$I_{DS_5} = I_{SS}$, which means

$$\boxed{I_{DS_1} = I_{DS_2} = \frac{I_{SS}}{2} = \frac{25}{2}\,\mu A = 12.5\,\mu A} \quad -[13]$$

Neglecting $(1+\lambda V_{DS})$ (λ = small) from Saturated Transistor current, we get

$$V_{GS} = V_T + \sqrt{\frac{2I_{DS}}{\beta'(W/L)}} \qquad \text{i.e. } V_{OV} = \sqrt{\frac{2I_{DS}}{\beta'(W/L)}}$$

(c) ICMR evaluation.

Given $V_{in_{min}} = -1.15\,V$ $\qquad V_{in_{max}} = 2\,V$

Now $V_{inmin} = V_{SS} + V_{DSat_5} + V_{GS1}$

$$= V_{SS} + V_{DSat_5} + V_{T1} + \sqrt{\frac{2I_{DS1}}{\beta'(W/L)_1}} = -1.15\,V$$

Also

$$V_{inmax} = V_{DD} - V_{Tp3} - \sqrt{\frac{2I_{DS3}}{\beta_p'(W/L)_3}} - V_{DSsat} + V_{GS1} = 2V$$

$$2 = V_{DD} - V_{Tp3} - \sqrt{\frac{2I_{DS3}}{\beta_p'(W/L)_3}} + V_{Tn1}$$

by using $V_{Dsat} = V_{GS} - V_T$ relation,

$$2 = V_{DD} - V_{TP3} + V_{Tn1} - \sqrt{\frac{I_{DS5}}{\beta_p'(W/L)_3}}$$

$$2 = 2.5 - 0.7 + 0.7 - \sqrt{\frac{I_{DS5}}{\beta_p'(W/L)_3}}$$

or $$\frac{I_{DS5}}{\beta_p'(W/L)_3} = (0.5)^2 \quad \text{or} \quad \beta_p'(W/L)_3 = 4I_{DS5} = 150\,\mu A$$

$$\therefore (W/L)_3 = \frac{2 \times 50\mu A}{50 \times 10^{-6}} = 2$$

If we include Body Bias effect

$V_{TP_{max}} = -0.85$ $\quad V_{TP_{min}} = -0.55\,V$

$V_{TN_{min}} = +0.55$ $\quad V_{TN_{max}} = +0.85\,V$

Then $\quad 2 = 2.5 - 0.85 + 0.55 - \sqrt{\dfrac{I_{DS5}}{\beta_p'(W/L)_3}}$

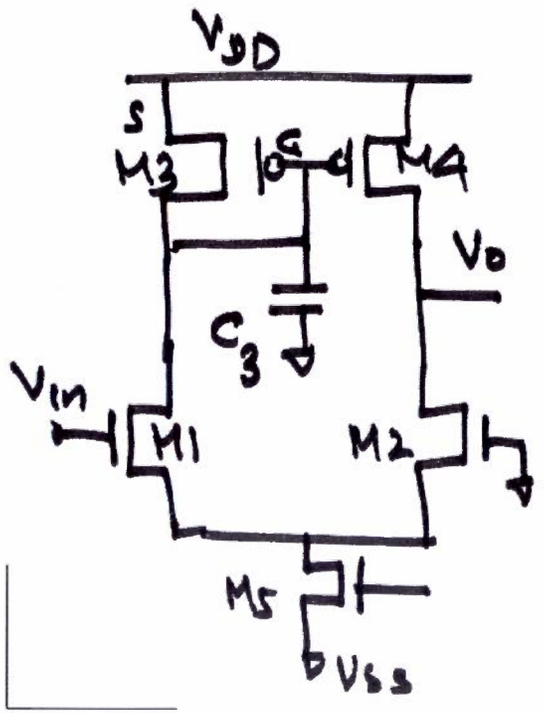
$$\frac{I_{DS5}}{\beta_p'(W/L)_3} = 0.04$$

or $\quad (W/L)_3 = \dfrac{25\times10^{-6}}{50\times10^{-6}\times0.04}$

Then $\boxed{(W/L)_3 = 12.5 \simeq 12}$

Hence $\quad (W/L)_3 = (W/L)_4 =$ Either 2 or 12 depends upon accuracy

Before we proceed further for evaluations of other $(W/L)_s$ of transistors, we wish to confirm that poles & zeros due to capacitor C_3 in the Diffamp ($M_1 - M_3$ arm) are far far away from GBW, so that they can be neglected in overall response evaluations.



Here
$C_3 = 2C_{gs_3}$

Eq. Ckt as