3.4 – Biasing – summary.

3.4.1

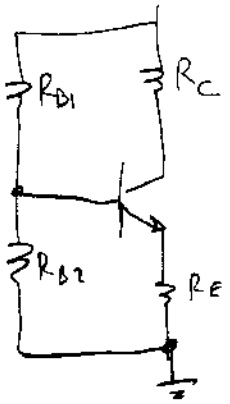
Very beta dependent

Not used, except as introduction.

3.4.2 Voltage divider biasing.

Add emitter resistor

Use voltage divider on base



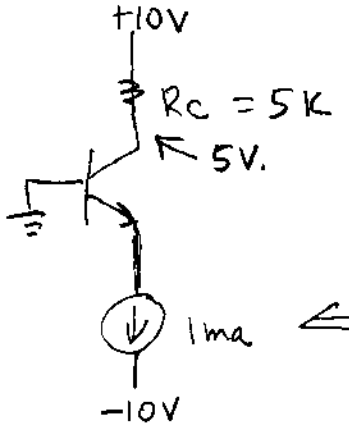
→ R_E reduces DC gain.

→ Some voltage across R_E masks effect of V_{BE} variations.

→ Choose R_{B1}, R_{B2} ratio for proper voltage – open circuit.

→ Then value (scale) for effective series resistance

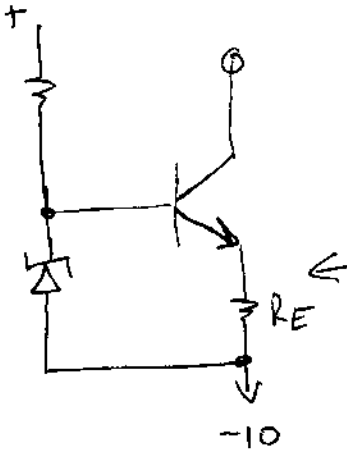
3.4.3 Current source biasing.



← How to make this ?

Two ways:

Method #1 (not in book)



← Set zener and R_E for desired current

Example: 5.6V zener makes V_{RE} 5V.

$$R = \frac{V}{I} = \frac{5}{1ma} = 5K$$

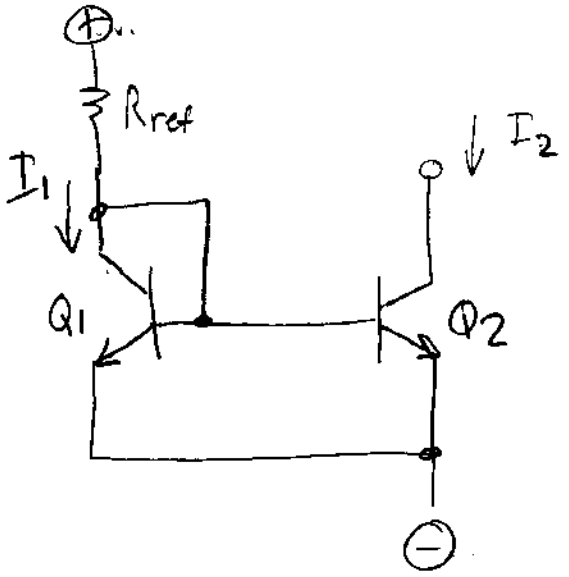
Hw -

Sec 3.4	p	#
3.4.1	140	24, 25
3.4.2	144-145	26, 27, 28, 29
3.4.3	147	30, 31

p.	#
156	31, 34
157	37, 40
158	43, 46
159	49, 52

Method # 2 – "current mirror"

Use 2 transistors:



If Q_1 and Q_2 are identical. (exactly!)

$I_1 \cong I_2$

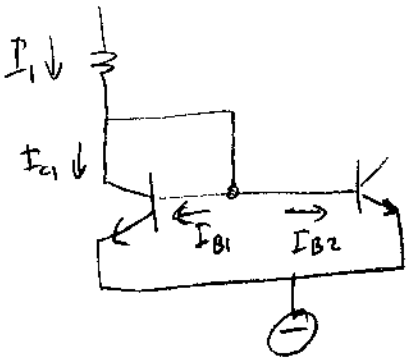
(ignoring r_c (Early voltage))

Example For 1ma ± 10V supply

$$V_{Rref} = 20 - .6 = 19.4$$

$$Rref = \frac{V_{Rref}}{I_1} = \frac{19.4}{1ma} = 19.4K$$

More accurately ...



$$I_1 = I_{C1} + I_{B1} + I_{B2}$$

Since Q_1, Q_2 are identical,

$$V_{BE1} = V_{BE2}$$

$$I_{C1} = I_{C2}$$

Substituting ...

$$I_1 = I_{C2} + 2I_{B2}$$

$$= I_{C2} + 2\frac{I_{C2}}{\beta}$$

$$I_1 = I_{C2}\left(1 + \frac{2}{\beta}\right)$$

$$I_{C2} = \frac{I_1}{\left(1 + \frac{2}{\beta}\right)}$$

For $\beta = 100$ --

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

$= 1 + \frac{2}{100}$

$= 1.02$