

EE 420 / ECG 620

$$\frac{V_{oc}}{i_{sc}} = \frac{V_s}{V_s / 200k} = 200k$$

Analog IC Design



MARCH 18, 2015

Lecture 18

$$C_1 = 23.3 \text{ fF}$$

$$g_{m2} = 150 \mu\text{A/V}$$

$$C_2 \approx 1 \text{ pF}$$

$$R_2 = R_{oc,nsu} \parallel R_{ic,nsu} = 3.75 \text{ G} \parallel 2.45 \text{ G}$$

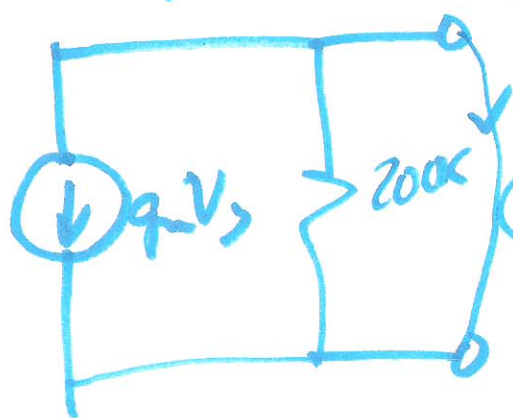
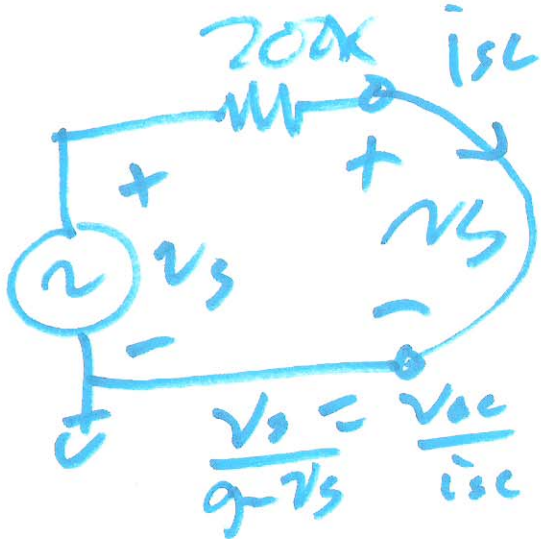
$$= \underline{\underline{1.56 \text{ G}\Omega}}$$

$$C_c = 10 \text{ pF}$$

$$R_1 = 200k$$

$$g_{m1} =$$

$$g_{m1} = -\frac{1}{200k}$$



$$\underline{f_1} \approx \frac{1}{2\pi g_{m2} \cdot R_2 R_1 \cdot C_c} = \frac{1}{2\pi \cdot \frac{1}{6.5K} \cdot 1.5 \times 10^9 \cdot 200K \cdot 10^{-11}}$$

$10^9 \cdot 10^{-11} = 10^{-2}$

$$-1 \approx \frac{1}{2\pi R_1 \cdot C_x}$$

$$A_v = g_{m1} R_1 \cdot g_{m2} R_2 = \frac{6.8}{6.5K} \cdot 1.5 \cdot \frac{2000}{2}$$

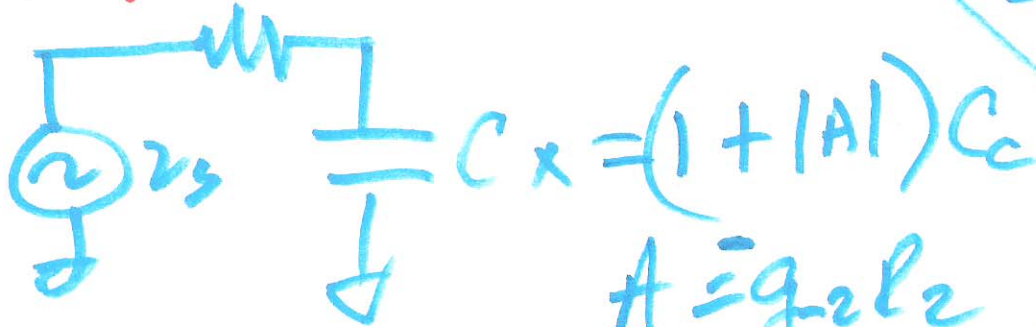
$$= \frac{6.5}{20.4}$$

$$= \frac{1}{3} \text{ Hz}$$

$$= \frac{1}{3} \text{ Hz}$$

$$f_{in} = \frac{g_{m1}}{2\pi C_c} = \frac{1}{200K} \approx 80K$$

$$150K \cdot 1.5K = 225K$$



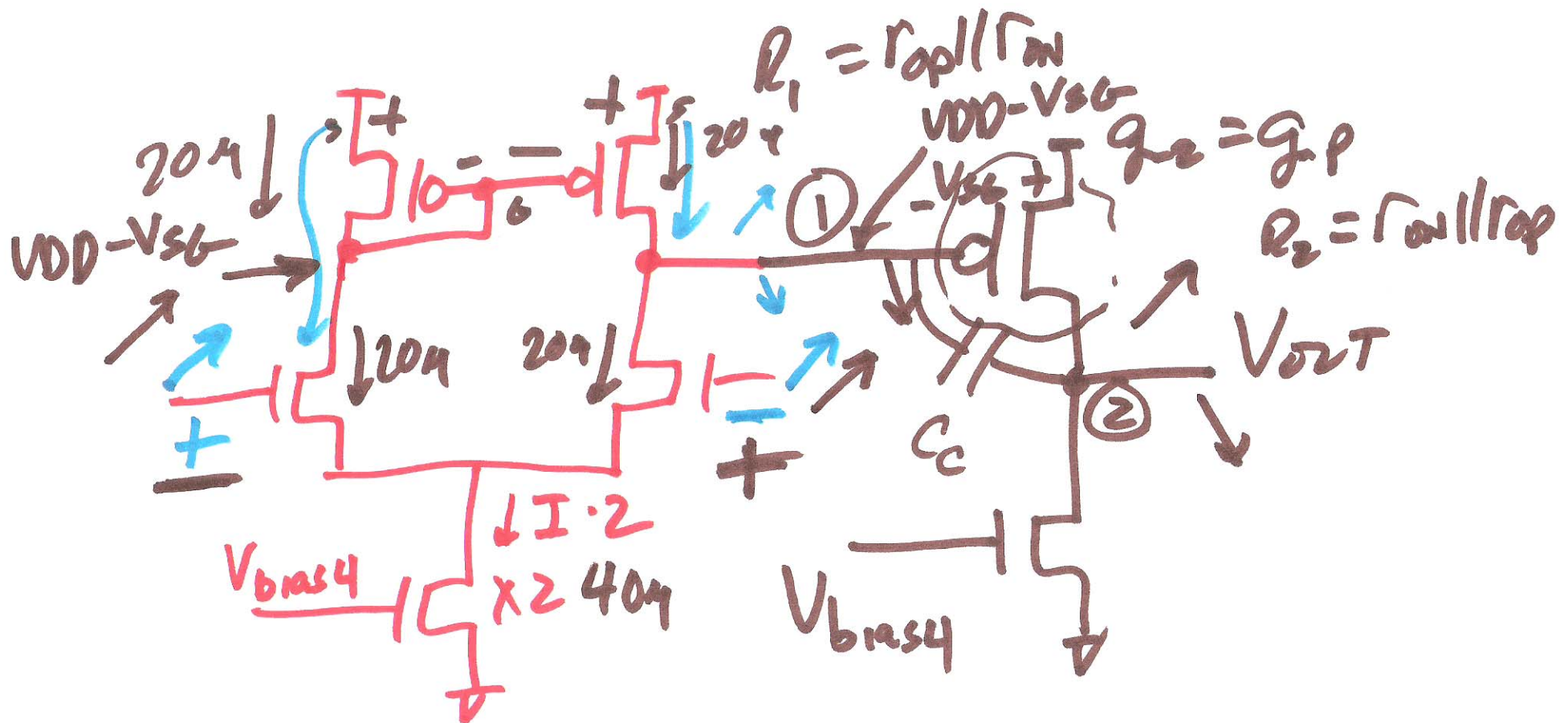
$$C_x = (1 + |A|) C_c$$

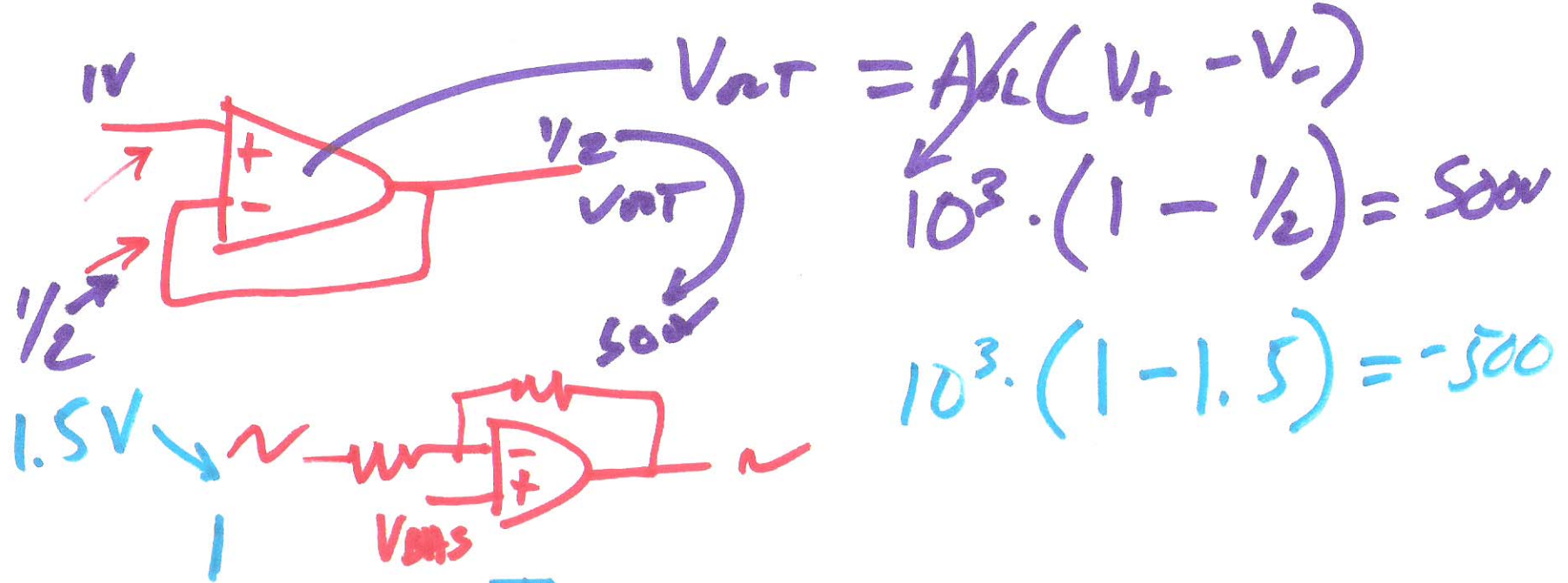
$$A \approx g_{m2} R_2 \quad A \gg 1 \quad C_x \approx g_{m2} R_2 C_c$$

$$f_z = \frac{g_{m2}}{2\pi C_c} = \frac{150\mu}{2\pi 10p} = 2.4 \text{ MHz}$$

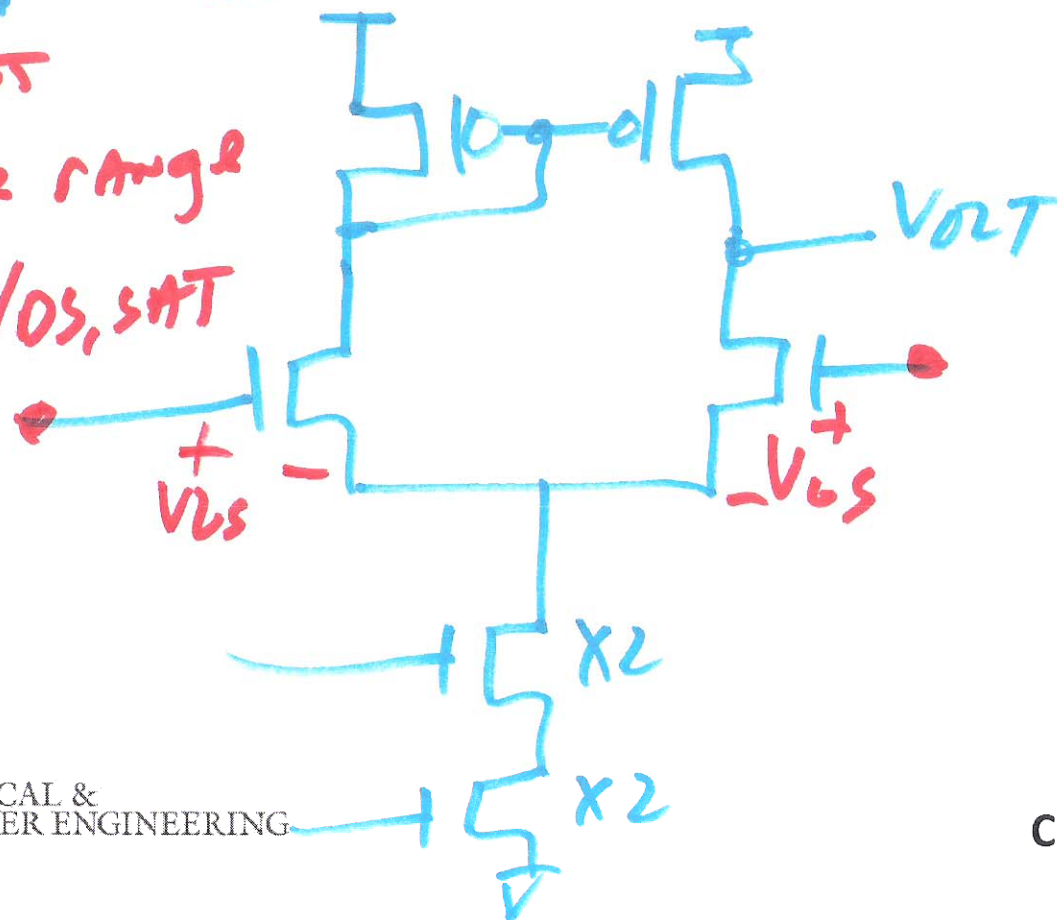
differential - Amplifiers

$$= 2.4 \text{ MHz}$$

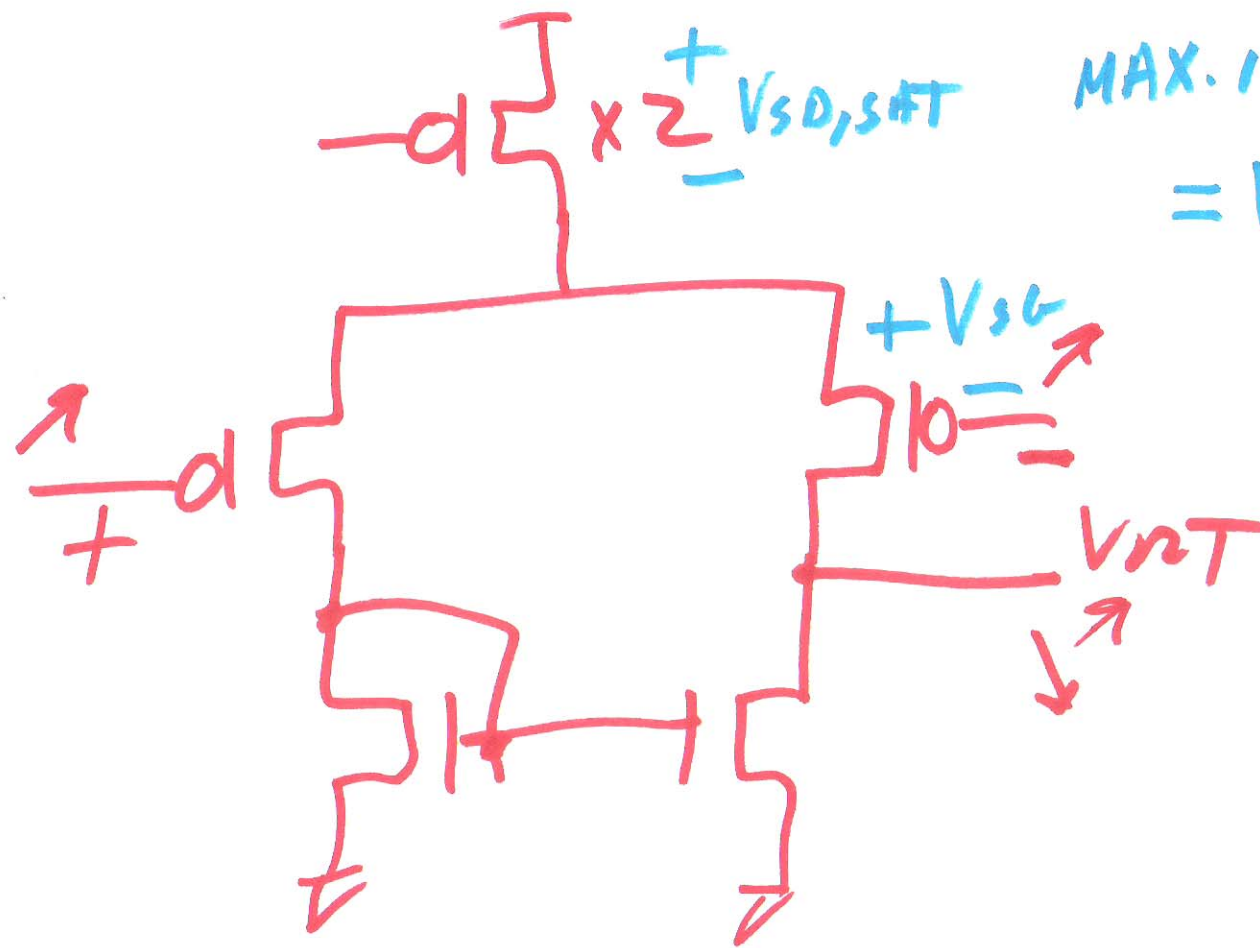




Minimum input
 Common-mode range
 $= V_{GS} + 2V_{DS,sat}$



4)



$$-d \times \frac{+}{-} V_{SD,sat}$$

MAX. INPUT CMR

$$= VDD - V_{SD,sat}$$

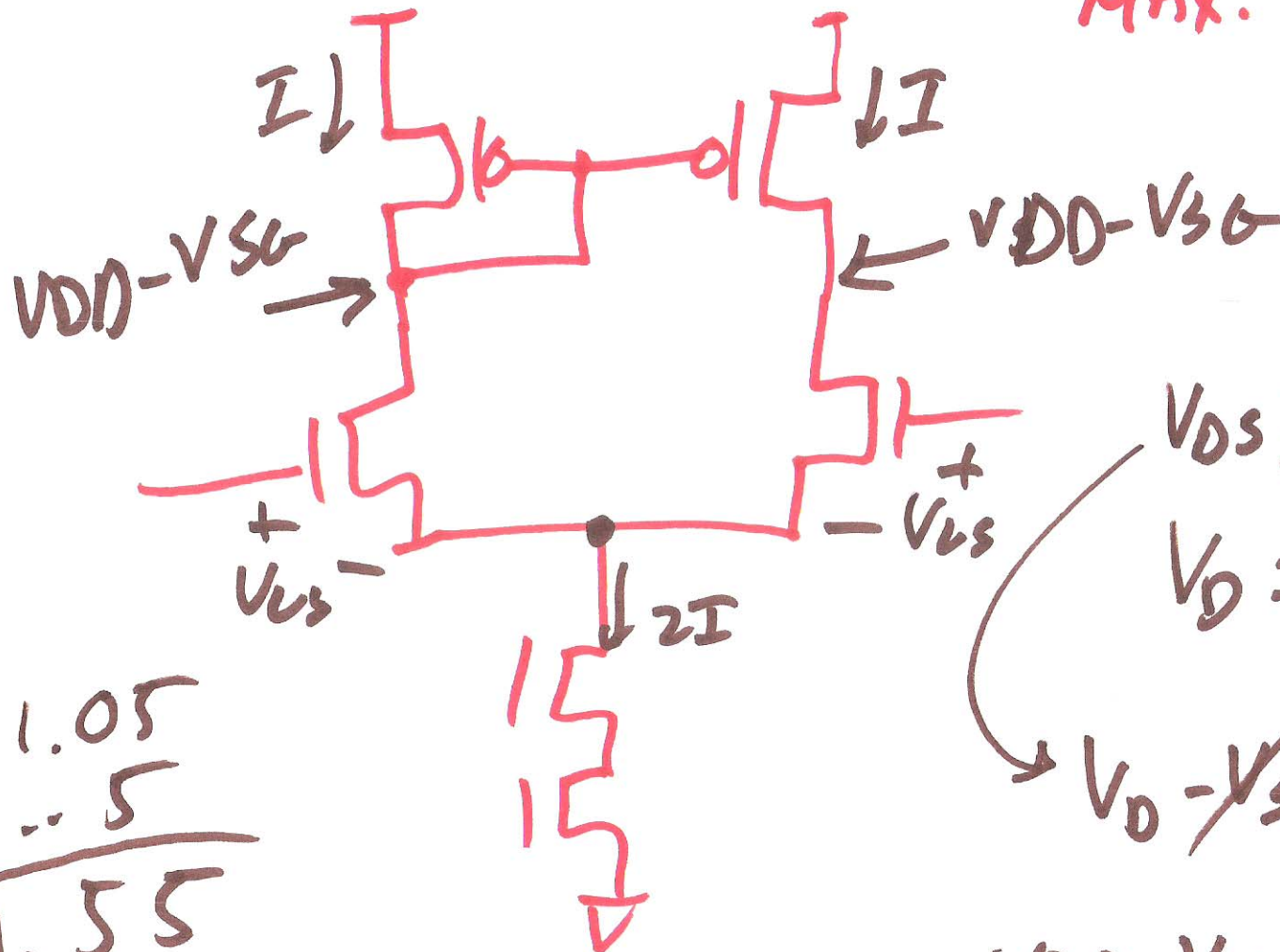
$$-V_{SG}$$

$$= 5 - 2.5$$

$$- 1.15$$

$$= \underline{\underline{3.6V}}$$

MAX. input CM voltage



$$V_{DS} \geq V_{GS} - V_{THN}$$

$$V_D = V_{DD} - V_{SG}$$

$$V_D - V_S \geq V_G - V_S - V_{THN}$$

$$V_{DD} - V_{SG} \geq V_{IMAX,CM} - V_{THN}$$

$$V_{IMAX,CM} \leq V_{DD} - V_{SG} + V_{THN}$$

$$5 - 1.15 + .8 = 4.65V \leftarrow \text{MAX}$$

$$\begin{array}{r} 1.05 \\ - .5 \\ \hline 1.55 \end{array}$$

Min

6)