Triplicator

Stereo Triple Tracker with Effects Loops

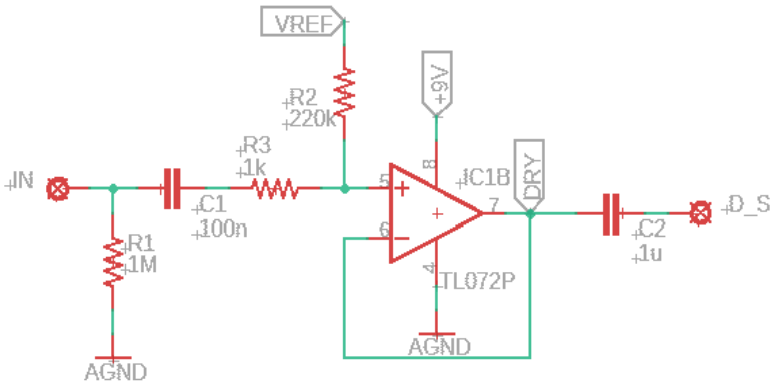
Overview

In every band I've played in, I was the only guitarist. It can sometimes be challenging to get a nice, full soundscape when you've only got one guitar, which has led to the proliferation of double trackers. Some of the more advanced ones have multiple voices, as well. However, I decided I wanted to do a triple tracker that allowed panning of the signals in stereo as well as having effects loops for the voices. This naturally led me to want an effects loop and panning controls for the “dry” signal as well. Letting all these ideas stew in my brain led me to come up with the Triplicator.

How it Works

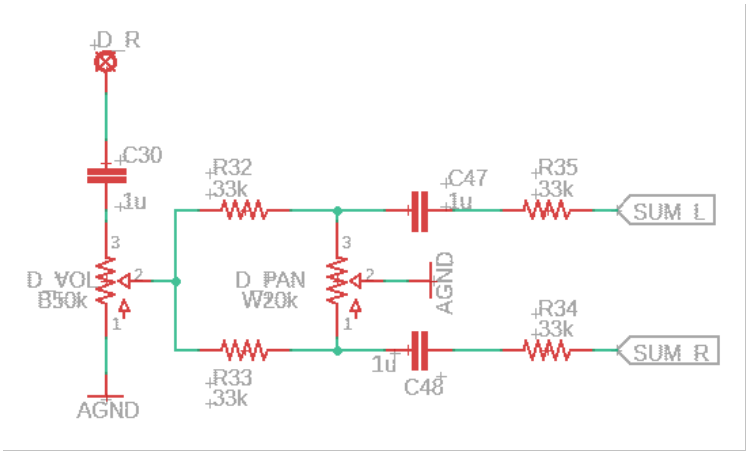
The Triplicator consists of a single effects loop with level and pan controls in parallel with what are essentially two of my Stalker circuits with added effects loops and panning. The circuit is large, but not overly complex.

The first stage of the Triplicator is an input buffer/splitter. This is a non-inverting opamp stage. The signal “Dry” goes to the input to each of the delay stages while the D_S solder pad is the effects loop send pad for the dry/direct signal.



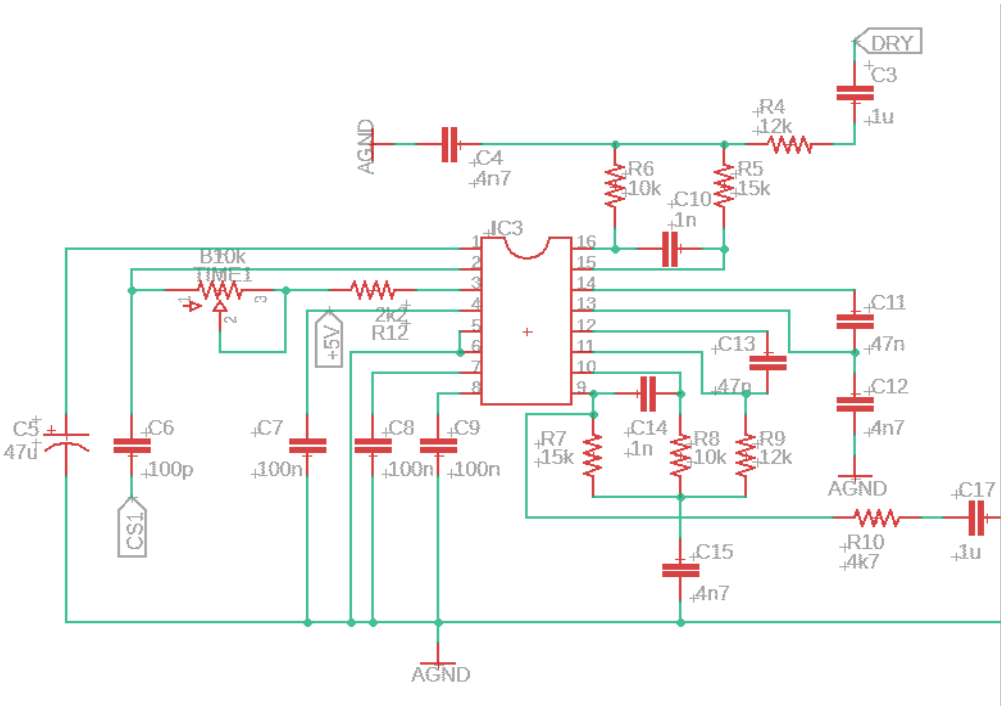
Triplicator Input Stage

The return from the effects loop goes through the volume control first, followed by the panning control. This control topology comes from R.G. Keen's "Panning for Fun" article. I changed resistor values so that I could use a W20k potentiometer, as I found a linear potentiometer bunched the panning effect at the two extremes quite a lot. A W taper pot is designed specifically to deal with that and it makes the control much more responsive. You can use a B taper in a pinch, but I highly recommend the W taper. They are available at Tayda, StompBoxParts.com, and other places. The output from the pan control goes to the inputs of the left and right summing amplifiers (more on those later).



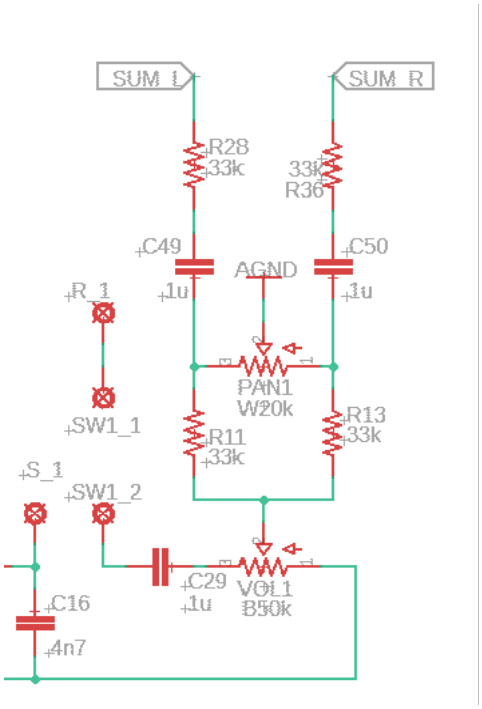
Triplicator Direct Signal Volume and Pan Controls

Each delay stage is identical and is based around the ES56033. The circuit could be designed around the more commonly available PT2399, but the ES56033 was chosen because it has a minimum delay time of 14 ms as opposed to the 28 ms of the PT2399. The setup of this stage is essentially a copy/paste of the Stalker. I may have tweaked the values of a couple resistors or capacitors to slightly change the corner frequencies of the multi-feedback low pass filters on both input and output of the chip, but the architecture is the same.



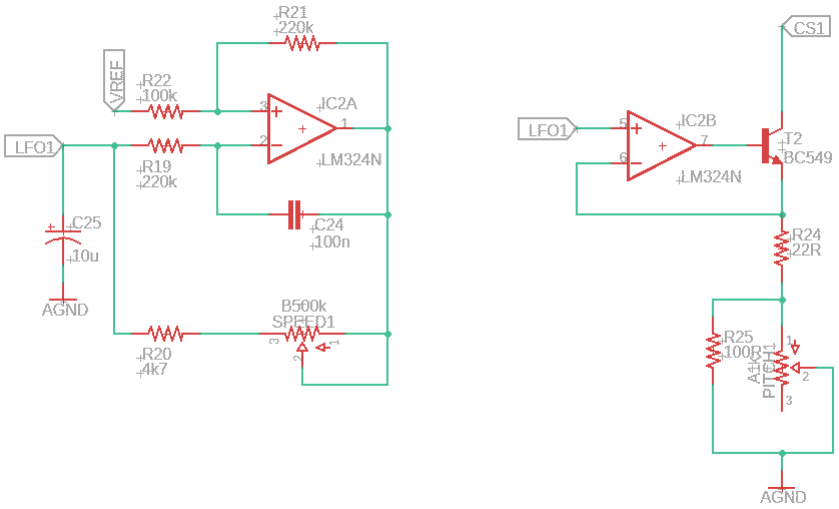
Triplicator Delay Stage

The output of the delay stage is then sent to it's effects loop out. Because there is no feedback control, the output opamp stage of the ES56033 serves to buffer the signal to the loop. The return of the loop then goes to pads for the footswitch that controls whether the delayed signal is summed into the output signal or not. I actually have solder pads that will ground each stage's effects loop return to disable that voice, if desired. The volume and pan controls are identical to that of the dry/direct signal and they sum into the output signal in the same way.



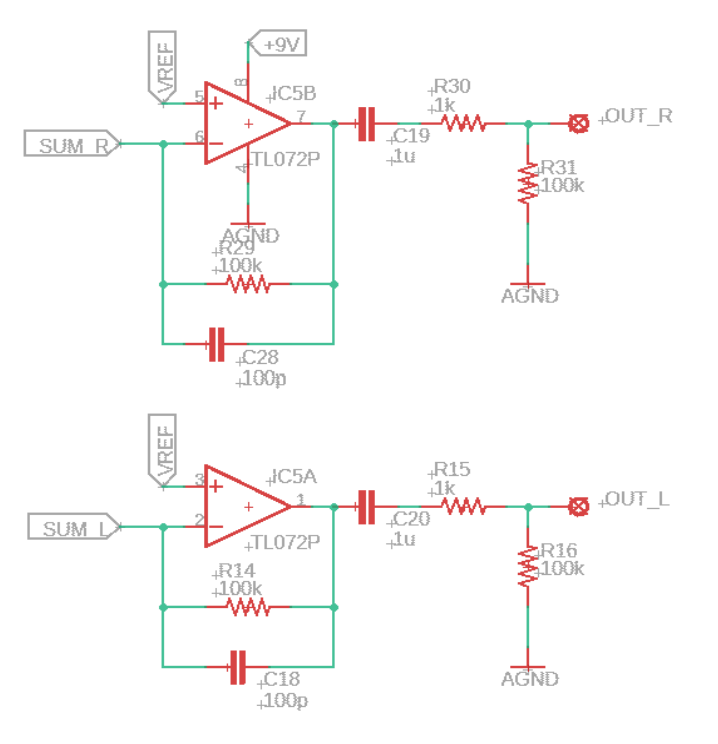
Triplicator Delay FX Loop, Volume, and Pan Controls

Each delay stage also has modulation. The topology is that of a relaxation-mode LFO feeding a current sink to modulate the ES56033's delay time. Because of the internal VCO compensation of the ES56033, a current sink must be used instead of directly varying the voltage on the F_adj pins. Note that we don't have to change the current being sinked by the VCO very much, as evident by looking at the resistor values in the Pitch control section. These values won't give wild oscillation; they are intended just to give some slight modulation to the pitch to further help with the double tracking effect by slightly detuning each voice. The speed is set by a trim potentiometer, as I didn't have space for more pots, and because it's meant to be very subtle, I set one to be very slow and one to be less slow, but not fast. This results in a more gradual detuning effect with longer time before the LFO voltage changes slope.



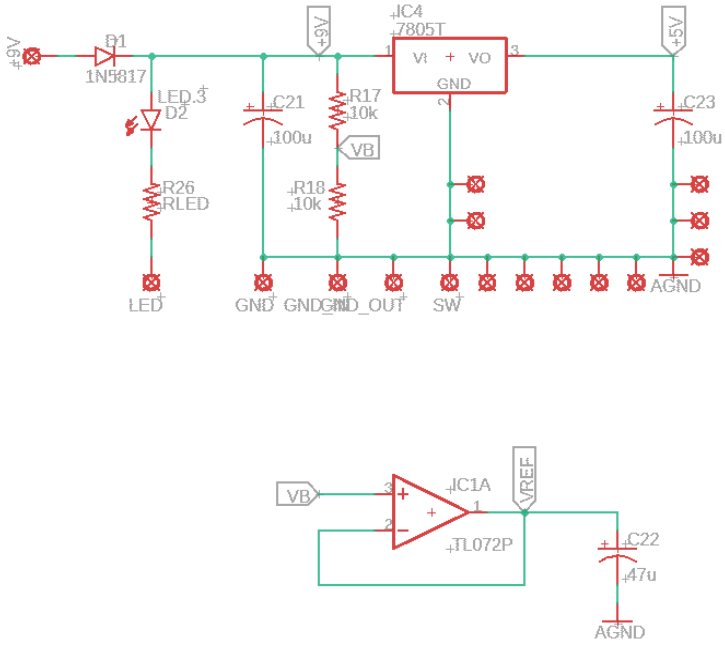
Triplicator LFO and Pitch Control

The outputs from each of the loop/volume/pan circuits are then summed into the stereo outs using a bog-standard inverting summing amplifier. These have some added gain to make up for the signal loss in the pan controls so that the panning doesn't cause weird volume increases or drops throughout its sweep.



Triplicator Output Summing Amplifiers

The power section is the last part of the circuit. It's pretty basic with a 5V regulator for the ES56033 chips and a buffered Vref to utilize the last opamp stage and to provide a stable reference voltage. The plethora of ground pads are for the normal connections as well as the plethora of jacks for the effects loops. Note that, due to the current draw of the ES56033 chips, a TO-220 package LM7805 regulator should be used rather than the TO-92 sized 78L05 for heat dissipation purposes.



Triplicator Power Section

BOM

The BOM below is the list of parts I used for mine along with quantities. All parts are through hole with resistors being 1/4W. I got everything from Tayda with the exception of the ES56033 chips, which I order from Aliexpress (I've ordered from several vendors with good luck).

Part	Qty.	Notes
22R Resistor	2	
100R Resistor	2	
1k Resistor	3	
2k2 Resistor	2	
4k7 Resistor	4	
10k Resistor	6	
12k Resistor	4	
15k Resistor	4	
33k Resistor	12	
100k Resistor	6	
220k Resistor	5	
1M Resistor	1	
Current Limiting Resistor	3	
100pF Capacitor	4	
1nF Capacitor	4	
4.7nF Capacitor	8	
47nF Capacitor	4	
100nF Capacitor	9	
1uF Ceramic/Film Capacitor	16	
10uF Electrolytic Capacitor	2	
47uF Electrolytic Capacitor	3	
100uF Electrolytic Capacitor	2	
A1k Potentiometer	2	16mm PCB Mount
B10k Potentiometer	2	16mm PCB Mount
B50k Potentiometer	3	16mm PCB Mount
W20k Potentiometer	3	16mm PCB Mount
500k Trimmer	2	
1N5817	1	

LED	3	Bypass indicator
BC549	2	
ES56033E	2	
TL072	2	
LM324	1	
LM7805	1	5V regulator
Enclosure	1	
1/4” input jack	8	Switched Box Style, 1 Stereo
DC power jack	1	
4PDT footswitch	1	
DPDT footswitch	2	

Schematic

The schematic for this project is a way too big to be legible on a single sheet, so it is included as a separate image in the project documentation folder.

Build Notes

Here are some things I noted from building the Rubber Ducky that might be helpful to you. Please read this section to make sure you don't go through excessive frustration.

Enclosure Size/Drilling

The Triplicator fits in a 1590X-sized enclosure (at minimum!). It's a big circuit with lots of controls, switches, and jacks. **Careful drilling is a must!** The 8 jacks along the top will *just* fit, but there is literally zero room for error. I drilled the holes for my jacks a little oversized so that I could get them to all fit in there. It really is a very tight fit, but possible.

The power jack should either get installed underneath the jacks and between two pots, or on one of the sides. The fit under the jacks and between the Time2 and Vol1 controls is ideal and works well, but you need to use a low profile power jack.

Drilling for foot switches needs to be done with care! I drilled my footswitch holes too close to the sides so I couldn't install a 4PDT switch for the bypass and had to do a compact/low profile DPDT with a relay board.

The actual board and pots have some side to side wiggle room, but not too much. I drilled mine off-center by about 2 mm and it still fit fine.

Jacks

Because of the number of jacks, these need to be no bigger than the box-style jacks. Open frame and Marshall style jacks are a complete no-go in a 1590X. With the box jacks, they will fit in, but they will take a tiny bit of convincing.

Effects Loop Auto Bypass

I used mono switched box jacks, which allowed me to connect the switch of the send jack to tip of the return jack so that, in the case that an effects loop is disconnected, you can still use the voice without manually patching the jacks.

Effects Loop Enable/Disable

It's possible to install extra footswitches for turning the effects loops on/off, but that would require a significantly larger enclosure. All you would do is use a DPDT (at minimum) for true bypass switching and use the send and return pads as the “input” and “output” of your switches.

In Closing

I'm not going to lie, the Triplicator is a bit of a beast to build, with the jack wiring alone taking quite a while. However, it's a really fun effect and totally worth it if you want some double tracking with each voice having its own effects. Give it a shot!