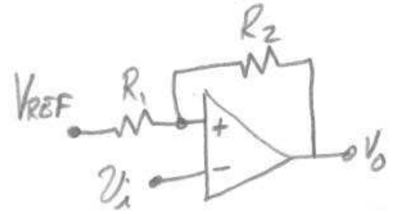
Schmitt Trigger Problem

Pertinent Equations

Inverting: $V_S = \left(\frac{R_2}{R_1+R_2}\right) V_{REF}$



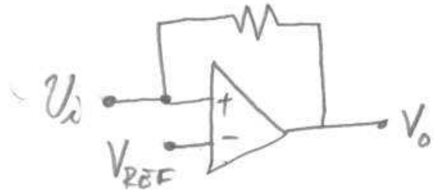
$V_T = V_S + \left(\frac{R_1}{R_1+R_2}\right) V_o$ ← This is the transition voltage

$V_{T(L\to H)}$ when V_o is @ negative rail

$V_{T(H\to L)}$ when V_o is @ positive rail

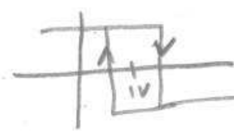
Non-inverting: $V_S = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$

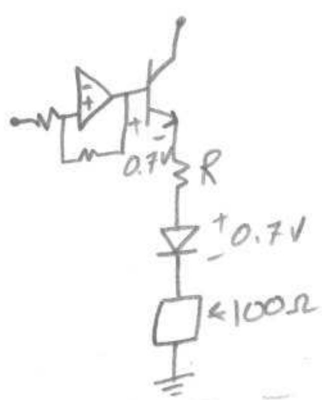
$V_T = V_S - \left(\frac{R_1}{R_2}\right) V_o$



Ex 15.7 Inverting with $V_S = 1V$; hysteresis width is 100 mV

$\pm 10V$ rails, $I_R = 200\mu A$ w/ $V_o = +10V$





$1 = \left(R_2/R_1+R_2\right) V_{REF}$

$$\left.\begin{aligned} V_{T(L\to H)} &= 1 - \left(\frac{R_1}{R_1+R_2}\right)(10) \\ V_{T(H\to L)} &= 1 + \left(\frac{R_1}{R_1+R_2}\right)(10) \end{aligned}\right\} \quad \begin{aligned} V_{T(L\to H)} &= 0.95V \\ V_{T(H\to L)} &= 1.05V \end{aligned}$$

$$\frac{R_1}{R_1+R_2} = 0.005 \Rightarrow \frac{R_1+R_2}{R_1} = 200 \Rightarrow 1 + \frac{R_2}{R_1} = 200$$

$$\therefore \underline{\frac{R_2}{R_1} = 199} \;\;\&\;\; \frac{R_1}{R_2} = 5.025\times 10^{-3}$$

$$R = \frac{10 - 1.4 - 100(200\mu A)}{200\mu A}$$

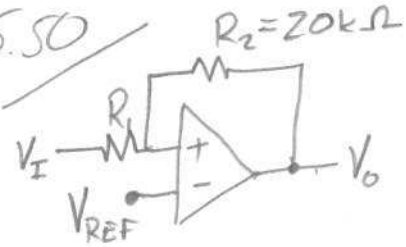
$$\underline{R = 42.9k\Omega}$$

$$\left(R_2/R_1+R_2\right)V_{REF} = 1 \Rightarrow V_{REF} = 1\left(\frac{R_1+R_2}{R_2}\right) = 1\left(1 + R_1/R_2\right)$$

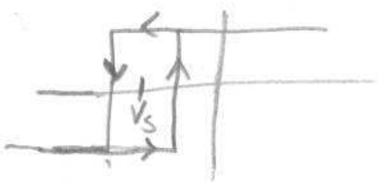
$$= 1\left(1 + 5.025\times 10^{-3}\right)$$

$$V_{REF} = \underline{1.005V}$$

15.50



Non-Inverting



$$V_S = V_{REF}\left(1 + \frac{R_1}{R_2}\right)$$

$$V_T = V_S - \left(\frac{R_1}{R_2}\right)V_o$$

Rail Voltages: $\pm 12V$

$$\left.\begin{array}{l} V_{T(H\to L)} = -2V \\ V_{T(L\to H)} = -1V \end{array}\right\} V_S = \underline{-1.5V}$$

$$-1.5 = V_{REF}\left(1 + \frac{R_1}{R_2}\right)$$

$$V_{T(H\to L)} = -2 = -1.5 - \left(\frac{R_1}{R_2}\right)12$$

$$0.5 = \frac{R_1}{R_2} \cdot 12$$

$$\frac{R_1}{R_2} = 0.0417 \Rightarrow R_1 = \underline{833\Omega}$$

for $R_2 = \underline{20k\Omega}$

$$V_{REF} = \frac{-1.5}{1.0417}$$

$$\underline{V_{REF} = -1.44V}$$