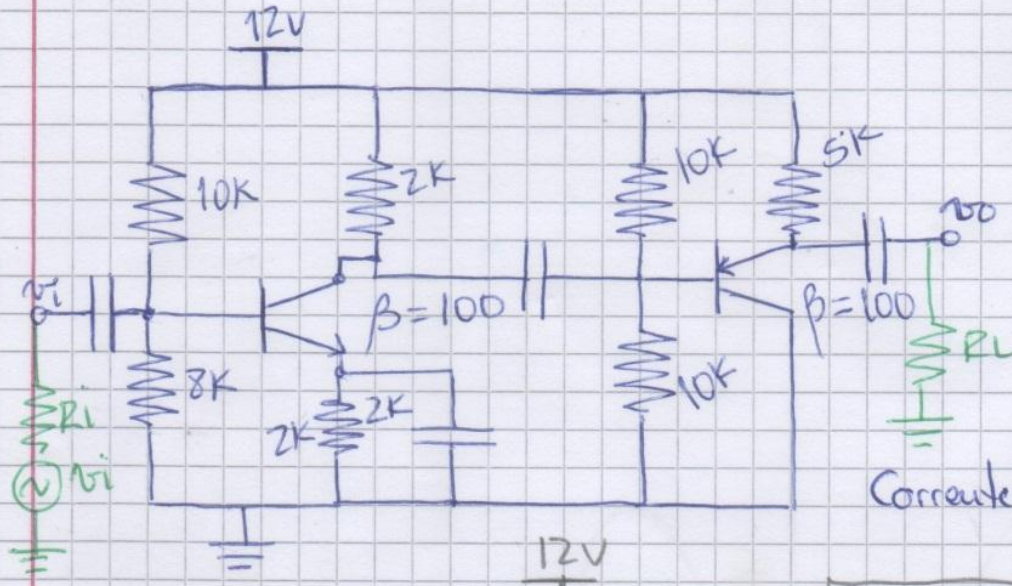
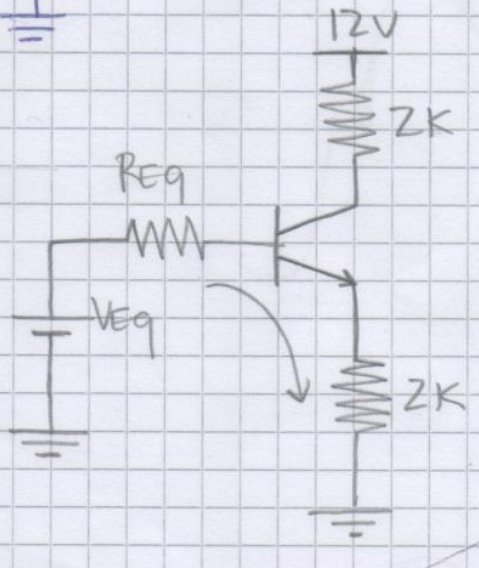
24/01/2013 - Aula Teórica



Corrente Contínua



$R_{Eq} = 10K \,||\, 5K$

$R_{Eq} = 4444,4\ \Omega$

$V_{Eq} = 12 \times \frac{8K}{8K + 10K}$

$= 5,33V$

$V_{Eq} - R_{Eq} I_B - 0,7 - 2K I_E = 0$

$I_E = (\beta + 1) I_B = 101 I_B$

$5,33 - 4444,4 I_B - 0,7 - 2000 \times 101 I_B = 0$

$I_B = 22,4\ \mu A$

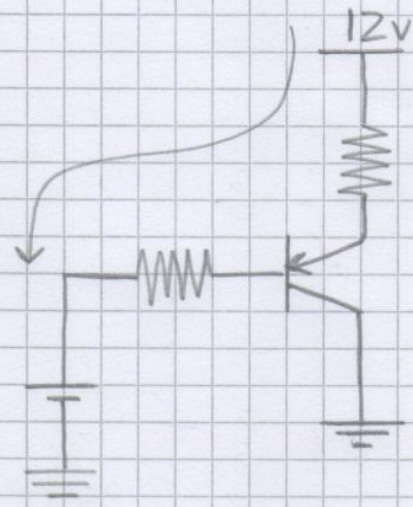
$I_C = \beta I_B = 2,24mA$

$I_E = (\beta + 1) I_B = 2,27mA$

$V_C = 12 - 2K I_C = 7,51V$

$V_E = 2K I_E = 4,54V$

$V_B = V_E + 0,7 = 5,24\,V$



$$R_{eq} = 10K \parallel 10K = 5K\,\Omega$$

$$V_{eq} = 12\,\frac{10K}{10K+10K} = 6V$$

$12 - 5K I_E - 0,7 - R_{eq} I_B - V_{eq} = 0$

$I_E = 101\, I_B$

$I_B = 50\,\mu A$

$I_C = \beta . I_B = 5mA$

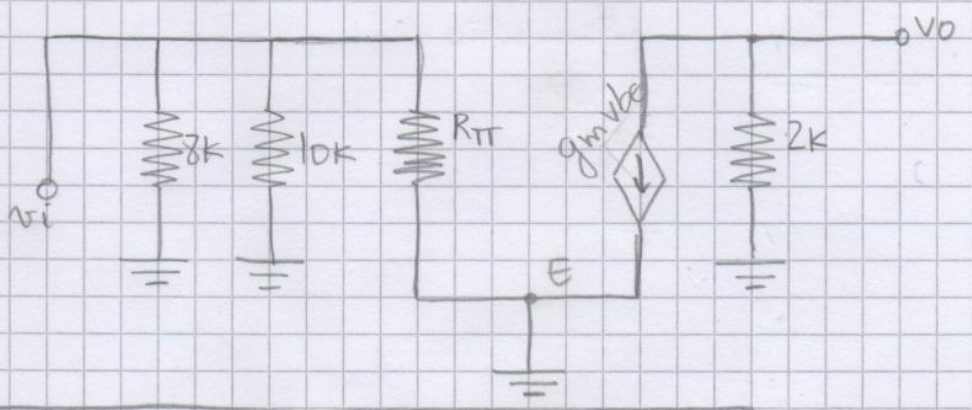
$I_E = (\beta+1)\, I_B = 5,05\,mA$

$V_E = 12 - 5K I_E = 6,95V$

$V_B = V_E - 0,7 = 6,25V$

$V_C = 0$

Corrente Alternada



$$R_{TT} = \frac{V_T}{I_B} = \frac{26m}{22,4\mu}$$

$R_{\Pi} = 1158\,\Omega$

$$g_m = \frac{I_C}{V_T} = \frac{2,24m}{26m} = 86,3\,mA/V$$

$Z_i = 10K \parallel 8K \parallel R_{\Pi}$

$Z_i = 919\,\Omega$

Z_o calcula-se com $v_i = 0$

$v_{bE} = 0$

$g_m v_{bE} = 0$

$Z_o = 2K\Omega$

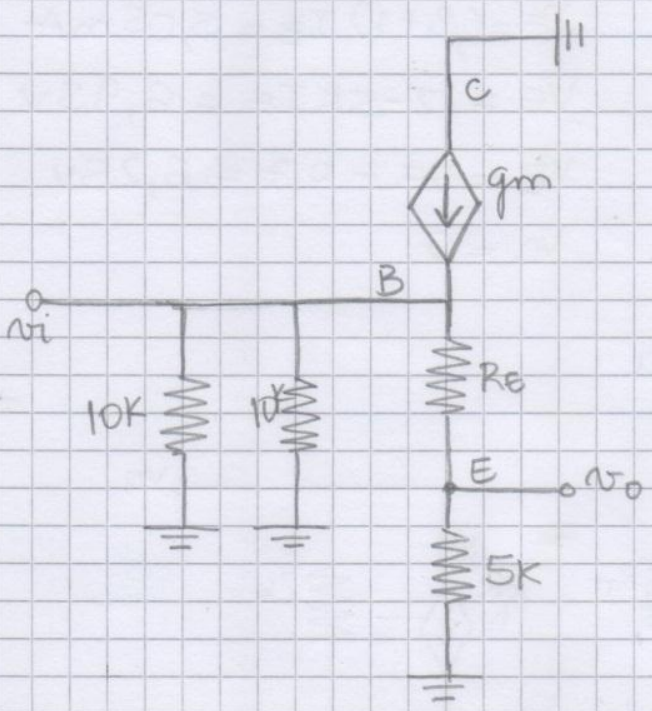
$V_O = -g_m v_{bE} \times 2K$

$V_O = -86,3 \times v_i \times 2K$

$v_o = -172,6\, v_i$

$A_v = -172,6$

ganho



$$R_E = \frac{V_T}{I_E} = \frac{26m}{5,05m} = 5,14\,\Omega$$

$$g_m = \frac{I_C}{V_T} = 192,3mA/V$$

$$Z_i = \frac{v_i}{i_i}$$

$Z_i = 10K \,||\, 10K \,||\, (R_E + 5K)(\beta + 1)$

$Z_i = 4765,3\,\Omega$

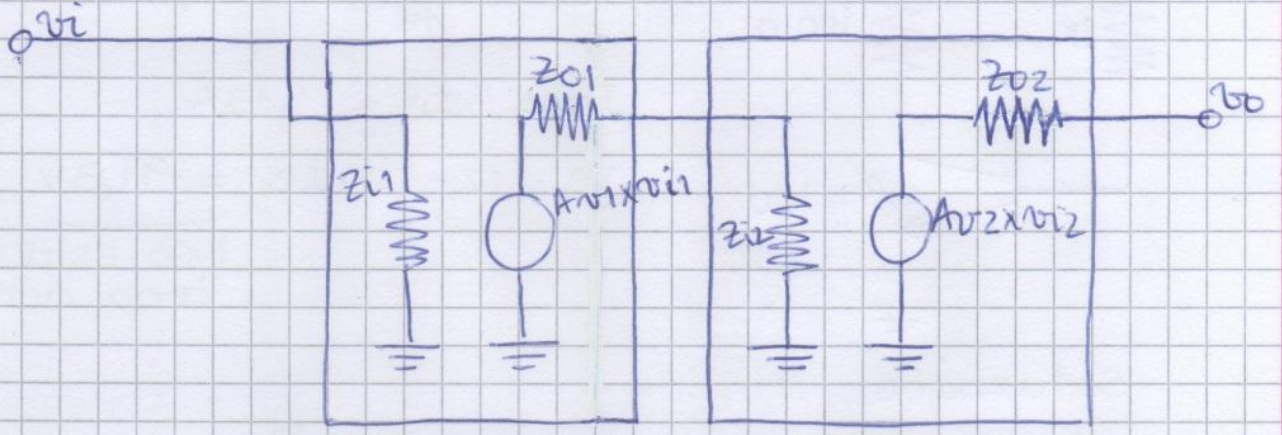
Z_o calcula-se com $v_i = 0$

$Z_o = R_E \,||\, 5K$

$Z_o = 5,12\,\Omega$

$v_o = v_i \frac{5K}{5K + RE} = 0,99\, v_i$

$A_v = 0,99$



$v_{i2} = A_{v1} \cdot v_{i1} \times \frac{z_{i2}}{z_{o1} + z_{i2}} = -172,6 \times v_{i1} \frac{\times 4765}{2000 + 4765}$

$v_{i2} = -121,6 v_i$

$v_o = A_{v2} v_{i2}$

$v_o = 0,99 \times (-121,6) v_{i1}$

$v_o = -120,4\, v_{i1}$

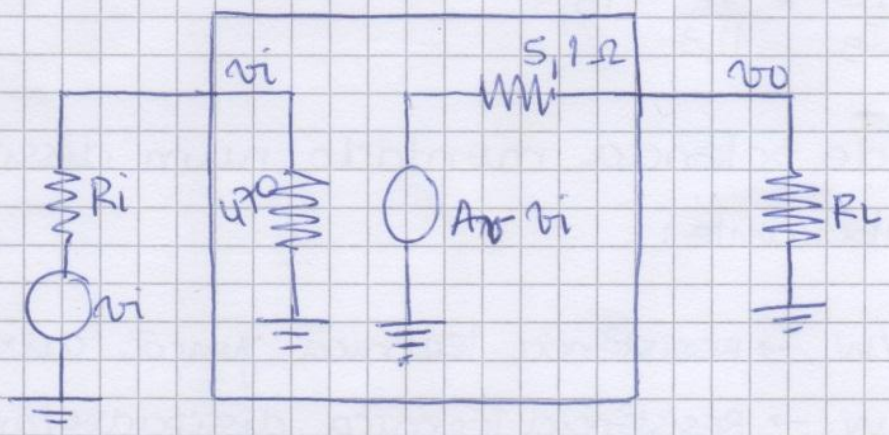
Amplificador Total

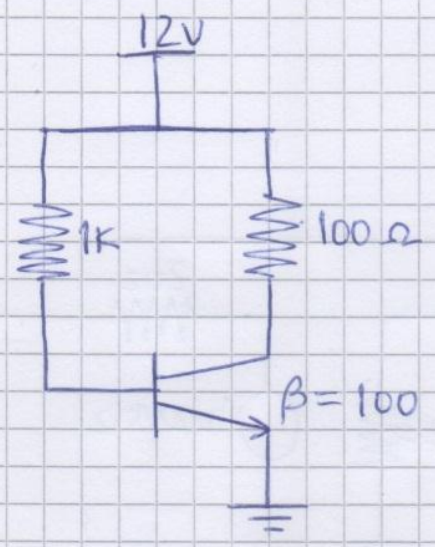
$Z_i = 4765\ \Omega$

$Z_o = 5,1\ \Omega$

$A_v = -120,4$

ganho





Super zona Activa

$12 - 1K I_B - 0,7 = 0$

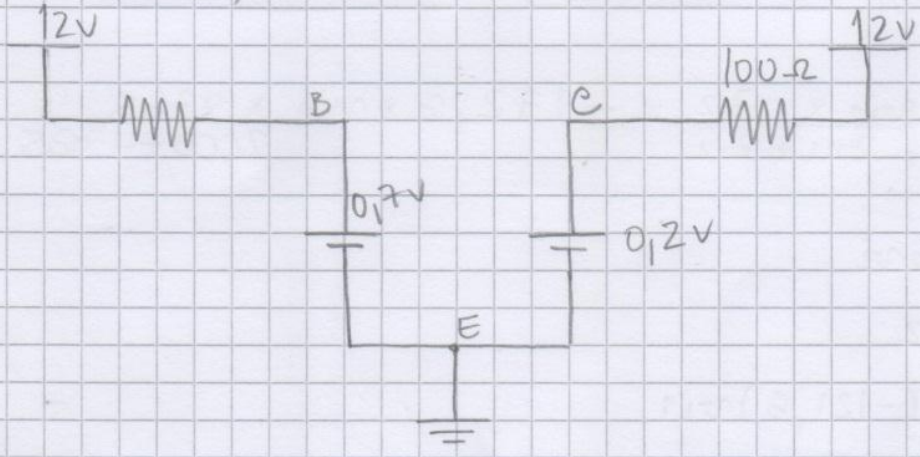
$I_B = \frac{12 - 0,7}{1K} = 11,3mA$

$I_C = \beta I_B = 1,13A$

$V_C = 12 - 100 I_C = -99,3V$

Não está na zona activa

Saturação



$V_B = 0,7V$

$V_C = 0,2V$

$I_B = \frac{12 - 0,7}{1K} = 11,3mA$

$I_C = \frac{12 - 0,2}{100} = 118mA$

Sat. Forte

$\beta_{forçado} \leq \frac{\beta}{10}$

$\beta_{Forçado} = \frac{I_C}{I_B} = \frac{118}{11,3} = 10,4$

Transistor de potência montado num dissipador

Dados de fabricante:

$\theta_{JC} = 20°C/W$ → Resistência térmica junção/caixa

$\theta_{SA} = 6°C/W$ → Resistência térmica dissipador/ambiente

Com um termómetro medi:

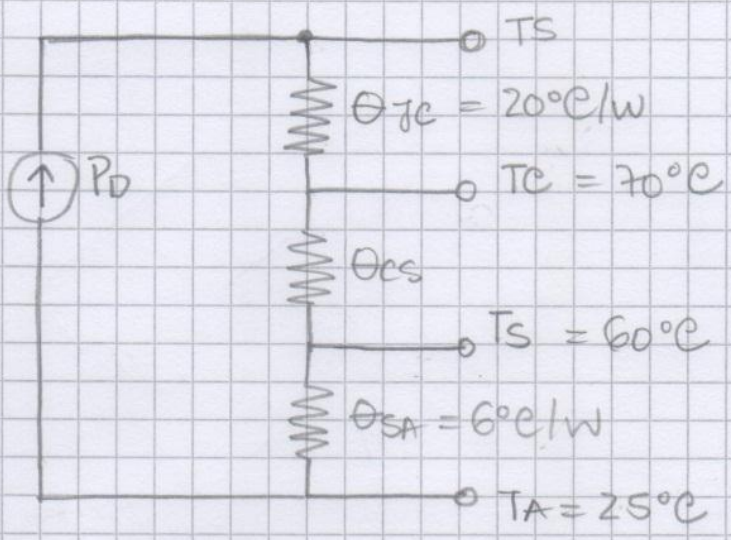
$T_A = 25°C$ $T_S = 60°C$ $T_C = 70°C$

Calcular:

θ_{CS} - Resist. térmica caixa / dissipador

T_S - Temperatura da junção

P_D - Potência dissipada



$$I = \frac{V}{R}$$

$$P_D = \frac{T_S - T_A}{\theta_{SA}} = \frac{60 - 25}{6} = 5{,}83\ W$$

$$P_D = \frac{T_C - T_S}{\theta_{CS}} \quad (\theta_{CS} =) \quad \frac{70 - 60}{5{,}83} = 1{,}71\ °C/W$$

$$P_D = \frac{T_J - T_C}{\theta_{JC}} \Rightarrow T_J = 20 \times 5{,}83 + 70 = 187\ °C$$