

ColoredThro

Building instructions

v1.1

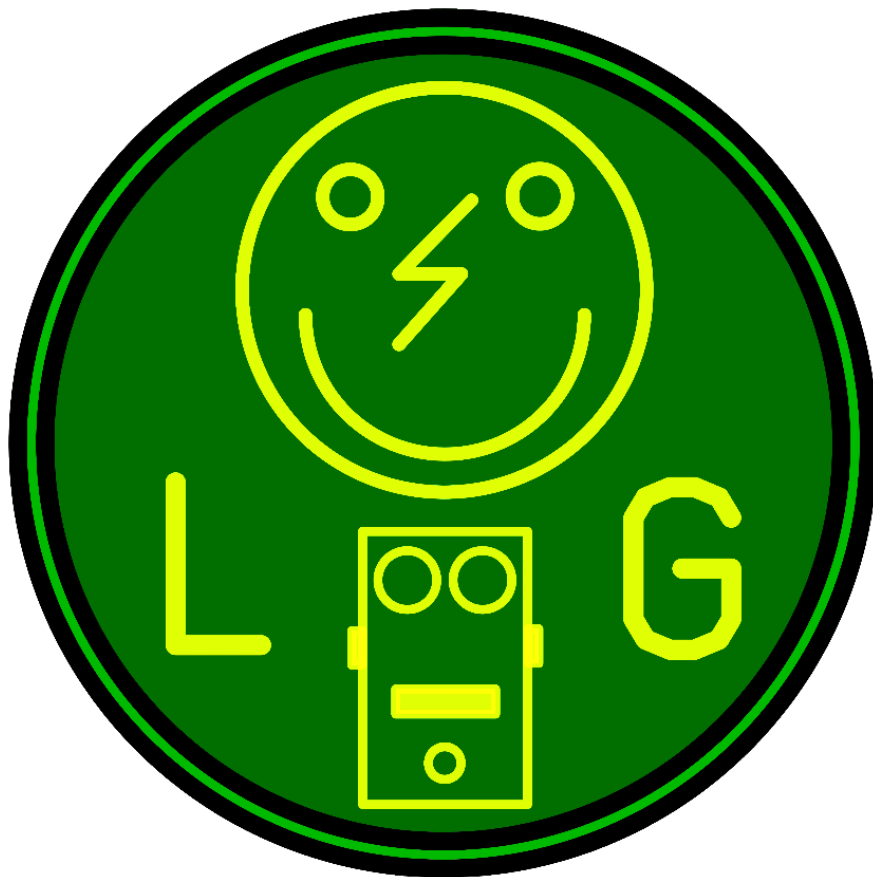


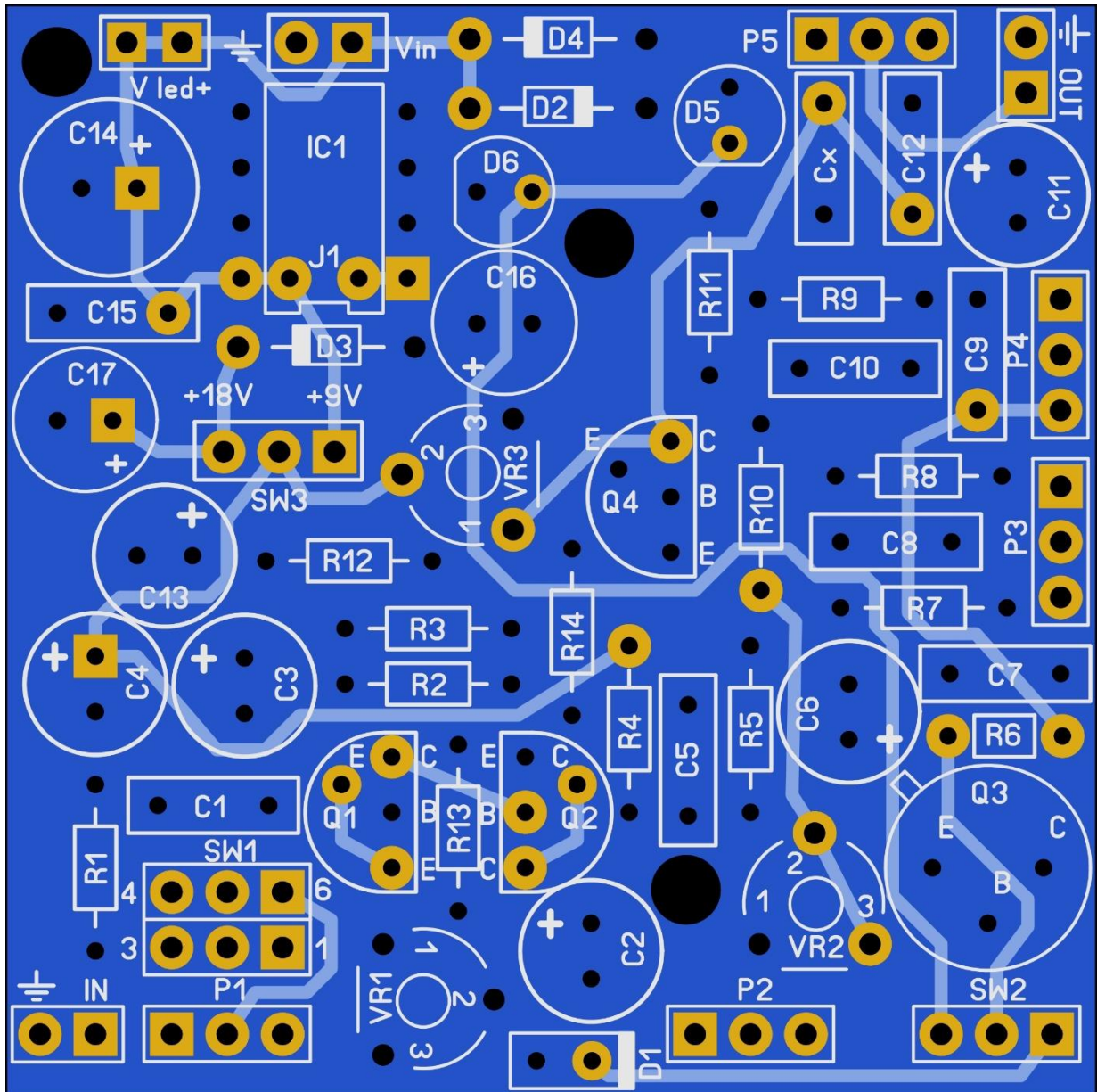
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Read this entire manual thoroughly before you start building the effect! There are some available options and mods and you should choose which one you want to incorporate before starting your build.

Last update: 29-12-2019

PCB layout



Dimensions: 50 mm x 50 mm
1.97 inch x 1.97 inch

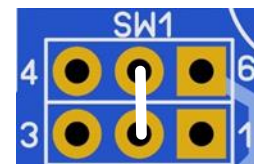
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Components

This PCB gives you the option to build a clone of either a Coloursound Powerboost, Coloursound Overdrive or Throbak Overdrive Boost. Parts differ per type as described in the table below. Decide which one you want to build and choose the appropriate parts. You should also take a good look at the mods section for other options and required parts.

Part	Coloursound		Throbak	Part	Coloursound		Throbak
	Power boost	Overdriver	Overdrive Boost		Power boost	Overdriver	Overdrive Boost
C1	220n	220n	220n	IC1	ICL7990S	ICL7990S	ICL7990S
C2	22u	10u	22u	Q1	BC169C	BC109	2N2222A
C3	22u	22u	22u	Q2	BC184C	BC109	2N2222A
C4	22u	22u	22u	Q3	NC	NC	2N404
C5	220p	220p	200p	Q4	BC109	BC109	2N2222A
C6	10u	10u	4u7	R1	NC	NC	2M2
C7	10n	10n	10n	R2	150k	150k	150k
C8	100n	100n	100n	R3	1k2	470R	470R
C9	100n	100n	100n	R4	120k	120k	120k
C10	10n	10n	10n	R5	jumper	12k	12k
C11	22u	10u	22u	R6	4k7	4k7	4k7
C12	220n	220n	220n	R7	5k6	5k6	5k6
C13	10u	22u	22u	R8	39k	39k	3k9
C14	100u	100u	100u	R9	4k7	4k7	4k7
C15	100n	100n	100n	R10	180k	150k	150k
C16	10u	10u	10u	R11	33k	33k	33k
C17	10u	10u	10u	R12	1k2	470R	470R
Cx	NC	NC	NC	R13	12k	NC	NC
D1	NC	NC	1N34A/1N270	R14	470R	jumper	jumper
D2	1N5817	1N5817	1N5817	SW1	jumper 2-5	jumper 2-5	DPDT/3PDT
D3	1N5817	1N5817	1N5817	SW2	NC	NC	SP3T ON/OFF/ON
D4	1N4001	1N4001	1N4001	SW3	SPDT	SPDT	SPDT
D5	NC	NC	LED Red 5mm	VR1**	B10k	B10k	B10k
D6	NC	NC	LED Red 5mm	VR2**	B10k	B10k	B10k
P1*	NC	NC	B500k	VR3**	B10k	B10k	B10k
P2	B10k	B10k	C10k				
P3	B100k	B100k	B100k				
P4	B100k	B100k	B100k				
P5	Jumper 2-3	Jumper 2-3	A100k				

Jumper 2-5 means ->



Capacitors with values < 1nF are MLCC, values of 1nF – 1uF are SMF (except C15, which can be MKT) and all values > 1uF are Electrolyte. **P1-P5** are 16mm Alpha pots (**A=log, B=linear, C=rev. log**), **VR1-VR3** are 6 mm trimpots. **All parts must be rated 25V+**

* The Throbak uses an internal pot. Use a Alpha 16mm (external) or a Bourns 3296W style (internal) trimpot

** See the **Biasing** section for options before choosing to solder the trimpots!

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Power section

The effect has been designed to be able to operate on +9V or +18V using an internal charge pump. **SW3** enables you to switch dynamically between the +9V and +18V setting. If you do not want to use the switch then do not forget to solder a jumper between the middle pad and the desired voltage pad. NEVER let the outer 2 lugs of **SW3** touch each other and also never connect all 3 pins of **SW3** together. If the IC gets hot then there is a short in the power section and you must disconnect the effect immediately from the adapter and find the fault.

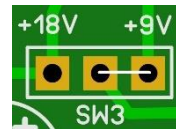
You can choose between 3 options for the power section:

1. **No charge pump:**

Do NOT install: **C16, C17, D2, D3, IC1, J1 and SW3**

Extra jumpers: **SW3** on 9V pad and middle pad

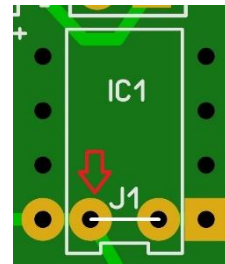
The effect can now be used with a standard +9V adapter or an +18V adapter



2. **Charge pump using a ICL7660S:**

Place all components as stated on the PCB and connect a jumper wire between leg 1 and 8 (marked **J1**) of **IC1**. Do not forget to place the jumper before placing the DIP-8 socket for **IC1**.

NB. Only use the 7660S and not any other version without the S.



The effect can now only be used with a +9V adapter but you can switch it internally to +9V or +18V using **SW3**.

3. **Charge pump using a LT1054:**

You can place all components as stated on the PCB just do NOT connect **J1** (pin 1 and 8 of **IC1**)!!

The effect can now only be used with a +9V adapter but you can switch it internally to +9V or +18V using **SW3**.

Which IC should I choose? ICL7660S or LT1054? In this application it does not really matter. The LT1054 can give more current @18V (100mA) than the ICL7660S (45mA @18V) but the ColoredThro does not draw that much current in any configuration. On the other hand the ICL7660S is much cheaper than the LT1054, so that could be a good reason to use it. But then again, maybe you have a stash of LT1054 you want to use.

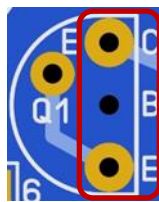
Modifications

Gain mod

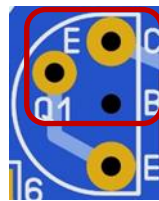
The standard 10K Gain pot (**P2**) has all the action crammed up at the end of the sweep. To make it more versatile you could use a C10k, C5k or C1k pot instead.

Transistors

Q1, **Q2** and **Q4** can be any silicon transistor you can think of. 2N2222A, 2N5088, 2N3904 etc, etc. Note that I modified the PCB so it can both fit standard modern transistors (CBE) and eg. vintage BC169C (CEB). Double check the datasheet of your transistor to be sure that you connect the right pin to the right pad! Here is an example of using a 2n5088 as **Q1**



And also a BC169C as **Q1**



NB The pin layout for **Q2** is different so watch carefully when inserting the transistor in the correct pads.

Q3 (only used in the Throbak) can be any germanium PNP transistor you like 2N404, AC128, AC132, etc. or you could even replace it with a germanium diode by connecting the cathode to **Q3 B** and the anode to **Q3 C**

Mix and match

You could mix a few options of different versions to get a custom effect. I think it would be a good idea to add **R1** (pull down resistor) and **P5** (volume) to the Colorsounds. This way you can reduce the pop when switching on the effect and add a volume control. You could also consider adding the clipping options to the Colorsound (**D1, Q3** and **D5, D6** using **SW2**).

Feedback capacitor Cx

Cx is an optional filter to reduce the harshness and some high frequency hiss from the effect perceived by some. You can experiment with values between 100pF and 470pF. As default you can try 100pF.

Additional clipping options

Originally the Throbak does not come with the LED setting, only the germanium. If you do not want this, you can leave out **D5** and **D6** and use a SPST instead of the SP3T in **SW2**. Otherwise you can always experiment with different types of LED's or use 1N4148, 1N914, etc.



Build sequence

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!

Start by soldering the jumpers and resistors (except for **R6**). If needed you can create a jumper using a spare piece of lead from a resistor or diode. Next come the diodes **D2**, **D3** and **D4** and then the MLCC capacitors.

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 small SMF and MKT capacitors then solder the diodes **D5** and **D6** and the VR trim pots. The rest of the resistor **R6** comes next and should be mounted upright. Ditto for **D1**. Finish with soldering the electrolytes.

I suggest you now drill the holes in your enclosure so you can use it during the off board wiring.

Note: Really take some time to determine where to place the pots, switches, jacks and PCB in the enclosure before you start drilling. Measure twice, drill once.

You are almost ready to rock, well... not really. The difficult part starts now.

Besides the components mentioned in the Bill Of Materials table, you will need:

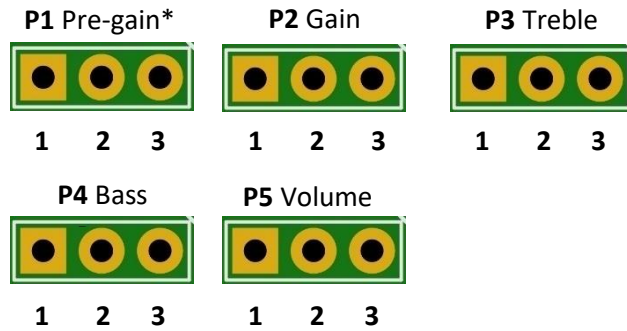
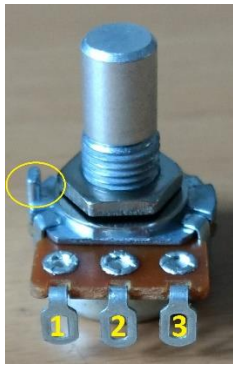
- **2 input jacks.** 2 mono jacks if you are not going to use a battery but only the 9V adapter. 1 mono (for output) and 1 stereo jack (for input) if you will be using both a 9V battery and the 9V adapter.
- **1 x 3PDT footswitch** (9 pins)
- **2,1mm DC jack** (isolated).
- **9v battery clip** (optional).
- **22 gage stranded hook-up wire.**
- **LED holders.** This enables you to mount the LEDs in the enclosure.
- **1 x LED (3mm or 5mm depending on your taste)**
- **Hammond 125B or 1590BB** case (or similar) in your favorite color. A 1590B will also fit if you leave out the battery.

Off board wiring

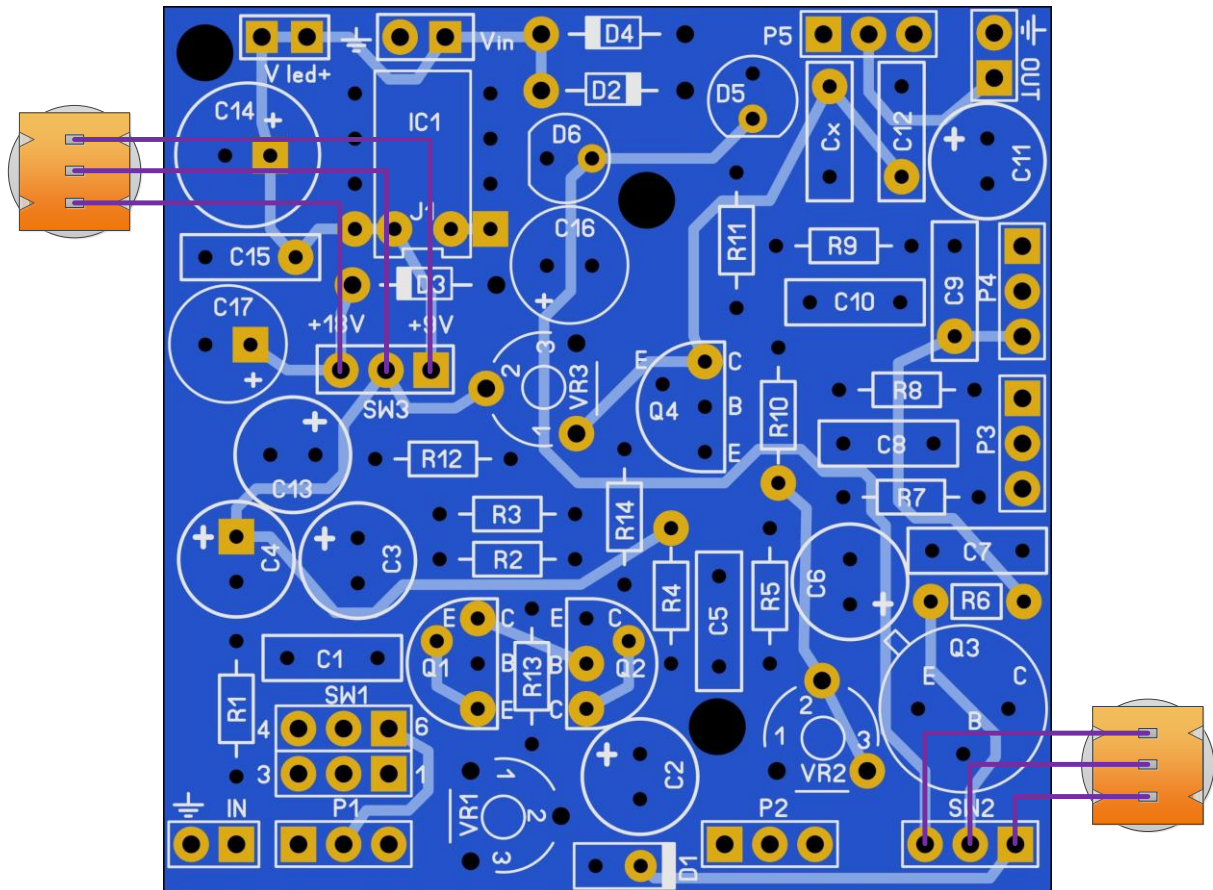
Potentiometers

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 a sort of extra shielding against external noise.

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



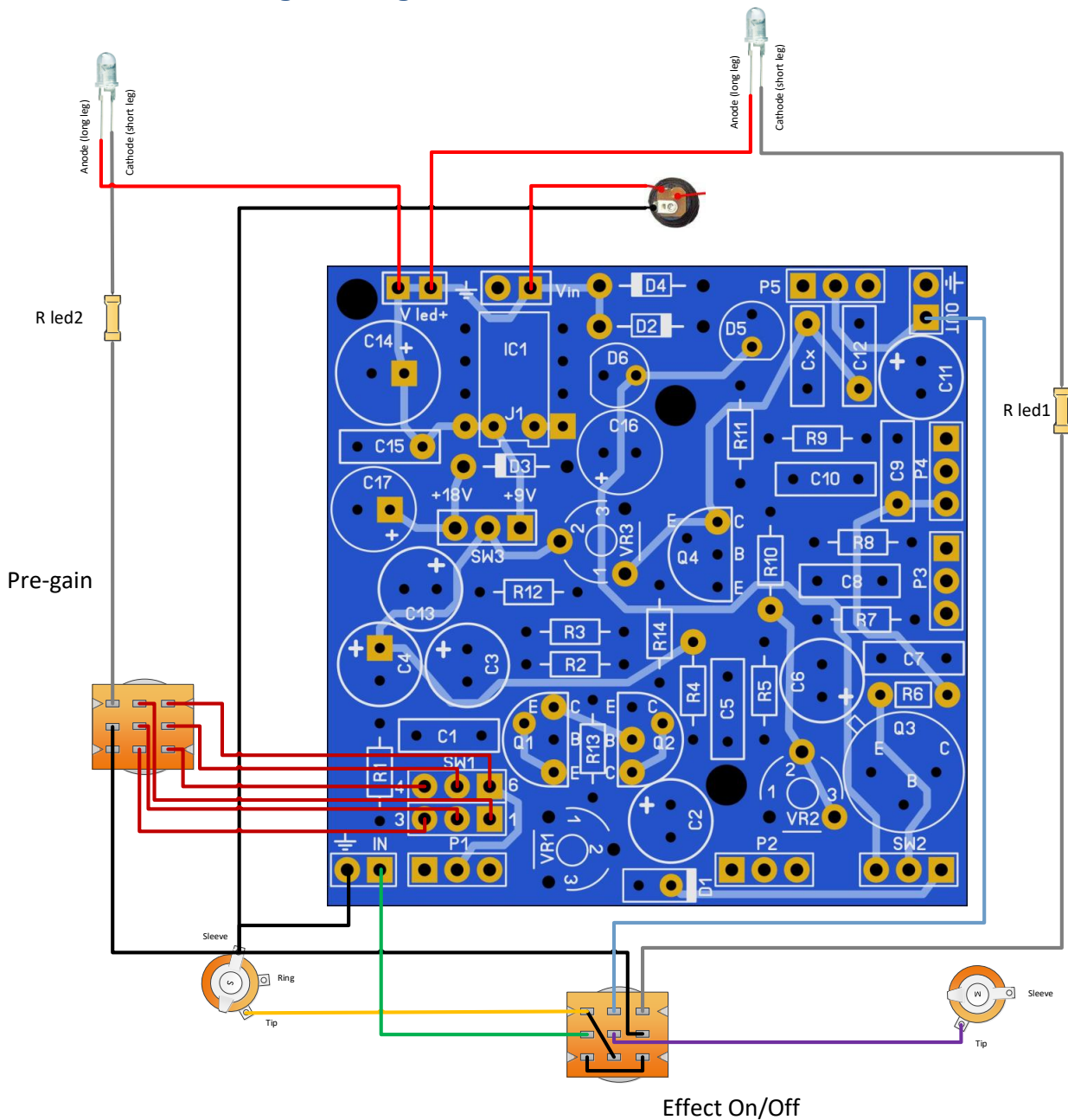
Miniswitches



* The Throbak uses an internal trimpot for the pre-gain. If you do not want an extra external pot you can substitute the **P1** Alpha pot for an internal trimpot (Bourns 3296W style)



Footswitch and stargrounding



Note that **R led1** and **R led2** are **4k7** resistors. You can change these values depending on the type of LED you use, but 4k7 is safe enough for almost all LEDs @+9V. The pre-gain switch can either be a standard or footswitch! You are also free to leave the LED out on the Pre-gain switch and use a standard DPDT toggle switch.

It is now time to place your transistors and IC in the sockets if needed. Connect everything, build it in your enclosure and enjoy your effect!

The sleeve on the output jack is not connected on purpose. Make sure the output jack is in good electronic contact with the enclosure else you can try and connect the sleeves of the input and output together. If you test the unit outside of an enclosure you need to connect the output sleeve to ground!

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Biasing

The transistors **Q1**, **Q2** and **Q4** need to be biased. The best way to do this is by using the biaspots **VR1-VR3**.

The Colorsounds did not come with bias pots, but had fixed resistors. These original resistor values are mentioned in the table below. If you prefer you can place resistors instead of the trimpots. If so, omit the trimpots and instead connect the fixed resistors with the correct value mentioned below to the pads marked **1** and **2** of **VR1-VR3**.

However, I recommend that you use the trimpots. Every transistor is different and may or may not sound optimal with the given values. Start by setting the trimpots to the values mentioned in the table (preferably before soldering them to the pcb). To measure the resistance correct use an digital multi meter and measure the resistance between pins marked **1** and **2**. For your convenience I marked these pins also on the backside of the PCB. After setting the pots, test the effect. If it does not meet your expectations you can measure the voltage per transistor. I marked the collector pads of each transistor on the backside of the PCB. Use the red probe on these pads and the black probe to ground to get a good reading. Adjust the corresponding trimpot to get to the target voltage. If both techniques do not give you your optimal sound then find your own sweet spot.

Biaspots	Transistor	Colorsound		Throbak	Target voltage	
		Power boost	Overdriver	Overdrive Boost	@9V	@18V
VR1	Q1	4k7	6k8	5k6	2.5V	5V
VR2	Q2	1k8	1k8	2k	5V	10V
VR3	Q4	3k9	1k8	1k5	6.5V	13V

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.

