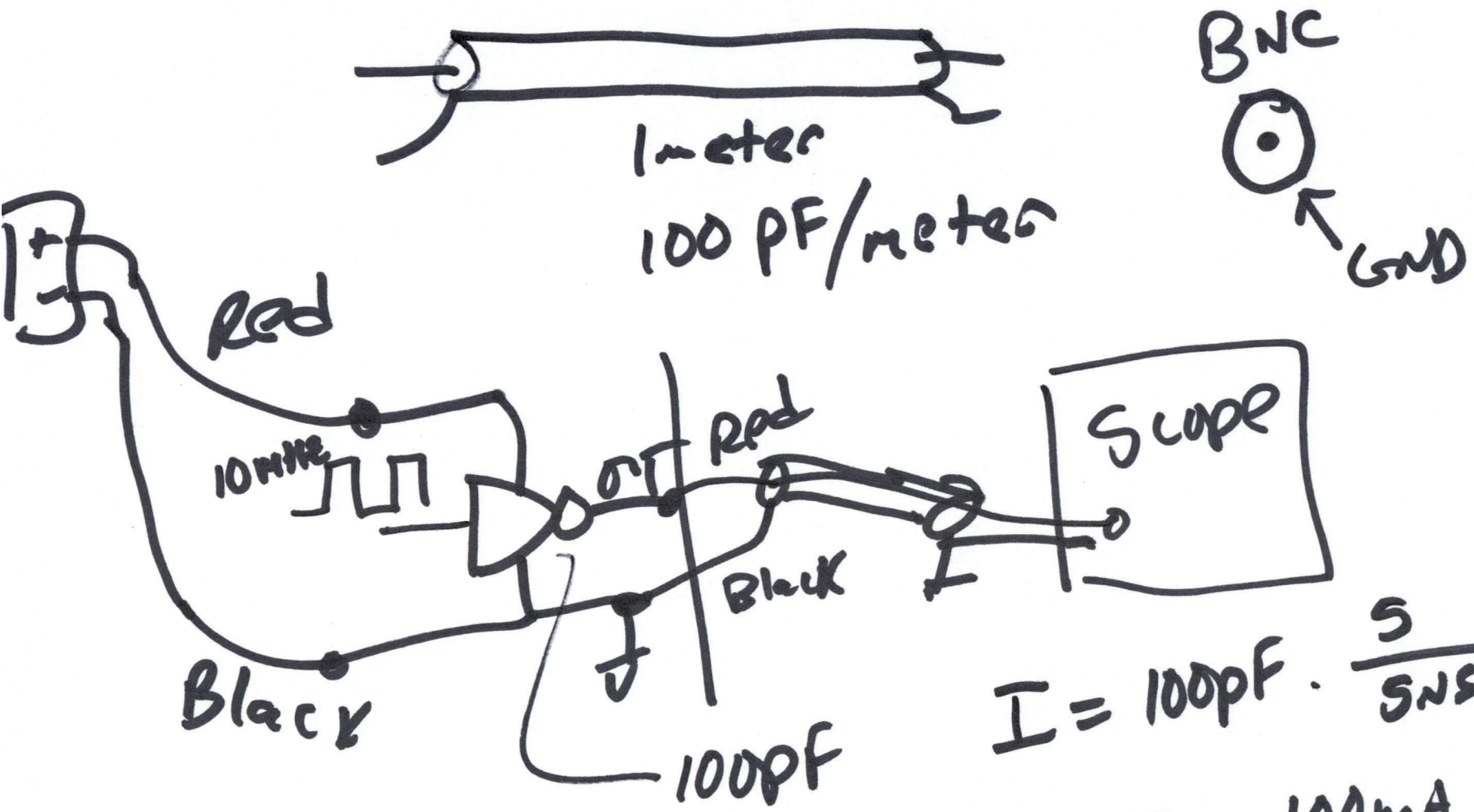
$$C_L = 10 \text{ pF}$$

$$\Delta V = 250 \text{ mV}$$

$$C_d = \frac{5 \cdot 10}{5 - .25} \text{ pF}$$

$$C_d = 10.5 \text{ pF}$$

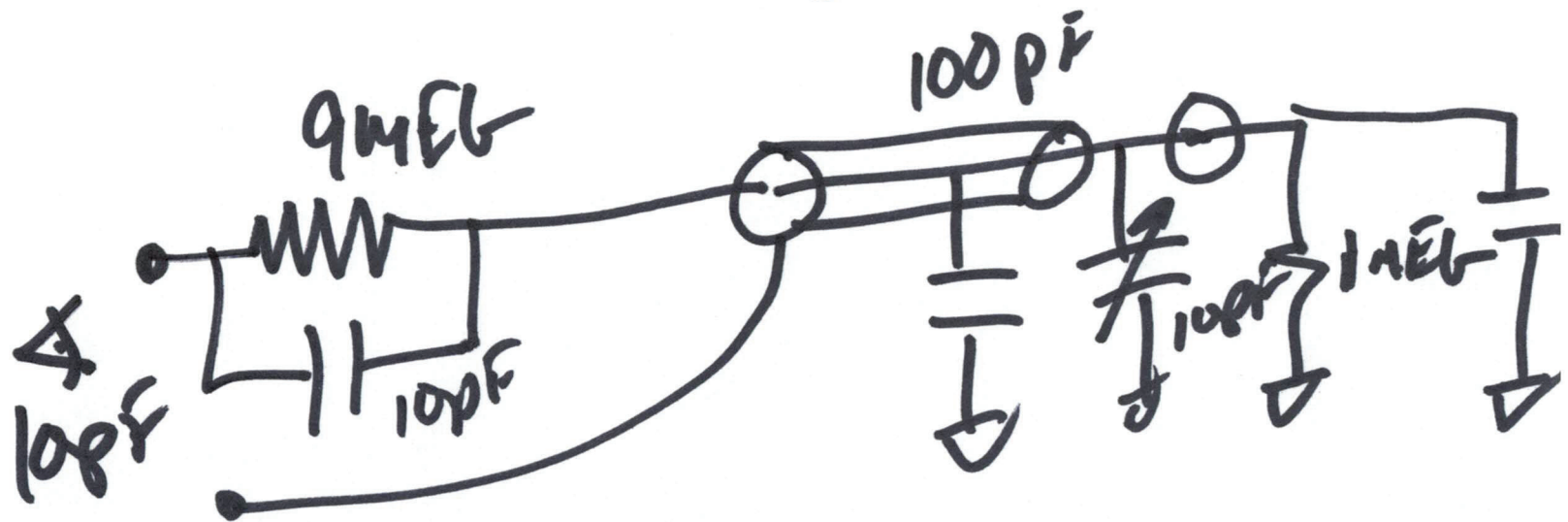
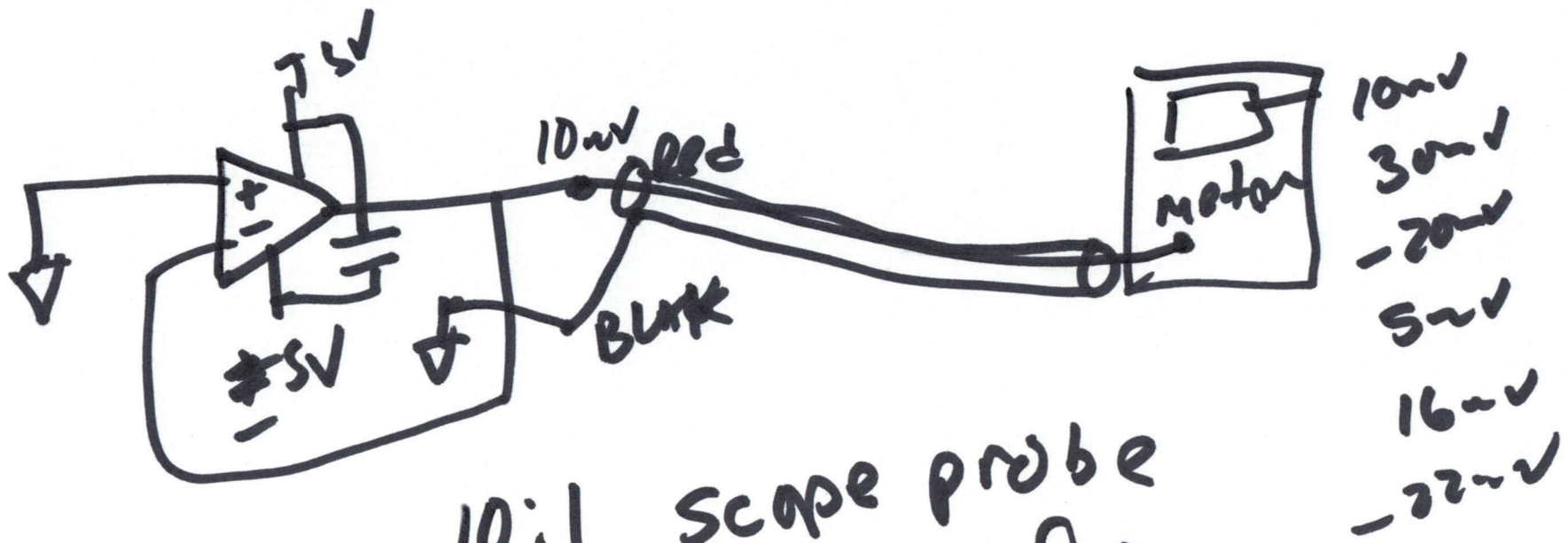
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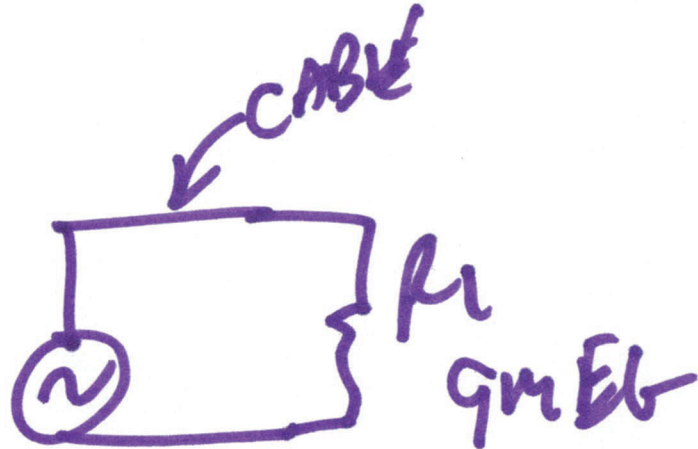
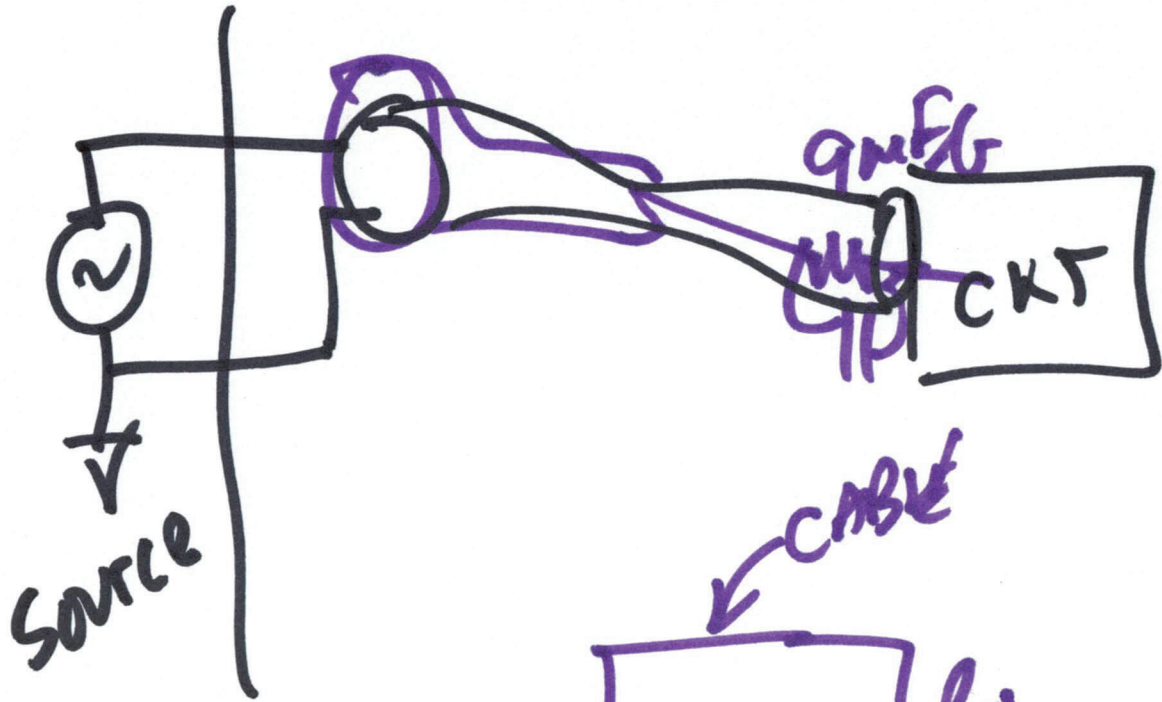


$$I = 100\text{pF} \cdot \frac{5}{5\text{ns}}$$

$$I = 100\text{nA} = 0.1\text{A}$$

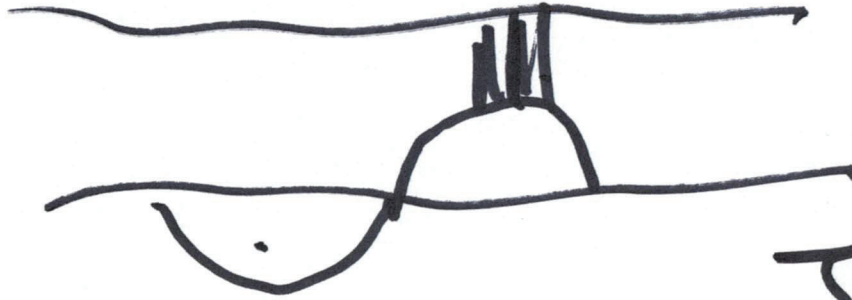
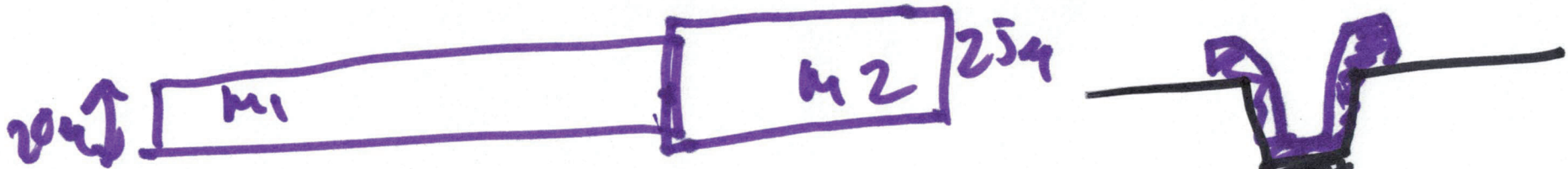
6)



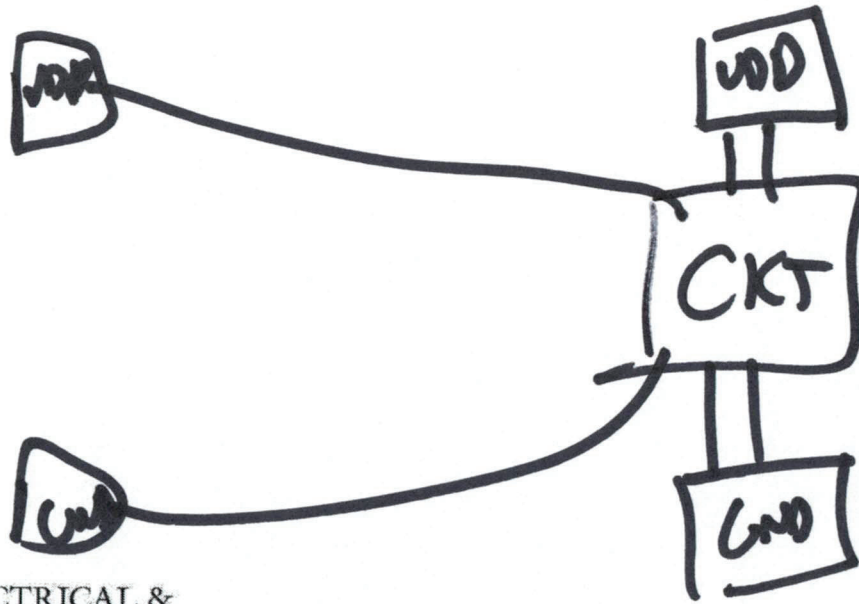




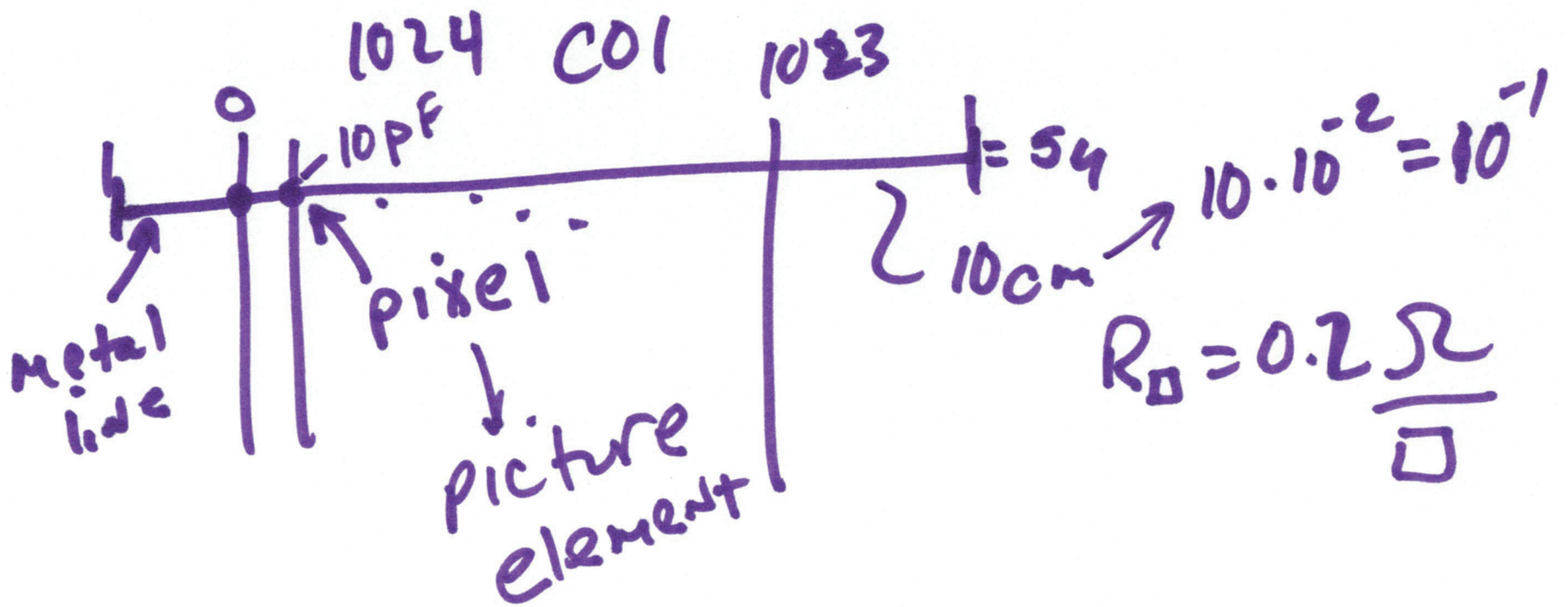
# Electromigration



$$|J_A| = \frac{I \cdot A}{4r}$$



9/



$$t_d = 0.35 r \cdot l \cdot C \cdot l$$

$10^5 \cdot 10^{-6}$

$$= 0.35 \cdot 0.2 \frac{100,000 \Omega}{5 \Omega} \cdot 10 \text{ pF} \cdot 1024$$

$$t_d = 14.34 \text{ s}$$

delay through row