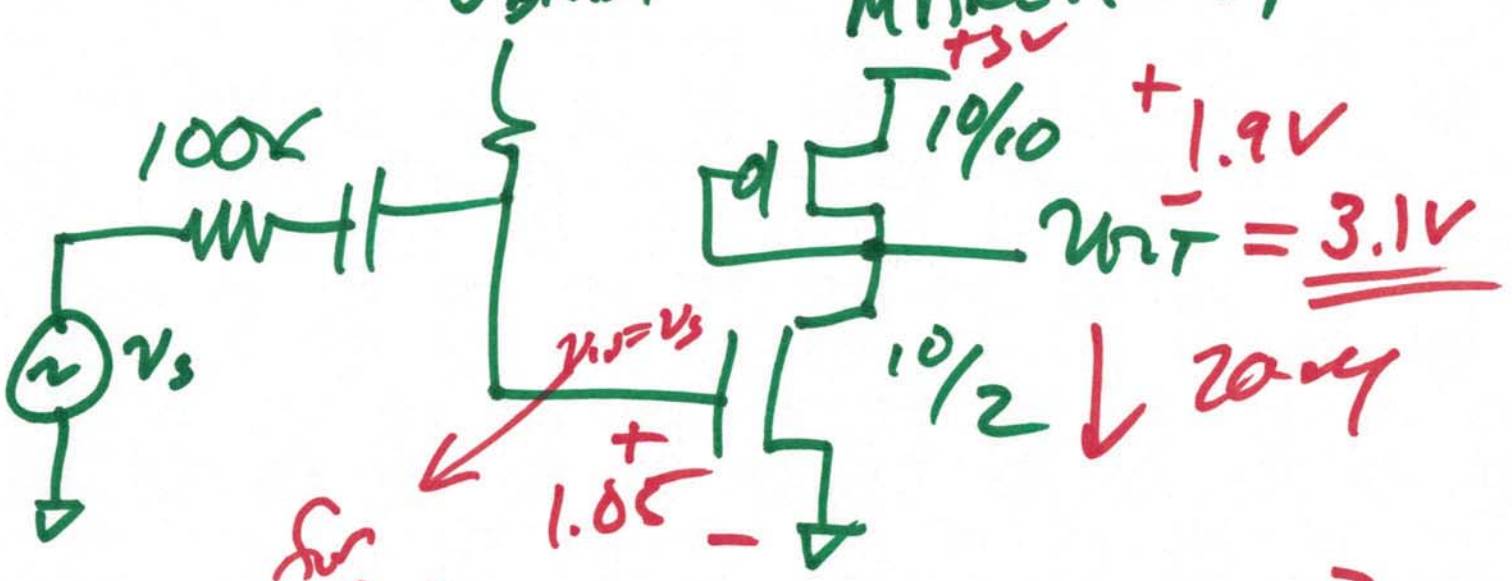
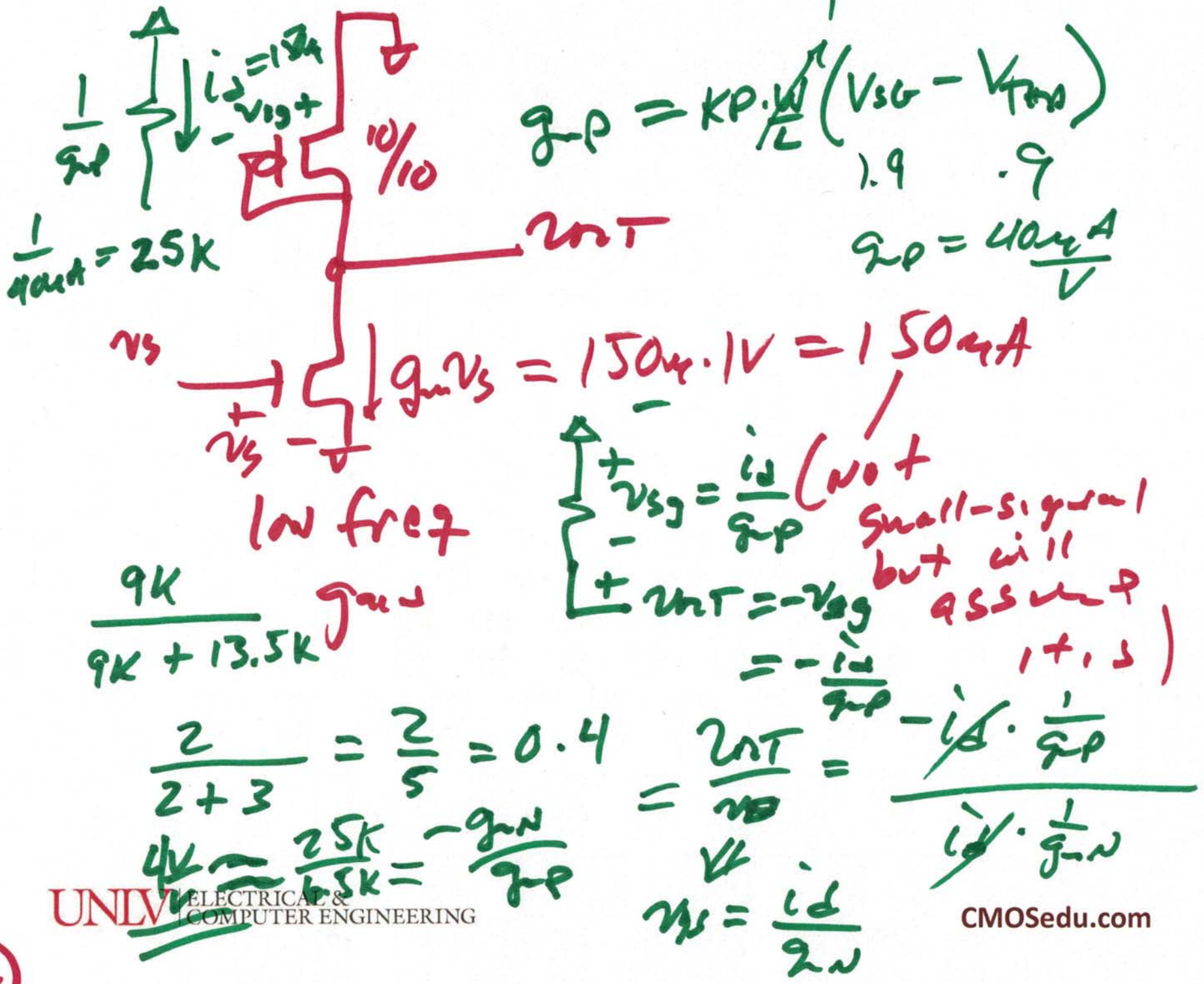
EE 420 / ECG 620
Analog IC Design
Lecture 13
MARCH 6, 2017

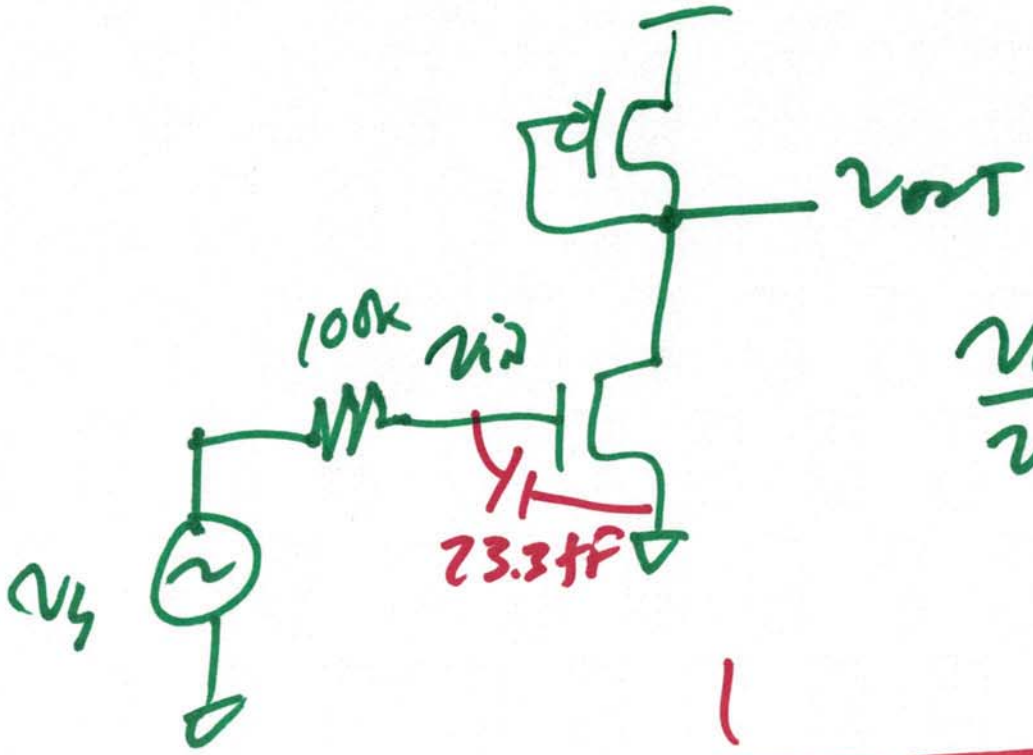


$$20/4 = \frac{40/4}{2}(V_{SG} - .9)^2$$

$$V_{SG} = 1.9V$$

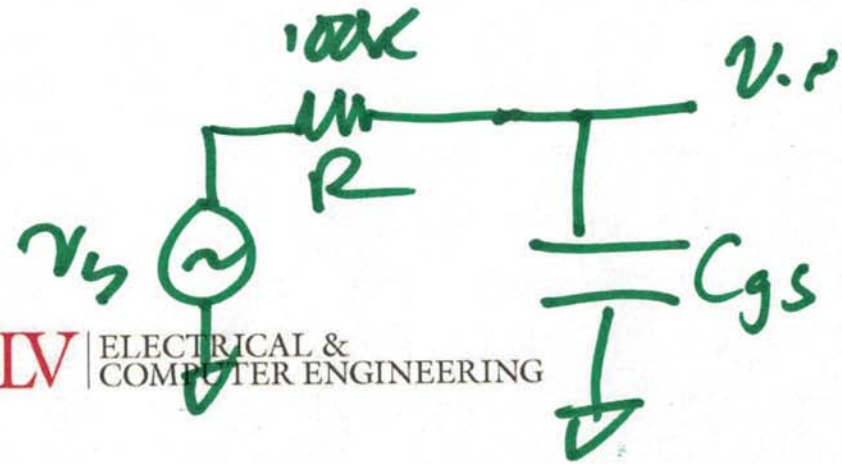


2)



$$\frac{v_{out}}{v_{in}} = -\frac{g_{mN}}{g_{DP}} = -\frac{\frac{1}{g_{DP}}}{\frac{1}{g_{mN}}}$$

$$f_{3dB} = \frac{1}{2\pi \cdot 100k \cdot 23.3fF} = 68\,MHz$$



$$v_{in} = v_s \cdot \frac{\frac{1}{j\omega C_{gs}}}{\frac{1}{j\omega C_{gs}} + R}$$

$$\frac{v_{in}}{v_s} = \frac{1}{1 + j\omega C_{gs} \cdot R}$$

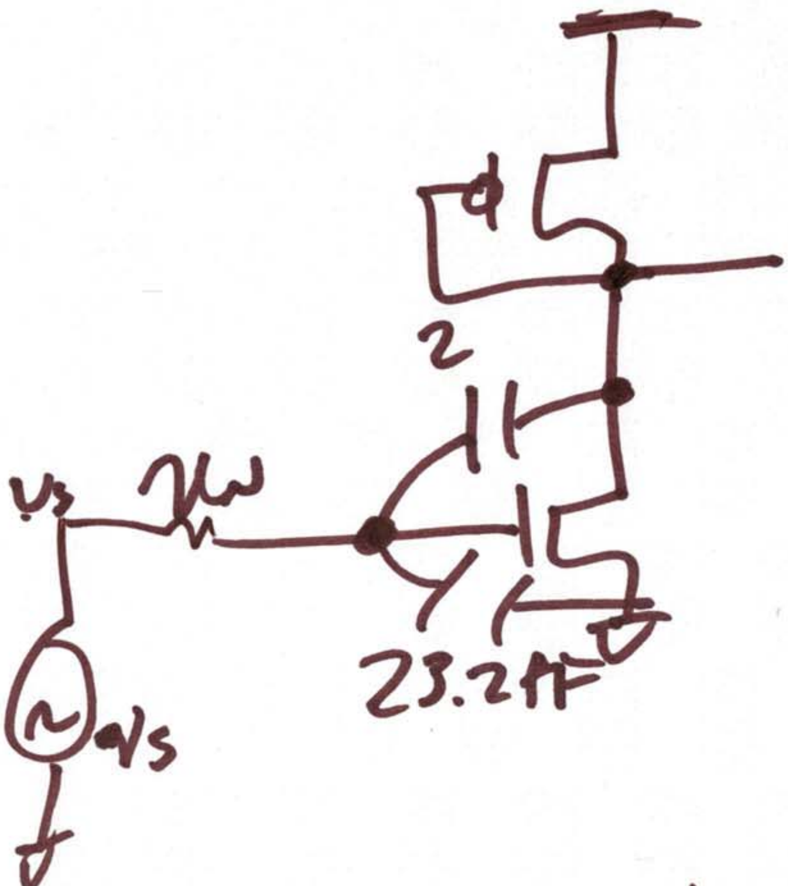
3)

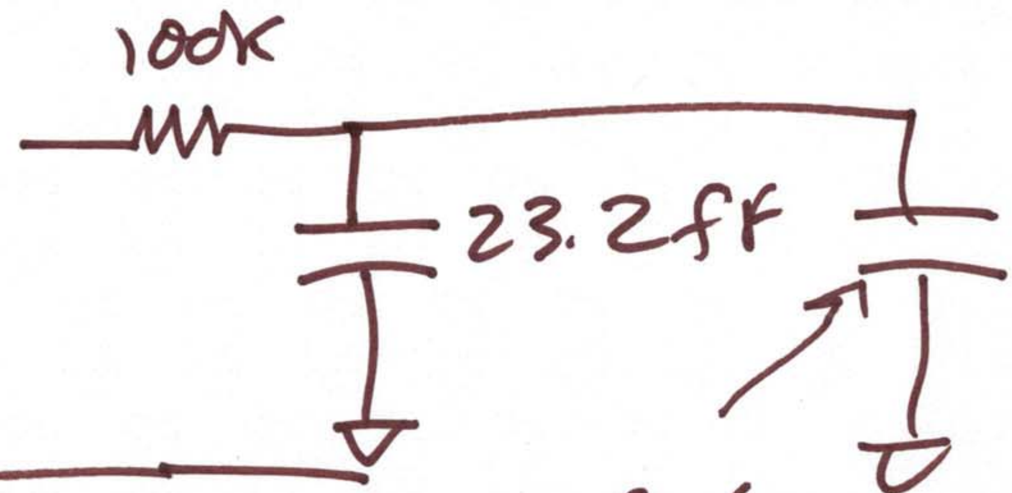
$$\frac{v_{in}}{v_s}\cdot\frac{v_{out}}{v_{in}} = -\frac{g_m N}{g_m P}\cdot\frac{1}{1+jwC_{gs}\cdot R}$$

$$\frac{v_{out}}{v_s} = \frac{-\frac{g_m N}{g_m P}}{1+jwC_{gs}\cdot R}$$

$$f_{3dB} = \frac{1}{2\pi C_{gs}\cdot R} = 68MHz$$

$$\frac{-4}{1+j\frac{f}{f_{3dB}}} = \frac{-4}{1+j\cdot f\cdot 2\pi C_{gs}\cdot R} = \frac{-4}{1+j\frac{f}{\frac{1}{2\pi C_{gs}\cdot R}}}$$



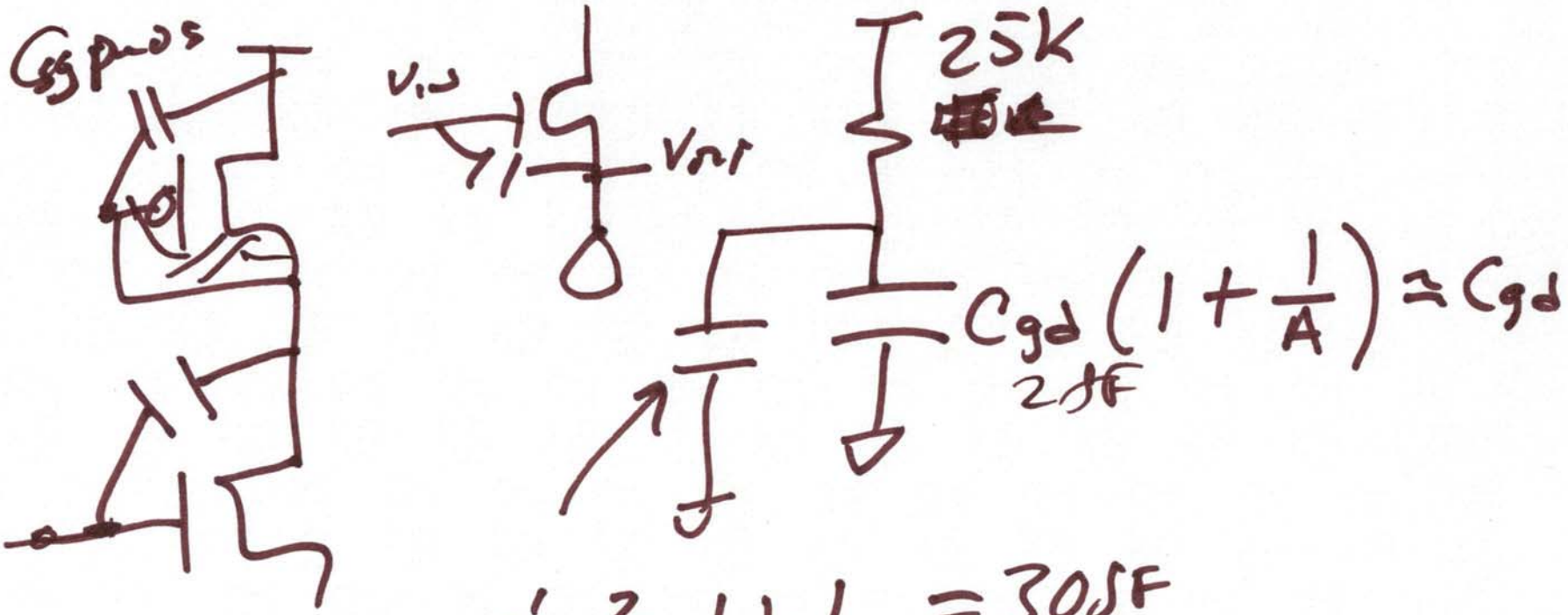


$$f_{3dB} = \frac{1}{2\pi \cdot 100k \cdot 33.2fF}$$

$2fF(1+|4|)$

$10fF$

$$= \underline{\underline{48\,MHz}}$$



$$C'_{ox}\cdot\frac{2}{3}\cdot W\cdot L = 30fF$$

$$1.75\,\frac{fF}{\mu m^2}\cdot\frac{2}{3}\cdot 10\mu\cdot 10\mu = 30fF$$

$$f_{3dB_{OUT}} = \frac{1}{2\pi\cdot 25K\cdot 32fF} = \frac{.159}{4\times 25K\cdot 32fF} = \frac{.159}{800\cdot 10^{-12}}$$

$$\simeq \frac{1.59}{800}\cdot 10^{9}$$

$$.2\cdot 10^{9}$$

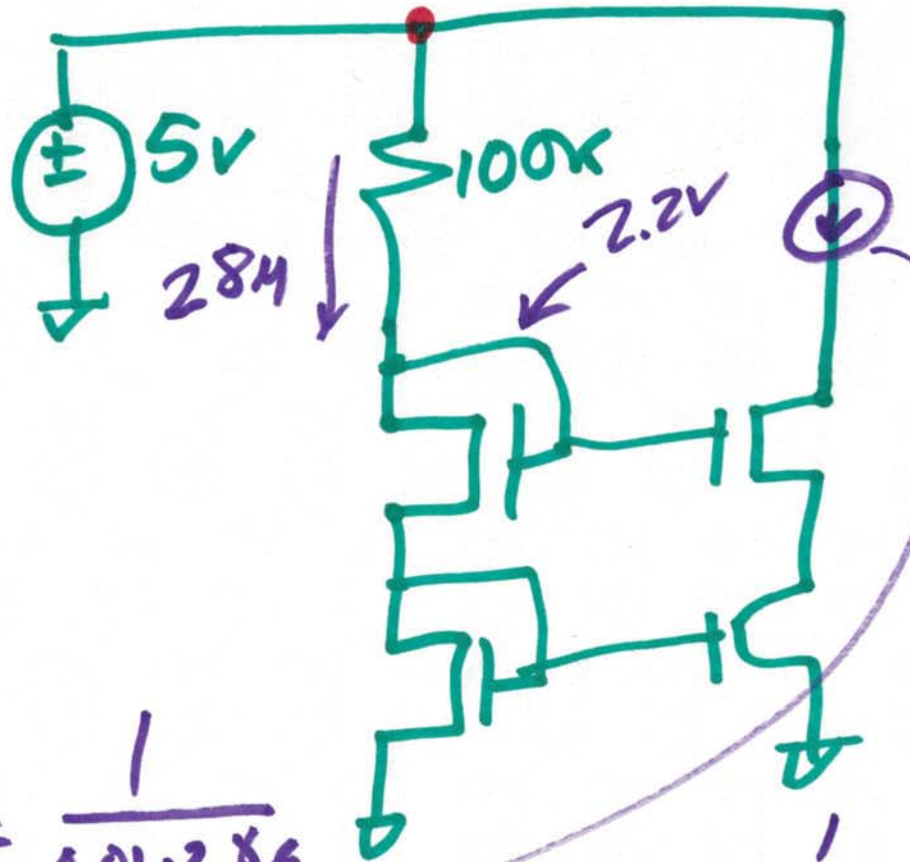
$$200MHz$$

Homework &
Quizzes

Last year's Midterm

Examples from the book

EOC from the book



$$\frac{5-2V_{GS}}{100K} = \frac{120\mu}{2}\cdot .5\left(V_{GS}-.8\right)^2$$

($\frac{120\mu}{2}\cdot .5$)

$$5-2V_{GS} = 30\left(V_{GS}-.8\right)^2$$

L R

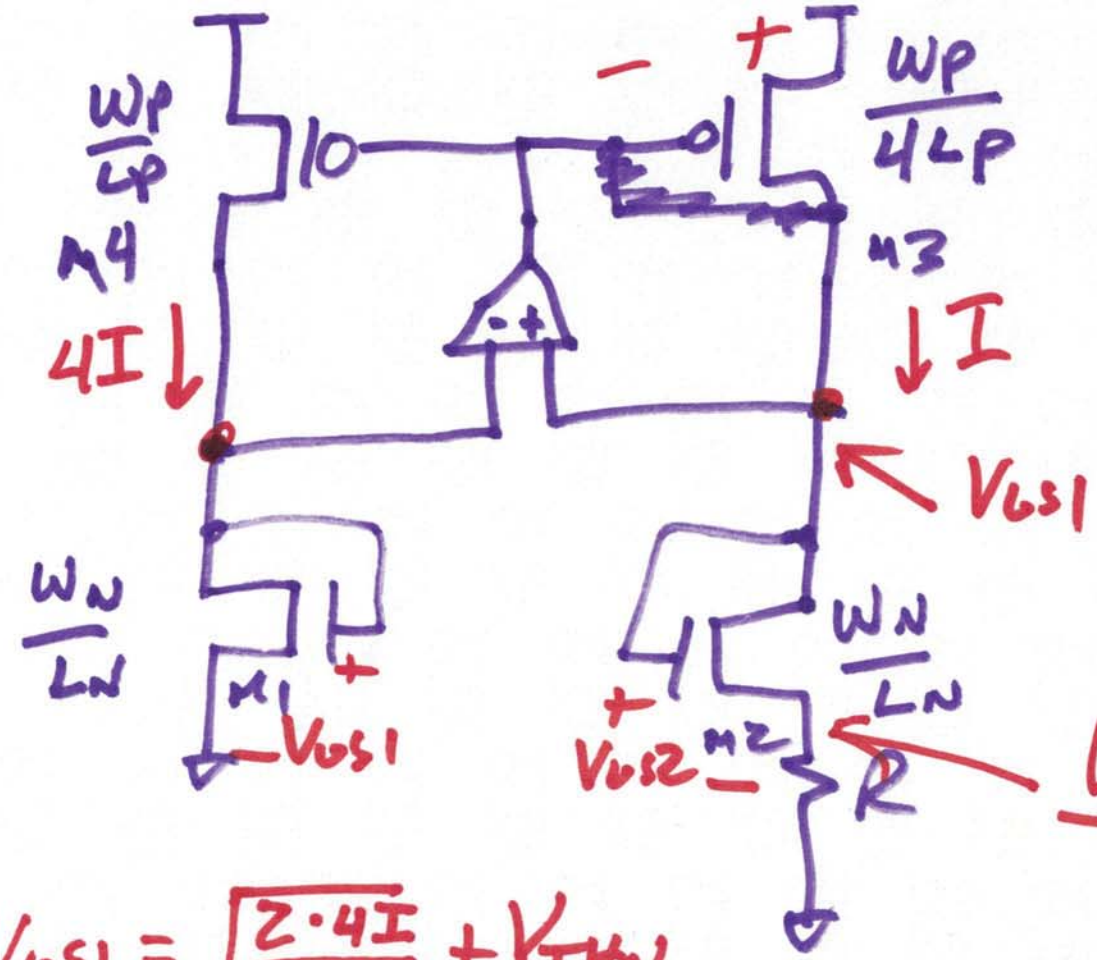
V_{GS}	L	R
1V	3	1.2
1.1	2.8	2.7
1.15	2.7	3.675
1.05	2.9	1.875
→ 1.08	2.94	2.35

$$r_o = \frac{1}{0.01\cdot 28\mu}$$

$$r_o = \frac{1}{0.01\cdot I_D}$$

$$g_m = \sqrt{2\,28\mu\cdot\frac{10}{2}}$$

$$i_T = \frac{1\mu V}{R_{outs}} = \frac{1\mu V}{g_m r_o^2}$$



Calculate the current in the circuit

$$\frac{V_{GS1} - V_{GS2}}{R} =$$

$$V_{GS1} = \sqrt{\frac{2 \cdot 4I}{K_{PN} \cdot \frac{W_N}{L_N}}} + V_{THN}$$

$$V_{GS2} = \sqrt{\frac{2I}{K_{PN} \cdot \frac{W_N}{L_N}}} + V_{THN}$$