6 BJ Transistor amplifiers

1) Task

Estimate the operating point of a transistor (I_{CQ}, $U_{(CEQ)}$) operating in an amplifier circuit fromFigure1 . For calculations, assume: R_B = 220 kΩ, R_C = 1 kΩ, R_E=510 Ω, V_{CC} =10 V, U_{BE} =0.65V, β = 100.

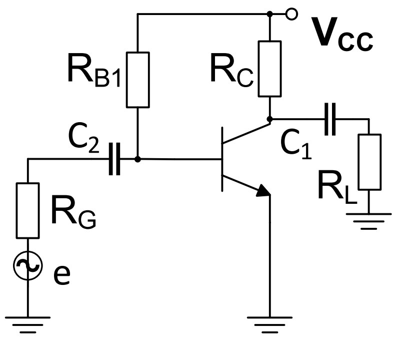

Figure1 . Common emitter amp.- base polarization.

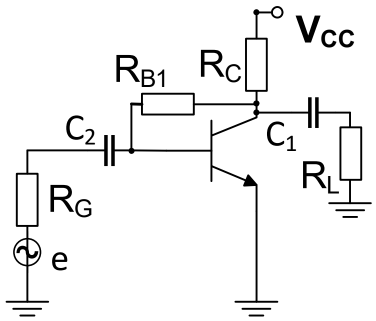

Figure2 . Common emitter amp. .- .- base polarization with collector feedback

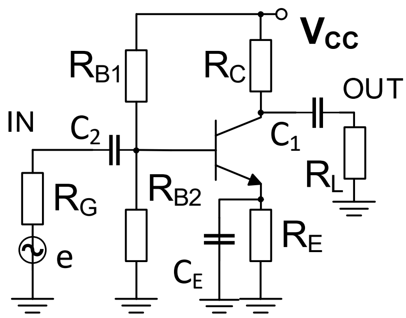

Figure3 . Common emitter amp. .- potentiometric polarization with emitter feedback

2) Task

Estimate the operating point of a transistor (I_{CQ}, U_{CEQ}) operating in an amplifier circuit fromFigure2 . For calculations, assume: R_B = 133 kΩ, R_C = 1.8 kΩ, V_{CC}=10 V, $U(_{BE)}$ = 0.65 V, β = 100.

3) Task

Estimate the operating point of a transistor (I_{CQ}, U_{CEQ}) operating in an amplifier circuit fromFigure3 . For calculations, assume: R_{B1} = 15 kΩ, R_{B2} = 8.2 kΩ, R_C = 820 Ω, RE = 510 Ω, V_{CC} = 10V, U_{EB} = 0.65 V, β = 100.

4) Task

Estimate the operating point of a transistor (I_{CQ}, $U_{(CEQ)}$) operating in an amplifier circuit fromFigure4 . For calculations, assume: R_B = 100 kΩ, R_C = 8.2 kΩ, R_E = 10 kΩ,± Vcc = ± 12 V, UEB = 0.65 V, β = 200.

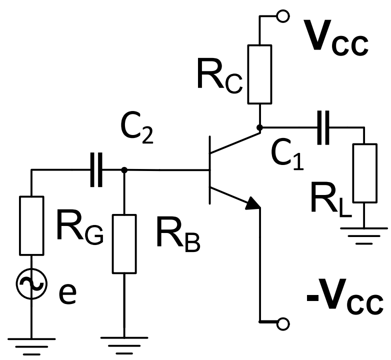

Figure4 . Common emitter amp with negative emitter polarization.

5) Taskk

Estimate the operating points of the transistors (I_{CQ}, U_{CEQ}) operating in the amplifier circuit fromFigure5 . For calculations, assume: R_{C1} = 10 kΩ, R_{C2} = 5 kΩ, R_{E1} = 5 kΩ, R_{E2} = 6.1 kΩ, R(F) = 100 kΩ, VCC = 18 V, UBE1 = $UBE2$ = 0.65 V, β(1) = β(2) = 100.

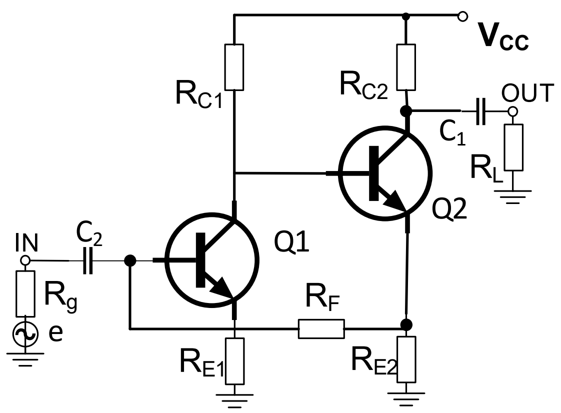

Figure5 . Dual BJT amp with feedback end emitter feedback of Q1

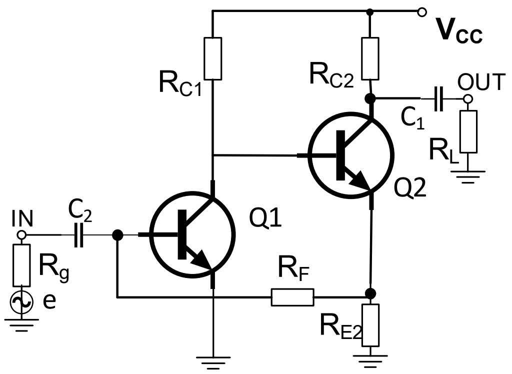

Figure6 . Dual BJT amp with feedback end without emitter feedback of Q1

6) Taskk

Estimate the operating points of the transistors (I_{CQ}, U_{CEQ}) operating in the amplifier circuit fromFigure6 . For calculations, assume: R_{C1} = 15 kΩ, R_{C2} = 5 kΩ, R_{E2} =1.2 kΩ, RF =100 kΩ, V_{CC} =18 V, U_{BE1} = U_{BE2} = 0.65 V, β1 = β2 =100.

7) Task

Draw small-signal equivalent circuit diagrams of amplifier circuits fromFigure7 in the medium, low and high frequencies.

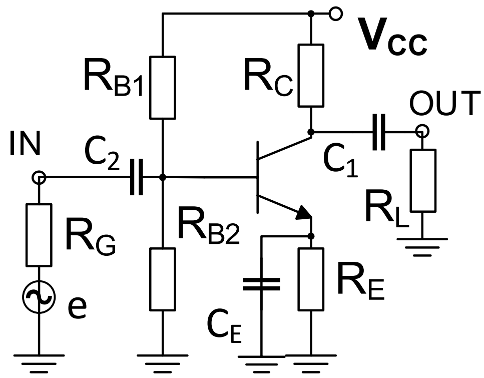

Figure7 . Common emitter amplfier.

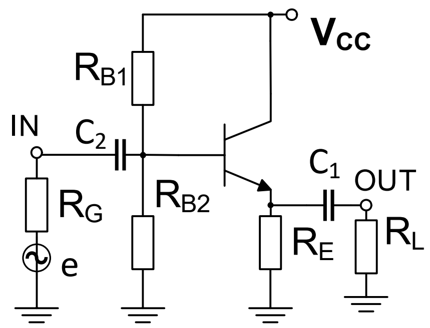

Figure8 . Common collector amplifier

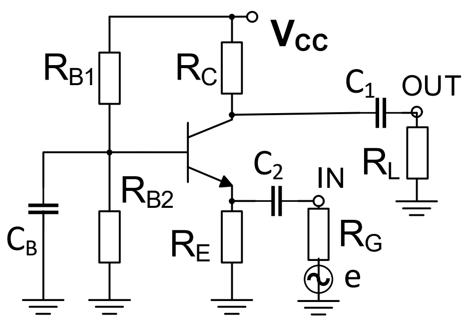

Figure9 . Common base amplifier

8) Task

Draw small-signal equivalent circuit diagrams of amplifier circuits withFigure9 in the mid-frequency range.

9) Task

Estimate the equivalent parameters of small-signal equivalent models of a bipolar transistor operating at the operating point I_{CQ}= 1 mA, U_{CEQ}= 5 V. For calculations, assume β = 100, U_{EY} = 100 V, $r_{bb'}$= 50 Ω. a) hybrid π-type model;

b) h matrix type model;
c) y matrix type model.

10) Task

Estimate the effective voltage gain of the amplifier fromFigure7 . For the calculation, assume: R_{B1} = 56 kΩ, R_{B2} = 20 kΩ, RC = 6.8 kΩ, RE=3.3 kΩ, RG = 1 kΩ, RL= 10 kΩ, β = 200, transistor operating point ICQ= 1mA, UCEQ= 5 V.

11) Task

Estimate the effective current gain of the amplifier fromFigure7 . For the calculation, assume: R_{B1} = 56 kΩ, R_{B2}= 20 kΩ, RC = 6.8 kΩ, RE=3.3 kΩ, RG = 1 kΩ, RL = 10 kΩ, β = 200, transistor operating point ICQ = 1mA, UCEQ = 5 V.

12) Task

Estimate the input and output resistance of the amplifier fromFigure7 . For calculations, assume: R_{B1} = 56 kΩ, R_{B2} = 20 kΩ, RC = 6.8 kΩ, RE=3.3 kΩ, RG = 1 kΩ, RL = 10 kΩ, β = 200, transistor operating point ICQ= 1mA, U(CEQ) = 5 V.

13) Task

Estimate the lower limit frequency of the amplifier circuit fromFigure7 . For calculations, assume: R_{B1} = 56 kΩ, R_{B2} = 20 kΩ, R(C) = 6.8 kΩ, RE=3.3 kΩ, C(1) =1µF, C(2) = 1 µF, C(E) = 100 µF, R(G) =1kΩ, R(L) = 10 kΩ, β = 200, transistor operating point ICQ= 1mA, UCEQ= 5 V.

14) Taskk

Estimate the upper limit frequency of the amplifier circuit fromFigure7 . For calculations, assume: R_{B1} = 56 kΩ, R_{B2} = 20 kΩ, R_C= 6.8 kΩ, RE=3.3 kΩ, Cbc = 4.5 pF, fT =150 MHz, R(G) = 1 kΩ, RL = 10 kΩ, β = 200, transistor operating point ICQ= 1mA, UCEQ= 5 V.

15) Task

Estimate the effective voltage gain of the amplifier fromFigure8 . For the calculation, assume: R_{B1} = 570 kΩ, R_{B2} = 3.9 MΩ, R_E=10 kΩ, RG =5 kΩ, RL =10 kΩ, β = 200, transistor operating point ICQ= 1 mA, UCEQ= 5 V.

16) Task

Estimate the effective current gain of the amplifier fromFigure8 . For the calculation, assume: R_{B1} = 570 kΩ, R_{B2} = 3.9 MΩ, R_E=10 kΩ, RG =5 kΩ, RL=10 kΩ, β = 200, transistor operating point ICQ= 1 mA, UCEQ= 5 V.

17) Task

Estimate the input and output resistance of the amplifier fromFigure8 . For calculations, assume: R_{B1} = 570 kΩ, $R_{B)}$ = 3.9 MΩ, R_E=10 kΩ, RG =5 kΩ, RL =10 kΩ, β = 200, transistor operating point ICQ= 1 mA, UCEQ= 5 V.

18) Task

Estimate the effective voltage gain of the amplifier fromFigure9 . For the calculation, assume: R_{B1} = 100 kΩ, R_{B2}= 20 kΩ, R_C= 500 Ω, RE=1 kΩ, RG = 20 Ω, RL = 10 kΩ, β = 200, transistor operating point ICQ= 1mA, UCEQ= 10 V.

19) Task

Estimate the effective current gain of the amplifier fromFigure9 . For the calculation, assume: R_{B1} = 100 kΩ, $R_{(B2)}$ = 20 kΩ, R_C = 500 Ω, RE=1 kΩ, RG = 20 Ω, RL = 10 kΩ, β = 200, transistor operating point ICQ= 1mA, UCEQ= 10 V.

20) Task

Estimate the input and output resistance of the amplifier fromFigure9 . For calculations, assume: R_{B1} = 100 kΩ, R_{B2} = 20 kΩ, R_C = 500 Ω, RE=1 kΩ, RG = 20 Ω, RL = 10 kΩ, β = 200, transistor operating point ICQ= 1mA, UCEQ= 10 V.