

# ARCHIBALD2022

## FX TYPE: OVERDRIVE

Based on the BK Butler® Tube Driver™

Enclosure Size: 125BB

Softie compatibility: none

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### About the 2022 update:

1. Fixed misaligned EQ pot (previous version was 0.6mm off axis).
2. Removed cooper pour underneath the LM317 regulator.
3. Changed optional output buffer from DIP switch to external DPDT toggle.
4. Changed DPDTs from regular size to miniature style to match 9mm potentiometers.

This document has been updated to reflect the 2022 changes. You can find the complete documentation for the 2021 version in the .zip file associated with the Archibald on the mbp website.

### Overview

Just how good does the **Archibald** sound? So good, even your grandma will say “Damn, son - that tone is legit!” The BK Butler Tube Driver™ doesn’t really need much explanation. It’s been championed by the likes of Eric Johnson and David Gilmour as well as become a mainstay on many mortal guitar player’s pedalboards. The Tube Driver™ delivers a harmonic richness that (even though they may come close) most discrete analog pedals cannot achieve. And, the Archibald delivers a lot of extra features on top of the stock circuit to sweeten the deal.

The Archibald is derived from the Bajaman Real Tube project on freestompboxes (somewhere around 2009, I think). His project spec’d an AC power supply with a half-wave rectifier for the bi-polar power. The Archibald uses a voltage inverter instead. Other additions include: an external Bias control (a popular mod to the Tube Driver), two styles of tone control (selectable by a switch) and an optional JFET output buffer to recover from the lossy Hi/Lo tone control.

This project is not terribly complicated, but will require some patience to put together. It uses a daughter board to mount the tube and that is a little bit of extra work. Well worth it, though: no tube sticking out of the enclosure!

### Controls

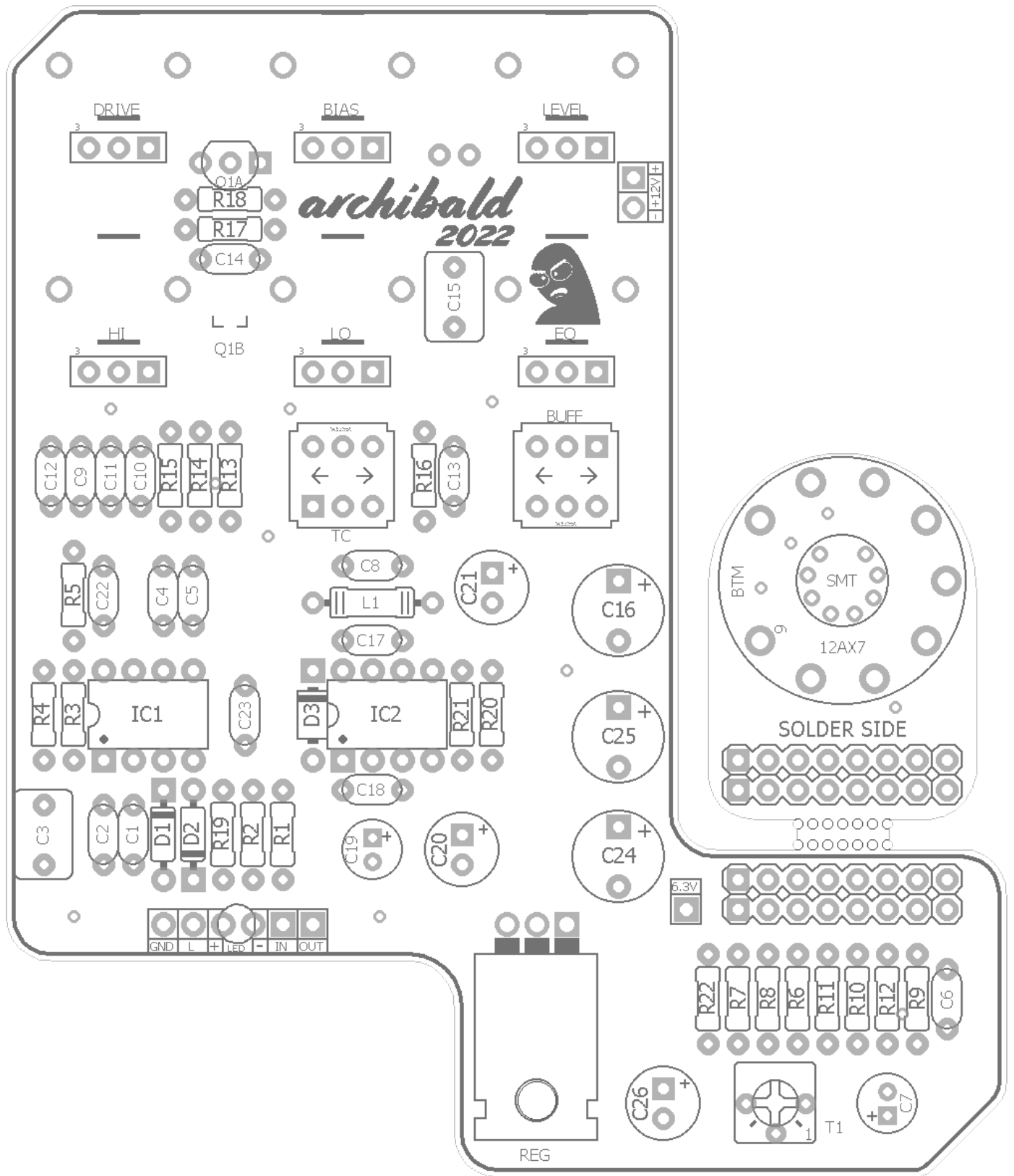
- **LEVEL, DRIVE** - As is typical with dirt pedals.
- **BIAS** - A very popular mod for the Tube Driver. CCW: stock setting. As it is turned clockwise the output will become more compressed and squishy. It also reduces the volume output.
- **TC** - This switch selects between two different tone controls. In the left position, the EQ control is active, and LO and HI are deactivated. In the right position, the LO and HI controls are active, and the EQ is deactivated.
- **EQ** - A simple tone/presence control.
- **LO, HI** - Low and High frequency boost. This mode is quieter than the EQ mode, so you will need to adjust the LEVEL to compensate.
- **BUFF** - In **stock** mode (right pos.), the Level control follows directly after the tone control. In **buffer** mode (left pos.), a simple JFET buffer is added before the Level control. This offers the benefit of a little gain recovery from the passive tone section and very low output impedance to drive subsequent pedals further along your signal chain. It’s not necessary, but a nice option to have.
- **T1** - Use this trimmer to adjust the LM317 regulator for the proper tube heater voltage (see Notes).

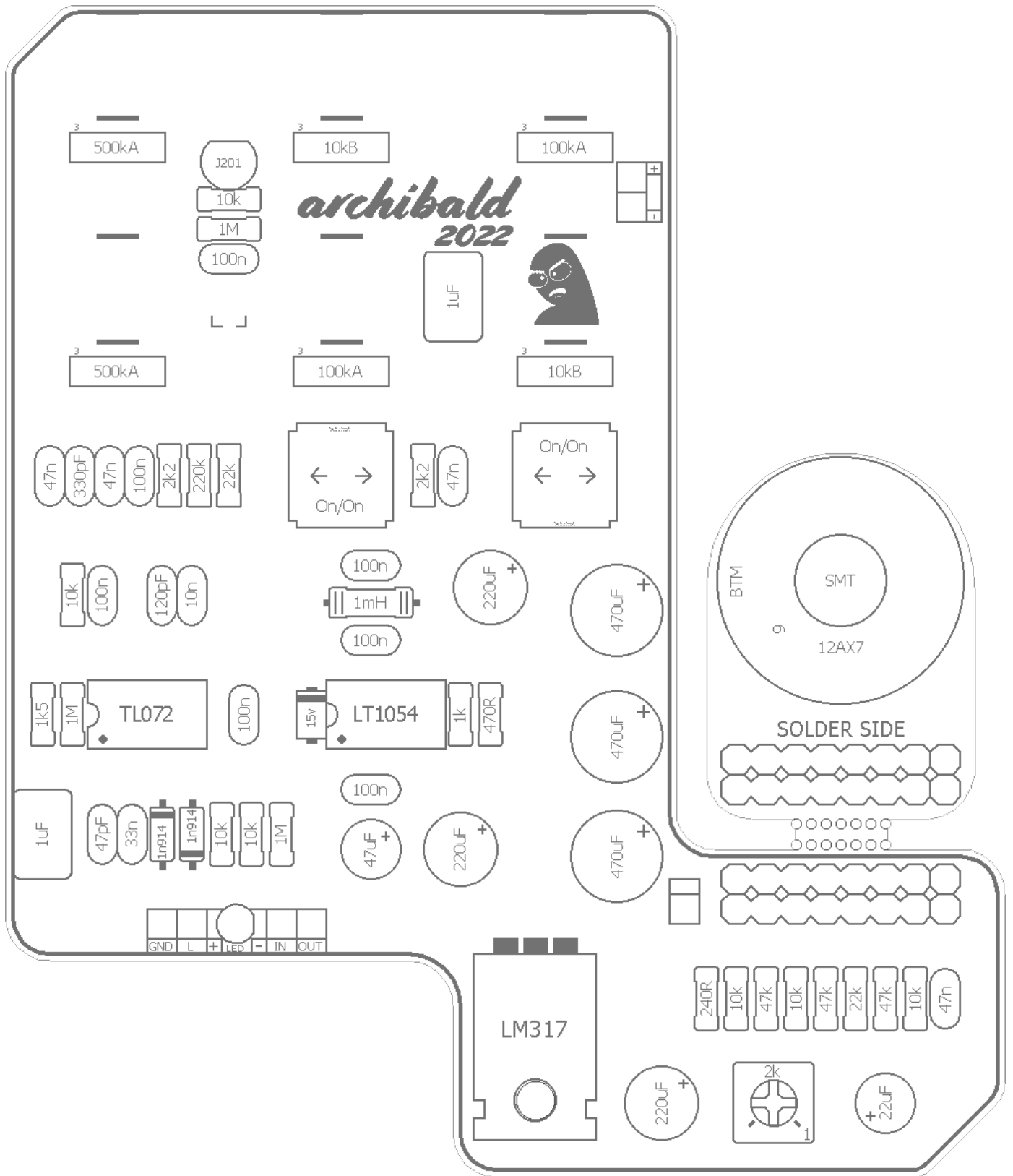
**The Archibald will run on either 9 or 12v, but I highly recommend using 12v. Do not go higher than 15v or the voltage inverter may fail. Current consumption is about 350mA, so you’ll want a power supply rated 500mA or higher.**

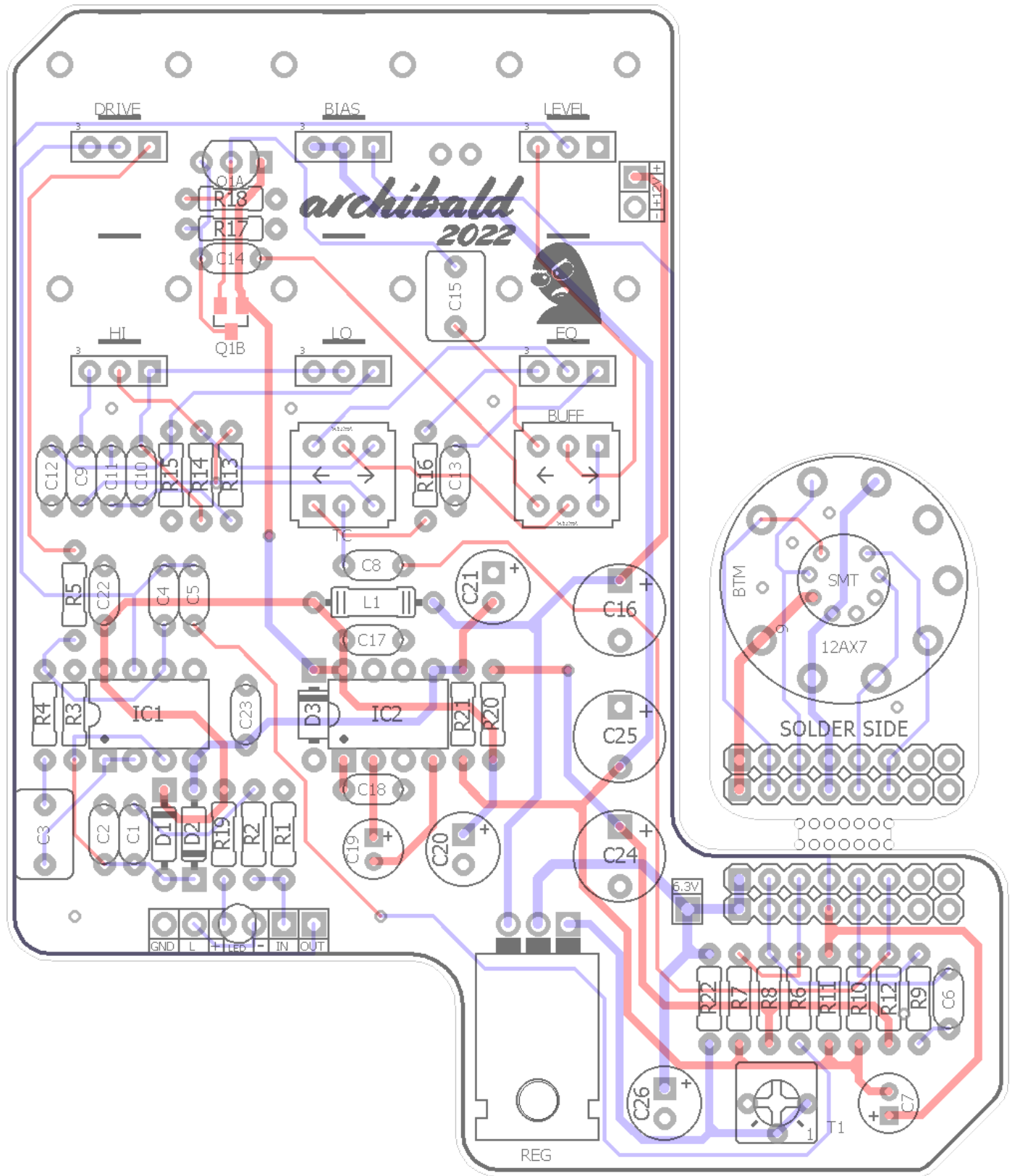
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**Terms of Use:** You are free to use purchased **Archibald2022** circuit boards for both DIY and small commercial operations. You may not offer **Archibald2022** PCBs for resale or as part of a “kit” in a commercial fashion. Peer to peer re-sale is fine, though.

**Technical assistance** for your build(s) is available via the [madbeanpedals forum](http://madbeanpedals.com). Please go there rather than emailing me for assistance on builds. This is because (1) I’m not always available to respond via email in a timely and continuous manner, and (2) posting technical problems and solutions in the forum creates a record from which other members may benefit.







Resistors		Caps		Diodes	
R1	1M	C1	33n	D1	1n914
R2	10k	C2	47pF	D2	1n914
R3	1M	C3	1uF	D3	15v Zener
R4	1k5	C4	120pF	<b>Inductors</b>	
R5	10k	C5	10n	L1	1mH
R6	10k	C6	47n	<b>Transistors</b>	
R7	10k	C7	22uF	Q1	J201
R8	47k	C8	100n	<b>Regulators</b>	
R9	10k	C9	330pF	REG	LM317
R10	22k	C10	100n	<b>ICs</b>	
R11	47k	C11	47n	IC1	TL072
R12	47k	C12	47n	IC2	LT1054
R13	22k	C13	47n	<b>Switches</b>	
R14	220k	C14	100n	TC	On/On
R15	2k2	C15	1uF	BUFF	On/On
R16	2k2	C16	470uF	<b>Tubes</b>	
R17	1M	C17	100n	V1	12AX7
R18	10k	C18	100n	<b>Trimmers</b>	
R19	10k	C19	47uF	T1	2k
R20	470R	C20	220uF	<b>Pots</b>	
R21	1k	C21	220uF	BIAS	10kB
R22	240R	C22	100n	EQ	10kB
		C23	100n	LEVEL	100kA
		C24	470uF	LO	100kA
		C25	470uF	DRIVE	500kA
		C26	220uF	HI	500kA

Values	QTY	Type	Rating
240R	1	Metal / Carbon Film	1/4W
470R	1	Metal / Carbon Film	1/4W
1k	1	Metal / Carbon Film	1/4W
1k5	1	Metal / Carbon Film	1/4W
2k2	2	Metal / Carbon Film	1/4W
10k	7	Metal / Carbon Film	1/4W
22k	2	Metal / Carbon Film	1/4W
47k	3	Metal / Carbon Film	1/4W
220k	1	Metal / Carbon Film	1/4W
1M	3	Metal / Carbon Film	1/4W
47pF	1	Ceramic / MLCC	16v min.
120pF	1	Ceramic / MLCC	16v min.
330pF	1	Ceramic / MLCC	16v min.
10n	1	Film	16v min.
33n	1	Film	16v min.
47n	4	Film	16v min.
100n	7	Film	16v min.
1uF	2	Film	16v min.
22uF	1	Electrolytic	16v min.
47uF	1	Electrolytic	16v min.
220uF	3	Electrolytic	16v
470uF	1	Electrolytic	25v
470uF	2	Electrolytic	16v
1n914	1		
Zener	1	15v, 1W	
Inductor	1	1mH, *included with PCB	
J201	1		
LM317	1	220 style	
TL072	1		
LT1054	1		
DPDT	2	Mini On/On	
12AX7	1		
2k	1	Bourns 3362p	
10kB	2	PCB Right Angle, Metal Shaft	9mm
100kA	2	PCB Right Angle, Metal Shaft	9mm
500kA	2	PCB Right Angle, Metal Shaft	9mm

**What's included with the Archibald2022 PCB:**

12AX7 tube socket  
Dual 8-pin header for connecting the main and daughter board  
1mH inductor

**MPF102 (Sub for J201):**

<https://stompboxparts.com/semiconductors/mpf102-jfet-nos-fairchild/>

**MMBFJ201 (surface mount version):**

<https://www.mouser.com/ProductDetail/512-MMBFJ201>

**15v Zener:**

<https://www.mouser.com/ProductDetail/512-1N4744A>

**DPDT (On/On):**

<https://smallbear-electronics.mybigcommerce.com/dpdt-on-on-sub-mini-pc-mount-short-lever/>

<https://lovemyswitches.com/taiway-sub-mini-dpdt-on-on-switch-pcb-mount-short-shaft/>

**(Nut-less type):** <https://stompboxparts.com/switches/dpdt-sub-mini-toggle-switch-on-on-pcb-mount/>

**2k Bourns Trimmer:**

<https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/2k-ohm-trimmer-potentiometer-cermet-1-turn-3362p.html>

**9mm Pots:**

<https://stompboxparts.com/pots/9mm-potentiometer/>

<https://www.taydaelectronics.com/catalogsearch/result/?q=9mm+potentiometer>

**Low Profile DC Jack:**

<https://stompboxparts.com/power-connections/dc-power-jack-2-1mm-low-profile/>

<https://lovemyswitches.com/thinline-lumberg-dc-power-jack-2-1mm/>

**1/4" jacks:**

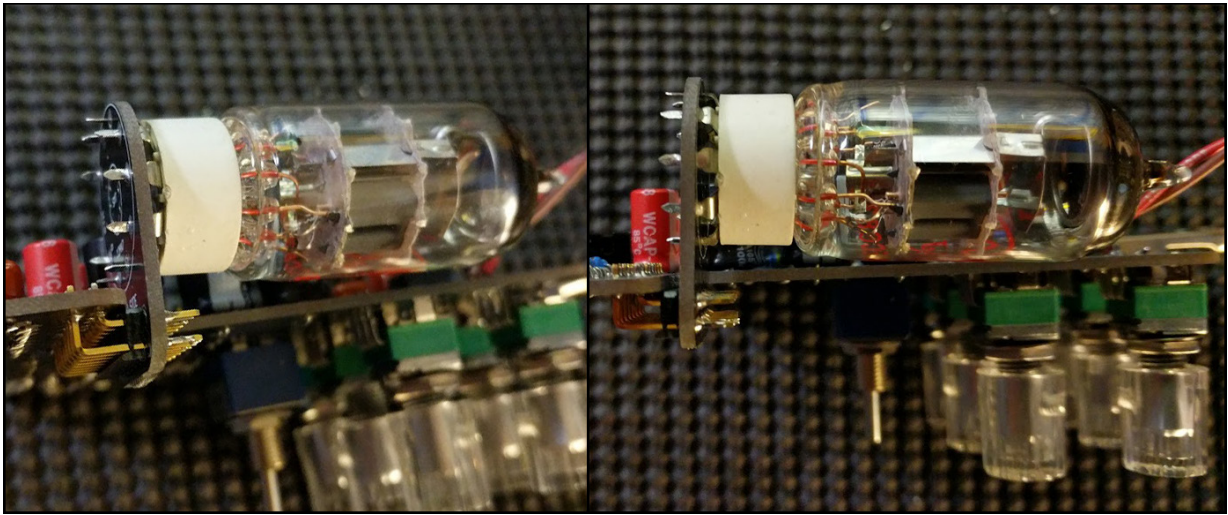
<https://lovemyswitches.com/1-4-mono-jack-lumberg-klbm-3/>

<https://lovemyswitches.com/1-4-mono-jack-neutrik-rean-nys229/>

**My preferred 3PDT switch:**

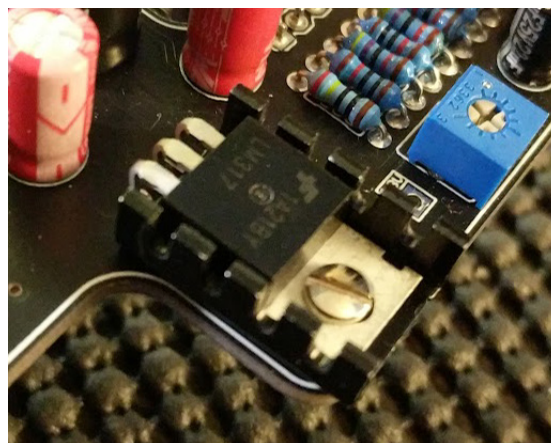
<https://lovemyswitches.com/pro-3pdt-latched-foot-switch-solder-lugs-feather-soft-click/>

Before you begin, break off the tube board from the main board. You can use wire cutters to trim any nibs left over. The main audio board and tube board are joined by dual-8 pin headers and the header is included with the PCB. The pin header will be placed *on the bottom* of the main board with the long side soldered to the main board and short side to the tube board.



You want to have the tube and main boards orthogonal to one another so that the tube runs parallel to the main board. It doesn't have to be perfect, just close. I suggest first soldering the pin header to the tube board, then soldering the socket to the tube board and finally the tube board to the main board (obviously, leave the tube off during all this). It helps if you solder one header pin first, then check the alignment. If you need to adjust it simply heat the joint with your iron and reposition it with your free hand. Once aligned solder the rest of the pins.

Under power, the tube will get warm but not hot. The LM317 will get *very* hot, so don't touch it. I used a heat sink on mine. This is not required but you can certainly do the same. If you don't have a heat sink, then leave a couple millimeters of air gap between the regulator and PCB. That will allow air to flow under the regulator and cool it.



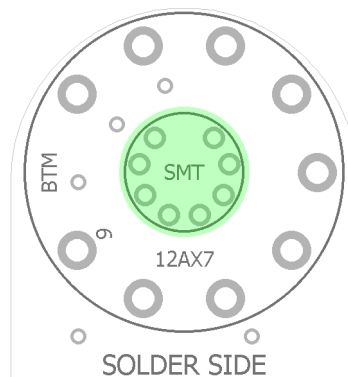
The best approach is to attach a heatsink to the regulator, then float it a few mm *above* rather than screw it directly through the PCB (as I did on my build). Leaving an air gap below the regulator improves heat dissipation. The 2022 version removes all the copper pours on both the top and bottom of the PCB to prevent LM317 failure (as one builder experienced with the 2021 version) but that simultaneously removes some heat dissipation one gains through large copper pours.

- I've seen one schematic attributed to some version of the Chandler Tube Driver that listed C12 as omitted. Not sure if that is accurate or not. I've included C12 in all my builds.

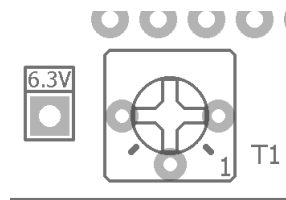


I've tested the Archibald with 12AX7, 12AT7 and the 12AU7. The AT7 and AU7 did not do well so I would stick with the AX7. I'm not sure if plate resistors need tweaking for the other two or something else. Surprisingly, the AU7 sounded better even though it is lower gain than the AT7. Maybe my AT7 is bad :(

The tube board also has the correct pad spacing and connections for sub-mini tubes. I did not have a chance to test one but the pin setup is correct. If you want to use one you'll have to solder it directly to the tube board. You cannot use the AX7 as a socket for a sub-mini without having to bend the leads around crazy-like.

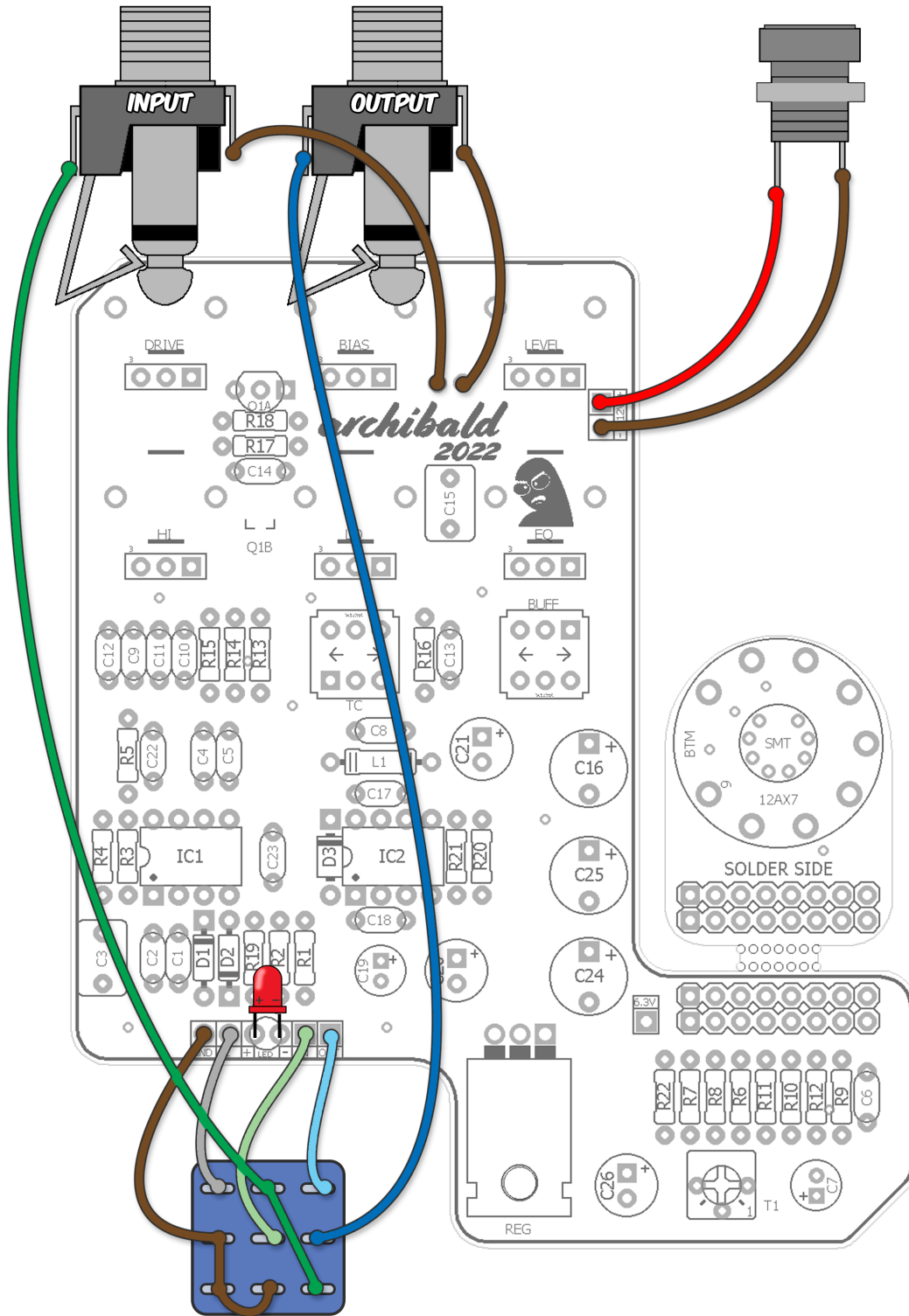


Before powering up for the first time, set the T1 trimmer to 50%. After powering up, use your DMM to measure the voltage at the test point. Adjust T1 until you read about 6.3v for the heater voltage. With the trimmer in the middle, it will already be very close to that.

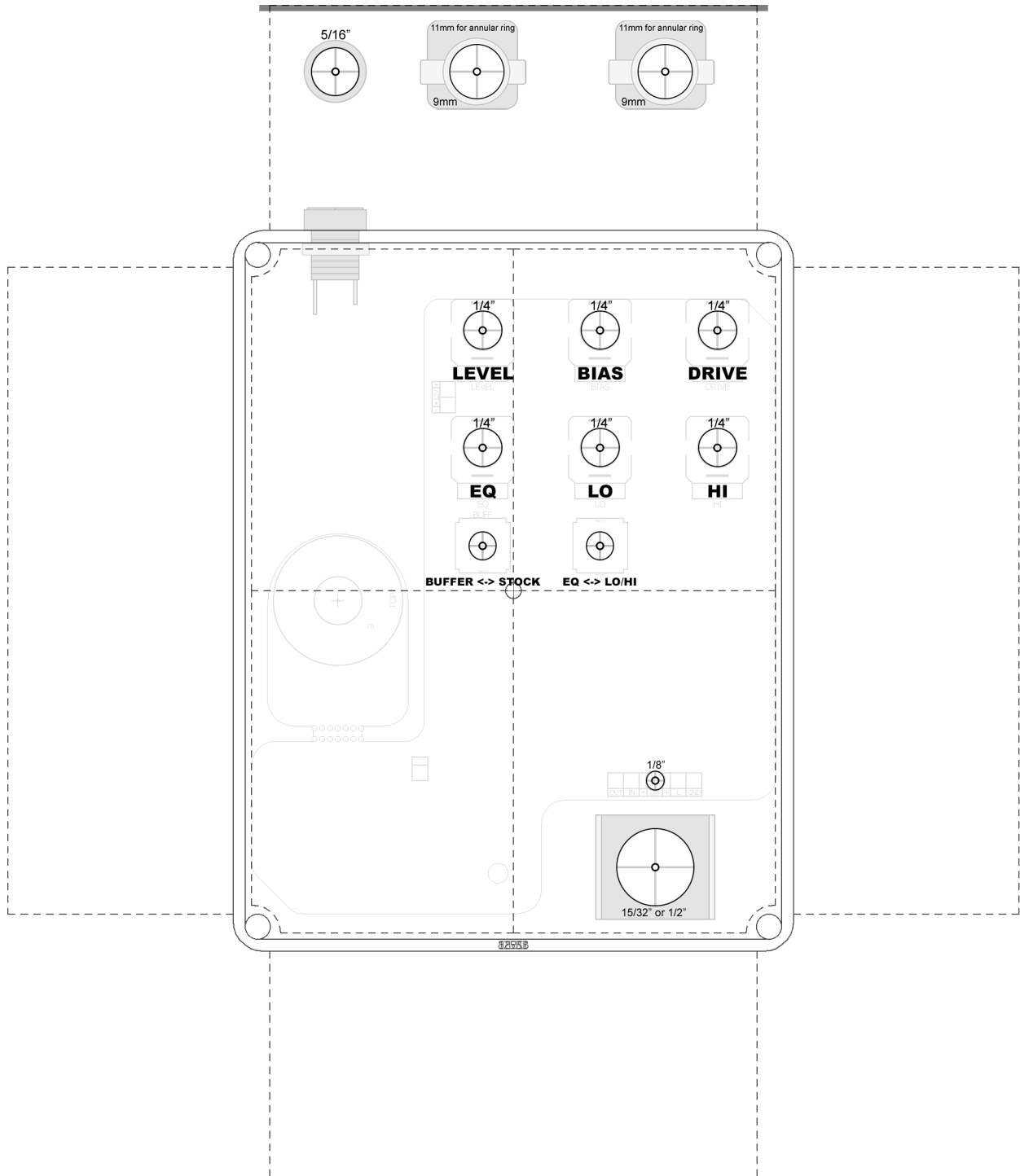


The Archibald has an optional JFET output buffer (you can use either a through-hole J201 in the Q1 spot or a surface mount MMBFJ201 in the Q1B spot). While the effect has plenty of output, the Hi/Lo tone controls are a bit lossy so it seemed like a logical thing to do to ensure a rock-solid, low output impedance from the effect.

A couple of builders of the 2021 version seemed to have had problem with the JFET buffer due to bad transistors (IOW, bad supplier). So, I suggest either obtaining your through-hole J201 from a reputable source or going with the surface mount version if you are comfortable with soldering SMD parts. If using through-hole, you can also sub in MPF102 or 2n5457 equally for the J201 in this instance.



**Note:** Drill Guides are approximate and may require tweaking depending on the types of jacks, switches and pots you use.



Use the Lumberg style 1/4" jacks or open frame metal jacks for this build. Enclosed jacks may not have proper clearance with the PCB.

IC1	TL072	V1	12AX7
1	480mV	1	5.52
2	480mV	2	-11.57
3	440mV	3	-11.12
4	-11.36	4	~0
5	13mV	5	~0
6	16mV	6	5.97
7	6mV	7	-11.68
8	11.65	8	-11.12
IC2	LT1054	9	6.33
1	1.52	Q1	J201
2	6.31	D	11.64
3	0	S	650mV
4	-5.17	G	187mV
5	-11.37	REG	LM317
6	2.57	VI	11.95
7	1.34	VO	6.33
8	11.65	ADJ	5.08

- 12.11vDC Power Supply
- Current Draw: 345mA
- On power up, the Archibald will draw excess current as the heaters settle. After 30 seconds or so it reads at about 345mA draw. This is why I suggest having a 500mA rated supply.



This build pic is from the 2021 version.

