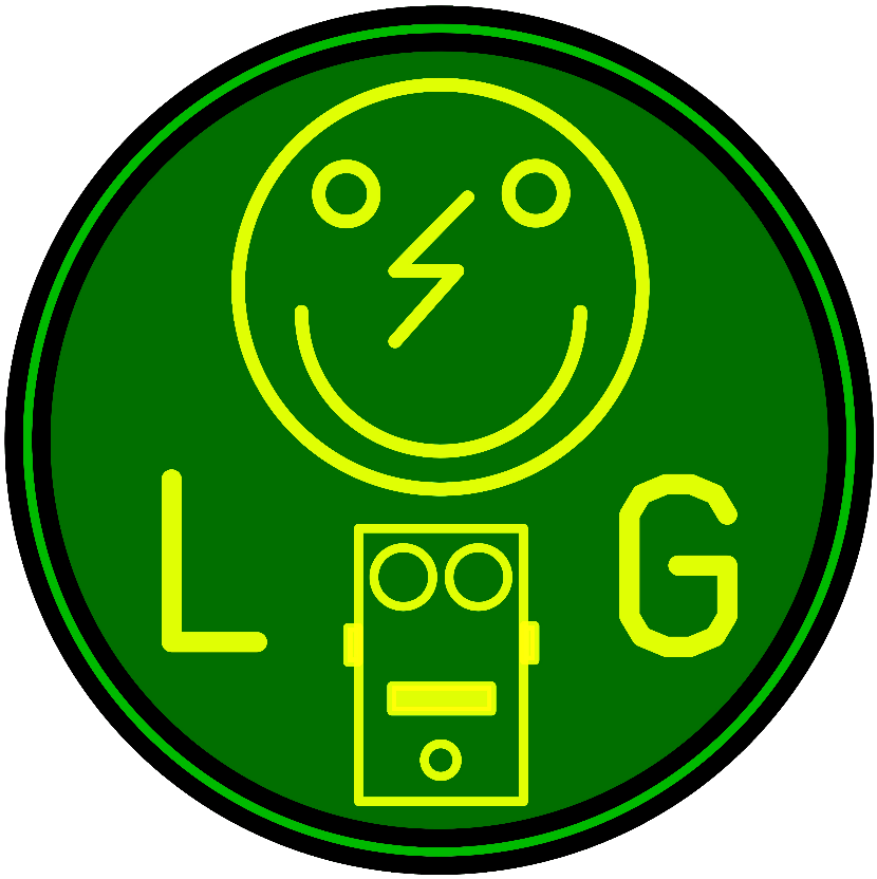
# Heavenly Red

# Building instructions

# v1.0



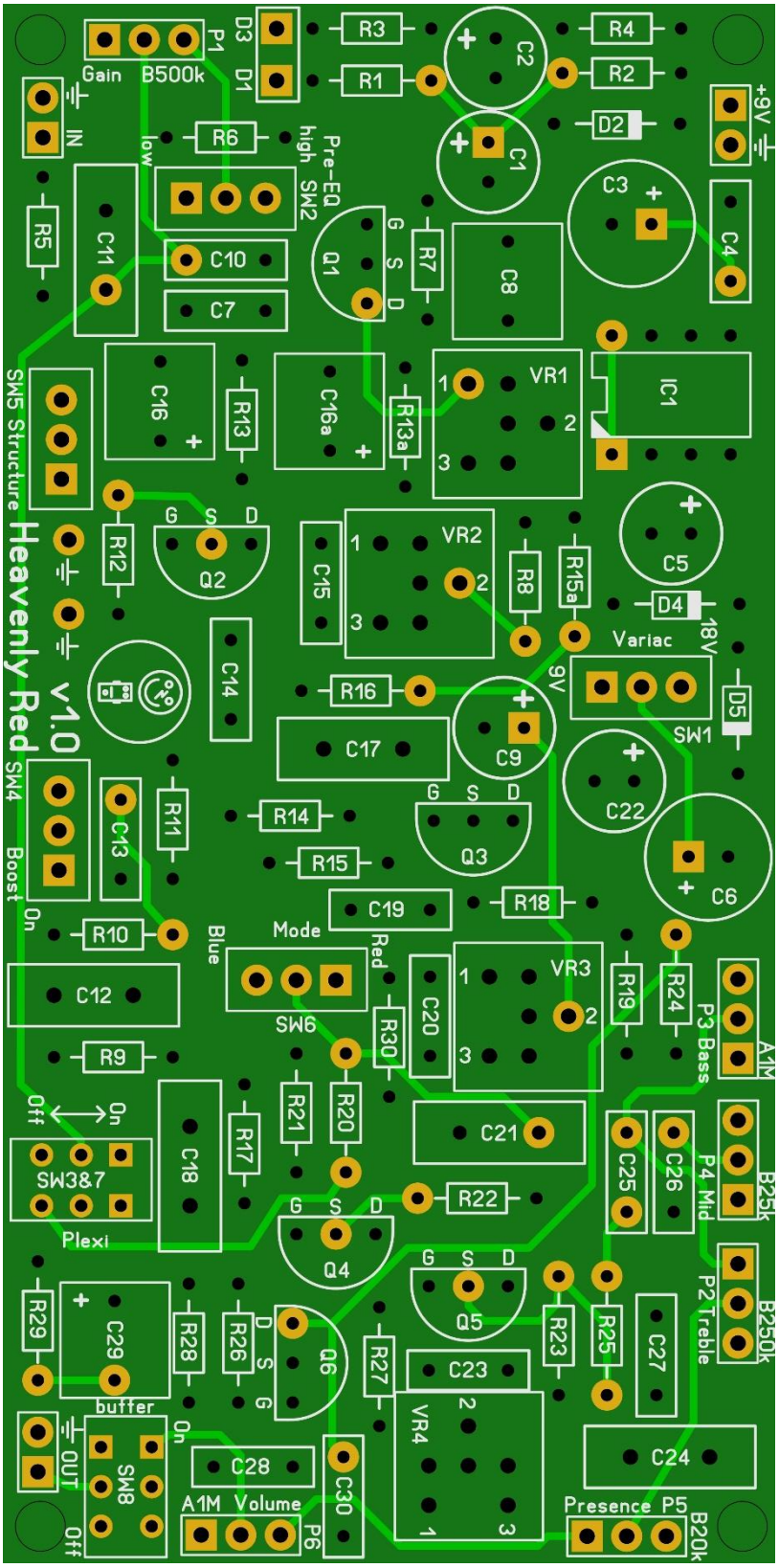

# Table of contents



**Read this entire manual thoroughly before you start building the effect! There are some available options and you should choose which one you want to incorporate before starting your build.**

Last update: 17-07-2019

# PCB layout




**Dimensions:** **100 mm x 49,5 mm**
**3.94 inch x 1.95 inch**

# Components

| Name | Value | Comment | Name | Value | Comment |
|---|---|---|---|---|---|
| **C1** | 10u | Electrolytic 25V+ | **R1** | 390R | 1% metalfilm |
| **C2** | 10u | Electrolytic 25V+ | **R2** | 4k7 | 1% metalfilm |
| **C3** | 100u | Electrolytic 25V+ | **R3** | 390R | 1% metalfilm |
| **C4** | 100n | SMF/MKT/Wima | **R4** | 4k7 | 1% metalfilm |
| **C5** | 10u | Electrolytic 25V+ | **R5** | 1M | 1% metalfilm |
| **C6** | 100u | Electrolytic 25V+ | **R6** | 68k | 1% metalfilm |
| **C7** | 4n7 | SMF/MKT/Wima | **R7** | 820R | 1% metalfilm |
| **C8** | 680n | SMF/MKT/Wima | **R8** | 100R | 1% metalfilm |
| **C9** | 10u | Electrolytic 25V+ | **R9** | 499k | 1% metalfilm |
| **C10** | 1n | SMF/MKT/Wima | **R10** | 499k | 1% metalfilm |
| **C11** | 470p | Wima/Silver Mica | **R11** | 100k | 1% metalfilm |
| **C12** | 470p | Wima/Silver Mica | **R12** | 4k75 | 1% metalfilm |
| **C13** | 1n | SMF/MKT/Wima | **R13** | 4k75 | 1% metalfilm |
| **C14** | 2n2 | SMF/MKT/Wima | **R13a** | 18k | 1% metalfilm |
| **C15** | 1n | SMF/MKT/Wima | **R14** | 499k | 1% metalfilm |
| **C16** | 2u2 | Wima/Electrolytic 25V+ | **R15** | NC | |
| **C16a** | 1u | Wima/Electrolytic 25V+ | **R15a** | 499k | 1% metalfilm |
| **C17** | 470p | Wima/Silver Mica | **R16** | 499k | 1% metalfilm |
| **C18** | 470p | Wima/Silver Mica | **R17** | 499k | 1% metalfilm |
| **C19** | 22n | SMF/MKT/Wima | **R18** | 10k | 1% metalfilm |
| **C20** | 470p | Wima/MLCC | **R19** | 100R | 1% metalfilm |
| **C21** | 470p | Wima/Silver Mica | **R20** | 499k | 1% metalfilm |
| **C22** | 10u | Electrolytic 25V+ | **R21** | 470k | 1% metalfilm |
| **C23** | 22n | SMF/MKT/Wima **OPTIONAL** | **R22** | 1k | 1% metalfilm |
| **C24** | 470p | Wima/Silver Mica | **R23** | 100k | 1% metalfilm |
| **C25** | 22n | SMF/MKT/Wima | **R24** | 100R | 1% metalfilm |
| **C26** | 22n | SMF/MKT/Wima | **R25** | 33k | 1% metalfilm |
| **C27** | 3n3 | SMF/MKT/Wima | **R26** | 2M2 | 1% metalfilm |
| **C28** | 100n | SMF/MKT/Wima | **R27** | 2M2 | 1% metalfilm |
| **C29** | 1u | SMF/MKT/Wima/Electrolytic | **R28** | 10k | 1% metalfilm |
| **C30** | 100n | SMF/MKT/Wima | **R29** | 100k | 1% metalfilm |
| **D1** | LED | On/Off LED | **R30** | 4M7 | 1% metalfilm |
| **D2** | 1N4001 | | **SW1** | SPDT | Variac |
| **D3** | LED | Boost LED | **SW2** | SP3T | Pre-EQ on-off-on |
| **D4** | 1N5817 | | **SW4** | DPDT | Boost Footswitch |
| **D5** | 1N5817 | | **SW5** | SP3T | Structure on-off-on |
| **P1** | B500k | Gain | **SW6** | SPDT | Mode |
| **P2** | B250k | Treble | **SW8** | DPDT | Output buffer |
| **P3** | A1M | Bass | **SW3** | DPDT | Plexi |
| **P4** | B25k | Mid | **VR1-6** | 100k | BIAS Trimpots |
| **P5** | B20k | Presence (Or B25k) | **Q1-Q6** | J201 | **IC1** LT1054 |
| **P6** | A1M | Volume | **All parts need to be 25V+ rated** | | |

# Power section

**IC1** can be either a LT1054 or a (cheaper) ICL7660S.

I do not advise the use of a battery in this build as the charge pumps will do strange things when the battery is depleted. This is why it is also left out in the off board wiring section.

If you want to leave out the Variac switch, you will need to do the following.

## Hardwire to 18V

If you connect **pads 2 to pad 3** with a jumper on **SW1**, you will feed the effect with 18V.

Pads are marked like this:

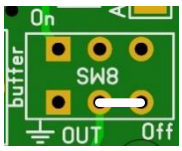

**3**
**2**
**1**

## 9V only

For this you can leave out **C5, D4, D5, IC1**. Add a jumper between **pad 1 and 2** on **SW1**

# Output buffer

I added a simple optional buffer (as designed by AMZ) in case you need it. I suggest you do not add it until you are in need of one, eg. when the pedal does not play nice with the other effects. To leave out the buffer, leave out **Q6, C28, C29, C30, R26, R27, R28, R29**. Solder a jumper between the bottom 2 pins on SW8. You can easily remove it if you decide to add the buffer.




# Build sequence

**Before starting with this section, make sure you have read the modifications section first!**

Soldering this board can be very complicated for some people since the solder pads are very close together. Use a magnifying glass to make the job easier.

The trick to soldering a PCB is to work from small to big components. My building sequence suggestions in this section are based on the parts I used myself. Sometimes some components are smaller (or bigger) so always use your own common sense and change the order accordingly. Usually capacitors can differ a lot in size depending on their rating and value.

**Note:** Do not blow on your solder in an attempt to cool it down. That can result in a bad join that might corrode! Also take extra care not to short components.

Start by soldering the resistors and jumpers (if applicable). If needed you can create a jumper using a spare piece of lead from a resistor or diode. Next come the diodes (not the LEDs).

If you want to experiment with other transistors then you could socket them instead of soldering them to the board. You'll need a some 20 SIL sockets, break off the sockets and solder them to the board. Now is the time to solder these sockets on the PCB as well as the socket for the IC. Place the transistors and IC once you are finished with all soldering and off board wiring!

Now continue by soldering the MLCC, small SMF/MKT/Wima capacitors then solder the internal trim pots (**VR1-VR4**). Now finish by soldering the transistors (if not socketed), the bigger MKT/WIMA and the electrolytic capacitors.

I suggest you now drill the holes in your enclosure so you can use it during the off board wiring. This PCB is very sensitive to noise! Keep the wires as short as possible and/or use shielding on the input and output.

Besides the components mentioned in the components table, you will need:

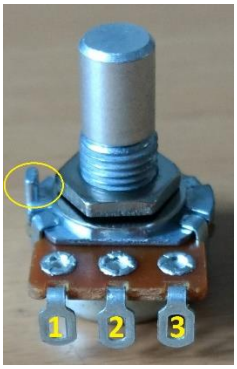
- **2 mono input jacks**.
- **2,1mm DC jack** (isolated).
- **22 gage stranded hook-up wire.**
- **2 x LED holders.** This enables you to mount the LEDs in the enclosure.
- **2 x Footswitch 3PDT** (9 pins)
- **Hammond 1590XX** case (or similar) in your favorite color. You can of course experiment with other enclosures, but measure twice before you start drilling!

# Off board wiring

## Potentiometers

In the pictures below you see the correct pin numbering of the pots (Alpha 16mm style).
Solder the wires accordingly and it is always a good idea to twist the wires together to create some extra shielding against external noise. The **rectangle pad** marks **pin 1**.

You can break off the pin I marked with the yellow circle with a small pair of pliers.



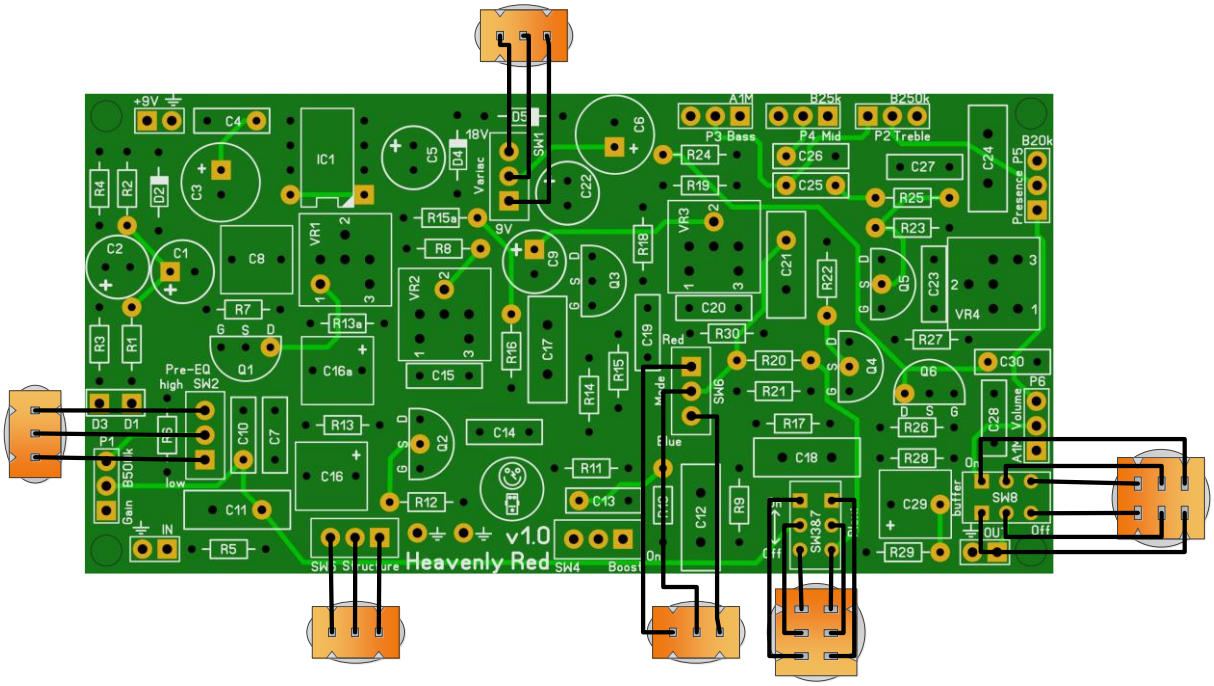


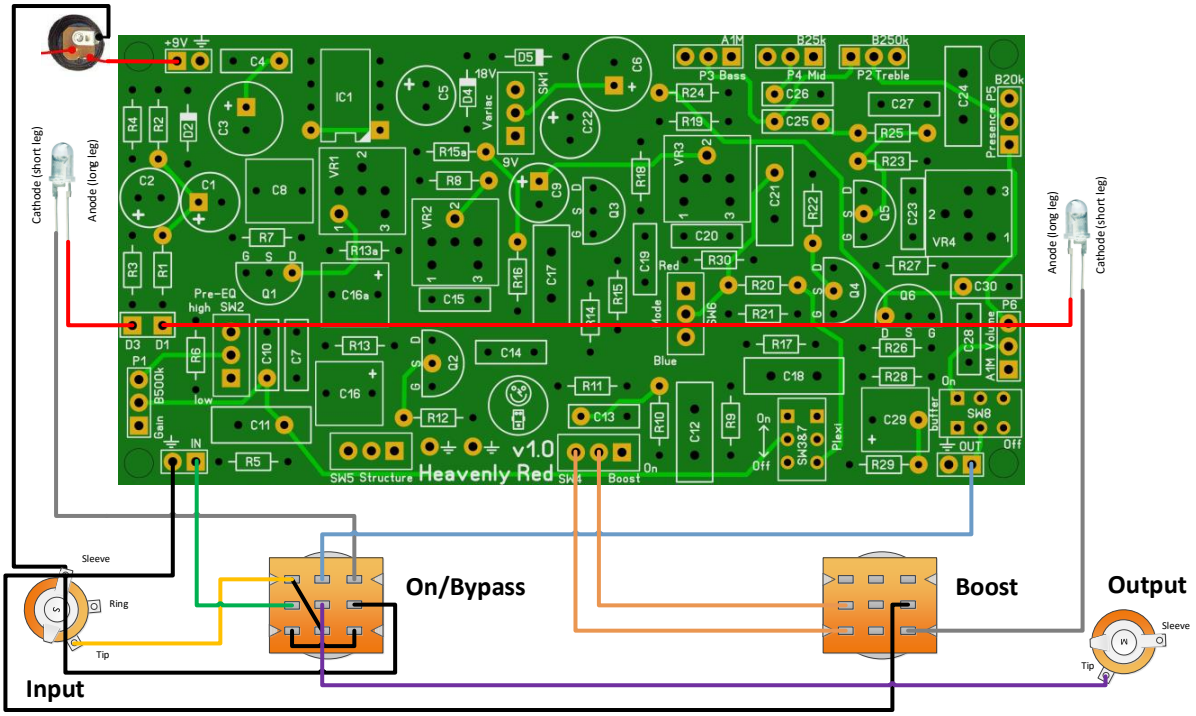
## Switches

The wiring for the switches is the same as for potentiometers, marking pin 1 with a **rectangle pad**.

SW3 and SW7 form a DPDT, so do not use 2 separate SPDT switches.

There is a small silkscreen error with the boost switch. Where it is marked as “On”, it should be “Off”, so the switch is marked in reverse.




The LED switching is made as described by AMZ's anti Led pop setup. No need for an external LED current limiting resistor. **Keep cables as short as possible to prevent interference!**

## Plexi switch function

When engaging the Plexi switch (**SW3&7**) the Mode switch (**SW6**), Boost switch (**SW4**) and Structure switch (**SW5**) get disabled because the Plexi mode bypasses **Q2** and **Q3**.

# Biasing

Biasing this effect is very difficult. Start by setting the following switches:

- Variac +9V
- Boost Off
- Red Channel
- Plexi Off
- Structure Off
- Buffer Off
- Pre-EQ to taste

Set the pots as follows:

- Max Gain
- Volume 90%
- Presence 90%
- Bass, Middle, Treble 50%

With a digital multimeter measure the Voltage at the drain of **Q4**. Turn **VR4** so it is at ½ of the input voltage from your wall wart. Usually that is about 4,5V. Now do the same with **Q3** and **VR3**, **Q2** and **VR2**, **Q1** and **VR1**. Now you have your effect set to a good starting point from which you can experiment with alternate settings. This is best done by ear.

Take your time and hear what the effect is of turning the different BIAS pots (**VR1-VR4**) on the sound.

Now turn on the Structure and see if it still sounds ok. If not, adjust the settings. Turn the structure off and boost on and check it again. Adjust if necessary. Finally turn both boost and structure on. Chances are it will squeal like a pig. This is not specific to this build and you can try to find a better setting by turning the bias pots and keep wiring as short and/or shielded as possible.

## Squealing

First of all, the effect will surely start squealing like a pig at max gain, max volume, structure and boost on. If you can build/have a small audioprobe, check the drain on Q4. That is the spot where the squeal will originate from.

To tame the beast, first try to lower the volume to 75%. Unity should be around 50% so you do not need to worry it will not reach unity. Secondly you can lower the presence a bit. If it still is not in a workable range for you, there is an extra capacitor added to the board **C23**. Experiment with values between 10n and 47n. However, higher values will come at the cost of loss in gain.

Also always double check your soldering, especially with ground pads. Keep wires as short as possible.

Lastly you can try to rebias the transistors to stop squealing. As said before take your time to find out what works and what not. Changing one thing may also have an effect on other settings, especially when it comes to biasing!

# Modifications

## Structure

The original only has a structure on-off. In this version I added an extra option for a second structure option formed by **C16a** and **R13a**. After some experimenting I found the 1uF/15k combination to have some added value, but feel free to experiment and let me know if you found a good combination.

## Pre-EQ

The original Bogner amp has the pre EQ set to switch between 470p and 4n7. The 7th heaven effect (GoosoniqueWorx) uses a 1n (**C10**) which I personally prefer. But you can choose any value between 100p – 6n8 for **C10** or **C11**.

## More Gain

Upping **P1** to B1M and changing **R21** to 1M will increase the maximum amount of gain. However be warned that the risk of squealing will also increase.

## Unity

Replacing **R23** with a 10k is reported to put unity gain closer to 50% on the volume knob

## R15 vs R15a, R30

The Bogner amp has **R15** and not **R15a**. The latter one was introduced in the 7th heaven although it is not clear why, could have something to do with the squealing. Also **R30** is in the Amps, but not in the 7th heaven.

# Troubleshooting

All PCB's have been 100% factory e-tested and out of every batch I receive I build an effect to double check, so there should not be a connection problem on the PCB itself.

The board is not working (at all), what now?

- Check if your 9V is plugged in correctly (and/or soldered correctly on the board). Pay special attention to the polarity.
- Check that you oriented the capacitors, IC's ,transistors and diodes the right way. SMF, MKT and ceramic capacitors as well as resistors do not need to be oriented. A likely sign of incorrect capacitors and/or orientation is when an effect is sputtering, rumbling or "motorboating".
- Check if you used the correct values of the components. For resistors you can look here: http://www.diyaudioandvideo.com/Electronics/Color/
- Double and triple check your soldering! A loose or cold solder can be really bad for your board.
- Replace the IC and/or transistors, one might be defective. Before doing that first unplug the 9V and wait for 5 seconds.
- Check that you have good/high grade components. A lot of Chinese sourced parts are fakes (especially high end opamps, audio capacitors, vintage diodes and transistors) so be careful that you source your parts from reliable suppliers.

# Schematic