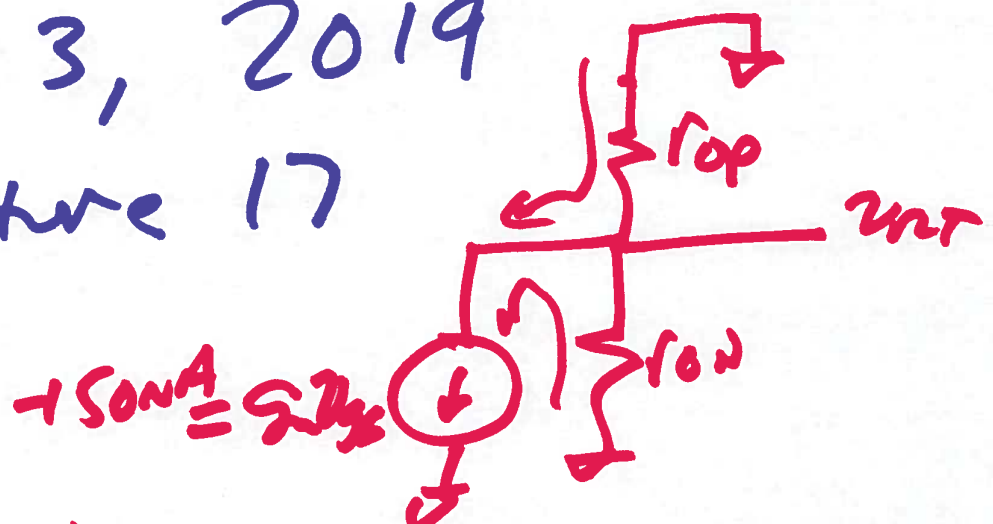
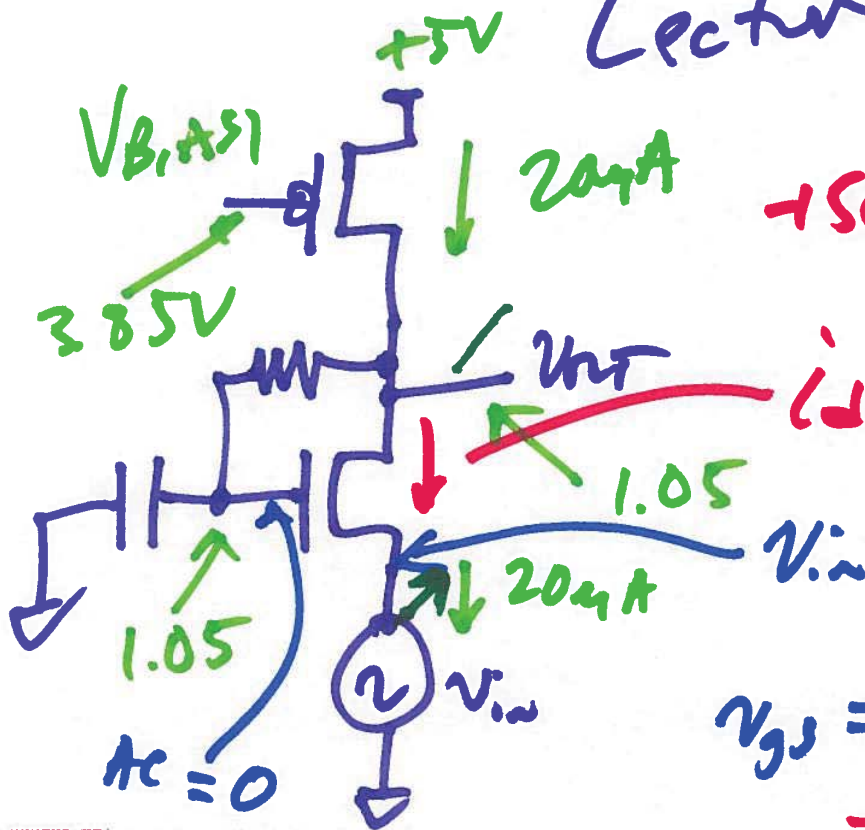
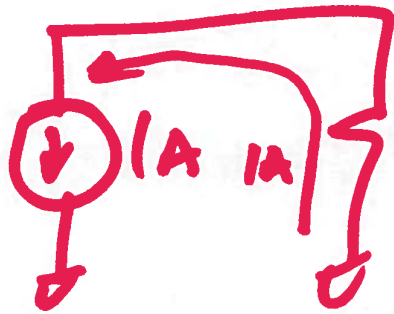


# EE 420 / ELG 620

## + .1V Analog IC Design

- April 3, 2019

Lecture 17



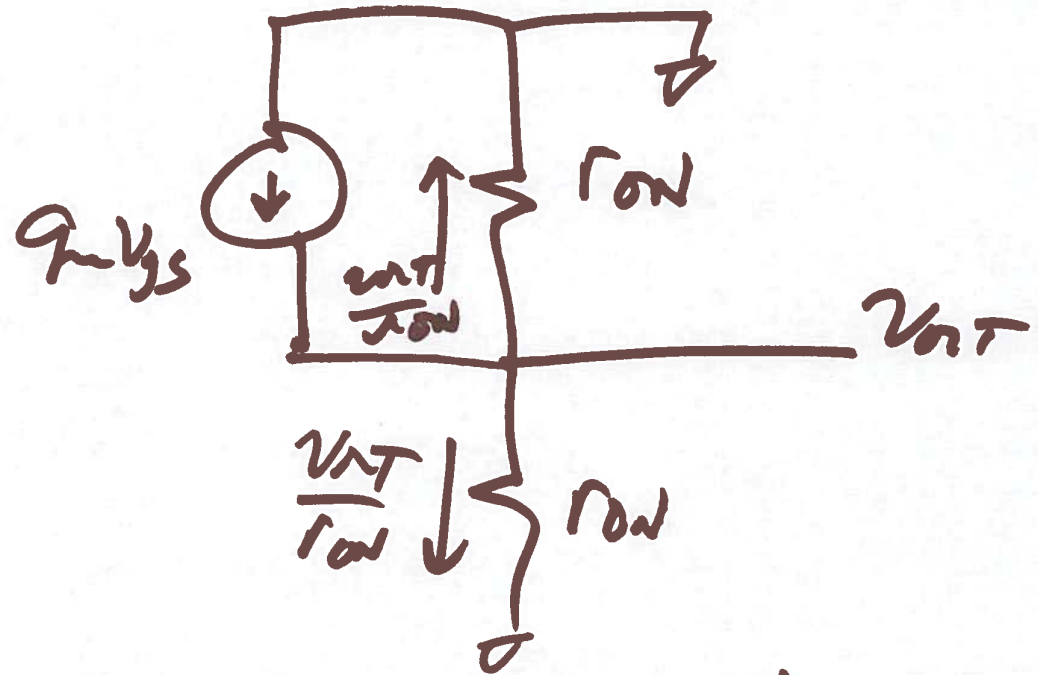
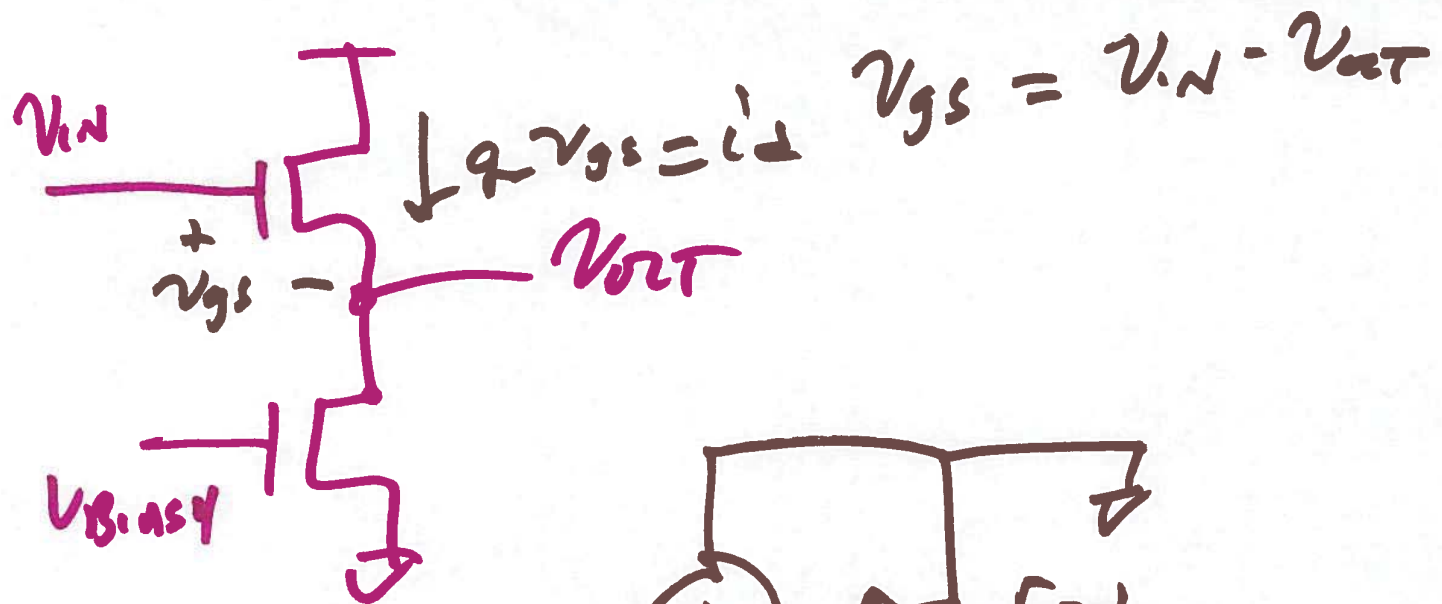
$$+150nA = g_m v_{gs}$$

$$i_d = g_m v_{gs} = 150n \cdot (-1mV)$$

$$i_d = -150nA$$

$$v_{gs} = -v_{in} = V_g - V_s = 7mV$$

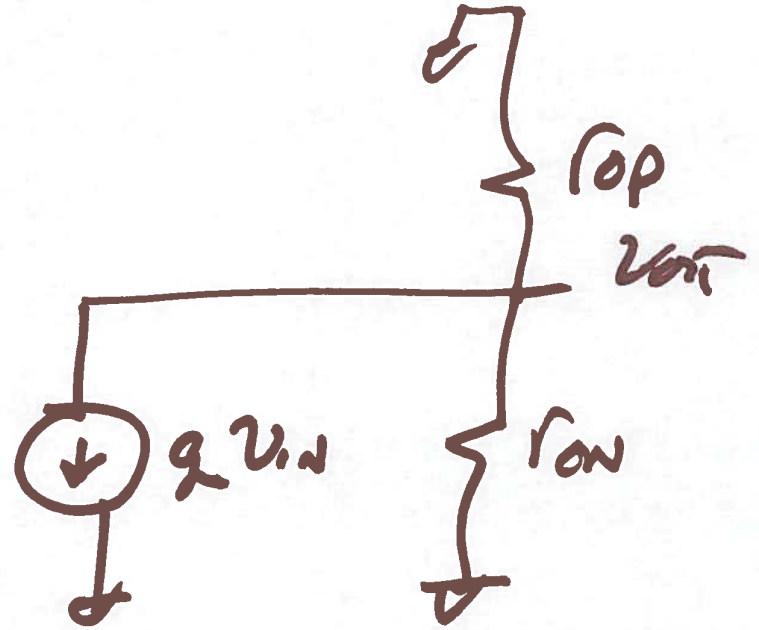
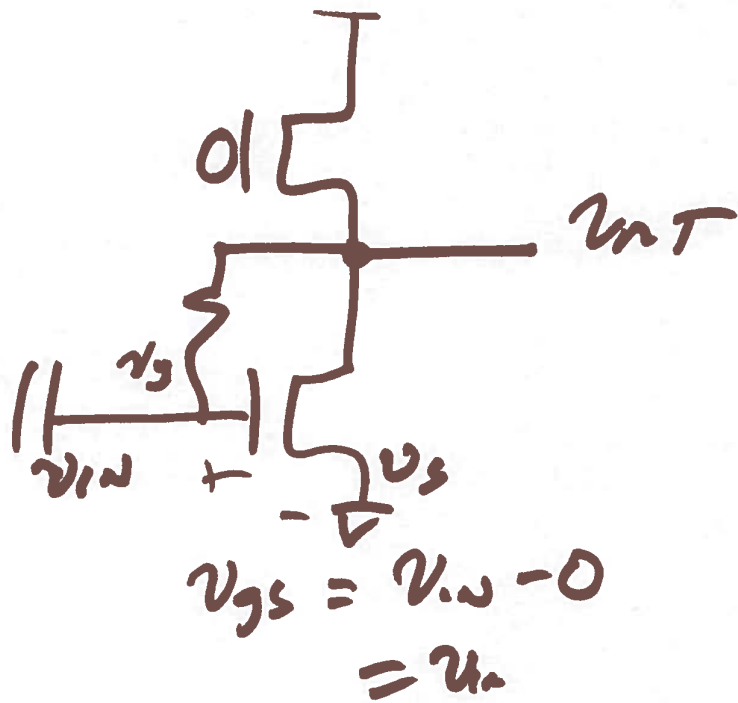
$$v_{inT} = \frac{+150nA}{2.2M} = 150nA \cdot 2.2MEG$$



$$g_m (V_{in} - V_{out}) = \frac{V_{out}}{r_{on}/2}$$

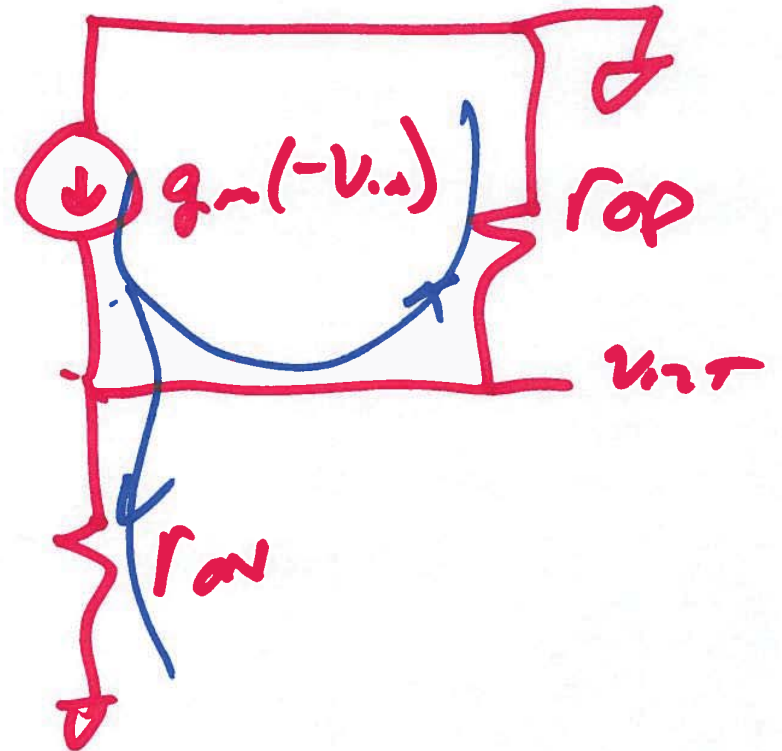
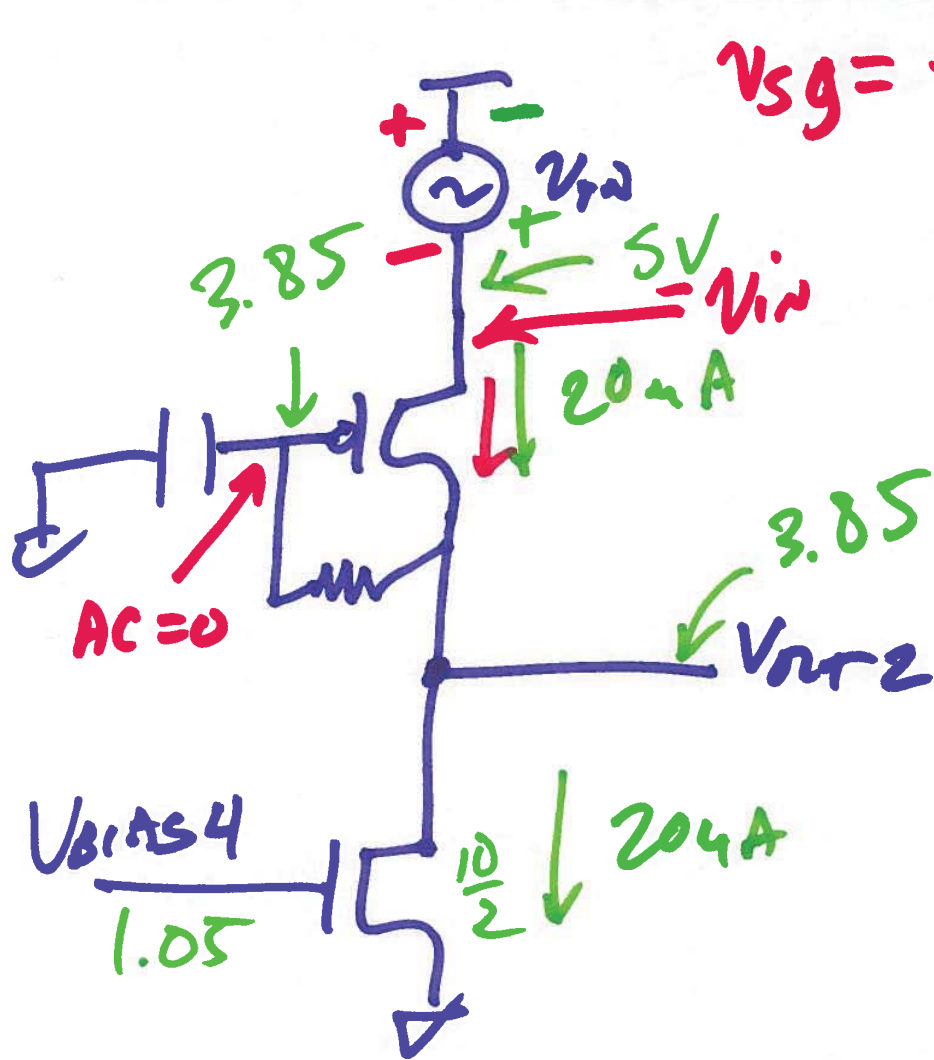
$$g_m V_{in} = V_{out} \left( g_m + \frac{2}{r_{on}} \right)$$

$$\frac{V_{out}}{V_{in}} = \frac{g_m}{\left( g_m + \frac{2}{r_{on}} \right)} = \frac{1}{1 + \frac{2}{g_m r_{on}}}$$



$$v_{out} = -g_m v_{in} \cdot r_{on} \parallel r_{op}$$

$$\frac{v_{out}}{v_{in}} = -g_m r_{on} \parallel r_{op}$$

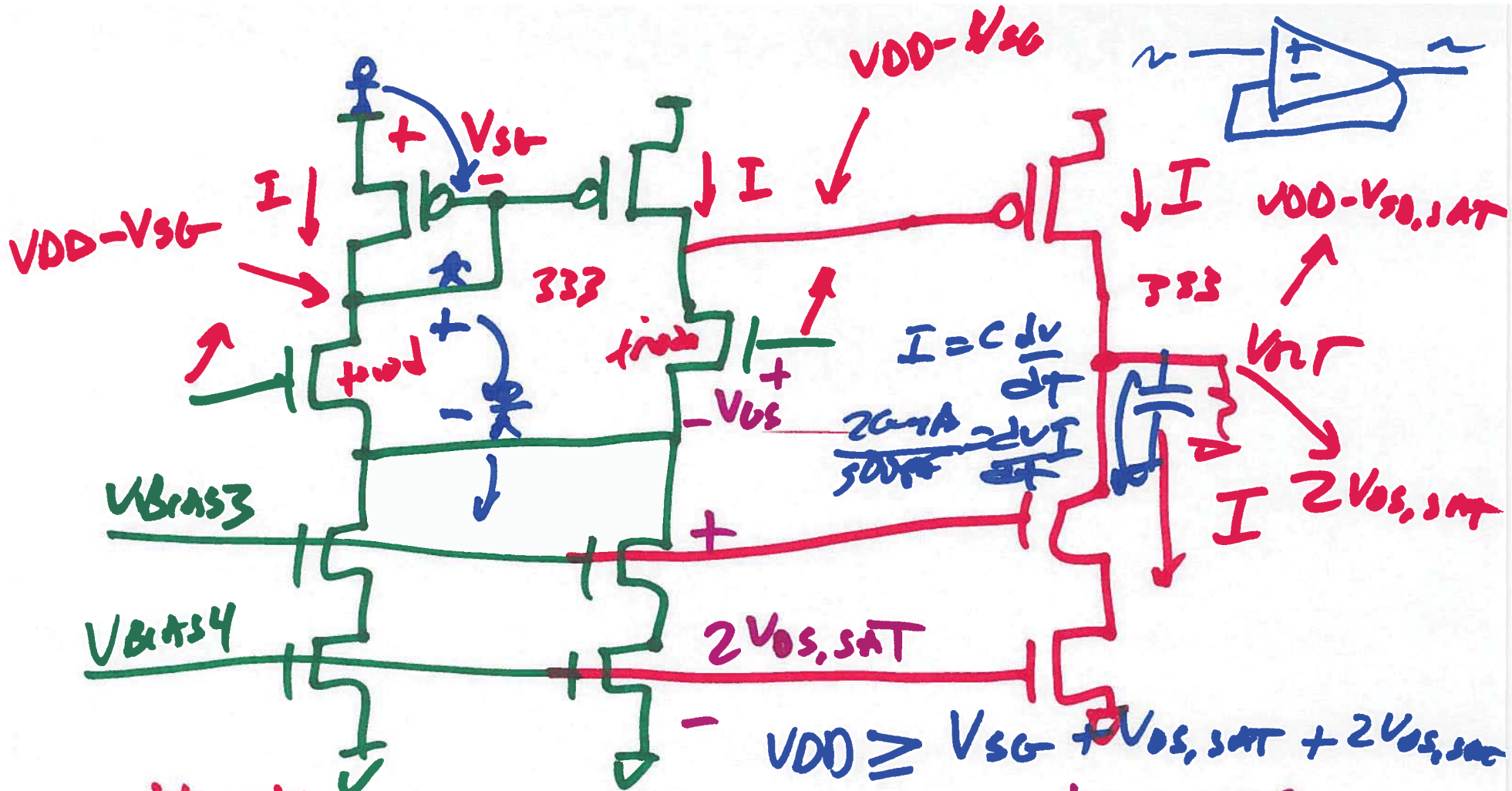


$$v_{out} = -g_m(v_{in}) \cdot r_{in} \parallel r_{op}$$

$$\frac{v_{out}}{v_{in}} = -g_m r_{in} \parallel r_{op}$$

$$= +g_m r_{in} \parallel r_{op}$$

4)



$V_{GS} \geq V_{GS} - V_{thn}$

MIN INPUT

COMMON MODE RANGE

$V_{DD} \geq V_G - V_{thn}$

$\Rightarrow = V_{GS} + 2V_{GS,sat}$   
(CMR)

$V_{DD} - V_{SG} \geq V_{GS} - V_{thn}$

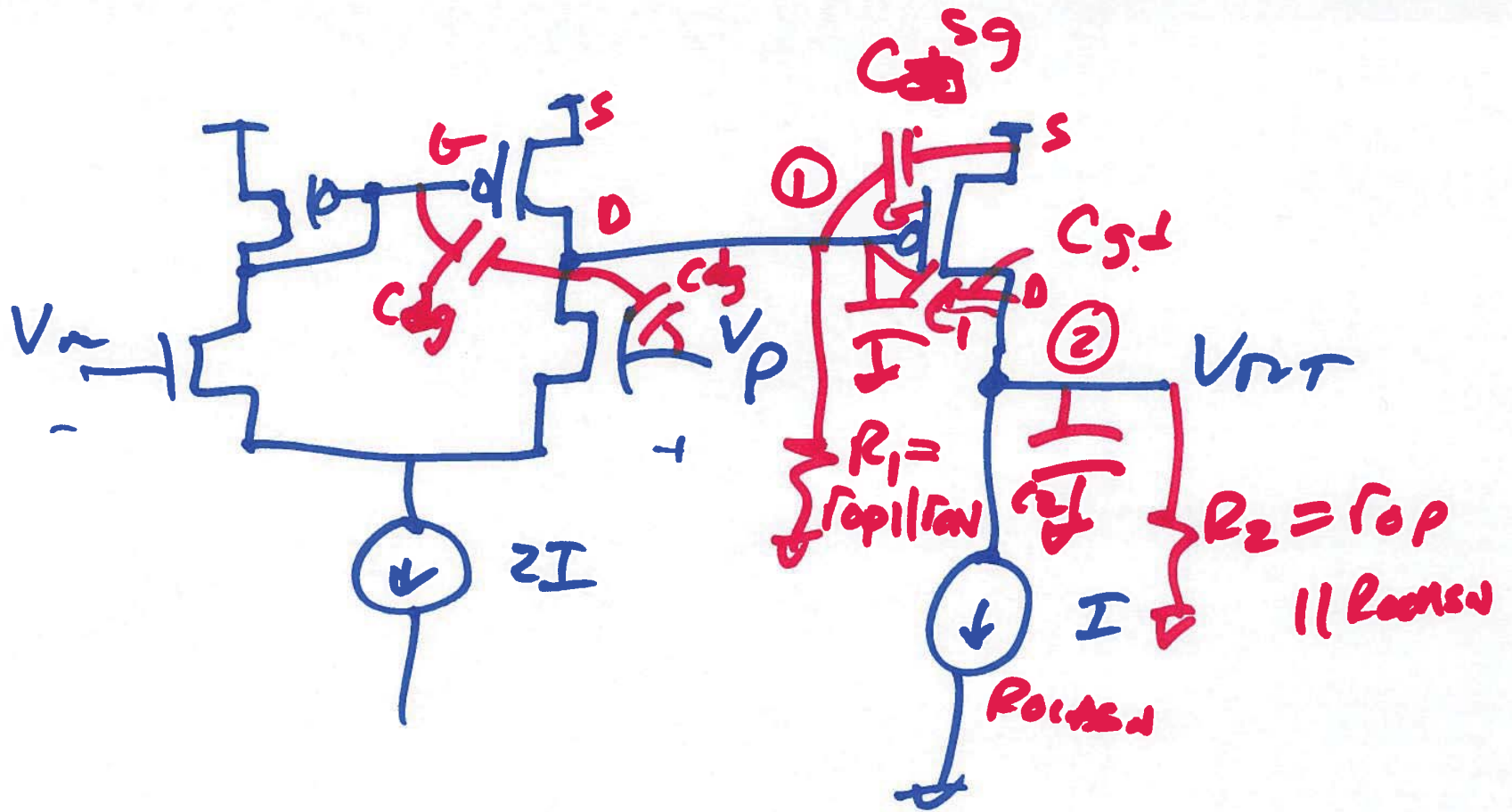
MAX INPUT

COMMON MODE RANGE

$= V_{DD} - V_{SG} + V_{thn}$  CMOSedu.com

5)





$$C_1 =$$

6)