

PROJECT NAME  
**DRACO**

BASED ON  
Dr. Boogey

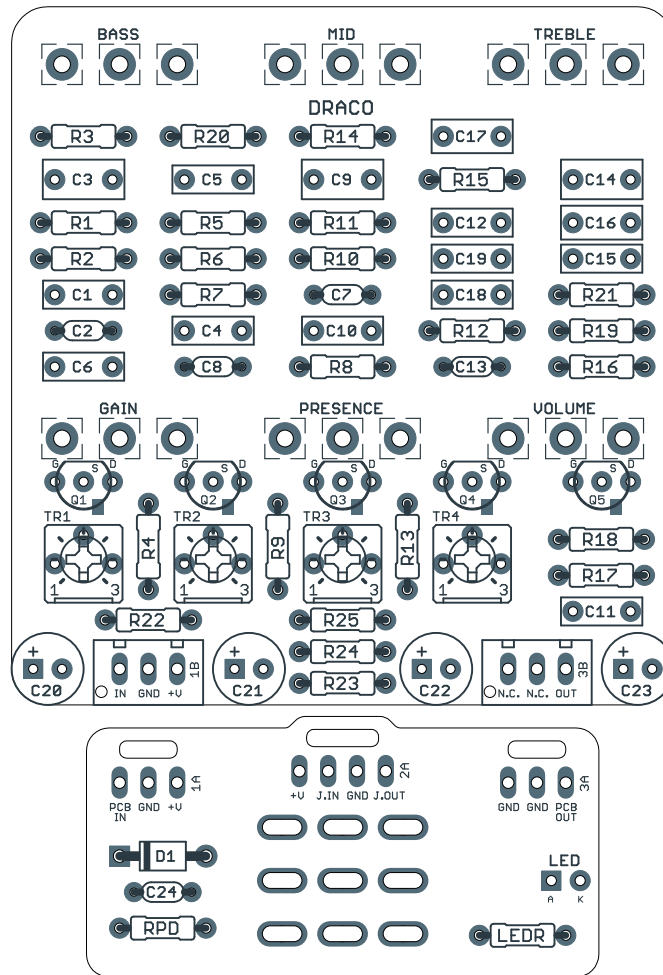
BUILD DIFFICULTY  
■■■■□ Intermediate

EFFECT TYPE  
Amp emulation / distortion

DOCUMENT VERSION  
1.0.0 (2023-03-24)

**PROJECT SUMMARY**

A JFET conversion of the Mesa/Boogie Dual Rectifier Solo Head that originated in the DIY community and has become a classic high-gain distortion effect.



Actual size is 2.3" x 2.42" (main board) and 1.78" x 0.86" (bypass board).

# TABLE OF CONTENTS

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1	Project Overview	8	Drill Template
2	Introduction & Usage	9	Enclosure Layout
3-5	Parts List	10	Wiring Diagram
6	Build Notes	11	Licensing
7	Schematic	11	Document Revisions

## INTRODUCTION

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The Draco Amp Distortion is based on the Dr. Boogey, which first appeared on the [DIYStompboxes forum on January 17, 2005](#) as an original design by user “electrictabs”.

It uses the basic [Fetzer Valve technique](#) pioneered by Runoffgroove to convert the Mega/Boogie Dual Rectifier Solo Head tube stages into JFETs but otherwise keep the tone-shaping as close to the original as possible. Nothing can perfectly emulate tubes, but whatever the case, the result is an excellent high-gain distortion pedal.

It has undergone a few minor community tweaks since the original design, such as scaling the tone stack for lower noise and the addition of Miller capacitors on the JFETs, but for the most part it’s an excellent example of nailing it the first time. We’ve incorporated all of these best-practice changes into our version, as well as greatly improving the power supply filtering.

The Draco includes footprints for both through-hole or surface-mount (SMD) JFETs. Since the J201 is very difficult to find in TO-92 through-hole format, and many DIY hobbyists are intimidated by SMD parts, Aion FX offers [J201s in SMD format](#) that have been pre-soldered to adapters so they can be used as through-hole parts.

Important note: Due to the extremely high-gain nature of the pedal, it tends to oscillate on higher gain settings. This is normal, but see the build notes for more information as well as suggestions for how to minimize or eliminate this oscillation.

## USAGE

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The Draco has the full 6-knob control set of the original Mesa amplifier:

- **Gain** controls the amount of gain between the first two stages that overloads the following stages.
- **Bass, Mid and Treble** form a standard 3-band Fender/Marshall/Vox-style tonestack.
- **Presence** controls the high-end treble response via a passive filter near the output.
- **Volume** controls the overall output.

## 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—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	1M	Metal film resistor, 1/4W	
R2	68k	Metal film resistor, 1/4W	
R3	1k8	Metal film resistor, 1/4W	
R4	15k	Metal film resistor, 1/4W	
R5	2M2	Metal film resistor, 1/4W	
R6	680k	Metal film resistor, 1/4W	
R7	470k	Metal film resistor, 1/4W	
R8	1k8	Metal film resistor, 1/4W	
R9	15k	Metal film resistor, 1/4W	
R10	470k	Metal film resistor, 1/4W	
R11	1M	Metal film resistor, 1/4W	
R12	3k9	Metal film resistor, 1/4W	
R13	15k	Metal film resistor, 1/4W	
R14	330k	Metal film resistor, 1/4W	
R15	220k	Metal film resistor, 1/4W	
R16	1k8	Metal film resistor, 1/4W	
R17	15k	Metal film resistor, 1/4W	
R18	10k	Metal film resistor, 1/4W	
R19	4k7	Metal film resistor, 1/4W	
R20	5k1	Metal film resistor, 1/4W	
R21	2k2	Metal film resistor, 1/4W	
R22	100R	Metal film resistor, 1/4W	Power supply filter resistor.
R23	100R	Metal film resistor, 1/4W	Power supply filter resistor.
R24	100R	Metal film resistor, 1/4W	Power supply filter resistor.
R25	100R	Metal film resistor, 1/4W	Power supply filter resistor.
RPD	2M2	Metal film resistor, 1/4W	Input pull-down 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	100n	Film capacitor, 7.2 x 2.5mm	
C2	220pF	MLCC capacitor, NP0/C0G	
C3	1uF	Film capacitor, 7.2 x 3.5mm	
C4	22n	Film capacitor, 7.2 x 2.5mm	
C5	2n2	Film capacitor, 7.2 x 2.5mm	

## PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C6	1n	Film capacitor, 7.2 x 2.5mm	
C7	22pF	MLCC capacitor, NP0/COG	
C8	220pF	MLCC capacitor, NP0/COG	
C9	1uF	Film capacitor, 7.2 x 3.5mm	
C10	22n	Film capacitor, 7.2 x 2.5mm	
C11	1n	Film capacitor, 7.2 x 2.5mm	
C12	22n	Film capacitor, 7.2 x 2.5mm	
C13	220pF	MLCC capacitor, NP0/COG	
C14	1uF	Film capacitor, 7.2 x 3.5mm	
C15	6n8	Film capacitor, 7.2 x 2.5mm	
C16	220n	Film capacitor, 7.2 x 2.5mm	
C17	220n	Film capacitor, 7.2 x 2.5mm	
C18	15n	Film capacitor, 7.2 x 2.5mm	
C19	15n	Film capacitor, 7.2 x 2.5mm	
C20	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C21	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C22	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C23	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C24	100n	MLCC capacitor, X7R	Power supply filter capacitor.
Q1	J201	JFET, N-channel	See build notes for sourcing info.
Q2	J201	JFET, N-channel	See build notes for sourcing info.
Q3	J201	JFET, N-channel	See build notes for sourcing info.
Q4	J201	JFET, N-channel	See build notes for sourcing info.
Q5	J201	JFET, N-channel	See build notes for sourcing info.
D1	1N5817	Schottky diode, DO-41	
TR1	50k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P
TR2	50k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P
TR3	50k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P
TR4	50k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P
GAIN	1MA	16mm right-angle PCB mount pot	
TREBLE	25kA	16mm right-angle PCB mount pot	
MID	5kB	16mm right-angle PCB mount pot	
BASS	100kA	16mm right-angle PCB mount pot	
PRES.	10kB	16mm right-angle PCB mount pot	
VOL.	100kA	16mm right-angle PCB mount pot	

## PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
LED	5mm	LED, 5mm, red diffused	
IN	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X 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.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

## BUILD NOTES

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### Biasing

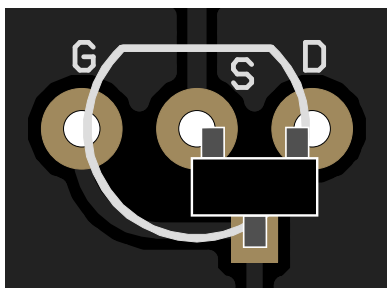
The first four JFETs need to be biased with a multimeter for optimal performance. (Q5 is set up as a buffer and does not require any adjustments.)

To start with, the four trimmers should be set at 50% (12:00). Then, with the multimeter's black lead touching ground and the red lead touching the "D" (drain) pad of the corresponding JFET, adjust the trimmer until you read approximately half the supply voltage (nominally **4.5–4.8V**).

### Using SMD JFETs

The J201 JFET is no longer available in through-hole format. This PCB uses a hybrid through-hole/SMD outline for each JFET. An extra "G" (gate) pad is included to accommodate surface-mount devices without the need for adapters.

SMD JFETs should be oriented as follows:



All surface-mount JFETs use the same pinout, so this configuration will fit any type that we're aware of. However, always check the datasheet if you're uncertain—they're difficult to desolder.

### Using through-hole adapters

If you're not confident in your ability to work with surface-mount parts, Aion FX offers [MMBFJ201 JFETs](#) (the SMD version of the J201) that come pre-soldered to adapters for use in through-hole designs. These are from the same manufacturer as the ones used when this project was originally developed and will perform identically.

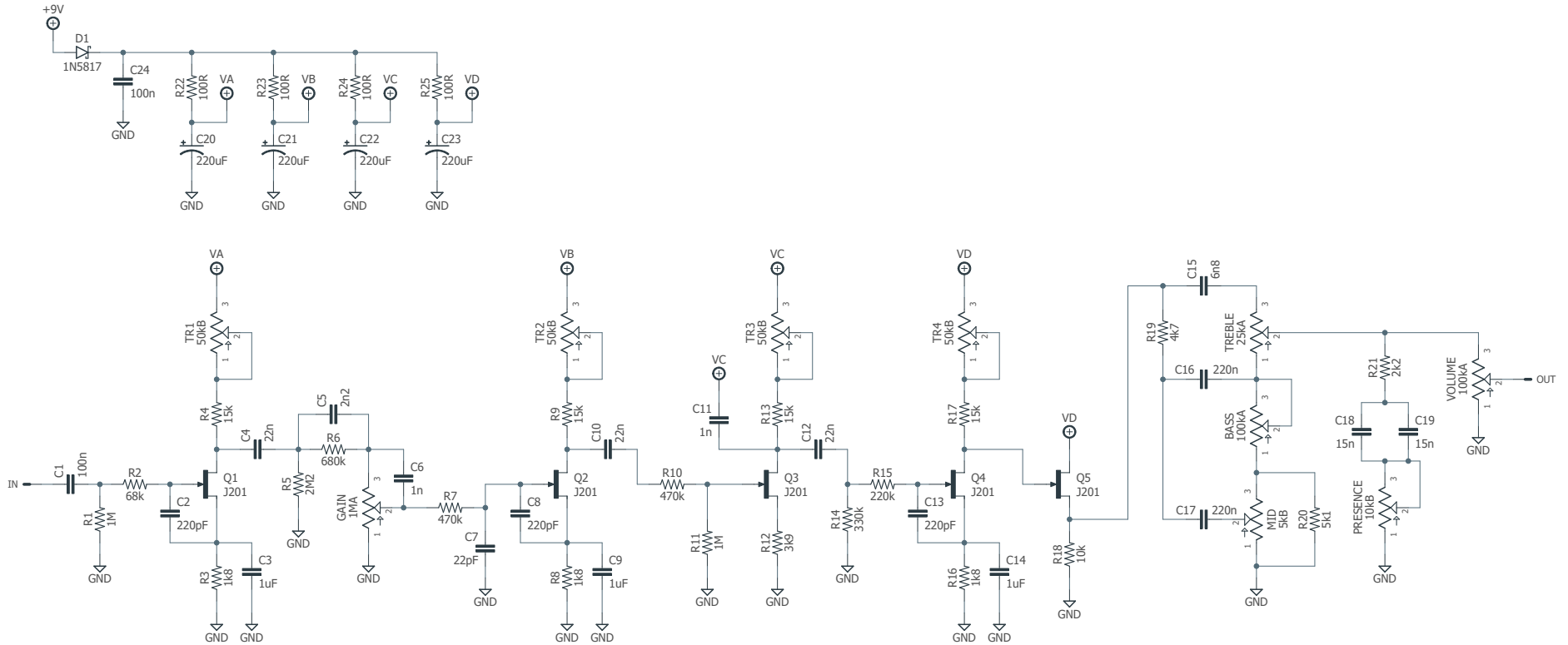
### Oscillation

The Dr. Boogey circuit is well-known for oscillating at high gain settings. The Draco layout is highly optimized for signal flow and performs better than any other version we've tested, but some of it is just inherent to the circuit. It also varies greatly based on the rig.

If the oscillation is too much, you can try any of the following, in order:

- Use a buffer before the Dr. Boogey. Low-impedance signals are less susceptible to interference.
- With the gain control set at maximum, adjust the bias of Q1 until it goes away.
- Use JFETs with higher  $V_{GS(off)}$  for Q1 and Q2, e.g. 2N5457.
- Use shielded wire for the input. (This likely wouldn't do much more than a buffered input signal.)

# SCHEMATIC



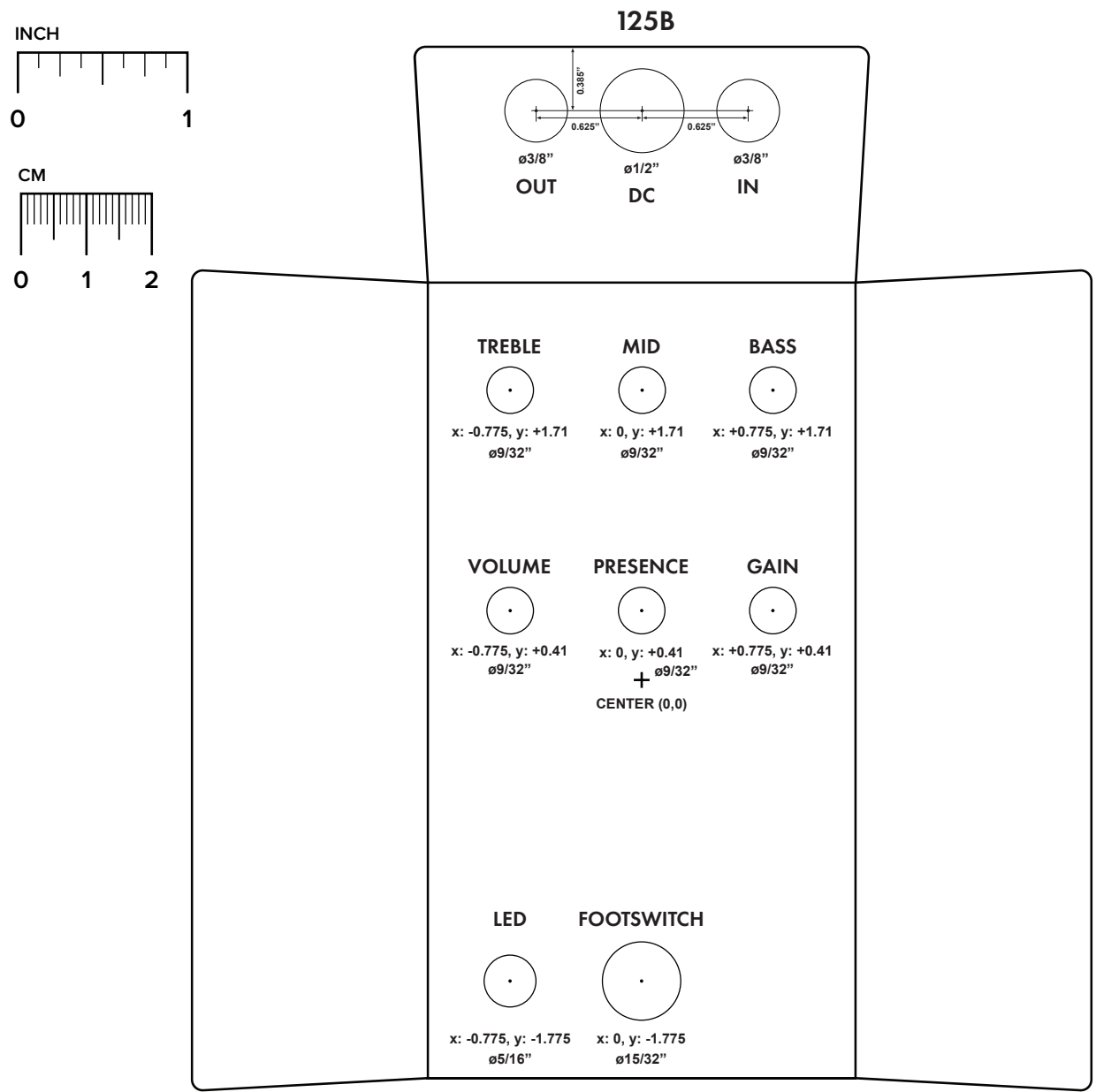
# DRILL TEMPLATE

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](#). Open-frame jacks will not fit in layouts with 5 or more knobs due to the placement of the DC jack.

**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.

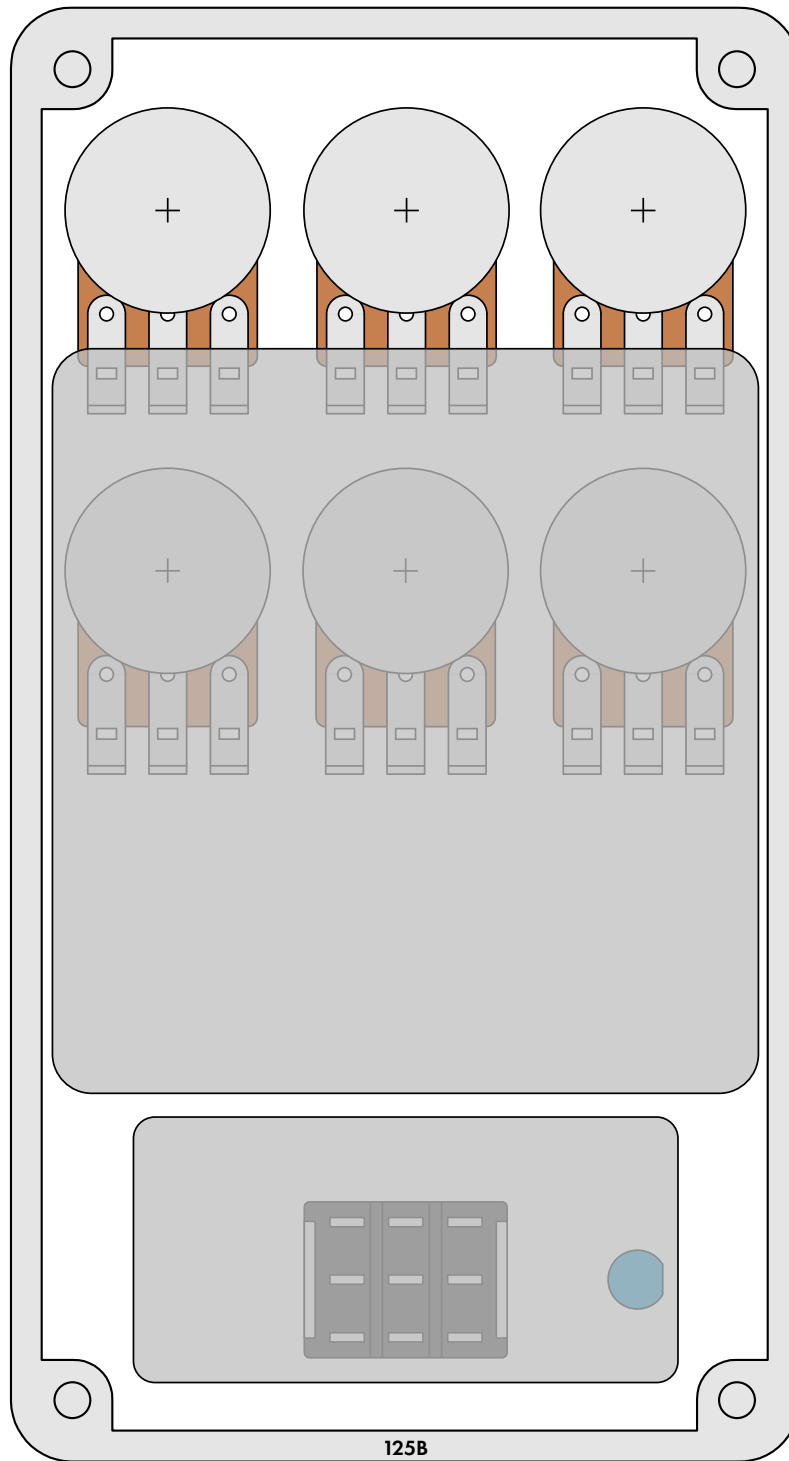




# ENCLOSURE LAYOUT

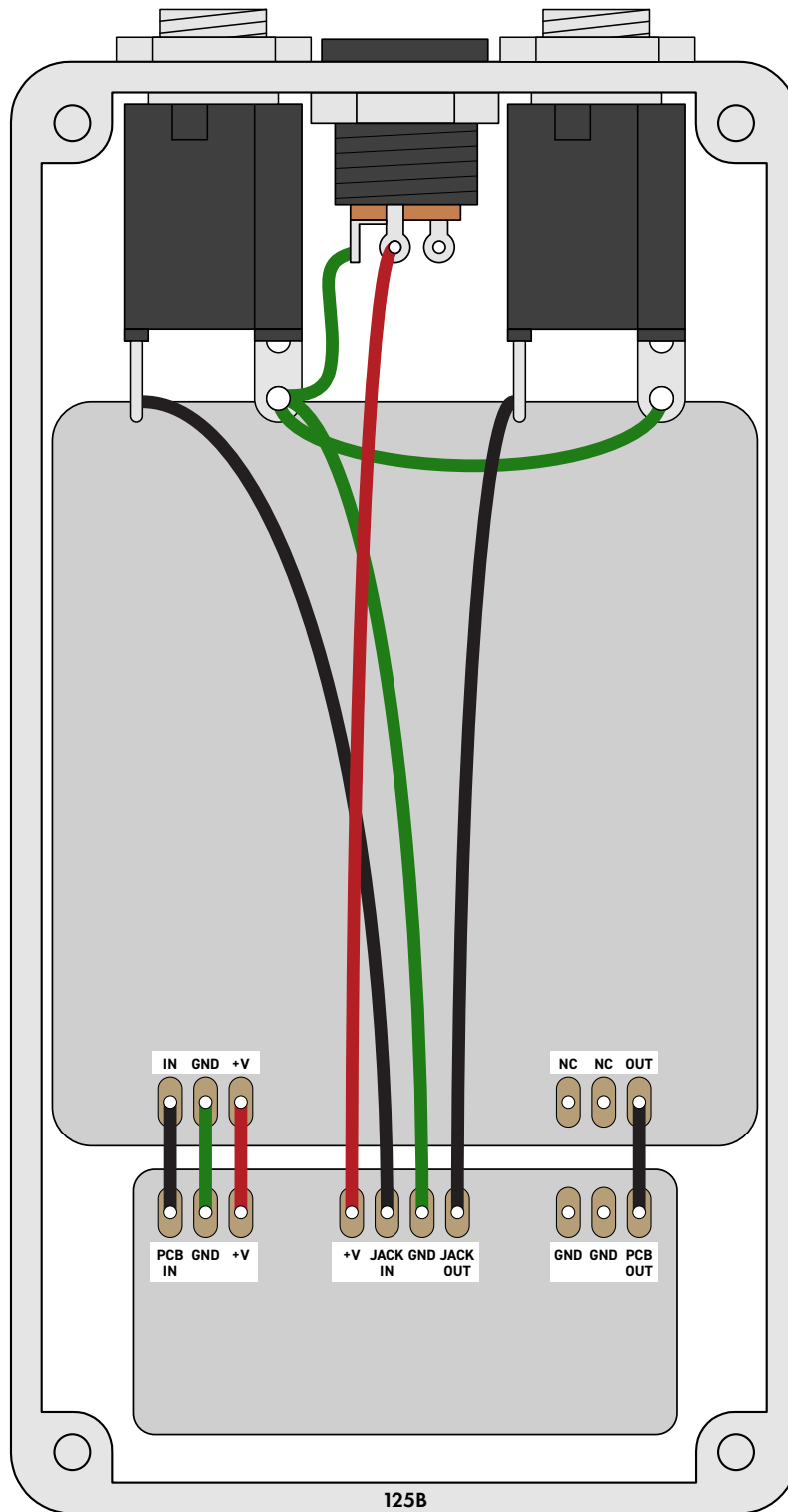
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Enclosure is shown without jacks. See next page for jack layout and wiring.



# WIRING DIAGRAM

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## LICENSE & USAGE

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**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

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### 1.0.0 (2023-03-24)

Initial release.