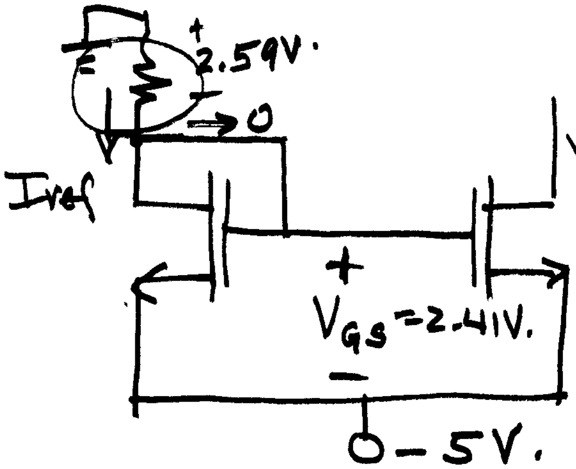
MOSFET CURRENT MIRROR



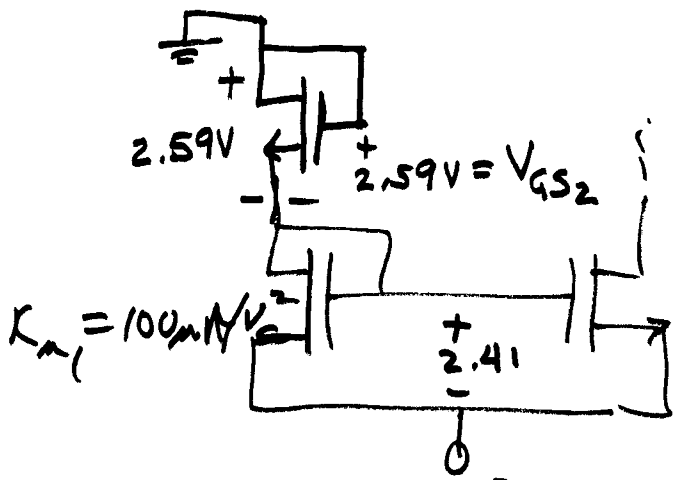
$$V_{GS} = \sqrt{\frac{I_D}{K_n}} + V_{TN}$$

$$K_n = 100\mu A/V^2 \qquad V_{TN} = 1V$$

$$I_D = 200\mu A$$

$$V_{GS} = \sqrt{\frac{200\mu}{100\mu}} + 1 = 2.41V.$$

$$R = \frac{5 - 2.41}{200\mu} = \frac{2.59}{200\mu A} = 12.95K$$



$$I_D = K_n(V_{GS} - V_{TN})^2$$

$$200\mu A = K_n(2.59 - 1)^2$$

$$K_n = \frac{200\mu}{(2.59-1)^2} = 79.1\mu A/V^2$$

$$K_{n_1} = \frac{k_n'}{2}\frac{W}{L} = 100\mu A/V^2$$

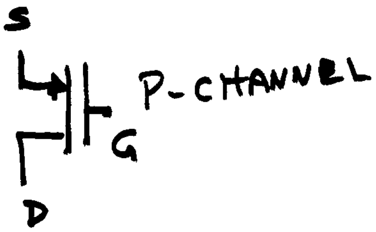
$$K_{n2} = 79.1\mu A/V^2$$

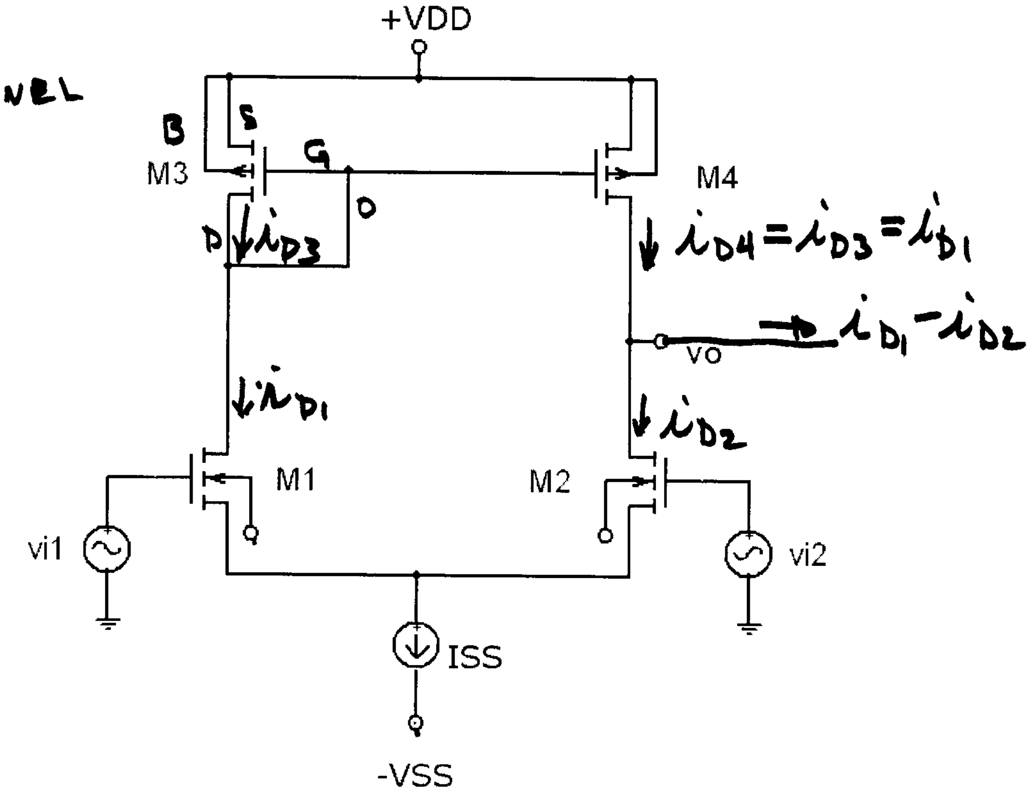
$$\frac{K_{n2}}{K_{n_1}} = 0.791 = \frac{(W/L)_2}{(W/L)_1}$$

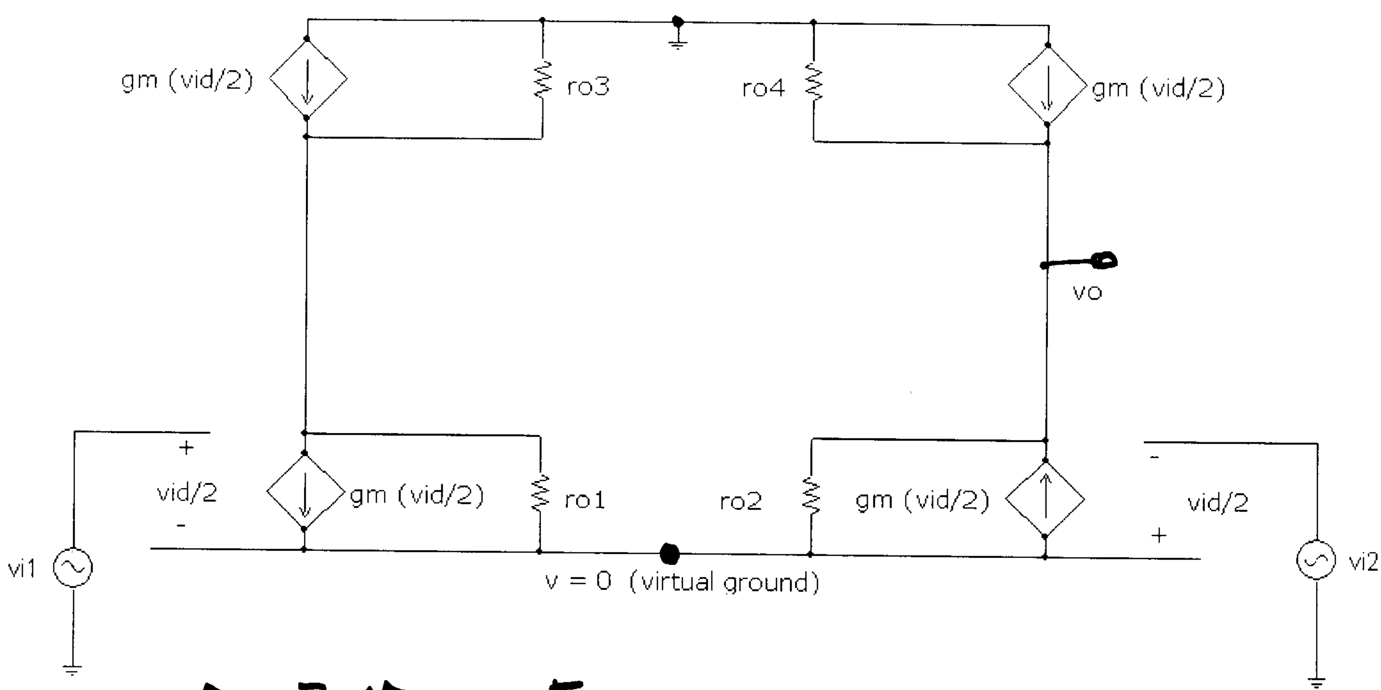
$$L_2 = L_1$$

$$W_2 = 0.791 W_1$$

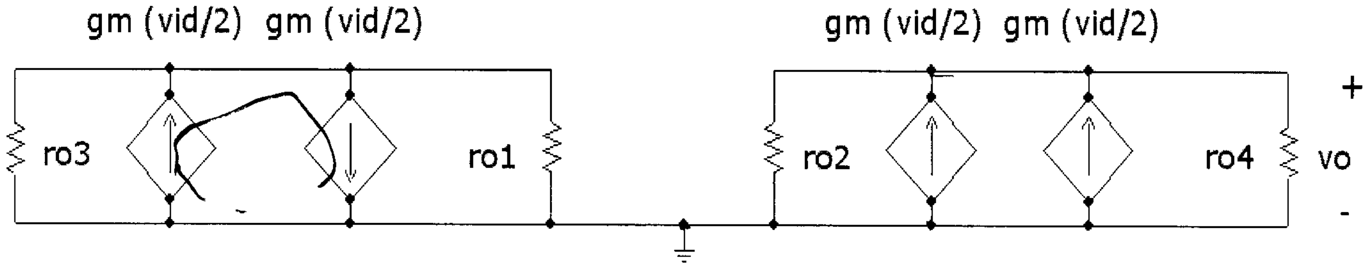
A CMOS DIFFERENTIAL AMPLIFIER

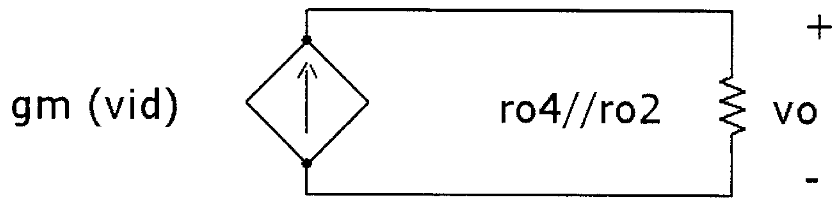






$$v_{id} = v_{i1} - v_{i2}$$





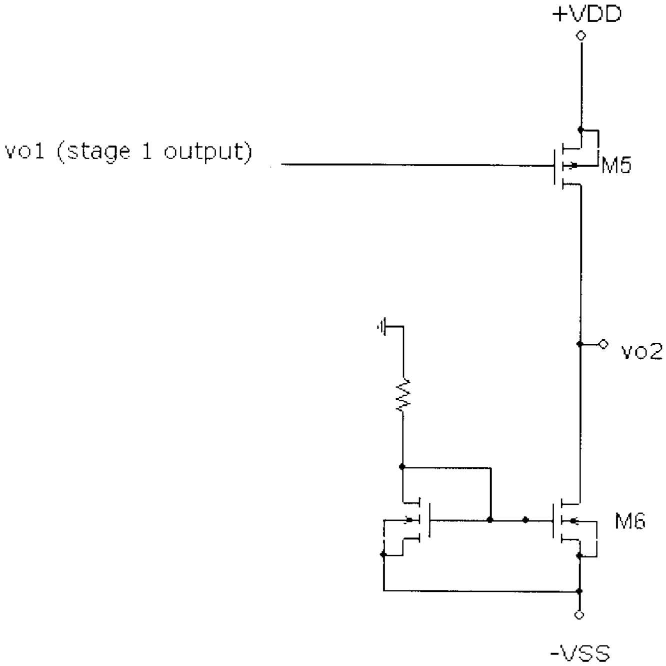
$$= g_m v_{id} (r_{o4} // r_{o2})$$

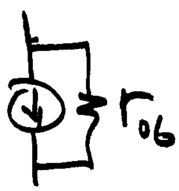
$$A_{vd} = \frac{v_o}{v_{id}} = g_m (r_{o4} // r_{o2})$$

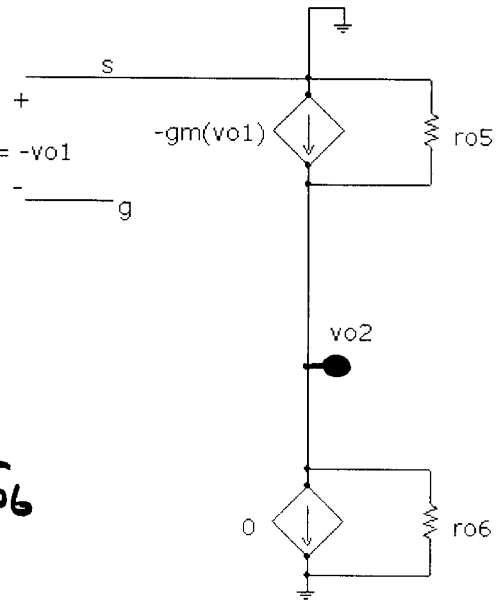
$$g_m = 2\sqrt{K_n I_{DQ}}$$

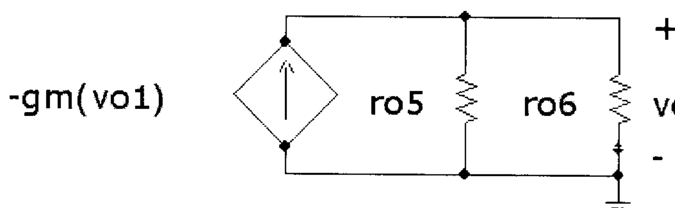
$$r_o = \frac{V_A}{I_{DQ}} = \frac{1}{\lambda I_{DQ}}$$

STAGE 2









$$v_{o2} = -g_m v_{o1} \left(r_{o5} // r_{o6} \right)$$

$$\frac{v_{o2}}{v_{o1}} = -g_m \left(r_{o5} // r_{o6} \right)$$

STAGES 1 AND 2 TOGETHER