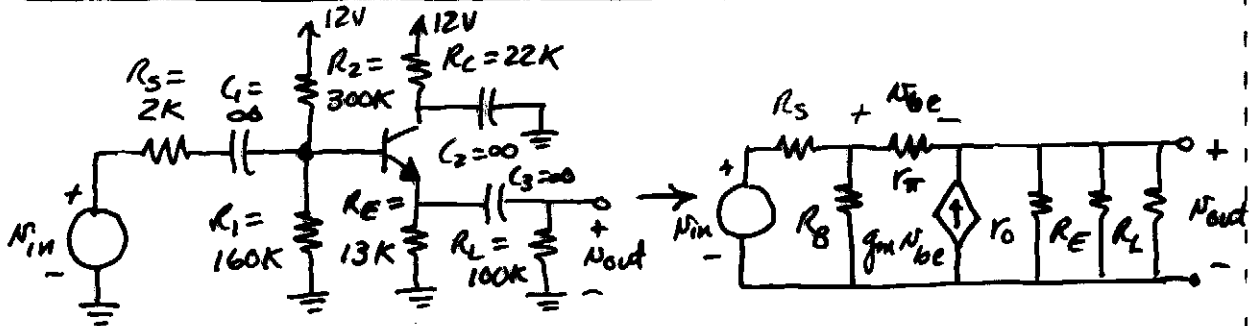


Common Collector Example - Continued

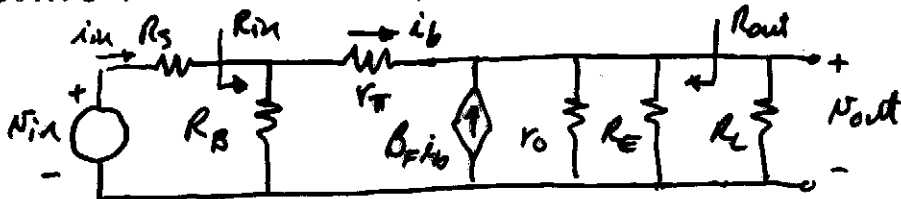


$R_B = R_1 || R_2 = 104.35 k\Omega$       Assume  $\beta_F = 100$  &  $V_A = 50$

Q-point:  $I_C = 245 \mu A$  and  $V_{CE} = 3.64 V$

$g_m = \frac{I_C}{V_T} = 9.8 mS$ ,  $r_{\pi} = \frac{\beta_F}{g_m} = 10.2 k\Omega$  &  $r_o = \frac{V_A + V_{CE}}{I_C} = 423 k\Omega$

Convert to a current controlled model -



$R_{in} = R_B || [r_{\pi} + (1 + \beta_F)(r_o || R_E || R_L)] = \underline{\underline{98.5 k\Omega}}$

$R_{out} = R_E || \left[ \frac{r_{\pi} + R_B || R_S}{1 + \beta_F} \right] || r_o = \underline{\underline{119.6 \Omega}}$

Voltage gain = ?

$$\frac{N_{out}}{N_{in}} = \left( \frac{N_{out}}{i_b} \right) \left( \frac{i_b}{i_{in}} \right) \left( \frac{i_{in}}{N_{in}} \right) = (1 + \beta_F) [r_o || R_E || R_L] \times \left[ \frac{R_B}{R_B + r_{\pi} + (1 + \beta_F) r_o || R_E || R_L} \right] \times \left( \frac{1}{R_S + R_{in}} \right)$$

CC & CD:  $= (101)(17.3k) \times (0.05597) \times \left( \frac{1}{101.5k} \right) = 0.963 V/V$

(All followers have voltage  $\leq 1$ )

large input resistances

Small output resistors  $\approx \frac{1}{g_m}$