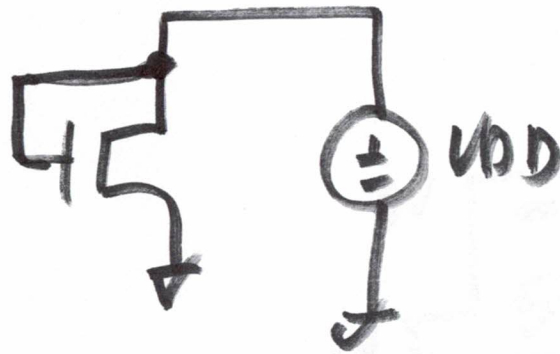


EE 421 / ECG-621

Lecture 13

Oct. 7, 2015

$I_{D,av}$

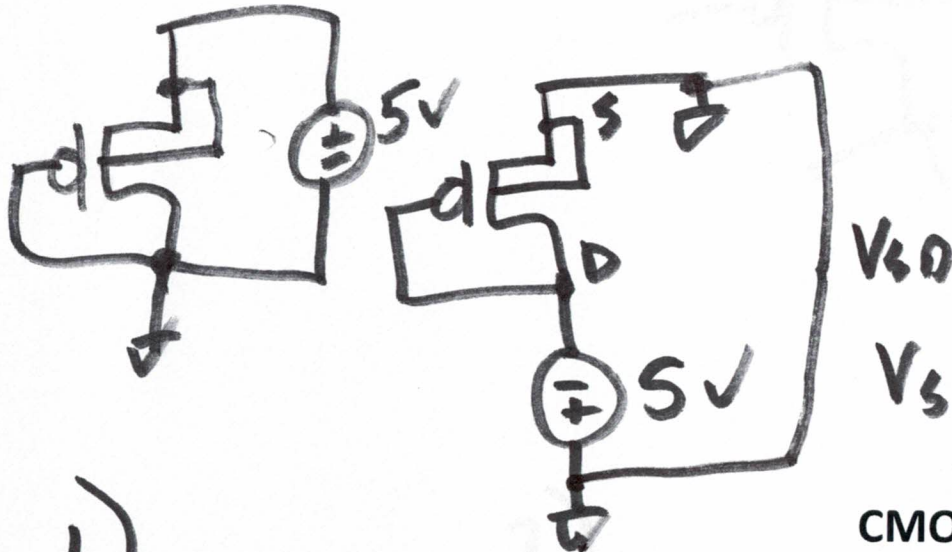


$$I_{D,av} = I_{av} \cdot W$$

$$I_{av} = \frac{I_{D,av}}{W} \left(\frac{4A}{4\mu} \right)$$

I_{drive}

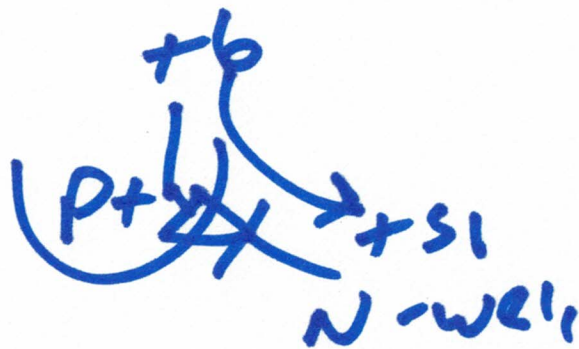
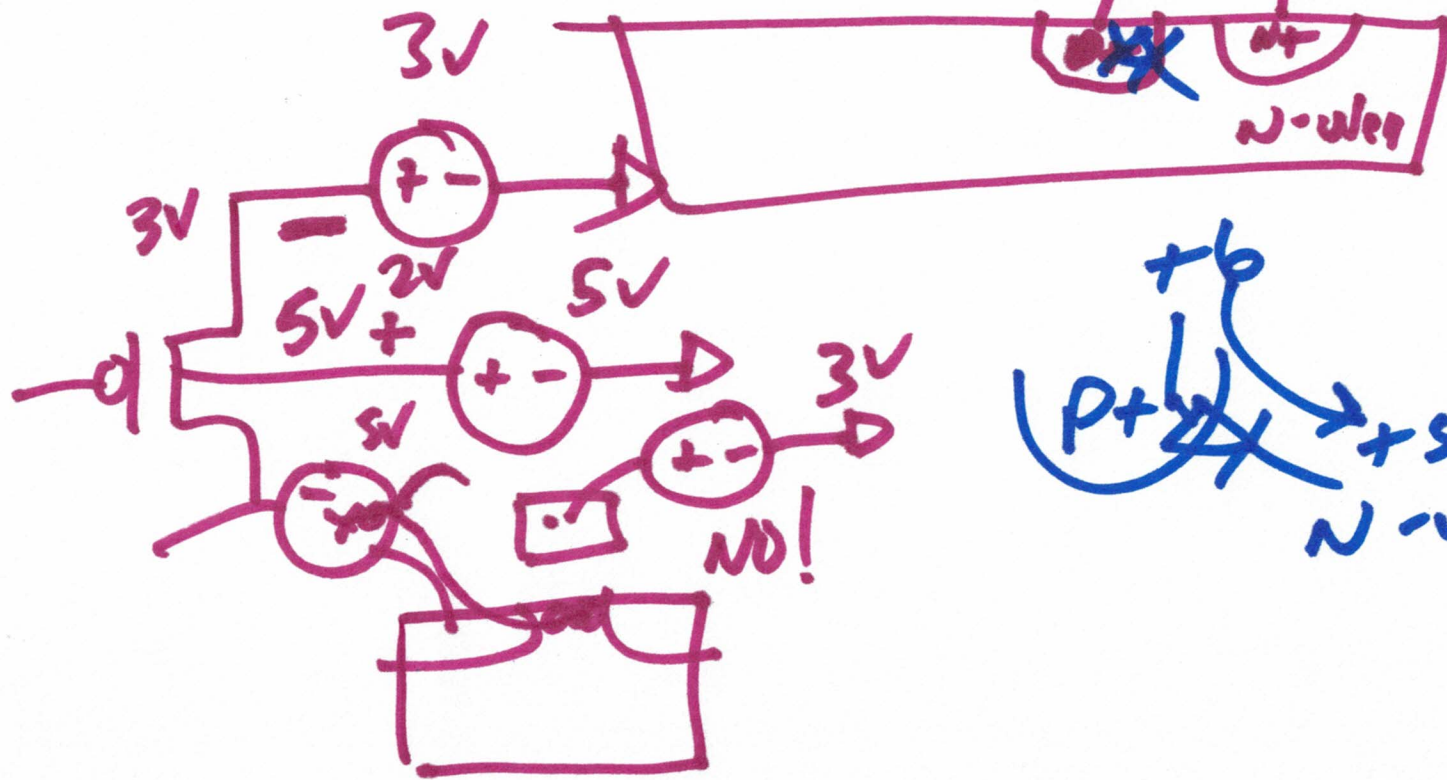
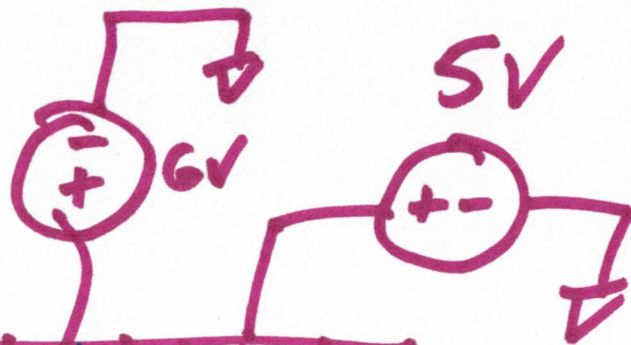
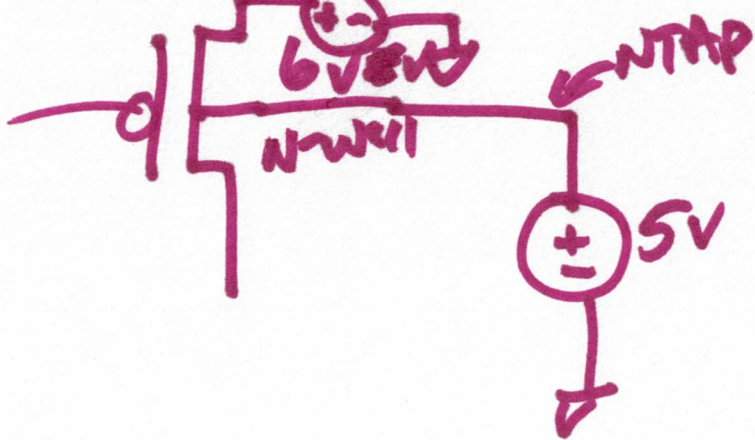
$I_{D,SAT}$



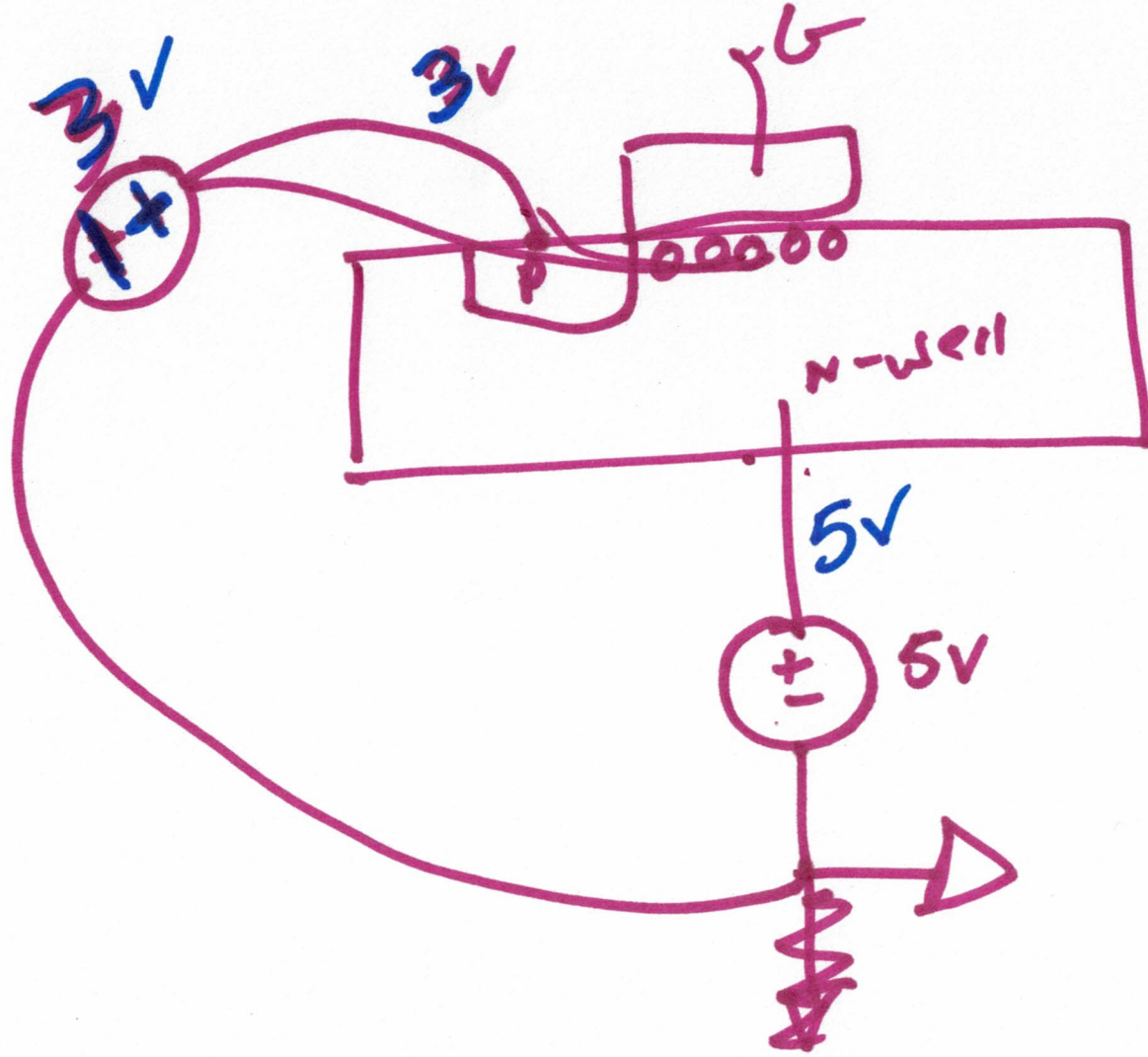
V_{SD}

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

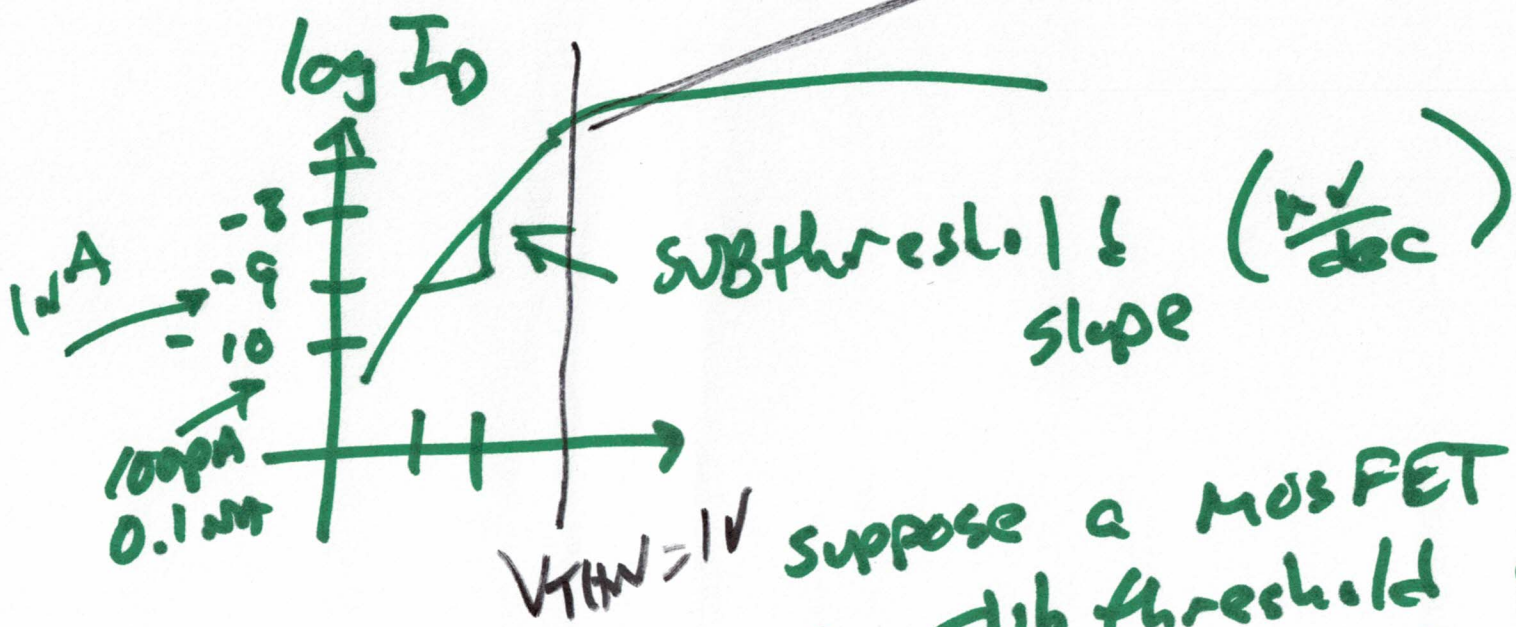
1)



2)

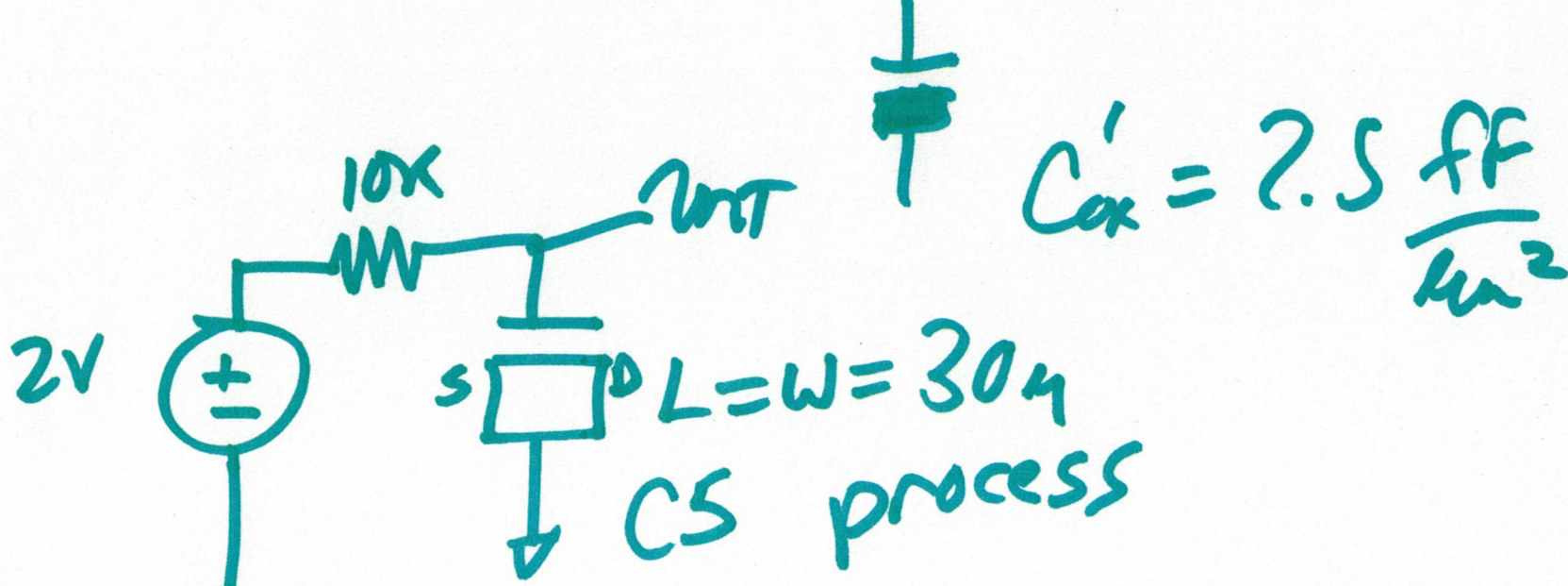


3)



suppose a MOSFET has a subthreshold slope of $100mV/dec$. if $V_{THN} = 1V$ and the current that flows at $V_{GS} = 0.631V$ is $9.7nA$ how much current flows at a V_{GS} of $0.831V$?

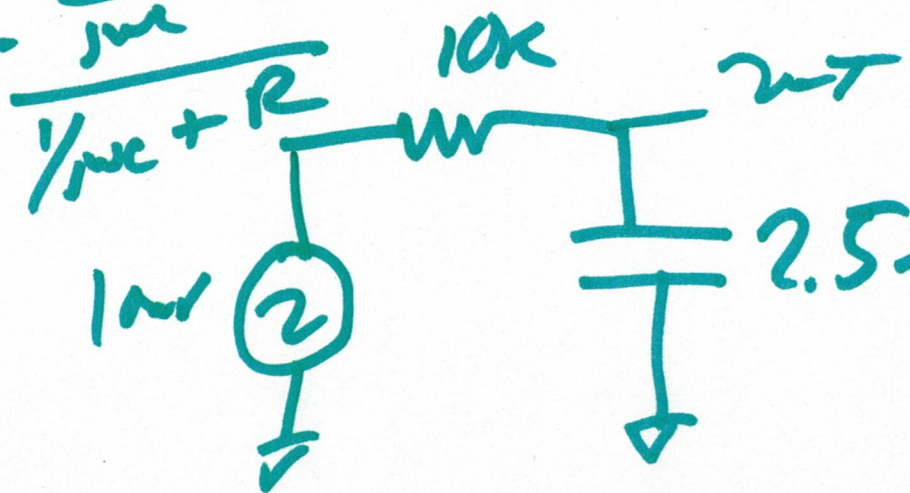
$$0.974nA = 970nA$$



5uV = $\frac{10mW \cdot \frac{1}{j\omega C}}{\frac{1}{j\omega C} + R}$

10mW peak

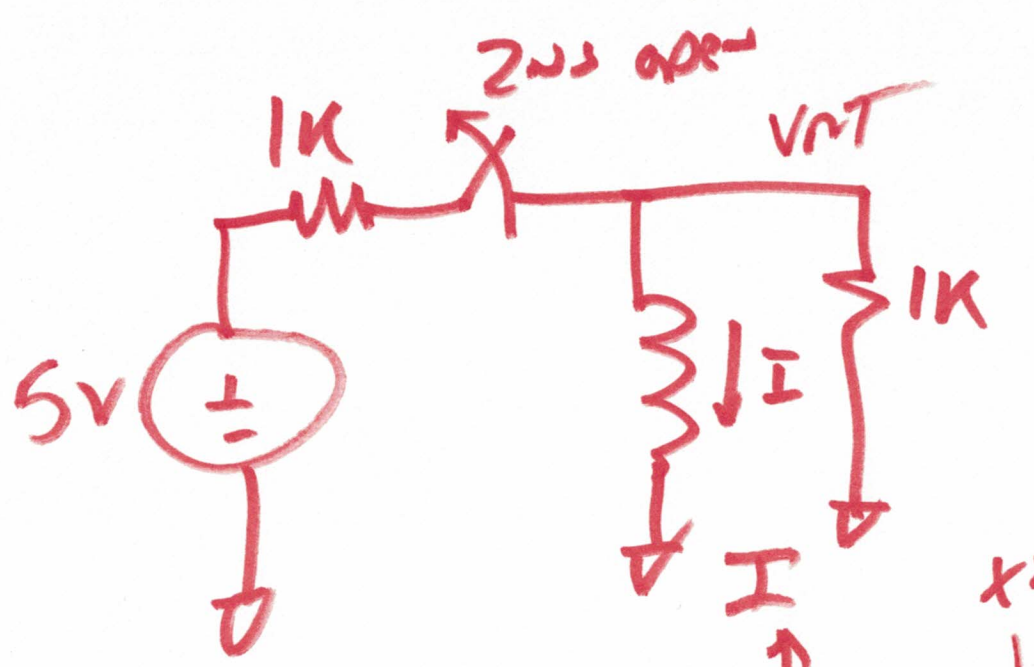
AT what f is $2uT = 5uV$ peak



$$\frac{1}{2} = \frac{1}{\sqrt{1 + (j \cdot 2\pi f \cdot 10k \cdot C)^2}}$$

5)

Circuits problem

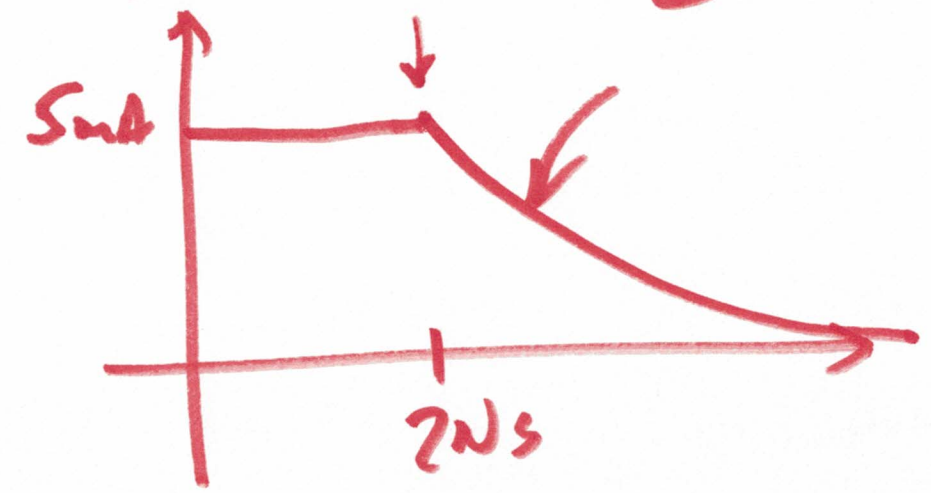


freq. response
step response

20% \rightarrow 80%
10% \rightarrow 90%

$$I = 5mA e^{-\frac{t}{\tau}}$$

$$I = 5mA e^{-\frac{(t-2ns)}{\tau}}$$



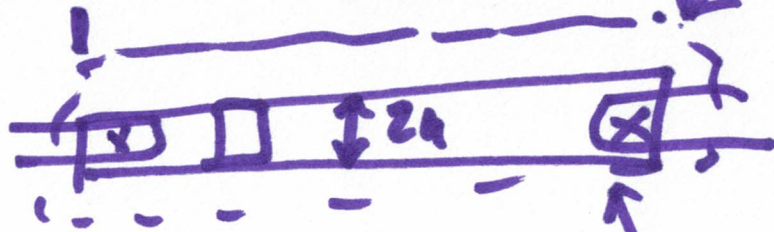
b)

Layers → Layout

RC-delays

through N-well

300nm



N-select P+

N+

Metal 1

sheet resistance.

$$R = 150 \cdot 50 = 7.5K$$

ACTIVE

$$r = 50 \Omega/\square$$

$$C = C_{i0} = 200 \text{ aF}/\mu\text{m}^2$$

$$r = 50$$

$$C = 200 \frac{\text{aF}}{\mu\text{m}^2} \cdot 2 \mu\text{m} \cdot 2 \mu\text{m} = 800 \text{ aF}$$

metal layer loaded every 1μm with

$$t_d = 0.35 \cdot 50 \cdot 800 \cdot 10^{-18} \cdot 150^2$$

100 aF

estimate t_d

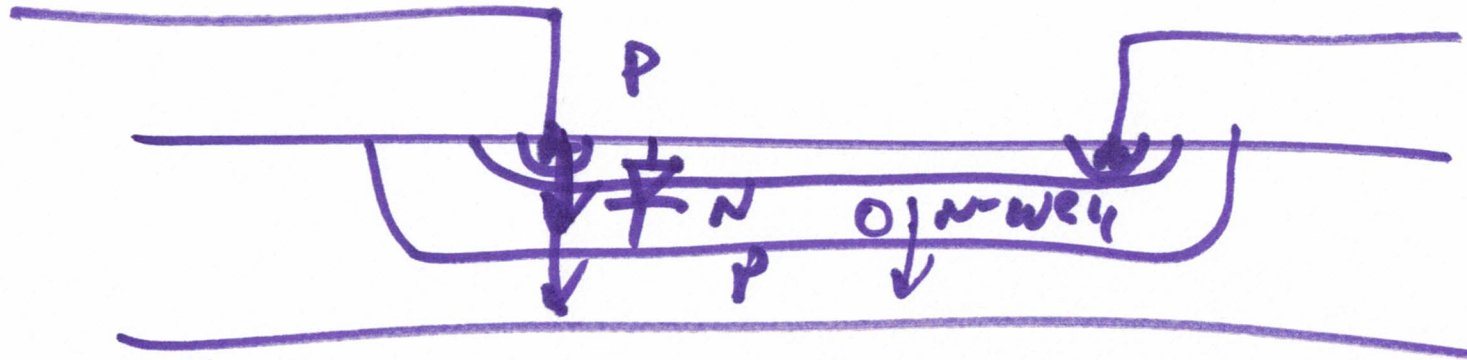
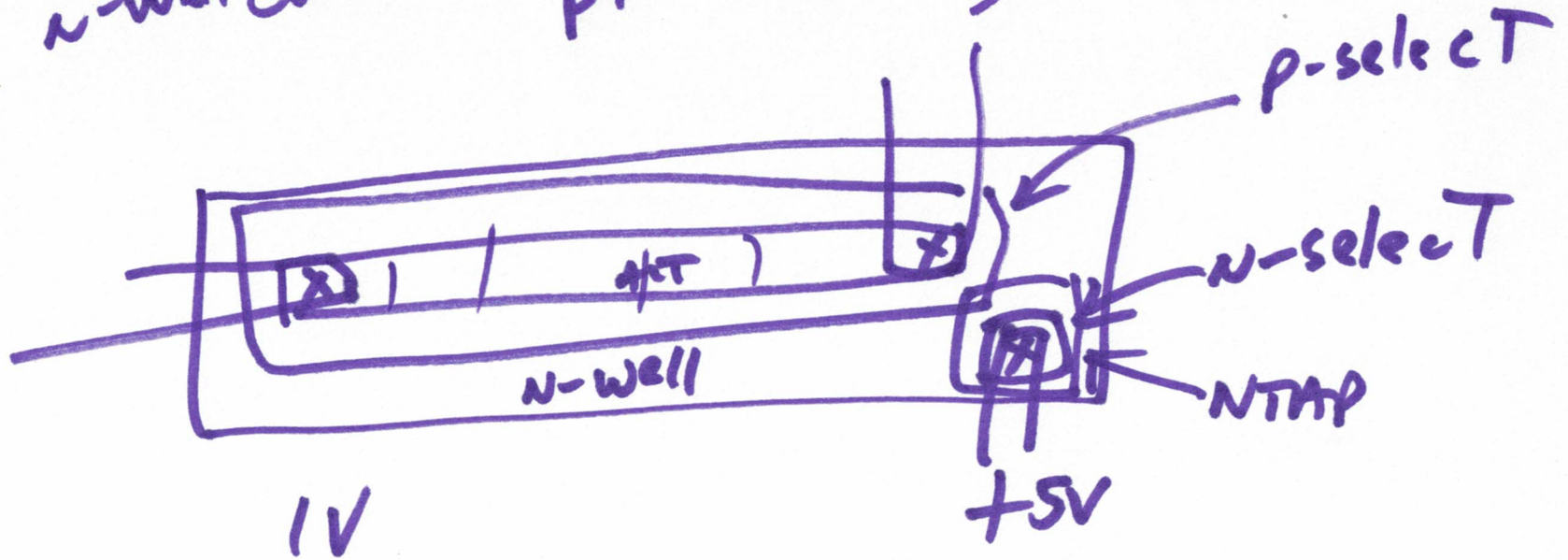
study H.W.

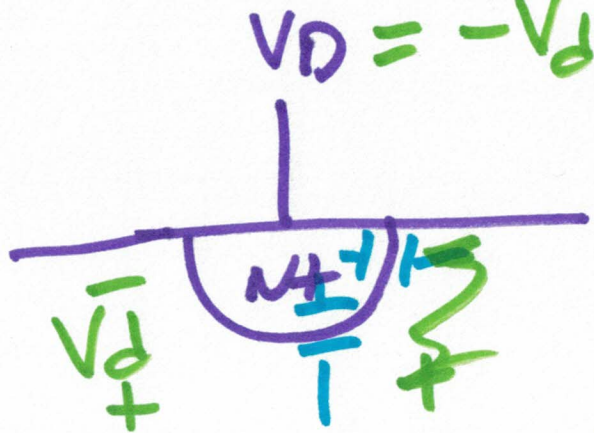
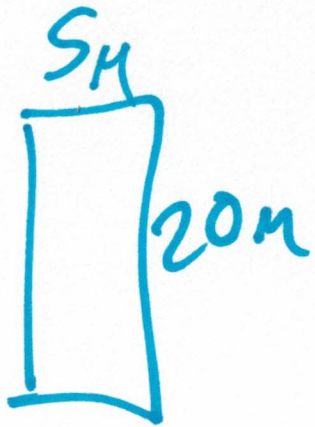
7)

ACTIVE LAYERS
 P-substrate connection
 N-well connection

N+ resistor
 P+ resistor

S/D OF MOSFETS





$$C_{jsw} = 1 \text{ fF} / 4 \mu\text{m}$$

$$C_{jb} = \frac{10 \text{ fF}}{\mu\text{m}^2}$$

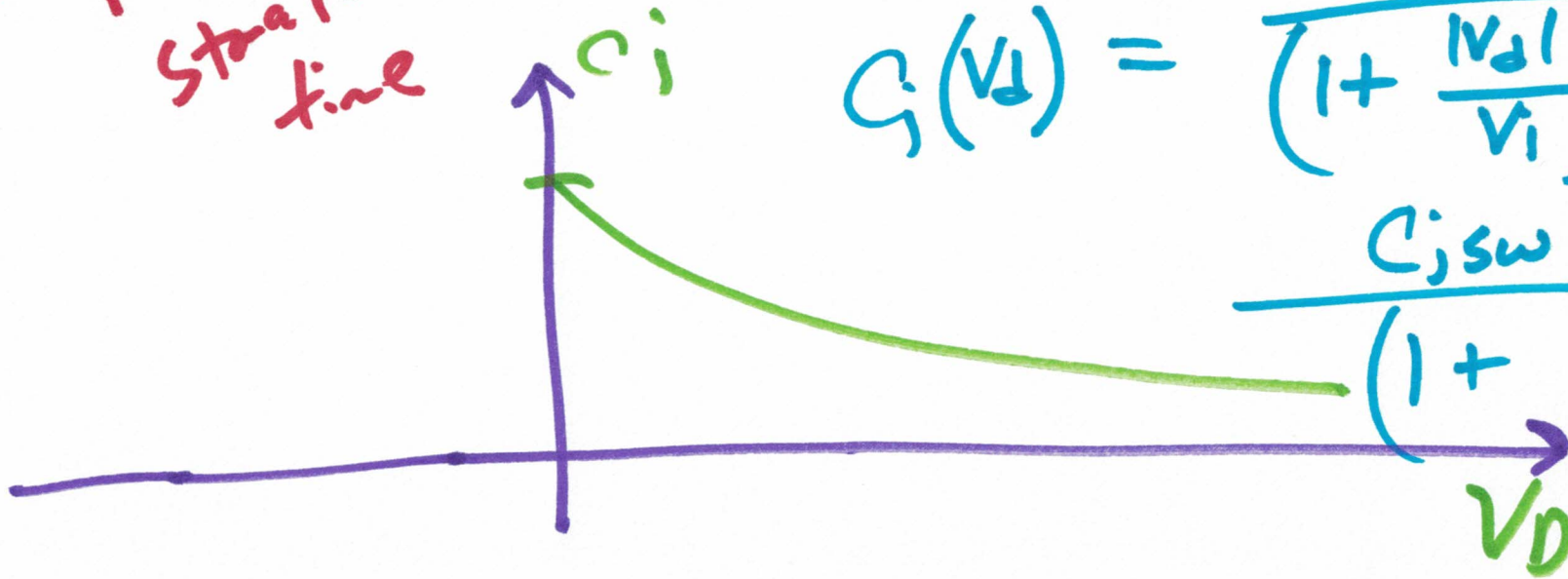
Reverse Recovery
Storage
time

Sketch C_j vs. V_D

$$C_j(V_D) =$$

$$\frac{C_{jb} \cdot 5 \cdot 20}{\left(1 + \frac{|V_D|}{V_i}\right)^{m_j}} +$$

$$\frac{C_{jsw} \cdot 50}{\left(1 + \frac{|V_D|}{V_{jsw}}\right)^{m_{jsw}}}$$



9)

Polyl - poly 2

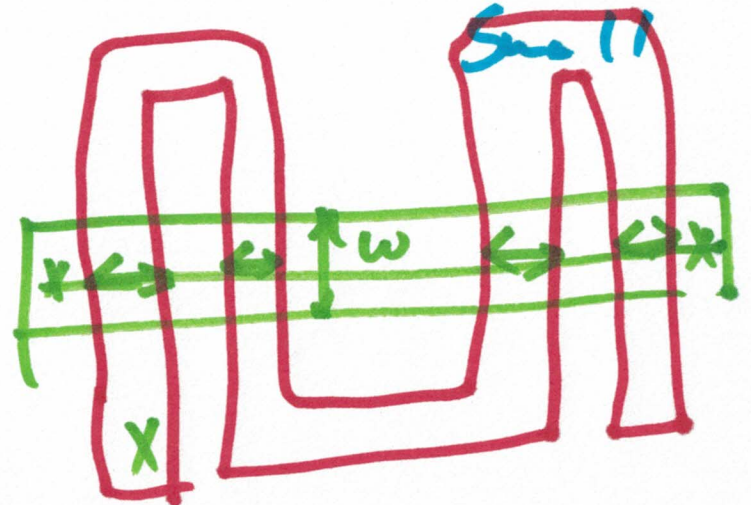
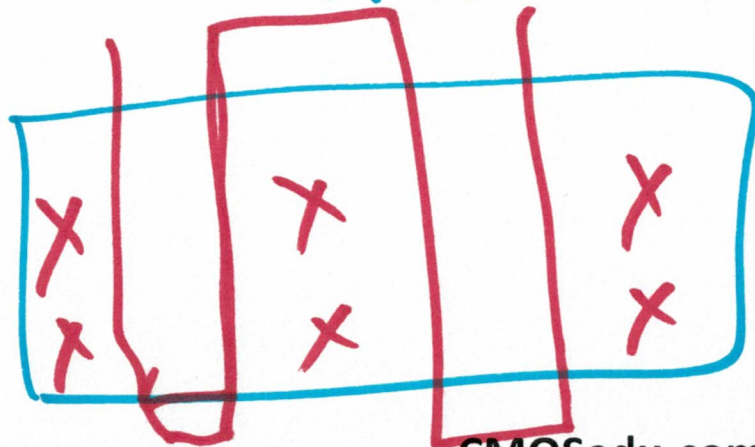
LAYOUT Cross-sectional
VIEW

Study
Assigned H.W.
Quizzes
End of chapter problems

you're very helpful. A LOT
A LOT

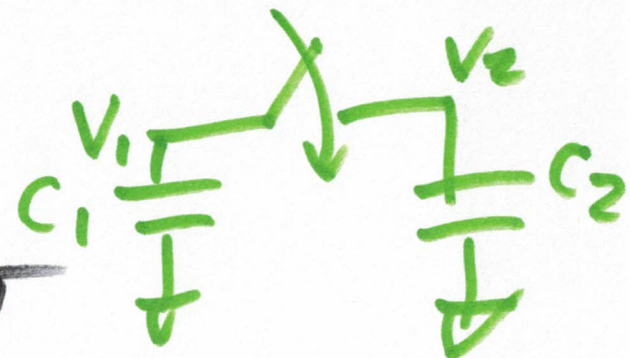
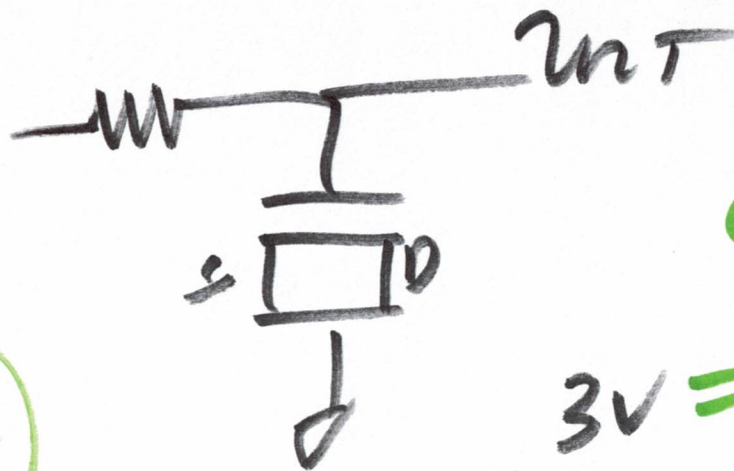
LAYOUT of resistors

MOSFET LAYOUT W/ Big
OR
Small



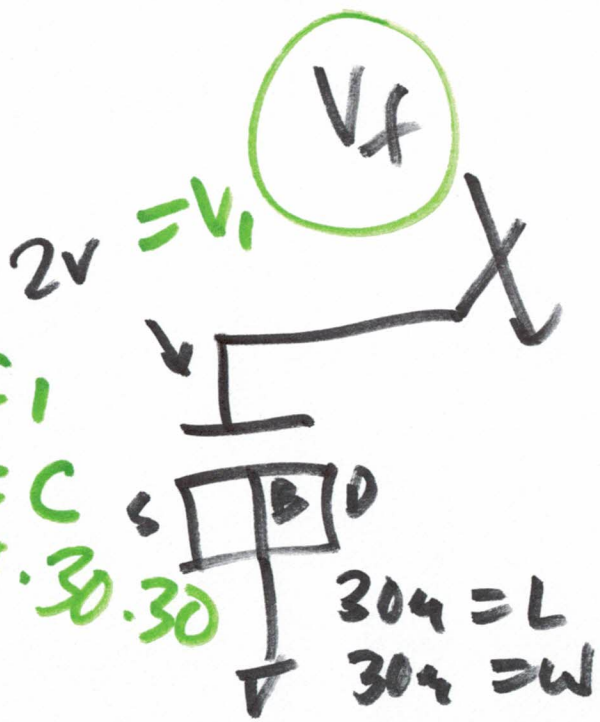
MOSFETS, Ch. 6

Short questions



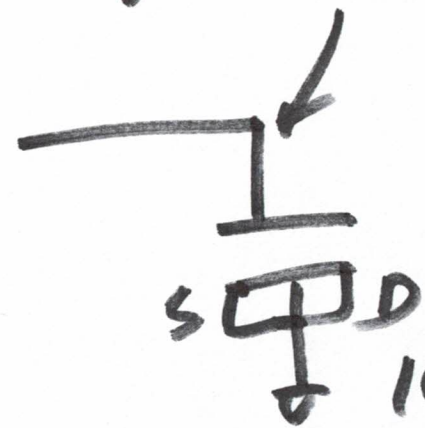
$$C_1 V_1 + C_2 V_2 = V_f (C_1 + C_2)$$

$$3V = V_2$$



$$C_1 = C = 2.5 \text{ fF} \cdot 30 \cdot 30$$

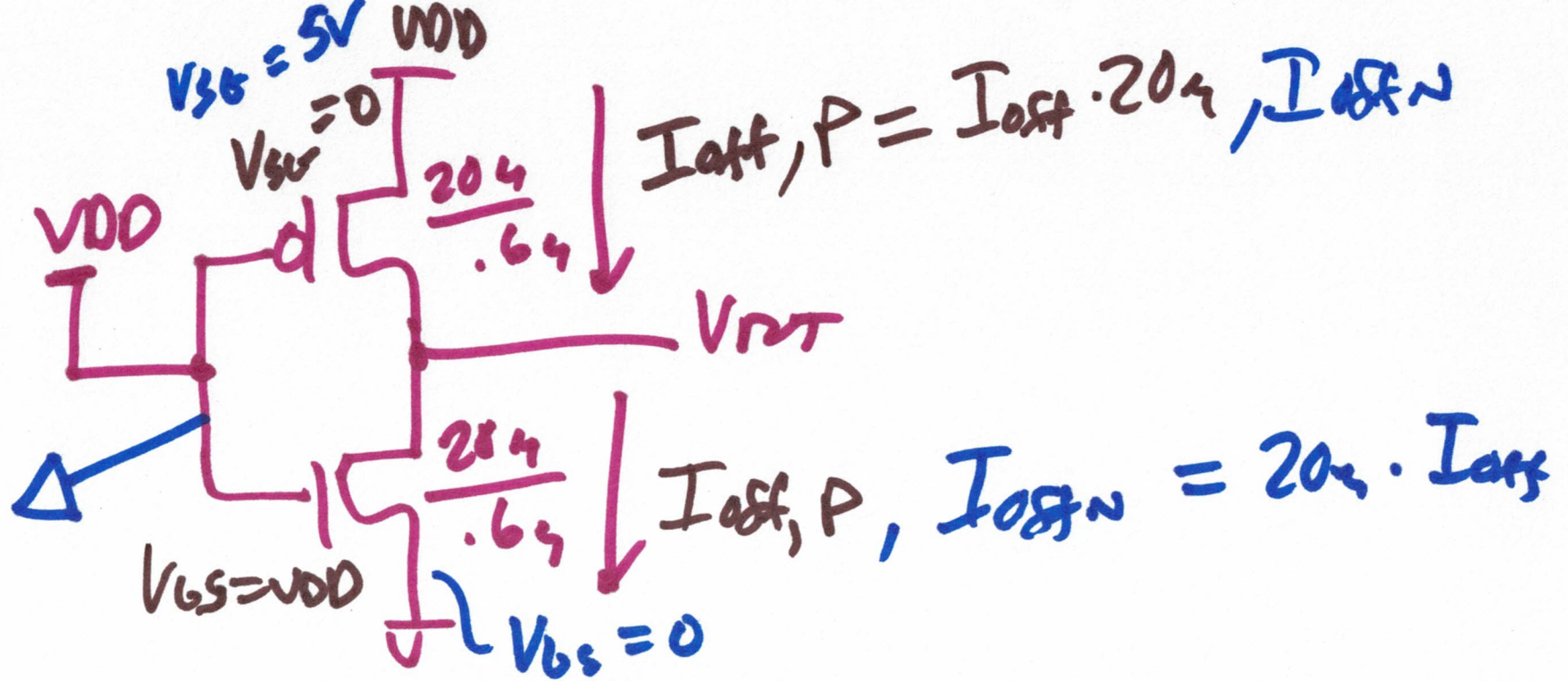
$$30 \mu = L = W$$



$$100 \mu = L = W$$

$$2.5 \text{ fF} \cdot 100 \cdot 100 = C_2$$

11)



12)