

Electronics Lab

Bipolar Junction Transistor

BJT operating regions

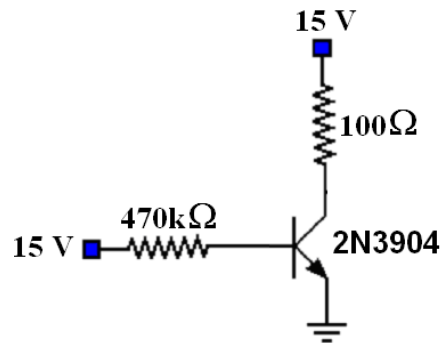
Initial multimeter tests: Using an npn transistor like the 2N3904 and a digital multimeter make the following measurements:

- Measure the resistance collector-emitter. How much do you expect? How much did you get?
- Use the diode checking option in the multimeter to test the base-emitter junction. Make sure that it gives you the correct polarity and the threshold voltage.
- What about the base-collector junction? Should you also get the same response as the base-emitter? Check with the multimeter.

Repeat these measurements with a pnp transistor like the 2N3906.

Simple biasing of an npn transistor: *Common Emitter configuration.*

a) Connect the circuit shown in the figure:



b) Measure the voltage base emitter. How much do you expect?

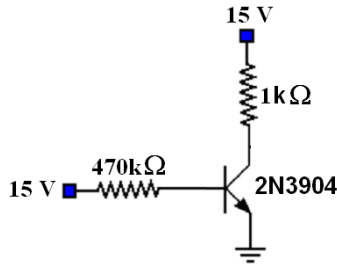
c) Calculate and measure the voltage collector emitter assuming the gain $\beta=180$. Was the value close? In what region is the transistor operating?

d) Calculate and measure I_B and I_C , compare the real values with the theoretical ones.

e) To get an idea of the range of values in transistors of the same batch. Measure again VCE for two other transistors and compare the values.

Optimal biasing the npn transistor: *Finding the best biasing.*

a) Connect the circuit shown in the figure:



b) Measure the voltage collector-emitter and use that value to find the value of β of that transistor.

c) Based on the measured gain calculate the best resistance to put the transistor in the middle of the active region. Select the closest standard resistance and connect it instead of the 470kohm resistor.

d) Check that the voltage collector emitter is approximately half the source voltage.

Operating regions: *Biasing and operating a transistor.*

Connect the circuits shown in the figures. For each one calculate and measure the voltage collector emitter and determine in what region it is working:

