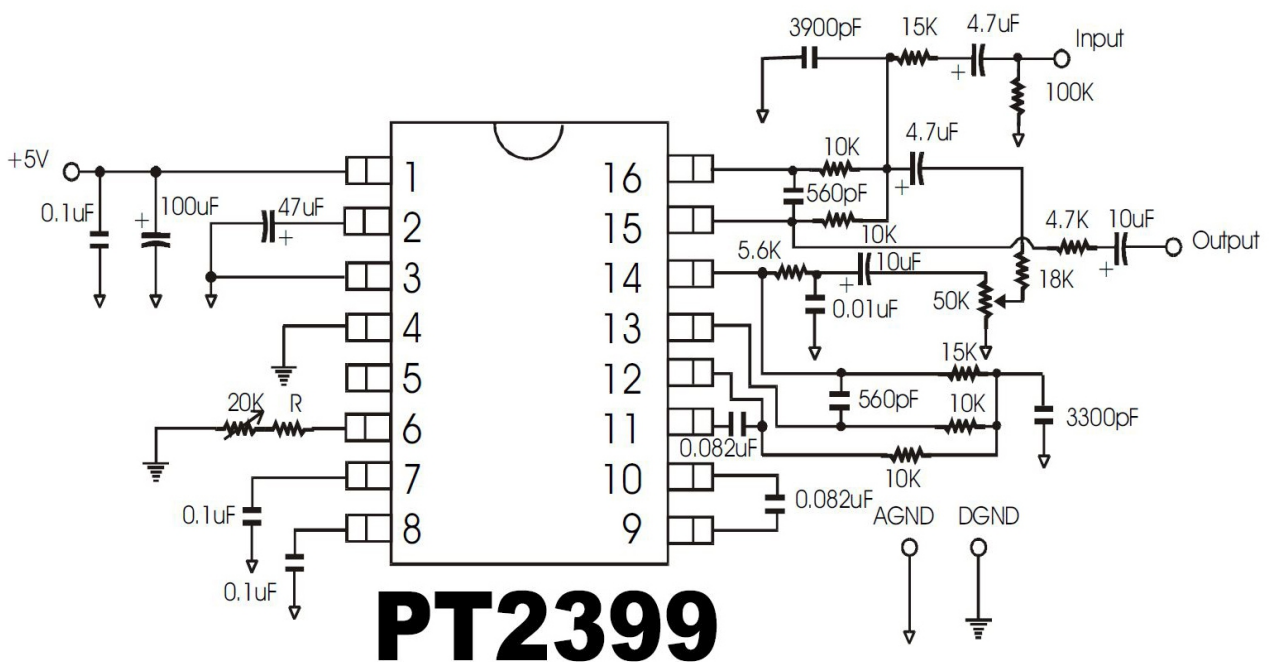# Rob Mods Simple Delay Pedal
(May 2021)

Here's a simple delay pedal built with a cheap PT2399 module.

This module can be bought from Ebay and AliExpress for just a few dollars. The circuit on this board is similar but *not identical* to the echo circuit from the PT2399 datasheet.

PT2399 ECHO APPLICATION CIRCUIT

The module needs some minor modifications. The onboard feedback pot was removed, as was the power terminal block, plus the input and output header pin terminals. The existing resistor between pin 6 and earth (labled "R27") was removed. The amount of resistance between pin 6 and earth controls the internal oscillator and therefore the delay time. The datasheet has a table of values and delay times. Note the increase in distortion (THD) as the time (td) increases.

TABLE 1: RESISTOR/DELAY TIME VALUES

R	27.6K	21.3K	17.2K	14.3K	12.1K	10.5K	9.2K	8.2K
fck	2.0M	2.5M	3.0M	3.5M	4.0M	4.5M	5.0M	5.5M
td	342ms	273ms	228ms	196ms	171ms	151ms	136.6ms	124.1ms
THD	1.0%	0.8%	0.63%	0.53%	0.46%	0.41%	0.36%	0.33%

R	7.2K	6.4K	5.8K	5.4K	4.9K	4.5K	4K	3.4K
fck	6.0M	6.5M	7.0M	7.5M	8.0M	8.5M	9.0M	10M
td	113.7ms	104.3ms	97.1ms	92.2ms	86.3ms	81ms	75.9ms	68.1ms
THD	0.29%	0.27%	0.25%	0.25%	0.23%	0.22%	0.21%	0.19%

R	2.8K	2.4K	2K	1.67K	1.47K	1.28K	1.08K	894
fck	11M	12M	13M	14M	15M	16M	17M	18M
td	61.6ms	56.6ms	52.3ms	48.1ms	45.8ms	43ms	40.6ms	38.5ms
THD	0.18%	0.16%	0.15%	0.15%	0.15%	0.15%	0.14%	0.14%

R	723	519	288	0.5
fck	19M	20M	21M	22M
td	36.6ms	34.4ms	32.6ms	31.3ms
THD	0.14%	0.13%	0.13%	0.13%

Note: R = External Resistor (Ohms), please refer to PT2399 Surround/Delay Time Application Circuit
fck = Clock Frequency (Hz)
td = Delay Time
THD = Total Harmonic Distortion

The input impedance of the module was measured at 12KΩ, so a guitar signal needs buffering. I chose a simple, single fet voltage follower circuit.
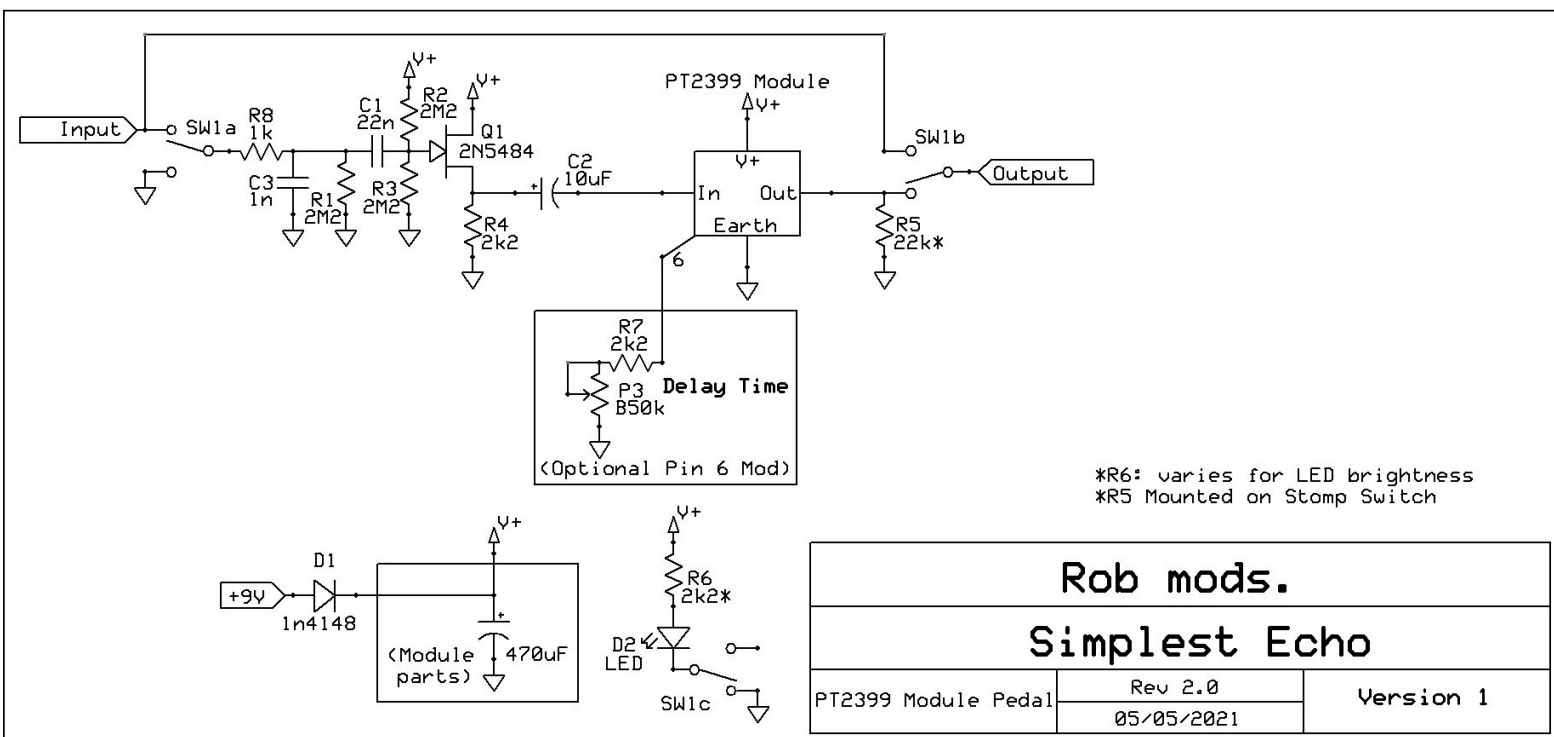
The slight (~0.5dB) loss through the buffer is made up by the module with its ~1dB of gain, so I chose to omit a volume control, as the pedal would be very close to unity gain.

The output of the module is 180 degrees out of phase with its input. The buffer design doesn't address this, but I decided to keep the single fet design for the sake of simplicity.

The module also has a high frequency roll-off from ~8khz. Again, I left this as is for the sake of simplicity. It is rare the resonant frequency of a guitar pickup would be higher than this. (Not to mention the treble roll-off of typical 12" guitar cab speakers.)

The module's output is floating, so I've added a 100k resistor (R5) to earth. This needs to be at least this value since the output impedance of the module is relatively high. The resistor bleeds the 10uF coupling cap to reduce switch-pop from the stomp switch.

To replace the pin 6 resistor (R27), I used a B50K pot in series with

a 2.2k resistor. The highest resistance (52.2k) is well beyond the datasheet's values, but there are several well known DIY PT2399 delay pedals that use this or higher values. The distortion is slightly audible at higher settings. The 2.2k resistor is there for three reasons. Firstly, to set the lowest delay time. Secondly, to limit the current at pin 6. And finally, to stop the chip from potentially crashing on power up. It is a known fault with the PT2399, that a pin 6 resistance below 2K-ohms can cause it to latch up irretrievably. (There is a simple workaround, but delay times below 50ms are not really needed for a delay pedal.) There is a good analysis of the PT2399 on www.electrosmash.com.

The new feedback pot (also B50K) was installed with double-sided tape on the bottom of the board. It was hard wired to the original through-hole solder pads.
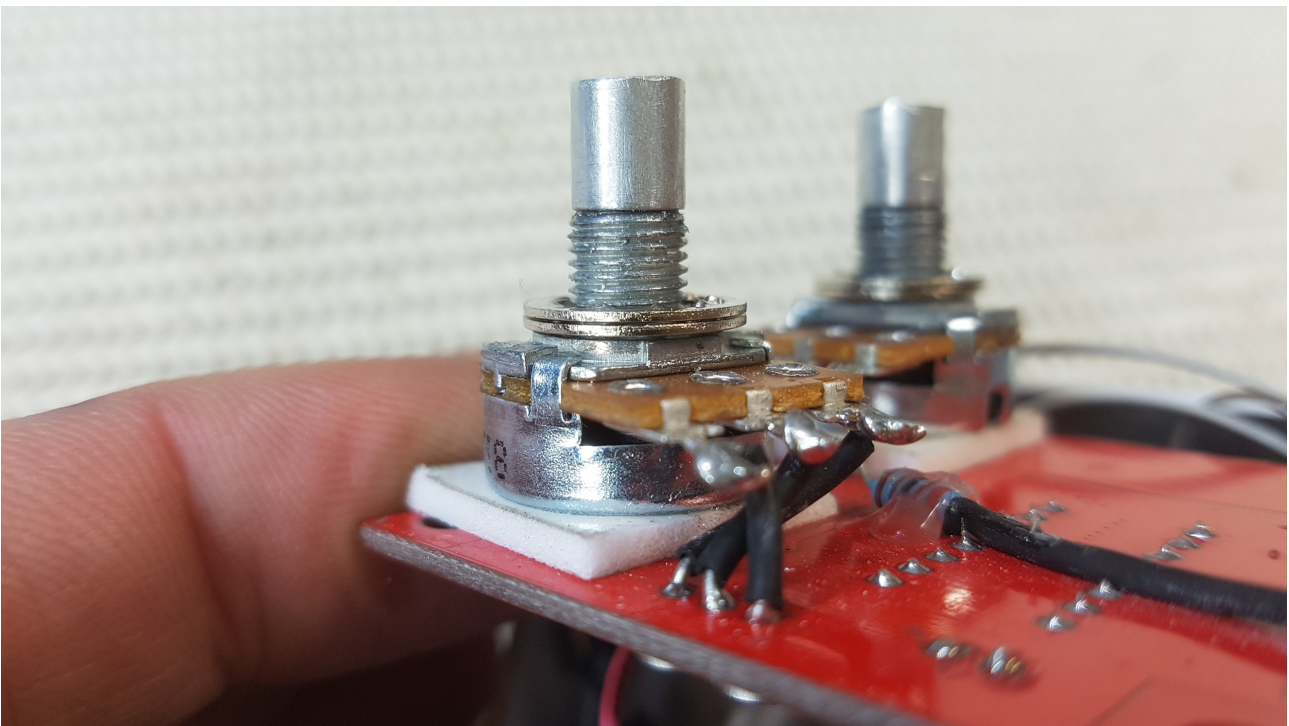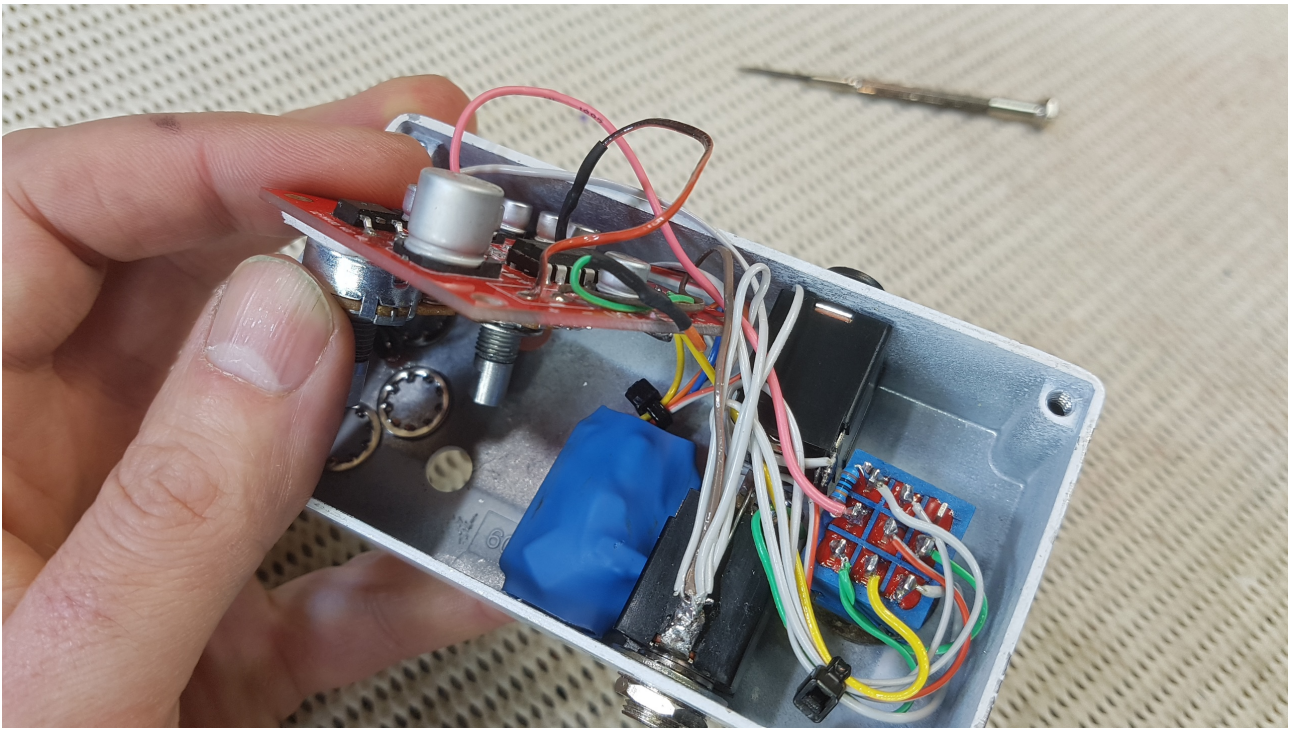

The delay time pot was installed in a similar way, with the anti-clockwise lug wired straight to the vacant earth pad from the removed output signal connector. The 2.2k resistor was wired directly from the pin 6 solder pad (labelled "s") to the middle and clockwise lugs of the delay time pot. The resistor was held in place with a drop of hot glue, and the long leg was covered in a length of heatshrink to prevent shorting to the IC legs. The pots can now be used to mount the module.
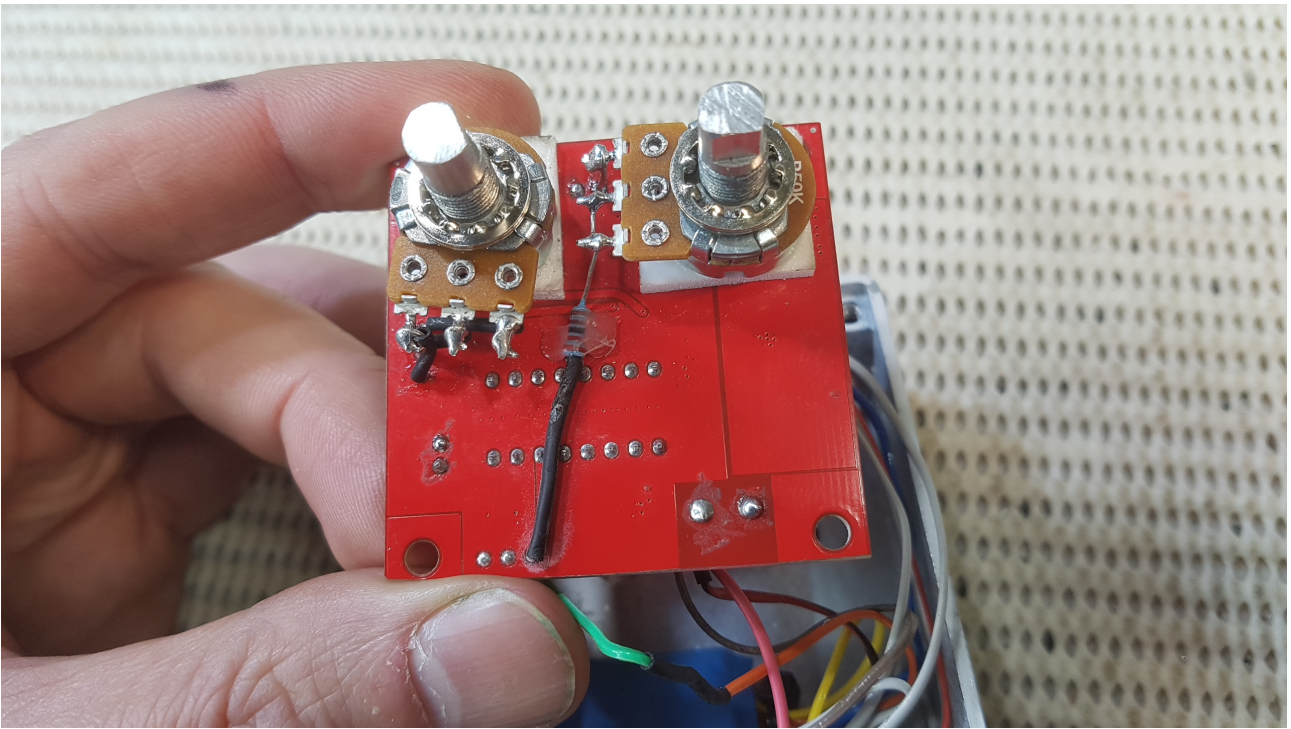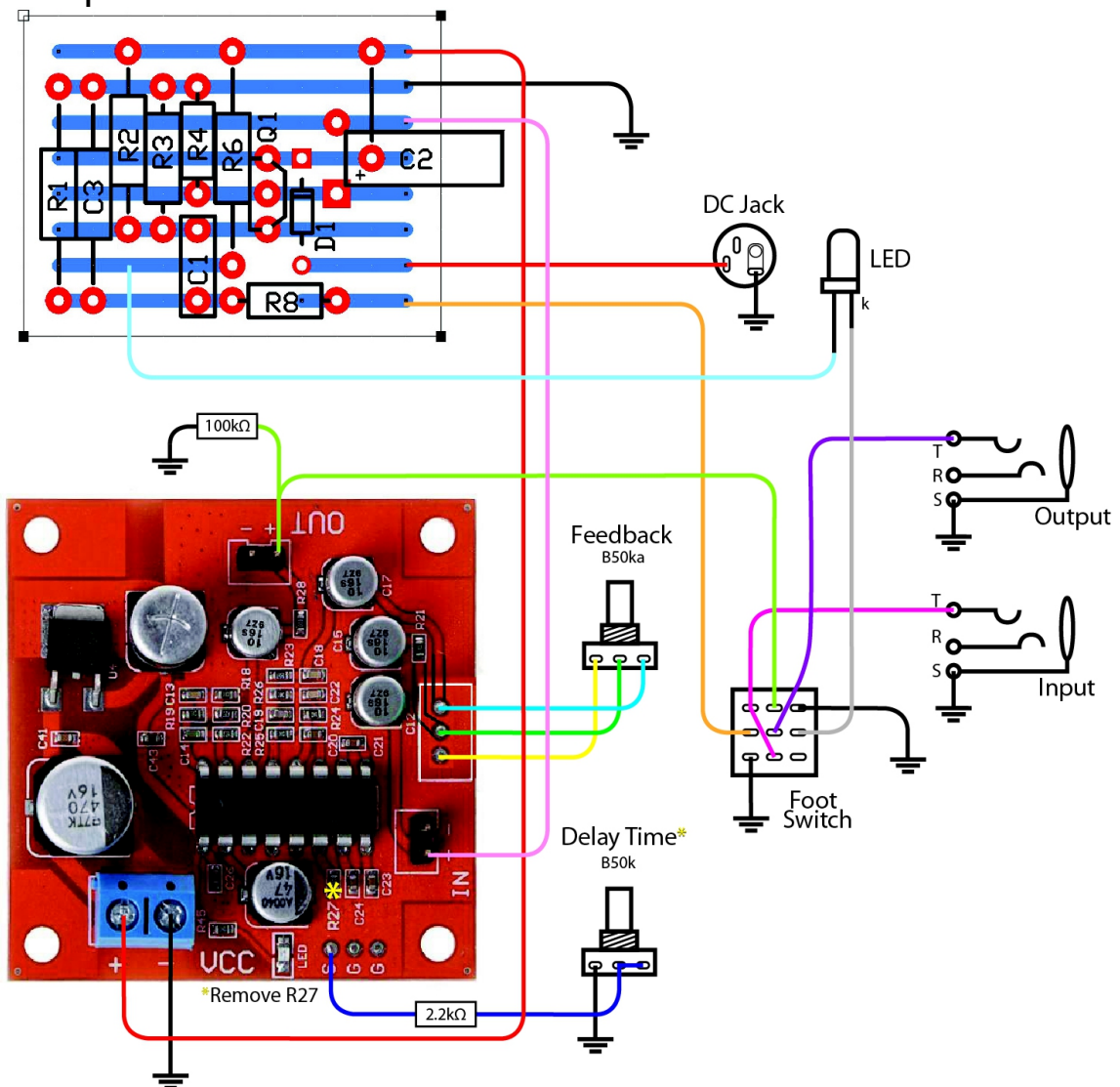
The buffer was made on a small piece of stripboard.

V+ (to module)
Earth
Output

LED

R2 R3 R4 R6 Q1

R1 C3

C2
+

C1

D1

R8

Batt+/DC Jack
Input
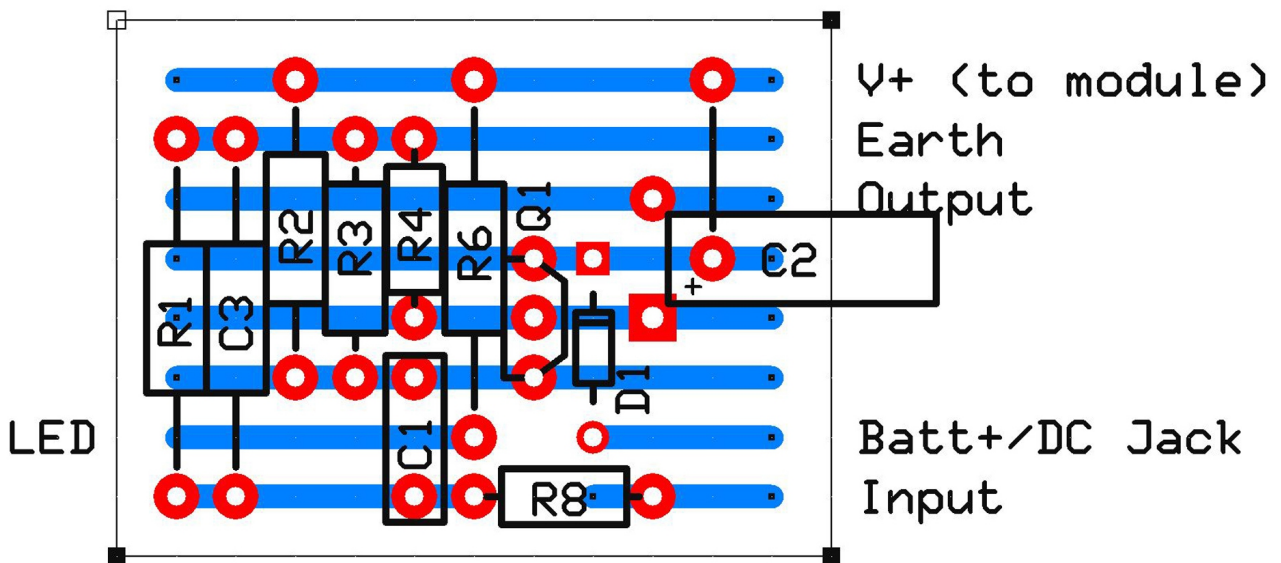
It was encased in heatshrink, and installed with double-sided tape to the underside of the top of the enclosure between the pots and the jacks. The module is placed over it. For this reason, the output coupling cap (C2) was placed on its side.

Here's the wiring diagram. The 100k resistor (R5) was mounted on the stomp switch.

DC Jack

LED

100kΩ

OUT

Feedback
B50ka

T
R
S
Output

T
R
S
Input

Foot
Switch

Delay Time*
B50k

*Remove R27

2.2kΩ

VCC

The enclosure was finished with self-priming white, followed by a water slide decal, and finished in 3 coats of satin clear coat. The artwork was recoloured and adapted from a scanned coffee cup.

Rob mods. May, 2021.