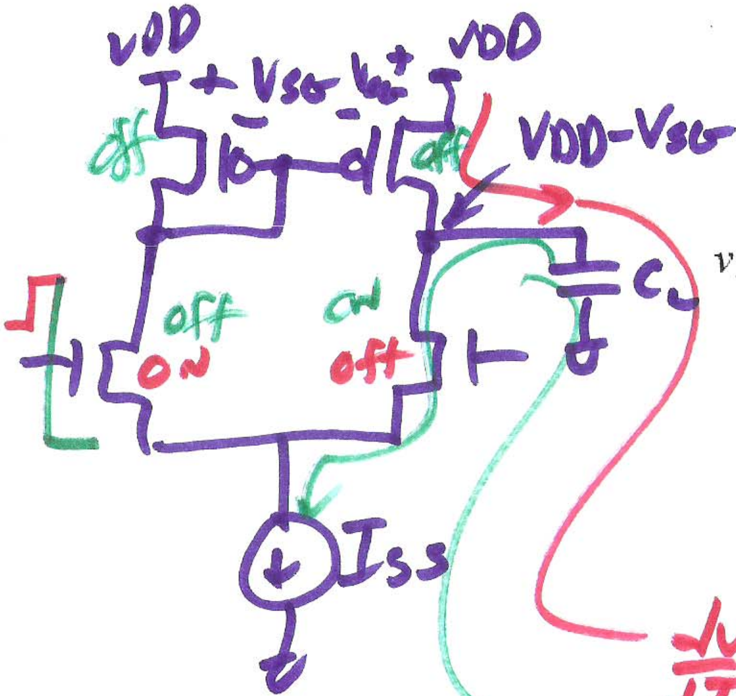
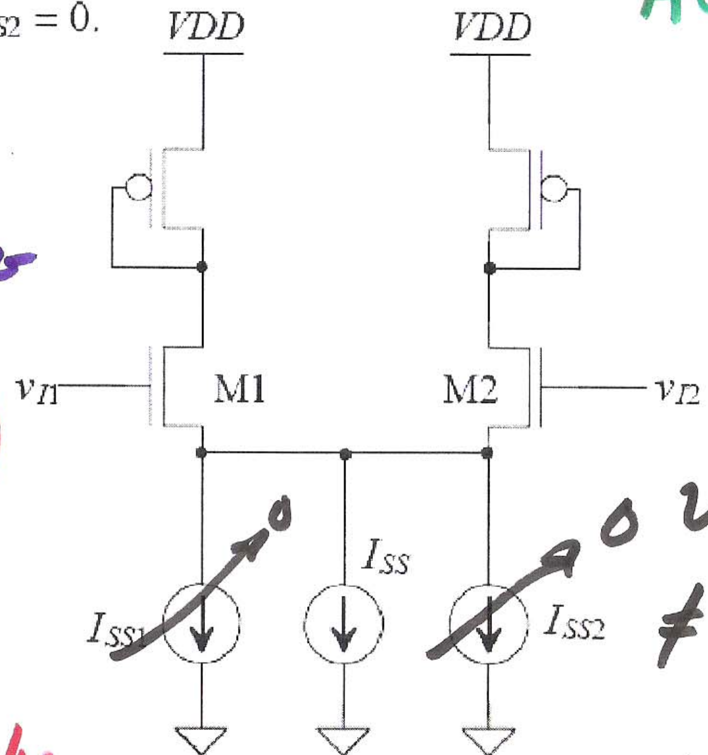
27.2

Adaptive biasing

If $v_{I1} = v_{I2}$ then $I_{SS1} = I_{SS2} = 0$.



$\frac{dv}{dT} = I_{ss}/C$



0 $v_{I1} = v_{I2}$

≠0 $v_{I1} \neq v_{I2}$

Figure 27.18 Adaptively biased diff-amp.

$\frac{dv}{dT} = \frac{I_{ss}}{C}$

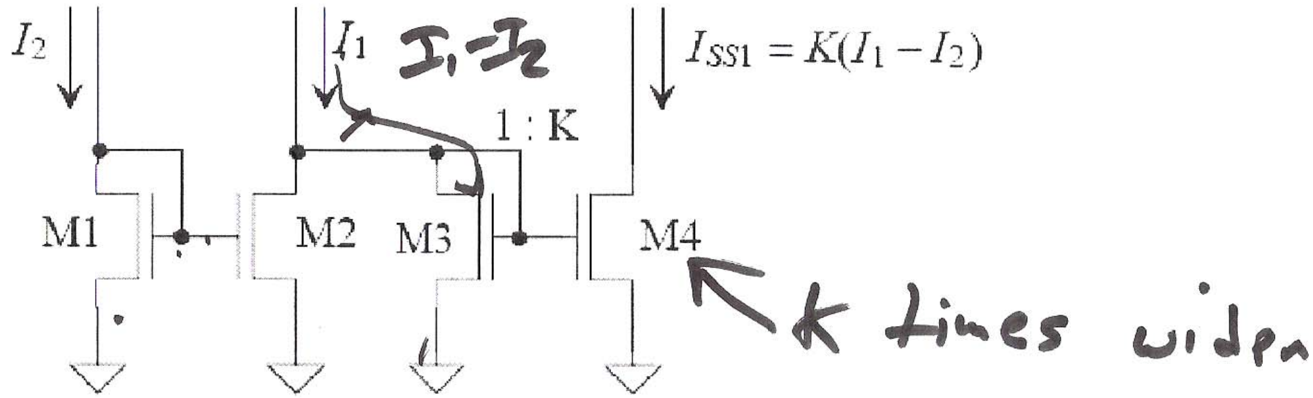


Figure 27.19 Current diff-amp used in adaptive biasing.

2)

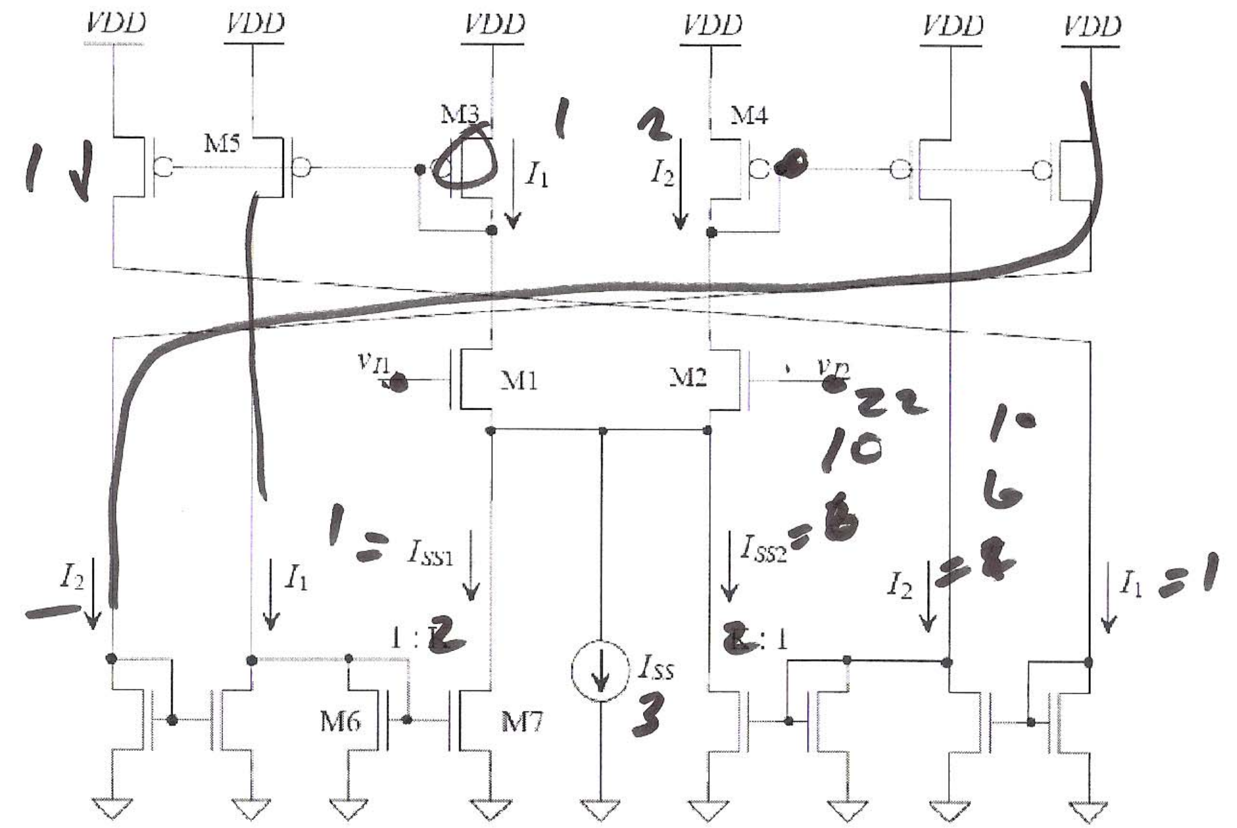


Figure 27.20 Adaptively biased diff-amp.

K>1 we positive f.b.

$$I_{SS2} = I_{SS}(1 + K + K^2 + K^3 \ldots)$$

K<1

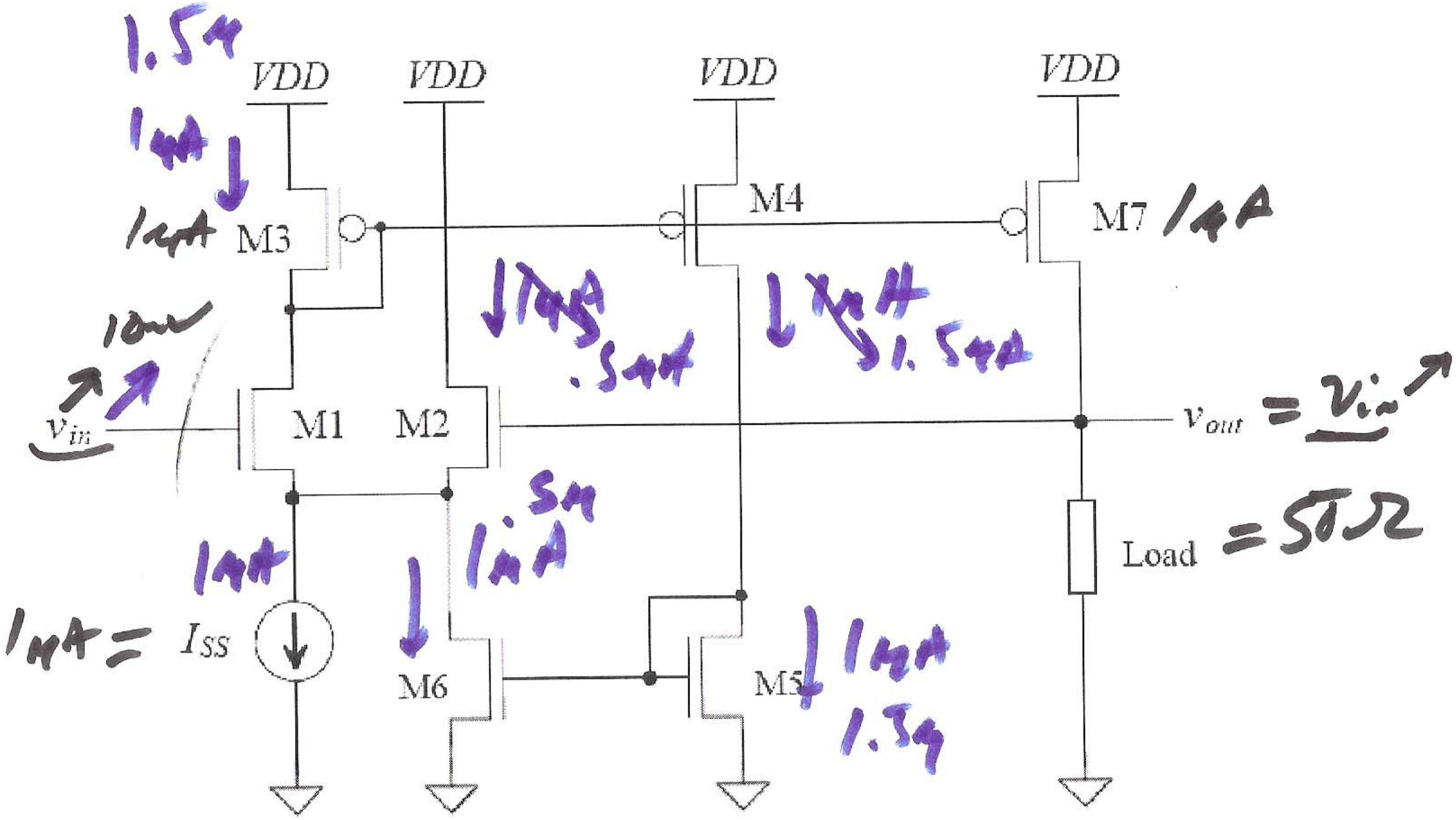
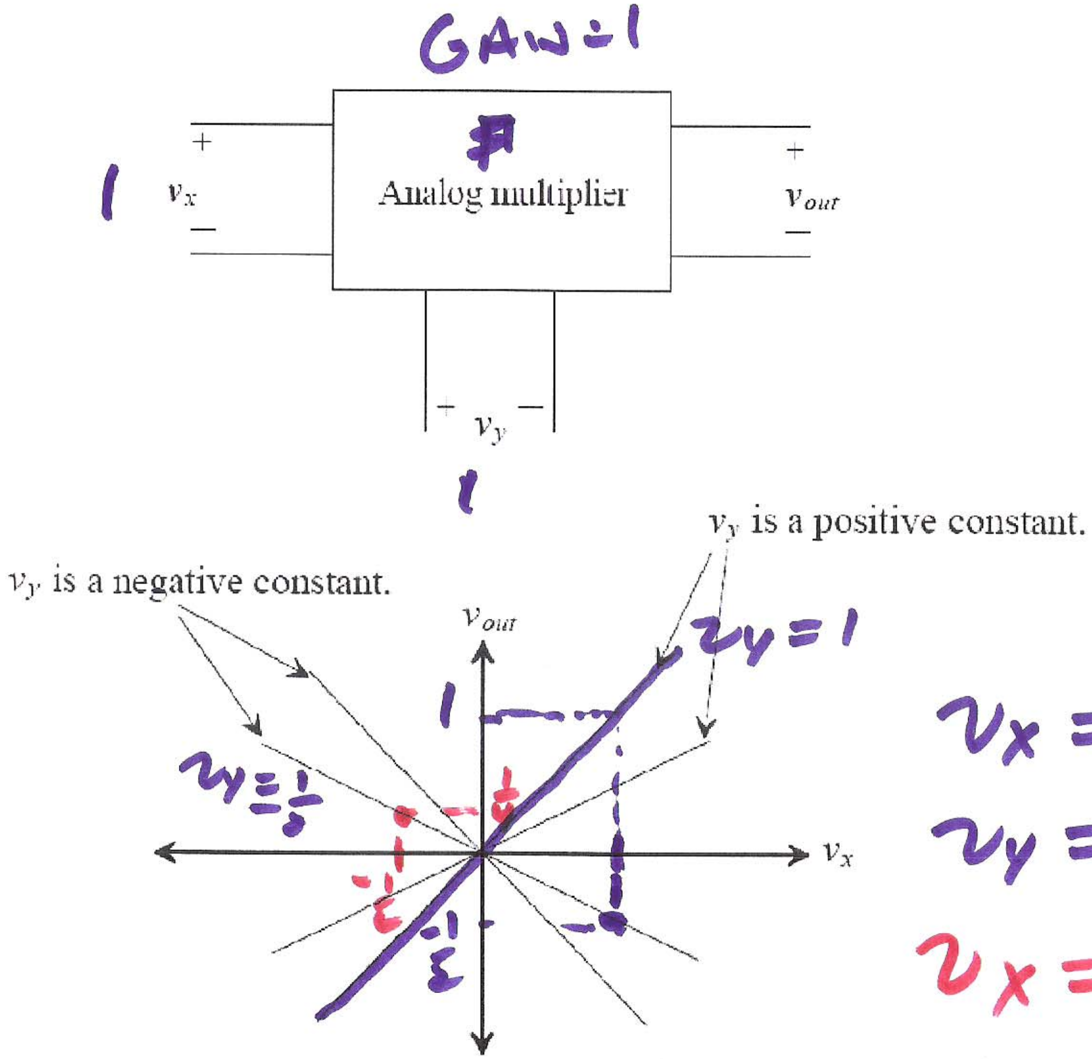


Figure 27.21 Adaptive voltage follower.

4)



$v_x = 1$

$v_y = -\frac{1}{2}$

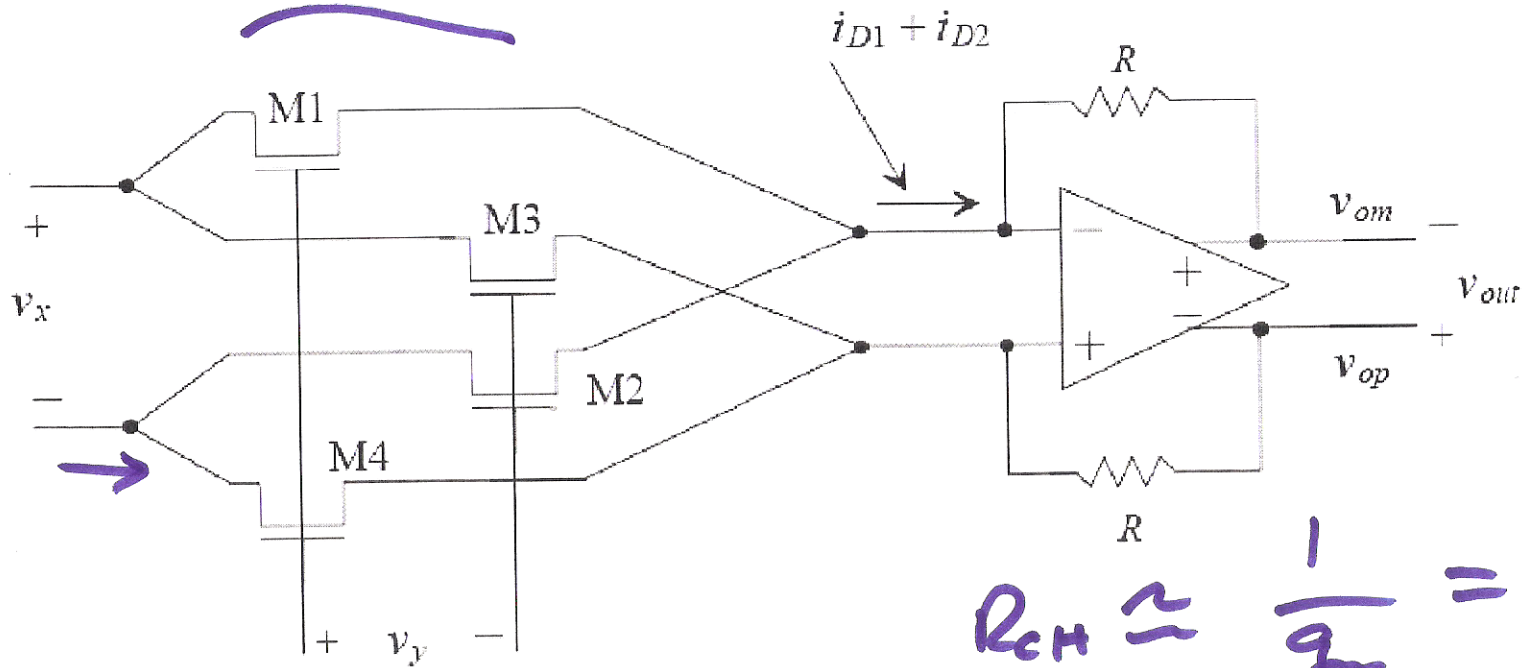
$v_x = -\frac{1}{2}$

$v_y = -\frac{1}{2}$

Figure 27.22 Operation of a four-quadrant analog multiplier.

5)

Operate in triode



$R_{CH} \simeq \frac{1}{g_m} = \frac{1}{KP_n \frac{W}{L} (V_{DS} - V_{THN})}$

Figure 27.23 CMOS analog multiplier.

$v_x = i \cdot R_{CH} = \frac{i}{KP_n \frac{W}{L} (V_{DS} - V_{THN})}$

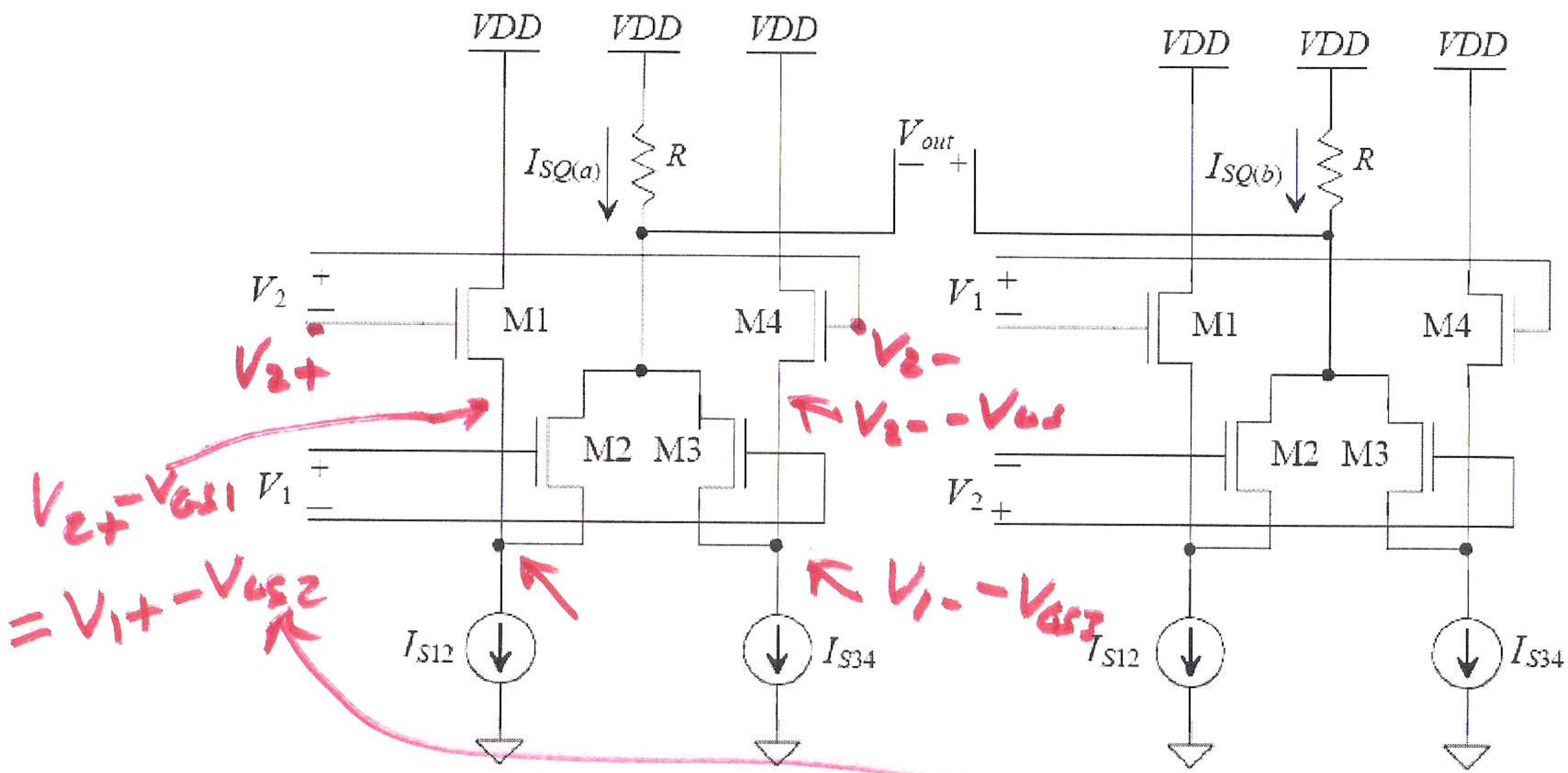


Figure 27.28 (a) Sum-squaring circuit and (b) difference squaring circuit.

$$I_{D1} + I_{D2} = I_{S12}$$

$$I_D = \frac{\beta}{2}(V_{GS} - V_{THN})^2 \rightarrow V_{GS} = \sqrt{\frac{2I_D}{\beta}} + V_{THN}$$