

PROJECT NAME

EPHEMERIS



BASED ON

Xotic EP Booster

BUILD DIFFICULTY



EFFECT TYPE

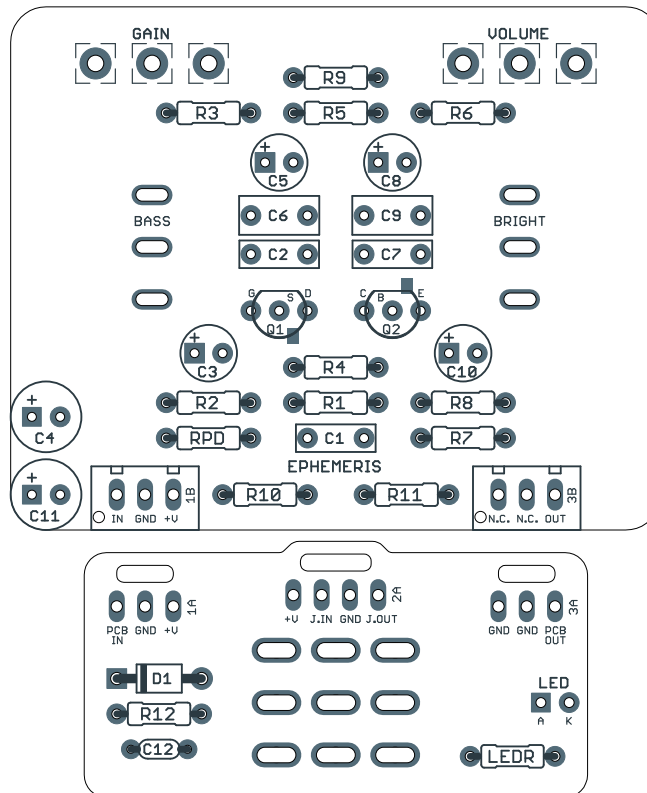
JFET boost/preamp

DOCUMENT VERSION

1.0.0 (2023-11-24)

PROJECT SUMMARY

A hybrid JFET/BJT boost circuit loosely based on the preamp section of the Echoplex EP-3 tape delay.



Actual size is 2.3" x 1.86" (main board) and 1.78" x 0.86" (bypass board).

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INTRODUCTION

The Ephemeris JFET Booster is based on the Xotic EP Booster, a one-knob boost first released in 2009 that is loosely based on the preamp section of the Echoplex EP-3 tape delay. There have been some minor changes to the circuit throughout production, but [we traced one in 2023](#) to ensure that we had the most accurate representation of the circuit.

In addition to the gain knob, the original EP Booster also has a DIP switch on the inside with two additional settings. In the stock circuit, the minimum gain setting is +3dB above unity. One of the DIP switch settings adds a resistor at the output that essentially just turns down the volume and sets the minimum gain position at unity gain instead.

The second mode disables a treble-cut filter. This could be called a treble boost, but in practice it provides something more like a flat response while the stock mode has a slight cut above 3.2kHz for a vintage-sounding warmth.

The Ephemeris moves the treble cut to a front-panel control, and replaces the fixed resistors at the output with a true volume control. The gain and volume controls are somewhat redundant, but at high gain levels it's possible to get the second transistor to clip, so different combinations of gain & volume can yield different tones. You can still dial back to unity gain as well, so the pedal can be used as a tone enhancer or buffer.

We have also ported the "Bass" switch from the earlier version of the EP Booster, and added a third position which cuts bass a bit, inspired by the original EP-3 preamp. More on this in the build notes.

USAGE

The Ephemeris has the following controls:

- **Gain** sets gain of the JFET stage.
- **Volume** sets the volume level at the output.
- **Bright** (toggle switch) disengages a hi-cut filter between the stages.
- **Bass** (toggle switch) selects the frequency range of the filter, with Low and Hi settings as well as an in-between Mid.

PARTS LIST

This parts list is also available in a spreadsheet format which can be imported directly into Mouser for easy parts ordering. Mouser doesn't carry all the parts (most notably potentiometers) so the second tab lists all the non-Mouser parts as well as sources for each.

[View parts list spreadsheet](#) →

PART	VALUE	TYPE	NOTES
R1	33k	Metal film resistor, 1/4W	
R2	1M	Metal film resistor, 1/4W	
R3	4k7	Metal film resistor, 1/4W	
R4	8k2	Metal film resistor, 1/4W	
R5	1k	Metal film resistor, 1/4W	
R6	15k	Metal film resistor, 1/4W	
R7	1M	Metal film resistor, 1/4W	
R8	10k	Metal film resistor, 1/4W	
R9	100R	Metal film resistor, 1/4W	
R10	10k	Metal film resistor, 1/4W	
R11	10k	Metal film resistor, 1/4W	
R12	390R	Metal film resistor, 1/4W	Power supply filter resistor.
RPD	1M	Metal film resistor, 1/4W	Input pulldown resistor. Can be as low as 1M.
LEDR	10k	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
C1	47n	Film capacitor, 7.2 x 2.5mm	
C2	22n	Film capacitor, 7.2 x 2.5mm	
C3	1uF	Electrolytic capacitor, 4mm	
C4	10uF	Electrolytic capacitor, 5mm	
C5	OMIT		Can use 10uF here and leave C6 empty. See build notes.
C6	1uF	Film capacitor, 7.2 x 3.5mm	Can omit and use 10uF for C5. See build notes.
C7	3n3	Film capacitor, 7.2 x 2.5mm	
C8	OMIT		Can use 10uF here and leave C9 empty. See build notes.
C9	1uF	Film capacitor, 7.2 x 3.5mm	Can omit and use 10uF for C8. See build notes.
C10	47uF	Electrolytic capacitor, 5mm	Reference voltage filter capacitor.
C11	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C12	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
Q1	2N5457	JFET, N-channel, TO-92	
Q2	2N5088	BJT transistor, NPN, TO-92	Can substitute BC549C (rotate 180 degrees).
GAIN	10kC	16mm right-angle PCB mount pot	Reverse audio (reverse log or antilog) taper.
VOLUME	50kA	16mm right-angle PCB mount pot	Audio (log) taper.
BRIGHT	SPDT on-on	Toggle switch, SPDT on-on	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
BASS	SPDT on-off-on	Toggle switch, SPDT center off	
IN	1/4" stereo	1/4" phone jack, closed frame	Switchcraft 112BX or equivalent.
OUT	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X or equivalent.
DC	2.1mm	DC jack, 2.1mm panel mount	Mouser 163-4302-E or equivalent.
BATT	Battery snap	9V battery snap	Optional. Use the soft plastic type—the hard-shell type will not fit.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

C5/C6 and C8/C9 capacitors

The EP Booster uses 10uF capacitors (C5 and C8) as signal couplers immediately after both the JFET and transistor stages. We recommend keeping electrolytic capacitors out of the signal path wherever possible. This PCB includes space for an alternate film capacitor (C6 and C9) in each of these positions, in which case C5 and C8 can be omitted entirely.

Due to the low source impedance, 1uF is more than enough to pass all useful bass frequencies. However, if you want to stick as closely as possible to the original circuit, use 10uF for both.

Bass switch

The original EP Booster (Rev. 1) had an internal switch to add bass. Overwhelmingly, players felt like the switch didn't actually do anything, and this was our experience in prototyping as well. We recommend using 1uF for C3 and 10uF for C4. The original values are 10uF for C3 and 100uF for C4.

The 22n setting (middle position) is an addition to our version of the circuit, inspired by the original EP-3 unit that used this value in one of the variants.

Volume knob

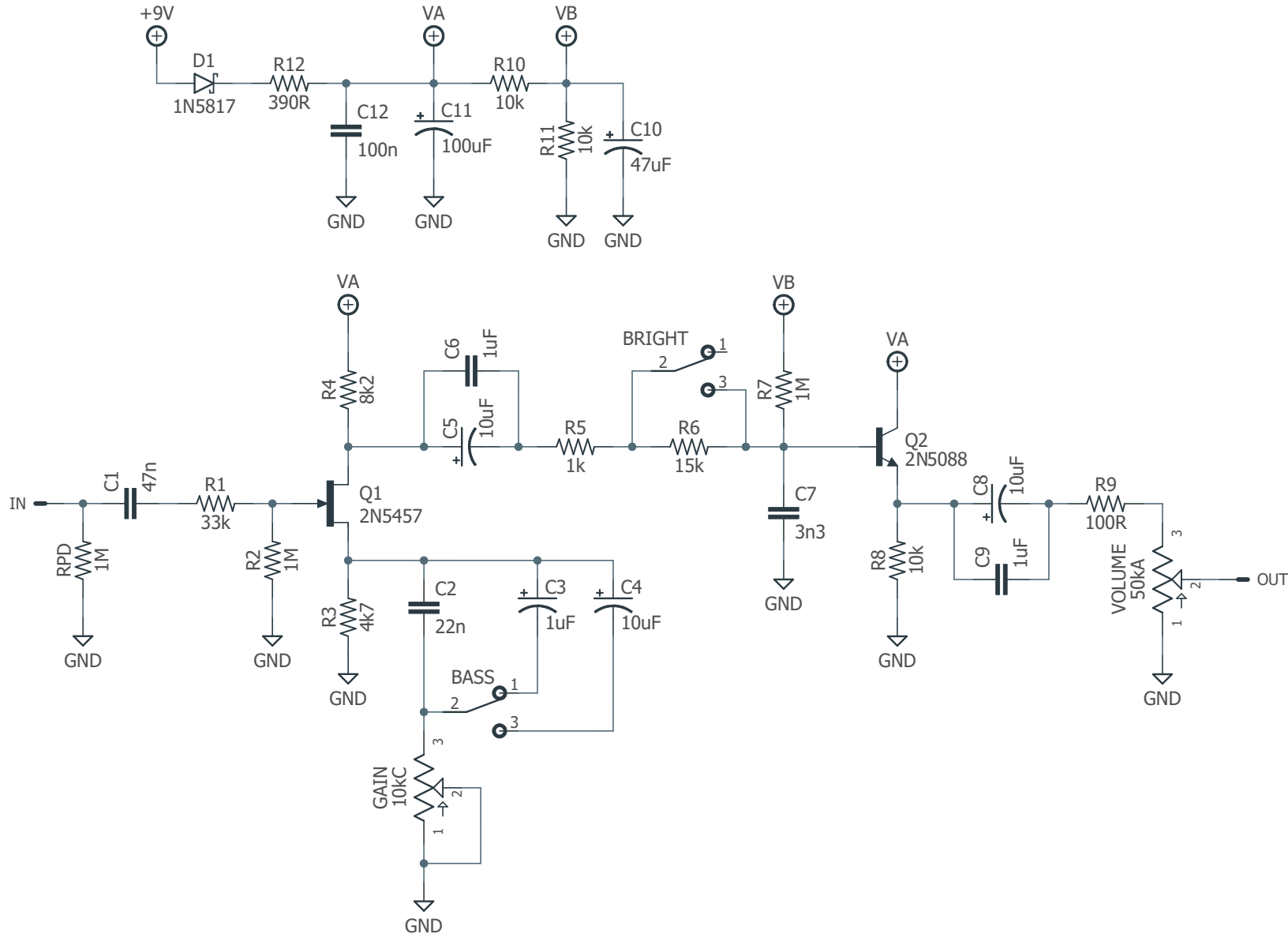
The Rev. 2 circuit replaced the bass switch with a +3dB Boost switch. This is actually a slickly-marketed volume cut, since the +3dB setting is equivalent to the stock Rev. 1 circuit. We have replaced this with a full volume knob so that the circuit can get down to unity gain. Just note that

Transistor substitutions

The EP Booster uses the BC849C for Q2, which is the SMD equivalent of the BC549C. The Ephemeric PCB uses the USA E-B-C convention, so we recommend using the 2N5088 or 2N5089. If you do want to use a BC549C, just make sure to rotate it 180 degrees from the silkscreen.

Q1 is a MMBF5457, which is the SMD version of the 2N5457. These are [available from Aion FX](#) mounted to through-hole adapters and will perform identically to the ones used in the original.

SCHEMATIC



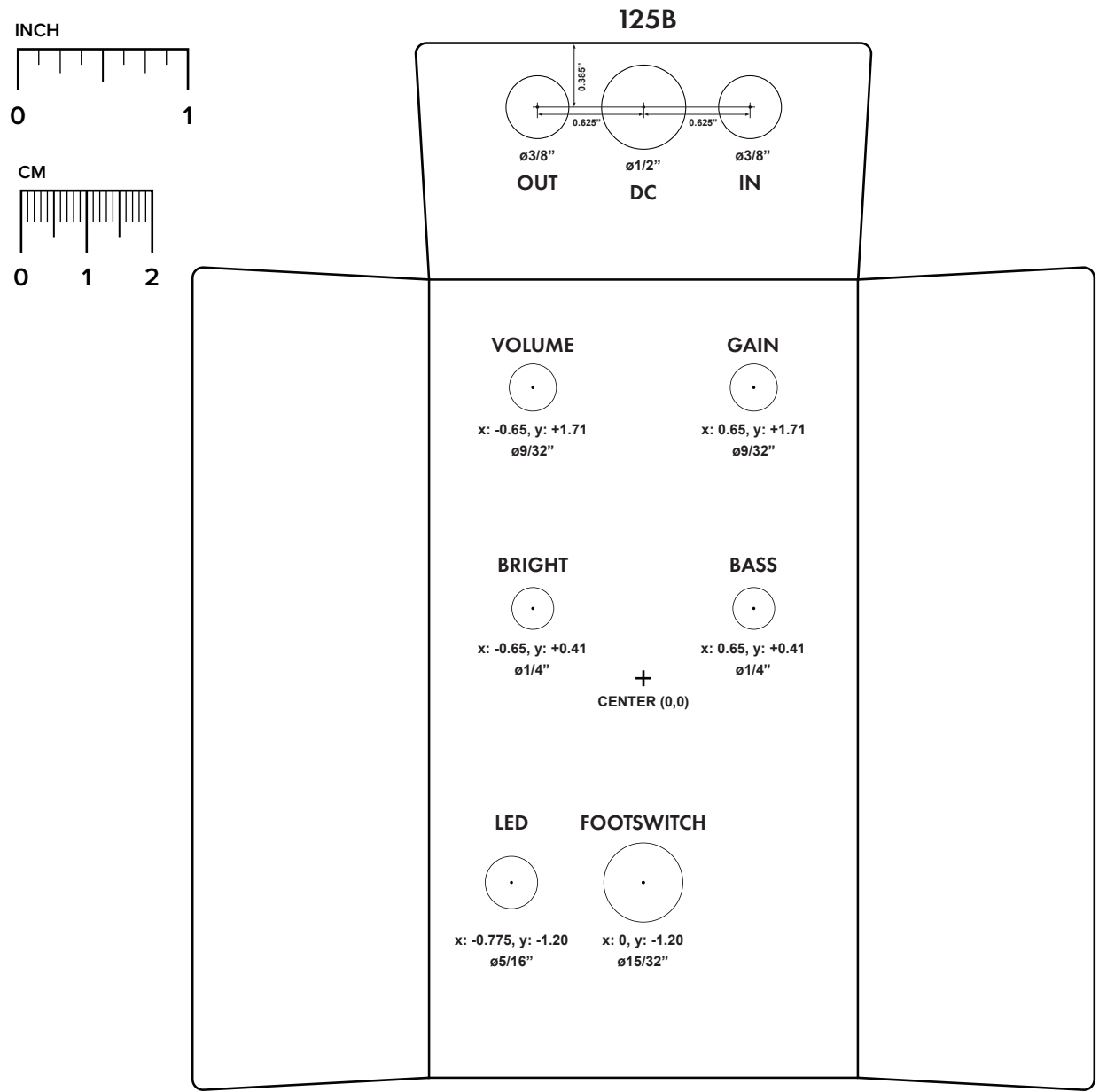
DRILL TEMPLATE

Cut out this drill template, fold the edges and tape it to the enclosure. Before drilling, it's recommended to first use a center punch for each of the holes to help guide the drill bit.

Ensure that this template is printed at 100% or "Actual Size". You can double-check this by measuring the scale on the printed page.

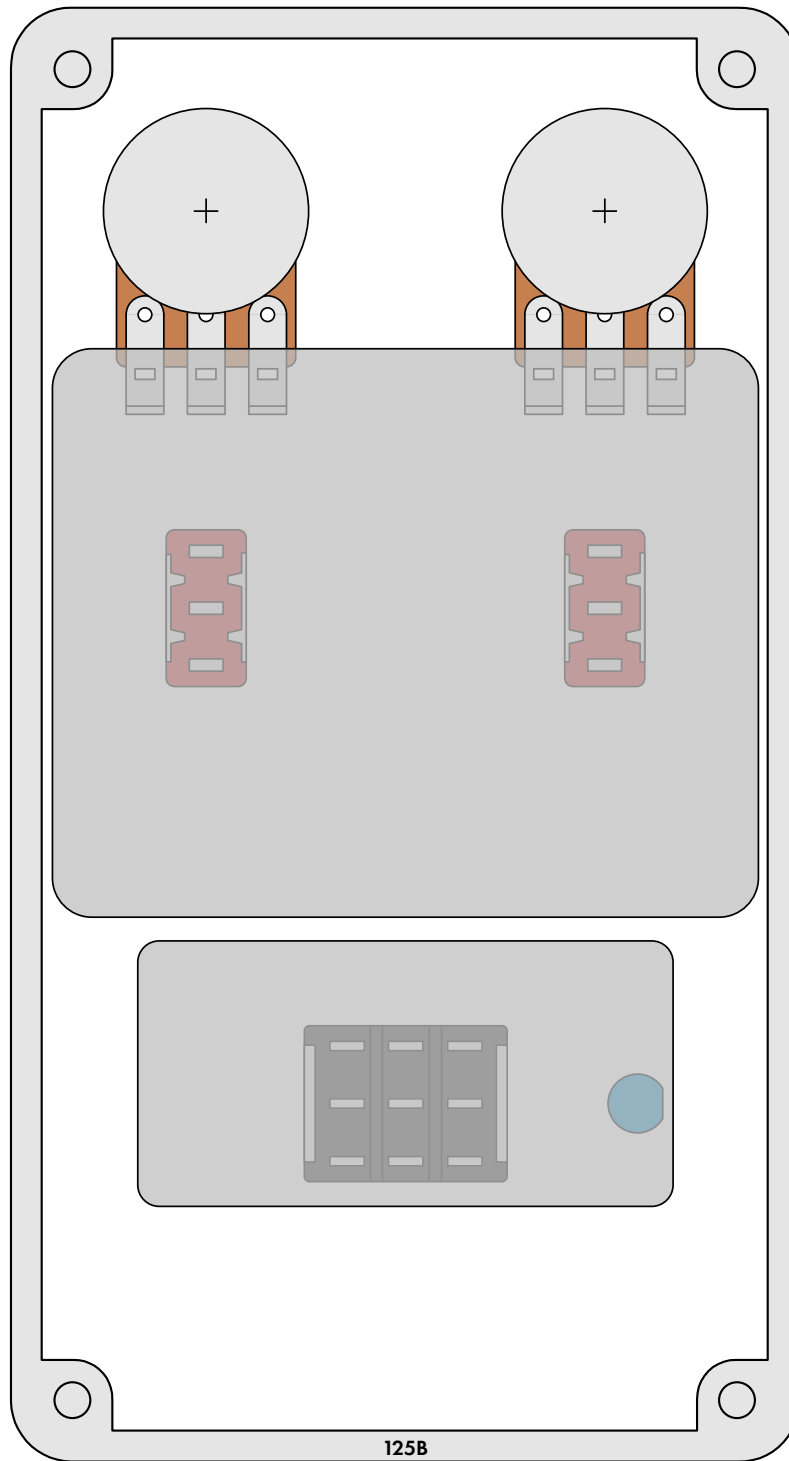
Top jack layout assumes the use of closed-frame jacks like the [Switchcraft 111X](#). If you'd rather use open-frame jacks, please refer to the [Open-Frame Jack Drill Template](#) for the top side.

LED hole drill size assumes the use of a [5mm LED bezel](#), available from several parts suppliers. Adjust size accordingly if using something different, such as a 3mm bezel, a plastic bezel, or just a plain LED.



ENCLOSURE LAYOUT

Enclosure is shown without jacks. See next page for jack layout and wiring.



WIRING DIAGRAM



*Shown with optional 9V battery. If battery is omitted, both jacks can be mono rather than one being stereo.
Leave the far-right lug of the DC jack unconnected.*

LICENSE & USAGE

No direct support is offered for these projects beyond the provided documentation. It's assumed that you have at least some experience building pedals before starting one of these. Replacements and refunds cannot be offered unless it can be shown that the circuit or documentation are in error.

All of these circuits have been tested in good faith in their base configurations. However, not all the modifications or variations have necessarily been tested. These are offered only as suggestions based on the experience and opinions of others.

Projects may be used for commercial endeavors in any quantity unless specifically noted. No attribution is necessary, though a link back is always greatly appreciated. The only usage restrictions are that **(1) you cannot resell the PCB as part of a kit without prior arrangement, and (2) you cannot “goop” the circuit, scratch off the screenprint, or otherwise obfuscate the circuit to disguise its source.** (In other words: you don't have to go out of your way to advertise the fact that you use these PCBs, but please don't go out of your way to hide it. The guitar effects industry needs more transparency, not less!)

DOCUMENT REVISIONS

1.0.0 (2023-11-24)

Initial release.