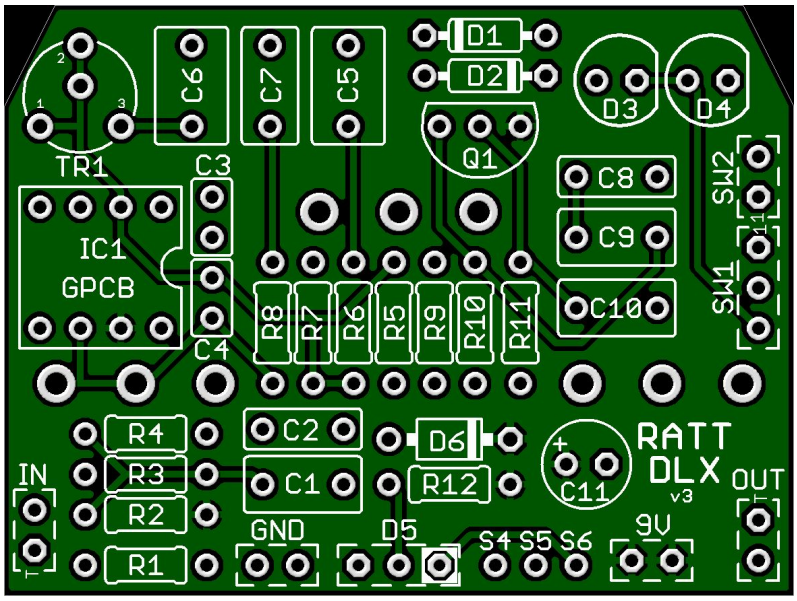
RATT DELUXE

The Best Mod Friendly Ratt Style Circuit

Our latest Ratt Style circuit includes on-board mount pots and sleek new design. Every bit the same otherwise as our previous version. This is our best sounding and the most versatile Ratt you will ever need. Of course you may always hand wire the pots instead of board mounting. With SIX multiple clipping options (see our Clipping Chart- Page 3) and our version of the Ruetz Mod makes this the King of all Ratts!

Board Dimensions are 1.95” by 1.47” inches



Part #	GPCB Values	Original
R1	1M	1M
R2	1M	1M
R3	1M	1M
R4	1k	1k
R5	10k*	
R6	4k7	560R
R7	100R*	47R
R8	1k	1k
R9	1k5	1k5
R10	1M	1M
R11	10k	10k
R12	1k8*	CLR

Part #	GPCB Values	Original
C1	220n	22n
C2	10n	1n
C3	22p to 33p*	30p
C4	100p	100p
C5	470n	4µ7
C6	330n	2µ2
C7	220n	4µ7
C8	3n3	3n3
C9	220n	22n
C10	220n	1µ
C11	47µ	100µ
TR1	100R*	

Part#	GPCB Value	Original
D1	1N914	1N4148
D2	1N914	1N4148
D3	LED	
D4	LED	
D5	Bi-Color LED*	
IC1	LM308	LM308
Q1	2N5459	2N5458
GAIN	A500k	A100k
FILTER	B100k	A100k
LEVEL	A100k	A100k
SW1	SPDT ON-OFF-ON	
SW2	SPST or SPDT	

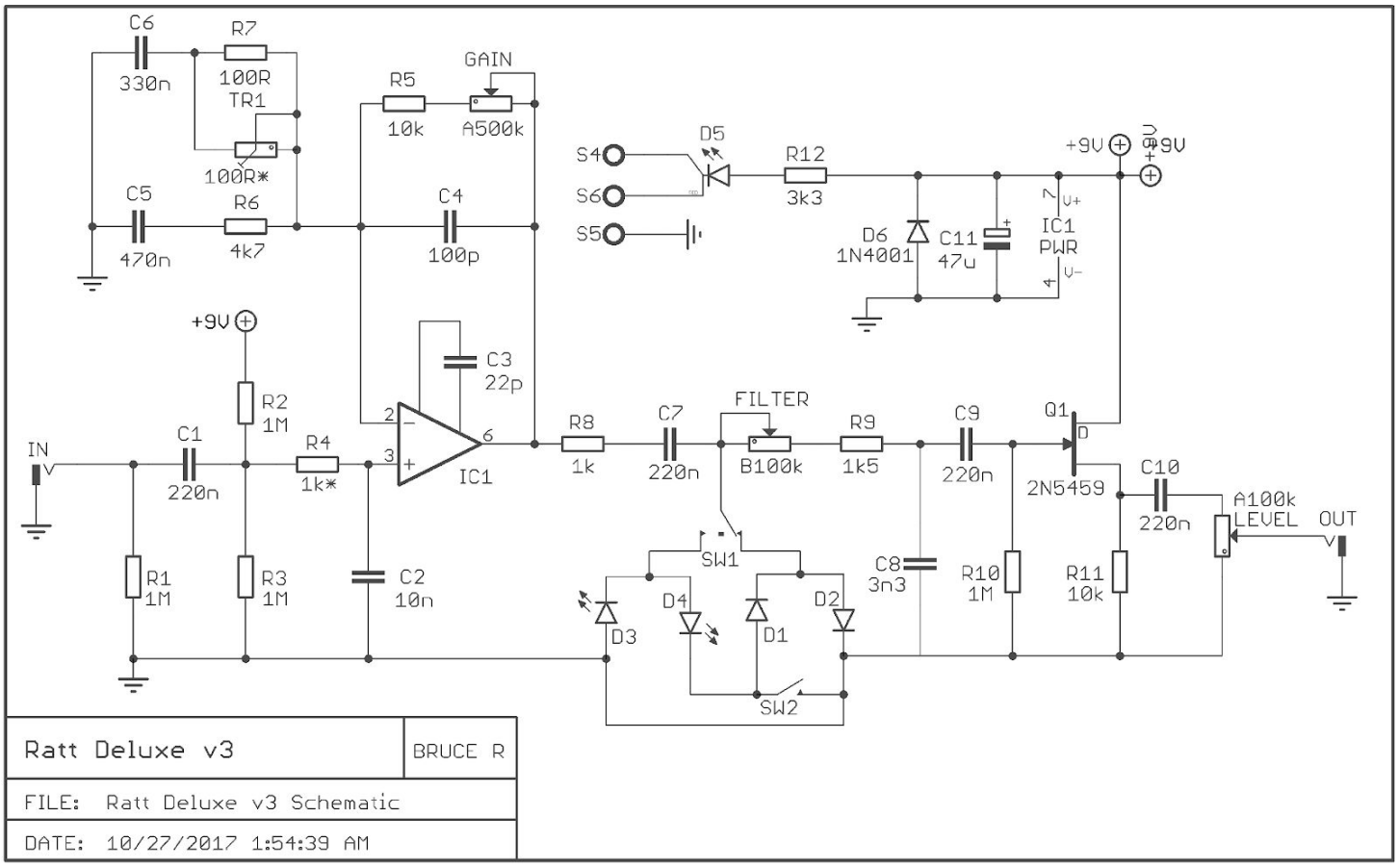
*** See Text**

D6 - This is a circuit protection diode. 1N4001 or similar is fine. IC1 – LM308 or use an LM301. Q1 – 2N5459, 5458 or 5457 all work.

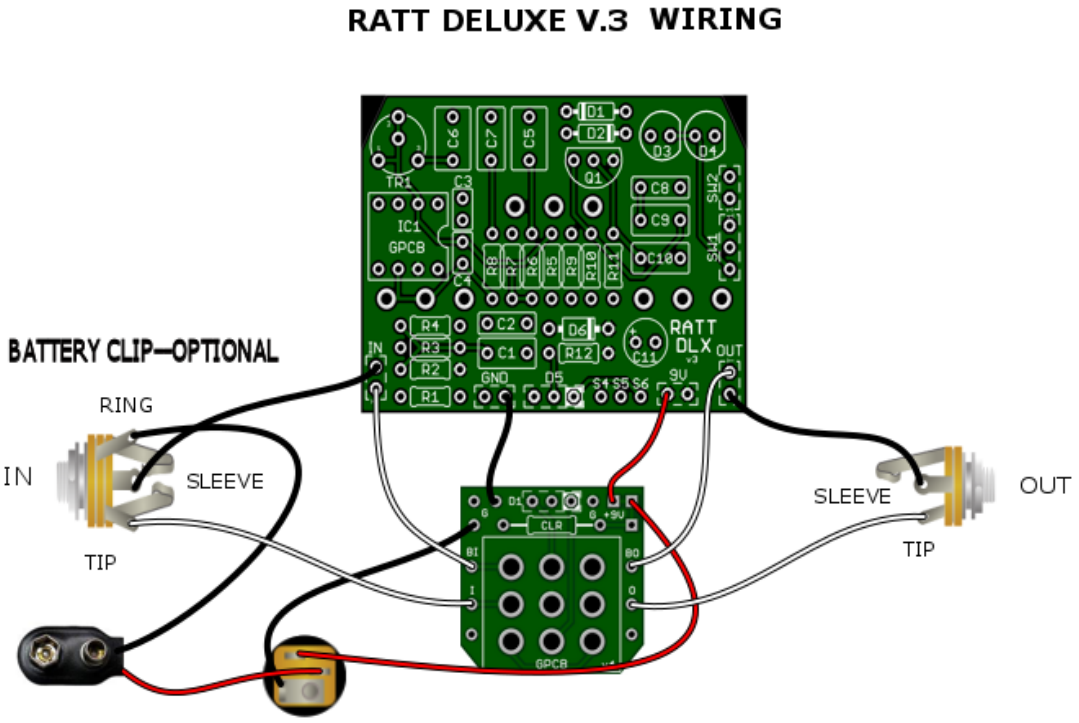
R7 and Trimmer TR1 are both 100R which is not to be confused with 100K. R stands for Ohms so 100R is 100 Ohms, not K Ohms.

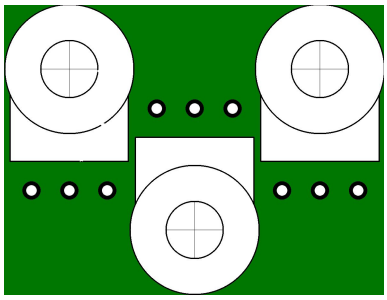
The original values for the ProCo Rat™ are given in orange and can be used instead of the modified version. **Differences are minimal.**

More important build notes below:



WIRING DIAGRAM





Note: If you purchase a pre-drilled enclosure just opening the holes up a little will allow On-Board pots to fit better in enclosures not drilled specifically for this board. A slightly larger hole will be covered by the washer and nut. Place board in enclosure first with on-board pots and solder just one leg till you have a perfect fit before finishing it off. Do not simply solder pots first without "fitting". Use anti-static barrier between Pot and Board!

MODS/TWEAKS

As quoted from Tonmann's documentation for version 1 of this circuit board, there are various tweaks that can be applied to the circuit:

R5: This has been added to prevent the Gain pot from being turned completely off. This is useful in that you can set the minimum gain (via the value of R5) when the Gain pot is at 0% rotation, this will give more usage out of the gain pot itself. There are two methods to adjust the value of R5 for minimum gain:

Method 1:

- **Socket R5** and try different values – 10kΩ is suggested as a starting point.

Method 2 (The second method is a bit more involved):

- Don't install R5, wire lugs 2 & 3 of the Gain pot as usual.
- Wire lug 1 of the Gain pot to the right hand (from the layout diagram) pad of R5
- Set the Gain pot to give the desired minimum gain
- Remove the wire from the right hand pad of R5 and measure the resistance between lugs 1 & 2
- Choose the nearest standard value for R5 and solder it to the board.

R7 – TR1: This is a version of the Ruetz mod.

I don't think this mod really warrants an external pot so I have used an on board trim pot. If you want to make this mod with an external pot, don't install the trim pot and wire the external pot to the respective pads. Although a fuller explanation of what this mod does will be given on request on the forum at www.guitarpcb.com, it basically reduces the high frequencies a lot less than the bass and mid frequencies when the gain pot is turned down.

The best results will be obtained when the R7 – TR1 value is between 0Ω (a wire jumper) and 100Ω, there are several methods to achieve this:

- Socket R7 and don't install the trim pot. Try different values for R7 ranging from a jumper up to 100Ω. GuitarPCB carries 100**R** trim pots.
- Using a 1kΩ trim pot (which is more obtainable) in conjunction with R7 at 120Ω or 100Ω will yield the desired results.

IC1 – C3: If you are using the suggested LM308 for the op amp, C3 should be installed, the value of this capacitor determines the roll-off of high frequencies, small values roll off less high frequency than larger values. The original 30pF capacitor may be harder (more expensive) to find, using a 33pF capacitor will make little difference. Although I have suggested a value of 22pF, different values can be tried, a "socket and see" approach. I would suggest values between 10pF and 100pF. Other types of mono op amp can be tried. LM301, TL071 etc...

Diodes: There are many different types and combinations of diodes that can be tried, the fast switching diode family 1N4148, 1N4448, 1N914, 1N916 etc can be interchanged with no noticeable difference, the actual measured forward voltage of each diode is probably more important.

LED: Apart from the standard red clipping LEDs, other colors could be tried for slightly different results.

RATT CLIPPING CHART

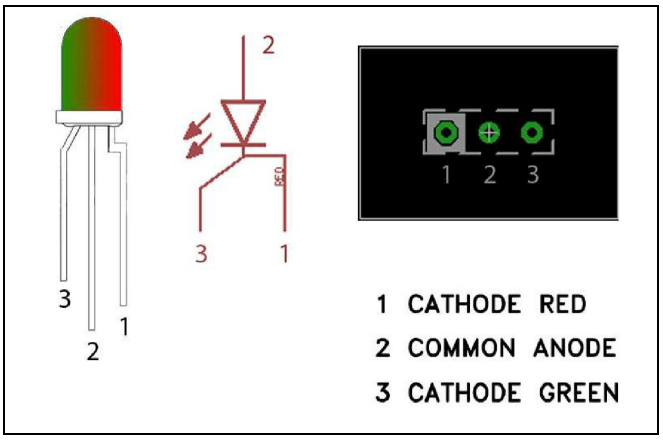
SW1	SW2	CLIPPING	SYMMETRICAL	ASSYMETRICAL	DIODES
LEFT	CLOSED	YES	YES		D3>D4
LEFT	OPEN	YES	NO	YES	D3>D4,D1,D2
CENTER	CLOSED	NO	----	----	NONE
CENTER	OPEN	NO	----	----	NONE
RIGHT	CLOSED	YES	YES		D1>D2
RIGHT	OPEN	YES	NO	YES	D1.D4.D3>D2

RATT CLIPPING CHART – Shows six different Options when using SW1 and SW2

Q1: The original 2N5458 JFET in conjunction with R11 at 10kΩ will set the bias point at the source of Q1 to around 2.2V. This enough when using the diodes to clip the signal but not enough when using op amp clipping, Q1 will clip one half of the output signal (this may or may not be desirable). Using a 2N5459 should increase the bias voltage to over 3V – impossible to predict due to variance in JFET characteristics. I would suggest using the 2N5459 and measuring the voltage at the source pin, anything more than about. 2N5457 will also likely work well in this position. Please use genuine transistors (avoid many eBay sellers from China) Test voltages.

3.2V is good, if the voltage is lower than 3v, increasing the value of R11 will raise the bias voltage.

STATUS LED



D5 is a common anode bi-color LED. The diagram at right shows the pin-out, schematic symbol and pads for a common anode LED. The pin-out for the bi-color LED is as follows:

When connected correctly the LED will light red when power is applied and the circuit is in bypass mode. The LED will light green when in effects mode. Currently, Red/Green LED's are available for a reasonable price at GuitarPCB.com. Other bi-color common anode LED's are available on the market, and other colors may be offered in the GuitarPCB.com PCB Shop at a future date.

You may also decide to use a single-color standard LED. If you choose to do this instead of a bi-color LED, connect the Anode to pad 2, and the cathode to pin 3. The LED will light when the pedal is on, and will be off when the pedal is in bypass mode. The Current-Limiting Resistor **(R12)** may need to be adjusted to accommodate different LED's to adjust the LED brightness. For the GuitarPCB.com Red/Green common anode LED's, the suggested range is 1k (bright) to 2k2 (dim). For standard single-color red, green or yellow LED's, 2k2 – 4k7 is the appropriate range.

If you decide to use a bi-color LED, you need to be aware of potential issues if using a metallic LED bezel. These bezels come with 2-lead LED plugs, which not work well for 3-lead LEDs. We recommend the following potential solutions:

Do not use a bezel. You can drill a 3mm or 5mm hole (depending on the size of your LED) in your enclosure, and then use epoxy or hot-glue gun to secure the LED in the interior of the pedal if the leads are not securing the LED.
Use a plastic bezel. Since plastic is non-conductive it will not cause a short.
Insulate the bi-color LED leads. This is quite easy. Just take some ~18-22 gauge wire, strip off a piece of insulation, and slip it onto the 2 outside LED leads that may short against the LED bezel.

Plan Your Enclosure! If you use a 1590A, 1590B, 1290NS or any enclosure, you must plan carefully. Unless you use a very deep enclosure, you will need to mount the 3PDT switch on the same side as the components, so that when you insert the populated board into the enclosure, you are looking at the back of the board, not the component side. Otherwise, you may end up with a problem with components sticking too high out of the enclosure, which will prevent the back of the enclosure from being screwed on (see the problem illustrated below). You can also try mounting short items on the top of the board, and put the 3PDT and all taller components on the underside, however it is **critical** that pin orientation be correct on components like integrated circuits, transistors, diodes, polarized caps, etc. Be sure to drill your enclosure so that other components such as audio jacks and pots do not interfere with board components. Plan carefully, and consider using a deep enclosure!

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If they do not have a KIT listed send them a note asking if they can help you out.