Lizard Kisses

Overdrive pedal kit by Pedal Markt

April 24, 2025

Contents

1 Introduction

Lizard Kisses is a color and texture device. With different clipping and brightness options, it can act as a boost, an overdrive, or a distortion. It stacks well with other pedals, responds to your playing, and is a classy beast all around!

Lizard Kisses enclosure was designed by Agata Fiz.

Figure 1: Lizard Kisses: oustide and inside

The pedal was originally conceived for the workshops at Pedal Markt. The intention was to make it as easy to build and customize as possible.

You will find the stock values for components in the BOM below. There are separate sections further in the document that describe how you could try out alternative parts to get different sounds.

The circuit is based around a discrete operational amplifier. Discrete means it's built out of single transistors, as opposed to an integrated circuit aka a chip. You can find the schematic and the circuit breakdown further in the document.

2 BOM – Bill of Materials

BOM is a document that lists the parts you'd need to build a project. Each row corresponds to a component with a certain value, for example, a 'ceramic capacitor with value 1nF.' There could be one or more actual physical parts per row, their designators are listed in the *Reference* column.

Components in the BOM are listed in order of assembly. Go through the table top to bottom. If you haven't built a kit before, check out the Step-by-step Instructions first.

In the BOM *text in italic font* gives tips about how to mount or solder parts.

If you'd like to experiment with some of the parts, for example, Brightness Caps and Clipping Diodes, please socket them. Guides for that are in the respective sections.

Table 1: BOM

	Ref	Value	Qnty	Description
Outboard				
	–	Enclosure	1	*Mount both pots, both toggle switches, DC jack, Footswitch and LED Lampshade into the enclosure before soldering*
	–	Lampshade	1	Small transparent plastic part for the LED, *mount in enclosure before putting the boards in*
	–	Rubber Ring	1	*Use it to keep LED Lampshade in place*
	–	DC Jack	1	Black plastic part with a nut, *mount in enclosure before soldering*
	–	DC Cable	1	Red and black cables in a JST connector, *cut to* $\approx 12cm$ *and solder to DC Jack once it's mounted in enclosure*
	–	Audio Jack	2	*Only mount these in the enclosure together with the main board once they are wired up*
Main board, floor side				
	GND	Wire	2	$\approx 10cm$, black, *strip and tin the ends*
	IN	Wire	1	$\approx 10cm$, any color, *strip and tin the ends*
	OUT	Wire	1	$\approx 10cm$, any other color, *strip and tin the ends*
	R7	4.7k	1	Resistor
	R13	20k	1	Resistor
	R1	1k	1	Resistor for the LED, *larger value will make the LED dimmer, values up to 6.8k are reasonable*
	R12	1k	1	Resistor
	R6, R10	2.2k	2	Resistor
	R2, R5, R8	1M	3	Resistor
	R3, R4, R9, R11, R14, R15, R16	10k	7	Resistor
	D2	1N4148	1	Diode, *orientation matters*
	switch up	1N4148	3	See Clipping Diodes section
	Q1	TP0606	1	P-channel MOSFET, *orientation matters*

Continued on next page

Table 1: BOM (Continued)

	Q5	2N3906	1	PNP transistor, *orientation matters*
	Q2, Q3, Q4, Q6	2N3904	4	NPN transistor, *orientation matters*
	C5, C8	47p	2	Ceramic capacitor
	C3	47n	1	Film capacitor
	C9	100n	1	Film capacitor
	C6 (bright)	330n	1	See Brightness capacitors section
	C7 (dark)	470n	1	See Brightness capacitors section
	–	Power Socket	1	2-pin JST on the bottom-left of the board, *orientation matters*
	switch down	Red LED	2	See Clipping Diodes section
	C4, C10, C11	1u	3	Film capacitor
	C1	100u	1	Electrolytic capacitor, *orientation matters*
	C2	47u	1	Electrolytic capacitor, *orientation matters*
Main board, player side				
	–	Ribbon cable	1	Pads for that cable are in the bottom-center of the main board, *solder one end to main board, another to switch board,* ***make sure pin names on the two boards match, IN on one board is connected to IN on the other board etc***
	VOL, GAIN	A100k	2	Potentiometers, *mount in enclosure before soldering*
	BRIGHT	On-On	1	2-position switch, *mount in enclosure before soldering*
	CLIP	On-Off-On	1	3-position switch, *mount in enclosure before soldering*
	–	LED	1	*Insert in PCB first. Solder last, once the main board is in the enclosure. Orientation matters*
Switch board, player side				
	–	Footswitch	1	Switch, *mount in enclosure before putting the boards in*

2.1 Note on values

Different kits and schematics designate values differently. For example, these usually mean the same value:
$2.2\,\mathrm{k\Omega} = 2.2k = 2k2 = 2.2 \times 10^3 Ohm = 2200 Ohm$
$4.7\,\mu\mathrm{F} = 4.7u = 4u7 = 4.7 \times 10^{-6} Farad = 0.0000047 Farad$

Table 2: Component values

Value	Multiplier	Unit
Resistance		
100 Ω, 100R, 100	1	Ohm
1 kΩ, 1k	10^3	Ohm
1 MΩ, 1M	10^6	Ohm
Capacitance		
1 pF, 1p	10^{-12}	Farad
1 nF, 1n	10^{-9}	Farad
1 µF, 1u	10^{-6}	Farad

3 Clipping Diodes

There could be two sets of clipping diodes in Lizard Kisses. The on-off-on 'BITE' switch toggles between one of the two sets (on) or no diodes in the middle (off) position.

There are 8 pads per each (on) position of the switch you can use to insert diodes. Pads 2 and 3, 6 and 7 are connected by the PCB.

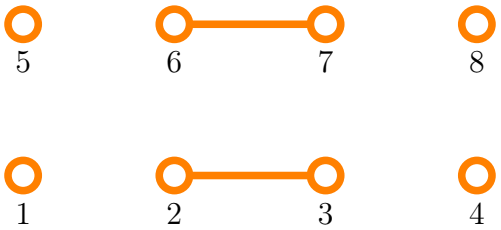
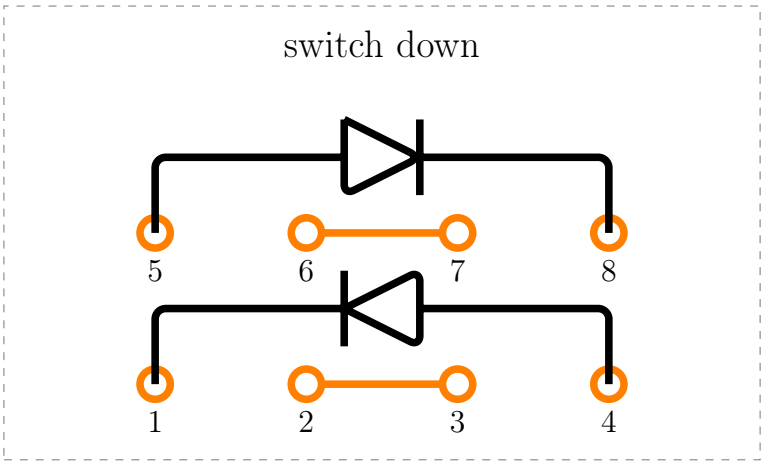


Figure 2: Pads for a single set of diodes

3.1 Stock clipping setup

The stock clipping diode combinations are:

- **switch down:** two red LEDs, pointing in opposite directions. That combo leads to symmetrical clipping around 1.6 V.
- **switch up:** two 1N4148 silicon diodes in series, pointing in one direction, one 1N4148 pointing in the other direction. That combo leads to asymmetrical clipping. One part of the waveform will be clipped around 0.7 V, another around 1.4 V



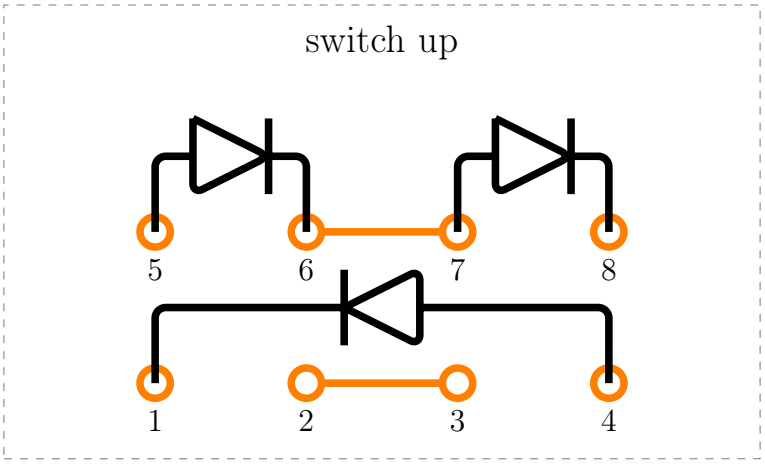


Figure 3: Stock clipping setup

3.2 Experiments with diodes

If you'd like to play with different combinations of diodes, I'd recommend putting four 4-pin sockets into each row of pads. Two 4-pin sockets for the "switch up" position, two 4-pin sockets for the "switch down" position.

For each of the two toggle positions you could try:

- Mixing types of diodes, for example, silicon pointing in one direction, LED in the opposite direction;
- Putting diodes in series to increase the clipping voltage.

The higher the clipping voltage the less distorted the signal will be.

Different types of diodes will lead to different clipping voltages. Roughly speaking here are some types of diodes in order of increasing clipping voltage: germanium diodes, silicon diodes, Red LEDs, Blue LEDs.

Putting diodes in series doubles the clipping voltage.

4 Brightness Capacitors

The LISP switch on Lizard Kisses toggles between a single bright capacitor, and bright+dark capacitors in parallel. By putting capacitors in parallel, we add their values together to get a darker sound. The way the circuit is set up, the larger the value of overall capacitance, the more low-end goes through.

The stock capacitor values are:

- bright: 330 nF
- dark: 470 nF

If you'd like to experiment with putting other capacitor values, socket the two capacitor slots. I'd recommend cutting short the middle pin of a 3-pin socket.

As for the values to try, the lower the capacitor value the less low-end will go through. The reasonable range of values to try is between 10 nF and 4.7 µF.

5 Step-by-step Instructions

5.1 Mount parts on enclosure

- Mount the pots, the toggle switches, the lampshade, the DC jack, and the footswitch on the enclosure as shown below;
- Cut to $\approx 12cm$ and pre-tin the ends of DC cables;
- Solder the DC cable to the DC jack.

Figure 4: Inside and outside of the enclosure with parts mounted

Figure 5: How to mount potentiometers and the footswitch

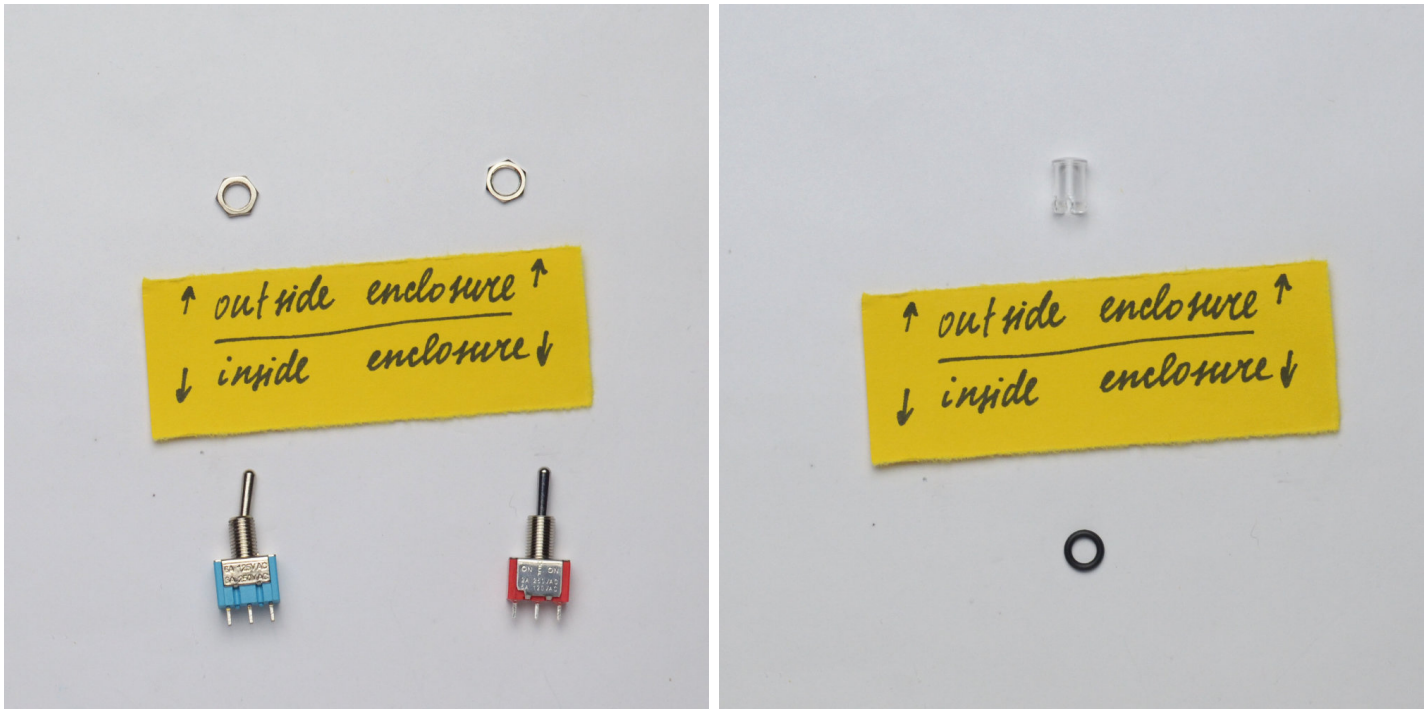


Figure 6: How to mount toggle switches and the lampshade

5.2 Populate main board

- Go through the **Main Board, floor side** section of the BOM table from top to bottom;
- One component at a time:
  - Insert the part into the PCB;
  - Flip the PCB and solder the part to the pads;
  - Cut the excess component leads;

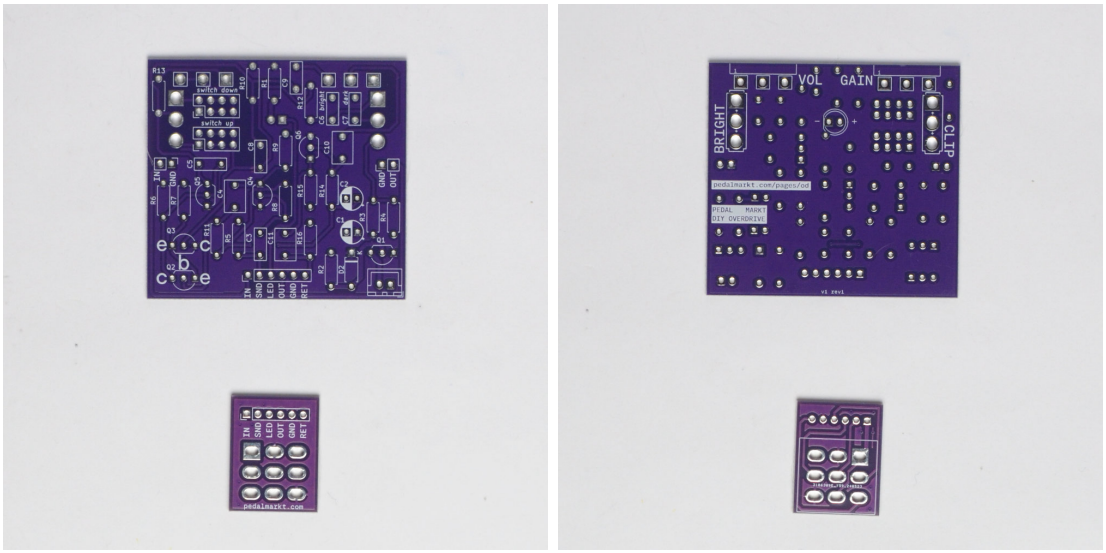


Figure 7: Main and switch boards, floor side on the left, player side on the right

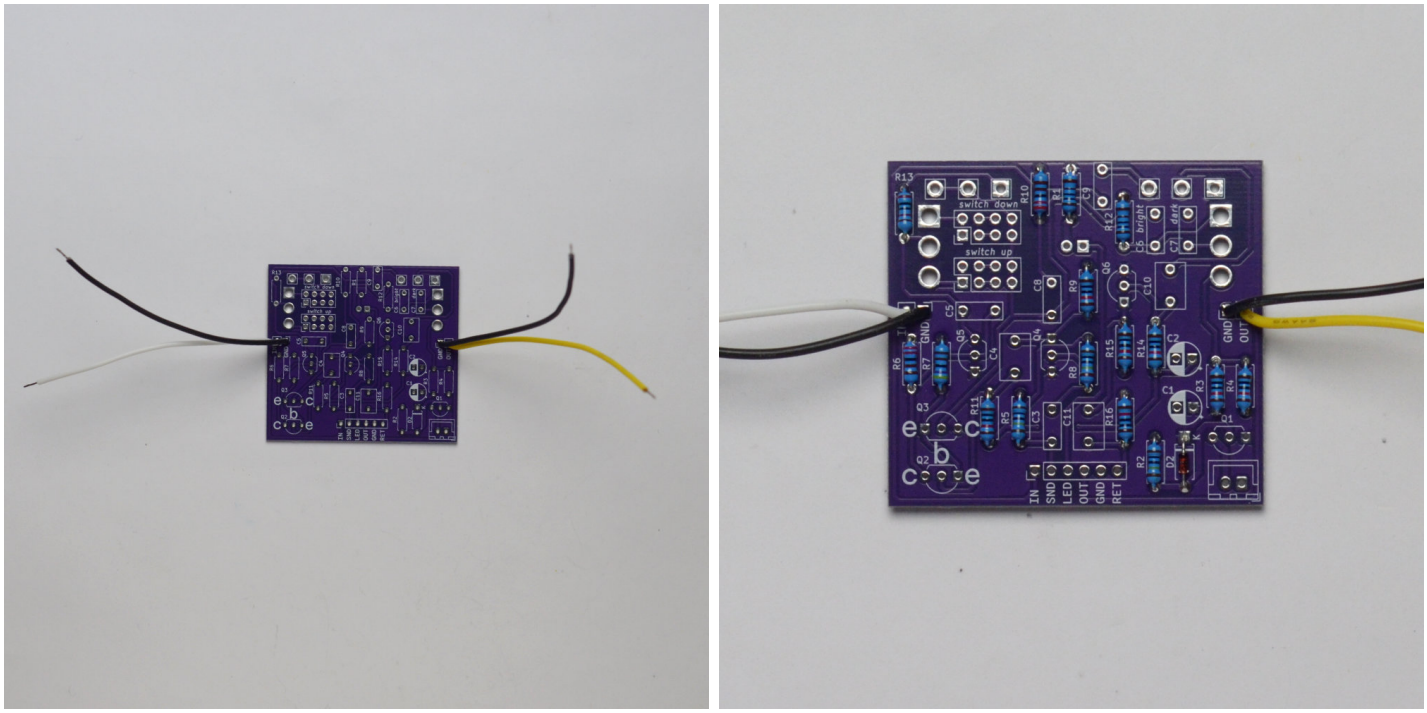


Figure 8: Wires soldered on the left, resistors on the right

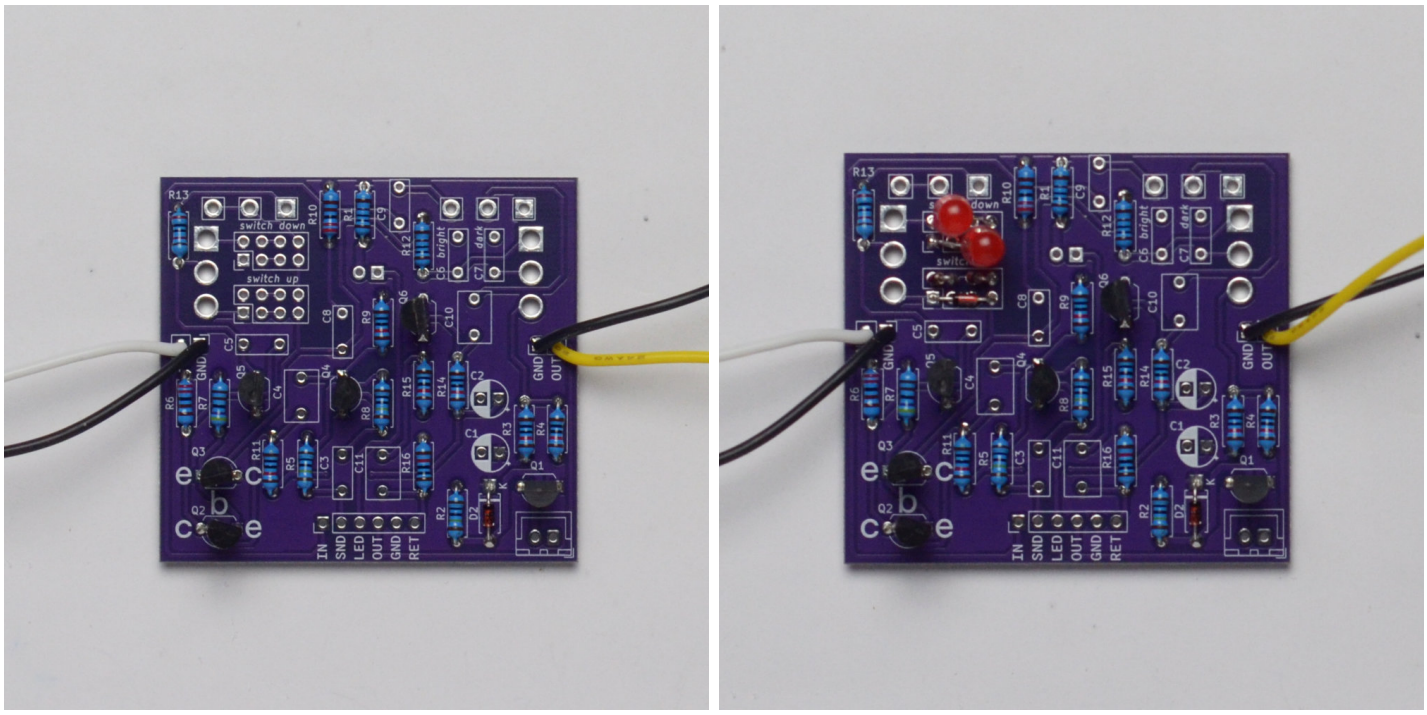


Figure 9: Transistors soldered on the left, diodes on the right

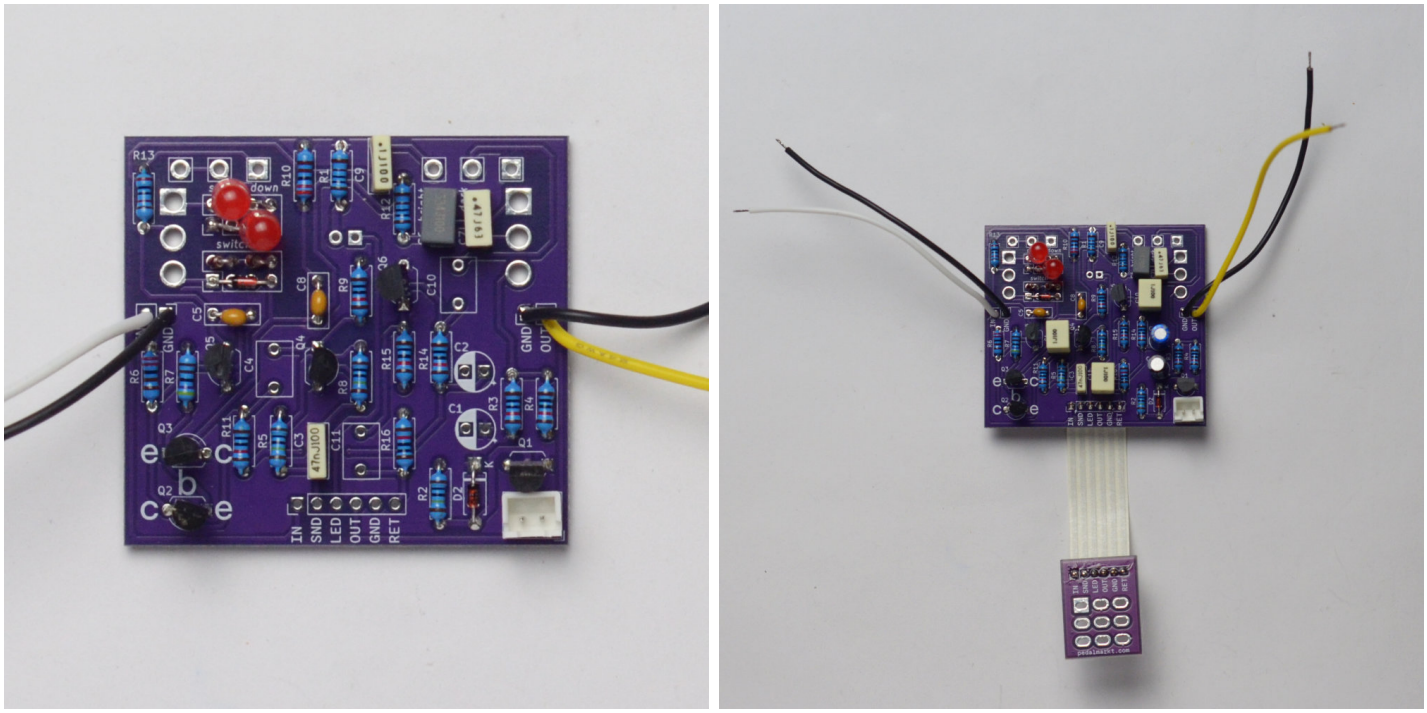


Figure 10: Caps soldered on the left, switch board and ribbon on the right

5.3 Solder jacks and LED

- Solder audio jacks to the wires coming from the Main Board. Black (GND) wire should be connected to the lug that is connected to the round part on the inside of the jack socket. The colored wire (IN or OUT) should be connected to the other lug.
- Place the LED into the pads **on the player side** of the board. The short leg of the LED should go into the "-" (minus) pad. Do not solder the LED just yet.

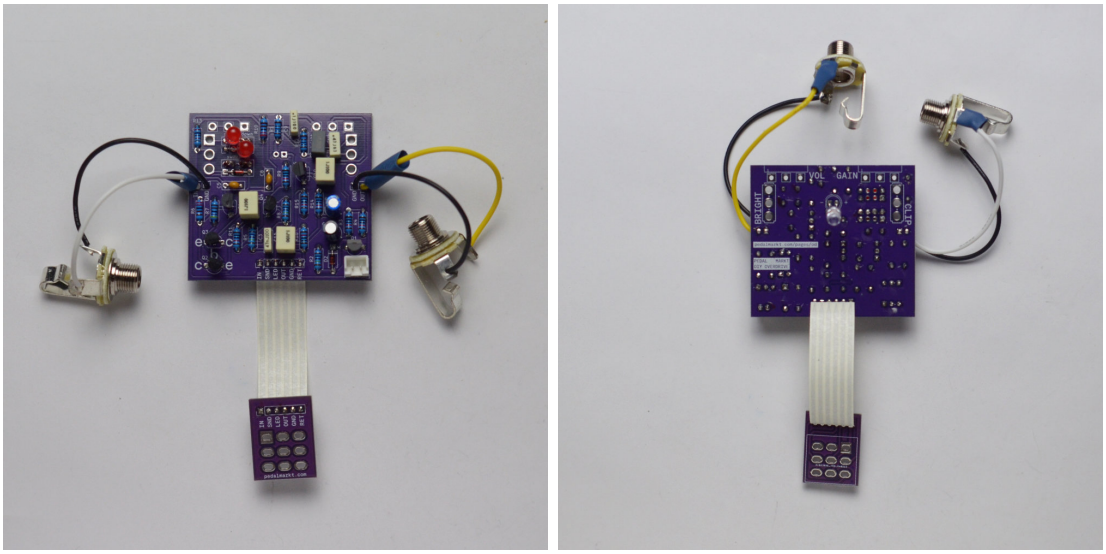


Figure 11: Audio jacks soldered on the left, LED placed but not soldered on the right

5.4 Mount boards into enclosure

- Place the main board into the enclosure, floor side of the board facing you;
  - Make sure all the legs of the potentiometers and toggle switches get inserted into their dedicated pads;
  - Make sure the LED gets inserted into the lampshade. You might have to press on the lampshade from the other side of the enclosure so that it doesn't lift from the enclosure;
  - Solder the pots, the toggle switches and the LED to the main board;
- Place the switch board onto the footswitch and solder them together.

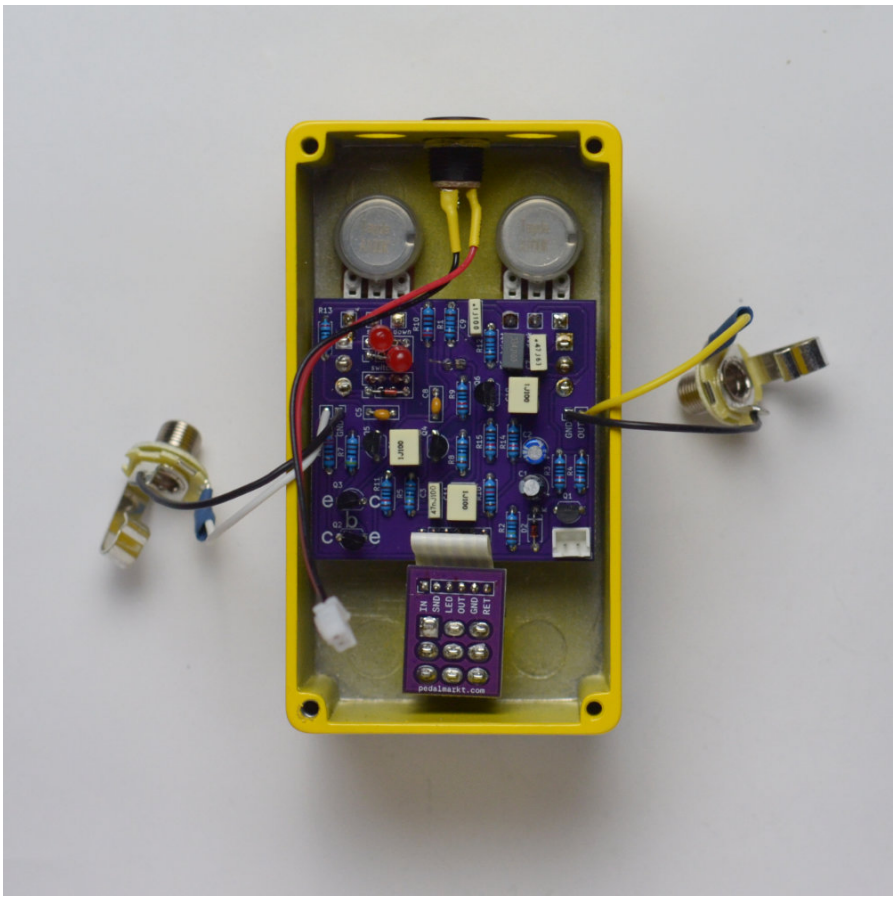


Figure 12: Inside of the enclosure with boards mounted

5.5 Complete the pedal

- Mount the audio jacks onto the enclosure;
- Connect the DC cable to the socket on the bottom right of the board;
- Plug in and test the pedal!

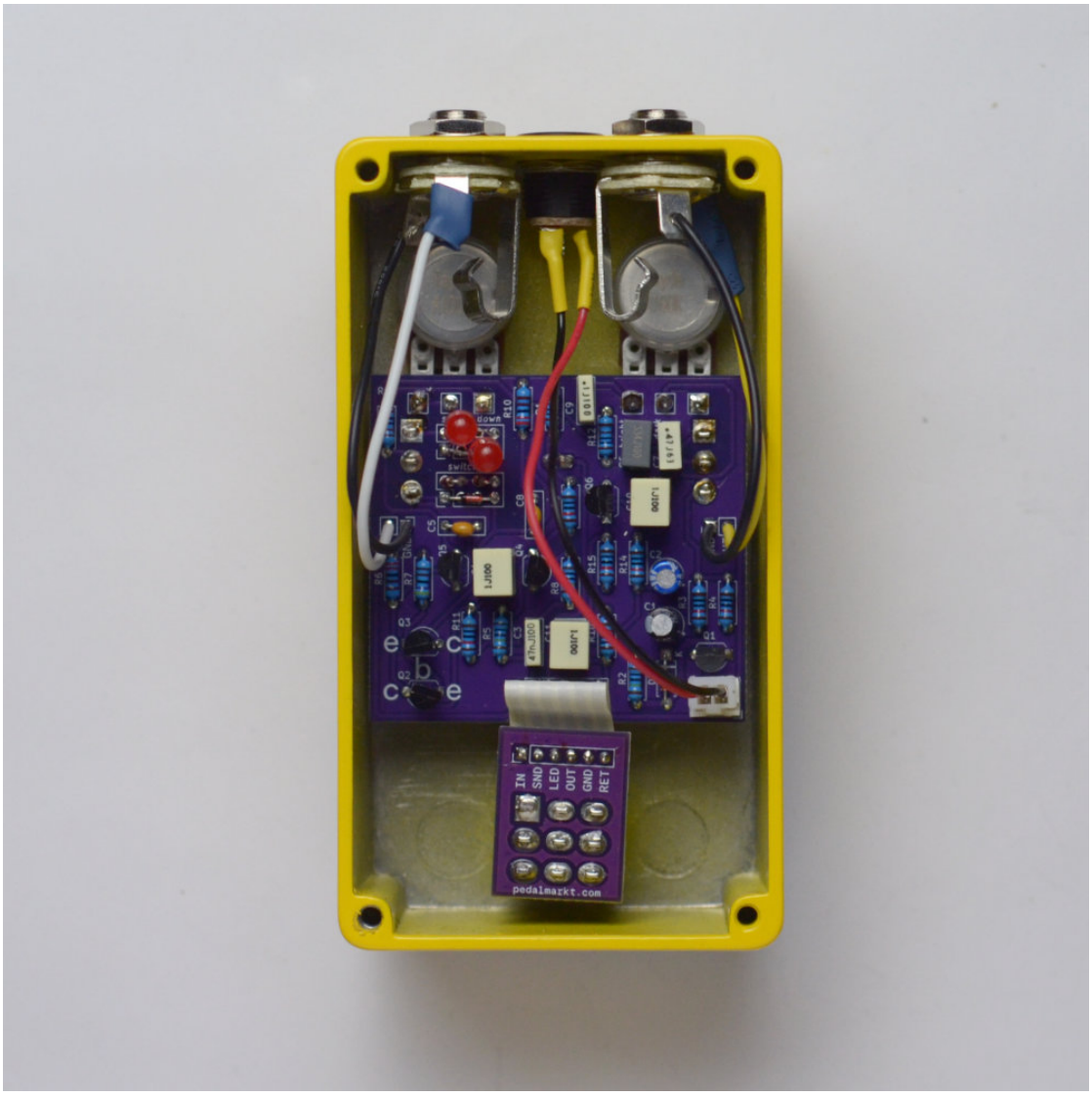


Figure 13: Built pedal

6 Circuit breakdown

The core of the circuit is an amplifier, an active circuit that makes an audio signal louder. We can wary the gain of that amplifier. At some point, at higher gain settings the signal 'wants' to get louder than what the circuit can handle. It hits a ceiling and gets clipped. The more clipped the signal is, the more distorted and compressed it sounds.

A specific kind of circuit that's used here is called a non-inverting amplifier. Let's look at its basic version. The gain here is proportional to the ratio of the two resistors in its feedback loop: R_{fb}/R_{gnd}.

In our case, the Peck (Gain) control (RV_1 in schematic) on the pedal varies R_{fb}.

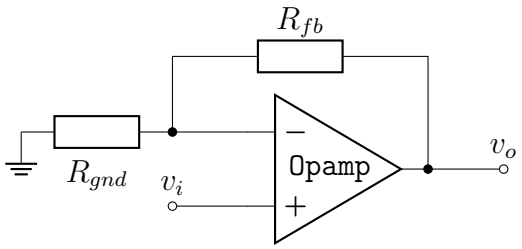


Figure 14: Non-inverting amplifier based on an opamp

There are a few changes to that basic circuit. First, there is a capacitor in the feedback loop of the opamp. Its role is to affect which frequencies get amplified. In other words, C_{gnd} in combination with R_{gnd} acts as a high-pass filter.

The value of the capacitor C_{gnd} is what the LISP (Brightness) toggle is switching (C_6 or $C_6 + C_7$ in schematic).

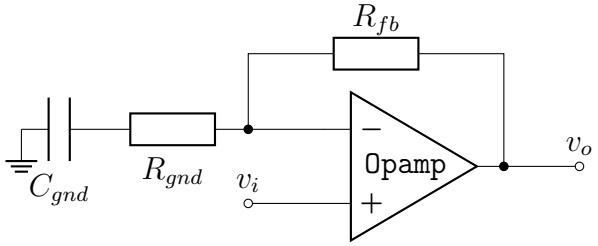


Figure 15: Non-inverting amplifier with a high-pass filter

To make the distortion effect more intense we can put clipping diodes into the feedback loop of the opamp, see Non-inverting amplifier with a high-pass filter and clipping diodes.

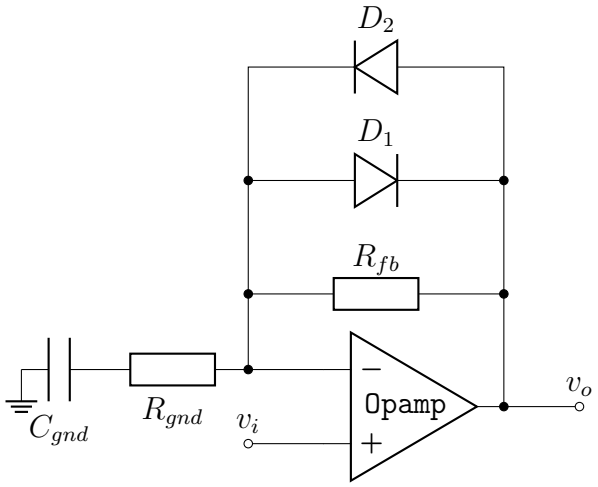


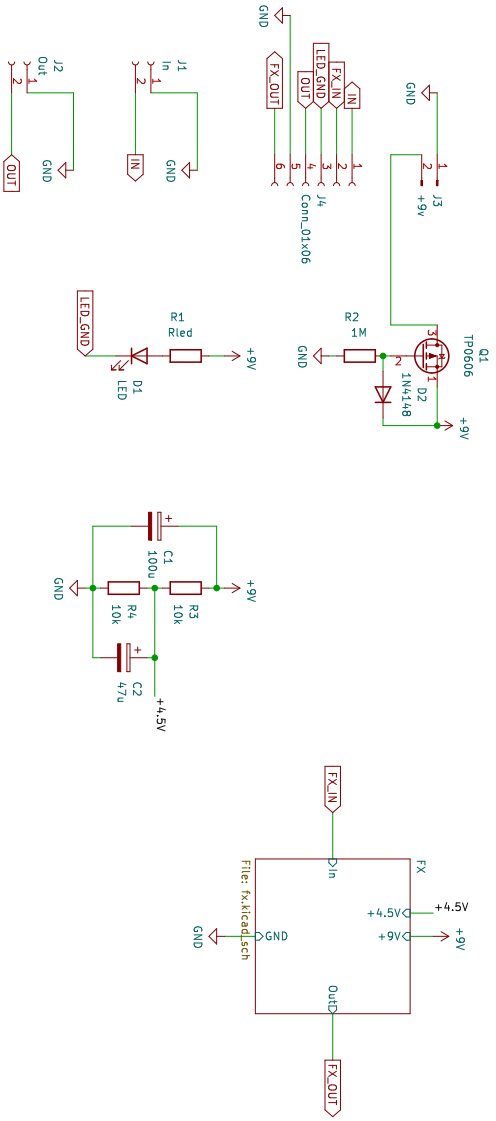
Figure 16: Non-inverting amplifier with a high-pass filter and clipping diodes

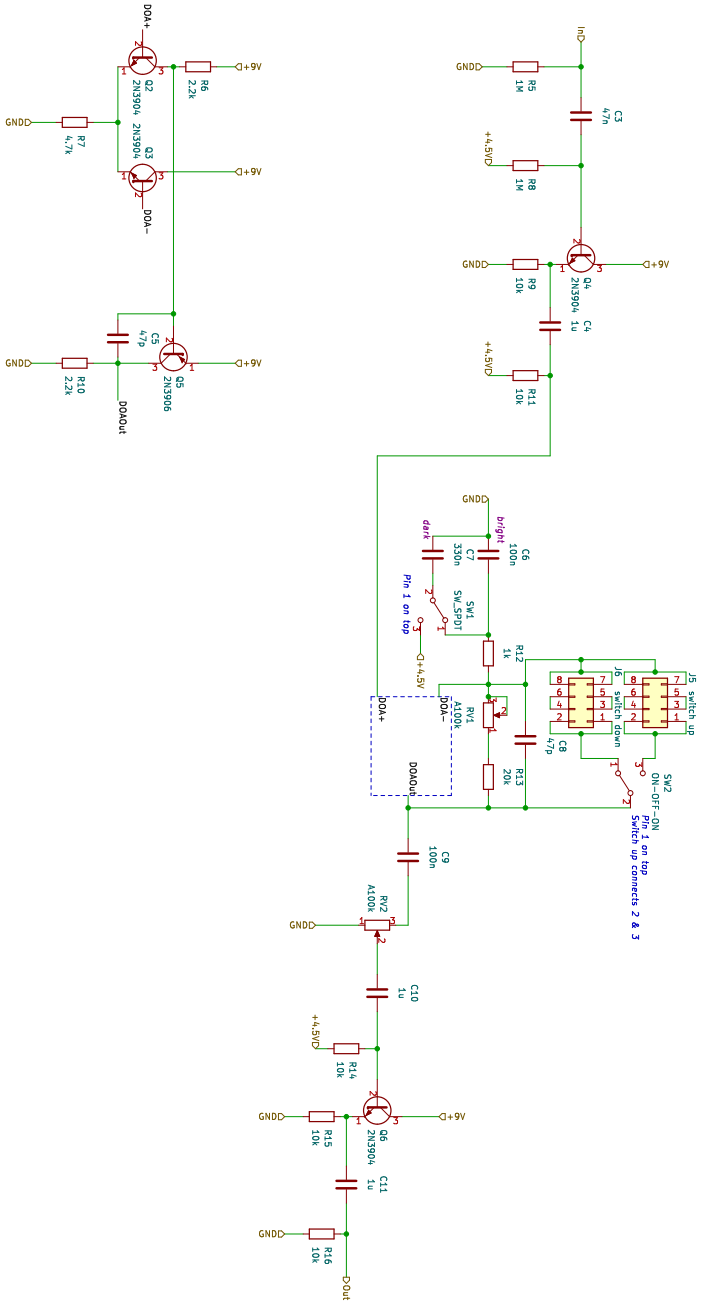
Another important note about the way Lizard Kisses implements the non-inverting amplifier is it's using a discrete opamp. Discrete means it's built out of single transistors, as opposed to an integrated circuit aka a chip. DOA_+, DOA_- and DOA_{out} in the schematic correspond to the positive, negative, and output terminals on the abstract opamp above.

The rest of the circuit is pretty standard:

- Transistor Q_4 and surrounding components form an input buffer;
- Transistor Q_6 and surrounding components form an output buffer;
- Pot RV_2 is a volume control used to compensate for the added gain;
- MOSFET Q_1 and surrounding components form a reverse voltage protection circuit;

7 Schematic


GND
FX_OUT
LED_GND
FX_IN
OUT
IN
J2
Out
J1
In
J4
Conn_01x06
J3
+9V
R1
Rled
LED_GND
D1
LED
R2
1M
Q1
TP0606
D2
1N4148
C1
100u
R4
10k
R3
10k
C2
47u
+4.5V
FX
File: fx.kicad_sch
In
Out


DOA+
Q2
2N3904
R6
2.2k
+9V
GNDD
R7
4.7k
Q3
2N3904
+9V
DOA-
C5
47p
Q5
2N3906
GNDD
R10
2.2k
+9V
DOAOut
In
GNDD
R5
1M
C3
47n
+4.5V
R8
1M
GNDD
R9
10k
Q4
2N3904
+9V
C4
1u
+4.5V
R11
10k
GNDD
dark
bright
C7
330n
C6
100n
Pin 1 on top
SW1
SW_SPDT
+4.5V
R12
1k
J6
switch down
J5
switch up
DOA+
DOA-
RV1
A100k
C8
47p
R13
20k
DOAOut
SW2
ON-OFF-ON
Pin 1 on top
Switch up connects 2 & 3
C9
100n
GNDD
RV2
A100k
C10
1u
+4.5V
R14
10k
GNDD
R15
10k
Q6
2N3904
+9V
C11
1u
GNDD
R16
10k
DOut