$P_{out} := 200\ mW$ $R_{load} := 16\ \Omega$ $R_{in\_min} := 10\ k\Omega$ $R_{out\_max} := 5\ \Omega$

$BW_{min} := 20\ kHz$ $V_{in} := 20\ mV$ amplitude

$V_T := 25\ mV$

$V_{out} := \sqrt{P_{out} \cdot R_{load}} = 1.789\ V$

$I_{out} := \sqrt{\frac{P_{out}}{R_{load}}} = 111.803\ mA$

$A_{CE} := 3$

$A_{diff} := 42$

$\frac{V_{out}}{\frac{V_{in}}{\sqrt{2}}} = 126.491$

$\beta_{AB} := 90$

$\beta := 325$

$V_{CC} := 15\ V$ $V_{EE} := -15\ V$

$f_c := 20\ kHz$

$$X_C = \frac{1}{2\ \pi \cdot f \cdot C}$$

$C := 470\ \mu F$

$\frac{1}{2\ \pi \cdot f_c \cdot C} = 0.017\ \Omega$

Class AB

$V_{BN} := 0.7\ V$ $V_{BP} := -0.7\ V$ $A_{AB} := 1.5$

$V_{BB} := V_{BN} - V_{BP} = 1.4\ V$

$i_{L\_max} := \sqrt{\frac{P_{out}}{R_{load}}} = 111.803\ mA$

$V_{BEQ1} := 0.7\ V$

$fA := 10^{-15}\ A$

$i_{B\_max\_AB} := \frac{i_{L\_max}}{\beta_{AB}} = 1.242\ mA$

$I_{bias} := 3\ mA$

$\frac{V_T}{\frac{i_{L\_max}}{2}} = 0.447\ \Omega$

$I_R := 1\ mA$

$I_{C1} := I_{bias} - I_R = 2\ mA$

$I_S := \frac{I_{C1}}{e^{\frac{V_{BB}}{2 \cdot V_T}}} = 1.383\ fA$

$R_{eq} := \frac{V_{BB}}{I_R} = 1.4\ k\Omega$

$R_1 := \frac{V_{BEQ1}}{I_R} = 700\ \Omega$

$R_2 := R_{eq} - R_1 = 700\ \Omega$

$V_{CC} = 15\ V$

Constant current source Zener diode

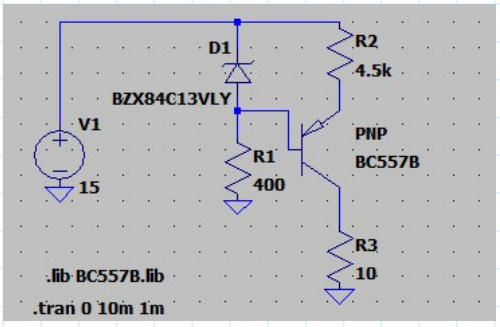
$V_{zener} := 13\ V$ $V_{diode} := 0.7\ V$

$V_{Eset} := V_{CC} - V_{zener} + V_{diode} = 2.7\ V$

$R_{set} := \frac{V_{CC} - V_{Eset}}{I_{bias}} = 4.1\ k\Omega$

$I_{zener} := 5\ mA$

$R_Z := \frac{V_{CC} - V_{zener}}{I_{zener}} = 400\ \Omega$



Output modstand

$V_B := 1.4\ V$ $V_{BE} := 0.7\ V$

$V_E := V_B - V_{BE} = 0.7\ V$

$I_E := \frac{V_E}{R_{load}} = 43.75\ mA$

$R_{out} := \frac{V_T}{I_E} = 0.571\ \Omega$

WAS trin

$i_{C\_max\_WAS} := i_{B\_max\_AB} = 1.242\ mA$

$A_{CE} = 3$

$R_{IN} = (\beta + 1) \cdot (r_e \cdot R_E)$

$i_B = \frac{v_{in}}{R_{IN}}$

$v_o = -R_C \cdot i_b \cdot \beta$

$v_o = -R_C \cdot \frac{v_i}{R_{IN}} \cdot \beta$

$\frac{v_o}{v_i} = -\frac{R_C}{(r_e + R_E)} \cdot \frac{\beta}{\beta + 1}$

$\frac{v_o}{v_i} = -\alpha \cdot \frac{R_C}{r_e + R_E} = -\alpha \frac{R_C}{R_E}$ $\alpha := \frac{\beta}{\beta + 1} = 0.997$

$R_C := 4.7\ k\Omega$

$A_{CE} = -\alpha \cdot \frac{R_C}{R_E}$ $R_E := \alpha \cdot \frac{R_C}{A_{CE}} = 1.562\ k\Omega$

DC

$V_B = \frac{R_{B1} + R_{B2}}{R_{B1} \cdot R_{B2}} \cdot V_{CC}$ $V_{CE} := 4\ V$ $V_{RC} := 13\ V$ $V_C := 2\ V$

$V_E := -2\ V$ $V_{RE} := V_E - V_{EE} = 13\ V$

$V_B := V_E + V_{BE} = -1.3\ V$

$R_{B1} := 5.1\ k\Omega$

$V_B = \frac{R_{B1} - R_{B2}}{R_{B1} + R_{B2}} \cdot V_{CC} \xrightarrow{solve, R_{B2}} \frac{-5.1 \cdot k\Omega \cdot V - 58.846153846153846154 \cdot k\Omega \cdot V}{V - 11.538461538461538462 \cdot V}$

$R_{B2} := \frac{-5.1 \cdot k\Omega \cdot V - 58.846153846153846154 \cdot k\Omega \cdot V}{V - 11.538461538461538462 \cdot V} = 6.068\ k\Omega$

$I_E := \frac{V_E - V_{EE}}{R_E} = 8.323\ mA$

$I_B := \frac{I_E}{(\beta + 1)} = 25.532\ \mu A$ S.429

Commen mode amplifier

DC analyse

$V_{C\_CM} := V_B = -1.3\ V$ $I_{EE\_CM} := 4\ mA$ $\alpha = 0.997$

$I_{E\_CM} := \frac{I_{EE\_CM}}{2} = 2\ mA$

$V_{C\_CM} = V_{CC} - R_{C\_CM} \cdot I_{E\_CM} \cdot \alpha$

$V_{BE} = 0.7\ V$

$R_{C\_CM} := \frac{V_{CC} - V_{C\_CM}}{I_{E\_CM} \cdot \alpha} = 8.175\ k\Omega$

$0\ V + V_{BE} + I_{E\_CM} \cdot R_{E\_CM} + V_{ce} - V_{EE} = 0$

AC

$r_e := \frac{V_T}{I_{E\_CM}} = 12.5\ \Omega$ $A_{diff} = 42$

$\frac{v_d}{2} = i_b \cdot r_\pi + i_e \cdot R_{E\_CM} = i_b \cdot (\beta + 1) \cdot r_e + i_b \cdot (\beta + 1) \cdot R_{E\_CM} = i_b \cdot (\beta + 1)\ (r_e + R_{E\_CM})$

$v_d = 2 \cdot i_b \cdot (\beta + 1)\ (r_e + R_{E\_CM})$

$v_{o1\_cm} = -\beta \cdot i_{b\_cm} \cdot R_{C\_CM}$

$\frac{v_{o1\_cm}}{v_d} = \frac{-\beta \cdot i_b \cdot R_{C\_CM}}{2 \cdot i_b \cdot (\beta + 1) \cdot (r_e + R_{E\_CM})} = -\frac{\beta \cdot R_{C\_CM}}{2 \cdot (\beta + 1) \cdot (r_e + R_{E\_CM})}$

$A_{diff} = \frac{\beta \cdot R_{C\_CM}}{2 \cdot (\beta + 1) \cdot (r_e + R_{E\_CM})} \xrightarrow{solve,\ R_{E\_CM}} -12.5 \cdot \Omega + 0.097023809523809513402 \cdot k\Omega$

$R_{E\_CM} := 12.5 \cdot \Omega + 0.097023809523809513402 \cdot k\Omega = 109.524\ \Omega$

$R_{IN} := 2 \cdot (\beta + 1)\ (r_e + R_{E\_CM}) = 79.56\ k\Omega$

$V_{ce} := -V_{EE} - V_{BE} - I_{E\_CM} \cdot R_{E\_CM} = 14.081\ V$

Strøm spejl

$$I_{C\_SP} := I_{EE\_CM} = 4\ mA$$

$$I_{B\_SP} := \frac{I_{C\_SP}}{\beta} = 12.308\ \mu A$$

$$I_{R\_SP} := I_{B\_SP} \cdot 2 + I_{C\_SP} = 4.025\ mA$$

$$V_{CC} - R_{SP} \cdot I_{R\_SP} - V_{BE} - V_{EE} = 0$$

$$R_{SP} := \frac{V_{CC} - V_{EE}}{I_{R\_SP}} = 7.454\ k\Omega$$