Analog Electronics II
Laboratory
Exercise 4
Cascade amplifier with BJT

Aim of the exercise

The aim of this laboratory exercise is to become familiar with the operation of the cascade connection of the amplifiers with bipolar junction transistors. Students learn about the transistor polarization, frequency characteristics and nonlinear distortions.

Equipment

- Oscilloscope;
- Function generator;
- Measurement set: digital multimeter, frequency meter, power supply;
- Soldering toolbox;
- Measurement toolbox;
- Soldering station;
- Prototype board.

Before the exercise please check the contents of the toolbox with the checklist on the box. If anything is missing report it to your teacher.

> **!** **Warning! Soldering iron is heated to the temperature above 300ºC. Please use it carefully in order to prevent getting burn.**
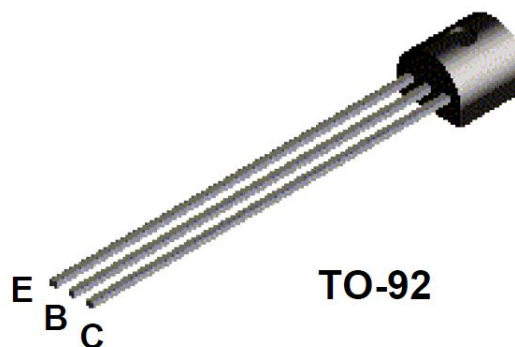

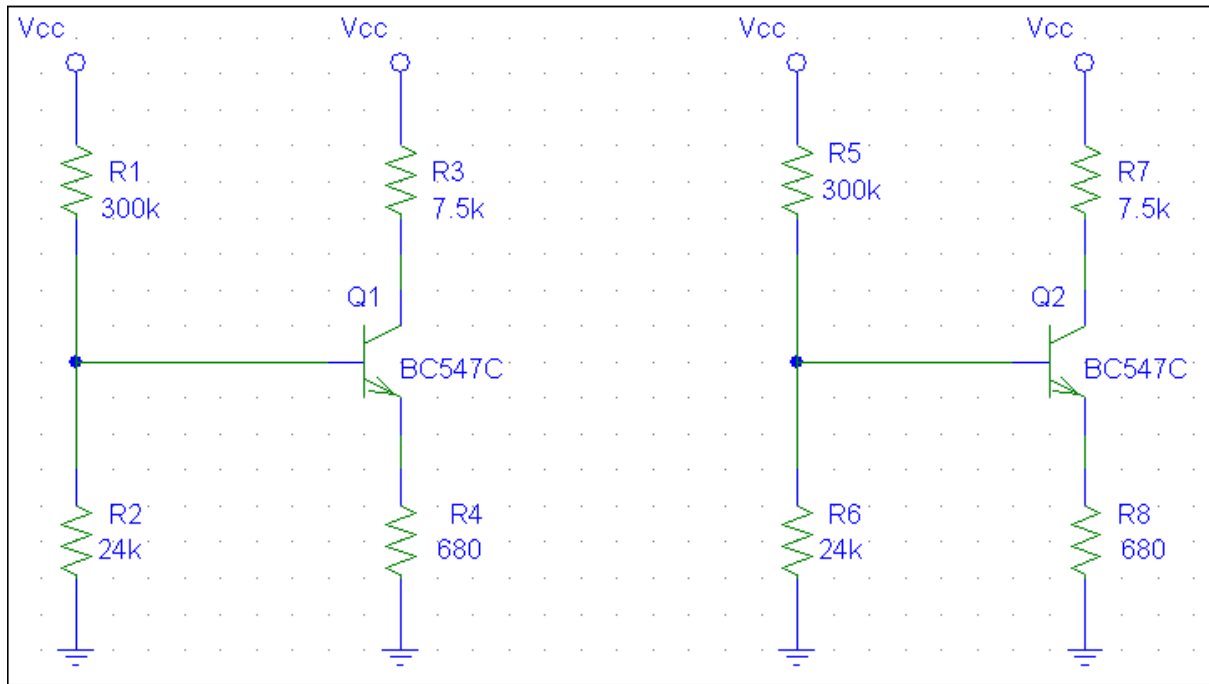**Fig. 1 Transistor pinning ©1997 Fairchild Semiconductor Corporation**

Fig. 2 Two BJT amplifiers

Tasks

1. Analysis of the parameters of the transistor amplifier circuits

1. Solder circuit illustrated in fig. 2 consisting of two independent amplifiers.
2. Supply the circuit with $V_{CC} = 15$V.
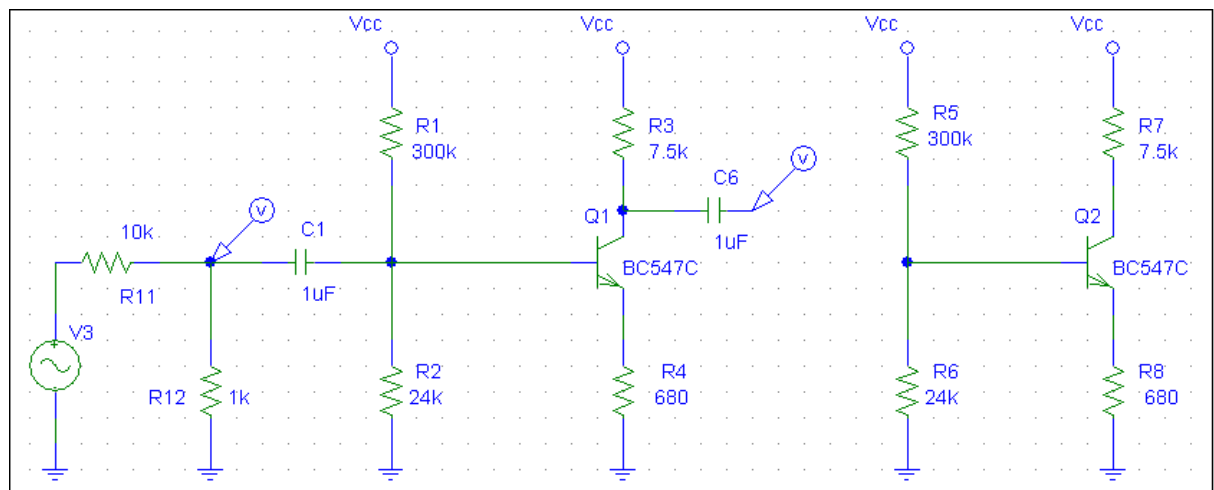3. Determine the point of work of both transistors.

Fig. 3 Two BJT amplifiers

4. Solder the circuit illustrated in fig. 3.
5. Connect the generator. Set the frequency of the generator to $f = 1$kHz and the input voltage amplitude to $V_{IN} = 10$mV.

6. Connect the oscilloscope probes to the test points indicated by voltage markers.
7. Plot the input and output voltage V_{IN} and V_{OUT}. Calculate the amplification A_v of the first amplifier.
8. Find the frequency characteristics of the amplifier (amplification vs. frequency). Remember to keep the constant input voltage.
9. Determine the frequency band of the amplifier.

2. Analysis of the point of work of the transistors in the cascade amplifier circuit with capacitive feedback.
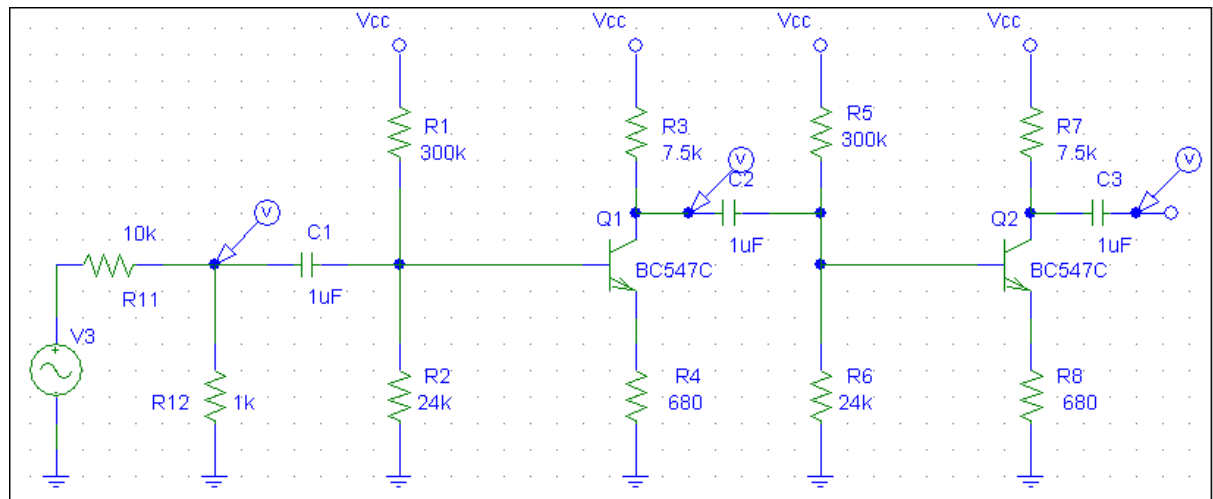

Fig. 4 Cascade connection of BJT amplifiers.

1. Solder circuit illustrated in fig. 4 consisting of two independent amplifiers.
2. Supply the circuit with $V_{CC} = 15V$.
3. Determine the point of work of both transistors with disconnected generator.

3. Analysis of the cascade amplifier circuit with capacitive feedback.

1. Connect the generator. Set the frequency to $f = 1kHz$ and the input voltage V_{IN} amplitude so that the output signal is maximum and not distorted.
2. Connect the oscilloscope probes to the test points indicated by voltage markers.
3. Plot the input and output voltage V_{IN} and V_{OUT}. Calculate the amplification A_v of the first amplifier.
4. Find the frequency characteristics of the amplifier (amplification vs. frequency). Remember to keep the constant input voltage.
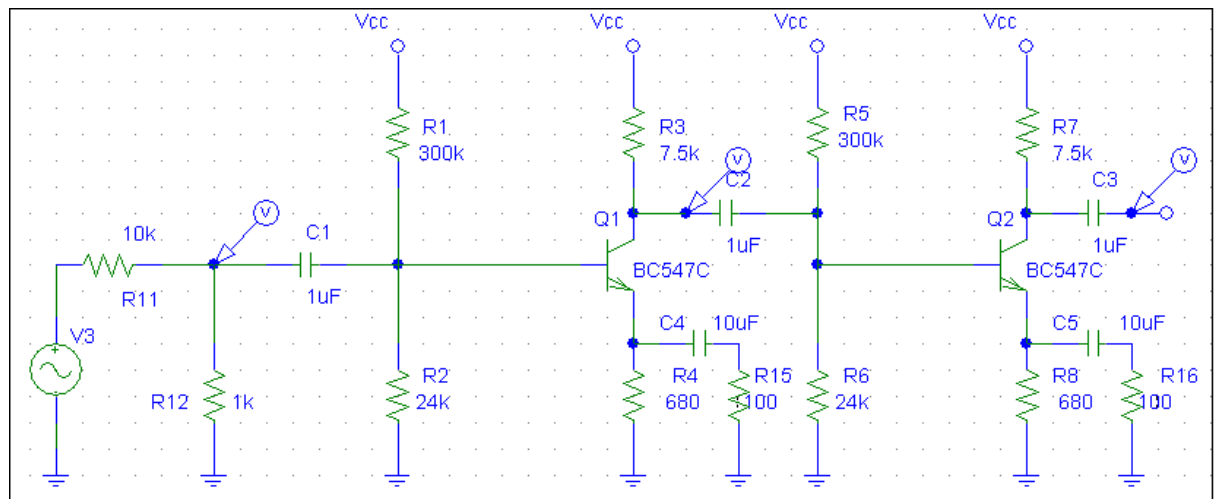5. Determine the frequency band of the amplifier.

Fig. 5 Cascade connection of BJT amplifiers

1. Solder the circuit illustrated in fig. 5.
2. Connect the generator. Set the frequency to $f = 1\text{kHz}$ and the input voltage V_{IN} amplitude so that the output signal is maximum and not distorted.
3. Connect the oscilloscope probes to the test points indicated by voltage markers.
4. Plot the input and output voltage V_{IN} and V_{OUT}. Calculate the amplification A_v of the first amplifier.
5. Find the frequency characteristics of the amplifier (amplification vs. frequency). Remember to keep the constant input voltage.
6. Determine the frequency band of the amplifier.

Additional information

Parameters, documentation and SPICE models of BC547 transistor:
http://www.semiconductors.philips.com/pip/BC547.html

Report preparation

The report must be delivered in electronic form to your teacher. Each page in header should have named and id numbers of persons carried out the exercise. Each report should include:

- schematics of the examined circuits (e.g. prepared in SPICE);
- measurements results;
- oscilloscope plots and;
- simulation results;
- comparison of the obtained measurement results and oscilloscope plots with SPICE simulation results;
- comments and conclusions;