Tremulus Lune: Build Document

Carcharias Effects
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1. About This Circuit

The Commonsound Tremulus Lune is one of the coolest, simplest, most easily modifiable optical tremolo circuits around, which was precisely the reason why I attacked this project early on in my DIY pedal-building game. It's easy to build, easy to modify, has a low parts count, and has a very easy-to-debug schematic full of all kinds of features. I am really the kind of musician that likes having many features and a wide range of options to choose from, enabling me to modify my sound for one style or instrument, and using the same piece of hardware for something completely different. So the Tremulus was perfect for me.

At its core, the Tremulus Lune is basically two modules interacting to produce a single effect. The first module is a simple input and output buffer centered around the TL072 dual op-amp, with a light-dependent resistor (LDR) stuck in between them. The second module is a low-frequency oscillator (LFO) that controls how light is emitted from an LED. The LED lights up at the speed, depth, and waveform governed by the oscillating voltage of the LFO, which interacts with the LDR in the buffer module, thereby proportionally controlling the amount of signal being let through or resisted by the LDR from the input buffer to the output buffer. Thus, the relationship between the oscillating LED and the LDR used to modulate the volume envelope of the input signal is what makes this an **optical** tremolo.

Tremolo parameters are really fun to tweak, and in my opinion deserve the freedom that knobs allow for continuous modification. Speed and Depth are an obvious must for any tremolo. Symmetry and Smoothness I believe are also necessary, because they allow you to shape the tremolo volume envelope to anything from a sine, square, triangle, and sawtooth waveforms. Spacing gives you extra control over the pulsewidth, which if that's your thing, gives you an extra dimension of musicality from the circuit itself (letting you cross over into a sort of analog granular synthesis territory). Finally, a Gain control is crucial, as tremolo circuits by nature typically create the **perception** of outputting signal volume that is lower than unity—while this is not entirely true, a little extra gain helps compensate for this perception and is particularly useful when tweaking all of the other parameters.

This version of the Tremulus Lune was based on Commonsounds revision v2.4.1 of their schematic. For more history and information about the original Tremulus Lune, check out the Commonsound website. They also include information about mods and tweaks that you can use to modify this circuit.

2. Controls

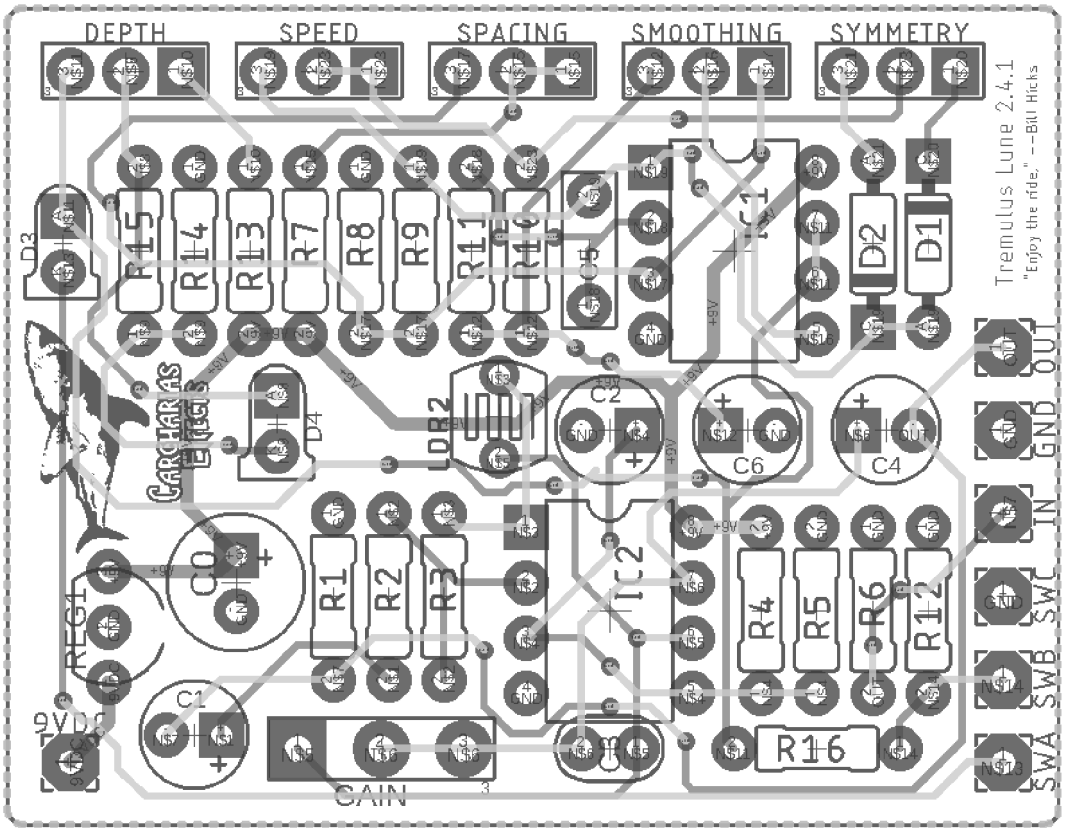
The following are the standard external controls for this pedal:

- **Speed** — Controls the speed of the LFO. At 100% CCW, the LFO module will oscillate slowly; at 100% CW, the module will oscillate quickly.

- **Depth** — This controls the depth of the LFO, or the difference between the peak (loud) and valley (quiet) parts of the oscillating waveform. At 100% CCW, there will be barely any difference between the peak and valley. At 100% CW, the difference between the two will be at its maximum.
- **Smoothing** — This controls how smoothly the LFO transitions between the peaks and valleys. At 100% smoothness, the transition is longer, creating a waveform that is more sinusoidal; at 0% smoothness, the transition is quicker and therefore the waveform resembles a square wave.
- **Symmetry** — This controls the symmetry of the rises and falls of the LFO, varying from inverse sawtooth (quick rise, slow fall), to triangular (equivalent rise and fall), to sawtooth (slow rise, quick fall).
- **Spacing** — Also known as pulse width, this controls the amount of time in between the LFO “pulses”. Less spacing will create smoother oscillations. More spacing creates choppier oscillations. Naturally, this is highly interactive with the Speed control.
- **Gain** — In order to deal with perceived loss of volume common to tremolo circuits (especially when the Depth is at 100% CW), the Gain controls the output volume of the circuit.

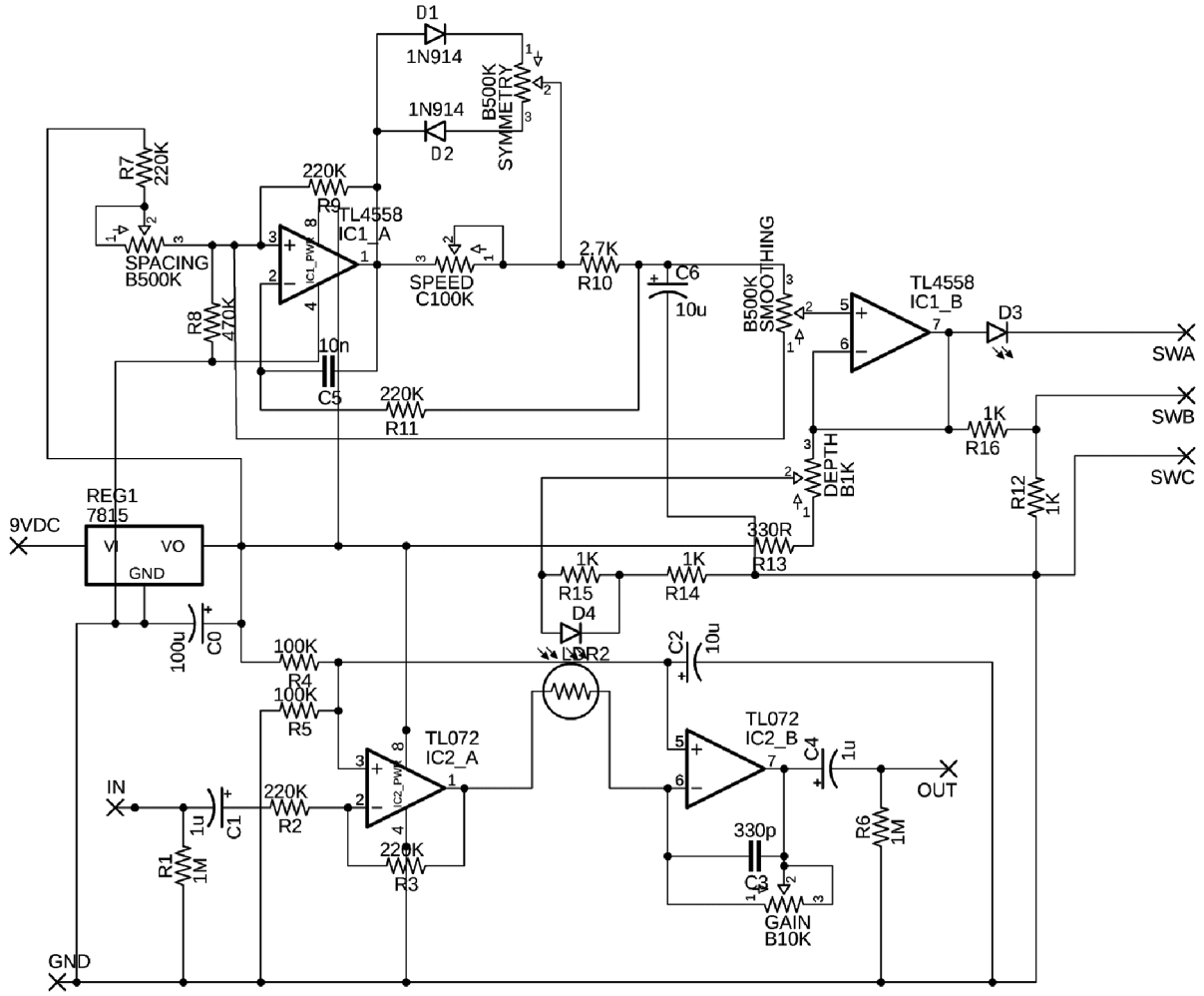
3. Circuit Board

The following is a screen capture of the printed circuit board (PCB):



4. Schematic

The following is a screen capture of this circuit's schematic, which can be used for reference when debugging:



5. Bill of Materials

You will need the following components to complete your build:

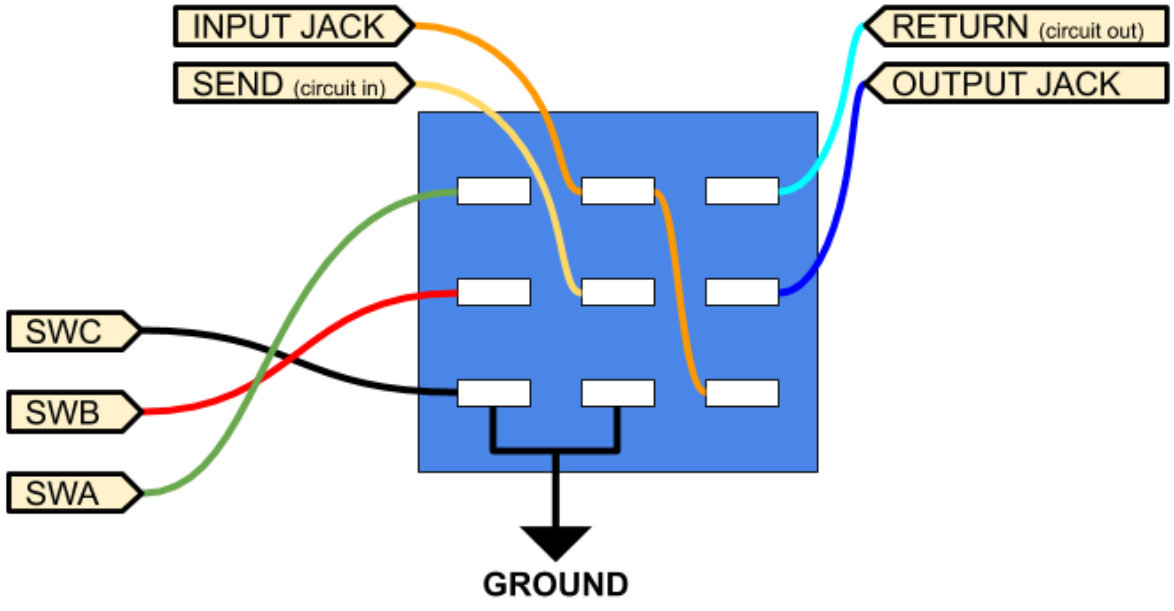
Qty	Value	Parts	Description
1	330p	C3	Capacitor - Ceramic
1	100u	C0	Capacitor - Electrolytic
2	1u	C1, C4	Capacitor - Electrolytic
2	10u	C2, C6	Capacitor - Electrolytic
1	10n	C5	Capacitor - Mylar
2	1N914	D1, D2	Diode
2	LED3MM	D3, D4	LED - Blue 3mm
1	LDR	LDR	Light Dependent Resistor

1	TL4558	IC1	Op Amp
1	TL072	IC2	Op Amp
1	78L09	REG1	Positive Voltage Regulator
1	B1K	DEPTH	Potentiometer
1	B10K	GAIN	Potentiometer
3	B500K	SMOOTHING, SPACING, SYMMETRY	Potentiometer
1	C100K	SPEED	Potentiometer
2	1M	R1, R6	Resistor
1	2.7K	R10	Resistor
4	1K	R12, R14, R15, R16	Resistor
1	330R	R13	Resistor
5	220K	R2, R3, R7, R9, R11	Resistor
2	100K	R4, R5	Resistor
1	470K	R8	Resistor

6. Build Notes

The following are a collection of notes, comments, and tips about this circuit.

- If you're using 78L09 voltage regulators in the T092 package, you may need to reverse the component orientation from how it appears on the PCB.
- Blue 3mm LEDs work great as the LFO LED.
- It is hard to read the labeled pads for the potentiometers. The square pad should be attached to pin 1 of each potentiometer.
- **Switch wiring:** If you're into using true bypass wiring like I am, and are using a 3PDT bypass switch, here's how I suggest wiring it:



- **Simplifying the controls** — Let's say that you want to externalize only a few of the Tremulus Lune's controls. There are plenty of options for that. Here's what I would suggest if you were going for a simple, sine-wave tremolo where the only external controls are **Depth, Rate,** and **Gain**:
    - Solder a 470K resistor between lugs 1 and 2 of the **Spacing** pads, jumper pads 2 and 3, and omit the potentiometer altogether. This minimizes the spacing between the oscillations.
    - Similarly to the Spacing control, solder a 470K resistor between lugs 1 and 2 of the **Smoothing** pads, jumper pads 2 and 3, and omit the potentiometer altogether. This gives you a fully smooth waveform; reversing this orientation will give you a fully square waveform.
    - Omit the **Symmetry** control. Do not jumper any of the pads.

Terms of Use

The printed circuit board (PCB) discussed herein may be used for DIY purposes, such as personal builds or small commercial operations. This PCB may not be resold as part of a commercial kit. Resale from peer to peer is approved.

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Change Log

- **Rev1 (June 19, 2019):** First draft of this document, includes all standard features.
- **Rev2 (August 19, 2020):** Made some additions for simplifying the controls. This document corresponds to **PCB rev1.0**.

Contact

If you encounter any problems or issues with the PCB, or have any questions or comments, feel free to reach out to me anytime. I will try my best to be as responsive as possible. Here are the best ways to reach me:

- Instagram/Facebook (DM): **Carcharias.Effects**
- Email: carcharias.effects@gmail.com
- Web: www.carchariaseffects.com/contact

I **love** seeing pictures of other peoples' builds, so feel free to tag me (**carcharias.effects**) on Instagram or Facebook.

Best of luck and happy building!