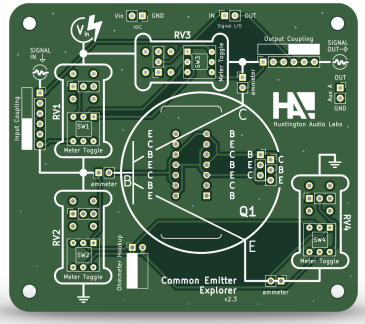


Huntington Audio Labs

Common Emitter Explorer Board

version 2

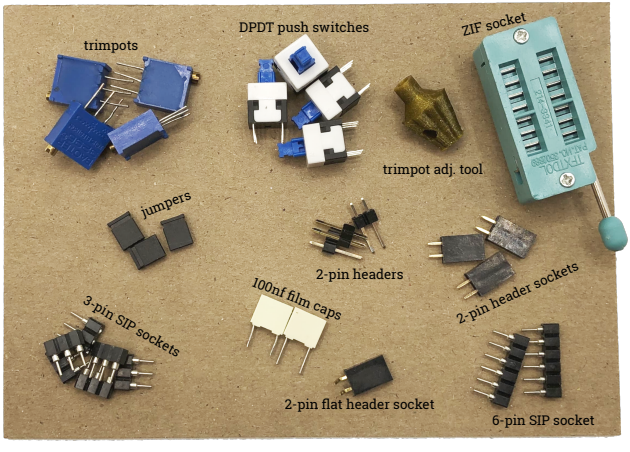
This **Common Emitter Explorer** board is an unassembled learning board kit for a beta-independent, common emitter amplifier. The simple circuit that underlies this explorer board is a great first circuit to digest and will prove to be a useful building block within more complex designs later on.

Drop in any BJT transistor and start exploring. Grab your multimeter and probe the test points while adjusting the trimpots to explore again and again. You can hope to achieve an intuitive understanding of transistor biasing, gain setting, and a better overall feel for how these components interact to produce a basic (and very useful) audio amplifier.

Parts Included

3-pin SIP sockets	**x6**
6-pin SIP sockets	**x2**
2-pin header sockets	**x3**
ZIF socket	**x1**
paper clips	**x4**
trimpots	**x4**
100nf film caps	**x2**

PCB	**x1**
3 jumpers	**x3**
2-pin flat header socket	**x1**
2-pin headers	**x3**
DPDT push switches	**x4**
trimpot adj. tool	**x1**



Assembly

If you're somewhat accustomed to soldering and PCB assembly, then by all means, approach this assembly in whatever way you see fit.

On the other hand, if you want a little guidance, here's how I've been assembling these. You might find these steps helpful.

1. Refer to the image (**figure 1**) and begin by inserting each part to its corresponding spot. Use painters masking tape to hold each part in place (**figure 2**).
2. After the parts are properly inserted and taped into place, solder a single leg/pin from each part onto the PCB. Do this for all the parts at once.
3. Remove the masking tape.
4. If any parts appear crooked or unevenly inserted (and you're anything like me) then you might want to take a moment to straighten them out, best you can. Since only a single leg has been soldered, correcting the unevenness should be simple. Just apply your hot soldering iron to the already soldered joint and give a corrective nudge to the part once the solder is molten.

5. Once all parts are to ready to your liking, then go over all remaining unsoldered pins and solder them up.
6. Next, prepare the paperclip trimpot supports. Snip each of the 4 paperclips as shown in the image (**figure 3**). Be sure to clip just about where indicated and ensure the ends are neatly trimmed. It's easiest to insert these into the PCB when the ends are offset in length from each other.
7. Carefully insert a single trimpot into one of the trimpot sockets. You'll use this as a reference to gauge the proper insertion depth for the paperclip.
8. Insert one of the sniped paperclips into the adjacent holes. Carefully push the paperclip through the holes until the round bend of the paperclip is just below the very top of the blue trimmer body. On the back side of the PCB, pin the paperclip in place by bending the long end down 90 degrees (**figure 4**). Repeat this process for the rest of the support holes.
9. Solder the paperclips into place from the back and snip off any excess.
10. Insert the three jumpers onto the pins of the 2-pin "ammeter" headers.

How to use

Ok. So you've got it assembled, now what? To start, I'd recommend reading up on the common emitter amplifier and BJT biasing. As a beginner myself, I found these two articles very helpful:

https://www.electronics-tutorials.ws/amplifier/transistor-biasing.html

https://www.electronics-tutorials.ws/amplifier/amp_2.html

There are also a number of excellent youtube videos that help breakdown how this circuit works.

That said, I'd expect that as a beginner, you'll find yourself (like I did) nice and confused if not totally lost after the reading. There's just no easy way to get a real feel for this without messing around yourself. So that's what this board is all about - a clean and efficient method of getting your hands on this circuit to see how it operates as you crank the knobs. Use this board to quickly explore gain and bias for any BJT in your collection of parts.

Setting trimpot values

Resistances for RV1 through RV4 can be set by turning a trimpot's knob to set the distance of the wiper (pin 2) from the start (pin 1) of the resistive track. Pin 3 is not used at all. Simply put, turning the knob clockwise will increase the resistance between pins 1 and 2 (simulates larger fixed resistor), while counter-clockwise turns will decrease the resistance (simulates smaller fixed resistor). Pin 1 is the pin closest to the tuning knob on each trimpot.

When placing the trimpots into the sockets refer to the SIP socket map image (**figure 6**). Make sure that pin 1 (the side where the top dial aligns) lines up with the corresponding pink circle from **figure 6**.

Each trimpot has an accompanying push button switch. When the button is NOT depressed (normal condition) the trimpot is wired 'in circuit' and operating as a resistor in the network. When the button is pushed down the corresponding trimpot is switched out from the circuit and momentarily connected to the ohmmeter hookup. This will disrupt the circuit's operation but it will allow you to read the trimpots value without having to actually remove the trimpot from the board.

Coupling Capacitors

The 6-pin SIP sockets are used here to accept the coupling capacitors, despite the capacitors obviously only having two legs. The larger number of socket positions allows for easier insertion of capacitors of varying types/sizes. The first three socket positions are all connected together and the last three socket positions are also connected together in the circuit. So be sure that the capacitors used here have one leg in any one of the first three positions (yellow mark in **figure 6**) and one leg in any one of the second 3 positions (green mark in **figure 6**).

Voltage In / Ground

If you are using an **NPN** transistor, you should connect the (+) positive lead of your supply to the V_{in} header socket and the (-) negative lead of your supply to the GND socket.

If you are using a **PNP** transistor you will reverse this, connecting the (+) positive lead of your supply to the GND header socket and the (-) negative lead of your supply to the V_{in} socket.

Audio Signal In / Out

This part is pretty self explanatory. Connect the incoming signal (the one you want to amplify) to the IN header socket of the "Signal I/O" section. The resulting, amplified signal will be output to the OUT header socket.

Aux A (OUT & GND)

This is a second hookup point for both the output signal and the circuit ground.

Transistor insertion

Notice the repeating "E", "C", and "B" designations that line each slot of the ZIF socket. These letters stand for Emitter, Collector, and Base respectively and indicate to you which leg of your transistor should go where within the ZIF socket depending on your transistors pin-out. Transistors come in many different packages so use whichever "E", "C", and "B" slots align best with your part. Lift the ZIF socket arm so its perpendicular to the board and then insert your part. Once fully inserted, bring the arm down to lock the part into place.

Exploring transistor function

There are a number of ways to explore the function of the transistor in this common emitter configuration.

- **Mess around and find out.** Use your good ol' eyes and ears! With the signal OUT hooked up to an amp, audio monitor, and/or oscilloscope, listen or view for the impact to the signal from the changes you make to your variable resistors.
- **Voltages across transistor leads.** Next, you can monitor the voltages across any two of the transistor leads by connecting your multimeter (voltmeter mode) to the sockets located to the right of the ZIF socket. You can read V_{CE}, V_{BE}, V_{BC} by connecting the multimeter leads to any combination of "B", "C", and "E" found at that header socket.
- **Current flow.** Remove the jumpers from the "ammeter" pins at any of the three test points and connect the leads of your multimeter (AC ammeter mode) to monitor the flow of current through that point. You'll need to use the *AC* ammeter function of your multimeter. Not all multimeters can measure AC currents.

figure 1 - Assembled board, top side

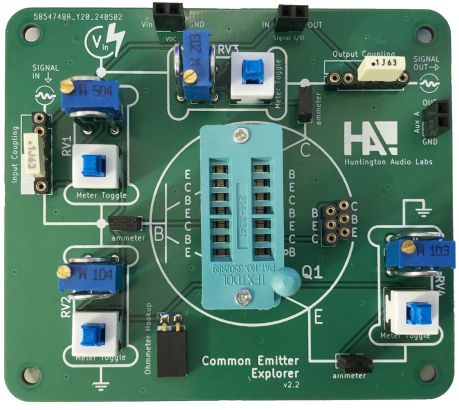


figure 2 - Parts inserted and taped

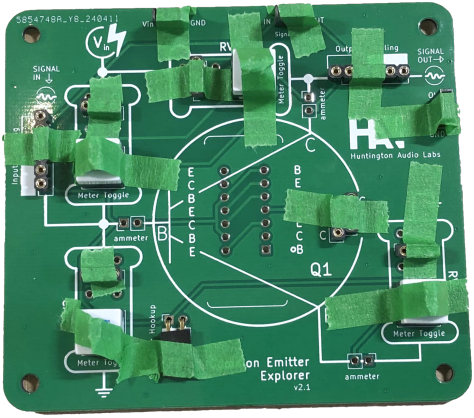


figure 3 - Paperclip snip

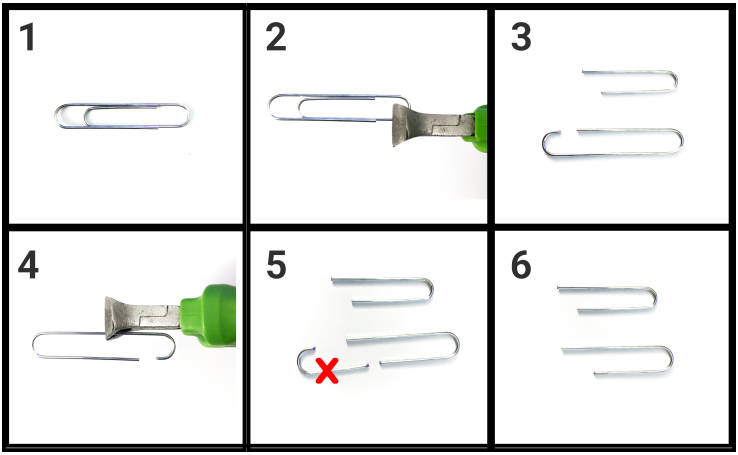


figure 4 - Securing paperclip with 90 degree bend

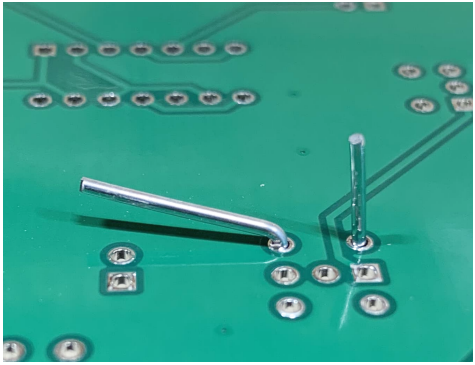


figure 5 - Underlying common emitter amplifier schematic

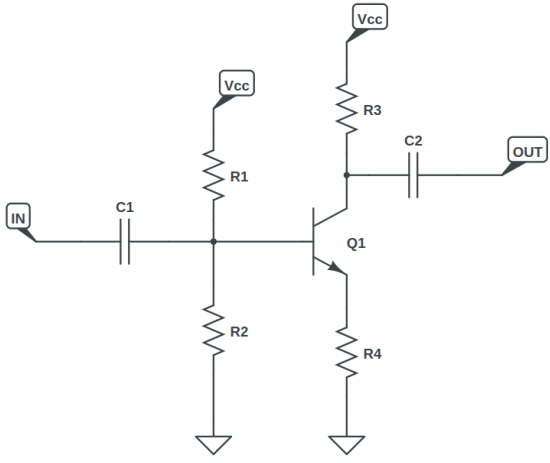


figure 6 - SIP Socket map & trimpot orientation.

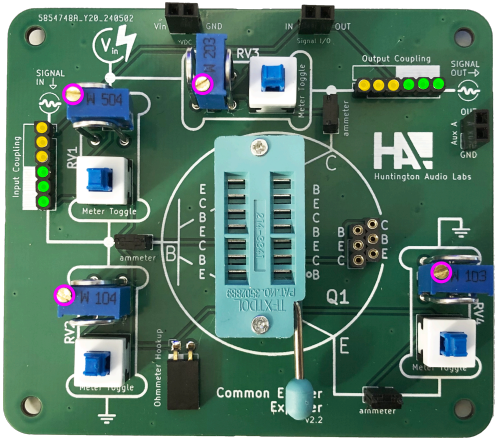


figure 7 - Reading trimpot resistance