

## Tutorial #5: Emitter Follower or Common Collector Amplifier Circuit

This tutorial will help you to build and simulate a more complex circuit: an emitter follower. The emitter follower or common collector circuit is widely used in amplifier configuration of bipolar junction transistors (BJTs) with gain of unity or less. It is recommended you complete tutorials 1-4 before proceeding. In this tutorial, we will build and simulate the circuit shown in **Figure 1**.

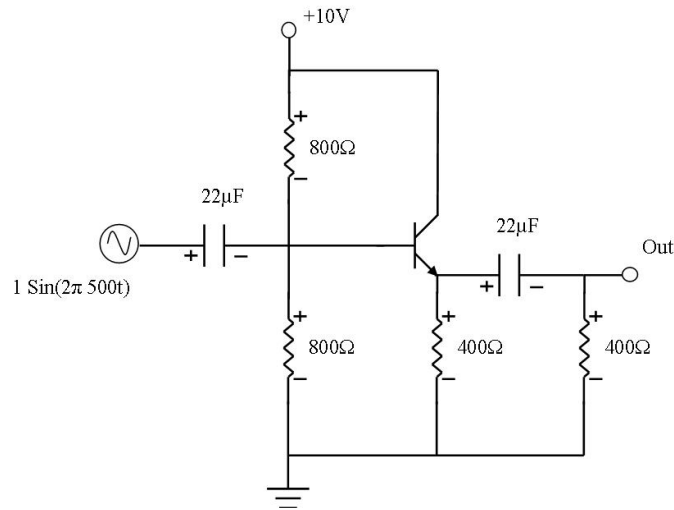


Figure 1: Emitter follower circuit to be simulated

**Step 1.** Open the circuit simulator and create a blank circuit.

**Step 2.** Place the transistor on the circuit board. Right click on the circuit board and select “Add Transistor (bipolar, NPN)” from the “Active Components” menu as shown in **Error! Reference source not found.** For now, we will use the default value of beta (100), but the beta value can be changed by right clicking on the transistor and selected “Edit.”

**Step 3.** Place all wires, resistors, and capacitors. Change the values to match **Figure 1**. To place a ground (the bottommost component shown in **Figure 1**), right click on the circuit board and select “Add Ground (g)” from the “Inputs/Outputs” menu. After placing these components, your circuit should look like **Figure** .

**Note:** If you have to move a component or a terminal, right click on the circuit board and select the desired action from the “Other” menu.

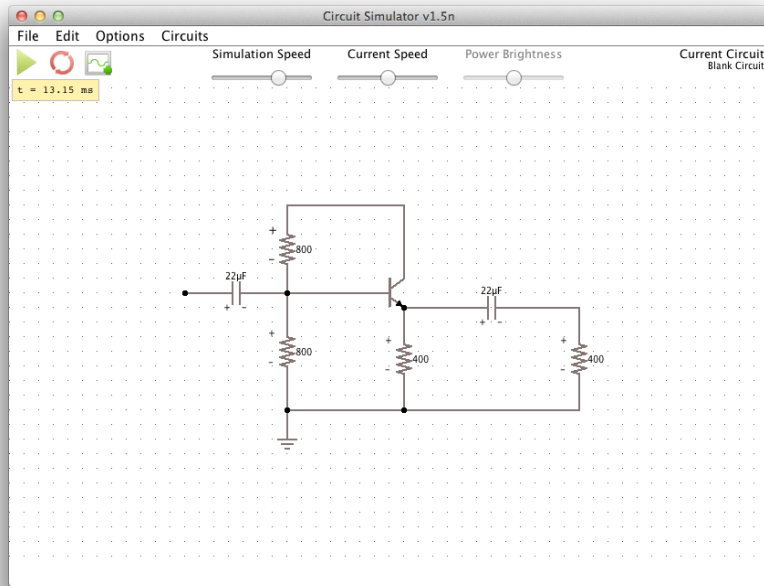


Figure 2: Circuit after placing transistor, resistors, and capacitors

**Step 4.** Place a single terminal AC source on the circuit board as shown in **Figure 3**. To place a single terminal AC source, right click on the circuit board and select “Add A/C Source (1-terminal)” from the “Inputs/Outputs” menu. To change the value of the A/C source, right click on it and select “Edit”. For this tutorial, set the Max. Value to 1 and the Frequency to 500.

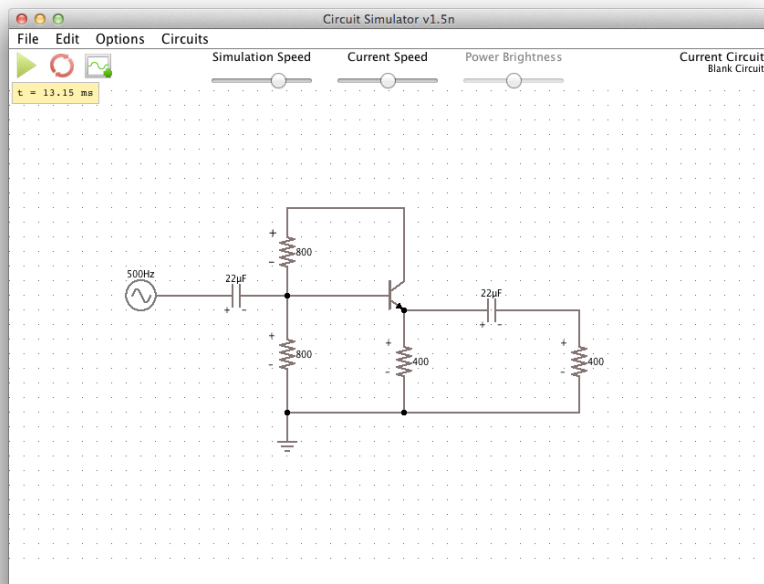


Figure 3: Circuit after placing single terminal AC source

**Step 5.** Place a single terminal DC source on the circuit board as shown in **Figure 4**. To place a one terminal DC voltage source, right click on the circuit board and select “Add Voltage Source (1-terminal)” from the “Inputs/Outputs” menu. Change the value of the voltage source to 10V.

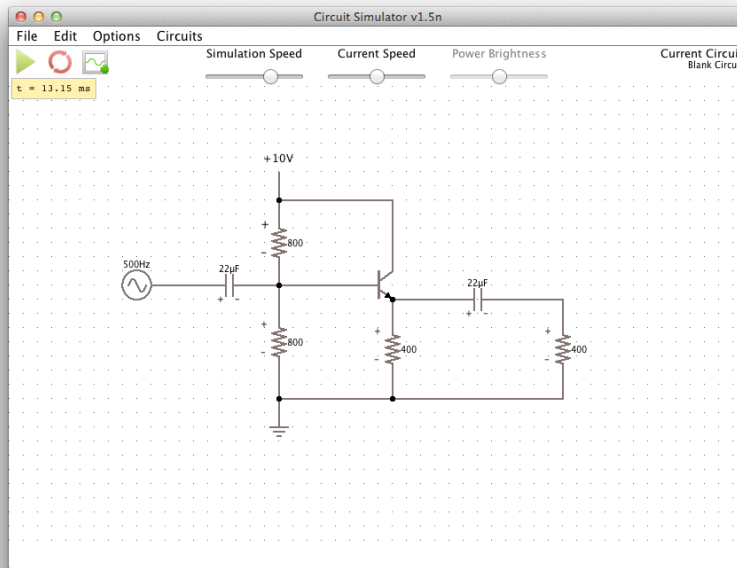


Figure 4: Circuit after placing single terminal DC voltage source

**Step 6.** An output terminal will be required to plot the output from the emitter terminal of the BJT. To place an output terminal, right click on the circuit board and select “Analog Output” from the “Inputs/Outputs” menu. To show the output voltage, right click on the analog output, select “Edit,” and check “Show Voltage” in the dialog box. The final circuit should be similar to Figure .

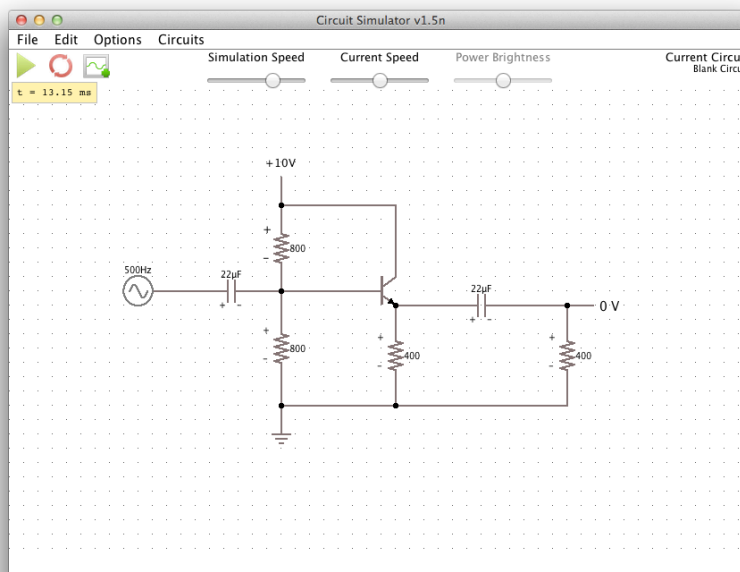


Figure 5: Completed circuit

**Step 7.** To plot the output, right click on Analog Output and select “View in scope”. Also, right click on A/C source and select “View in scope”. Go to oscilloscope window and select “Stack All” from “Stack” menu. You may see that the waveforms extend vertically out of the bounds of the window. To fit the waveforms to the window, select “Fit Ranges” from the “Amplitude Ranges” menu. The scope after this step should be similar to Figure 6.

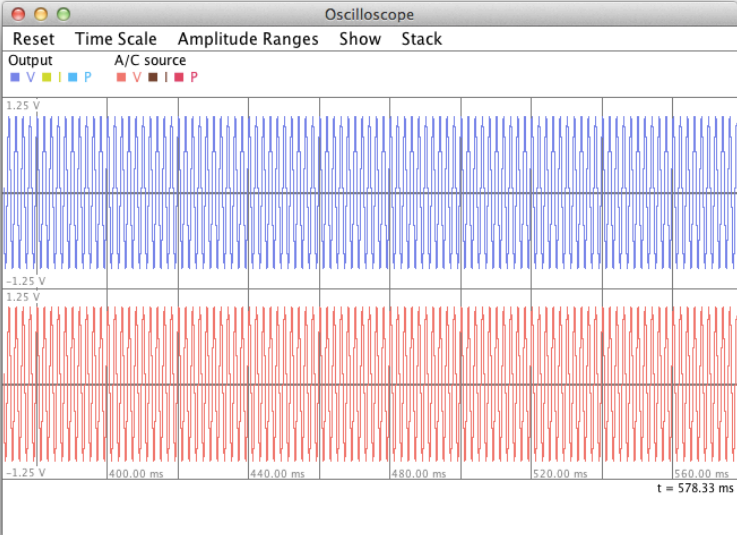


Figure 6: Oscilloscope with output voltage and A/C source

**Step 8.** You may find that the output waveforms are too dense to be clearly visible. To fix this, select “Time Scale 1/2x” from the “Time Scale” menu. This will provide a higher resolution along the time axis of the plot as shown in Figure .

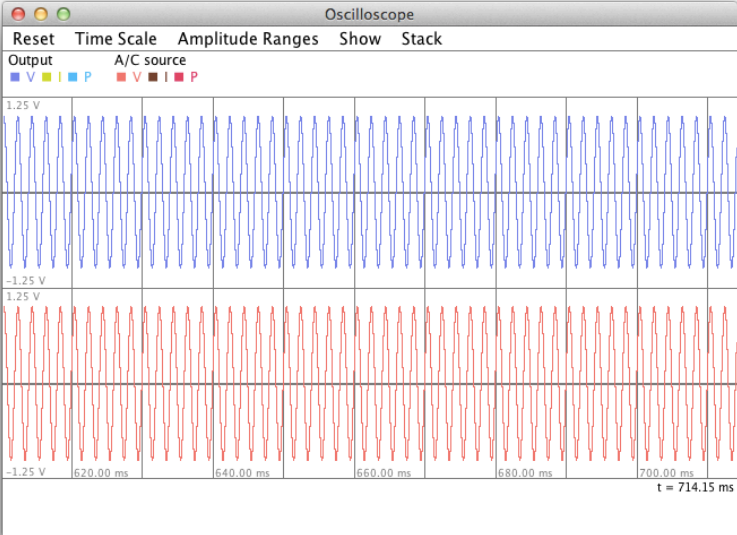


Figure 7: Output and A/C source voltage plot with smaller time scale

**Step 9.** It will be helpful to observe both peak values and frequency of the output. Check “Negative Peak Value” and “Frequency” in the “Show” menu. Corresponding peak values and frequency will appear at the bottom of the oscilloscope window when you select the output or A/C source. Final output will be similar to shown in **Figure** with peak values for output.

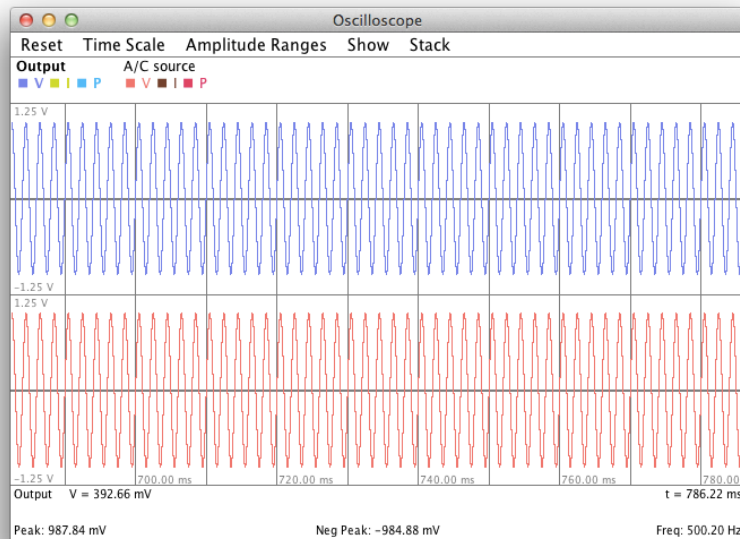


Figure 8: Output with peak values and frequency

**Step 10.** To save this circuit, go to the “File” menu, select “Save File”, and enter the desired location and file name. Circuits are saved as plain text (.txt) files. You can reload a circuit by selecting “Open” in “File” menu.