Daredevil
Through-Zero Flanger

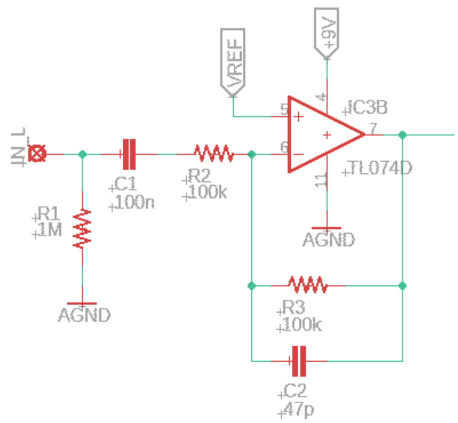
Overview

Flangers are a modulation effect that are rightly regarded as complex due to the very short delay times necessary and the components typically involved. Through-zero flangers are even more complex, because they require two delay lines with very short delay times. One delay stage has a static delay time while the other has a modulated delay time where at least part of that modulated delay time is greater than and part is shorter than the first delay stage's time. This creates a very intense effect where, when the modulated delay time “crosses zero”, or the same delay time as the first stage, the effect becomes inaudible, only to become audible again on the other “side”.

The Daredevil is the result of a request from someone on social media, as I wouldn't have considered doing it otherwise. However, being lacking in judgment as I am, I decided to give it a go. It uses two ES56028 chips, which I also used in the Alternate Dimension chorus. This chip allows for short delay times. One advantage of the through-zero concept is that a slightly longer minimum delay time is acceptable since the flanging stage only has to have a short delay time relative to the other stage.

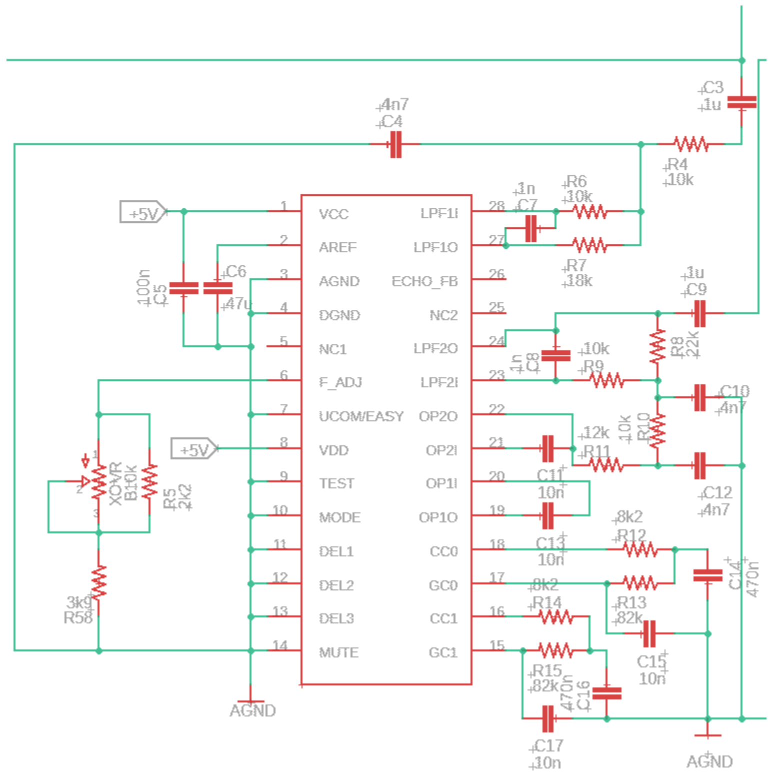
How it Works

At this point, it shouldn't be much of a surprise to see this input buffer. This is the same input buffer that many of my circuits use. It works well, so let's keep on using it. Note that below only shows the left side input buffer, but there is an identical one for the right side for use in stereo in/out configuration.



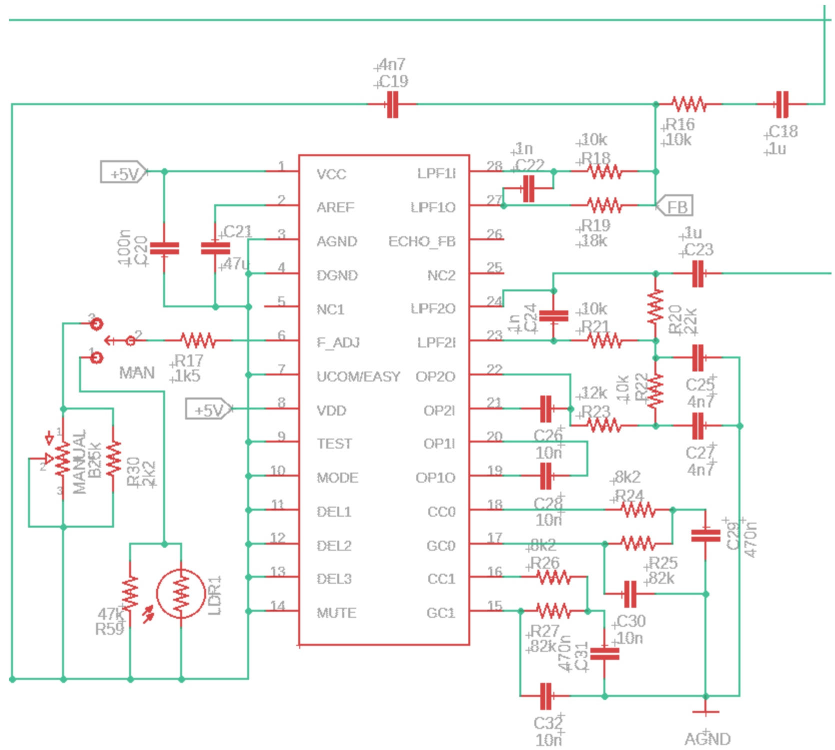
Daredevil Input Buffer

After the input buffer, we have two parallel delay stages. The signal from the input buffer is fed into each delay stage, but there is no dry signal out directly from the input buffer. This is because the “dry” signal is actually the signal that has been slightly delayed by the first “fixed” delay stage. You will notice the first delay stage has the typical multifeedback lowpass input and output filters as well as the necessary components for setting delay times and the like. However, one thing to note about this first delay stage is that the F_ADJ pin, which sets the delay time, has a potentiometer called XOVR. This potentiometer controls the delay time for the first stage, which in effect controls the “crossover” point of the through-zero flanging of the second stage. Changing this time changes where in the second stage's sweep that the zero happens. This can impact the effect in subtle but meaningful ways.



Daredevil Delay Stage 1

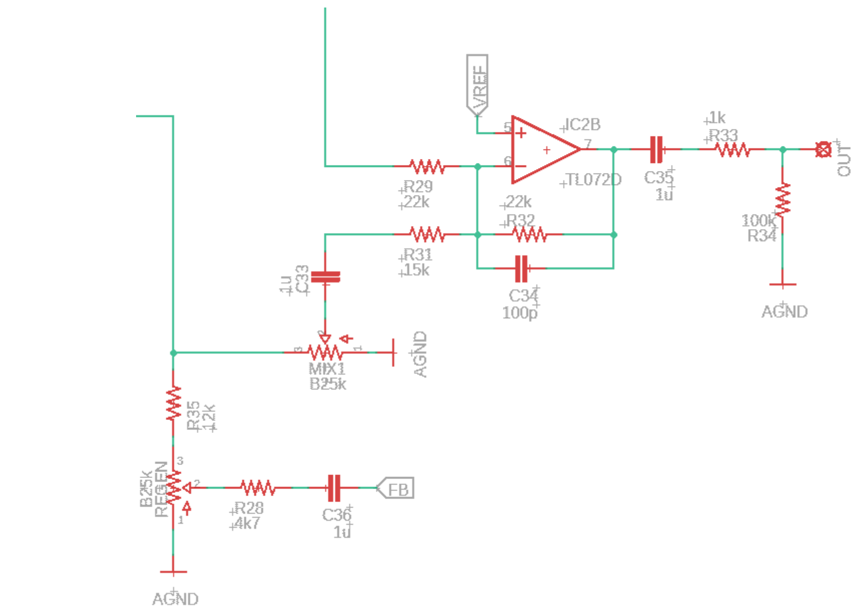
The second delay stage is set up very similarly to the first delay stage, but with two notable differences to the F_ADJ pin. First, there is a switch that switches between a potentiometer and a resistor paralleled by an LDR. When the switch is set to the potentiometer, this results in a static comb filter effect similar to the “Manual” or “Matrix” modes of other flangers. With the switch set to the resistor/LDR combo, the delay time is adjusted by the LDR which is coupled to an LED driven by the LFO, shown later. After significant experimentation I found that directly applying the LFO to the F_ADJ pin via resistor to result in too much noise. Using the LDR driven by and LED, the noise was reduced significantly.



Daredevil Delay Stage 2

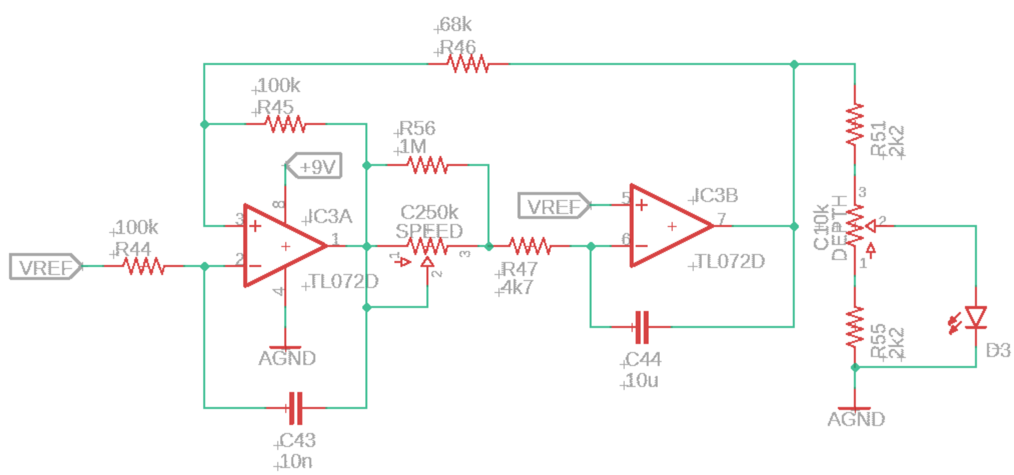
The signal path is completed by having controls for Regeneration (feedback) and Mix. Most flangers have a regeneration control, which feeds a very small amount of signal back in to the input to the flanging stage, which can result in a very intense effect. Most flangers do not, however, have mix controls. I decided to add one so that the effect can be set very extreme, but with a low mix for more variety.

The output buffer/summing amplifier is very much like that used on other projects.



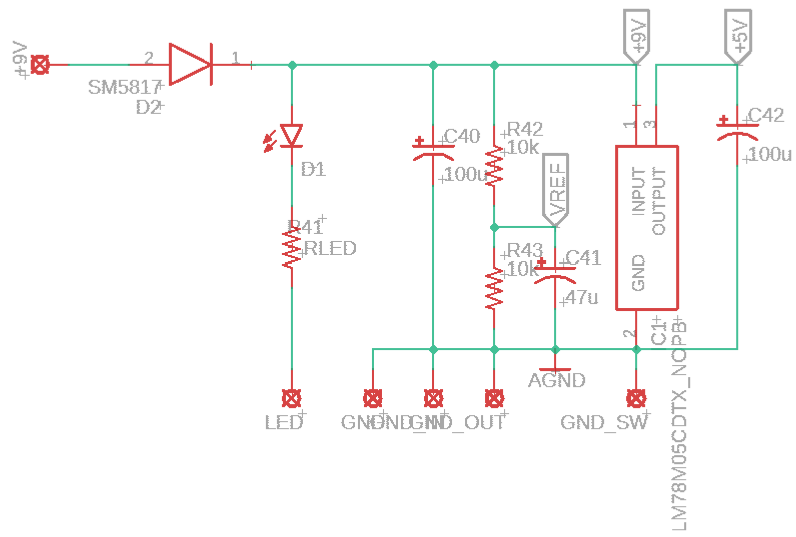
Daredevil Regeneration, Mix, and Output

Next is the LFO, which results in the modulation of the delayed signal. The LFO here is actually an almost direct copy from the MXR 117 flanger, a well-known analog flanger. The shape of this LFO is fairly unique. I actually auditioned several different LFO topologies and shapes and decided that this one was the best combination of simplicity and utility. The challenge with very slow LFO's is that the shape becomes much more noticeable. On a fast LFO, deviations from a certain shape aren't as noticeable due to the rapid change through the amplitude. The LFO drives an LED that is coupled to the LDR in second delay stage.



Daredevil LFO

The power section is pretty straightforward. The +9V and VREF (4.5V) power sources are for the input and output buffers and LFO, while the +5V is for the ES56028.



Daredevil Power Section

BOM

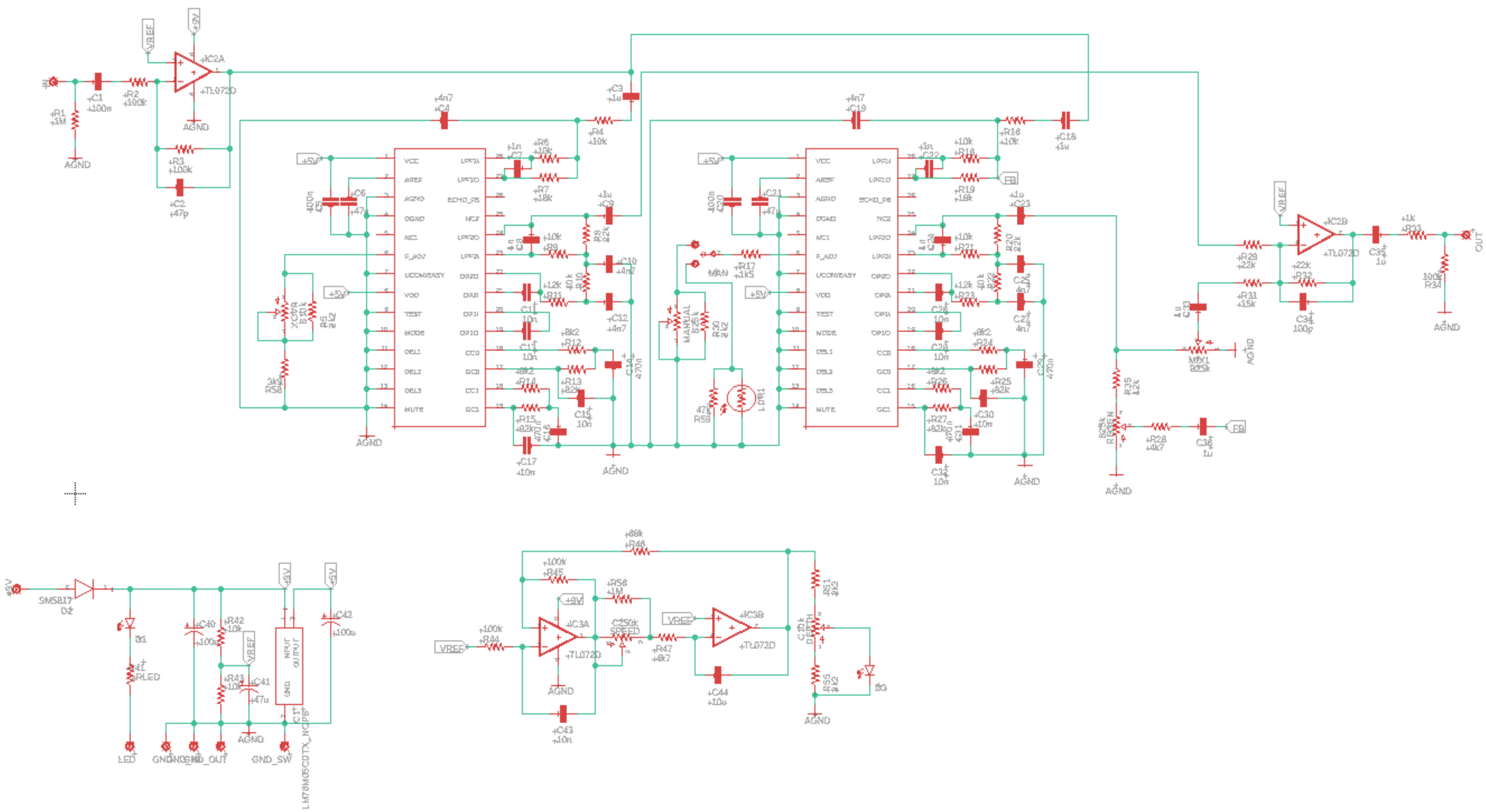
The BOM below is the list of parts I used for mine along with quantities. Note that, apart from electrolytic capacitors, all other parts are surface mount with caps and resistors sized at 0805. This was done to keep the board size easy to fit in a 125B. The ES56028S is readily found from UTSource online, where they are reasonably priced. Since they are still used by current production Boss units, I don't imagine they will go EOL for a while.

Part	Qty.	Notes
1k Resistor	1	
1k5 Resistor	1	
2k2 Resistor	4	
3k9 Resistor	1	
4k7 Resistor	2	
8k2 Resistor	4	
10k Resistor	10	
12k Resistor	3	
15k Resistor	1	
18k Resistor	2	
22k Resistor	4	

47k Resistor	1	
68k Resistor	1	
82k Resistor	4	
100k Resistor	5	
1M Resistor	2	
RLED	1	CLR for LED
KE10720 LDR	1	
47pF Capacitor	1	
100pF Capacitor	1	
1nF Capacitor	4	
4.7nF Capacitor	6	
10nF Capacitor	9	
100nF Capacitor	3	
470nF Capacitor	4	
1uF Ceramic Capacitor	7	
10uF Ceramic Capacitor	1	
47uF Ceramic Capacitor	2	
47uF Electrolytic Capacitor	1	
100uF Electrolytic Capacitor	2	
B10k Potentiometer	1	16mm PCB Mount
B25k Potentiometer	3	16mm PCB Mount
C10k Potentiometer	1	16mm PCB Mount
C250k Potentiometer	1	16mm PCB Mount
B5817	1	Voltage polarity protection
SPDT Toggle Switch	1	Manual Mode Switch
LED	2	
LM78M05	1	
TL072	2	
ES56028S	2	28 Pin SOIC
Enclosure	1	
1/4” input jack	2	
DC power jack	1	
3PDT footswitch	1	

Schematic

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



Daredevil Full Schematic

Build Notes

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

Enclosure Size/Drilling

TheDaredevil fits nicely into a 125B. The board is a little too wide to fit a 1590B. I also noticed some pots seem to extend slightly more from the mounting holes than the ones I used in my board layout and require just a little finagling to get into the holes that I had laid out in my artwork.

Jacks

Whatever jacks you use for in/out and power in 125B are fair game; no restrictions here.

In Closing

This is a large, fun project. Hopefully you enjoy it!