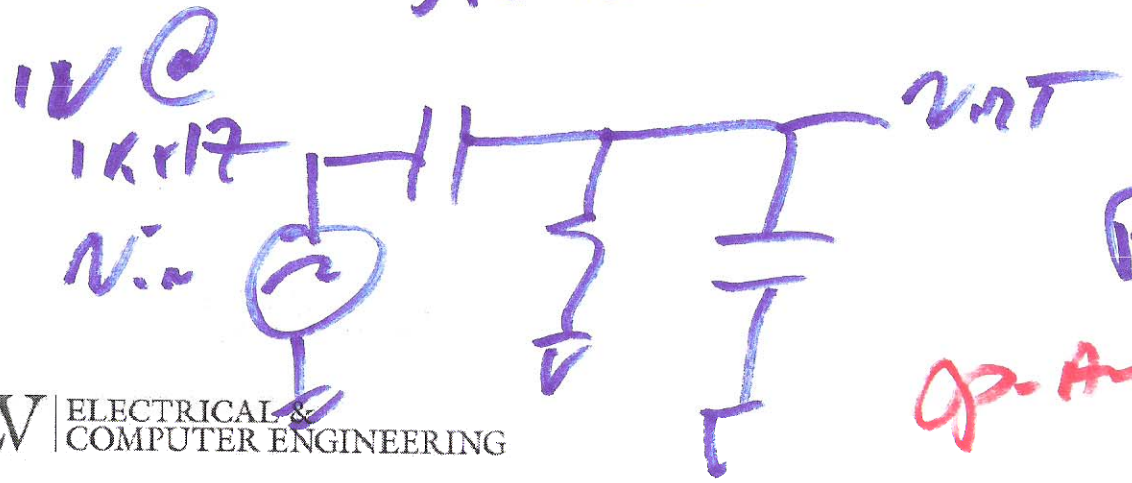
Lecture 14

OCT. 13, 2014

Review for mid-term

From ch. 1

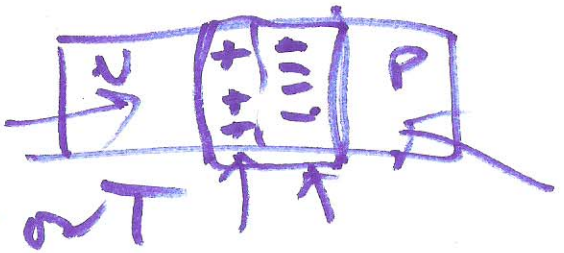
Sketch v_{IN} & v_{OUT} v.t



Bode plot

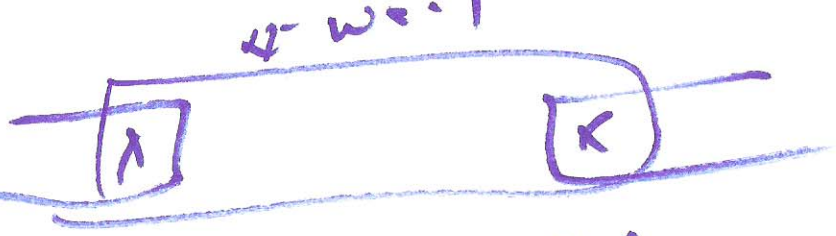
op-Amps

Ch. 2



N-Well → layout

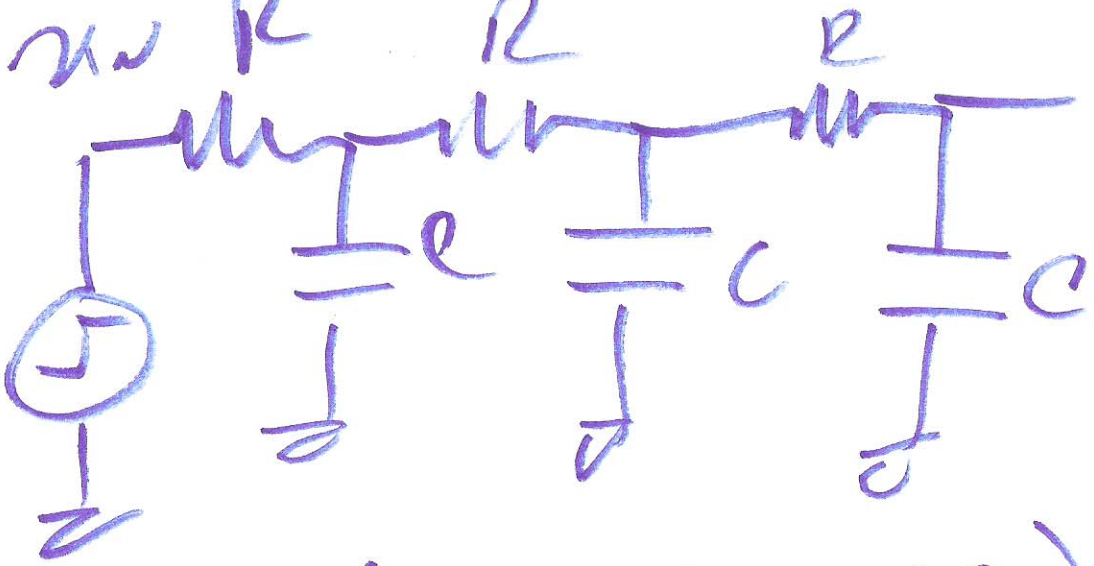
Sheet Resistance



Depletion C

1K/□

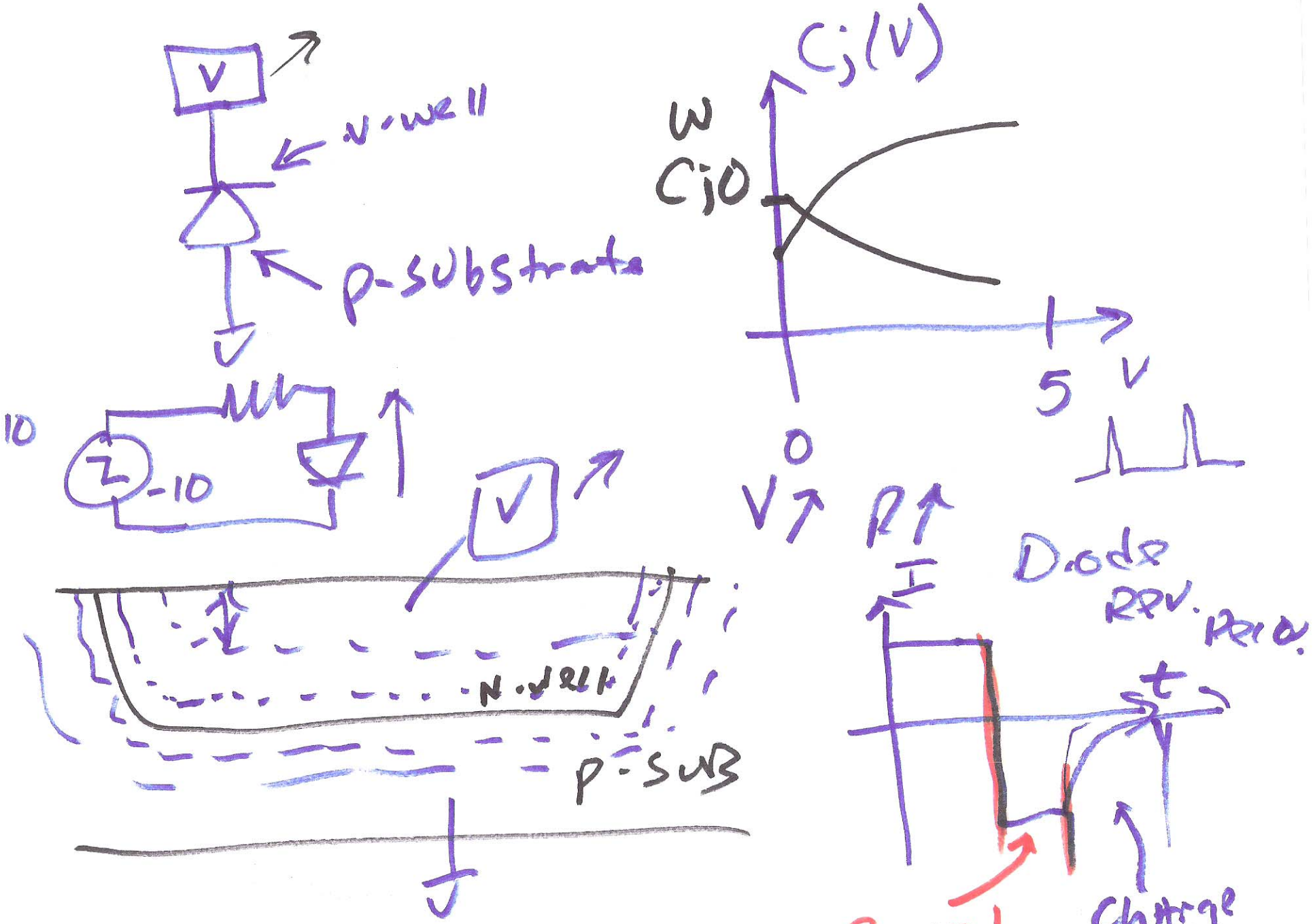
Distributed RC



$.35RC\,3^2$

$\frac{\ell(\ell+1)}{2} \approx \frac{\ell^2}{2}$ ℓ big

$0.7(RC + 2RC + 3RC)$


V
n-well
p-substrate
10
-10
V
N-well
p-SUB
$C_j(V)$
W
C_{j0}
0
V
5 V
R
I
Diode
Rev.
Rev.
t
Removed
stored
charge?
Charge
dep.
CAP

Ch. 3

Metal layers

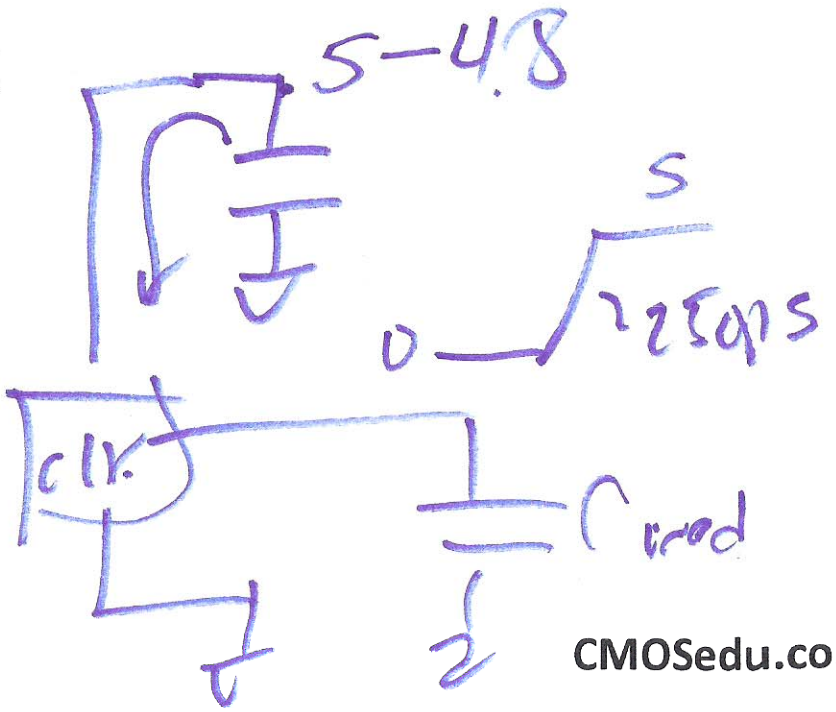
Layout VIA

NGL

electromigration

Power supply Decoupling

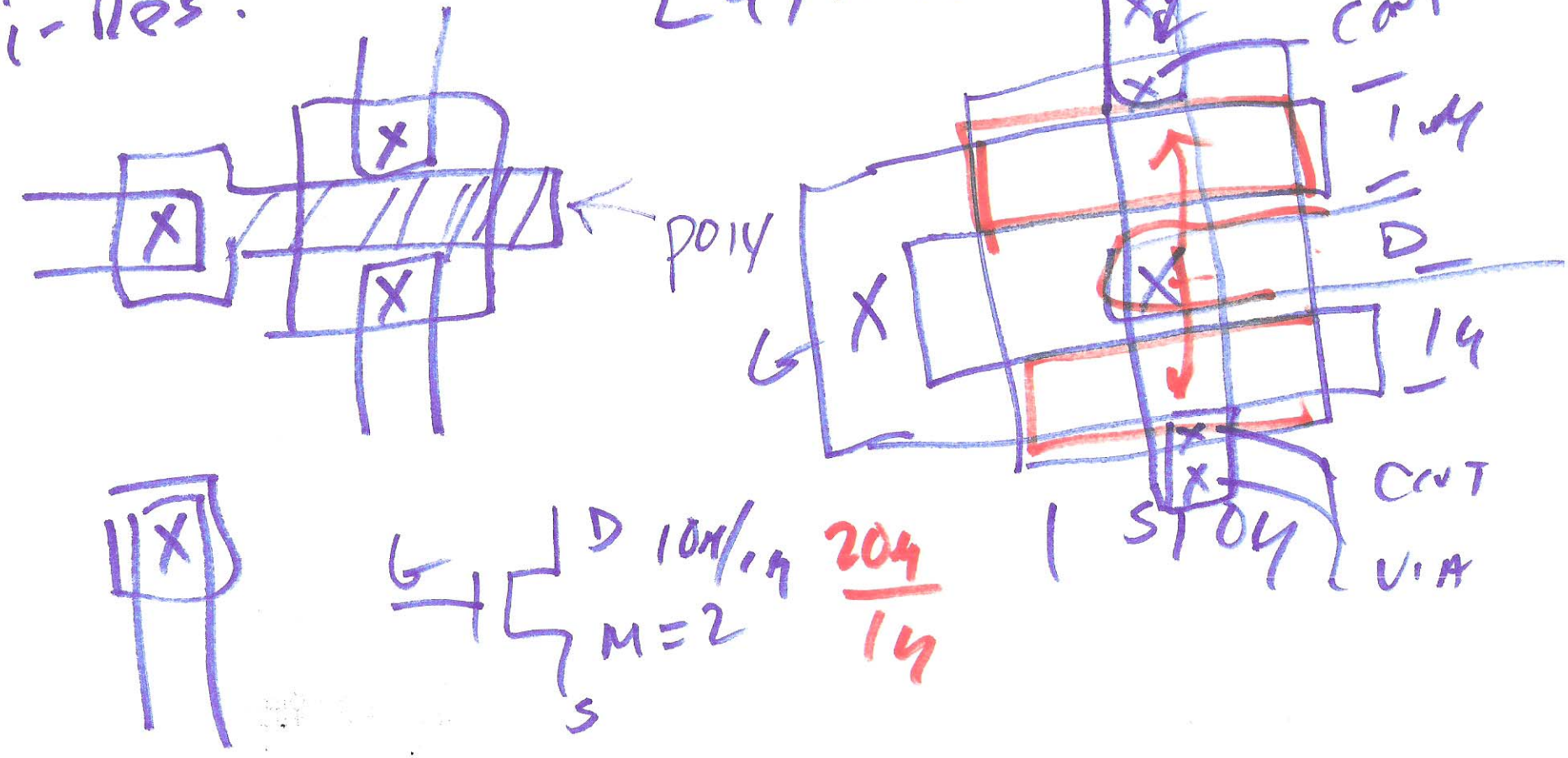
Sheet resistance



Ch. 4

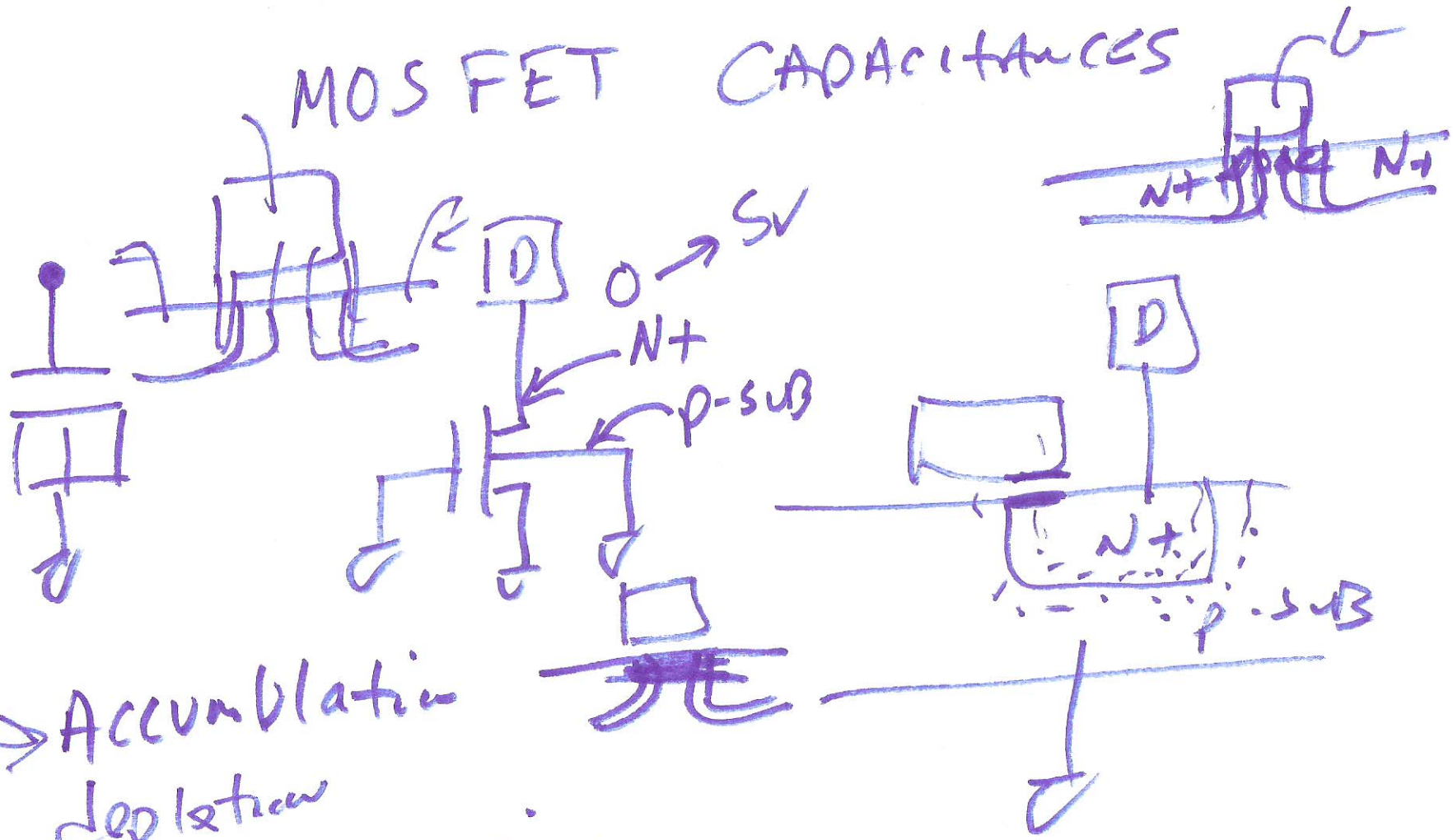
poly-poly Hi-Res.

Active & Poly Layouts



D 10u/1u 20u/1u
M=2
S

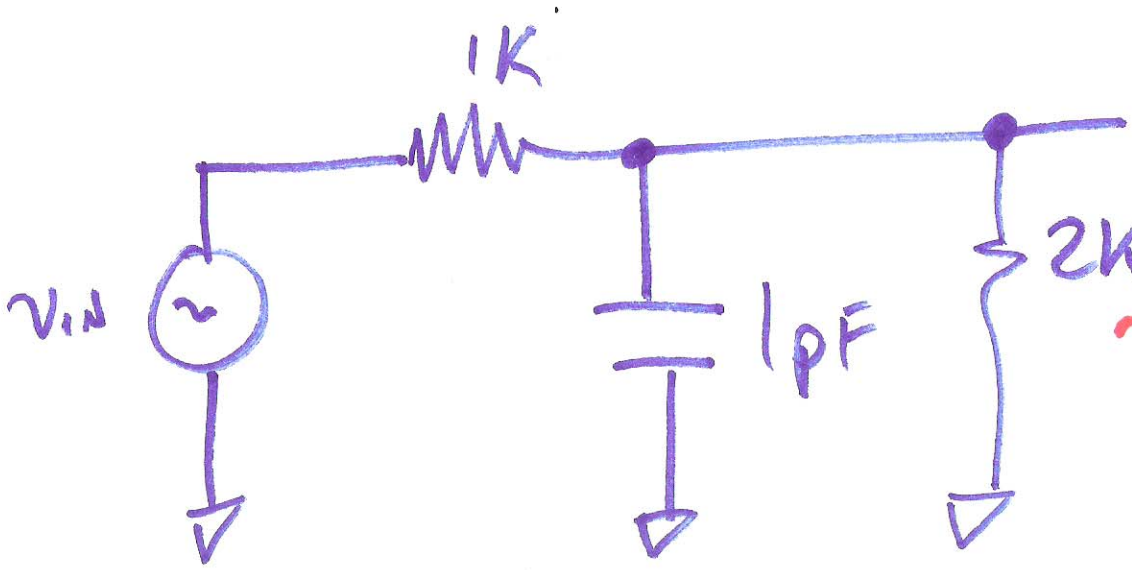
MOSFET CAPACITANCES

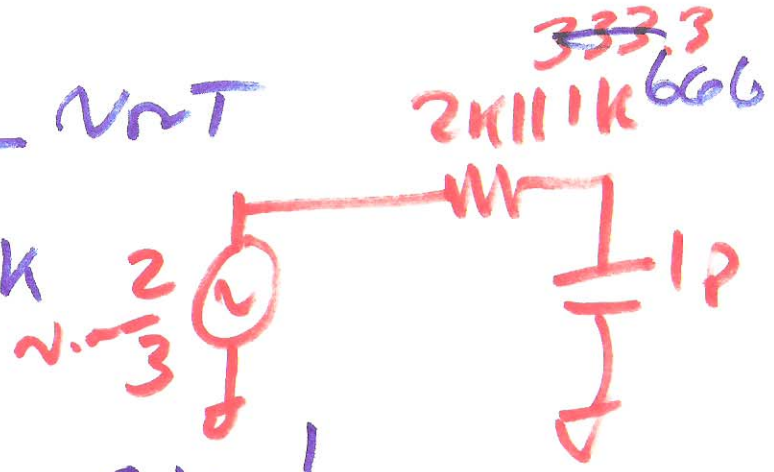


Accumulation
depletion
Strong inversion

Lateral diffusion

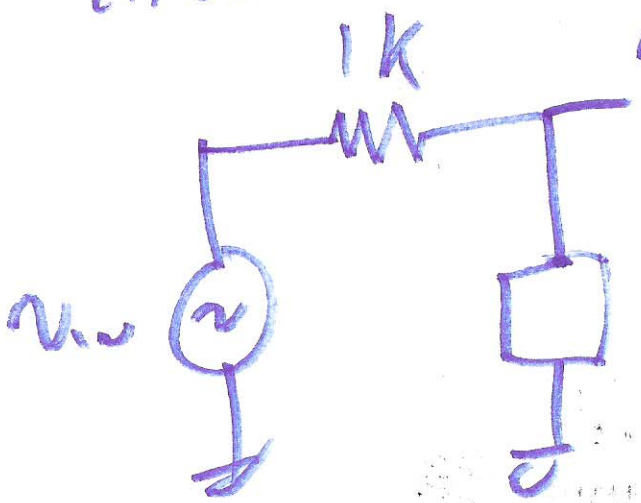
OVERLAP C





$$2K\cdot\frac{\frac{1}{jw1p}}{2K+\frac{1}{jw1p}}$$

$$\frac{1}{2\pi 666\cdot 10^{-12}}$$



$$v_{out}=v_{in}\cdot\frac{\frac{2K}{1+jw2e-9}}{\frac{2K}{1+jwz_N}+1K}$$

$$\frac{v_{out}}{v_{in}}=\frac{2K}{2K+1K+jwz_N}$$

7)

$$\frac{V_{nT}}{V_{in}} = \frac{2k + j0}{3k + j\omega 2e\text{-}6}$$

$$\left|\frac{V_{nT}}{V_{in}}\right| = \frac{\sqrt{(2k)^2+(0)^2}}{\sqrt{(3k)^2+(2\pi f 2n)^2}} = \frac{2k}{\sqrt{\quad}}$$

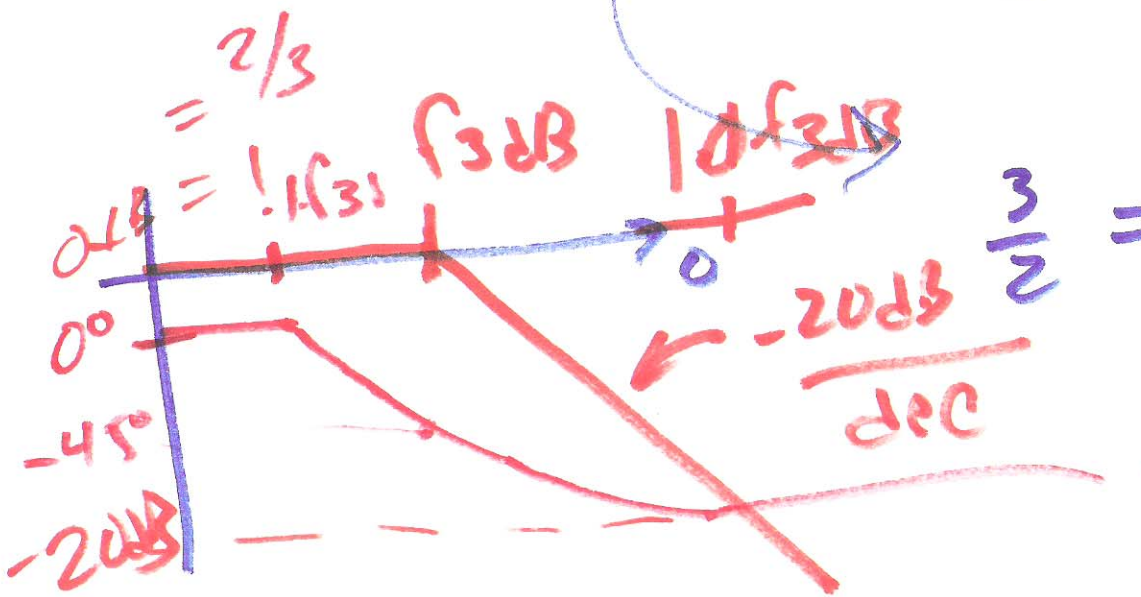
$$\theta = \frac{t_d}{T} \cdot 360^\circ \qquad 0$$

$$= t_d \cdot f \cdot 360 \angle \frac{V_{nT}}{V_{in}} = \tan^{-1}\frac{0}{2k} - \tan^{-1}\frac{2\pi f 2e\text{-}6}{3k}$$

$$= \frac{t_d}{T} \cdot 2\pi$$

$$\frac{V_{OT}}{V_{in}} = \frac{1}{\frac{3}{2} + jw\,1N}$$

$$= \frac{3}{3} \cdot \frac{1}{1 + j w \frac{2}{3} N}$$

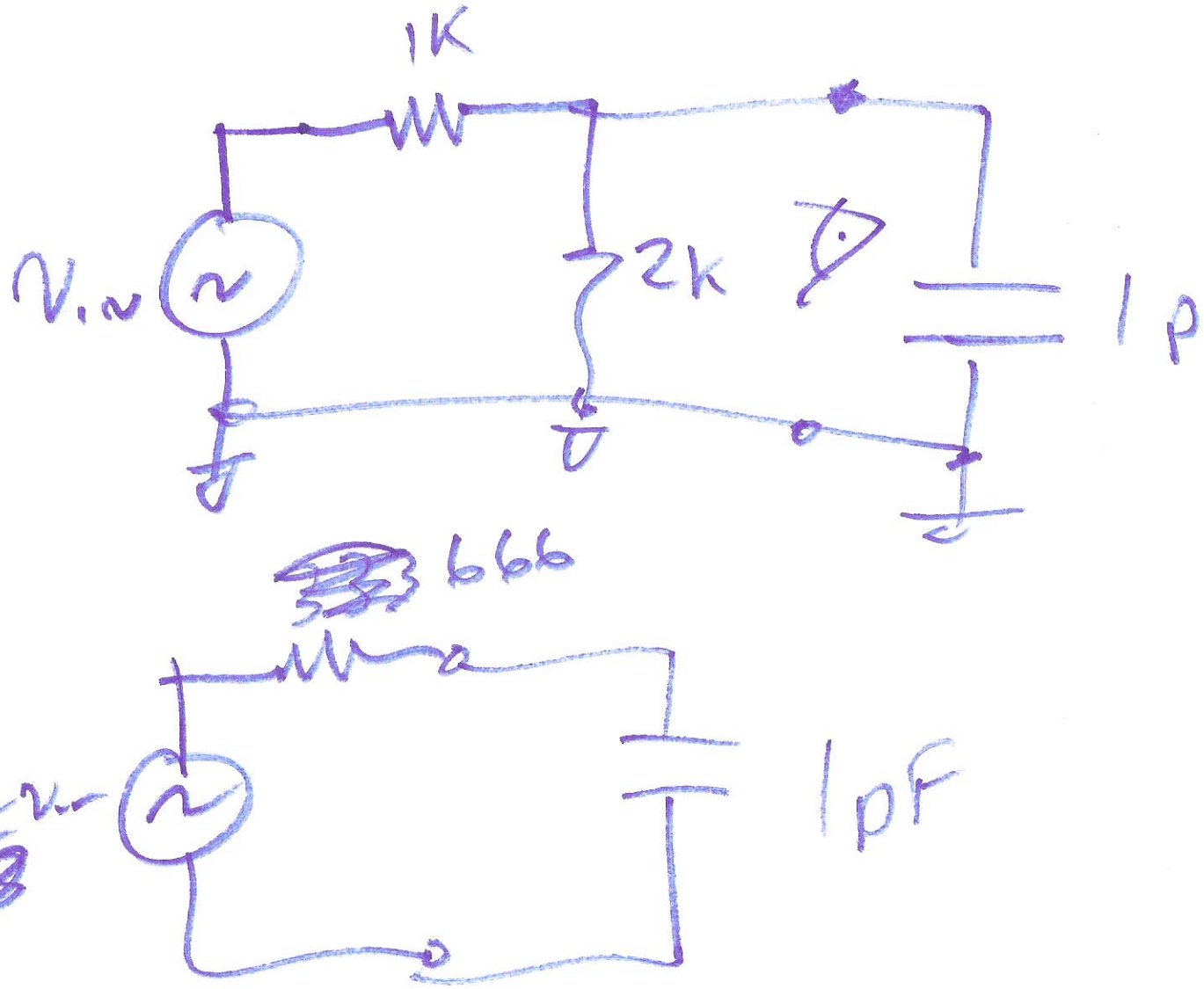


$$\frac{3}{2} = 2\pi f_{3dB} \cdot 1N$$

$$f_{3dB} = \frac{1}{2\pi\, 1N \cdot \frac{2}{3}}$$

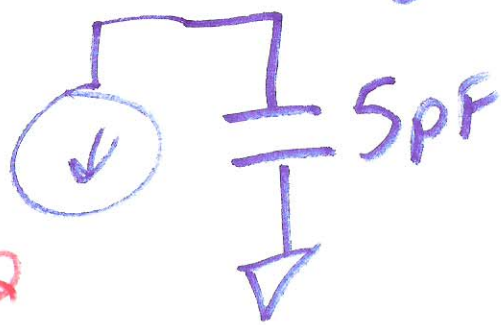
$$= \frac{1}{2\pi \cdot 666 \cdot 10^{-9}}$$

$$= \frac{1}{2\pi\, 666\, 10^{-12}}$$


1K
2K
1p
666
2V
3
1pF

1) $Q = CV = 25pC$

2) How current flows to discharge in 25ps?



$CV = Q$

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

$I = C\frac{dV}{dT}$

$Q = CV = 25pC \frac{1A \cdot 25ps}{1N}$

$I = 5p \cdot \frac{5}{25ps} = 1A$

$0.2V \cdot C = 25pC$

$C = \frac{25p}{0.2}$

$= 125pF$

$4.5V\ P_{AVG} = 5 \cdot I_{AVG}$

$1A = 5 \cdot \frac{25pC}{1NS}$

$= 125mW$