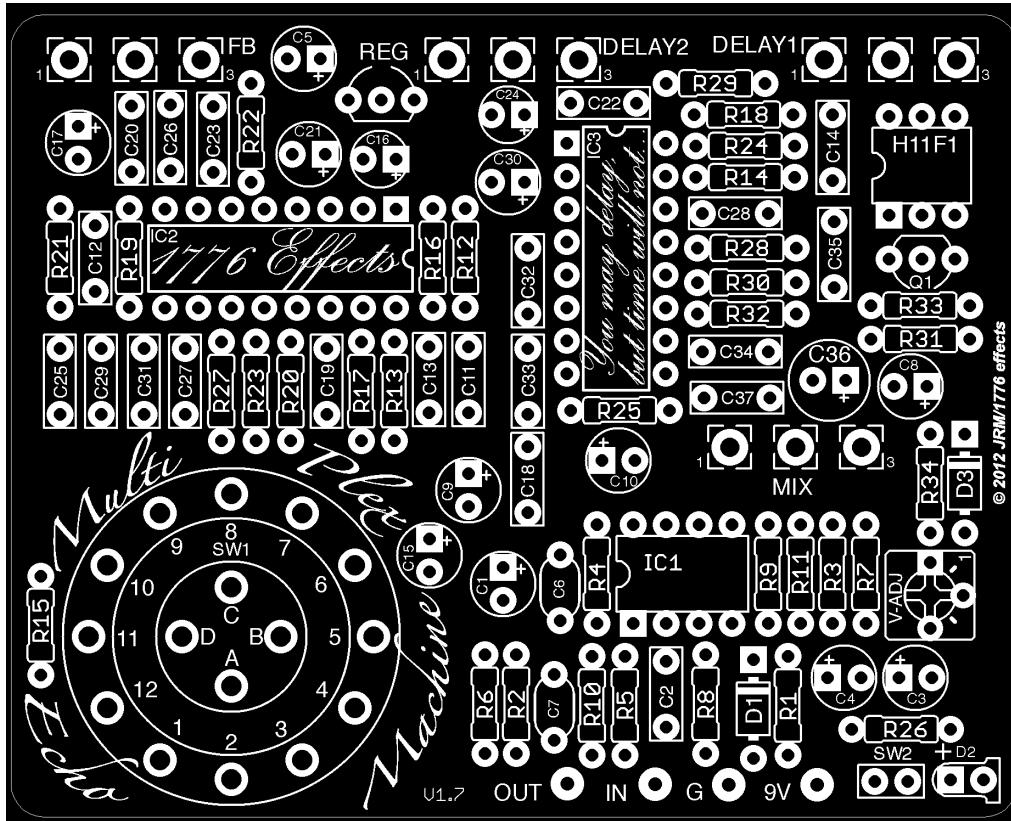


MULTIPLY ECHO MACHINE



The Multiplex Echo Machine is based on tape delays of the past. It has selectable “modes” that recreate a good approximation of the delay’s they emulate. It also includes a control for on the fly tape speed manipulation, allowing the repeats to speed up or slow down while pressing and releasing the footswitch.

WHAT TO EXPECT...

This is not a pristine digital delay, some noise will be experienced. Even tape delays have noise, it just adds to the character...

CONTROLS

Delay 1: Sets IC3's delay time

Delay 2: Sets IC2's delay time

Feedback: Repeats..

Mix: Adjusts the dry/wet blend

Tape Mode (SW1): Changes the way the signal is routed through the PT2399's to simulate tape delays of the past.

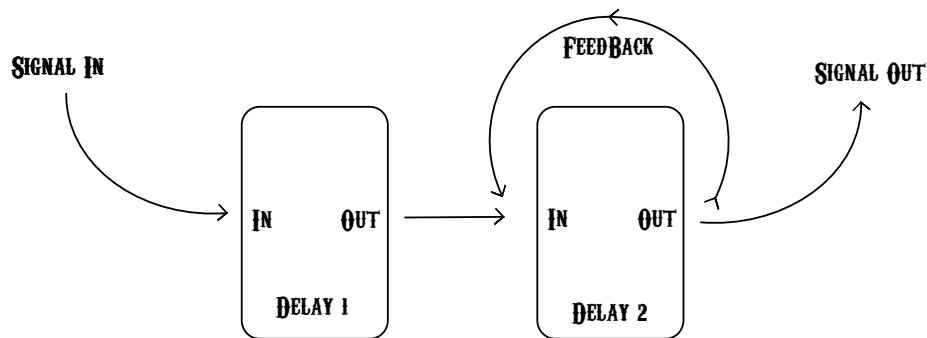
Tape Speed: Holding down the SPST momentary footswitch slowly speeds up the delay speed. Releasing it slows the speed back down to your time setting. It's highly interactive depending on how you have Delay 2 set.

TAPE MODES

BINSON MODE :

This simulates just one of the many cool things about the Binson Echorec. You can get one long repeat and then subsequent repeats of that note are repeated faster.

1776 TIP: For ultra LoFi fun set both delay pots to max delay time with the feedback set at one repeat. While playing hold and release the tape speed switch. This will create a detuned looping type chaos!

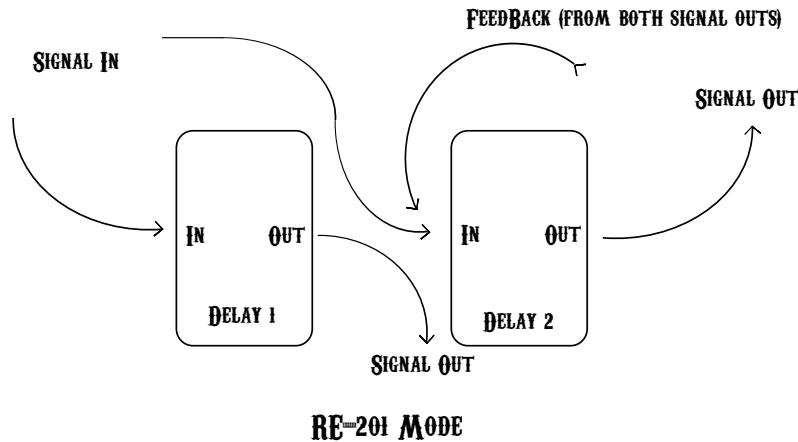


BINSON MODE

RE-201 MODE :

This simulates the dual rhythmic repeats of an RE-201 Space Echo. To best utilize this mode, Delay 1's time should be shorter than Delay 2's time. Once you get the hang of it you can find the rhythmic sweet spots pretty quick.

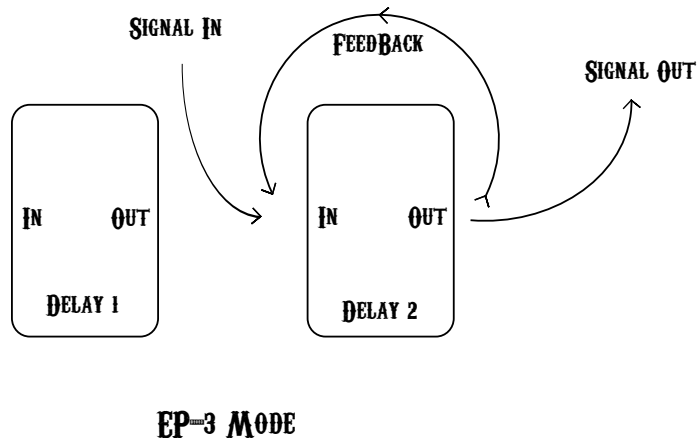
1776 TIP: For wacky repeats set Delay 2 shorter than Delay 1. Reversing the roles results in an unsynced delay sure to make kids cry...



EP-3 MODE :

This simulates the classic Echoplex. Nothing crazy, just a normal delay setup using only one of the PT2399's. Delay 2's pot sets the time. Delay 1 is nonfunctional.

1776 TIP: With a medium delay time hold the tape speed switch until the LED is fully lit. Play and then release the footswitch for a "dive bomb" type effect. Then quickly step on the switch again for more musical detune action.



MULTIPLEX PARTS LIST

Resistors		R28	20k	C21	47uF	Transistor	
R1	33R	R29	2k7	C22	1n	Q1	2N3904
R2	1k	R30	10k	C23	100n	IC's	
R3	10k	R31*	2M2**	C24	10uF Tant	IC1	TL072
R4	22k	R32	10k	C25	47n	IC2	PT2399
R5	100k	R33*	47k**	C26	100n	IC3	PT2399
R6	1M	R34	10k	C27	100n	Switches	
R7	10k	Capacitors		C28	1n	SW1	4P3T
R8	1M	C1	1 uF	C29	47n	Rotary	
R9	12k	C2	22n	C30	47uF	SW2	SPST
R10	200k	C3	47uF	C31	100n	<i>Momentary Footswitch</i>	
R11	20k	C4	100uF	C32	100n	Regulator	
R12	10k	C5	47uF	C33	100n	REG	78L05
R13	10k	C6	100pF	C34	100n	Misc	
R14	10k	C7	47pF	C35	47n	H11F1	H11F1
R15	22k	C8	1 uF	C36	100uF	<i>This is provided!</i>	
R16	5k1	C9	1 uF	C37	100n		
R17	10k	C10	1 uF	Diodes			
R18	10k	C11	4n7	D1	1n4001		
R19	1k	C12	22n	D2	LED		
R20	20k	C13	1n	D3	1n4001		
R21	2k	C14	4n7	Potentiometers			
R22	2k7	C15	1 uF	DELAY1	50kB		
R23	10k	C16	10uF Tant	DELAY2	50kB		
R24	10k	C17	1 uF	FB	50kB		
R25	1k	C18	10n	MIX	50kB		
R26	1k	C19	1n	Trimmer			
R27	10k	C20	10n	V-ADJ	2k		

*socketing recommended for experimentation!

**** USE 1M for R31 and 33k for R33 with black H11F1**

PARTS NOTES :

- All resistors are standard 1/4 watt.
- Caps - Electrolytic's should be 5 mm Dia. x 11 mm or smaller, 100uF's no bigger than 6.3 mm Dia. x 11 mm L in order to fit in a 1590BB. For C16 and C24 tantalum caps are recommended but not necessary.
- D2 is for the Tape Speed indicator LED
- V-ADJ is a 2k trimpot. The size is based off the Bourns 3362 series
 - Mouser P/N 652-3362R-1-202LF
 - Tayda SKU: A-607
- SW1 is a rotary 4P3T switch - Alpha SR2612F-0403-18ROB-D8-N
 - Small Bear SKU:0227
 - Mouser P/N 105-SR2612F-43-21RN
 - The shaft is slightly longer but it can be easily trimmed since it is plastic.
- SW2 is a SPST momentary (normally open) footswitch
 - Small Bear SKU:0206A
 - Mammoth P/N: 4SFSSPST-M 43
 - Tayda SKU: A-1091
- Potentiometers are standard length 16mm PCB mount, but solder lugs can be used.
- Enclosure size
 - This is designed to fit in a 1590BB but using a 125BB is highly recommended. It gives just a hair more room to work without sacrificing more pedalboard space. A 1790 would make it really EASY and give more room to spread out the 3PDT and SPST footswitch.
- PT2399's
 - With the nature of PT2399's socketing is HIGHLY recommended. Not all PT2399's are created equal. Many exhibit higher noise and you'll also get some that "motorboat". Since we aren't fishing I recommend buying a few from different suppliers and "demoing" which ones sound best. The best way to do this is in EP-3 mode with IC3 empty. Then you only need to swap out IC-2. When you find the best two PT2399's out of your batch use them in IC2 and IC3. Even with the best PT2399's you will experience some noise at certain settings of delay time and/or repeats. You can increase the filtering but the delay will sound more analog then tape.

BUILD NOTES :

Take your time! It's easy to rush and mix up component values. Slow down and enjoy the fun!

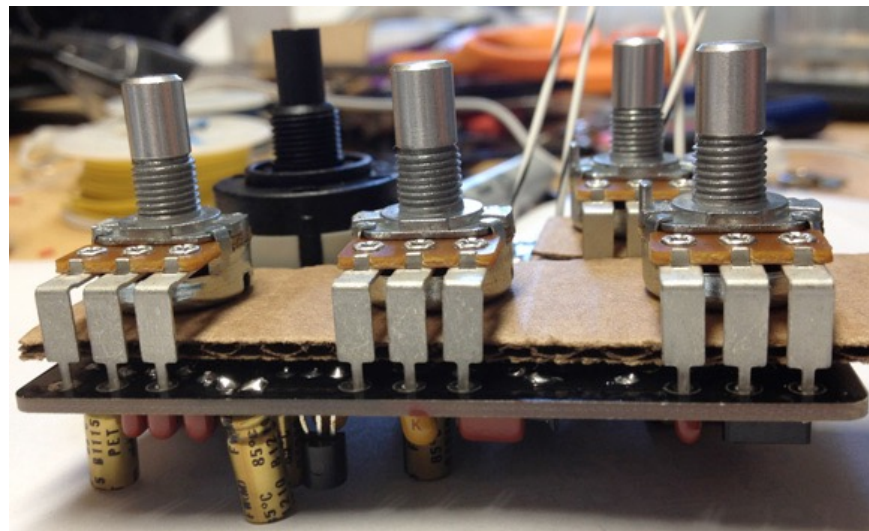
Because the 4P3T PCB mount rotary switch is slightly higher, the PCB mounted potentiometers need special spacing when soldering. There is a height difference between the switch and pots. To overcome the difference the pots must be soldered to the PCB near the end of the pins. The easiest way to do this is by placing a standard piece of cardboard between the pots and the PCB.

Here are the steps:

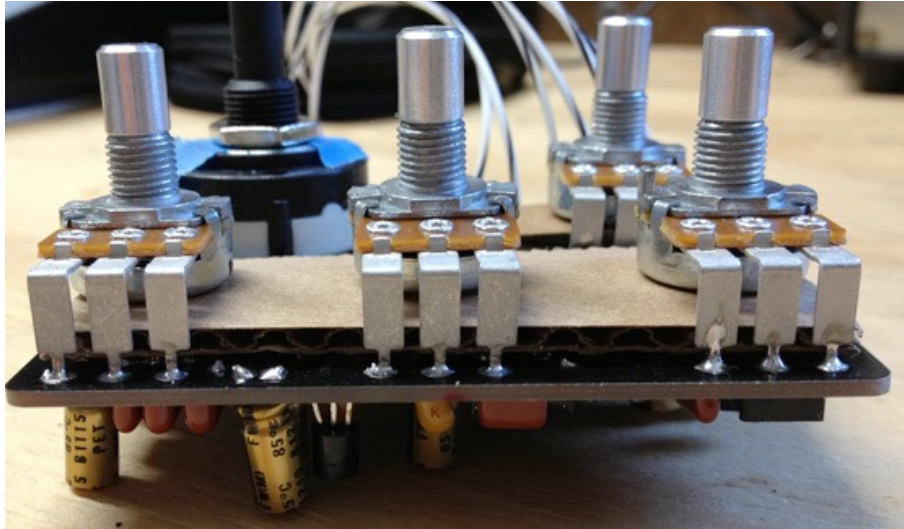
One: Take the PCB and place it component side down.

Two: Size and cut a piece of cardboard to slip under the pots.

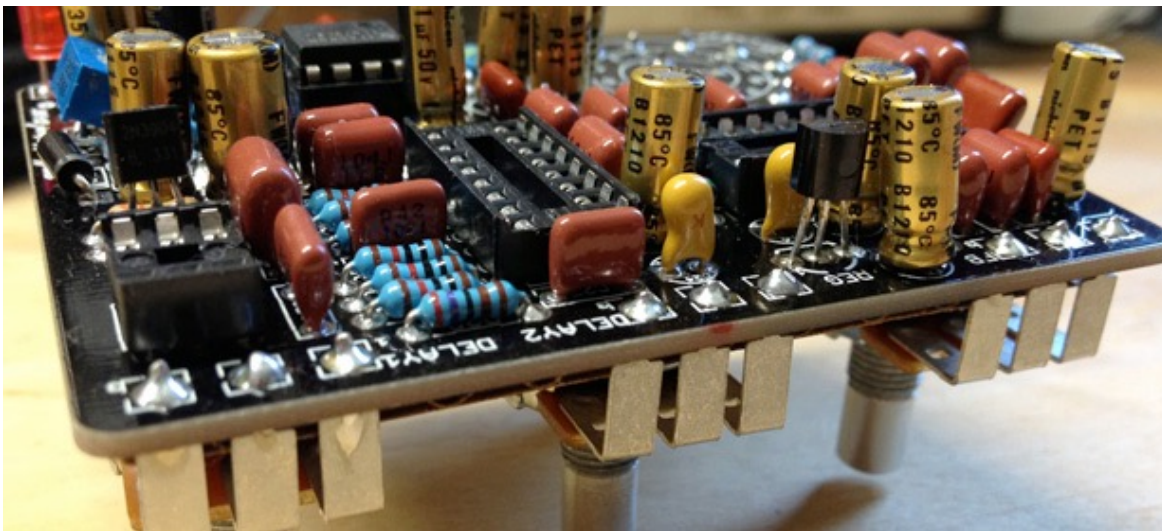
Three: Place the potentiometers in the correct locations. It will look like the picture...



Four: Solder in place, like so... (It's easiest to do the mix pot first)



Five: Then solder the pot pins on the component side as well.



4P3T TIPS :

Cut the nub off the 4P3T before mounting in the enclosure. --->



Before placing the 4P3T in the enclosure add some tape to hold the metal ring tab in place. If the ring falls out, place the notch back in the 3 spot. Failure to do so will result in chaos!



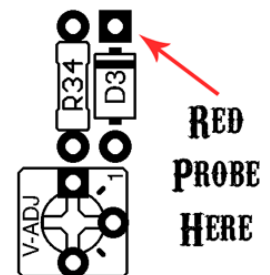
V-ADJ CALIBRATION FOR TAPE SPEED CIRCUIT

In order for the tape speed manipulation to be “ready” after powering up the pedal a pre-charge circuit was added. Previously, you would have to hold the momentary switch for an extended period for the circuit’s capacitor to first charge up. The pre-charge essentially lets the cap (C36) sit at idle partially charged until you’re ready to activate the switch.

The calibration is a set it and forget it adjustment. This is easily done before boxing the pedal but it can be performed after boxing if necessary. A video of the process can be found here www.youtube.com/watch?v=f-ePB7E_uOs

Calibration process:

- First, turn the trim pot fully counterclockwise BEFORE powering up.
- Connect +9v and gnd to the PCB circuit
- Put your multimeter on the DC V setting.
- Take the black probe and place it on a ground point.
- Take the red probe and place it on the cathode of D3.



- VERY slowly turn the trimmer clockwise until you get around 0.45V to 0.5V on the multimeter. It is important to go slowly because you are charging C36 as you turn the trimmer. You need to let the cap charge slowly, if you go too fast the LED (D2) will light up. If this happens turn the trimmer counterclockwise until the capacitor discharges and you read the correct voltage.
- The LED (D2) may light very dim after calibration, this is fine. If it is any brighter than dim you should recalibrate until it is dim or not visibly lit (closer to 0.45V)

MODS

Tape Speed Up/Down

The tape speed ramp up and release speed can be adjusted by changing R31 and R33. This will change the charging(R31)/discharging(R33) speed. They are interactive, so adjusting one will affect the other. For extra credit use potentiometers in place of R31 and R33. A good suggestion could be using a 2M Ω resistor in series with a 1MB pot for R31 and a 100k Ω pot for R33. I have not tried this. EXPERIMENTATION ENCOURAGED! Socketing these R31 and R33 is worthwhile at the very least.

Filtering

Replacing C13, C19, C22 and C28 with a higher value (1n5 or 2n2) will reduce noise but will be less tape like. Socket and adjust to taste if you're indecisive.

WIRING

3PDT wiring is standard FX wiring as shown in Madbean's wonderful wiring diagram.

http://www.madbeanpedals.com/tutorials/downloads/StandardWiring_MBP.pdf

The SPST momentary footswitch is wired to the SW2 pads on the PCB.

Note: D2 is a visual indicator of the Tape Speed Mod, it is not an on/off indicator for the effect. It can be PCB mounted. Use the drill guide for proper enclosure drilling. An additional LED is necessary along with a CLR as shown in Madbean's wiring diagram for effect on/off status.

ADDITIONAL NOTES :

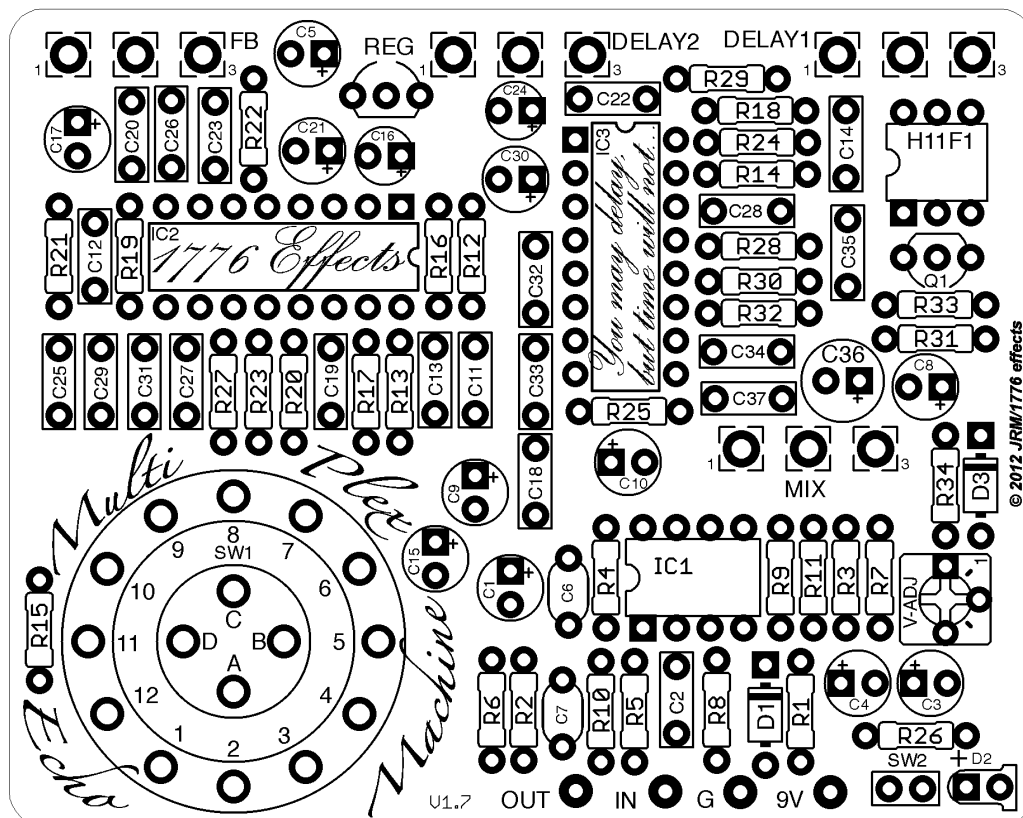
Each mode is slightly different as far as where your desired settings will sound nice. For example the EP-3 mode will oscillate at a different point on the feedback pot than the RE-201 mode will. This is to be expected. There will also be a “click” that will be repeated when you turn the modes switch. If you’re in a quiet gig setting I suggest turning off the effect and then switching modes if you need to.

The tape speed mod switch only changes the Delay 2 time setting. It works best when you have a long delay time set. In EP-3 mode it allows you to slowly glide between the set delay time and a short delay time then back again.

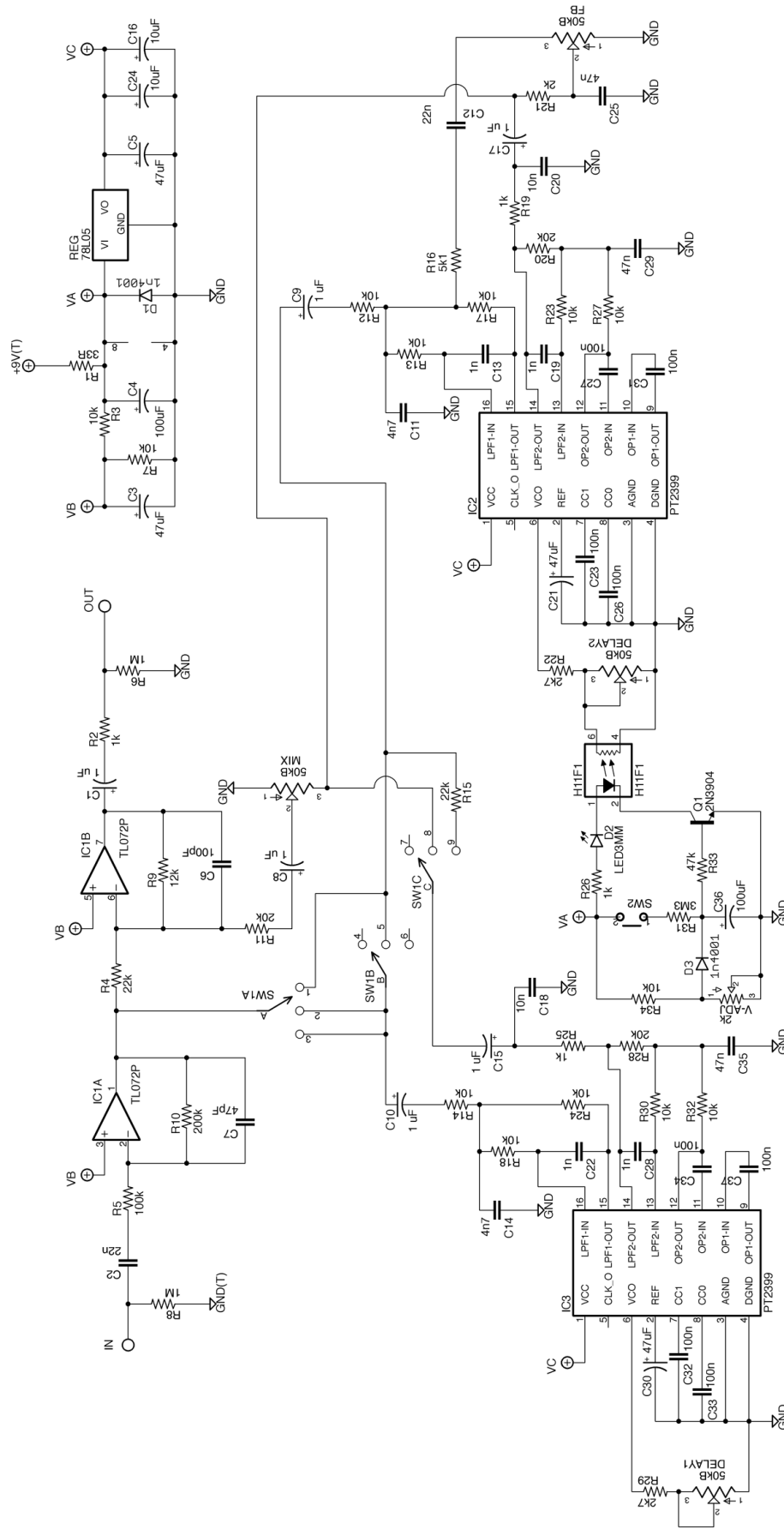
Have fun, there are many cool sounds to be found!

Last but not least, I owe a special thanks to Brian (aka Madbean) and all the crew on the forum. Without your support this project would have never happened!

Josh



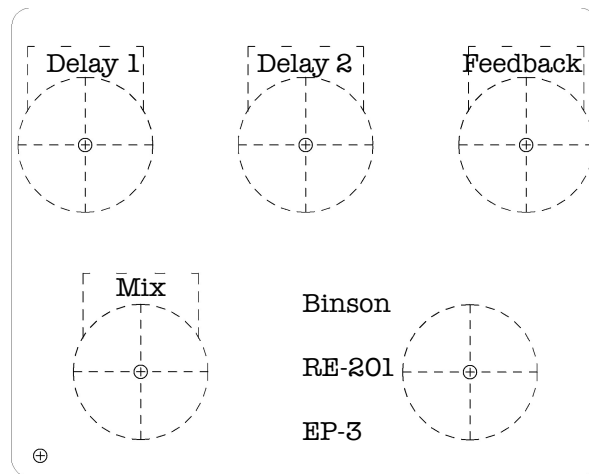
MULTIPLEX SCHEMATIC



DRILL GUIDE/CONTROL LAYOUT

Print at 100% scale for drilling! If placing in a 1590BB make sure to leave clearance next to enclosure screw corners as the PCB is slightly wider. Dry fit the PCB template inside to make sure you have clearance and then place the template on top of the enclosure to center-punch the hole locations.

PCB Size 2.44" H x 3.06" W



Tape Speed
LED

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