Cuz they's made for Giggin' !

Version 2.0.5

It is HIGHLY recommended that you read through all this documentation before undertaking this project. Don't let the size of this document scare you though, I just made few assumptions and tried to share the experience I had in as much detail as possible regarding this build. If you are already experienced with building DIY pedals and getting them mounted into enclosures, you are well on the way to a successful build.

Introduction, the Frog F-1a Tube Preamp PCB

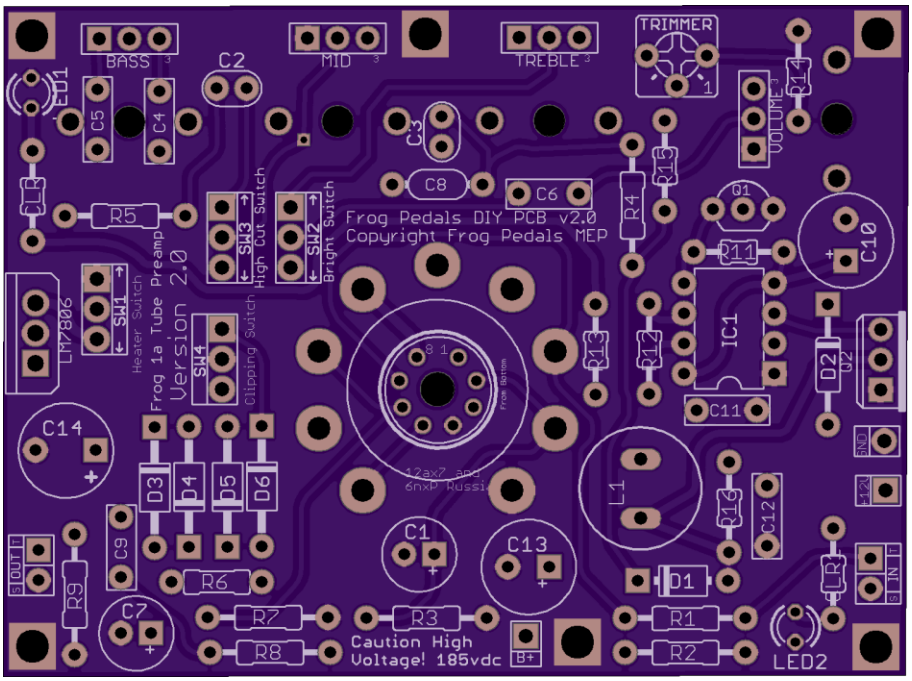

Sample Build using Russian Subminiature Vacuum tubes and my Ruggedized with standard preamp tube mounted on bracket internally

The Frog F1a tube preamp is based on the preamp section of the iconic Fender Dual Showman of the late 60's which was famous for its clean powerful tone. The folks at Alembic started producing a rack mounted version of this preamp in the 70's. It could be found in the racks of guitarists like David Gilmour and Phil Lesh and bassists like Bootsy Collins among many others. In recent years, the price of these units has begun to climb all the way up to $1000 - $1500. This build allows for the same legendary tone in a 1590BB style enclosure powered by a 9-12volt DC power supply.

Due to the high DC voltage in this build I do not recommend this as an option for someone's first build.

For periodic updates to this documentation and other additional information, you can go to www.frogpedals.com and join me on frogpedals Facebook page.

The bare board measures about 3 inches by 2.25 inches (77mm by 57mm)



Power Supply

With on-board switch mode power supply (SMPS) charge pump circuitry, the 9-12 volts DC is pumped up to an amazing 185+ volts DC which is supplied to the standard tube amp circuitry for Class A operation. No starved plate here.

Reminder: This voltage is no joke, and improper handling of the circuit can at the least knock you on your butt, and at worst could kill you. Always test the B+ test point (to right of R3 above) and a ground pad (standoff plated holes) with a volt/ohm meter for low/no voltage before handling!

Preamp Tube support

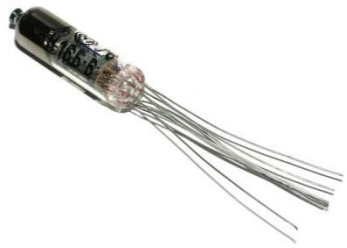
I have provided for regulated 6 volt DC heater supply to eliminate hum. There is also a heater switching option, built into the PCB circuit so you can use almost any 12ax7 or 6NxP Russian (or western 6vdc heater) twin triode preamp tube.

There is also solder-able socketing for the Russian 6n16b/6n17b subminiature tubes which are used in military guidance systems for their ruggedness. Only the cathode resistor is different and you don't need the heater switch. I have made this version with both a 6n16b and 6n17b Russian subminiature tube and it sounds great!

Here is a list of preamp tubes I have used so-far:

- 12AX7
- 12AU7

- 12BH7
- 12AT7
- 6n1P Russian equivalent of 12AU7
- 6n2P Russian equivalent of 12AX7
- 6GA7
- 6n16/6n17b subminiature



Tone

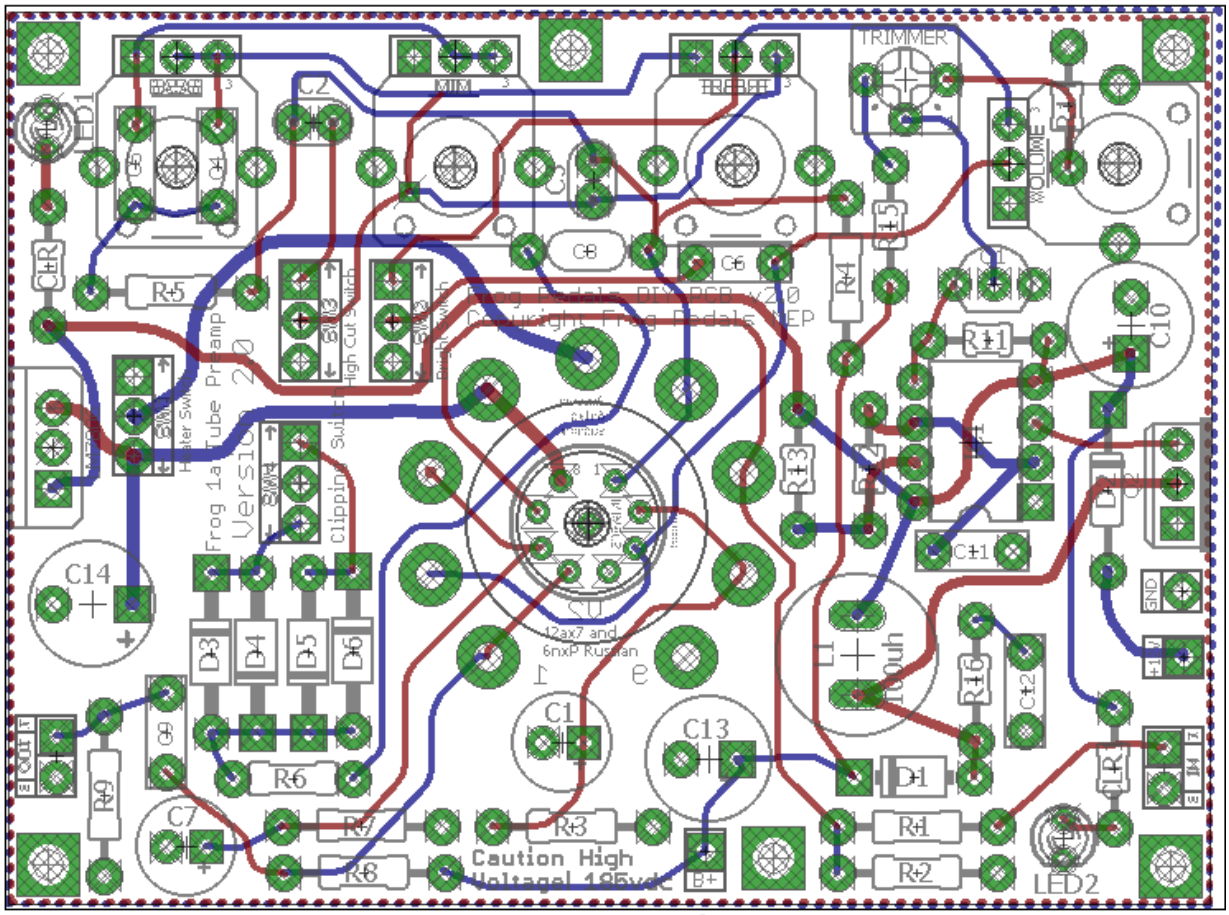
The original Fender bright switch is there with an additional switch added for mid bypass boost. I love this option. With these switching configurations, it kind of gives you a rhythm/lead type of vibe.

You can use different components for the standard Fender or Marshall tone section if you want. These two tone stack configurations are listed in the bill of materials (BOM). Use the Duncan Amp Tone Stack Calculator to see how the different component selections (see BOM table sections later in this document) affect the frequency response.

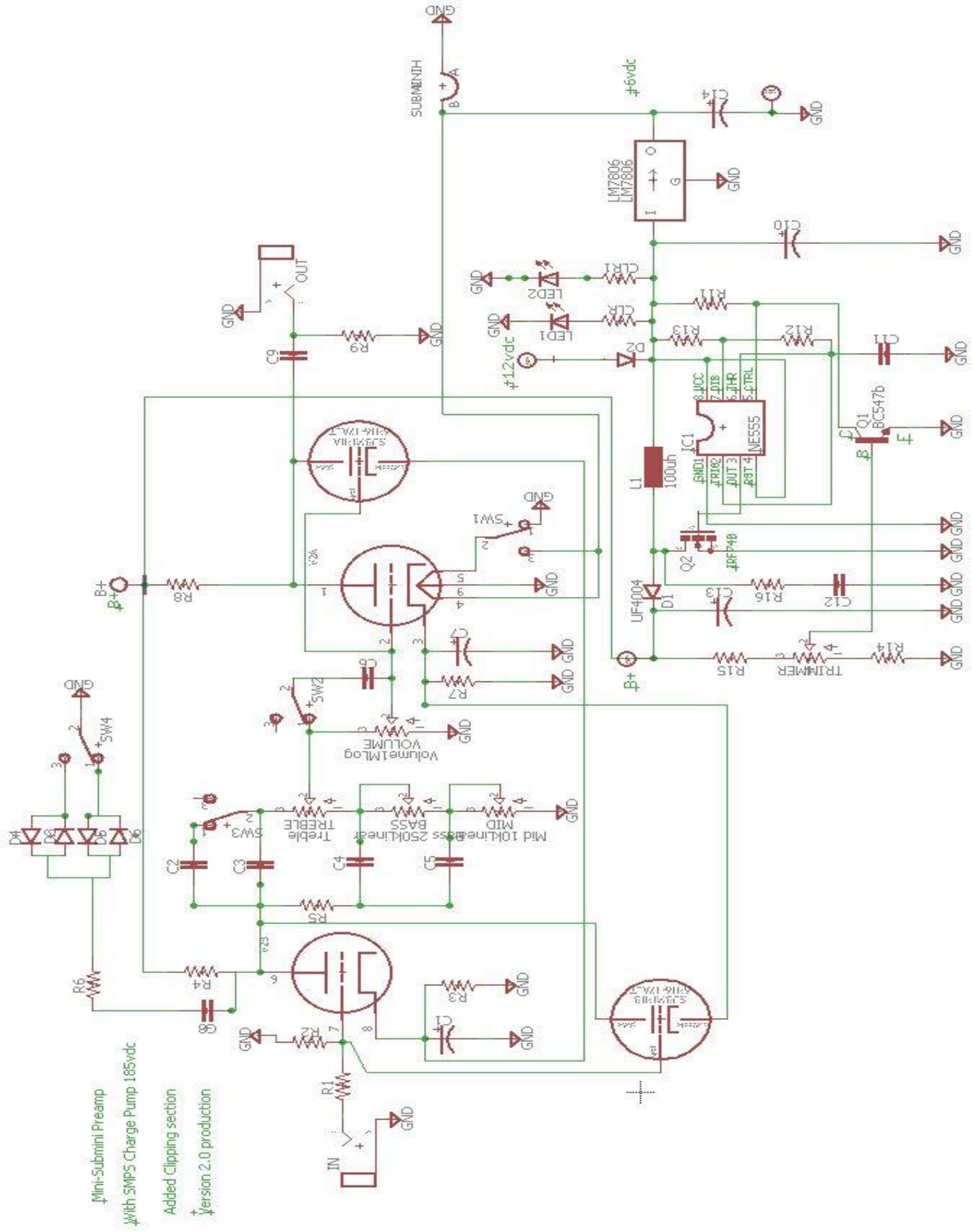
Clipping

There is an optional switchable diode clipping section where you can add a little dirt to the preamp. You can select two different clipping configurations if you wish or none at all with an ON/OFF/ON switch. Later in this document, I will provide some options and thoughts on some different diodes to try. This is where you may want to socket the diodes so you can experiment.

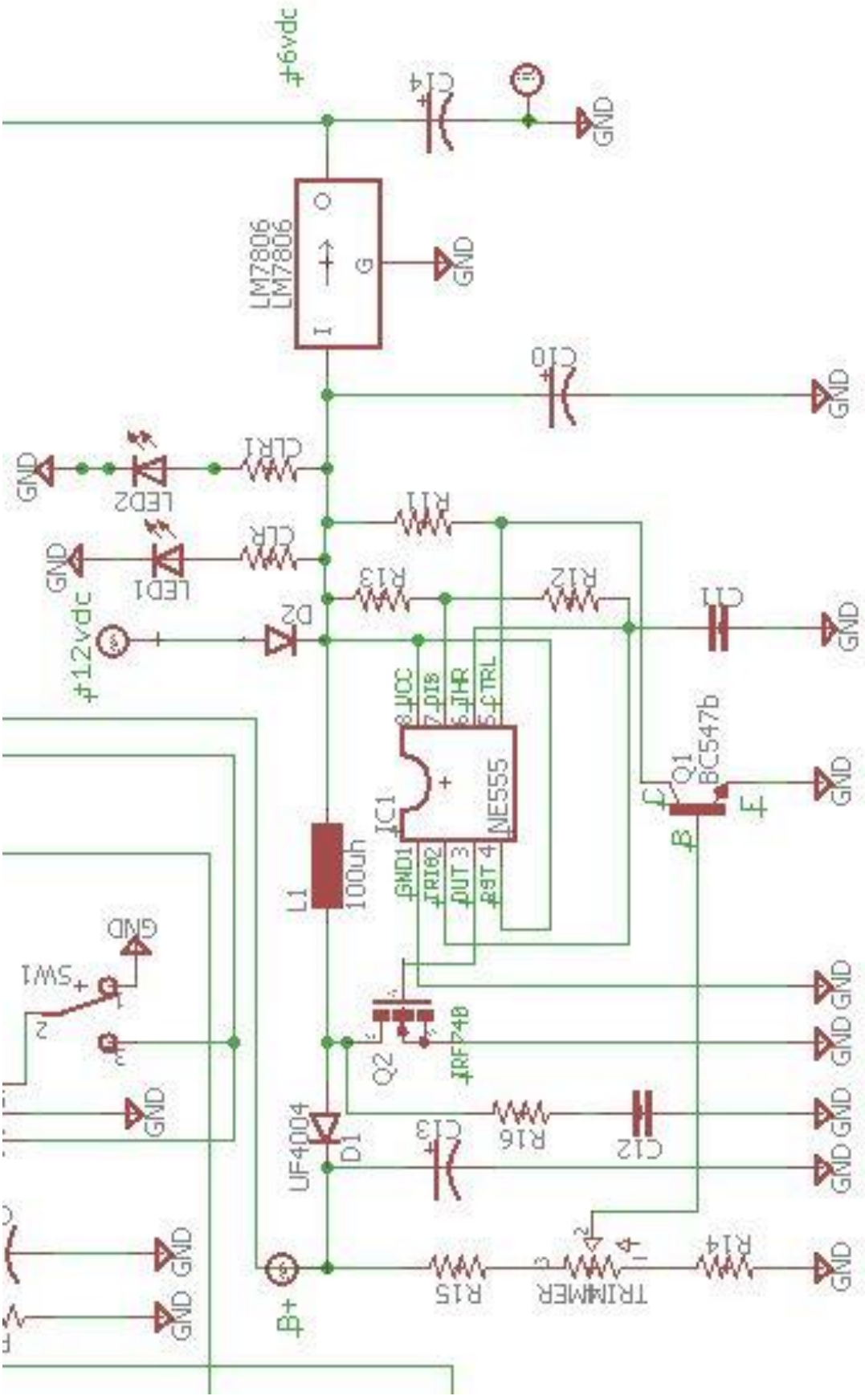
Schematics and Diagrams



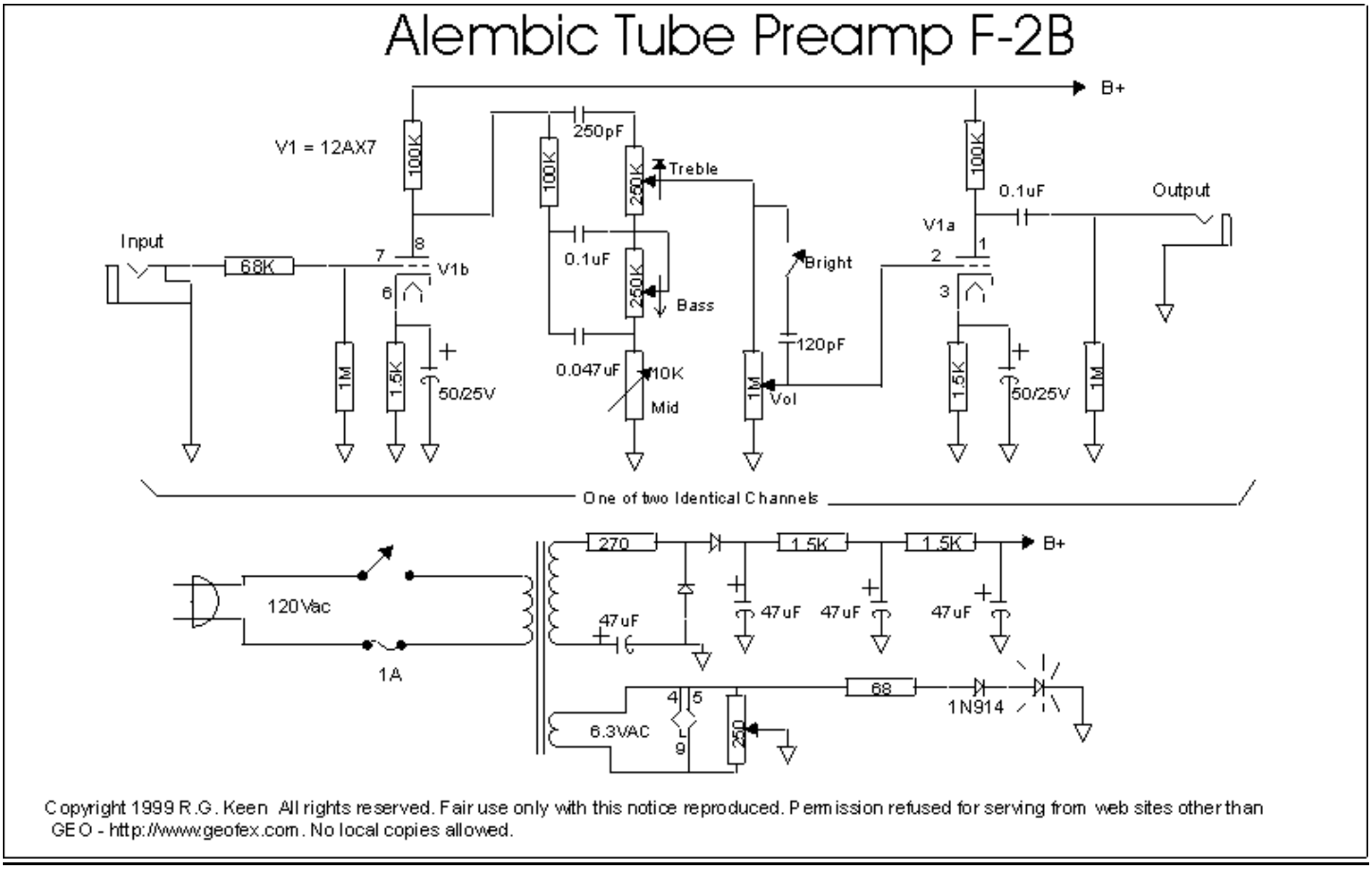
B+ Test Point


Mini-Submini Preamp
With SMPS Charge Pump 185vdc
Added Clipping section
Version 2.0 production

Close-up of Power Supply Section



Original version of Alembic F2b



Bill of Materials (BOM)

Component	Ref ID	Suggested Source	Part #	Optional	Note 1	Note 2	
High Voltage Power Supply							
NE555 timer chip	IC1	Mouser	595-NE555P			HV P/S	
8 position IC socket		Mouser			For NE555 chip above	HV P/S	
UF4004	D1	Mouser	512-UF4004			HV P/S	
1n5817	D2	Mouser	512-1N5817		For polarity protection	HV P/S	
IRF740pbf	Q2	Mouser	844-IRF740PBF			HV P/S	
Small Heatsink for above (Q2)		Mouser	567-274-3AB		The heatsink must be insulated or it could short out the positive voltage. This is just one sample	HV P/S	
Heatsink insulator kit		EBAY.Com	Set of 10 pcs TO-220 Insulator/Mounting Kits STAINLESS STEEL Rubberized Silicone		Link provided as an example of what you need to mount a voltage regulator to a heatsink or enclosure.	HV P/S	
BC547B	Q1	Mouser	512-			HV P/S	

Component	Ref ID	Suggested Source	Part #	Optional	Note 1	Note 2	
			BC547BTA				
100uH 1 amp inductor	L1	Mouser	580-13R104C		1 Amp or higher – The listed part number fits this board layout perfectly!	HV P/S	
1k Trimmer pot	Trimmer	Mouser	652-3362P-1-102LF			HV P/S	
470uf capacitor	C10	Mouser	667-ECA-1EHG471		Electrolytic 25v	HV P/S	
2.2 nf capacitor	C11	Mouser			Box or film cap	HV P/S	
100 pf capacitor	C12	Mouser			Film	HV P/S	
4.7uf capacitor	C13	Mouser	667-ECA-2VM4R7		**Electrolytic 250V (min.)**	HV P/S	
1K resistor	R13	Mouser			¼ watt metal film	HV P/S	
10k resistor	R12	Mouser			¼ watt metal film	HV P/S	
56k resistor	R11	Mouser			¼ watt metal film	HV P/S	
2.2k resistor	R16	Mouser			¼ watt metal film	HV P/S	
220k resistor	R15	Mouser			¼ watt metal film	HV P/S	
470R resistor	R14	Mouser			¼ watt metal film	HV P/S	
DC Power Jack		BLMS or many others	Outtie Switched 2.1mm DC Power Jack		BLMS is Bitcheslovemyswitches.com, Stupid name, nice prices	HV P/S	
General Power Supply Components							
Toggle Switch for power		BLMS	SPDT - ON ON - LONG SHAFT - SOLDER LUG		Mounted off-board. Not needed for initial testing of preamp. I install during final build after enclosure drilled and painted	P/S	
9-12 volt DC regulated Power Supply wall wart		BLMS	9VDC Pedal Power Supply		It is best to get a negative center power supply transformer (wall wart) to be more compatible with your other pedals. Make sure it is at least 1 amp (1000ma).	P/S	
Heater Power Supply							
LM7806	LM7806	Mouser	511-L7806CV-DG		1.5 amp rated	Heater P/S	
Small heatsink for above				Yes	Not needed if you mount LM7806 to enclosure	Heater P/S	
100uf capacitor	C14	Mouser	598-107CKS035M		Electrolytic 16-35v	Heater P/S	
Switch, On/Off - for Heater if needed	SW1	Mouser	10TC610	Yes	Optional if you will only use 12Ax7 tubes. If you will only use 12Ax7 tubes, a jumper can be placed where the switch would be.	Misc	
Miscellaneous							
Light Plate		Small Bear		Yes	This is a very cool option	Misc	
Tube Guard		Home Depot!			Aluminum/Stainless Steel drawer pull. Example only	Misc	
¼ inch Jacks	Input, Output	Mouser	568-NYS229		Get good jacks. CTC, Raen/Neutrik , etc. I have used cheap jacks but they aren't as	Preamp	

Component	Ref ID	Suggested Source	Part #	Optional	Note 1	Note 2	
					reliable. These are great jacks!		
Board Standoffs, screw type					10mm if you are using 9mm snap-in pots		
Stomp Switch		BLMS or Mammoth	3PDT Footswitch Latched - Solder Lugs - BLUE		For signal bypass, but if this preamp is an "always-on" device, then, is not needed. For higher quality, go with the Mammoth "Pro" version		
1590BB enclosure		BLMS Tayda Pedal Parts Plus	1590BB or equivalent.		Many suppliers, paint however you wish, or get powder coated enclosure	Misc	
Preamp and Tone Stack Circuit Components							
Vacuum Tube		Many sources			B98 Noval (12Ax7 type) or Russian subminiature 6n16b (med gain) or 6n17b (higher gain)	Preamp	
Tube Socket, Noval			9 pin Noval	Yes	Based on if you use a 12Ax7 type or subminiature type tube	Preamp	
68k resistor	R1	Mouser			¼ watt metal film	Preamp	
Mill Max socket for subminiature		Mouser	575-91743208	Yes	Based on if you intend to socketize a Russian subminiature tube	Preamp	
1 Meg resistor	R2, R9	Mouser			¼ watt metal film	Preamp	
100 K resistor	R4, R8	Mouser			**1 watt metal film**	Preamp	
1.5 k resistor	R3, R7	Mouser		Yes	¼ watt metal film – **12Ax7 tube type – see below**	Preamp	
Or for subminiature tube build							
1.8k resistor	R3, R7	Mouser		Yes	¼ watt metal film – **6n16b/6n17b subminiature tube type- see above**	Preamp	
47uf 25V	C1, C7	Mouser	647-UVR1E470MDD1TD		Electrolytic 16-25v	Preamp	
Not needed	**C15**				**Not needed – I skipped this number.**	**Preamp**	
.1 uf (100 nf)	C9	Mouser	505-MKS2F031001EKSSD		**180v minimum** – blocks high voltage DC	Preamp	
Bright switch ON/Off	SW2	Mouser	**10TC610**		**Sub mini** (not mini) pc mount switch with bushing or not. Can be any size if wired off-board	Preamp	
Mid Boost switch On/Off	SW3		**10TC610**		**Sub mini** (not mini) pc mount switch with bushing or not. Can be any size if wired off-board	Preamp	
10K-12k	R6				**Or can be replaced with a pot to set level of clipping….. untested**	Diode Clipping	
Diode clipping switch On/Off/On	SW4		**10pc Sub-Miniature Toggle Switch 2MS3T2B2M2QES On/Off/on 3P SPDT 1A250V**	Yes	**Sub mini** (not mini) pc mount switch with bushing or not. Must be On/Off/On switch, can be wired onboard or off-board. If off-board, a mini toggle with	Diode Clipping	

Component	Ref ID	Suggested Source	Part #	Optional	Note 1	Note 2	
			3A120V		solder lugs is fine. **Link is provided as an example.** Must be submini, pcmount (if on-board) and the spacing between the pins must be 2.5 mm		
Diodes for Clipping (in pairs usually)	D3, D4, D5 and D6			Yes	See diode clipping section in build instructions to choose.	Diode Clipping	
.1 uf (100 nf)	C8	Mouser	505-MKS2F031001EKSSD		**180v minimum** – blocks high voltage DC	Diode Clipping	
Tone Stack Components Fender style							
100k resistor	R5	Mouser			¼ watt metal film	Preamp	
680 pf (high-cut)	C2	Mouser			Ceramic disc, or film. **180v minimum** – blocks high voltage DC	Preamp	
250 pf	C3	Mouser			Ceramic disc, or film. **180v minimum** – blocks high voltage DC	Preamp	
.1 uf (100 nf)	C4	Mouser	505-MKS2F031001EKSSD		**180v minimum** – blocks high voltage DC	Preamp	
.047uf (47nf)	C5	Mouser	667-ECQ-E2473KFW		Film or Box type. **180v minimum** – blocks high voltage DC	Preamp	
120 pf (bright)	C6	Mouser			Ceramic disc, or film. **180v minimum** – blocks high voltage DC	Preamp	
B250k potentiometer	Treble, Bass	Tayda	SKU: A-1843		Pots can be installed onboard, or off-board. Linear taper	Preamp	
B10k potentiometer	Mid	Tayda	SKU: A-1847		Pots can be installed onboard, or off-board. Linear taper	Preamp	
A1Meg potentiometer	Volume	Tayda	SKU: A-1672		Pots can be installed onboard, or off-board. Audio taper	Preamp	
Tone Stack Components Marshall style							
33k resistor	R5	Mouser					
680 pf (high-cut)	C2	Mouser			Ceramic disc, or film. **180v minimum** – blocks high voltage DC		
470 pf	C3	Mouser			Ceramic disc, or film. **180v minimum** – blocks high voltage DC		
22nf	C4	Mouser	505-MKP2G022201E00MS		Film or Box type. **180v minimum** – blocks high voltage DC		
22nf	C5	Mouser	505-MKP2G022201E00MS		Film or Box type. **180v minimum** – blocks high voltage DC		
120pf (bright)	C6	Mouser					
B250k potentiometer	Treble	Tayda	SKU: A-1843		Pots can be installed onboard, or off-board. Linear taper		
B1Meg potentiometer	Bass	Tayda	SKU: A-1882		Pots can be installed onboard, or off-board. Linear taper		

Component	Ref ID	Suggested Source	Part #	Optional	Note 1	Note 2	
B25k potentiometer	Mid	Tayda	SKU: A-1857		Pots can be installed onboard, or off-board. Linear taper		
A1Meg potentiometer (volume)	Volume	Tayda	SKU: A-1672		Pots can be installed onboard, or off-board. Audio taper		

Suppliers

- Mouser.com – High quality parts, can be a bit more expensive, but the fewer sources you get parts from, the less shipping you will pay.
- PedalPartsPlus.com- I have not used them yet, but they are well regarded in the DIY pedal community.
- SmallBear-electronics.mybigcommerce.com – They have some unique parts. I like the "light plates"
- Taydaelectronics.com – cheap parts, but sometimes you get what you pay for. I use them as my primary source for 9mm pots, small resistors and other miscellaneous things.
- Bitcheslovemyswitches.com – I hate the name but they have good prices on switches and other parts. I especially like the 9 and 12 volt wall wart power transformers

DIY Resources

Madbeanpedals.com/forum is great if you need help, that is where I got started, DIYStompbox.com is great along with many other DIY guitar effect pedal websites and forums

Assumptions

- Many of the components listed above are my recommendation and what works for me. The suppliers are my suggested suppliers, but you can use any source as long as the component meets the specifications. Remember, you tend to get what you pay for.
- You should have a small tipped soldering iron (25-35 watt) for general soldering, for soldering in the submini tubes, I use the Weller WM120 Professional Solder Iron thin 12watt, 120 volt. Because it is expensive, I only use it for the submini tube soldering!

- Also you will need rosin core solder and project holder. Small gauge wire, #22-24 gauge, multiple colors preferred. Check out Barry's Best Hookup Wire at GuitarPCB.com for a good example.

- A 9 or 12 volt DC regulated power supply with center negative is required (see BOM above for example).

Primary power switching

I recommend a toggle or some other switch for powering on or off the unit. Because it takes about 10-15 seconds to warm up the tube's heater, it is not practical to switch the unit on/off with a stomp switch. If you choose to use a stomp switch, I would use the stomp switch only for bypassing the signal and maybe a LED that indicates either:

1. The signal is being run through the preamp, or,
2. The signal is being bypassed around the preamp

Note: GuitarPCB (and many other DIY board PCB producers) has a great little board that mounts on a 3pdt stomp switch that allows you to use a common cathode bi-color LED that will do exactly what I described above. I have been using this board and it is very inexpensive and is easy to use. They provide good documentation with it as well.

Building instructions

Another few notes before you start

Again, despite its small size, once populated and powered up, this a serious, potentially dangerous build if you don't use standard tube amp caution while handing this board. Always test the B+ test point with a volt-ohm meter for low/no voltage before handling! This could at the least knock you on your can, or up to and including, kill you! Sorry, just had to remind you. I don't want this to be the last guitar project you undertake (pun intended).

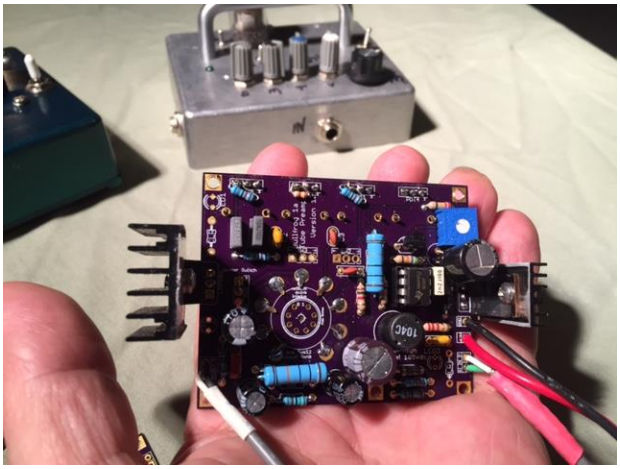
Test your components!

It is much easier to test components before you solder them rather than troubleshooting later. Using my volt-ohm meter (VOM), I test all resistors and caps. I have burned up a nice Aion Refractor PCB by putting an incorrect zener diode in (twice) because I trusted that the supplier put all the correct items in the bag. So double check polarized components and ensure they are placed on the board in the correct orientation.

Voltage regulator-important info

The mounting plates on the power regulator chips are set to the outside edge of the board to make it easier to mount to the enclosure or a heatsink. The LM7806 can be mounted directly to the enclosure or heatsink without an insulation kit because the metal tab of the regulator that has the mounting hole is equivalent to circuit ground. **DO NOT mount the Q2 IRF740pbf directly to the enclosure or, in my opinion, to a heatsink**

without an insulation kit referenced in the BOM. The metal tab with the mounting hole is positive voltage and without insulation, any contact with a grounded portion of the pedal by the metal mounting plate and/or heatsink will cause a short, destroying parts *(and maybe a small fire!)*.



Prototype build with heatsink on both regulators left and right

Drill Template print and verify first

I am struggling with the order of the "Drill the enclosure" instructions (in the following instructions) because I have done it both ways, meaning, I have done it after populating the board and I have done it before populating the board. I have always used the actual PCB to determine hole locations. I would always recommend that you print the drill template first, and using the bare PCB, verify that the holes tend to line up with the mounting holes in the PCB you intend to use and the center of the tube socket hole (provided just for this purpose).

Building the High Voltage Power Supply

There is no sense in loading up the board with all the components unless you have a working high voltage power supply section. First you will populate the high voltage power supply components and wires to the DC board input labeled +12vdc and ground. You can use either 9vdc or 12vdc, however the 6vdc regulator for the heaters will have to work harder by dissipating more heat if you use 12vdc). I have primarily used a 12vdc power transformer without any trouble.

Populate in this order

On the BOM, these components are indicated by the HV P/S note.

- Diodes (not the clipping diodes)
- Resistors
- Capacitors
- IC socket (8pin)
- trimmer pot
- inductor
- voltage regulator

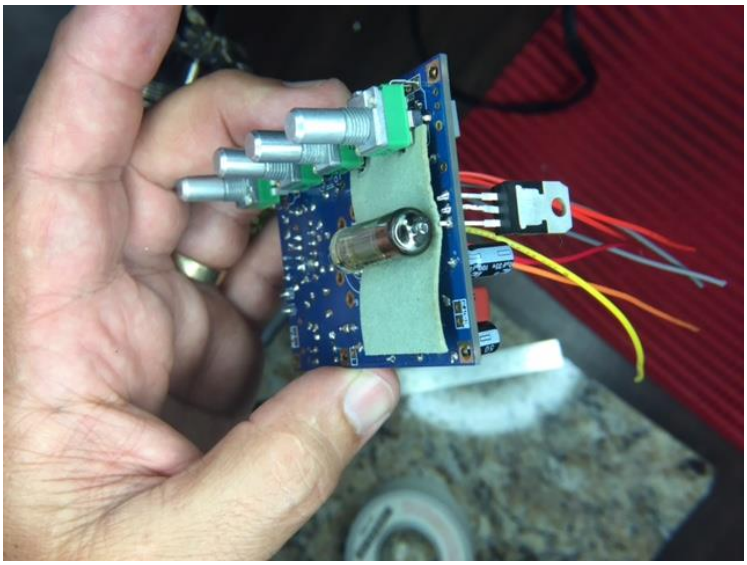
Always inspect each solder point for solder bridges. I use a lighted magnifying glass that attaches to my bench. Add the wires for +12vdc and ground and solder to the dc power jack.

Once all the SMPS charge pump components are installed, set the trimmer to about half/way or less *(to the left of center)* before you hook up to power. Make sure polarity of your power source is correct (center negative). Connect to power and with your volt-ohm meter, place one lead on ground and then test the B+ test point for high voltage. By turning the trimmer clockwise or counter-clockwise, you can set this to about +185vdc for now. We will reset it to about +185vdc later when it is under load. Unhook power and wait about 10 seconds. Once again, test the B+ test point for high voltage. You should see the voltage decreasing below one volt, usually into the 250 millivolts range and decreasing. **You have had your first success!**

If you didn't get the correct high voltage, recheck all your component values, and orientation of the components on the board. Resistors and inductors are not polarized. Box and film caps aren't either, however, Electrolytic caps, IC's, voltage regulators and diodes are polarized. A diode the wrong way is the most likely reason for no or extremely low voltage. Another possibility is cold solder joints. Make sure the solder points are good and reflow if necessary.

Low Voltage Power Supply

Now that the high voltage charge pump is working, we will move onto the tube heater supply. The first thing you will do is solder the LM7806 in the LM7806 component holes. For now, only solder part way in the holes so you have plenty of room to bend it over toward the enclosure for mounting or to give you plenty of room to mount the heatsink. The picture below illustrates how long I leave the leads on the regulator.


Bent over installation of Russian submini tube

If needed, you can reheat and move a bit lower later if needed. Solder the low voltage power supply capacitor (see BOM). Once again, respecting the high voltage power section of the PCB, connect the 9-12vdc. Test the voltage on the lead toward where the pots will be soldered in. You should see around 5.8-6vdc. That is within specifications for the heater (usually 6.3vdc +/- 20%). **Now the fun stuff!**

Building the Preamp Section

Drill the Enclosure

This project will best fit in a 1590BB at a minimum. First you should get your enclosure ready, meaning, you need to drill the holes you need for your particular configuration. If you are using PCB mounted potentiometers and switches, it is recommended that you drill the enclosure before soldering the controls to the PCB. You will also want to attach your board temporarily to the standoffs you have mounted on the enclosure. This allows you to align the controls up exactly before soldering. If you are mounting the pots or switches off-board, then this isn't as much of an issue.

Here is a quick list of items that may require a hole be drilled in the enclosure:

- Standoffs
- Pots
- switches (onboard and offboard)
- ¼ inch jacks
- stomp switch if used
- LEDs
- DC power jack
- 6vdc voltage regulator mounting hole if you are mounting it directly to the enclosure to dissipate heat instead of using a separate heatsink.

Drill the board standoffs and pot holes first and dry-fit the board with unsoldered pots first. If that looks good, then drill for the onboard switches you will be using and dry-fit them into the holes. Drill the LED holes and look down through to the PCB to make sure they line up fairly close.

Note: DO NOT get in a hurry and solder pots, switches, tube socket/or tube, or LEDs yet. You will regret it! Dry-fit only. We will solder them later at the proper time.

Once these are done, this will help you determine the best location for the DC power jack hole, offboard on/off switch and stomp switch hole until you have dry-fit the board onto the standoffs.

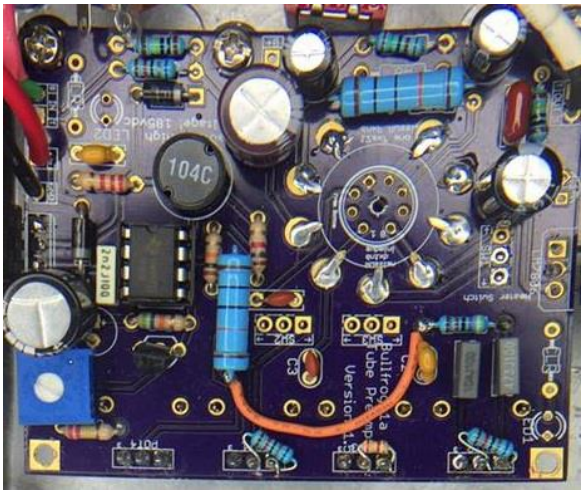
You can use the drill template attached to the build document or use the PCB to determine the locations of many of the drill holes. Remember, if using the board as a drill template to mark the holes, place the component side (the side with all the components labeled) down, on top of the enclosure. You should see the pot outlines on this non-component side. The pots, the switches and the tube socket are all mounted to the non-component side. Drill holes for the standoff screws. You do not have to use all the standoff mounting holes. If you are soldering the pots directly on the board, the corner standoff holes by the pots are probably not required. The two standoff holes I recommend be used at all times are the ones by the B+ and by R9. This will give the board a lot of support to insert or remove tubes if you are using a 12aX7 type tube socket. I

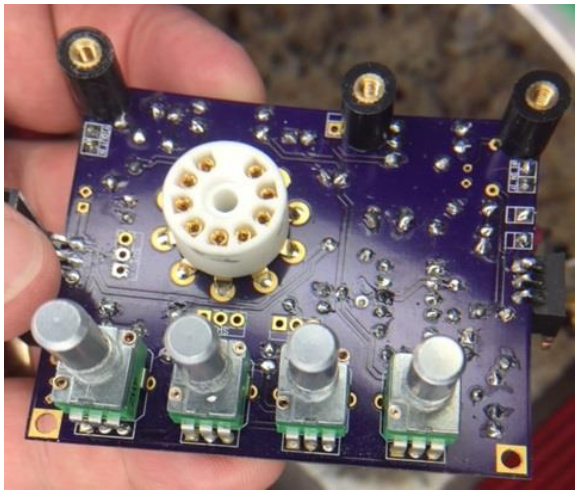
personally will always use the 3 holes on the side opposite the pots even with a subminiature tube. I tend to overbuild!

Populating the preamp section The BOM lists two of the many different versions that can be built on this board. Choose your tone stack type (Fender or Marshall) and your tube type first (12ax7/6n1p or subminiature 6n16b/6n17b). This will list the specific components needed for that configuration. Don't solder in your switches and pots yet. Also, wait on the "Diode clipping" components for now. They are not required for operation/testing of the preamp. We will do that later. The less variables at this point, is best.

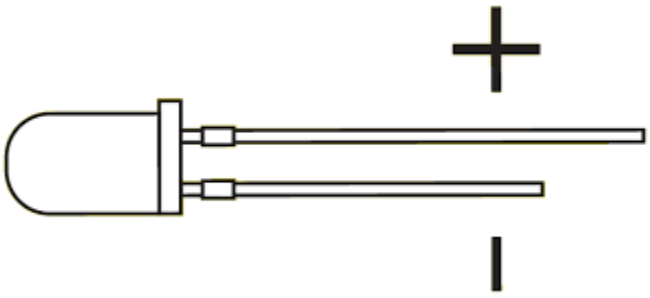
Start populating the resistors first, box capacitors next, then electrolytic capacitors.

Next, on the non-component side of the PCB, add the tube socket (if using a standard 12ax7 type tube). I fold over the pc mount contacts to hold it in place while soldering. Make sure the center hole of the socket stays aligned with the center hole in the PCB. Flood pc mount holes with solder so it will be strong enough to withstand insertion and removal of tubes. See the following pictures of my earlier prototype for component and non-componentside configurations *The orange jumper is NOT required in the PCB 2.0 version that is blue in color*.





Now you should be ready to dry-fit the PCB with the pots and selected switches in place by mounting on the board standoffs. If you want, you can also put the power LED in its holes (unsoldered) taking care to orient based on the polarity of the LED holes.



Thanks learn.sparkfun.com

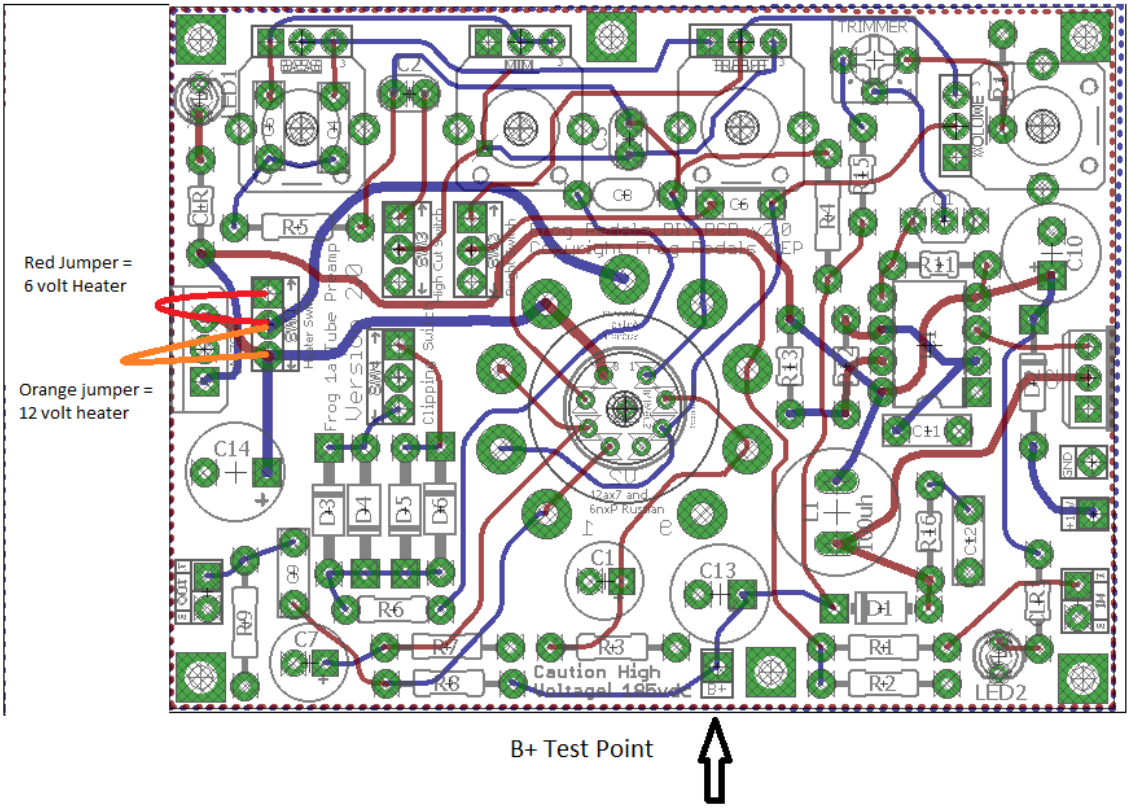
Once the board is mounted solidly into the enclosure, put the mounting washers and nuts on the pots and on the switches and orient them properly. Make sure their contact/leads are sticking through the holes in the PCB at least a little bit and solder them in place. Another option to reduce the complication and balancing act is to not put the switches and LED's in until the pots have been soldered in, then, one at a time place a switch or LED in place and then remount on the board standoffs, align and solder in and move on to the next component.

Testing the preamp

Before we begin

To test the preamp, the only PCB switch you need in place is the heater switch (or a jumper in place to replace it if you will use only 12Ax7 or 6nxP type tubes). No heater switch is required if you are using a subminiature tube. All the switches in one situation or another are optional.

If jumpering for using only one type of tube see the following illustration:



Jumpers are exaggerated to make them easier to see. They do not need to be long, just long enough to go from one hole to the other. Only one jumper allowed!

To test at this point it is fairly straight forward. You can temporarily connect it direct to the DC jack (without the switch for now) and can also connect wires to the In and Out pads on the board directly to ¼ inch audio jacks. The heater voltage regulator has a temperature protection built in. It will only work for a short time if it is not connected to a heat sink of some kind, which can be the enclosure, so you have to make a decision whether or not test in the enclosure. Because of the high DC voltage, I recommend you mount the PCB in the

enclosure. You are already probably used to taking it in and out already many times. Once the DC jack is connected *(make sure it is center negative to be compatible with most of your other 9VDC pedals*), turn all the controls to about ½ rotation or less. Place a preamp tube in the socket (12Ax7, etc.), connect to 9VDC wall wart, and the tube heater should begin to heat up within 5 to 10 seconds. Test the High Voltage B+ and reset to 185VDC (ish) using the trimmer. Connect to an amplifier or a PA input. Keep all input volume/gain knobs on your amplifier or PA very low to start. Hook a guitar to your input. Play while slowly turning up the input volume on your amplifier or PA. I have found with this preamp, for normal operation, my input volume on the amp is kept very low and the same on the PA. This board can pump out the volume.

A word about noise and hum

Generally speaking, because the power supply is operating at between 30 -40khz, well above the 20khz hearing of typical humans, it should not produce noise into the preamplifier circuit, however, other things may, which include: routing of wires within the enclosure, bad or low quality guitar cables and, something that you can almost never avoid, hooking up a guitar. Single coils will be noisier than humbuckers because they don't automatically cancel noise like humbuckers are designed to do. Proximity of a guitar or cables to a computer, heater, fluorescent light fixtures or a building with old, poorly implemented wiring system can all effect noise. What I have found on my prototypes is that they are pretty much noiseless. As you turn up the volume/gain, of course, any stray radio frequency being picked up from the environment via the cables or guitar can induce some noise.

Adding the Diode Clipping option

There are almost and endless number of diode, LED or mosfet clipping options you can try. I have tried germanium diodes and LEDs as well as silicon diodes. Feel free to experiment!

Germanium: D9E or 1n34a – fairly soft clipping

Germanium/Silicon: 1N34a and 1N4001 (mix and match, moderately soft clipping)

LEDs: 5mm Red – I liked these…they even light up a little bit!

Silicon: 1N914, or 1n4148 (functionally the same)- a little bit harsher or fizzier (hard clipping)

Put two different kinds of clipping pairs, for instance, a 1n34a and 1N4001 in one position (D4 and D5) and hard clipping, in the other, (D6 and D7).

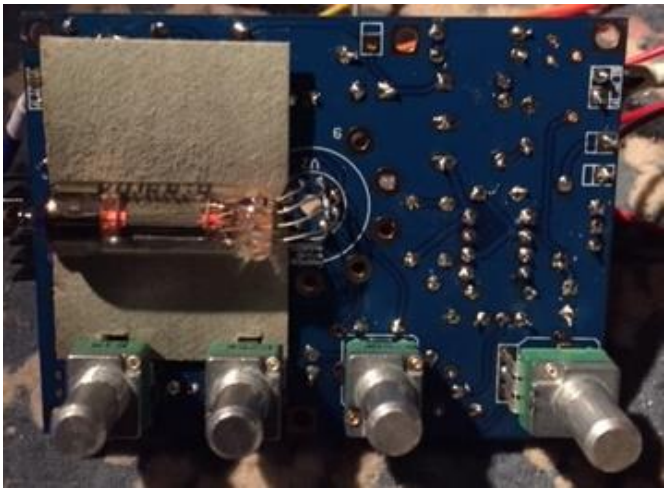
A special note about the Power LED configuration

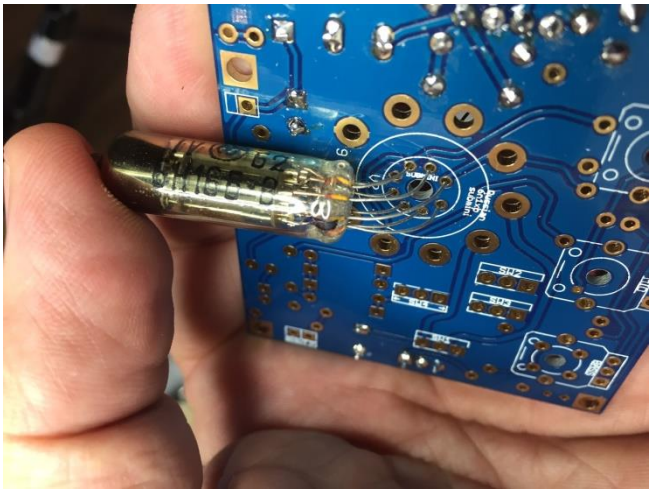
Two LED locations have been provided that you can use as power indicators. Normally you would use one of those locations; however, I like to add light plates to my favorite builds which require an LED to be pointing down inside the enclosure to light up the light plate. That is why I included a second LED location (next to the R2 resistor). If you choose not to use a light plate, then you can omit that LED and the resistor next to it labeled CLR (current limiting resistor). If you use a stomp switch PCB from GuitarPCB, like I recommended earlier, the LED associated with that would be your bypass indicator, separate from the LED power indicator.

Special instructions for subminiature tube installation (Russian 6n16b/6n17b)

This turns the project in some respects into an Expert level build. I have built using the Russian Sub-mini tubes, but getting the tube in correct is hard. In fact, I put a tube in 2 times incorrectly, so, make sure you are in a real good mood with lots of patience before starting this. Another thing is my regular soldering iron was way too fat to solder the submini tube correctly. I actually bought, just for this purpose, a small soldering iron I mentioned earlier under Assumptions, with an extremely small pointed tip. Once I did that, the soldering was quick and easy.

Another thing I have done with a submini tube build is to build it so it fits completely inside the enclosure, bent over underneath the PCB, so, the flying leads on the tube will each have to be custom bent and isolated from each other and I also added a piece of automotive gasket material to support the tube so it won't vibrate against the PCB.

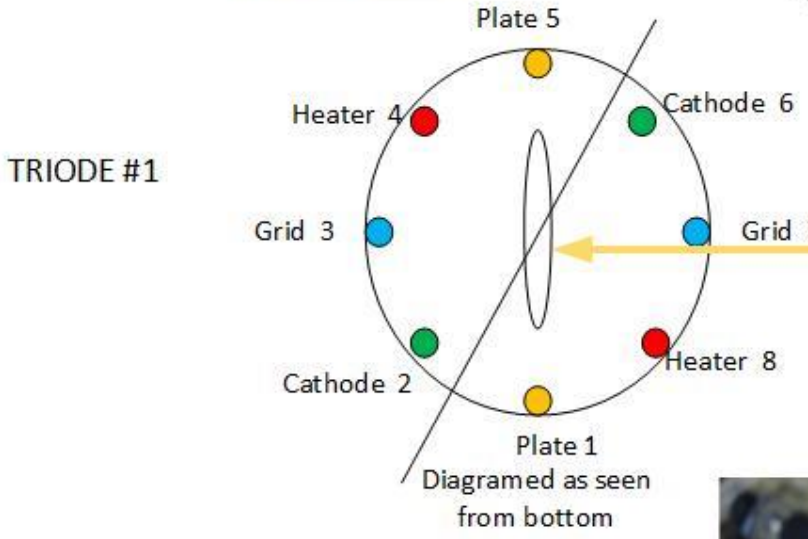


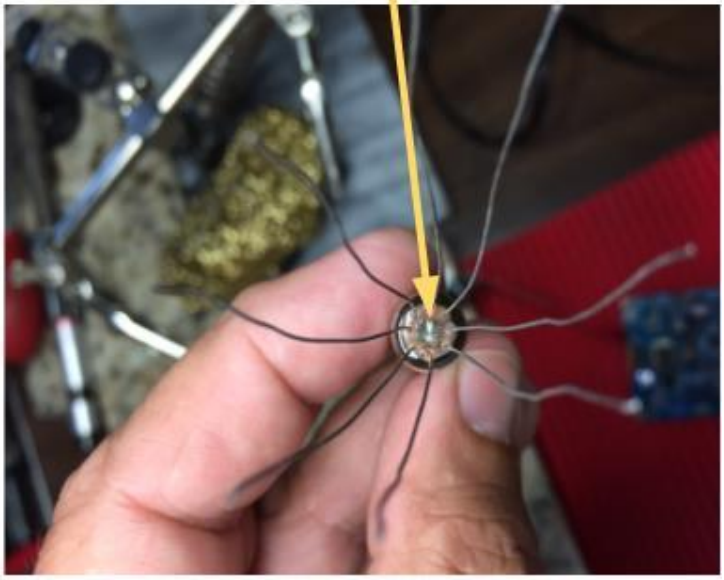


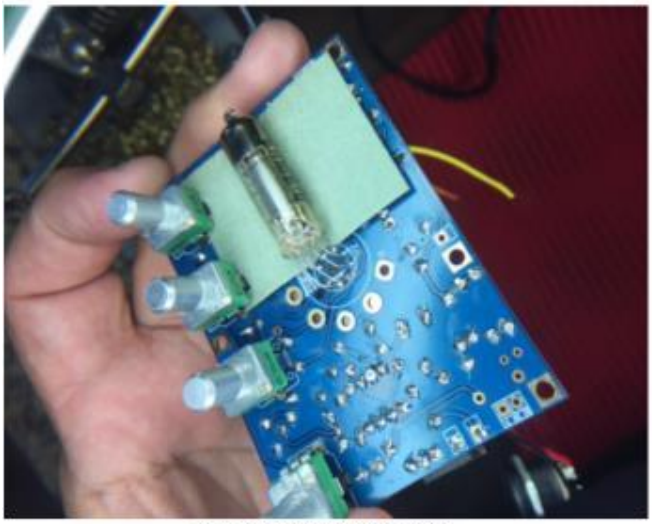
Below is a diagram to help you identify the leads before you put them in the holes. For now, if you put the leads in the holes, you don't need to solder the two leads required for the tube heaters because they should make enough contact to light up the heater if it is oriented correctly. If it doesn't light up, you can easily remove and re-orient the leads. I learned that after soldering it in and trying to remove it the first time. So, the power supply and the preamp board should be completely populated and ready to go before you solder this tube in place. The submini tube is soldered on the non-component side of the board. The same side as the pots and on-board switches are. The holes are numbered 1-8, but on the 2.0 version of the board, the numbers are on the component side, so as you look at the numbers, flip it over to the non-component side and mark with a marker, or nail polish the number one hole. The numbers do not directly correspond to the numbers of the bigger socket holes for the Noval socket.

RUSSIAN
6n16b/6n17b
subminiature
vacuum tube

Frog
Guitar Effects Pedals
Cuz, they's made for Giggin'







Russian Subminiature
6n16b
In preamp

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Another disclaimer: Don't produce for sale before you read this: Because of the nature of the SMPS power supply used on this device it is subject to FCC rules and regulations. The technology used to get the high DC voltage, requires the power supply operate between 30 and 40Khz. FCC certification of this before commercial sale is required. Electro Harmonix paid dearly for ignoring this. See this article for more information: New Sensor (Electro Harmonix) FCC Compliance Guide