

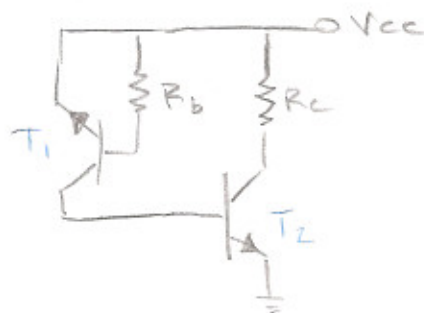
GIVEN: V_{CC} , $I_{C2(SAT)}$, $V_{CE2(SAT)}$, $V_{BE2(T)}$, $V_{CB1(T)}$
 $V_{BE1(T)}$, β_{10} , V_{out}' , V_{in}' , V_{in}^0

FIND: R_c , R_b , R_i

ANALYSIS: T_2 is in saturation mode.

$$I_{C(SAT)} R_c + V_{CE2(SAT)} = V_{CC}$$

$$R_c = \frac{V_{CC} - V_{CE2(SAT)}}{I_{C(SAT)}}$$



R_i is negligible.

$$I_{e1} = \alpha_i I_{c1}$$

$$I_{B2} \geq I_{B2}' = \frac{I_{c2(sat)}}{\beta_2}$$

$$I_{B2} = I_{c1}$$

$$I_{c1} = \beta_{ii} \cdot I_{B1}$$

$$I_{e1} + I_{B1} = I_{c1}$$

$$I_{B1} = \frac{I_{c1}}{1 + \beta_{ii}}$$

$$I_{B1} \cdot R_B + V_{CB1(T)} + V_{BE2(T)} = V_{CC}$$

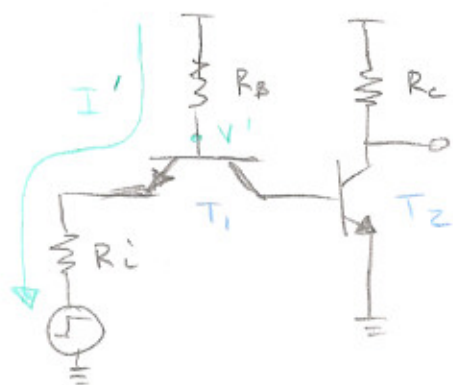
$$\frac{I_{c1}}{1 + \beta_{ii}} R_B + V_{CB1(T)} + V_{BE2(T)} = V_{CC}$$

$$I_{B2} = I_{c1} = \frac{V_{CC} - V_{CB1(T)} - V_{BE2(T)}}{R_B} (1 + \beta_{ii})$$

$$\frac{V_{CC} - V_{CB1(T)} - V_{BE2(T)}}{R_B} (1 + \beta_{ii}) \geq \frac{I_{c2(sat)}}{\beta_2}$$

$$R_B \leq \frac{V_{CC} - V_{CB1(T)} - V_{BE2(T)}}{I_{c2(sat)}} \boxed{(1 + \beta_{ii}) \beta_2}$$

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T_2 is in cut off mode.

$$I_{B2} = 0 = I_{C1} = I_{C2}$$

$$V' < V_{CE1}(T) + V_{BE2}(T)$$

$$I' R_B + V_{BE1}(T) + I' R_i + V_{in}^0 = V_{cc}$$

$$I' = \frac{V_{cc} - V_{in}^0 - V_{BE1}(T)}{R_B + R_i}$$

$$V' + I' R_B = V_{cc}$$

$$V' = V_{cc} - I' R_B$$

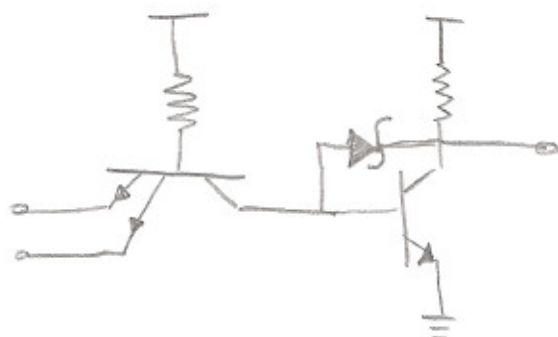
$$V_{CE1}(T) + V_{BE2}(T) > V_{cc} - R_B \frac{V_{cc} - V_{BE1}(T) - V_{in}^0}{R_B + R_i}$$

$$V_{CE1}(T) + V_{BE2}(T) - V_{cc} > -R_B \frac{V_{cc} - V_{BE1}(T) - V_{in}^0}{R_B + R_i}$$

$$R_B + R_i > -R_B \frac{V_{cc} - V_{BE1}(T) - V_{in}^0}{V_{CE1}(T) + V_{BE2}(T) - V_{cc}}$$

$$R_i < \left(\frac{V_{cc} - V_{BE1}(T) - V_{in}^0}{V_{CE1}(T) + V_{BE2}(T) - V_{cc}} + 1 \right) R_B$$

note: to prevent electron cloud, we add a schottky diode.



this is easily done by overlapping metal layer.

