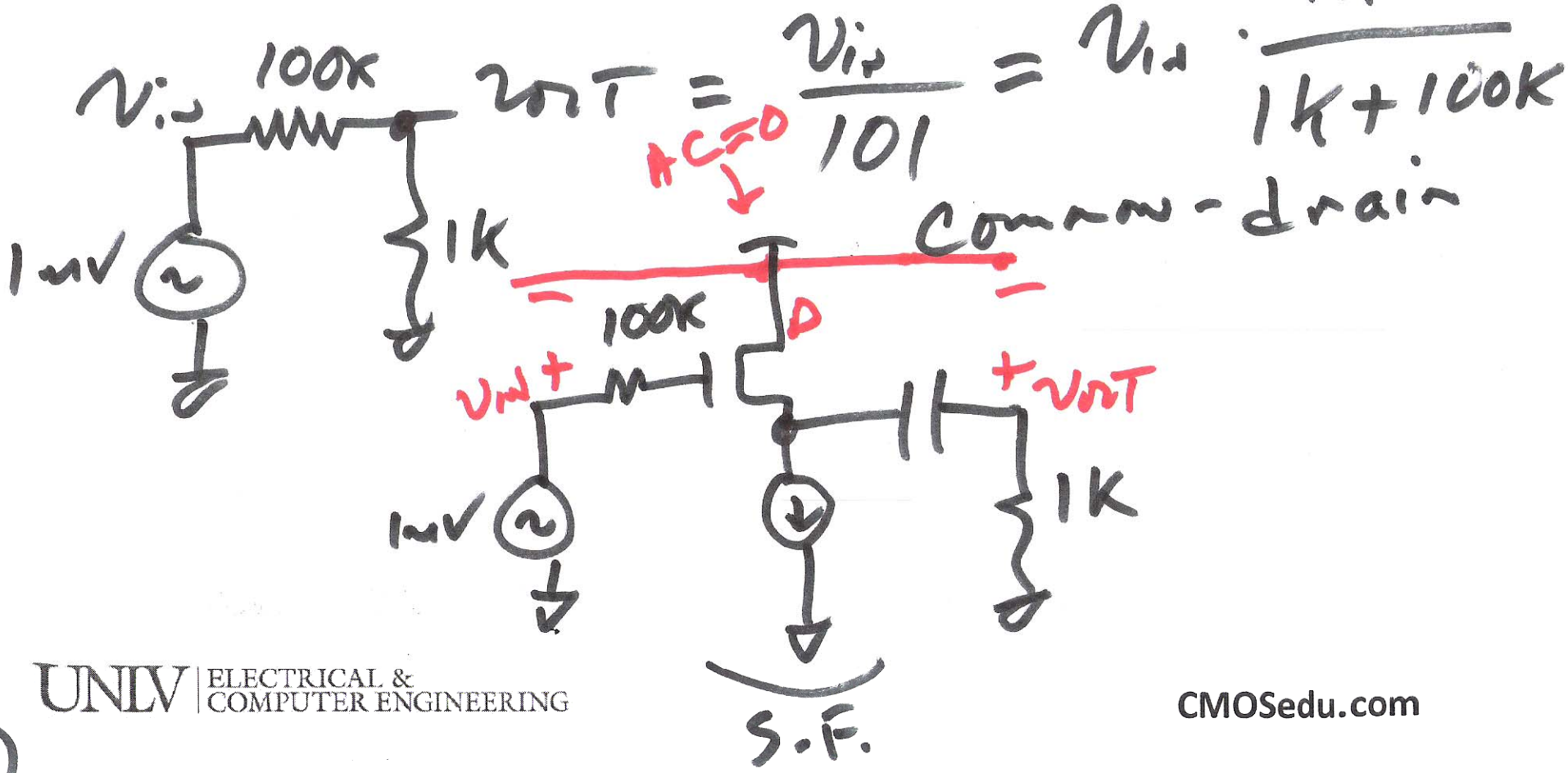
# Lecture 20

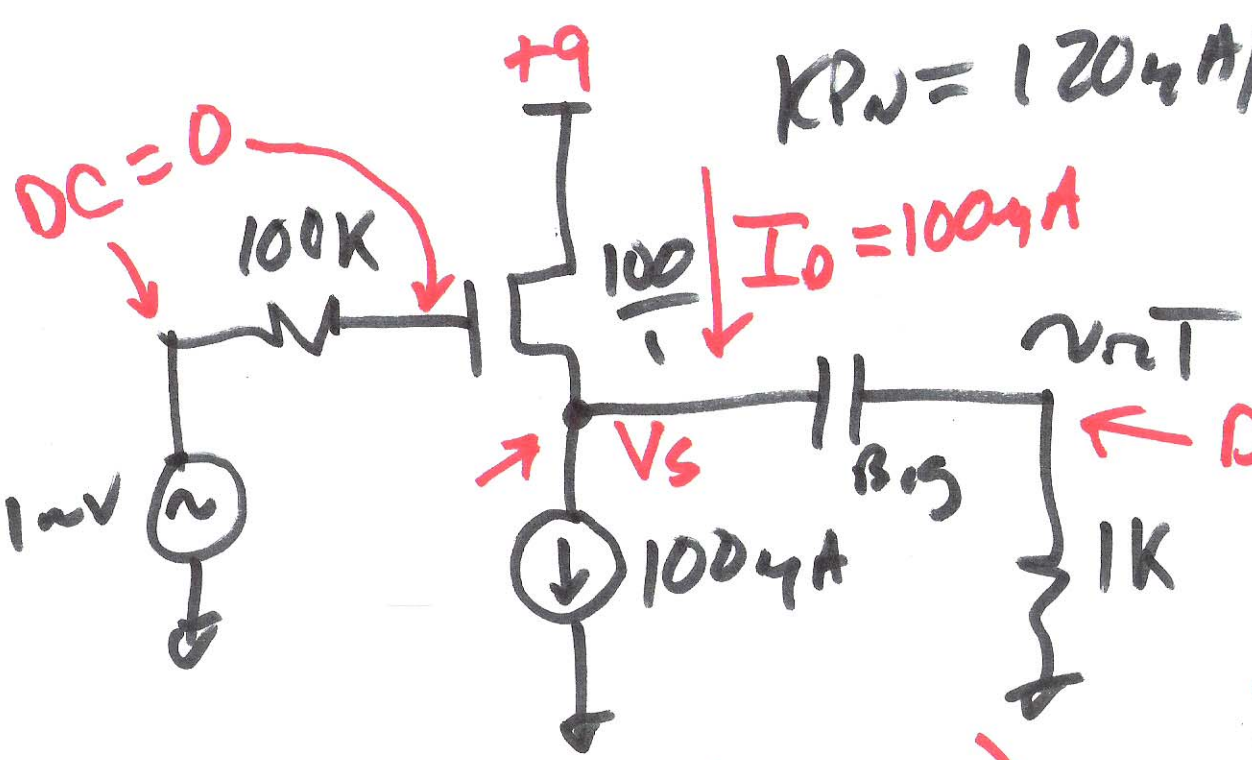
April 16, 2014

EE 320




$$V_{OUT} = \frac{V_{in}}{101} = V_{in} \cdot \frac{1K}{1K + 100K}$$

common-drain




$K_{PN} = 120\mu A/V^2$ $V_{THN} = 800mV$

$V_{OS} = \sqrt{\frac{2I_D}{K_{PN}\cdot\frac{W}{L}}} + V_{THN}$

$I_D = \frac{K_{PN}}{2}\frac{W}{L}(V_{GS} - V_{THN})^2$

$100\mu A = \frac{120\mu}{2}\cdot\frac{100}{1}(0 - V_S - .8)^2$

$V_{GS} = 0 - V_S = .92$

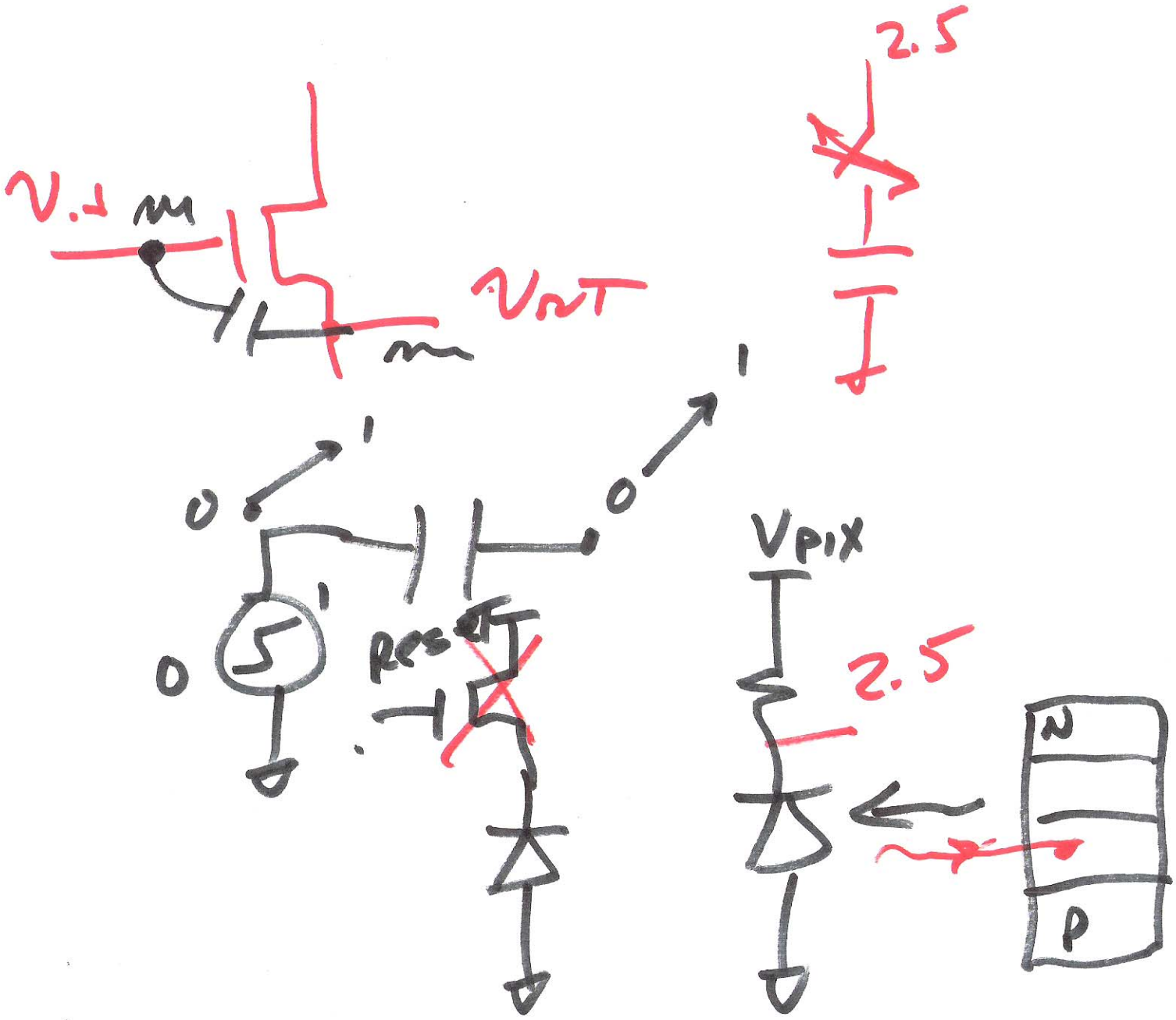
$\sqrt{\frac{200}{120\cdot 100}} + .8$

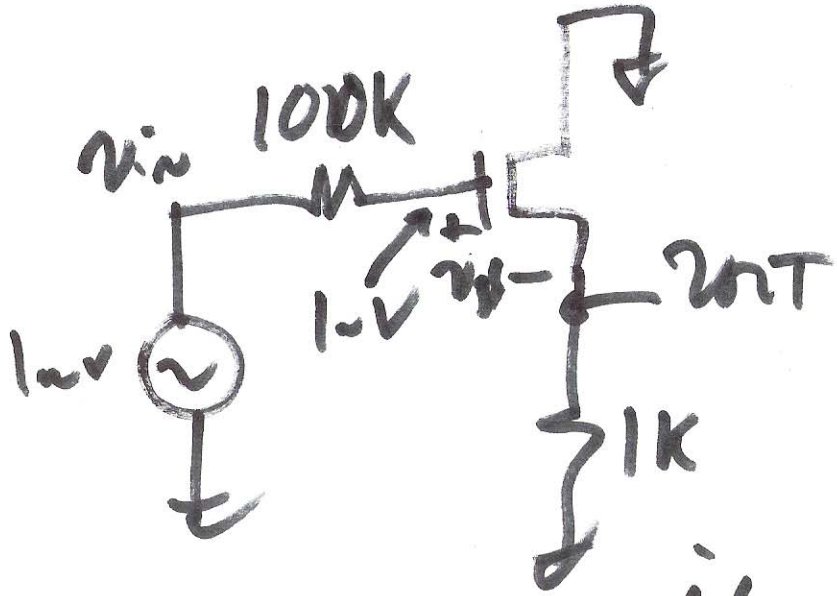
$V_S = -.92$

$g_m = \frac{120\mu A}{V^2}\cdot\frac{100}{1}(.92 - .8)$

$= 120\mu \cdot 12$

$g_m = 1.44\ \frac{mA}{V}$


2.5
VRT
1
0
1
0
1
0
VPIX
2.5
N
P




$1mV = v_{gs} + i_d \cdot 1k$

$v_{gs} = \frac{i_d}{g_m}$

$1mV = i_d\left(\frac{1}{g_m} + 1k\right)$

$i_d$

$v_{DT} = 1k \cdot .594$

$= .594mV$

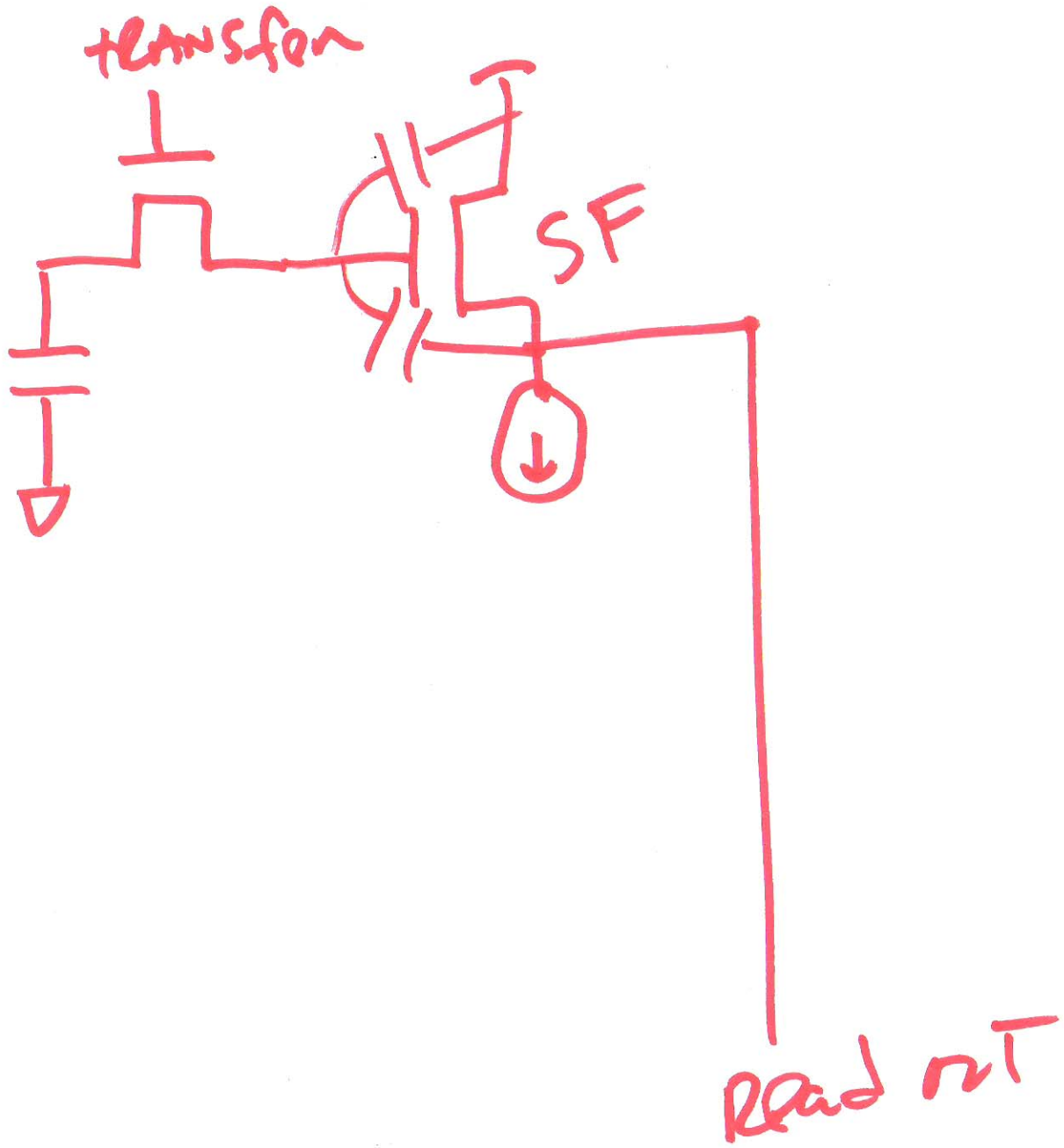
$= 0.59mV$

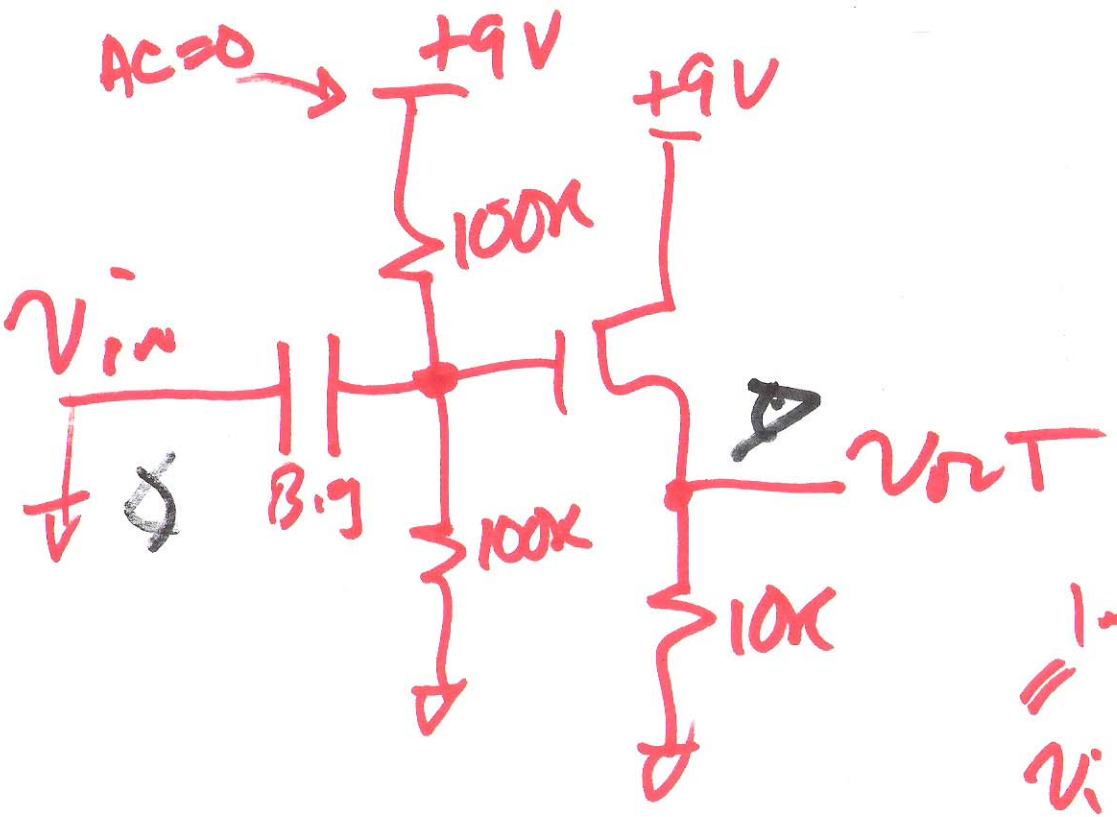
$g_m = 1.44mA$

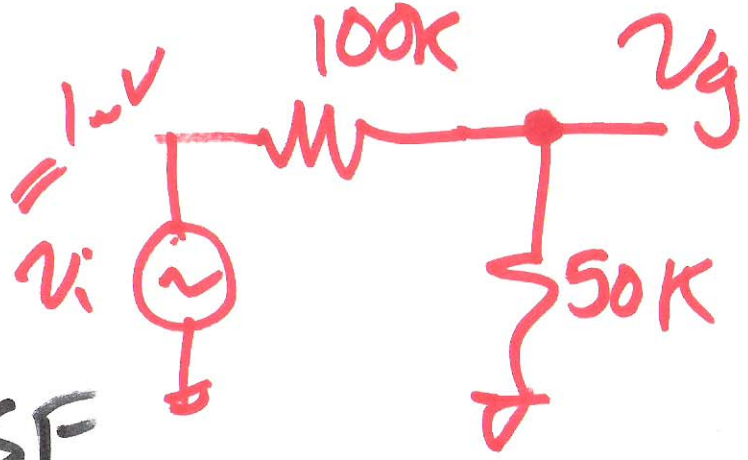
$i_s = \frac{1mV}{1694}$

$= .594$

$0.01mV$

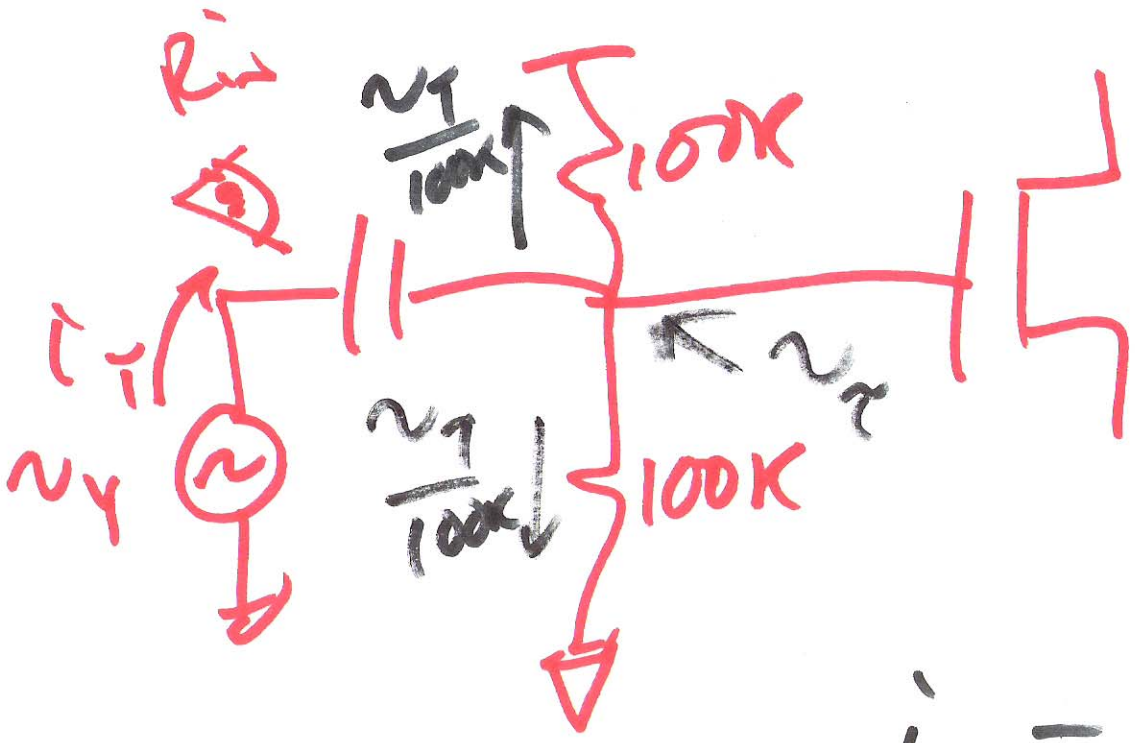

transfer
SF
READ OUT




$R_{in}$ = ? of this SF

$$V_g = V_i \frac{.50K}{100K + 50K}$$




$$R_{in} = \frac{v_T}{i_T}$$

$$i_T = \frac{v_T}{100k} + \frac{v_T}{100k}$$

$$R_{in} = \frac{v_T}{i_T} = \frac{1}{\frac{1}{100k} + \frac{1}{100k}}$$

$$= 100k \,||\, 100k$$

$$= 50k$$





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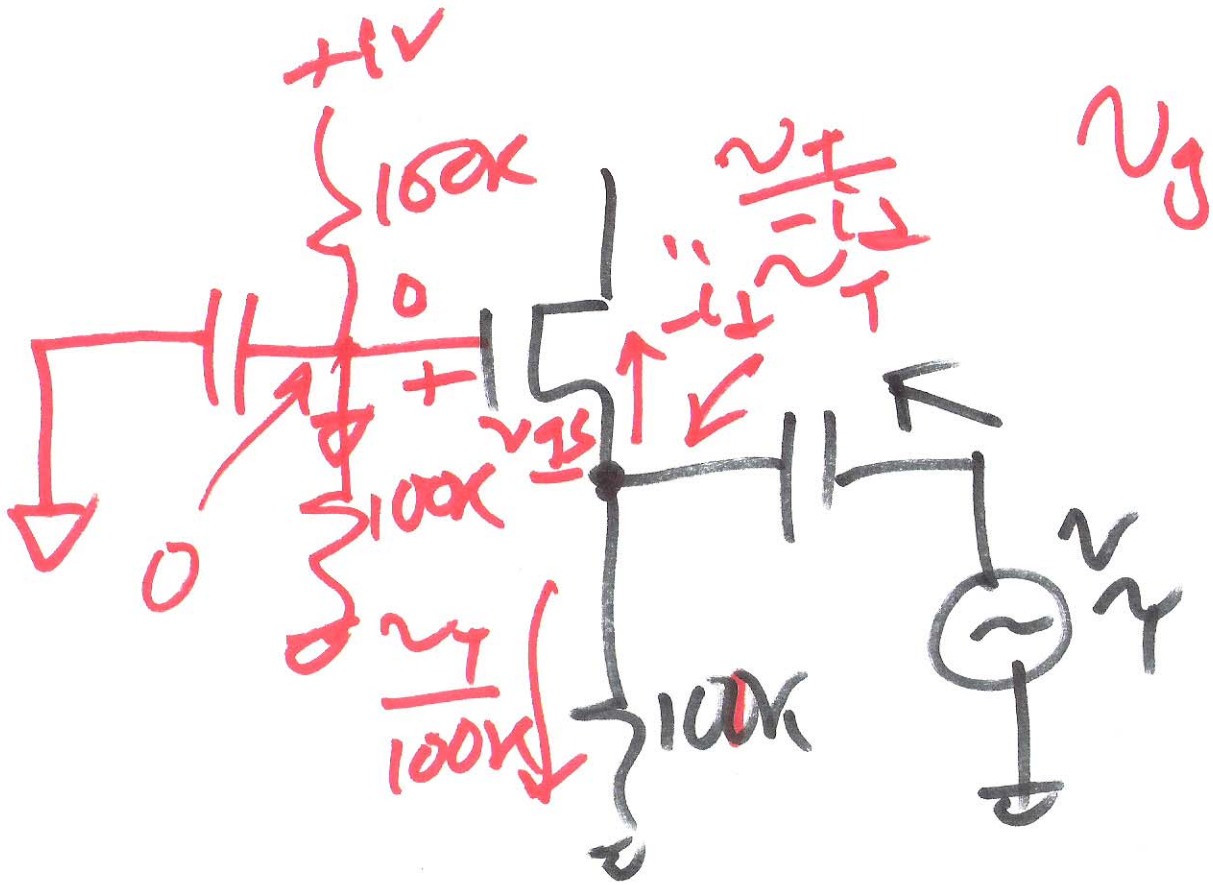


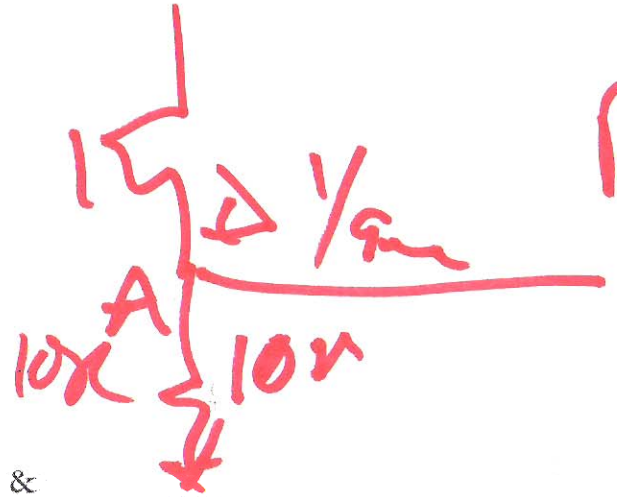

$$v_{gs} = 0 - v_T$$

$$v_{gs} = -v_T$$

$$v_{gs} = \frac{i_1}{g_m}$$

$$-v_T = \frac{i_1}{g_m}$$

$\frac{1}{g_m}$




$$R_{OUT} = 10K \parallel \frac{1}{g_m}$$

$$10K \parallel \frac{1}{.00288}$$

$$\cong \frac{1}{g_m}$$

$$= 340\Omega$$



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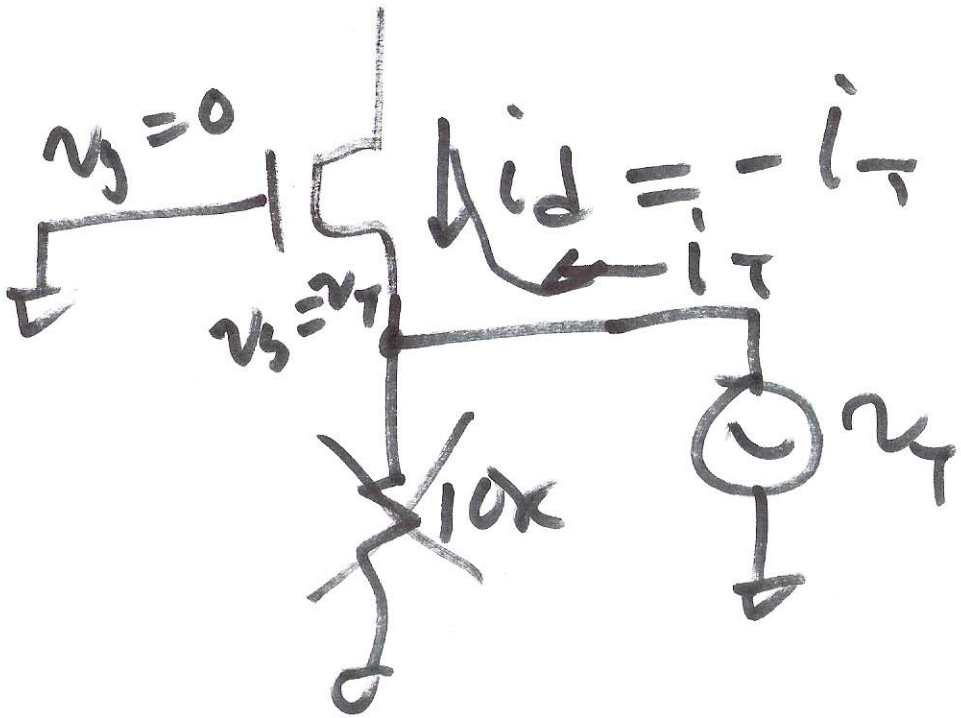
7)




$$v_{gs} = -v_T$$

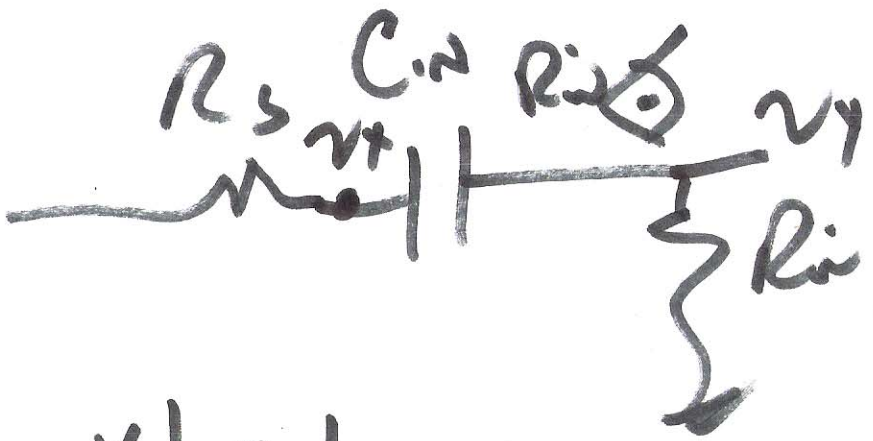
Rout to source

$$= \frac{v_T}{i_T}$$

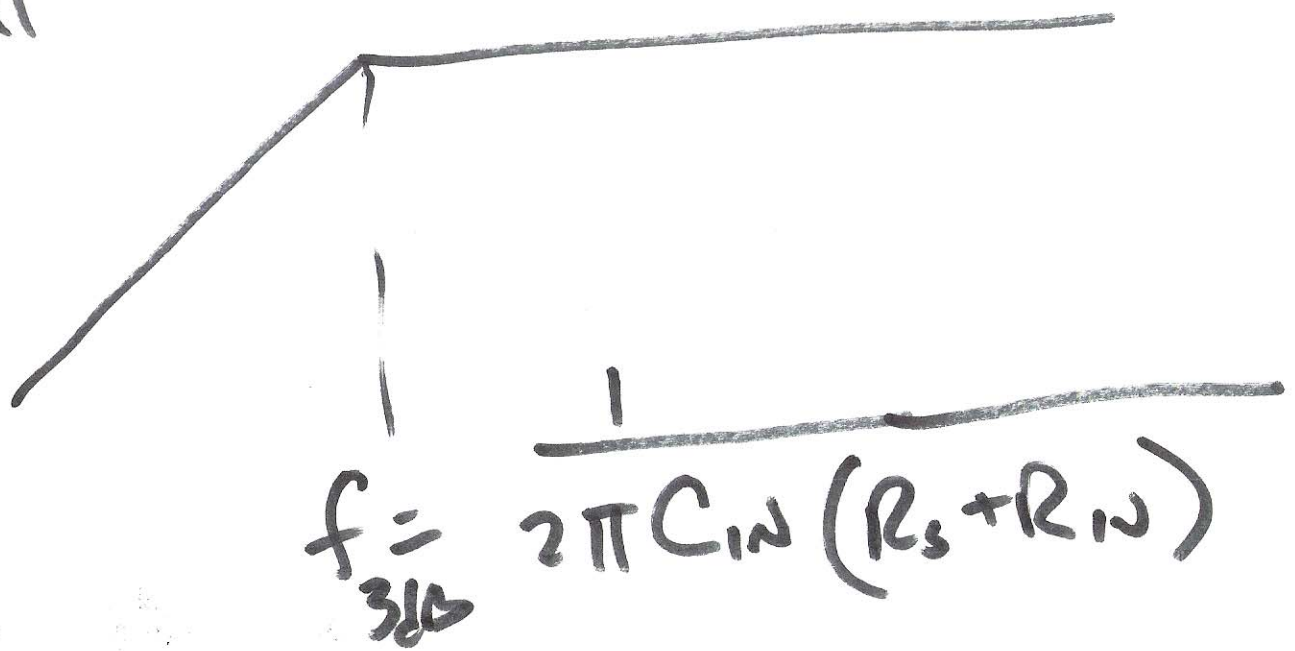
$$= \frac{-v_{gs}}{-i_d}$$

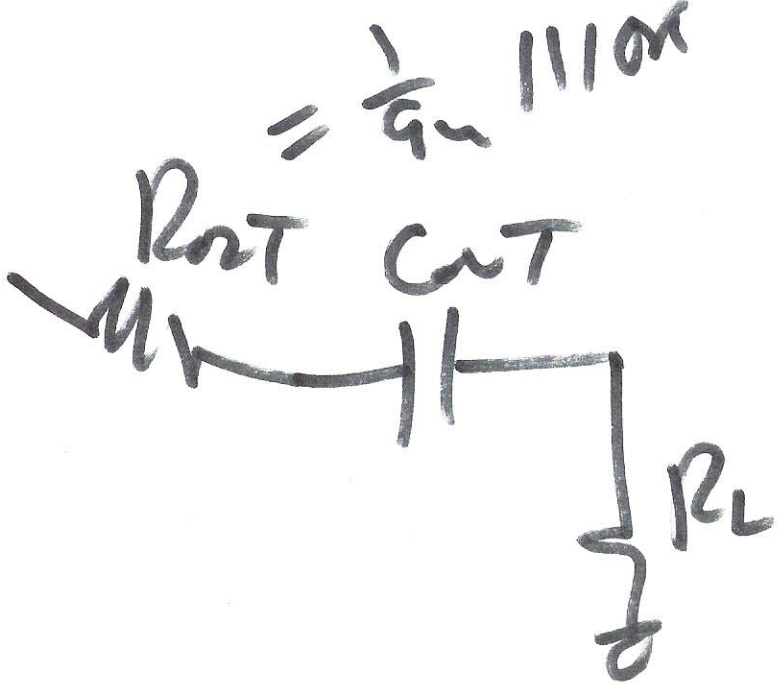
$$= \frac{1}{g_m}$$

$$R_{out} = 10k \parallel 1/g_m$$




$$\left|\frac{V_y}{V_x}\right| = 1$$






$$f_{3dB} = \frac{1}{2\pi C_{oT}(R_{oT} + R_L)}$$





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