

$$I_r = \frac{I_c}{\sqrt{\beta}} \quad (\text{half log between } I_c \text{ \& } I_b)$$

$$"k" = \frac{R1 + R2}{R1} \quad V_{be} \text{ multiplication factor}$$

$$V_z = k * V_b \Rightarrow V_b = V_z / k$$

$$I_c = I_s * (e^{\frac{V_z / k}{V_t}} - 1)$$

$$I_r = \frac{V_z}{R1 + R2}$$

$$I_z = I_r + I_c$$

$$I_z = \frac{V_z}{R1 + R2} + I_s * (e^{\frac{V_z / k}{V_t}} - 1)$$

$$S_z = \frac{d(I_z)}{d(V_z)} \quad \text{Transconductance "Sz"}$$

$$S_z = \frac{1}{R1 + R2} + \frac{1}{k * V_t} * I_c$$

$$\longrightarrow S_z = \frac{1}{R1 + R2} + \frac{1}{R1 + R2} * \frac{R1 * I_c}{V_t}$$

$$S_z = \frac{\frac{R1 * I_c}{V_t} + 1}{R1 + R2}$$

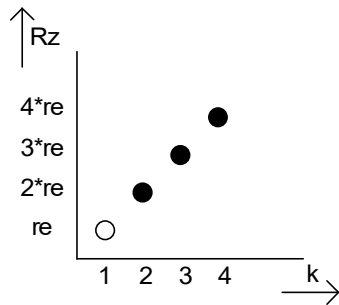
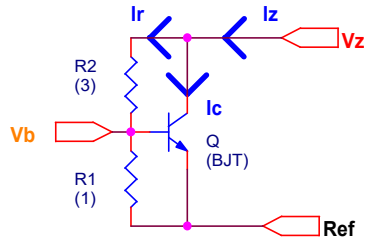
$$R_z = \frac{R1 + R2}{\frac{R1 * I_c}{V_t} + 1} \quad \text{Reciproprok of Sz}$$

$$\text{If } (R1 * I_c) / V_t \gg 1: \quad \text{eg: } R1 = 1.0\text{kohm}, I_c = 10\text{mA}, V_t = 25\text{mV} \\ \Rightarrow 10 / 0.025 = 400$$

$$R_z = \frac{(R1 + R2) * V_t}{R1 * I_c}$$

$$\longrightarrow R_z = k * \frac{V_t}{I_c} \quad I_c = 10\text{mA}, V_t = 25\text{mV} \\ \Rightarrow r_e = 25\text{mV} / 10\text{mA} = 2.5\text{ohm} \\ (\text{thermal resistance "re"})$$

$$R_z = k * r_e$$



Title			
RZ			
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