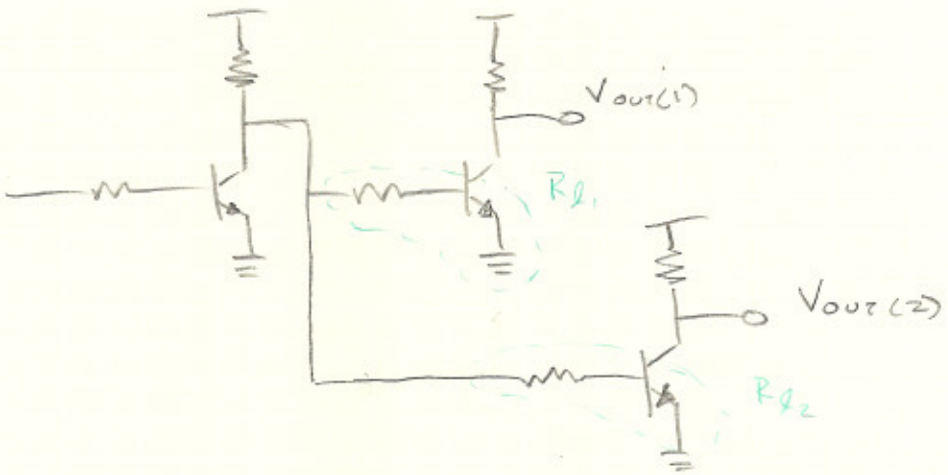
$$R_l \geq \frac{V_{out}' R_C}{V_{cc} - V_{out}'}$$

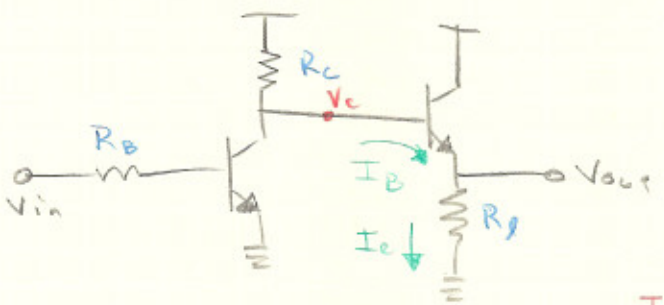
so we really don't want an R_l



$$\frac{1}{R_l} = \sum_{j=1}^{n} \frac{1}{R_{lj}}$$

if R_l becomes to low, then the next stage will not opperate properly.

so reduce this problem, we use a current driver.



T1 is in Cut off

$$I_c = \beta I_B$$

$$I_c + I_B = I_e$$

$$\beta I_B + I_B = I_e$$

$$I_B = \frac{I_e}{1+\beta}$$

$$V_c = V_{BE(T)} + I_e \cdot R_l$$

$$V_c = V_{cc} - I_B R_c$$

$$V_{BE(T)} + I_e R_l = V_{cc} - I_B R_c$$

$$V_{cc} + \frac{I_{e(2)}}{1+\beta_2} R_c = V_{BE(T2)} + I_{e(2)} R_l$$

$$V_{out}' \leq V_{OUT} = I_{e2} R_l$$

$$V_{cc} - V_{BE(T2)} = I_{E(2)} \left(R_l + \frac{R_c}{1+\beta_2} \right)$$

$$V_{OUT}' \leq V_{OUT} = \frac{V_{cc} - V_{BE(T2)}}{R_l + \frac{R_c}{1+\beta_2}} R_l.$$

$$\frac{V_{OUT}'}{V_{cc} - V_{BE(T2)}} \leq \frac{R_l}{R_l + \frac{R_c}{1+\beta_2}}$$

$$\frac{V_{OUT}'}{V_{cc} - V_{BE(T2)}} \leq \frac{1}{1 + \frac{1}{1+\beta_2} \cdot \frac{R_c}{R_l}}$$

$$1 + \frac{1}{1+\beta_2} \cdot \frac{R_c}{R_l} \leq \frac{V_{cc} - V_{BE(T2)}}{V_{OUT}'}$$

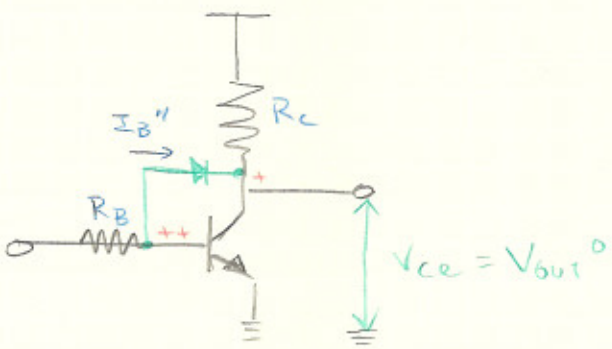
$$\frac{R_c}{R_l} \leq \left[\frac{V_{cc} - V_{BE(T2)}}{V_{OUT}'} - 1 \right] (1+\beta_2)$$

$$R_l \geq \frac{V_{OUT}' R_C}{V_{CC} - V_{OUT}' - V_{BE(T2)}} \left(\frac{1}{(1+\beta_2)}\right)$$

$\ll 1$

hence allows us to have a much lower R_l value.

T_1 is saturation



$$R_b \leq \frac{(V_{in}' - V_{CE})\beta}{I_{C(SAT)}} - R$$

$$I_B \geq I_B' = \frac{I_{C(SAT)}}{\beta}$$

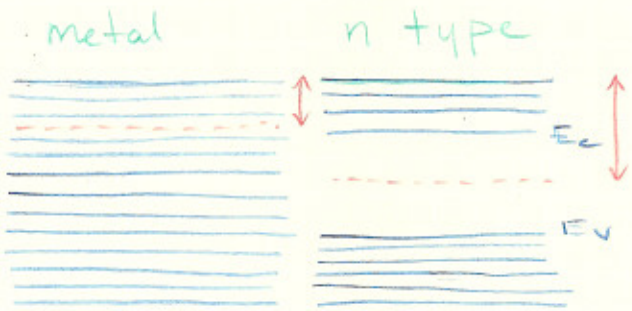
when we place diode, we want $V_{DT} \approx 0$

$$I_B = \frac{I_{C(SAT)}}{\beta} + I_B'' = I_B' + I_B''$$

when we make the diode a schotkey diode.

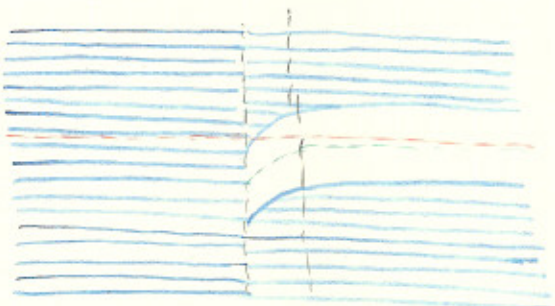
SCHOTKEY DIODE

Uses metal.



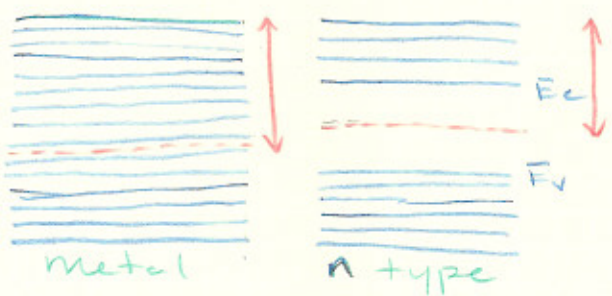
$\phi_m < \phi_n$

Connecting them we have



this region becomes more n

Another Case



$\phi_m > \phi_n$

Connecting them together.