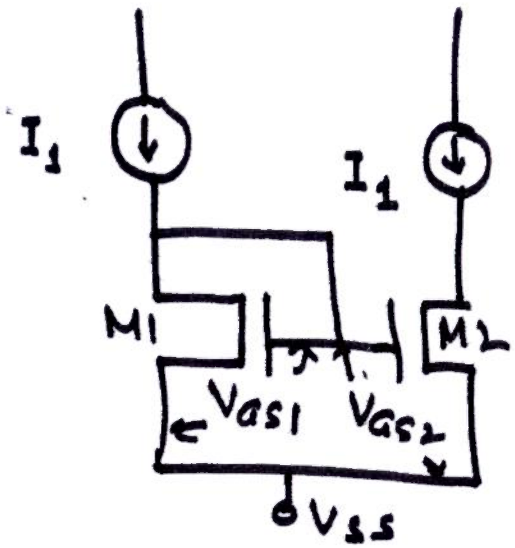
A Two Stage Single Ended

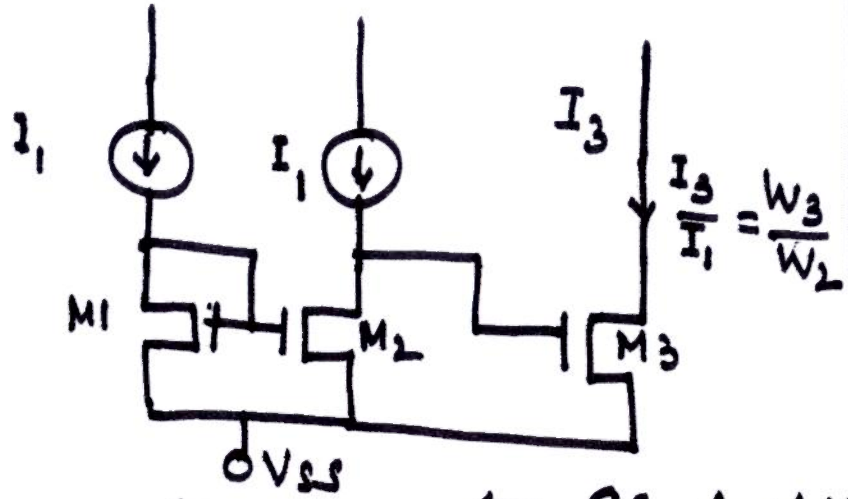
OPAMP DESIGN

&

Other OPAMP Structures (Cascode type)

Proof for $V_{GS3} = V_{GS4} = V_{GS6}$ in OPAMP





CDEEP IIT Bombay

Current Mirror: If $I_{DS_2} = I_{DS_1}$

then $W_1 = W_2$ & V_T is same for both.

$V_{GS1} = V_{GS2}$

$V_{GS1} = V_{DS1}$

$\therefore V_{GS2} = V_{DS1}$

and $V_{DS1} = V_{DS2}$

Since $V_{GS1} = V_{GS2} = V_{DS2}$

Hence if D_2 (V_{DS_2}) is connected to G_3, then

$V_{GS_3} = V_{DS2} = V_{GS1} = V_{GS2}$

$\therefore I_3 = \beta_n' \left(\frac{W}{L}\right)_3 (V_{GS_3} - V_T)^2$

$I_2 = \beta_n' (W/L)_2 (V_{GS2} - V_T)^2$

$\therefore \frac{I_3}{I_2} = \frac{I_3}{I_1} = (W/L)_3 / (W/L)_1$

Other OPAMPS

1. CASCODE OPAMP
2. High Performance OPAMP
3. High-Speed OPAMP
4. Differential Output OPAMP
5. Micropower OPAMP
6. Low Noise OPAMP
7. Chopper Stabilised OPAMP
8. Low-Voltage OPAMP

(A) Single Stage CASCODE OPAMP

To improve Stability Issues, one possibility that we have single Stage OPAMP (DIFFAMP) with Larger Gain. Since there is no second Stage, 'second pole' will not exist. Thus increasing the Stability. To improve the Gain, we can have CASCODE DIFFAMP.

CASCODE STAGE improves Rout and hence we can get Higher Gain $g_{m_1} R_{out} = A_{vo}$. Then

$$\text{Bandwidth} = \frac{GBW}{A_{vo}} = \text{Dominant Pole} = \frac{1}{R_{out} C_{out}}$$