Relay True Bypass Bicolor Building Instructions v1.0

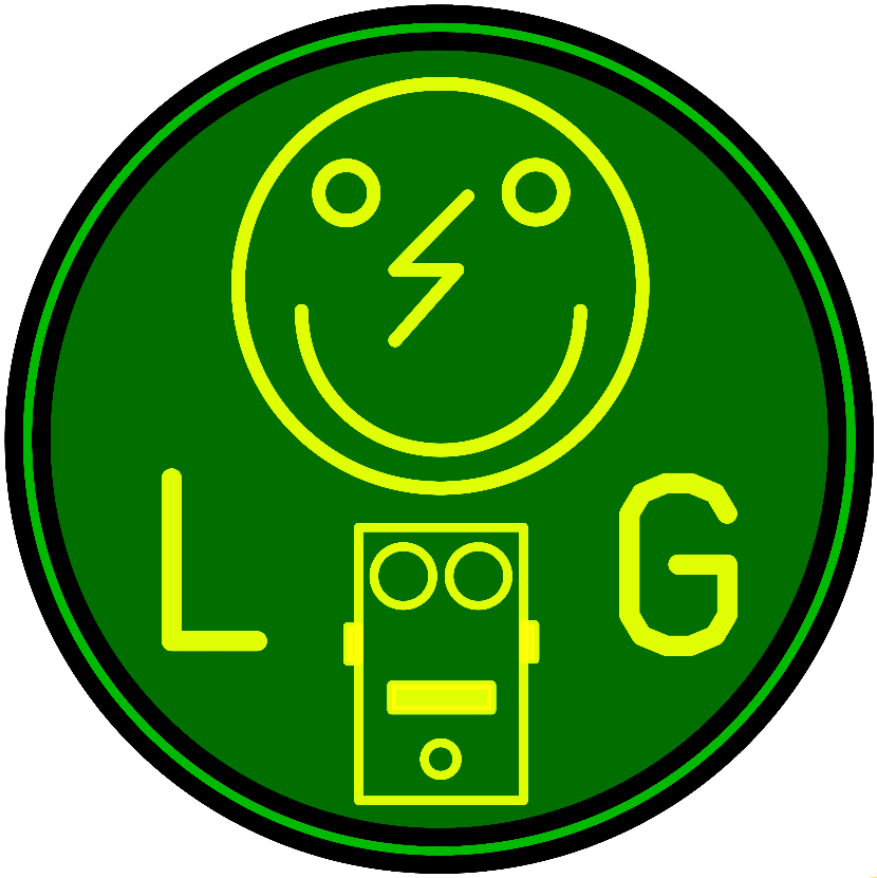


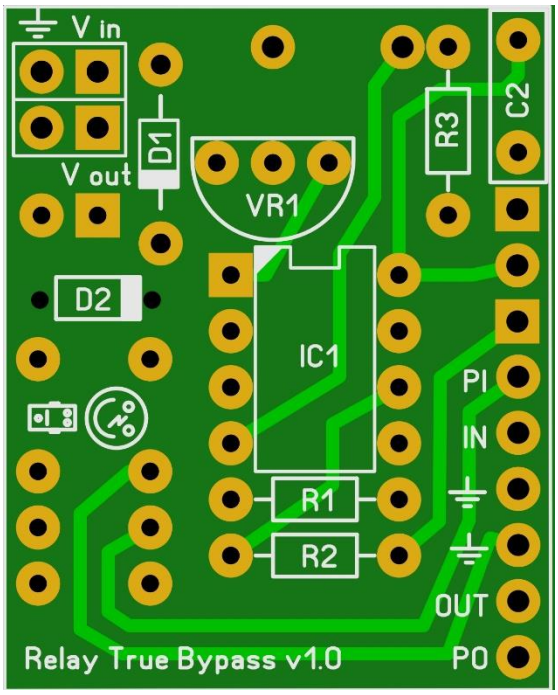
Table of contents

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.

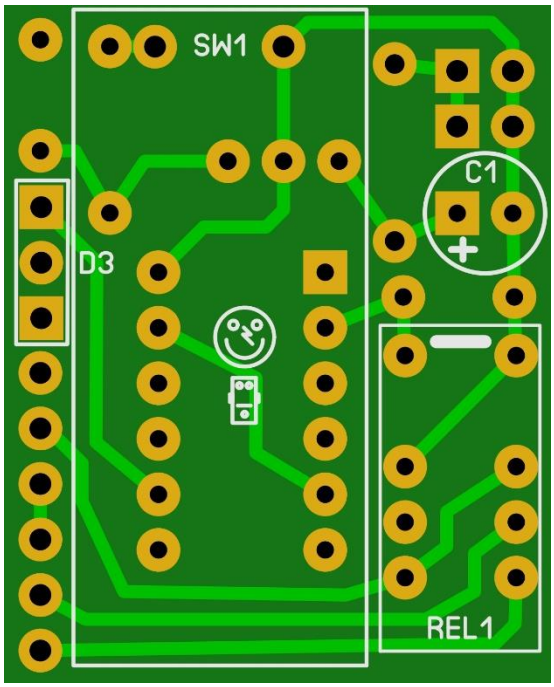
Last update: 23-06-2017

PCB layout

Top side



Bottom side



Dimensions: 25 mm x 31 mm
0.99 inch x 1.22 inch

Components

All parts must be rated 25V+ if used in conjunction with a charge pump

Name	Value	Comment
C1	100u	
C2	100n	
D1	1n5817	
D2	1N4148	
D3	LED	Common Cathode Bi-color diffuse LED
IC1	PIC12F675	
R1		see chapter “Building sequence”
R2		see chapter “Building sequence”
R3	10k	
REL1	NA5W-K	DPDT relay 5V alternative Omron G6S-2-5VDC
SW1	SPDT + 100n	Momentary switch with 100nF capacitor as filter
VR1	LM78L05	

Make sure you also get some double sided tape

Build sequence

Soldering this board can be complicated for some people since the solder pads are very close together and components must be placed on both sides of the board. 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 differ a lot in size depending on their rating.

Note: Do not blow on your solder in an attempt to cool it down. That will possibly result in a bad join that might corrode! Watch this video from EEVblog (no that’s not me) to learn more.

Start by soldering the resistors and D2 on the *top side*. I experimented with some common cathode LED’s and found that you get the best result when using diffuse LED’s. You can use this table for reference, but you are of course free to use different values:

LED (common cathode)				**@5V**	
Size	**Type**	**Color 1**	**Color 2**	**R1**	**R2**
5mm	Diffused	Red	Blue	820R	1k4
5mm	Diffused	Red	Green	1k	240R
3mm	Diffused	Red	Emerald	1k	4k7
3mm	Diffused	Red	Blue	240R	510R
3mm	Diffused	Red	Green	1k	240R

Do remember that the brighter you set the LED, the shorter it’s lifespan.

Next, you can solder D1 to the top side, followed by **IC1** (watch the orientation, pin 1 is marked by the square pad) and VR1. You can solder **C2** to the topside, but if you want to *save some space* you can solder it to the bottom side. Make sure you cut the leads as short as possible at the bottom side as much as possible without breaking any solder points. This is important as we will be sticking the switch to the bottom of the PCB later and we want to save as much space as possible..

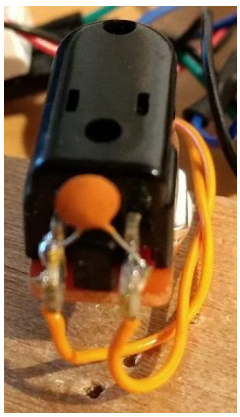
Flip the board and solder **C1** to the *bottom side* and then **REL1**.

Connecting the switch

Now is the point to make some decisions. This build is designed to save as much space as possible. To do this you could stick the momentary switch to the bottom of the PCB. If you do not want to do this then you can skip this part and connect the switch in another way as you desire.

1. First off, I advise you to cut a piece of double sided tape to fit the bottom of the momentary switch. I've designed to board to fit the standard type of momentary switch:

2. Now stick the switch to the bottom side of the PCB with the contacts facing the text **SW1**. Be sure that the tape does not cover the pads.
3. Then use a 100nF capacitor with long enough leads to solder the contacts to the **SW1** pads. If the leads of the capacitor are not long enough (or you do not want to solder the switch directly to the PCB) then solder the capacitor directly to the switch and use some long leads or wire to solder the switch to the PCB :

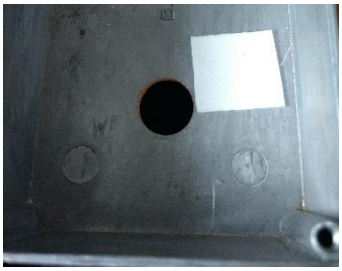


Lining up the LED

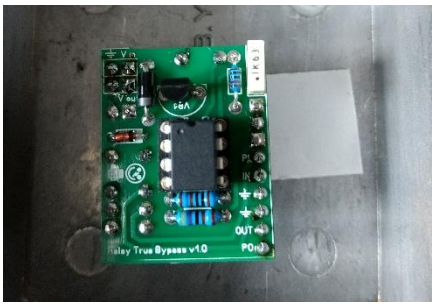
We are almost ready. Now it is time to decide how to connect the bicolor LED and where to drill a hole in your enclosure. I used and old enclosure I had lying around (BYOC, how fitting) so it does not really represent how tight you can build this!

1. Start by drilling the hole for your switch (approx. 15 mm from the bottom, but measure before you start drilling!!).

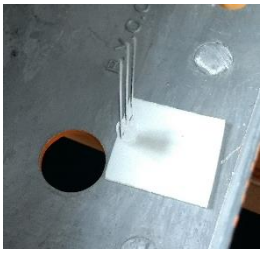
2. Stick some double sided tape to the right of the hole and remove the sticker revealing the sticky side.



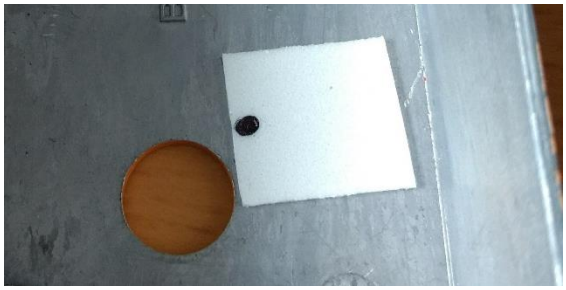
3. Insert the LED in the board (bottom side!) , but do not solder it! Orientation of the LED is not yet important as we are only going to use it as a placeholder for measurement.
4. Insert the PCB in the enclosure while holding the LED so it does not fall out. Place it the way you fit right and press the led so it sticks to the double sided tape.



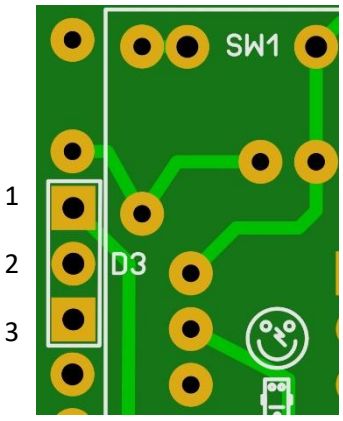
5. Now gently pull the board with switch out, making sure the LED sticks to the tape.

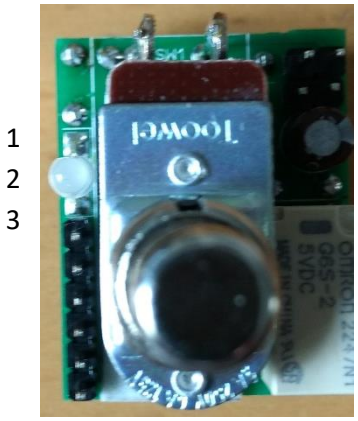


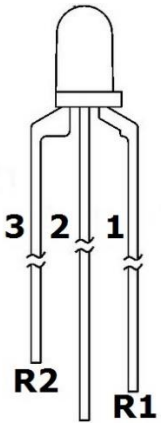
6. Press down on the led making sure not to damage it, but still hard enough to leave a mark in the tape. Remove the LED and mark that dent with a sharpie.



7. Now drill the hole. Be extra careful as you will be drilling from the inside out instead of the other way around.
8. Finish by reinserting the PCB and LED (still not yet soldered to the PCB). Make sure this time that you have oriented the LED correctly. Note that I numbered the pins for you in the pictures below. R1 and R2 refers to the Rled those pins connect to (see table in the first part of this building sequence):







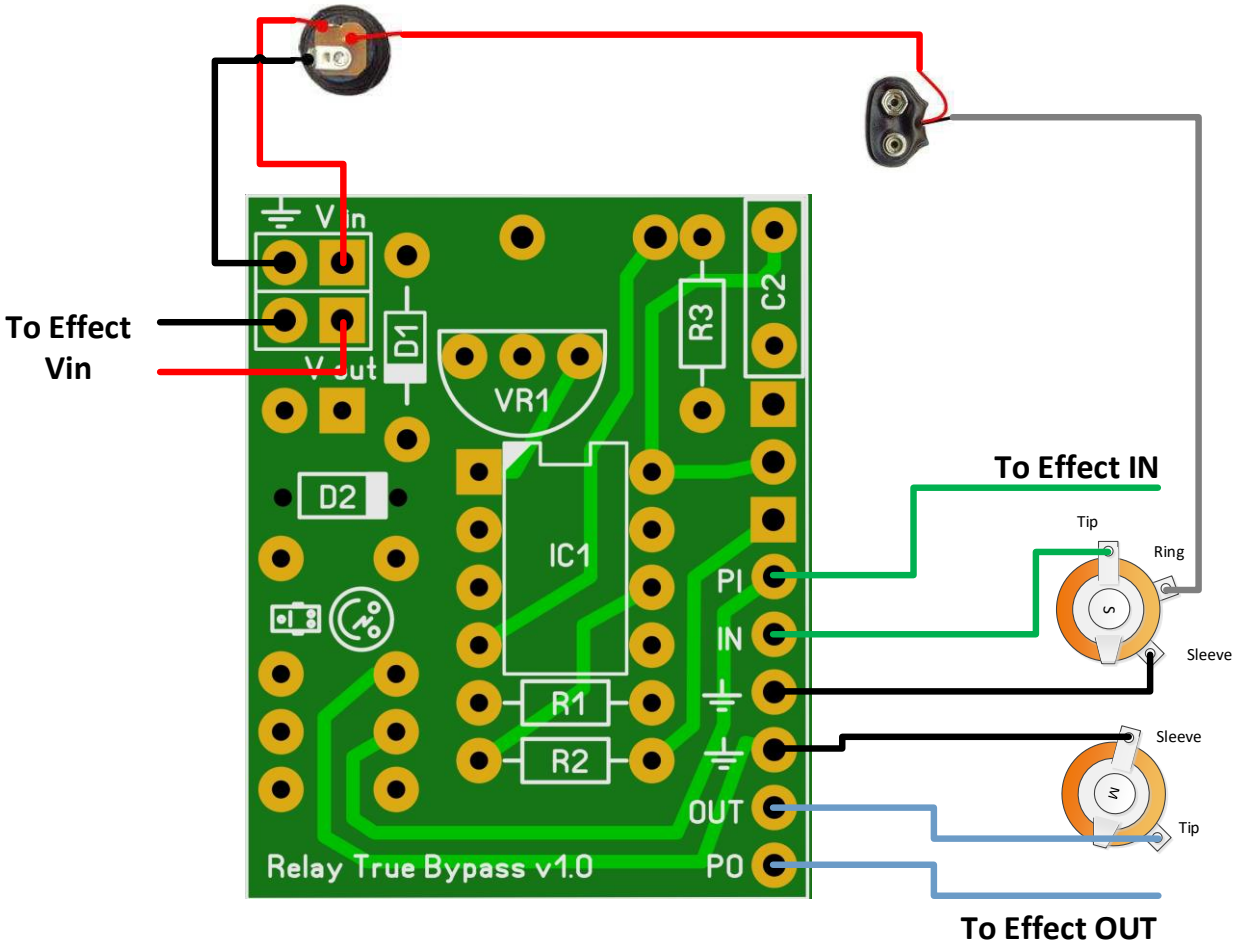
9. Make sure you screw the switch tightly to the enclosure and if all fits well, you can solder the LED to the PCB. I advise you to uninstall the PCB/switch for the off board wiring.

PS. If you want to save some extra space, you could turn everything 90 degrees. All steps still remain the same, but only 90 degreed different. I suggest you turn it to the left (counter clockwise) so the LED will stay above the switch. Note that I was too lazy to remove the tape before making the picture.

The finished switch

When you are ready, the switch should look something like this. Note that I chose to solder C2 on the topside, but you can save some room (as mentioned before) by soldering it to the bottom side. Also note that I use male headers. This is not a good idea when you use it in your build as it will take up a lot of space. I chose to use headers as I use the switch to test all my new boards and made it modular this way. Safes me a lot of time when testing.

Off board wiring



As you might have noticed in the diagram: Green means input and Blue means output.
Note: This board works on either **9V to 18V input**. Do not use any adapter rated over 18V!

Using and programming the switch

Features

Now that all the hard work is done, it is time to enjoy your switch. First let's look at the features.

1. **True bypass**. Your tone is not in any way affected by the switch. The digital part of the switch is only used to make the relay switch. The relay which passes your signal through is 100% analogue.
2. **Safe**. If there is a disaster and the power falls out to your pedals, the switch goes directly to bypass mode. This does not matter if all power cuts out (as your amp will also die), but in case your amp still works, you can continue playing.
3. **Reliable**. The relay is rated to switch over 100 million times mechanically and at least 500.000 times electrically @1A/30VDC, so it will last a lot longer as we are only passing mA and mV through the relay. A standard 3PDT switch is rated usually around 50.000 times mechanically.
4. **Programmable LED color**. I will elaborate on this in the next part of this manual.

Programming the switch

You can set the LED to 3 different colors, depending on the type of bi-color LED you've chosen.

1. **Press and hold** the switch for **at least 5 seconds**. The LED will start to flicker in all the available colors which indicates that it is in program mode.
2. **Release** the switch and it will start to flicker in the color it was set to last.
3. **Press** the switch for more than **½ second** (but less than 5 seconds) and release it to change color.
4. Once you found the color you want, you can either **wait** for 20 seconds so that the switch automatically leaves the program mode, or **press and hold** the switch again for at least **5 seconds** and when the led stops flickering you can release it to leave the program mode.

If the switch is not in program mode, it will function the same as any other switch. Press to engage the effect (LED will turn on) and again to switch your effect off (LED will turn off).

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 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've 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 joint 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