Degenerator24

FX Type: **DELAY**
Build Level: Intermediate
Based On: madbeanpedals original

Last Updated: November 20, 2024 3:48 PM

The *2024* version of the Degenerator has no significant circuit changes. It has been moved to the Standard Series with a new PCB layout.

Overview

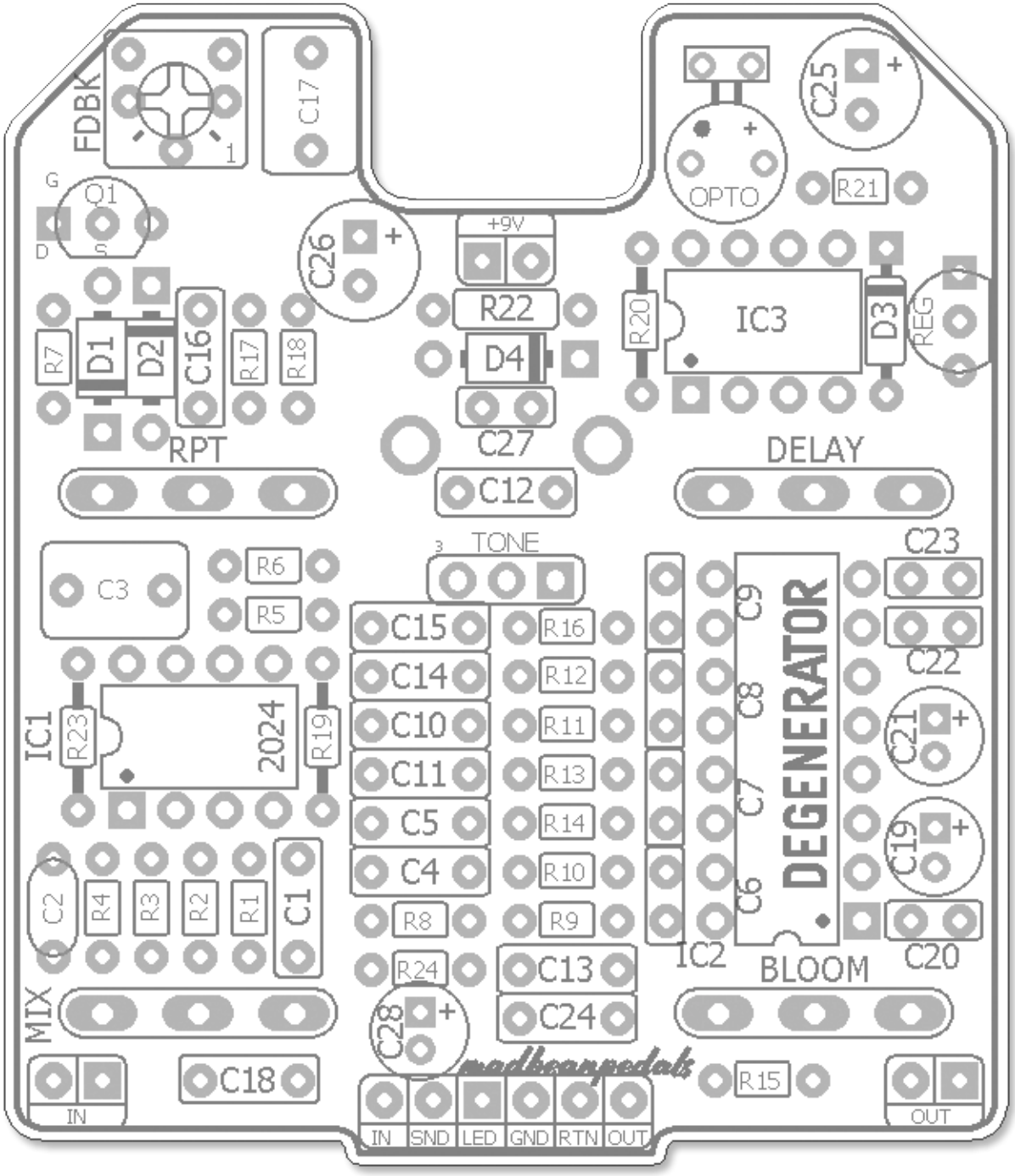
The Dengenerator was created with envelope driven modulation in mind. The delay circuit itself is pretty straight-forward and the real fun is in modulating that delay with picking dynamics. A simple “sound to light” style circuit was utilized via an LM386N-3. This lights up an LED in proportion to the input amplitude. The brightness of this LED controls a light dependent resistor which runs parallel to the “stopper resistor” of the delay control. I chose this over modulating the entirety of the delay range to keep the modulation subtle and controlled. However, you can get some neat pitch bending when the Bloom control is cranked. Additionally, there are two clipping diodes in the repeat path to clamp self-oscillation so the volume doesn’t get out of control. It has the added benefit of adding a bit of “tape saturation” effect at high repeat settings.

On its own, this PT2399 delay is very sweet sounding and will mix well with other instruments/band volumes. With the modulation feature, it is *smack*...chef’s kiss!

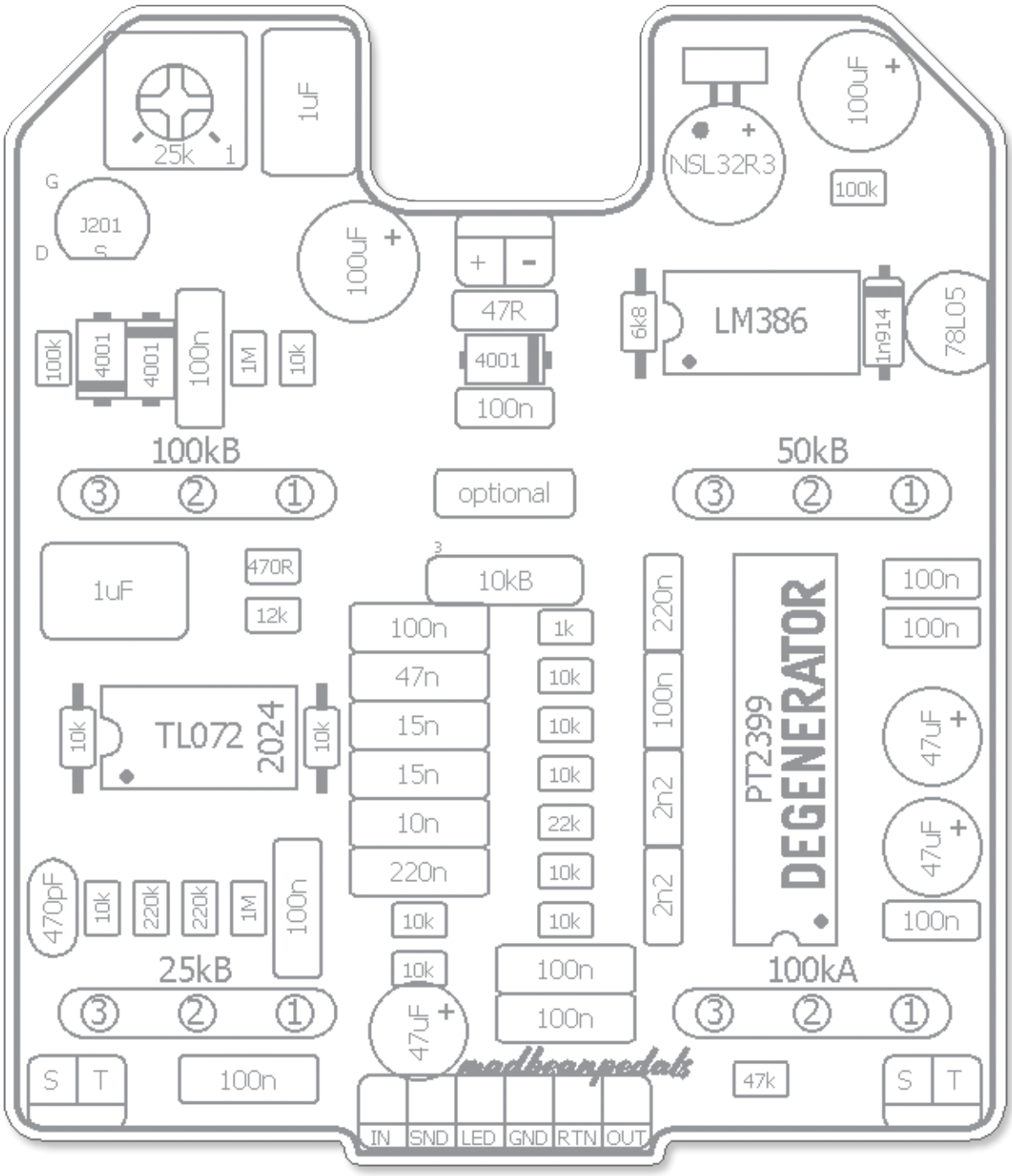
Controls

- **DELAY:** The delay range is around 50ms to 600ms.
- **RPT:** Delay repeats from 1 to “infinity” or self-oscillation.
- **MIX:** Delay signal volume.
- **TONE:** CCW: treble roll-off on the delayed signal. CW: full brightness.
- **BLOOM:** Sensitivity of the envelope driven modulation. CCW: no modulation. 9-12, subtle “blooming” effect on the delay. 12-CW: pitch bends on the delay (up to 1/2 step down or more).
- **FDBK:** This trimmer sets the upper limit of delay repeats. Adjust to taste.

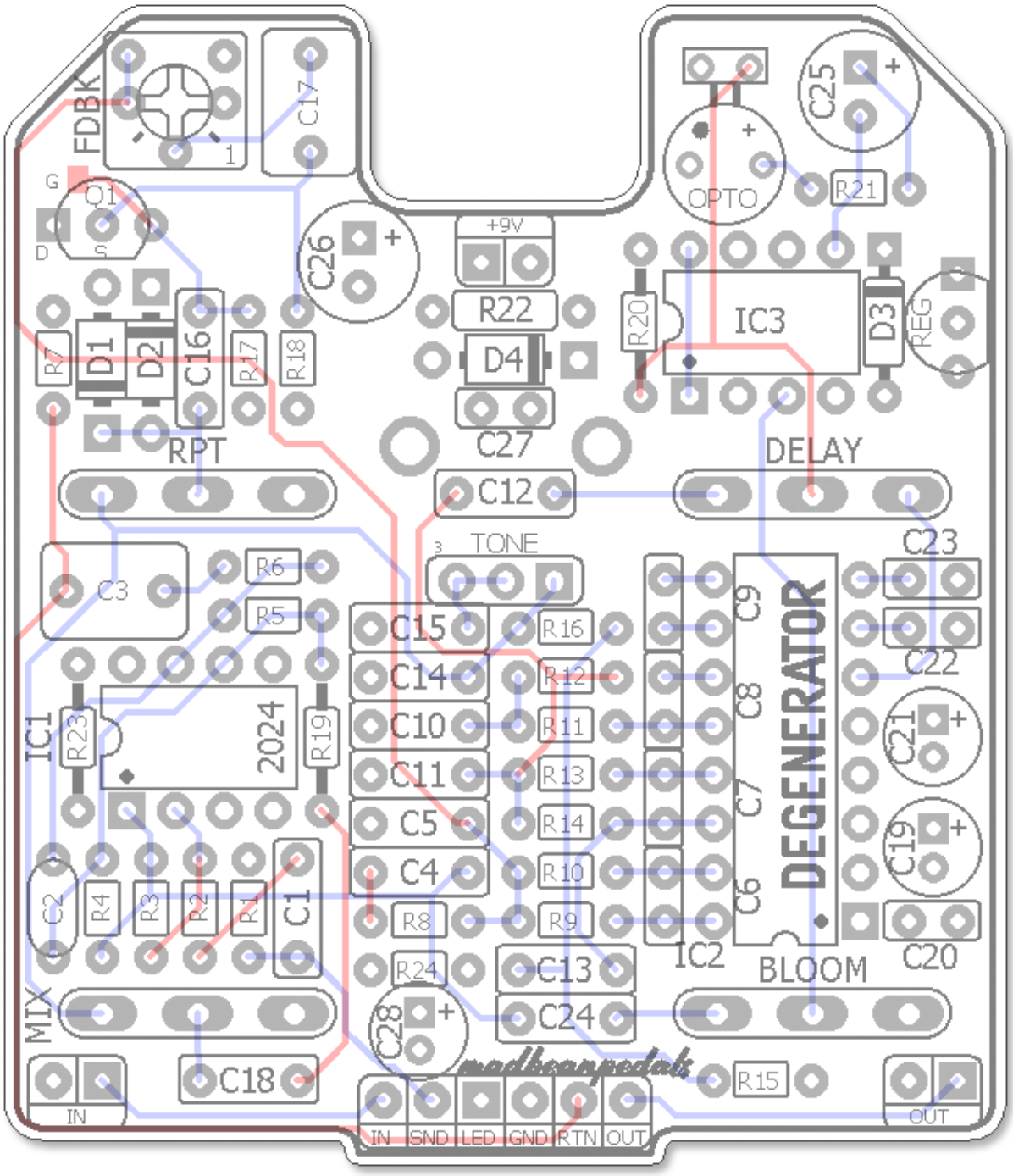
Parts Layout



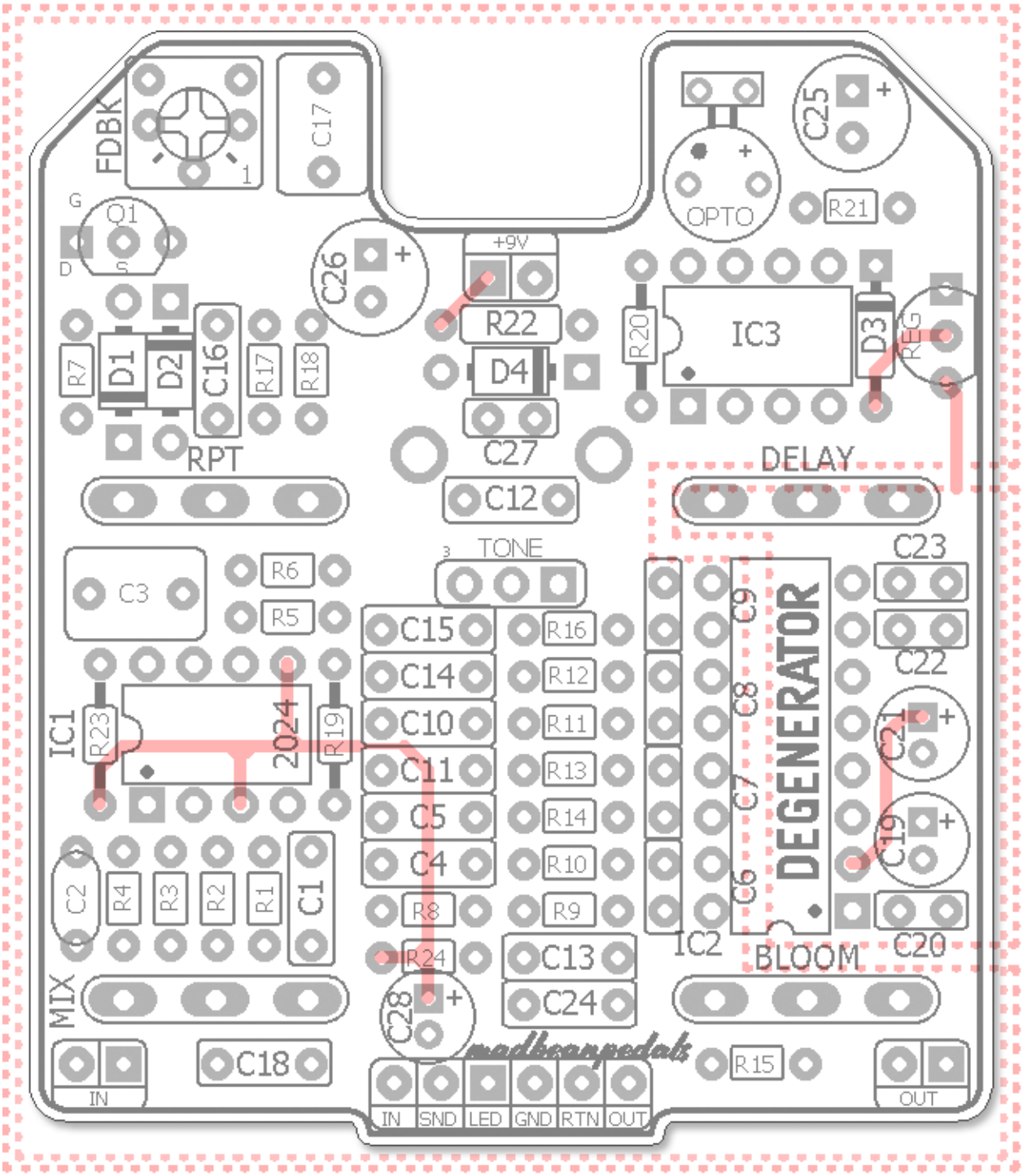
Component Values



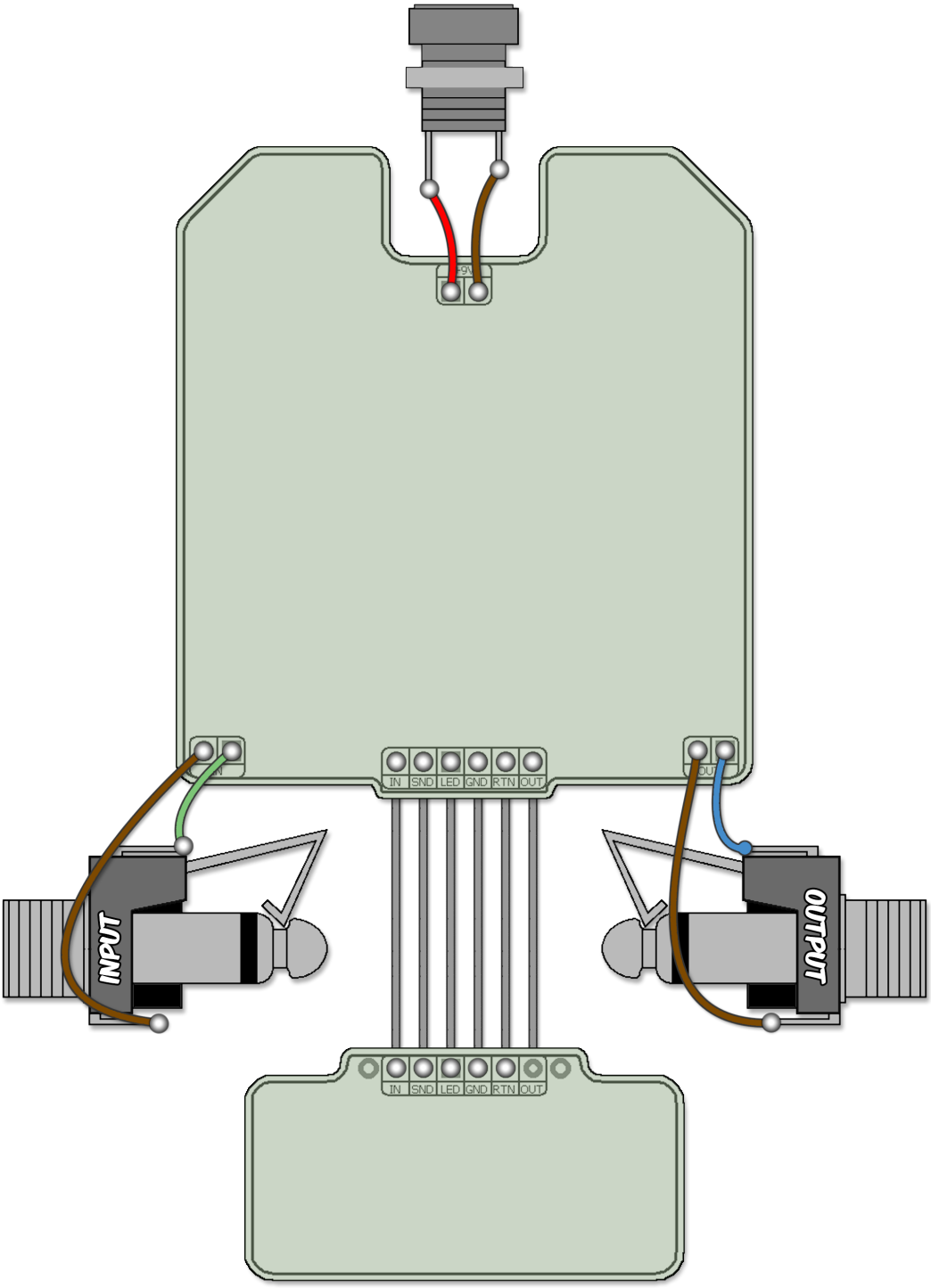
Trace Layout - Outer Layers



Trace Layout - Inner Layers



Wiring



Unless otherwise noted, all Standard Series projects have the same wiring regardless of which 3PDT bypass board is used. A 6-pin, 2” ribbon cable is recommended for soldering the connections between the two PCBs.

B.O.M.

Resistors		Caps		Diodes	
R1	1M	C1	100n	D1	1n4001
R2	220k	C2	470pF	D2	1n4001
R3	220k	C3	1uF	D3	1n914
R4	10k	C4	220n	D4	1n4001
R5	12k	C5	10n	Transistors	
R6	470R	C6	2n2	Q1	J201
R7	100k	C7	2n2	Regulator	
R8	10k	C8	100n	REG	78L05
R9	10k	C9	220n	Optical	
R10	10k	C10	15n	OPTO	NSL32R3
R11	10k	C11	15n	IC	
R12	10k	C12	optional	IC1	TL072
R13	10k	C13	100n	IC2	PT2399
R14	22k	C14	47n	IC3	LM386
R15	47k	C15	100n	Trimmers	
R16	1k	C16	100n	FDBK	25k
R17	1M	C17	1uF	Pots	
R18	10k	C18	100n	TONE	10kB
R19	10k	C19	47uF	MIX	25kB
R20	6k8	C20	100n	DELAY	50kB
R21	100k	C21	47uF	RPT	100kB
R22	47R	C22	100n	BLOOM	100kA
R23	10k	C23	100n		
R24	10k	C24	100n		
		C25	100uF		
		C26	100uF		
		C27	100n		
		C28	47uF		

Shopping List

Value	QTY	Type	Rating
47R	1	Carbon / Metal Film	1/4W
470R	1	Carbon / Metal Film	1/8W
1k	1	Carbon / Metal Film	1/8W
6k8	1	Carbon / Metal Film	1/8W
10k	11	Carbon / Metal Film	1/8W
12k	1	Carbon / Metal Film	1/8W
22k	1	Carbon / Metal Film	1/8W
47k	1	Carbon / Metal Film	1/8W
100k	2	Carbon / Metal Film	1/8W
220k	2	Carbon / Metal Film	1/8W
1M	2	Carbon / Metal Film	1/8W
2n2	2	MLCC, 2.5mm spacing	25v min
100n	4	MLCC, 2.5mm spacing	25v min
220n	1	MLCC, 2.5mm spacing	25v min
470pF	1	Ceramic / MLCC	25v min
10n	1	Film	25v min
15n	2	Film	25v min
47n	1	Film	25v min
100n	7	Film	25v min
220n	1	Film	25v min
1uF	2	Film	25v min
47uF	3	Electrolytic	25v min
100uF	2	Electrolytic	25v min
1n4001	3		
1n914	1		
J201	1	smd or through-hole	
78L05	1		
NSL32R3	1		
TL072	1		
PT2399	1		
LM386	1		
25k	1	Bourns 3362 or 6mm	
10kB	1	PCB Right Angle, Plastic Shaft	9mm
25kB	1	PCB Right Angle	16mm
50kB	1	PCB Right Angle	16mm
100kB	1	PCB Right Angle	16mm
100kA	1	PCB Right Angle	16mm

Additional Hardware

(1) 1590B enclosure
(2) Lumberg 1/4” Compact mono jacks
(1) Slim 2.1mm DC jack
(1) Standard 3PDT footswitch
(1) 5mm LED

Build Notes

- As mentioned in the introduction, this build requires 4 MLCC (multilayer ceramic capacitors). Regular box film types will simply not fit in the 2.5mm spacing each requires. However, you can use either 2.5mm or 5mm spaced MLCC (with 5mm it just bend the leads straight to fit properly) since the footprint of the MLCC is much smaller.

- MLCC are generally not stocked at smallbear and similar DIY vendors. And, they appear to have gotten quite a bit more expensive in the last couple of years so it's not practical for me to include these with the Degenerator PCB on a permanent basis. Tayda does stock them but most appear to be X7R dielectric which is not ideal for audio applications. But, they can be used as an alternative if that's what is available to you.

Here are some high quality C0G/NP0 dielectric caps I can recommend:

(2) 2.2nF (2.5mm spacing): https://www.mouser.com/ProductDetail/810-FG18C0G1H222JNT6
(1) 100n (2.5mm spacing): https://www.mouser.com/ProductDetail/810-FG16C0G1H104JNT6
(1) 220n (5mm spacing): https://www.mouser.com/ProductDetail/810-FG22C0G1H224JNT6

If Mouser is not an available or practical vendor for you sub these (or similar) in their place:

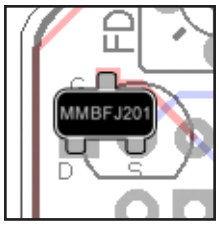
(2) 2.2nF: https://www.taydaelectronics.com/2200pf-50v-multilayer-monolithic-ceramic-capacitor.html
(1) 100n: https://www.taydaelectronics.com/0-1-uf-100v-multilayer-monolithic-ceramic-capacitor-multicomp.html
(1) 220n: https://www.taydaelectronics.com/0-22-uf-50v-multilayer-monolithic-ceramic-capacitor-multicomp.html

- I went with a fairly large current limiting resistor (R22, 47 Ohm) on the power supply in an effort to keep any noise at minimum.

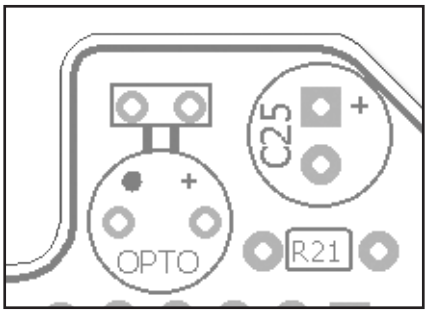
- C12 is optional and is not listed on the BOM or Shopping List. I included this option to allow for more low pass filtering on the delays when the Delay pot is turned up all the way (it only comes into play in the last 10% of its turn). Some PT2399 chips perform better than others so if yours gives off too much noise or any "puttering" at the max delay time, including C12 can reduce or eliminate that. It works by adding a cap in parallel with C11 when the delay pot is maxed. I suggest trying 10n, 15n, or 22n. I soldered in a socket for C12 on my build, but ultimately did not need it. I did not have any significant noise issues or puttering at the max delay setting.

Build Notes

- For Q1 you can use a through-hole J201, or the surface mount equivalent (MMBFJ201).



- I picked the NSL32R3 for the optical device because of its small footprint (something needed for this 1590B design). If you do not have one, you can roll your own with an LED and LDR. Any decent LDR will probably work fine since its only performing a very limited action. For the LED, use 3mm yellow or green. If you do roll your own, you will want to socket R21. 100k was used based on the precise response I wanted for the Bloom control when using the NSL32R3 (which has an extremely low On resistance). Other LDRs wil require tweaking R21 to taste to get an acceptable response. I'd start with 10k and work your way up. The idea is to keep the first half of the Bloom control subtle and the last half to create pitch bends on the delayed signal.



Note the orientation of the Opto device. "+" is the LED anode, and the dot is the LED cathode. The two pads on the left are for the LDR. One end connects to R20 and the other end to ground, putting both resistances in parallel.

- To adjust the FDBK trimmer, start with the trimmer full CCW and the RPT pot about 3/4 up. Now adjust the FDBK trim so that delay repeats are just on the verge of self oscillation but doesn't quite get there. Ideally, I like the 3/4 setting on the RPT pot to be "infinite" repeats (which just means a lot before it dies out completely, not that it goes on until the heat death of the universe). Then when the RPT is all the way up the delay goes into self-oscillation.

- For some real fun, try very short delay times with the Bloom control all the way up and RPT adjusted to taste. It can get pretty wacky!

Circuit Voltages

IC1	TL072
1	4.05
2	4.09
3	4.02
4	0
5	4.02
6	4.02
7	4
8	8.06

IC3	LM386
1	1.31
2	0
3	0
4	0
5	3.4
6	8.06
7	4.06
8	1.31

IC2	PT2399
1	5.68
2	2.85
3	0
4	0
5	3.21
6	2.85
7	0.71
8	0.72
9	2.85
10	2.85
11	2.85
12	2.85
13	2.85
14	2.85
15	2.85
16	2.85

REG	78L05
In	8.06
G	0.65
Out	5.68

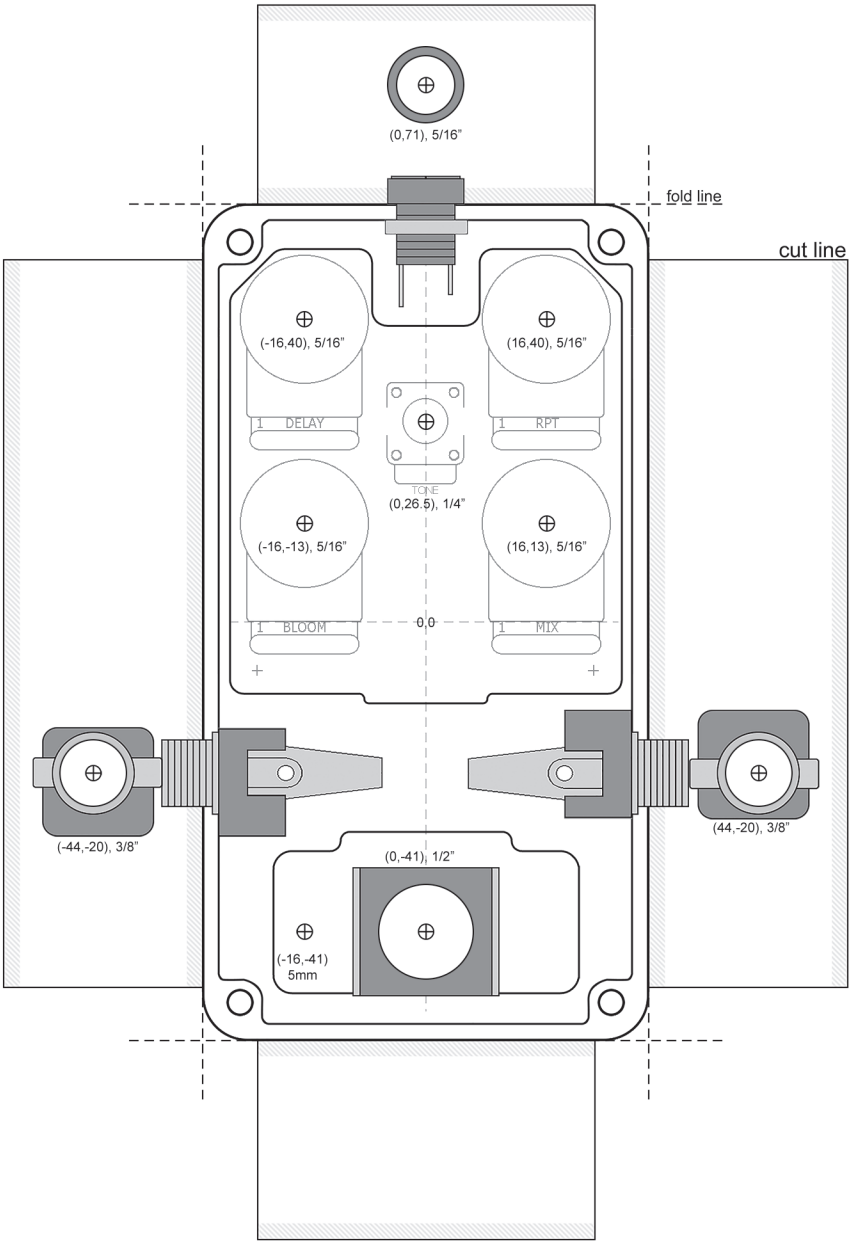
Q1	J201
D	8.06
S	0.67
G	88mV

9.44vDC One Spot supply
Current Draw: ~38mA

1590B Drill Template

Coordinates are denoted in (X,Y), drill size format starting from the center (0,0) location of the enclosure.

Link to Tayda Standard Series master drill template

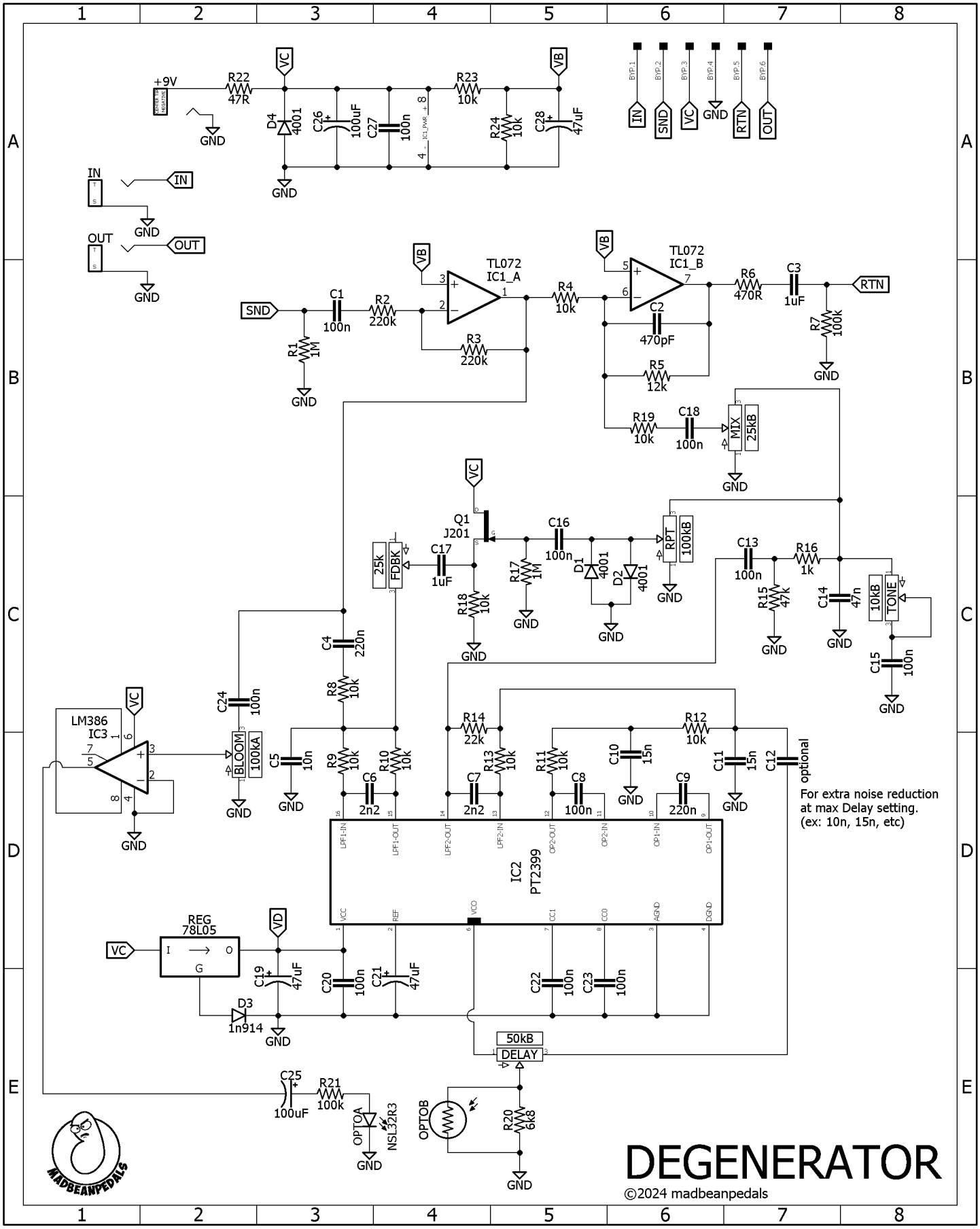


Hardware

1590B enclosure
16mm pots
Lumberg 1/4” Compact mono jacks
Slim 2.1mm DC jack
Standard 3PDT footswitch
5mm LED

NOTE: Different 1/4” and DC jack styles may require different sized drill holes.

Schematic


DEGENERATOR
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MADBEANPEDALS
IC2 PT2399
IC3 LM386
IC1_A TL072
IC1_B TL072
Q1 J201
REG 78L05
D1 4001
D2 4001
D3 1n914
D4 4001
OPTOA NSL32R3
OPTOB
For extra noise reduction at max Delay setting. (ex: 10n, 15n, etc)
+9V
GND
VC
VB
VD
IN
OUT
SND
RTN
BYP-1
BYP-2
BYP-3
BYP-4
BYP-5
BYP-6
R1 1M
R2 220k
R3 220k
R4 10k
R5 12k
R6 470R
R7 100k
R8 10k
R9 10k
R10 10k
R11 10k
R12 10k
R13 10k
R14 22k
R15 47k
R16 1k
R17 1M
R18 10k
R19 10k
R20 6k8
R21 100k
R22 47R
R23 10k
R24 10k
C1 100n
C2 470pF
C3 1uF
C4 220n
C5 10n
C6 2n2
C7 2n2
C8 100n
C9 220n
C10 15n
C11 15n
C12 optional
C13 100n
C14 47n
C15 100n
C16 100n
C17 1uF
C18 100n
C19 47uF
C20 100n
C21 47uF
C22 100n
C23 100n
C24 100n
C25 100uF
C26 100uF
C27 100n
C28 47uF
MIX 25kB
RPT 100kB
FDBK 25k
BLOOM 100kA
DELAY 50kB
TONE 10kB