PART 5 (FIG 8)

$V_{OV} = 200mV$, $I_{REF} = 1mA$, $R_L = 500\Omega$, $V_A = 2.5V$

$I_{REF} = \frac{\beta}{2}\left(\frac{W}{L}\right)_2 (V_{OV}^2)\left(1 + \frac{V_{DS2}}{V_A}\right)$ $\quad V_{DS2} = 200mV$

$\left(\frac{W}{L}\right)_2 = 144.68$

$\boxed{W_2 = 36.17\mu m,\ L_2 = 0.25\mu m}$

$I_{REF} = \frac{\beta}{2}\left(\frac{W}{L}\right)_1 (V_{OV})^2\left(1 + \frac{V_{DS1}}{V_A}\right)$ $\quad V_{DS1} = V_{G2} - V_{DS2} = 500mV$

$\left(\frac{W}{L}\right)_1 = 130.21$

$\boxed{W_1 = 32.55\mu m,\ L_1 = 0.25\mu m}$

$I_{REF} = \frac{\beta}{2}\left(\frac{W}{L}\right)_6 V_{OV}^2\left(1 + \frac{V_{DS6}}{V_A}\right)$ $\quad V_{DS6} = V_{G5} - V_{G1} = 500mV$

$\left(\frac{W}{L}\right)_6 = 130.21$

$\boxed{W_6 = 32.55\mu m,\ L_6 = 0.25\mu m}$

$\left(\frac{W}{L}\right)_6 = 3\left(\frac{W}{L}\right)_5$

$\boxed{W_5 = 10.85\mu m,\ L_5 = 0.25\mu m}$

$1.01 I_{REF} = \frac{\beta}{2}\left(\frac{W}{L}\right)_3 V_{OV}^2\left(1 + \frac{V_{DS3}}{V_A}\right)$ $\quad V_{DS3} = V_{G4} - V_{GS4} = 200mV$

$\left(\frac{W}{L}\right)_3 = 146.12$

$\boxed{W_3 = 36.53\mu m,\ L_3 = 0.25\mu m}$

$1.01 I_{REF} = \frac{\beta}{2}\left(\frac{W}{L}\right)_4 V_{OV}^2\left(1 + \frac{V_{DS4}}{V_A}\right)$ $\quad V_{DS4} = V_{DD} - (1.01 I_{REF}) R_L - V_{DS3} = 1.095$

$\left(\frac{W}{L}\right)_4 = 109.74$

$\boxed{W_4 = 27.44\mu m,\ L_4 = 0.25\mu m}$

* ALL TRANSISTORS IN STRONG INV. & SATURATION EXCEPT FOR M_5 WHICH IS IN THE LINEAR REGION.