PROJECT NAME

MONAD

aion DIY GUITAR EFFECTS

BASED ON
Univox Uni-Drive UD-50

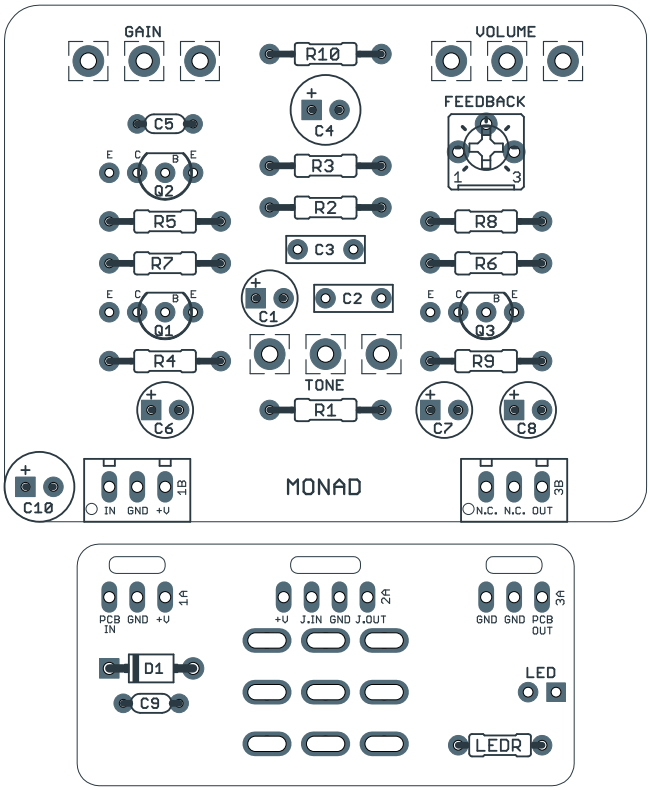
BUILD DIFFICULTY
▮▯▯▯▯ Beginner

EFFECT TYPE
Boost

DOCUMENT VERSION
1.0.0 (2018-12-15)

PROJECT SUMMARY

A basic 3-transistor booster that gets some grit at higher input levels. Best used to overdrive the input stage of a tube amplifier for natural amp drive.



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

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INTRODUCTION

The Monad Vintage Boost is an adaptation of the Univox Uni-Drive UD-50. The original Uni-Drive was in a wah-style enclosure, with the foot pedal controlling the overall volume and a rotary switch setting the input attenuation (which corresponds to the amount of transistor clipping that occurs). It also had a range knob to allow the user to set the minimum position of the volume treadle to tailor it to their liking.

Since the rotary switch is set up as a potentiometer with six fixed positions, in this project it has been converted to an actual potentiometer. And since the range control is only needed for a treadle, it's been omitted and merged into the output volume control.

Along with those changes, two modifications have been added. The first is an input capacitor blend control, allowing you to reduce the bass content for more of a treble boost than full-range. This is a common modification for vintage pedals with no tone control, often seen on variants of the Fuzz Face and Dallas Rangemaster.

The second modification is an internal trimmer that allows you to adjust the amount of feedback from the third stage back to the first stage. The default resistor is 8.2k in the original, but by setting it higher or lower, you can get some interesting tonal changes.

USAGE

The Monad has three controls:

- **Gain** sets the signal level at the input, which affects the amount of clipping and saturation produced by the following transistor stages.
- **Tone** is an input capacitor blend control, adding bass as you turn it up.
- **Level** sets the overall output of the effect.

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	150k	Metal film resistor, 1/4W	
R2	7k5	Metal film resistor, 1/4W	Some units used 2k here.
R3	100R	Metal film resistor, 1/4W	
R4	100k	Metal film resistor, 1/4W	
R5	100k	Metal film resistor, 1/4W	
R6	10k	Metal film resistor, 1/4W	
R7	3k9	Metal film resistor, 1/4W	Original is 4k. This is the nearest available value.
R8	8k2	Metal film resistor, 1/4W	
R9	3k3	Metal film resistor, 1/4W	
R10	10k	Metal film resistor, 1/4W	
LEDR	4k7	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.
C1	10uF	Electrolytic capacitor, 5mm	
C2	4n7	Film capacitor, 7.2 x 2.5mm	
C3	1n	Film capacitor, 7.2 x 2.5mm	
C4	10uF	Electrolytic capacitor, 5mm	
C5	39pF	MLCC capacitor, NP0/C0G	
C6	10uF	Electrolytic capacitor, 5mm	
C7	10uF	Electrolytic capacitor, 5mm	
C8	10uF	Electrolytic capacitor, 5mm	
C9	100n	MLCC capacitor, X7R	Power supply filter capacitor.
C10	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
Q1	2N3904	BJT transistor, NPN, TO-92	Substitute. Original used 2SC859. hFE of 150-200 is optimal.
Q2	2N3904	BJT transistor, NPN, TO-92	
Q3	2N3904	BJT transistor, NPN, TO-92	
FDBK	10k trimmer	Trimmer, 10%, 1/4" (3362P style)	
GAIN	500kB	16mm right-angle PCB mount pot	
TONE	100kB	16mm right-angle PCB mount pot	
VOL	10kA	16mm right-angle PCB mount pot	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
LED	5mm	LED, 5mm, red diffused	
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.

Transistor selection

The original Uni-Drive used Sanyo 2SC859 transistors, which are extremely rare these days. There is no datasheet available online. The only record of them is a spec sheet that lists the basic info in a table:

TRANSISTOR NUMBER	PM OA LT	PACK-AGE	LEAD INFO	VCB MAX	VCE MAX	VEB MAX	I C MAX	T J MAX	P TOT	F T MIN	C OB MAX	H FE	H FE BIAS	USE	MFR	EUR EQUIV	USA EQUIV	ISS
2SC857H	NS	T01	L02	150V	150V	5V	200MA	175C	200MWF	25M	20P	30MN	10MA	ALH	HIJ	BSX21	2N1990R	0
2SC858	NS	T092	L21	20V	12V	5V	50MA	125C	100MWF	90M	6P	240TP	1MA	ALN	SAN	BC184L	2N3707	0
2SC859	NS	T092	L21	20V	12V	5V	50MA	125C	100MWF	90M	6P	240TP	1MA	ALN	SAN	BC184L	2N3707	0
2SC860	NS	T072	L06	15V	12V	3V	30MA	125C	200MWF	400M	2P2	80TP	1MA	VLA	SAN	BFX73	2N918	0

With this, we can see that the typical hFE of a 2SC859 is 240 at 1mA test current.

Aion FX had the opportunity to take apart and measure an original Uni-Drive. Here's how the transistor gains measured with a Peak Atlas DCA55. (Note that the DCA55 uses 2.5mA as the test current, so the hFE measurement is not a direct comparison to the 240 listed in the datasheet, although it's close.)

- **Q1:** 161
- **Q2:** 155
- **Q3:** 184

So in reality, the gain is actually a fair amount less than the "typical" value provided by the datasheet. This makes the **2N3904** a good modern substitute, with real-world gain that is usually in the 170 to 200 range—and occasionally as low as the 150s.

Now, all this is not to say that the exact transistor gains make that big of a difference in sound for this pedal. This is just provided for posterity's sake. Experiment if you're curious, but either way, the 2N3904 is the one you want.

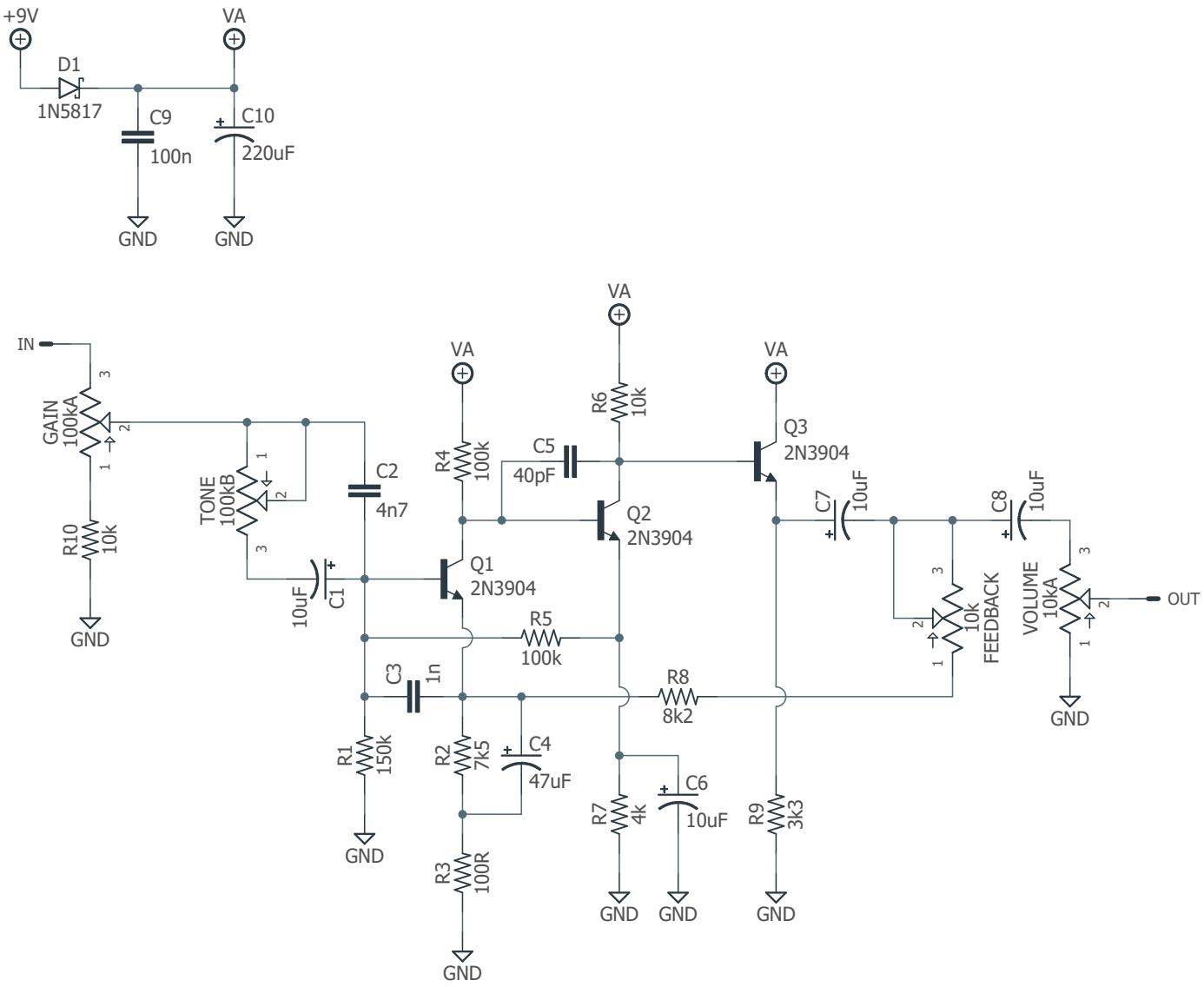
Feedback trimmer

The feedback trimmer is a modification that lets you adjust the amount of feedback from the third stage back to the first. The stock unit has an 8.2k feedback resistor for R8.

The parts listing calls for keeping the 8.2k resistor so that the trimmer's minimum setting is the stock Uni-Drive value. This allows you to reduce the amount of feedback by increasing the feedback resistor value, but not to reduce the resistor value and increase the feedback.

You may want to have the ability to adjust for more feedback instead of only less. In this case, reduce R8 from 8.2k down to something like 4.7k. It may be worthwhile to set the trimmer to the exact stock value before fitting it on the board (e.g. 3.5k, if a 4.7k resistor is used for R8) and mark it with a Sharpie so that you can easily set it back to stock after experimenting.

SCHEMATIC


+9V
VA
D1
1N5817
C9
100n
C10
220uF
GND
GND
IN
GAIN
100kA
R10
10k
GND
TONE
100kB
C2
4n7
10uF
C1
VA
R4
100k
Q1
2N3904
C3
1n
R1
150k
GND
R2
7k5
C4
47uF
R3
100R
GND
VA
R6
10k
C5
40pF
Q2
2N3904
R5
100k
R7
4k
GND
C6
10uF
GND
VA
Q3
2N3904
R8
8k2
R9
3k3
GND
C7
10uF
C8
10uF
10k
FEEDBACK
VOLUME
10kA
OUT
GND

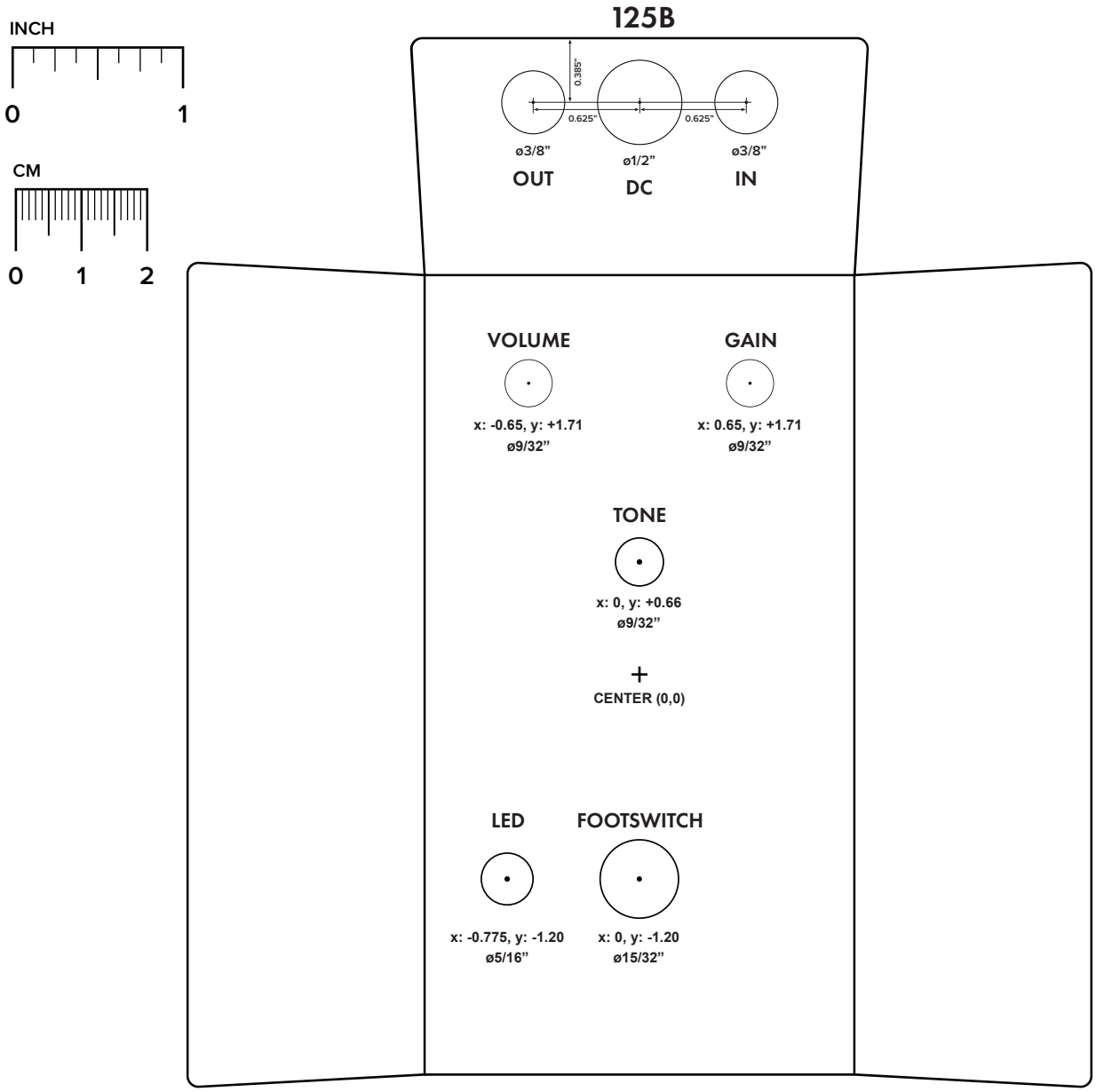
DRILL TEMPLATE

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.

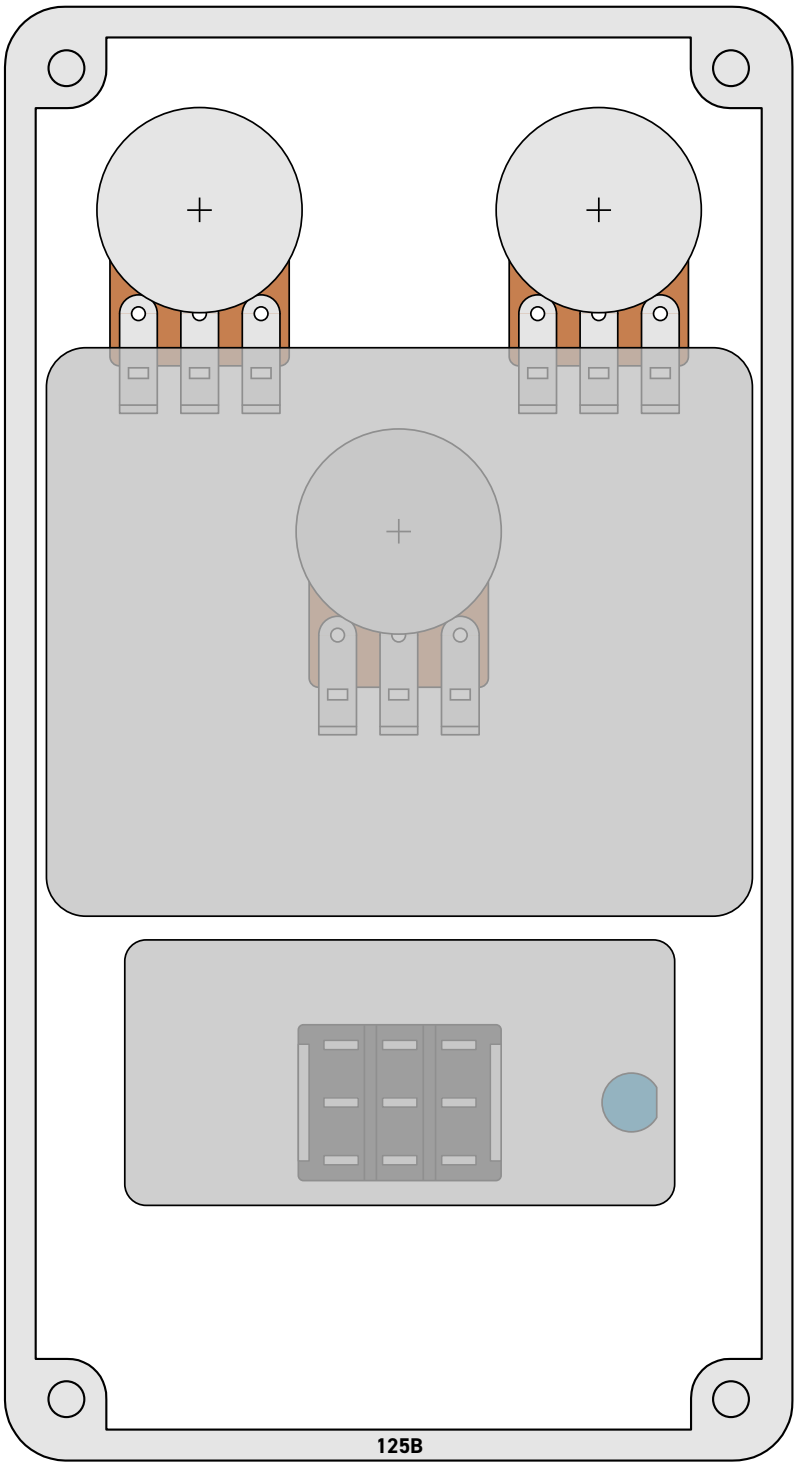
Top jack layout assumes the use of closed-frame jacks like the Switchcraft 111X. If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

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.

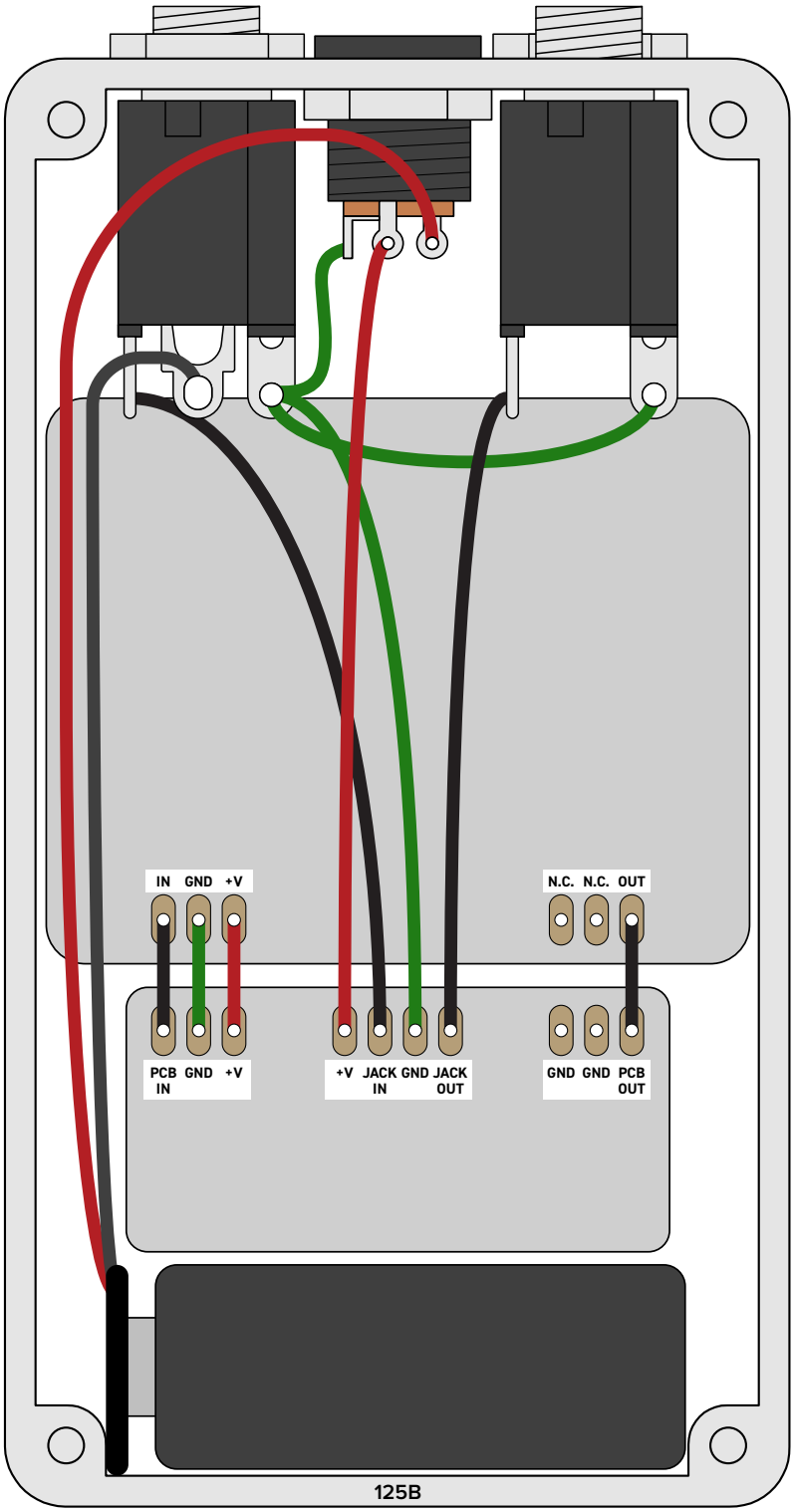


ENCLOSURE LAYOUT

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 cannotbe 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 (2018-12-15)
Initial release.