Transistor Amplifier

A versitile PCB layout for common topologies

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Contents

Introduction

I **hate** working with breadboards, I'm terrible at wire management and I have no where safe to put the breadboard and the project ends up breaking up.

So wherever possible I prefer to use a PCB, ideally something someone else made but I was shocked to find no suitable simple transistor amplifier board. It seems like the kind of thing you'd get for pennies on ebay.

I set about fixing that and hopefully making something someone else finds easy. The board was laid out with home etching in mind as well as making moving from sketched schematics to the board layout simple.

Theory of the Board

Most transistor amplifiers have similar layouts with parts which can be swapped out i.e. a resistor or a diode or omitted. I wanted my project to support a relatively wide range of tologies and be chainable.

Features

- Common Emitter
- Common Collector

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- Emitter Resistor
- Emitter Resistor with bypass capacity
- Collector Feedback
- Fixed Bias
- Divider Bias
- Diode Bias
- In and output capacitors

Layout

So here's the idea, you can pretty much omit, jumper or populate each part. For example, R2 could be omitted for a fixed bias (using only R1), it could be a diode with R1 to form a reference bias. R1 and R2 could be omitted with Rf forming a collector feedback bias. It's all pretty self explanatory once you look at some common layouts.

Jumpers allow output to be taken from either the collector or the emitter.

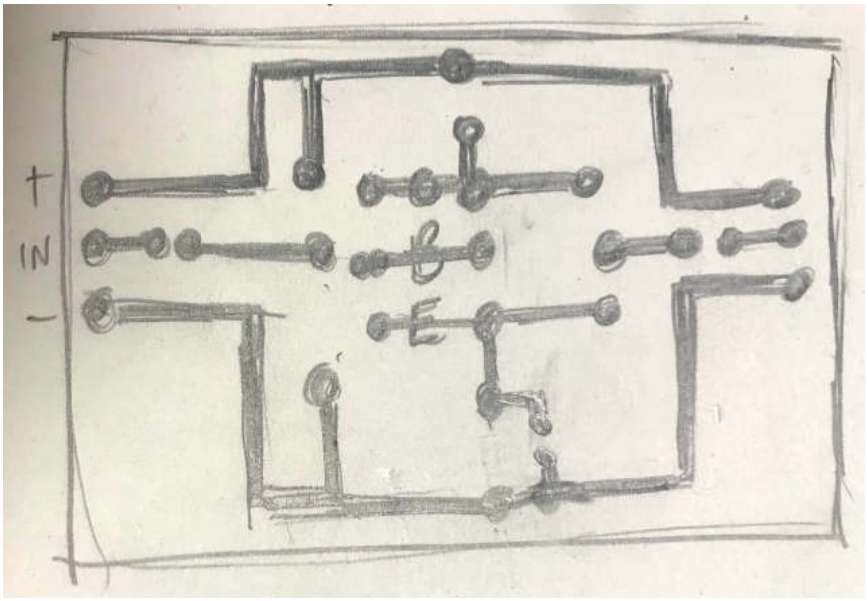

Figure 1: Here is my prototype sketch of the layout.

Schematic

You'd probably never have all these parts populated. The capacitors and output enabled are intended to be jumperable.

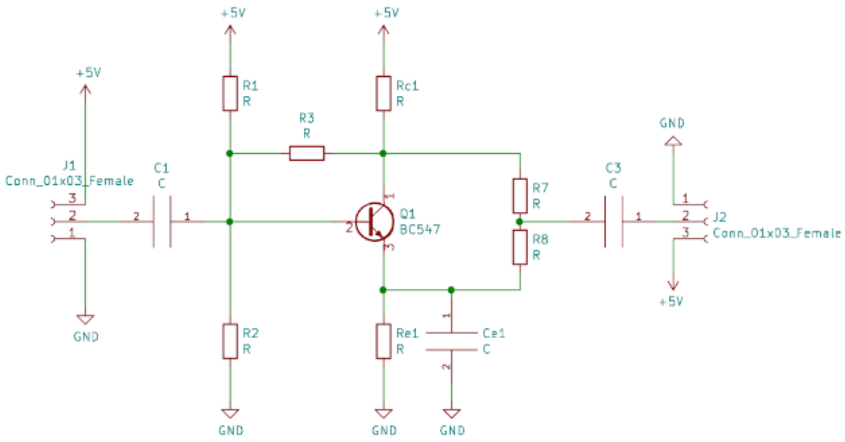

Figure 2: Here is the schematic most of these will be unpopulated or have jumpers in practice.

3D view

PCB

I've ordered a set of boards for testing from JLCPCB.

Manufactorer	JLCPCB
Layers	2
Width	72.4mm
Height	36.8mm
Boards	5
Cost	£6.90

Home etch files

I etch at home but Gerber files are attached below. The resist is mirrored about the horizontal axis which is typically needed, the layout is not.

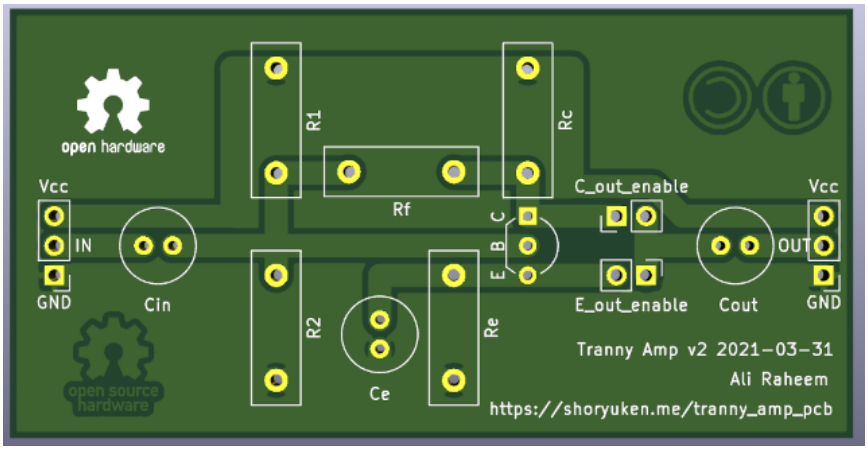

Figure 3: Topside 3D view of the PCB

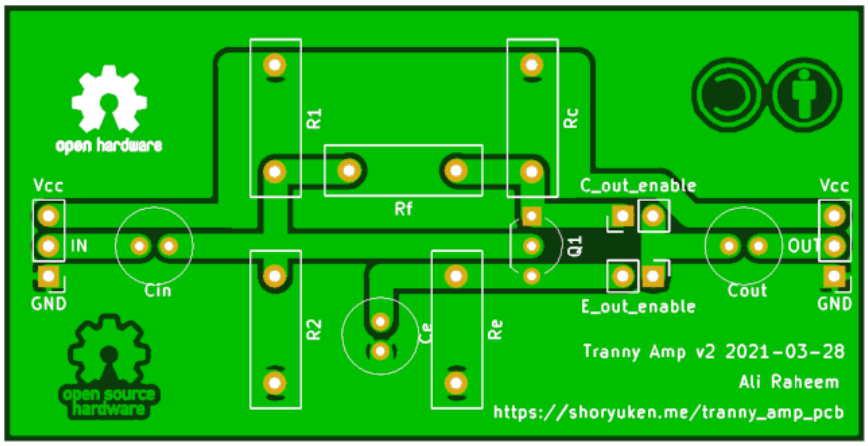

Figure 4: File submitted for JLCPCB manufactoring.

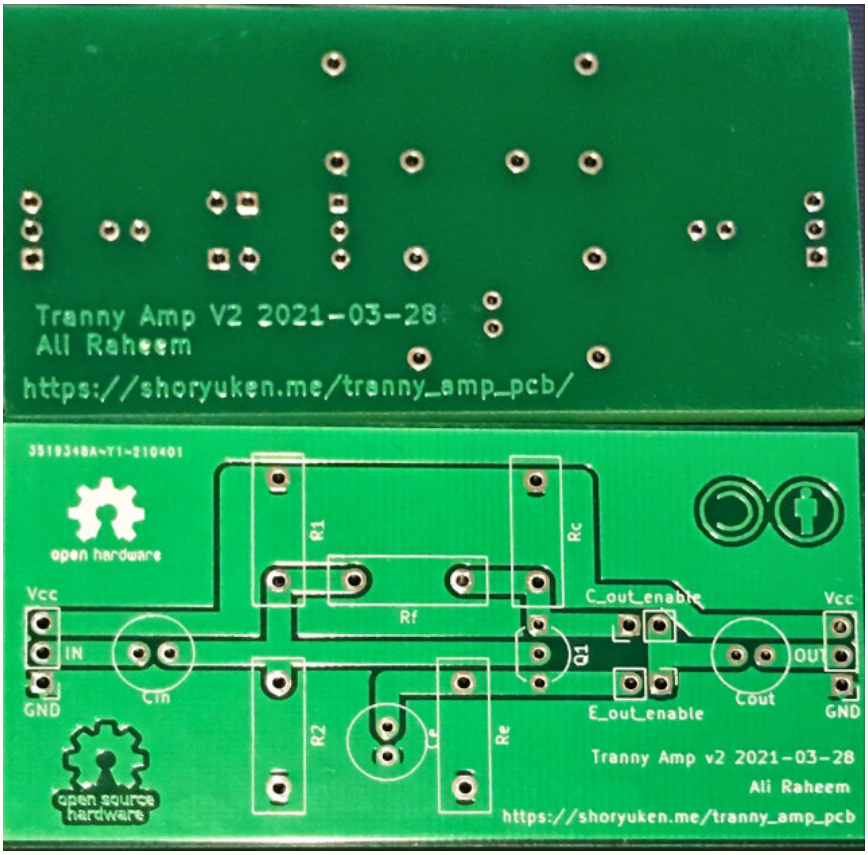

Figure 5: Board back from JLCPCB

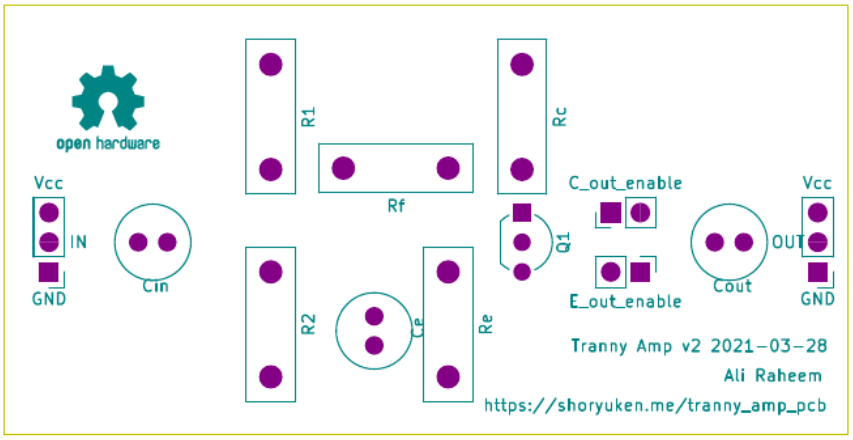

Figure 6: Layout of the parts and drill holes

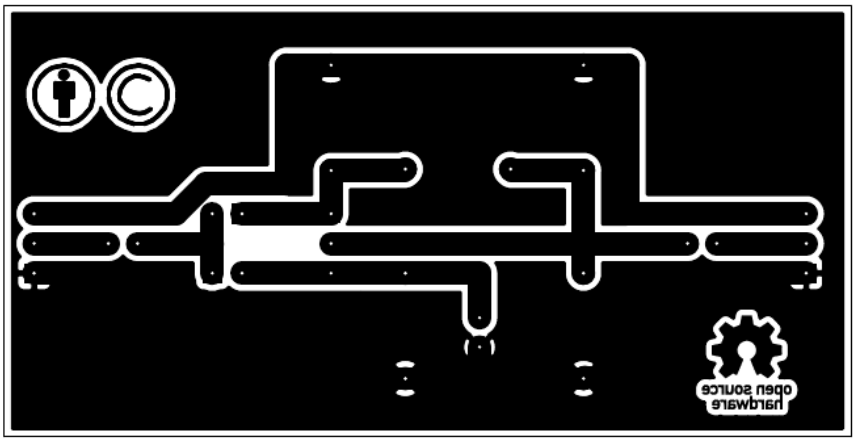

Figure 7: For home etching REVERSED

I've made a few of these (well the original version) and it worked easily with a home etching setup checking on OSH Park it estimates 3 boards for $21 (87x52mm 2 layer). That's pretty steep but this boards has **loads** of dead space most of it down to those axial resistors (R1/2/c/e). One option would be to rotate them or but I couldn't help trying to squeeze it down a bit. Lets call the above the Phat model and we now have...

Slim Model

I've also made a slim version (which is untested and I think tricky for home etching). But should be cheap to have made (OSH Park estimates $7 compared to the phat versions $21 for 3 boards).

Here the resistors are soldered in a radial format (axial resistors can be folded over).

I don't fancy getting in there and soldering the rats nest around the transistor but it's probably less tricky than it looks.

You could always scale it up and make a larger PCB but the tracks would be very thick and it might be hard to keep the iron hot enough especially with the ground fill.

3D view

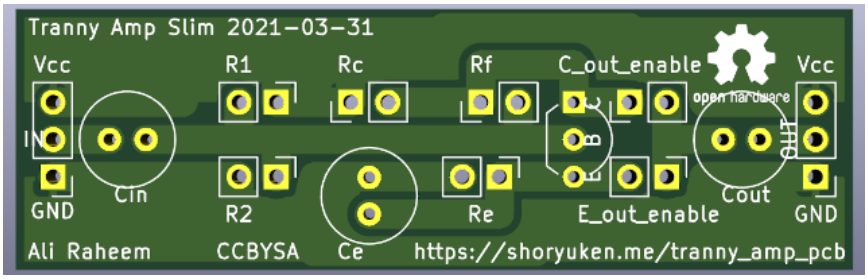

Figure 8: Topside 3D view of the PCB

Layout

Usage

My first use of this was for a simple electret microphone as in figure 10. You can see the abuse of the layout here to add most of a bandpass filter on this

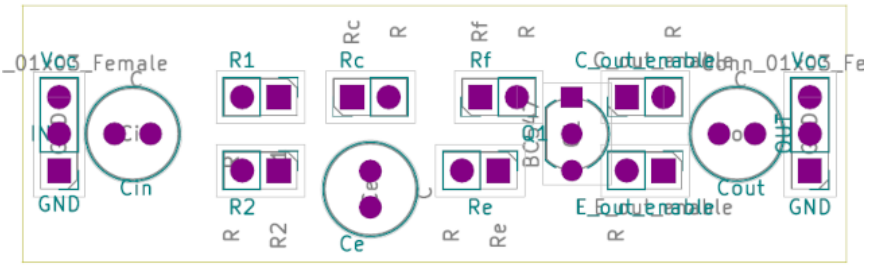

Figure 9: Layout of the parts and drill holes

board it's output goes through a final input resistor to complete it. It's a collector feedback bias NPN amplifier with a BC547C (hfe ~650).

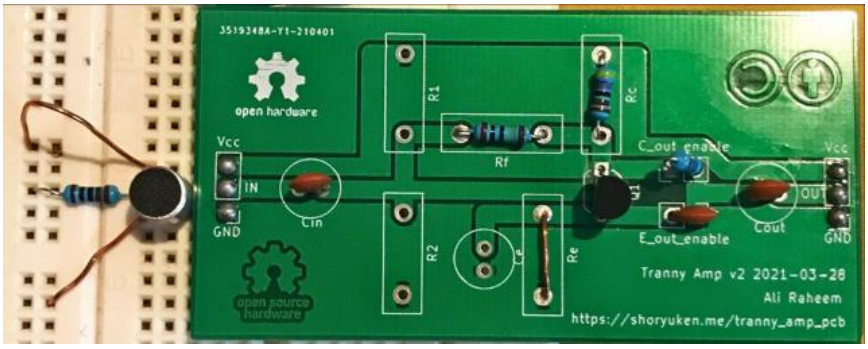

Figure 10: Electret microphone board

Files

- Kicad Files (Recommended phat version)
- Kicard Files for Slim Version

Changes

05-04-2021 Boards ready for shipping from JLCPCB

31-03-2021 Mark transistor Emitter Base and Collector in both models. Add CCSABY and OSHW logos and attribution. Update 3D Renders. Ground fill back copper.

Other Formats

- Web
- Text
- PDF