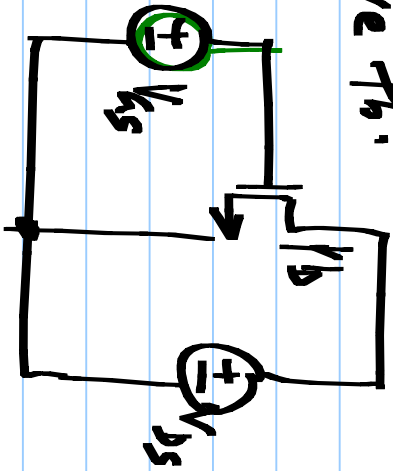
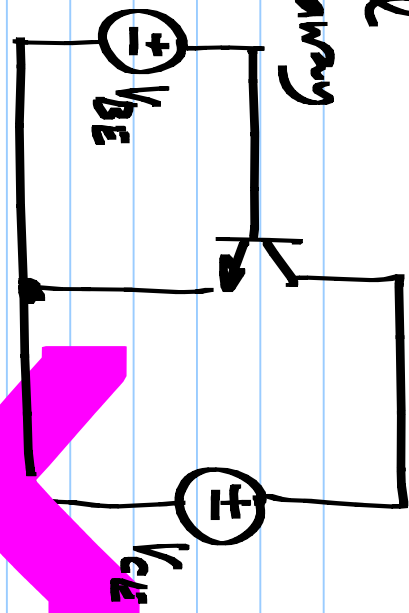


Electro Thermal $I_B \cdot V_{DS}$
 -ve f_b .

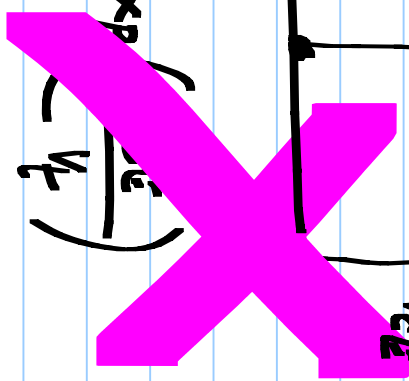


$$I_B \exp\left(\frac{V_{BE}}{V_T}\right) = I_{CS} - I_{BS}$$

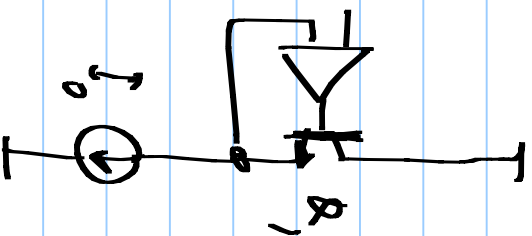
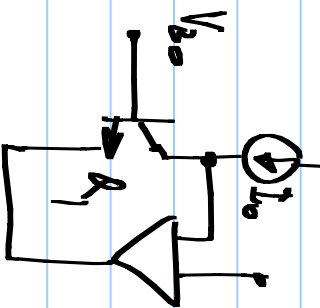
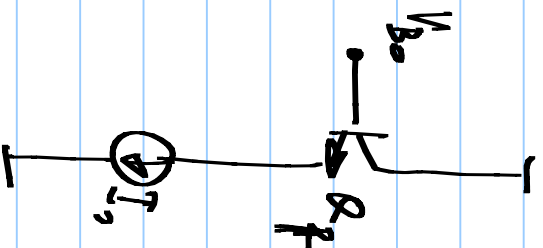
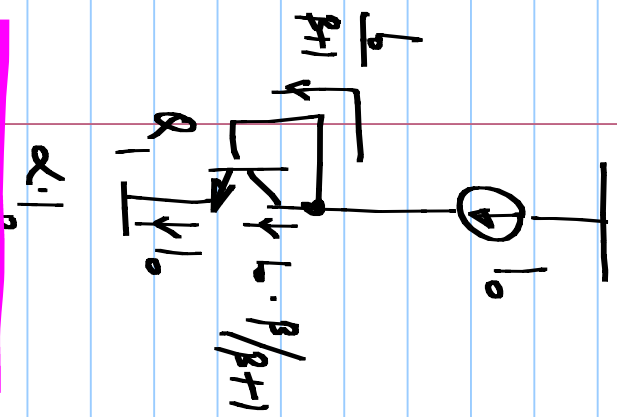
Thermal runaway $I_C \cdot V_{CE} + I_B \cdot V_{BE}$



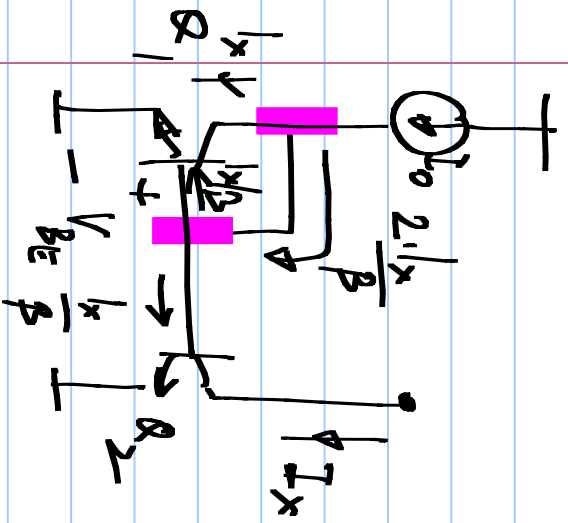
Electro Thermal +ve f_b . $I_B \exp\left(\frac{V_{BE}}{V_T}\right)$



Biasing a BJT at a constant current

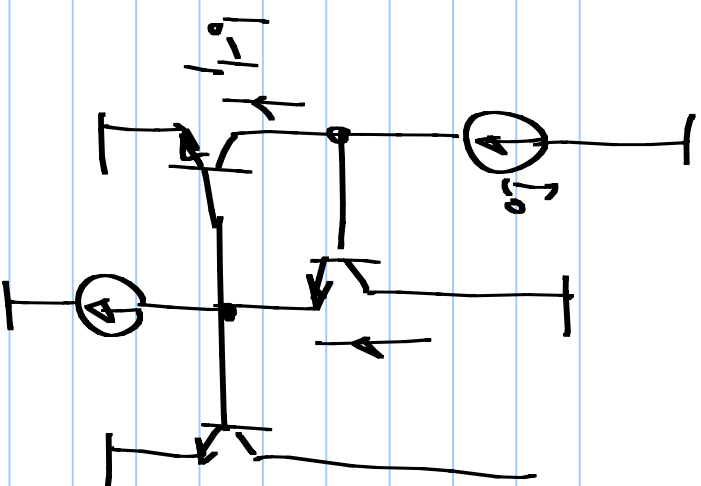


Current mirrors using a BJT

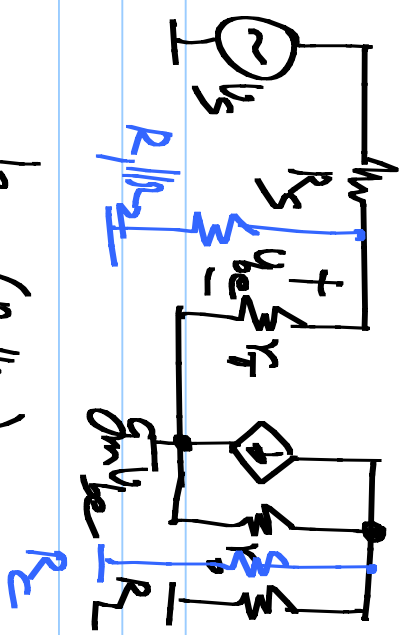
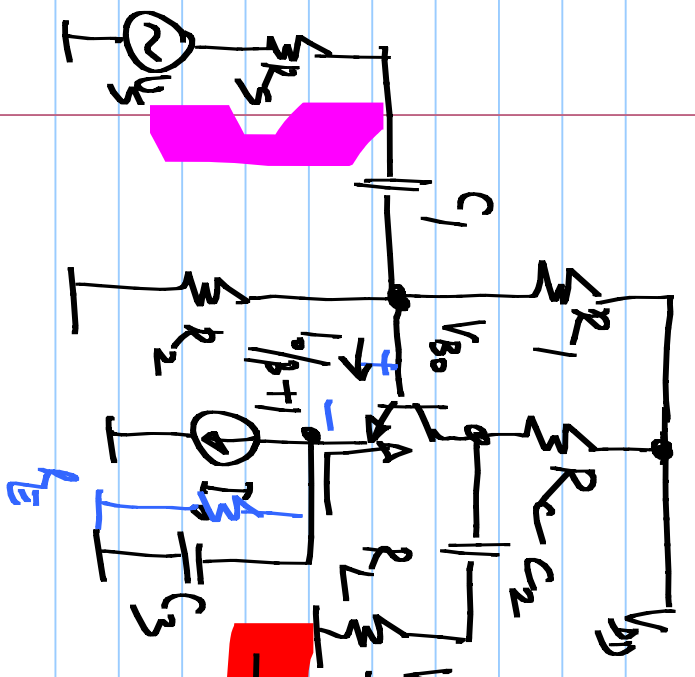


$$I_0 - \frac{2 \cdot I_x}{\beta} = I_x$$

$$I_x = \frac{I_0}{1 + \frac{2}{\beta}}$$



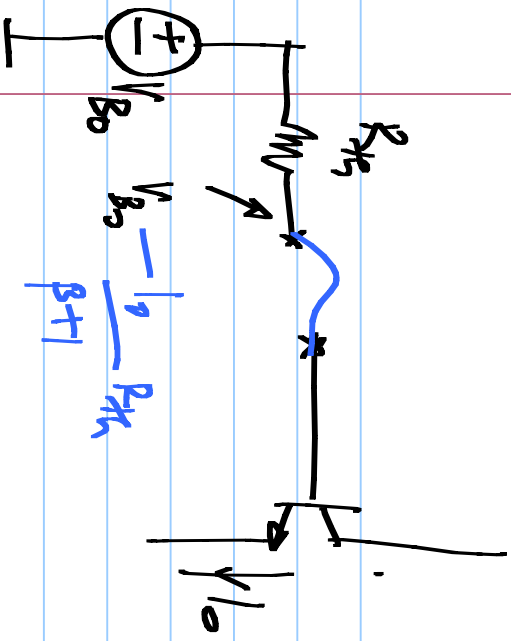
Common emitter amplifier



$$A_{v0} = \frac{R_2}{R_1 + R_2} \cdot \frac{1}{\beta + 1} \cdot (R_C \parallel R_L)$$

cannot be high

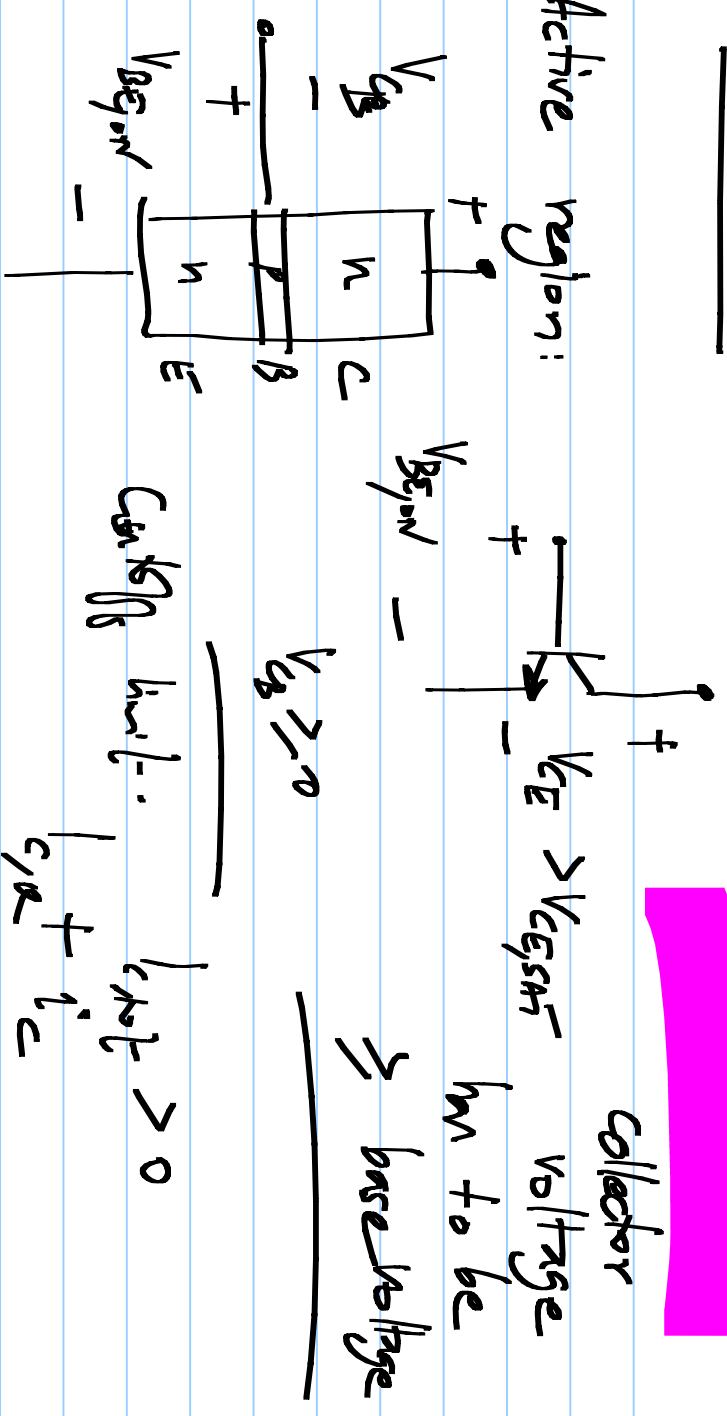
$$C_1 \gg \frac{1}{\omega [R_s + r_{be} \parallel R_2 \parallel R_1]}$$



Swing limits:

$$V_{CE, SAT} = V_{BE, ON}$$

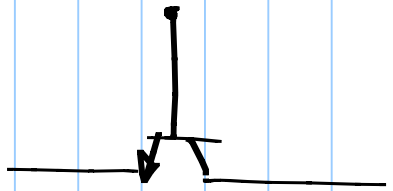
Active region:



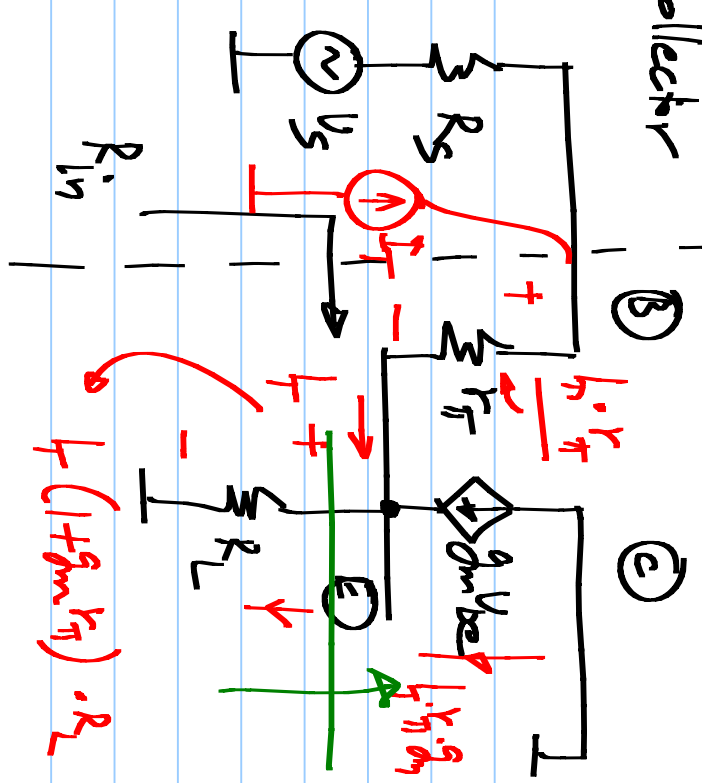
Collector current limit: $I_C > 0$

$I_C > I_B + I_E$

Emitter follower: (Common collector amp.)



-ve f.b.



$$\frac{V_o}{V_i} = \frac{R_L}{R_i + (1 + \beta) R_L}$$

$$R_i = R_b + (\beta + 1) R_L$$

