UBER TUBER

FX TYPE: Tube Overdrive

Important stuff:

The UberTuber is a tube-based overdrive. It requires an 18v 500mA (min.) power supply. I suggest the Dunlop 18v supply if you do not have a PS that meets this requirement.

https://www.amazon.com/Dunlop-ECB004-Adapter-18V-Barrel/dp/B0002E3FBK

You cannot use a charge pump to power the UberTuber. The current requirements are far too high.

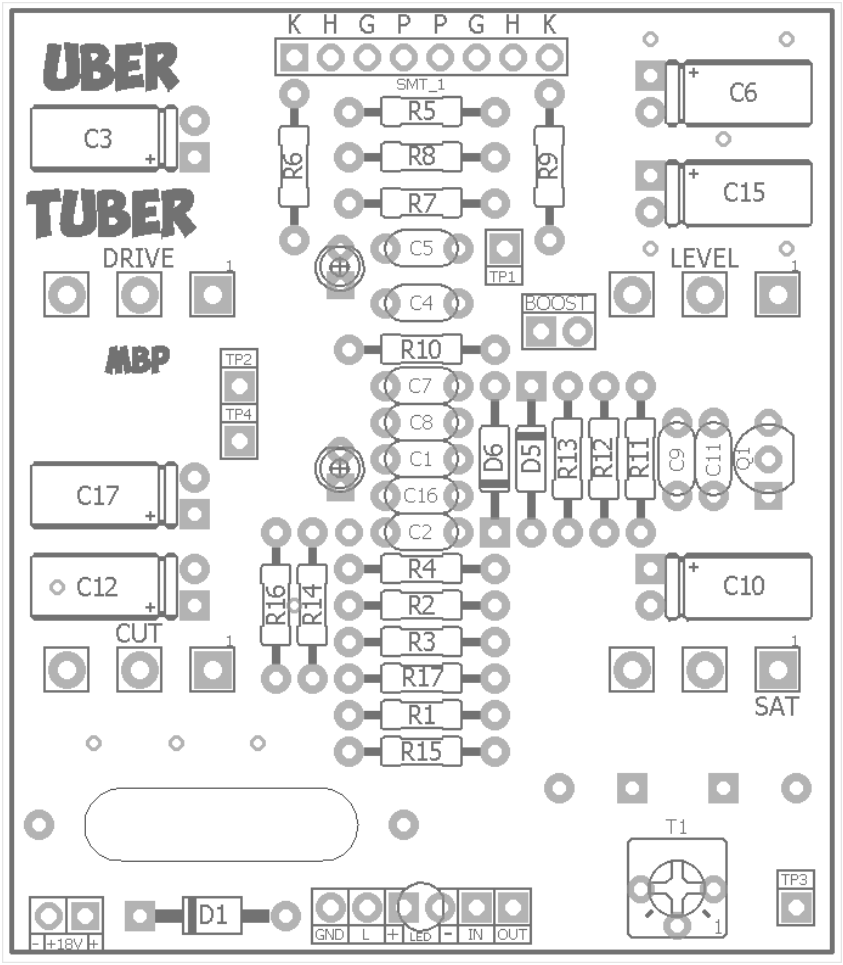
Even though the UberTuber is designed as a relatively low voltage circuit, it requires high current consumption and produces high temperatures. There is a risk of injury if you do not handle it properly.

Always make sure that your power is hooked up correctly. **The tube and 39R 5W resistor will get hot and you will get burned if you touch either.** Be aware of potential capacitor discharge whether or not the circuit is powered.

Use at your own risk: madbeanpedals is not responsible for any injury sustained due to improper handling when building or operating this effect project.

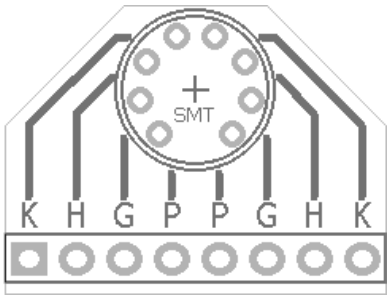
Main Board

2.3" W x 2.625" H



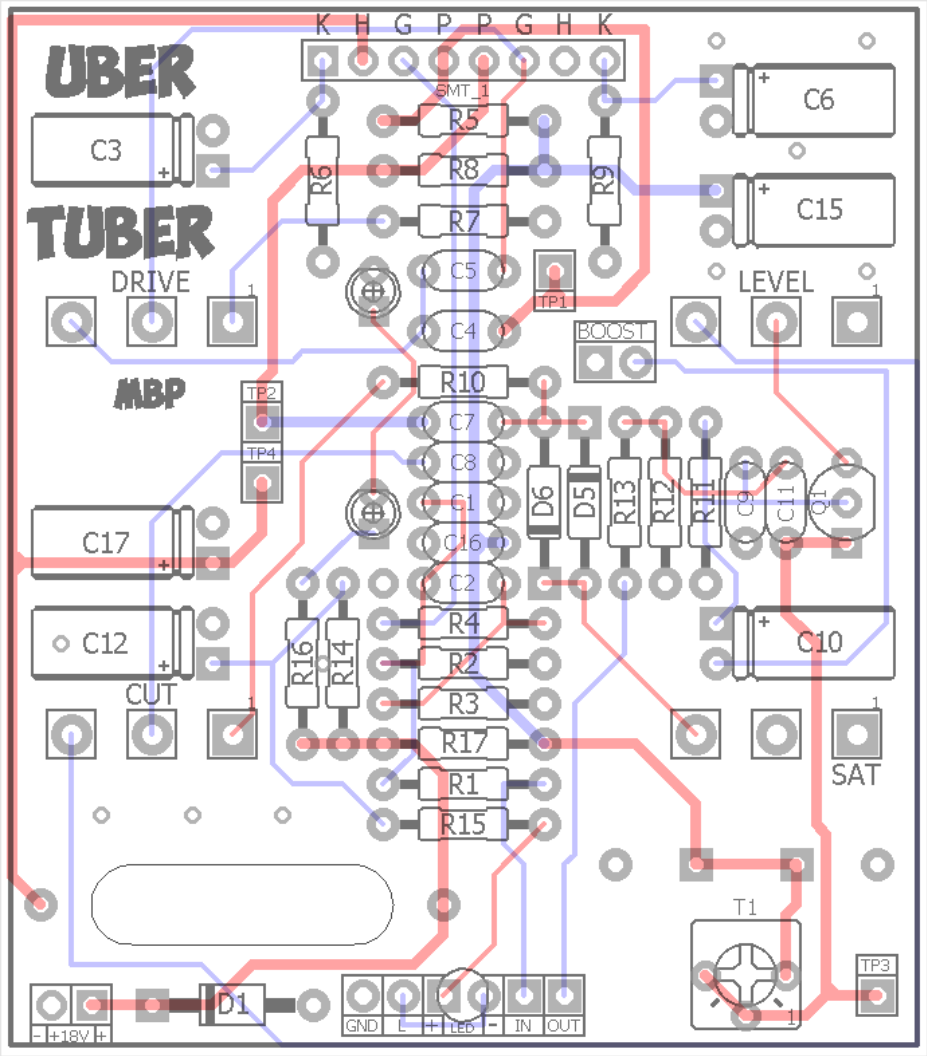
Daughter Board

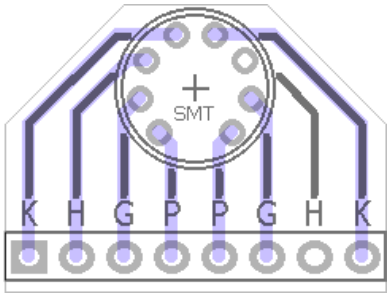
0.6" W x 0.8" H



Terms of Use: *You are free to use purchased **UberTuber** circuit boards for both DIY and small commercial operations. You may not offer **UberTuber** PCBs for resale or as part of a "kit" in a commercial fashion. Peer to peer re-sale is, of course, okay.*

Trace Routing





Unconnected pads are joined via ground planes (not shown).

B.O.M.

Resistors		Caps		Diodes	
R1	1k	C1	100pF	D1	1N4004
R2	1M	C2	47n	D2, D3	LED
R3	1M	C3	1uF	D5, D6	1n914
R4	22k	C4	4n7	**Transistors**	
R5	100k	C5	100pF	Q1	J201
R6	1k5	C6	1uF	**Tube**	
R7	47k	C7	10n	SMT_1	6111
R8	100k	C8	10n	**Switches**	
R9	1k5	C9	22n	BOOST	SPDT
R10	1k5	C10	1uF	**Header**	
R11	1k5	C11	220n	8-pin	Right Angle
R12	47k	C12	1uF	**Trimpot**	
R13	1k	C13	470uF	T1	100k
R14	1k	C14	470uF	**Pots**	
R15	4k7	C15	1uF	SAT	10kB
R16	4k7	C16	100n	CUT	50kA
R17	10R	C17	220uF	LEVEL	100kA
R18	39R			DRIVE	500kB

Shopping List			
Value	QTY	Type	Rating
10R	1	Metal Film	1/2W
39R	1	Wirewound	5W
1k	3	Metal Film	1/4W
1k5	4	Metal Film	1/4W
4k7	2	Metal Film	1/4W
22k	1	Metal Film	1/4W
47k	2	Metal Film	1/4W
100k	2	Metal Film	1/4W
1M	2	Metal Film	1/4W
100pF	1	Ceramic / MLCC	25v min.
100pF	1	Silver Mica	25v min.
4n7	1	Film	25v min.
10n	2	Film	25v min.
22n	1	Film	25v min.
47n	1	Film	25v min.
100n	1	Film	25v min.
220n	1	Film	25v min.
1uF	5	Electrolytic	25v
220uF	1	Electrolytic	16v
470uF	2	Electrolytic	25v
1N4004	1	Electrolytic	25v
LED	2	Diffused	3mm
1n914	2		
J201	1		
SMT	1	6111*	
Header	1	8-pin, Right Angle	2.54mm
SPDT	1	On/On	
100k	1	Bourns 3362p	
10kB	1	Long Pin PCB Mout	16mm
50kA	1	Long Pin PCB Mout	16mm
100kA	1	Long Pin PCB Mout	16mm
500kB	1	Long Pin PCB Mout	16mm

The 10R 1/2W resistor, 39R 5W resistor and the 8-pin header are included with purchase.

6111 Tube (You can use either the 6111 or 6111WA):
http://www.smallbear-electronics.mybigcommerce.com/miniature-tube-6111/

https://www.ebay.com/bhp/6111-tube

https://vacuumtubesinc.com/index.php/vacuum-tubes/6111-6111a.html

https://www.tubesforamps.com/products/subminiatures/6111wa-jan-nos

If you are a registered member of CE Distribution (limited to business accounts)
https://www.cedist.com/products/6111-triode-dual

6021 Tube alternative (untested in this build but it should work):
http://www.smallbear-electronics.mybigcommerce.com/miniature-tube-6021-cv3986/

100pF Silver Mica:
http://www.smallbear-electronics.mybigcommerce.com/capacitor-silver-mica-500v-10-pf-150-pf/

https://www.mouser.com/ProductDetail/Cornell-Dubilier-CDE/CD15FD101JO3F?qs=sGAEpiMZZMtLiKaZgV7flTkVLq%2fu65ALlmXuWCi9kNM%3d

1uF Electrolytic 50v:
https://www.mouser.com/ProductDetail/Nichicon/ULD1H010MDD1TD?qs=sGAEpiMZZMtZ1n0r9vR22cXWQnLnjDinFsxa2E5ImEjMTI9PsIgiMw%3d%3d

220uF 25v:
https://www.mouser.com/ProductDetail/Nichicon/UVY1E221MED1TA?qs=%2fha2pyFadug%252bs0LsNjY22vGWm9SbQ1CrDAO7VU0dAdbxfChAbLDnSA%3d%3d

470uF 35v:
https://www.mouser.com/ProductDetail/Nichicon/URZ1V471MHD1TO?qs=sGAEpiMZZMtZ1n0r9vR22bs3wl%252bFWq8FknDGs%252bDDobM%3d

1N4004:
https://www.mouser.com/ProductDetail/Diodes-Incorporated/1N4004-T?qs=sGAEpiMZZMtbRapU8LIZD6Aoap19JQAxV7DXsJ2UlJI%3d

J201:
http://www.smallbear-electronics.mybigcommerce.com/transistor-fet-j201-generic/

Bourns 3362p 100k trimpot:
https://www.mouser.com/ProductDetail/Bourns/3362P-1-104LF?qs=sGAEpiMZZMvygUB3GLcD7I39JMs%2f%2f%2fLOs09gVZSzi2c%3d

SPDT:
http://www.smallbear-electronics.mybigcommerce.com/spdt-on-on-short-lever/

SubMini SPDT:
http://www.smallbear-electronics.mybigcommerce.com/spdt-on-on-mountain-10tc410/

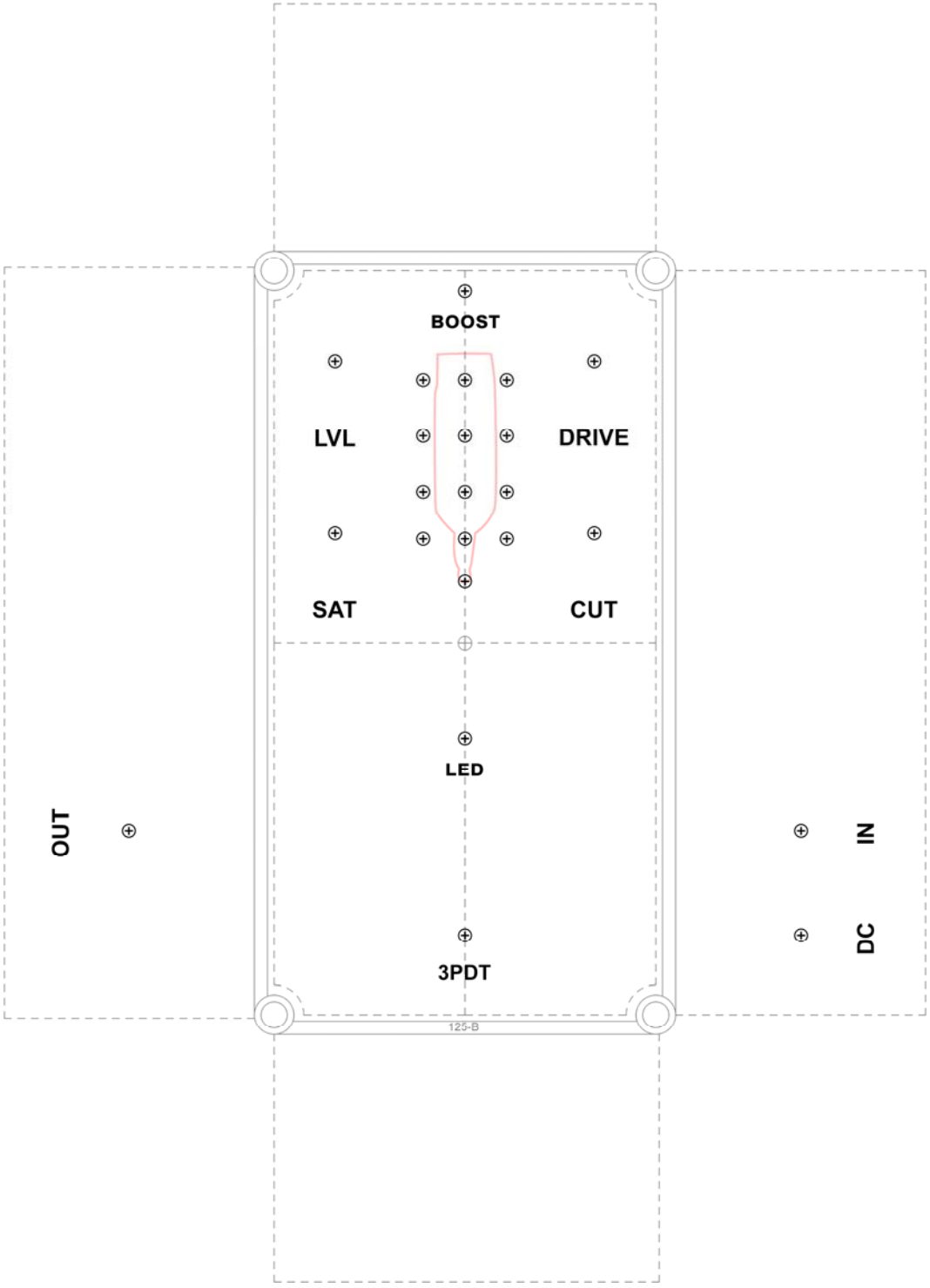
16mm Right Angle Long Pin Pots:
http://www.smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-rt-angle-pc-mt-long-pin-linear-audio/

Lumberg ¼" Jacks (recommended, but not required):
http://www.smallbear-electronics.mybigcommerce.com/lumberg-1-4-compact-shrouded-mono-jack/

DC Jack (required for size):
http://www.smallbear-electronics.mybigcommerce.com/dc-power-jack-all-plastic-unswitched-2-1-mm/

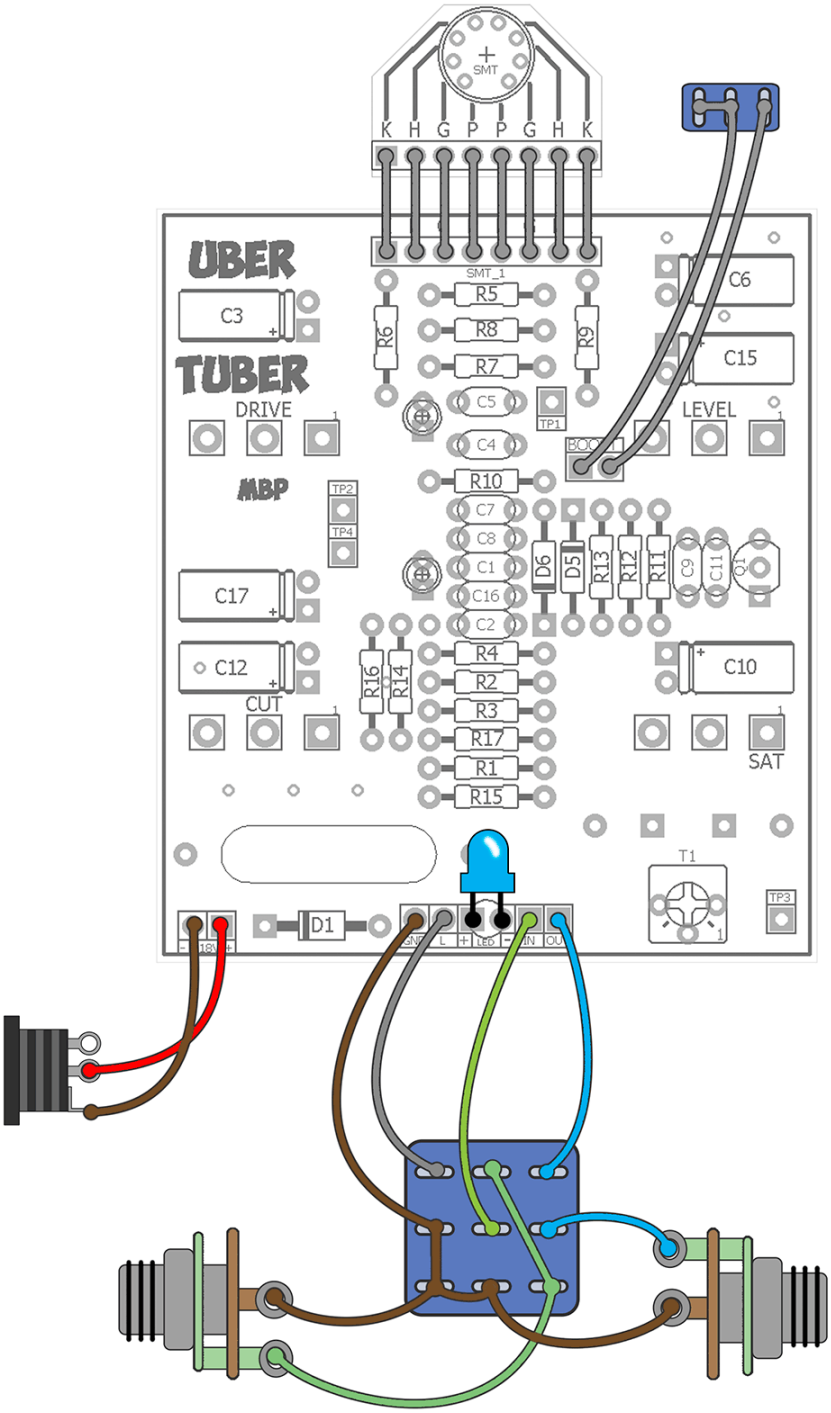
125B Drill Guide

7.65" H x 5.52" W



The red outline shows the approximate dimensions of the sub-mini tube. The drill spots over it are for drilling vent holes to allow heat to escape from the 125B enclosure. This may not be totally necessary but I recommend doing it. It's a little more work but could prevent overheating and it looks cool. Just use a drill bit that's small enough to leave space between holes.

Wiring Guide



The **UberTuber** is the 10th subminiature tube circuit project I designed. Wait…"What the ham and crackers", you say? "You've never released a tube project!" True…none of the previous nine projects were terribly good. I could never quite get it right; whether it was in how to handle the power supply, the actual layout and mounting of the tube, or just the circuit idea itself. The UberTuber is the first one I felt was good enough for public consumption. And…it is really, really good (I'm a humble man).

Why a tube overdrive? Because we can, silly! But, there is more to it. A tube overdrive bridges the gap between a discrete overdrive and a high gain tube amp. We use discrete components in our overdrive pedals to mimic or add to that sweet compression we get from pre-amp tubes running at a few hundred volts in our amplifiers. And, discrete designs do a great job at that…usually. But, a sub-mini tube overdrive gives us an alternative – some of that compression and even harmonics good amps produce at relatively low voltages.

Some sub-mini tubes are capable of running at 80-100v, however I chose to stick to a relatively safe 18v. The main reason for this is safety for the builder. With proper handling, this project is relatively safe to make and while there is a risk of injury you probably won't electrocute yourself. But, as I mentioned on pg.1 you must be careful when handling. I've burned myself on the tube and 5W resistor more than once because I got careless. You will too, if you are not careful. So, do the thing and not the other thing.

Controls

- **Level –** Sets the total volume output.
- **Drive –** Sets the amount of overdrive.
- **Sat –** CCW: minimum saturation for more of a boost. CW: maximum saturation for thicker overdrive.
- **Cut –** CW: rolls off treble.
- **Boost** – This switch increases volume output while adding some pick attack. Basically the UberTuber but rude. A RuderUberTuber, if you will.
- **T1** – Sets the bias point of the output JFET.

Notes

Please see the build guide at the end of this document.

The sub-mini tube has two sources of power: heater and plate voltages. In our case the sub-mini heater runs optimally at 6.3v. Current consumption is approximately 300mA from the datasheet. The heater voltage is produced by using a large resistor to drop the supply voltage to the appropriate value under load. This works out to be 39 Ohms at 5W. To calculate that we use these two formulas:

V =I*R
Rearranging for R we calculate the needed resistance by getting the voltage difference and dividing by the current draw. Here R is Ohms, V is Volts and I is Amperes.

R = (18 – 6.3)/0.3 = 39 Ohm

To calculate the necessary wattage for the resistor we use
P = I^2*R
Where P is Watts, I is amperes and R is Ohms. This gives us

P = 0.3*0.3*39 = 3.51W

3.51W is the minimum wattage we want to use to ensure our dropping resistor doesn't burn up. So, in this case we'll use 5W.

BTW: you might wonder why insist on an 18v supply for the entire circuit? Why not use a 9v supply, use the appropriate value dropping resistor for the tube heaters and then use a charge pump to get the 18v for the lower current needed for the tube plates? The answer is you could do that in some cases. For this first tube design I decided to play it safe: a dedicated supply with tons of decoupling and filtering to make this overdrive very quiet and avoid any potential noise or heterodyne the circuit might produce with other effects.

Mods

The one area I compromised on in the circuit was in dialing in the bass frequencies. As designed, C4 and the Drive pot form a high pass filter that rolls off some of low end. The reason I choose C4 as 4n7 is that higher values tended to get very flubby with high Drive settings on neck pickups. So much so that it seemed necessary to dial some of it out to keep the circuit balanced. If you want more bass and don't care about a flabby fat neck pickup then use 15n or 22n for C4.

Voltages

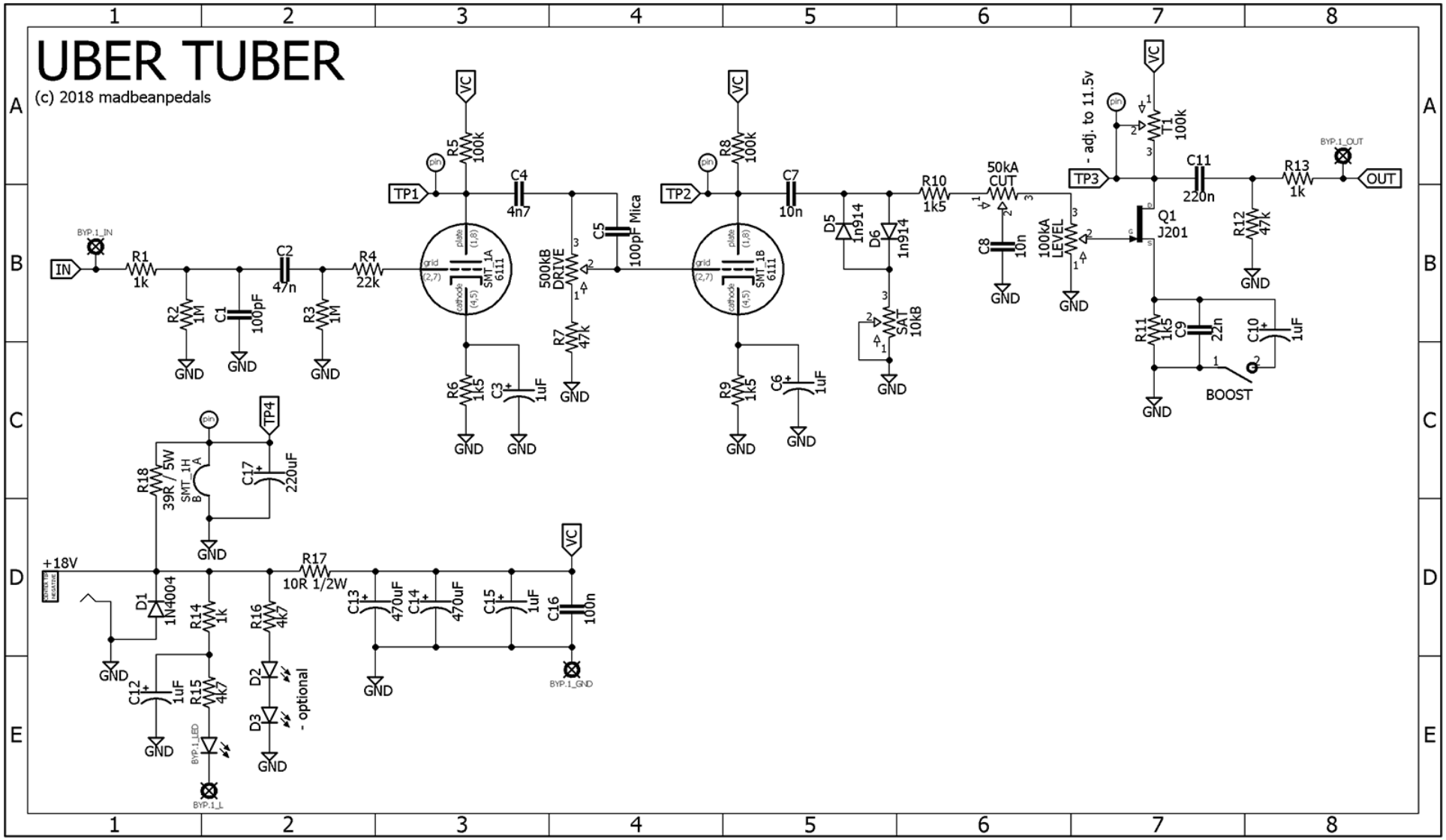
There are four test points for voltages, TP1 – TP4. Use your multimeter to verify these voltages on your build:

TP1 and **TP2** are the two plate voltages. These should be between 11 and 11.5v.
TP3 is the drain voltage for Q1. Using the 100k trimmer set the voltage on TP3 to about 11.5v.
TP4 is the heater. It should read about 6.3v. A little above or below is fine.

The **VC** voltage should be between 17.5v and 18v. It can be measured by taking a reading on the positive lead of either C13 or C14 on the top of the main board.

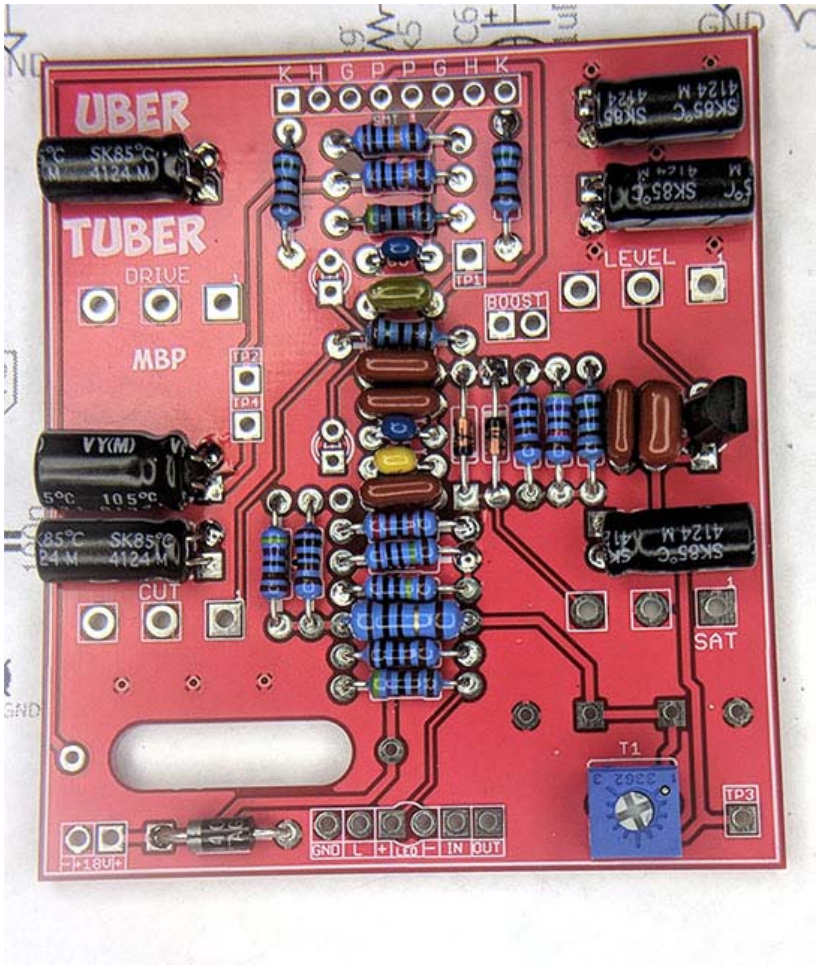
My Voltages		
TP1	Plate	11.52v
TP2	Plate	11.36v
TP3	Q1 Drain	11.5v
TP4	Heater	6.36v
VC		17.97v

Current Draw: 309mA @ 18v


UBER TUBER
(c) 2018 madbeanpedals
IN
BYP.1_IN
R1 1k
R2 1M
C1 100pF
R3 1M
C2 47n
R4 22k
TP1
R5 100k
C4 4n7
R6 1k5
C3 1uF
R7 47k
500kB DRIVE
C5 100pF Mica
TP2
R8 100k
C7 10n
R9 1k5
C6 1uF
D5 1n914
D6 1n914
SAT 10kB
R10 1k5
50kA CUT
C8 10n
100kA LEVEL
TP3
- adj. to 11.5v
T1 100k
C11 220n
Q1 J201
R12 47k
R13 1k
OUT
BYP.1_OUT
R11 1k5
C9 22n
C10 1uF
BOOST
TP4
R18 39R / 5W
C17 220uF
+18V
R17 10R 1/2W
D1 1N4004
R14 1k
R16 4k7
C12 1uF
R15 4k7
D2
D3
- optional
C13 470uF
C14 470uF
C15 1uF
C16 100n
BYP.1_GND
BYP.1_LED
BYP.1_L
VC
GND

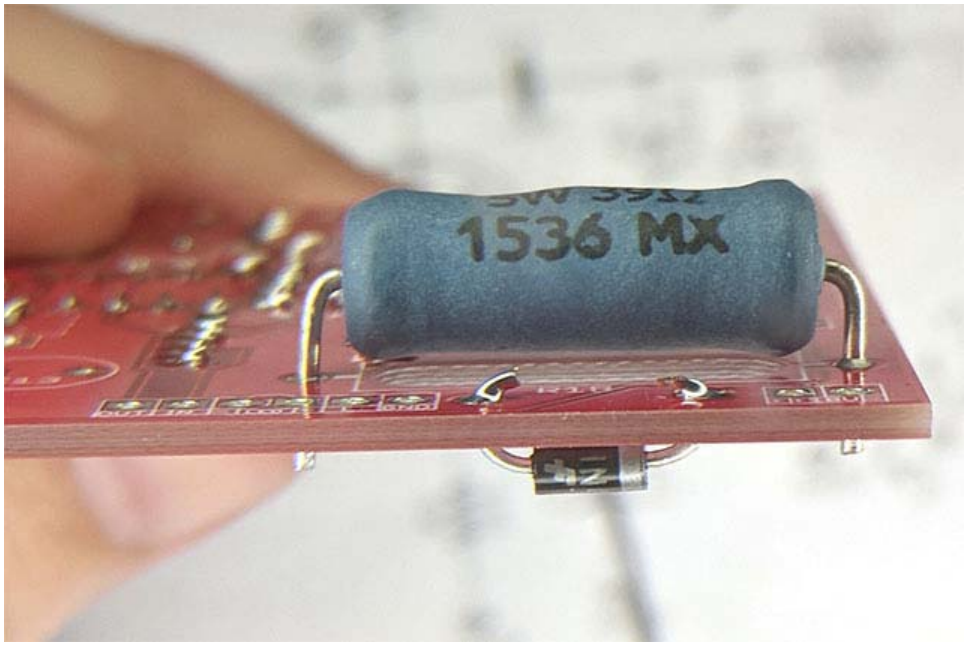
Build Guide

The UberTuber comprises two PCBs: the main board and daughter board. The main board houses all the circuit components. The daughter board holds the sub-mini tube. The daughter board is mounted at a right angle to the main board. When completed, the tube and control pots are on the same side (facing the top of the enclosure).

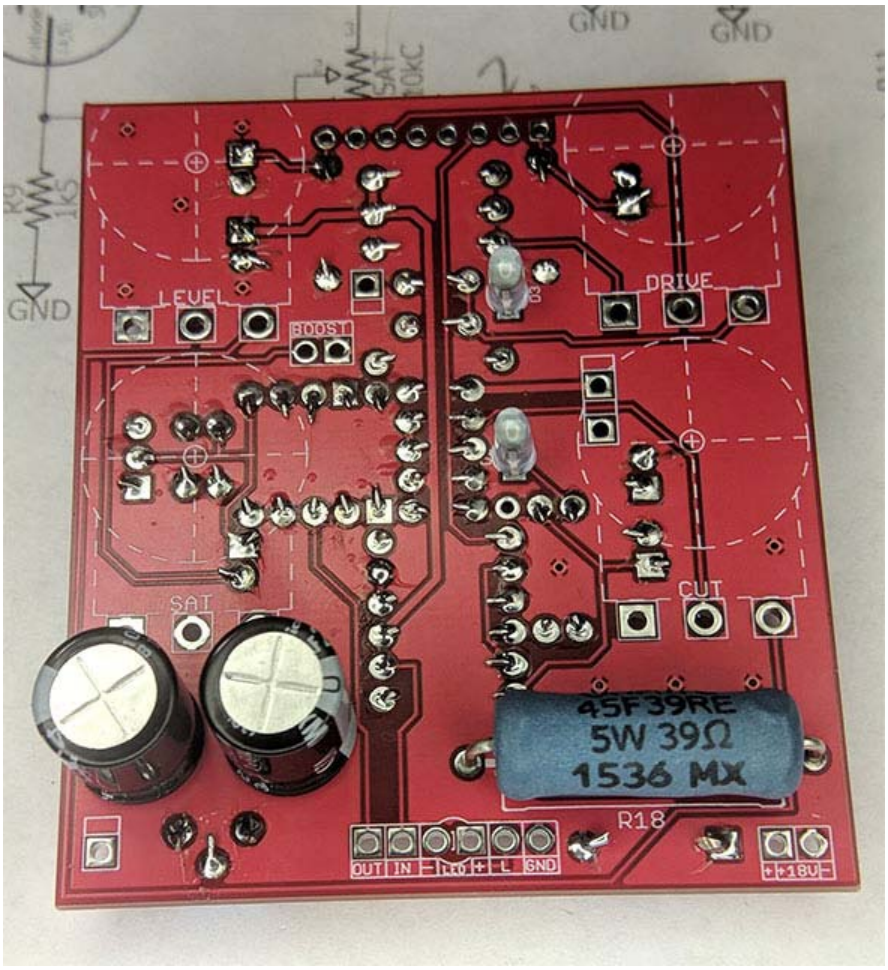


Begin by populating all the top layer components and soldering them in place. The electrolytic caps are bent as shown to be parallel to the board. This keeps their height low and helps fit everything in the 125B. If you use low-profile electrolytic caps (under 5mm high) you don't need to bend them at 90°: just solder them flush mounted.

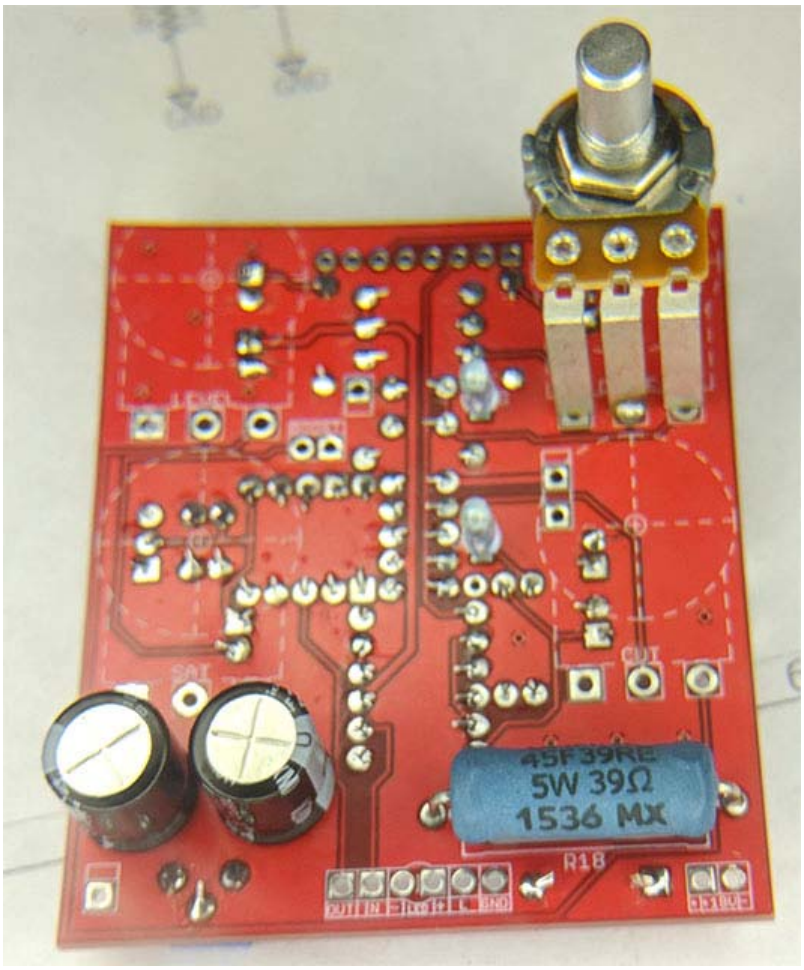
BTW: this version used a 470pF for C5 which I later changed to 100pF Silver Mica.



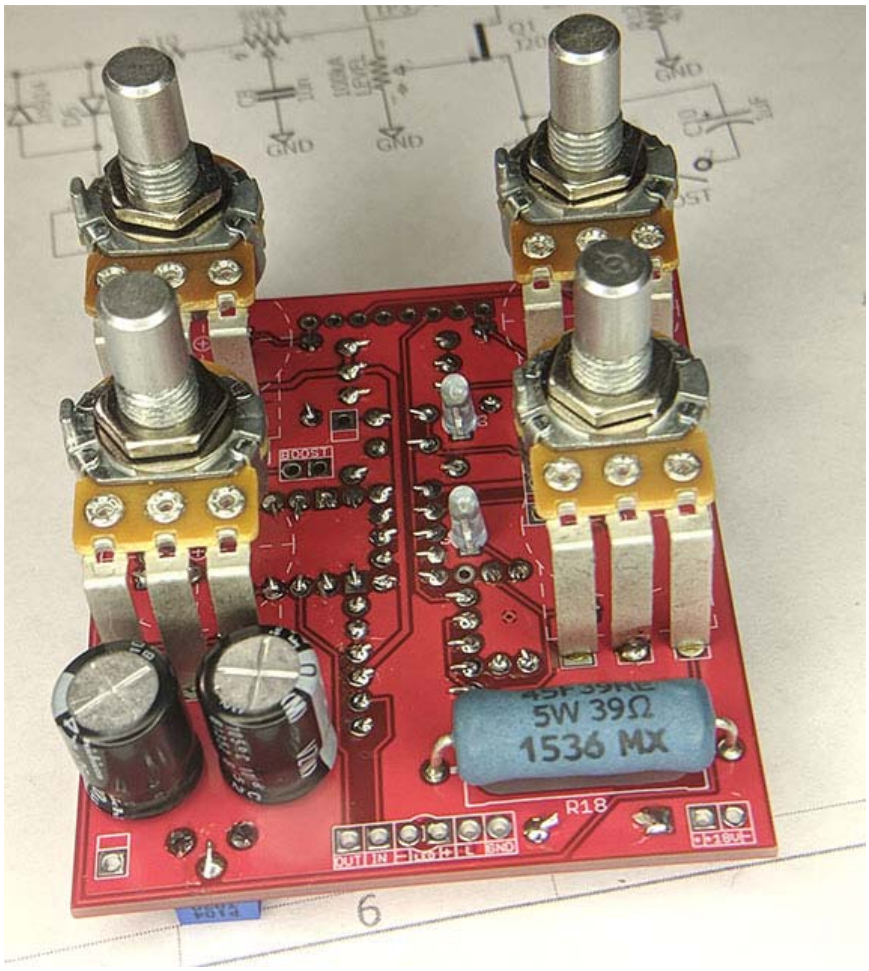
Solder the 39R 5W resistor on the bottom of the PCB as shown. While there is a cut-out on the PCB to allow heat to pass through the board, it's important to leave a small air gap between the resistor and PCB. This will prevent the PCB from taking excess heat and potentially damaging it.



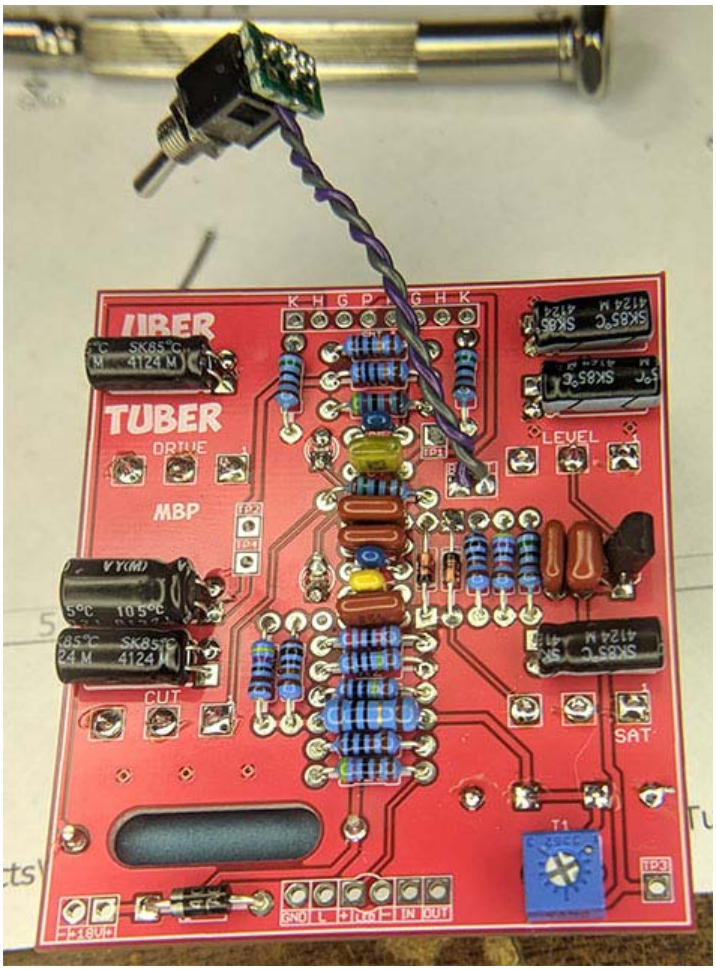
Solder the two 470uF caps to the bottom of the PCB. Then solder the two 3MM LEDs. Note: these LEDs are optional and not necessary to make the circuit work. They serve to light up the tube if you are drilling air vents into your enclosure (something you should do). You can omit the LEDs if you want.



Soldering the pots is more of a challenge than usual because there is no support to hold them in place. What I recommend doing it soldering the middle pin then while the solder is hot gently move it into place so the pins and PCB are at a right angle. Don't force this too hard or you will damage the PCB pads!



Solder the middle pins of the remaining pots like you did the first one. After that, flip the board over and top solder the remaining pins on all the pots. You should probably trim the tabs off the pots before soldering them in…unlike me.

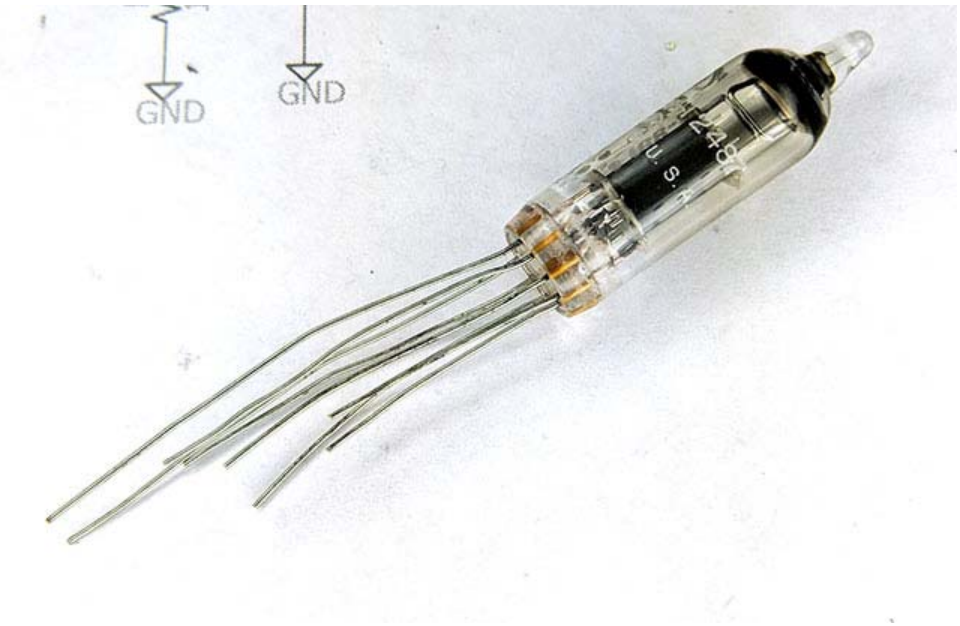


Next solder the switch in for the Boost control. You can use a regular size SPDT or a mini switch like I did here. Either should fit.

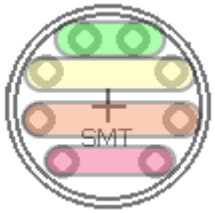
The leads on the tube form a U shape. This tells you the orientation.

You can see the same configuration on the daughter board. The pin layout is:
K: Cathode
H: Heater
G: Grid
P: Plate

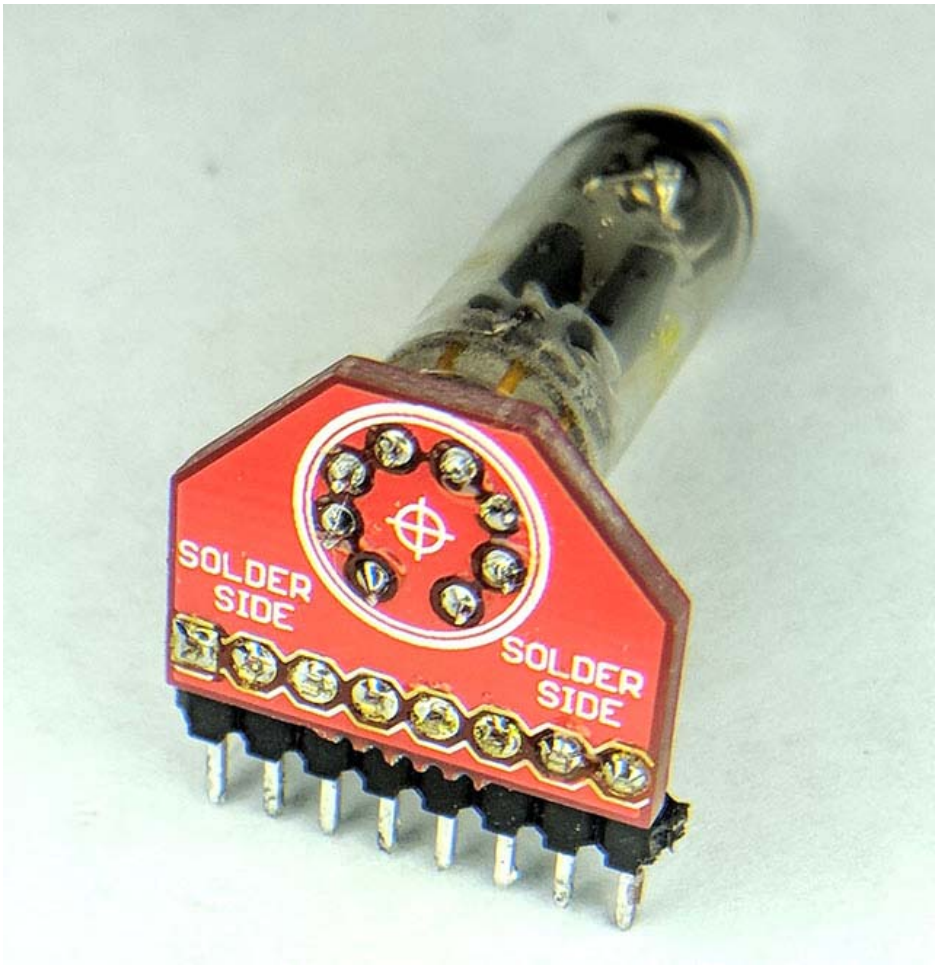
The pin layout is symmetrical along the vertical axis. The labeled side of the daughter board is the solder side. However, if you accidently solder to the other side don't worry – it will still work because of the symmetry.



Inserting the tube into the daughter board can be a bit aggravating. I found this procedure makes it a lot easier: cut pairs of leads to different lengths across the vertical access. This means you only have to insert two leads at a time rather than all 8.

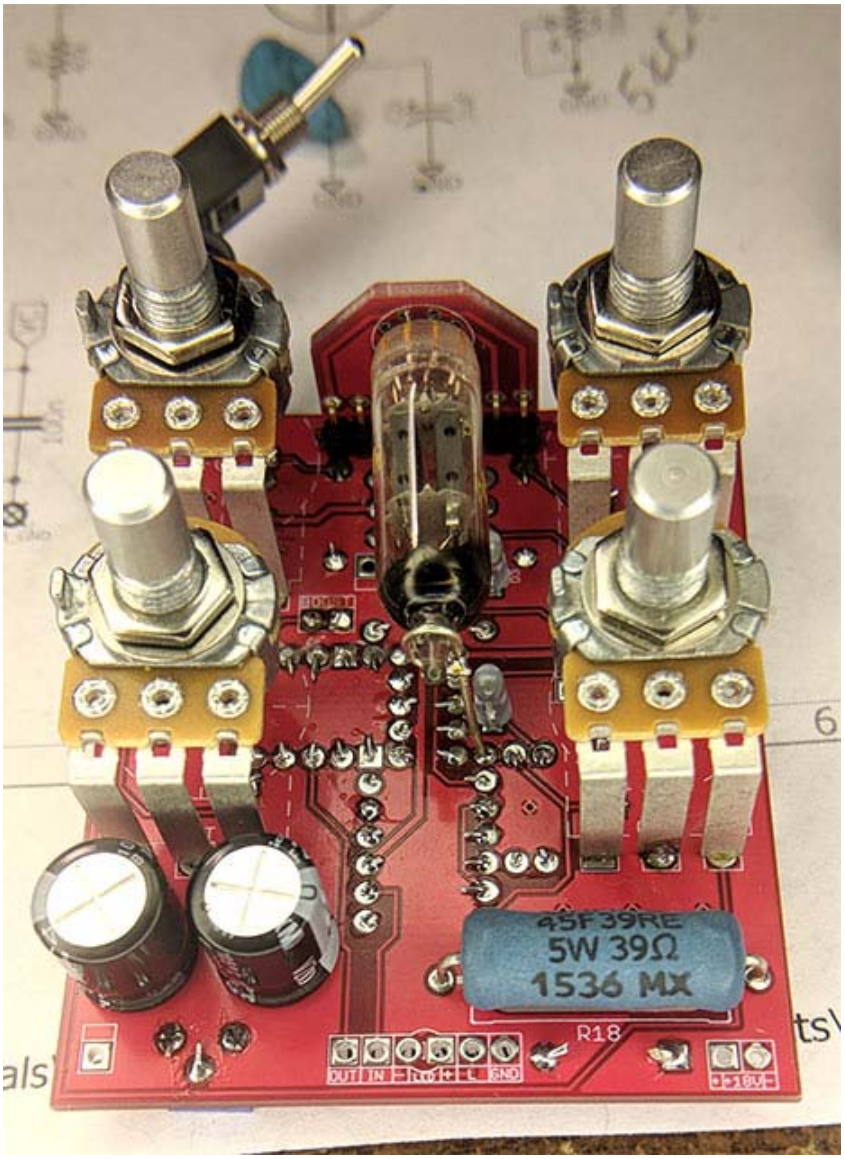


Cut these pairs of pins to different lengths



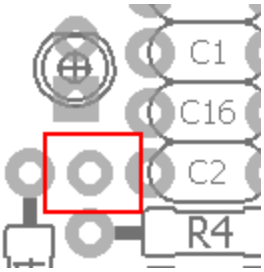
Note: this is a different daughter board I used on the prototype. It is slight taller than the final production board.

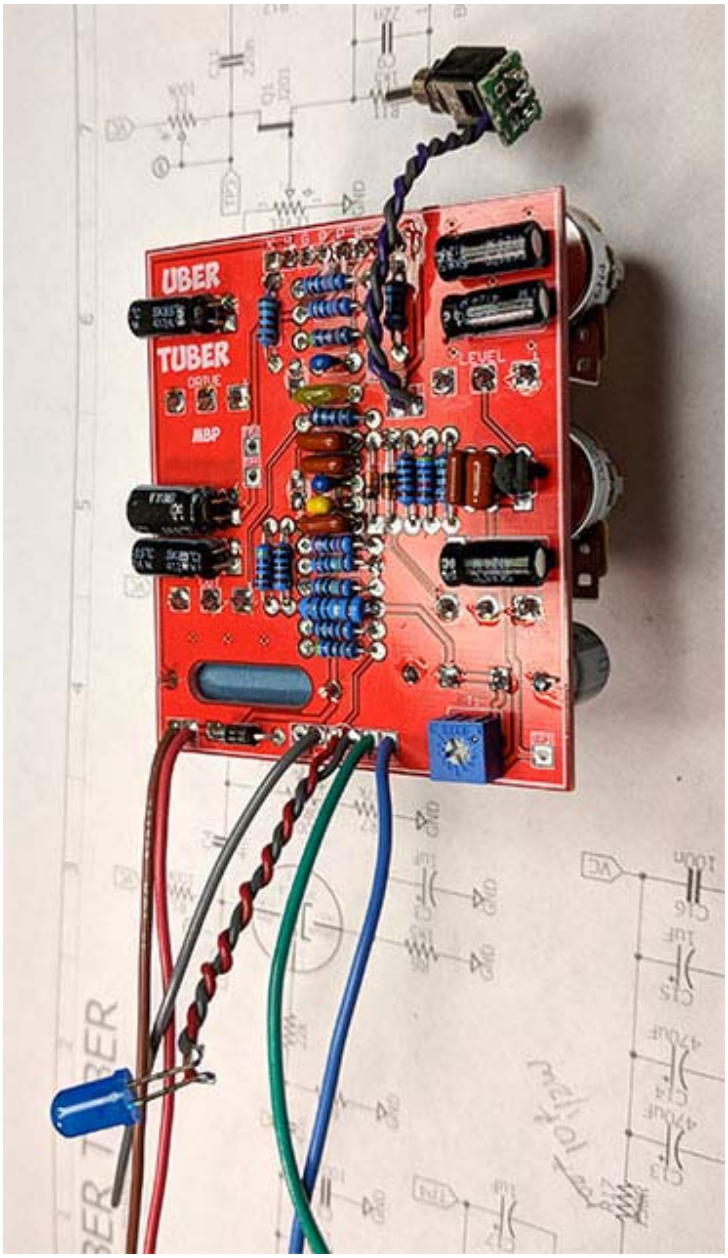
Push the tube so that it flush mounted to the PCB and solder the pins in place. Next, install the right angle pins. Solder the long side of the pins to the daughter board and trim the excess. The short side of the pins are the ones that get soldered to the main board.



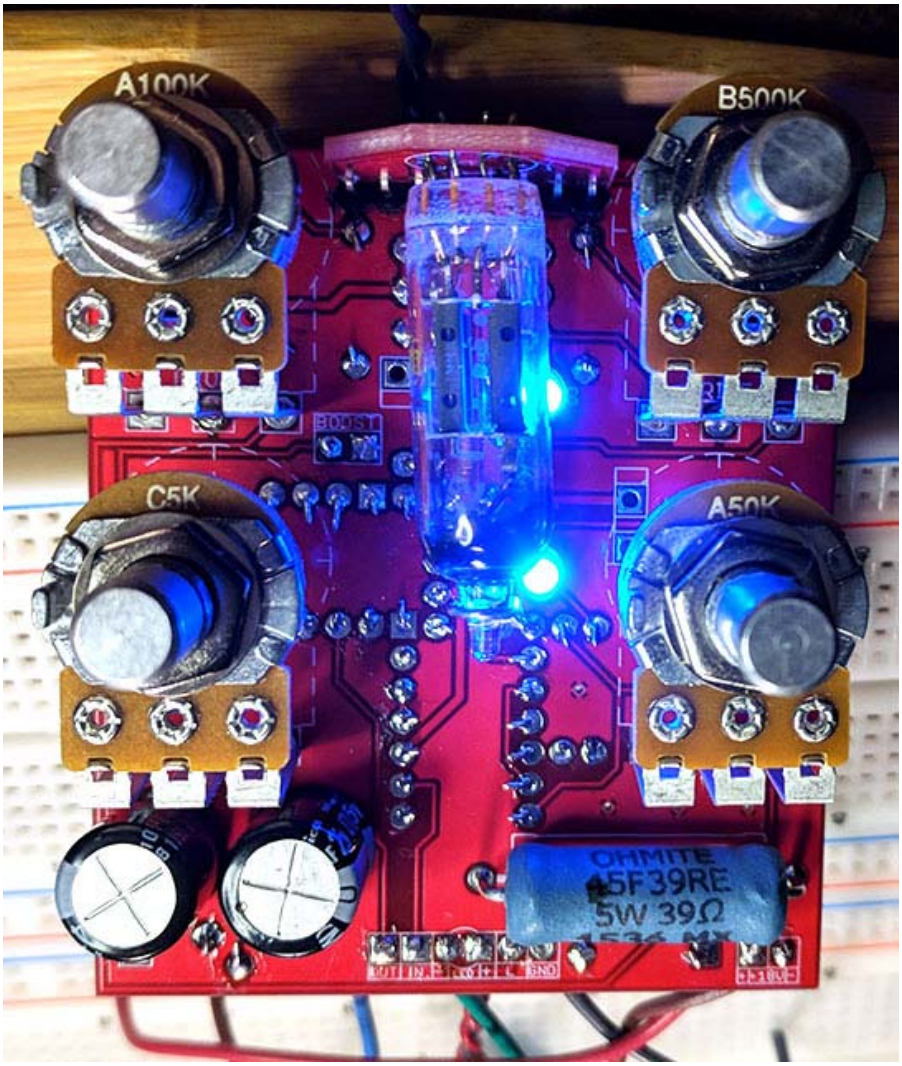
Solder the completed daughter board to the main board. This is also tricky like the pots because there is no support. The way I did it was to use some BluTac on the right angle pin header to hold the daughter board at an approximate right angle. Then I soldered one of the middle pins of the header on top. After that, I very gently pushed the daughter board into place so it formed a 90° angle with the main board. Use whatever method you want to get the end result – just be gentle when moving or pushing the daughter board around so you don't damage any solder joints or pads.

I also installed a small support for the tip of the tube. This is probably not necessary but it certainly doesn't hurt. I used some 20 gauge buss wire, bent one end into a small circle and soldered. The other end is soldered into this extra pad on the main PCB.





The completed assembly with the I/O wires soldered in. You can PCB mount your bypass indicator LED if you want. I soldered the blue LED with wires because that's the color I wanted for this build and I did not have any with full leads.



The completed circuit with power. You can see the LEDs I used are pretty bright! Again, those are optional. If you don't like them, don't use them. Once they are installed you cannot turn them off when the circuit is powered.

Again: when the circuit is powered keep your fingers away from the tube and 39R resistor. You will get burned if you touch them. It generally takes them a few minutes to cool off when the power is removed.

BTW: The 5kC pot was later changed to 10kB so don't be confused by that.