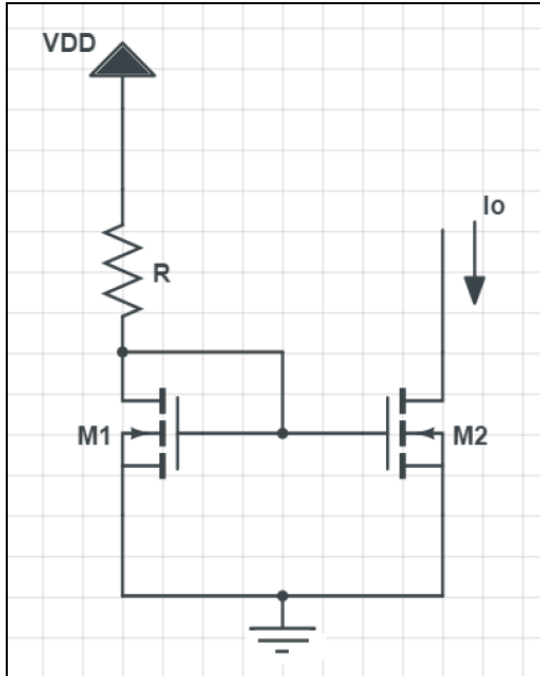


Name Avery Peiffer

ECE 0247 Quiz #7



1. (8 points) For this circuit what is the value of the output current, I_o ?

Assume that $V_{DD} = 2.5V$, $R = 15\text{ k}\Omega$, $V_t = 0.5V$, $k'_n = 80\text{ }\mu\text{A/V}^2$, $W_1/L_1 = 10$ and $W_2/L_2 = 30$

(Report your answer in units of μA)

$$I_o = 300\text{ }\mu\text{A}$$

Quiz 7

$V_{DD} = 2.5\text{ V}$
 $R = 15\text{ k}\Omega$
 $V_t = 0.5\text{ V}$
 $k'_n = 80\text{ }\mu\text{A/V}^2$
 $W_1/L_1 = 10$
 $W_2/L_2 = 30$

M1 is in saturation:

$$I_{D1} = \frac{1}{2} k'_n \left(\frac{W_1}{L_1} \right) (V_{GS1} - V_t)^2$$

$$I_{D1} = \frac{W_1/L_1}{W_2/L_2} I_{D2}$$

$$V_{GS1} = V_{GS2} = V_{GS} = V_G - 0$$

$$I_{D1} = \frac{V_{DD} - V_G}{R} \rightarrow V_G = V_{DD} - I_{D1} R$$

$$I_{D1} = \frac{1}{2} k'_n \left(\frac{W_1}{L_1} \right) (V_{DD} - I_{D1} R - V_t)^2$$

$$\frac{2 I_{D1} L_1}{k'_n W_1} = (V_{DD} - I_{D1} R - V_t)^2$$

$$V_{DD} - I_{D1} R - V_t = \sqrt{\frac{2 I_{D1} L_1}{k'_n W_1}}$$

$$I_{D1} = \frac{V_{DD} - V_t}{R} - \sqrt{\frac{2 I_{D1} L_1}{k'_n W_1}}$$

$$I_{D1} + \sqrt{\frac{2 I_{D1} L_1}{k'_n W_1}} = \frac{V_{DD} - V_t}{R}$$

$$I_{D1} + \sqrt{90000 I_{D1}} = 1.33 \times 10^{-4}\text{ A} \quad 1.965 \times 10^{-17}$$

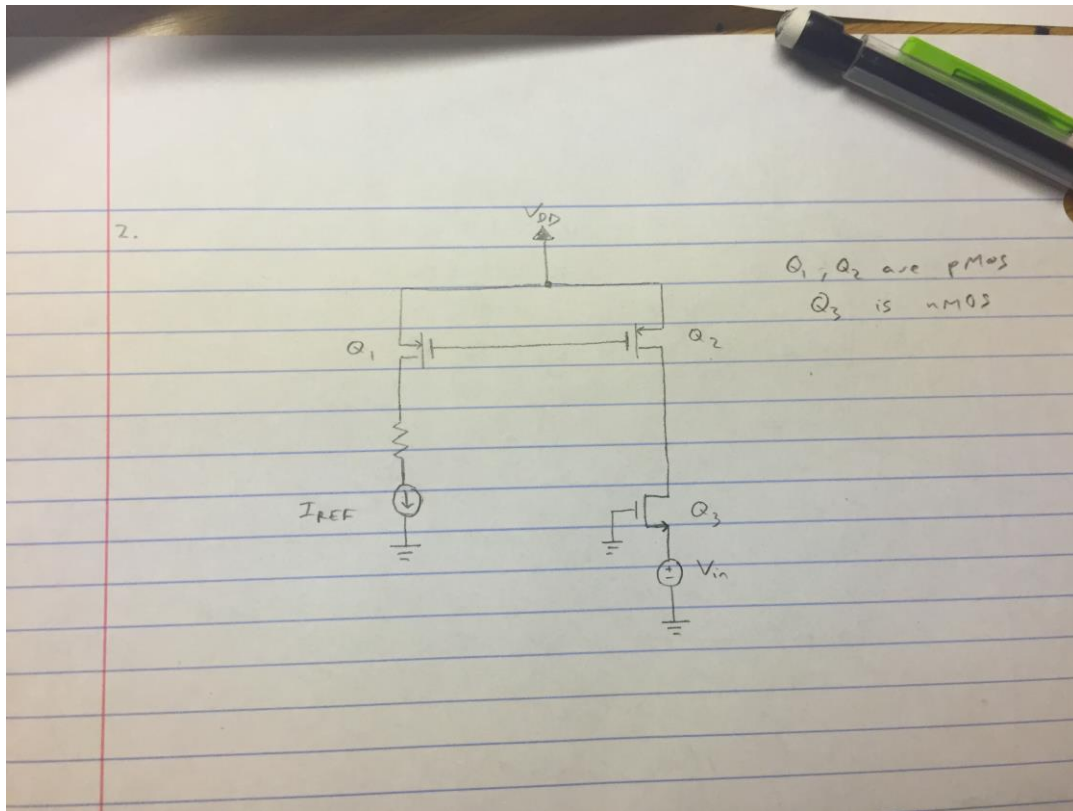
$$I_{D1} + 0.00327 \sqrt{I_{D1}} = 1.33 \times 10^{-4}\text{ A}$$

(used graphing calculator)

$$x = 9.97 \times 10^{-5}\text{ A} = 10^{-4}\text{ A} = 100\text{ }\mu\text{A}$$

$$I_o = 3 I_{D1} = 300\text{ }\mu\text{A}$$

2. (2 points) Sketch a transistor-level schematic for an active-loaded Common Gate Amplifier that uses only transistors (NMOS and/or PMOS) and no more than one resistor



EXTRA PAGES

[Leave the page unchanged if you are not going to use. Otherwise, specify the problem number you are working on here. Don't forget to notify "TO BE CONTINUED" in the original problem box]