DEGENERATOR

FX TYPE: Delay

Enclosure Size: 1590B

“Softie” compatibility: None

Overview

There was a time where mbp offered many different PT2399 delays from 1590A mini sized all the way up to overly-packed full feature delays. They dropped off the radar one by one in favor of more analog, BBD driven delay circuits. 2022 seems like a good time to bring a couple new PT2399 designs back into the fold.

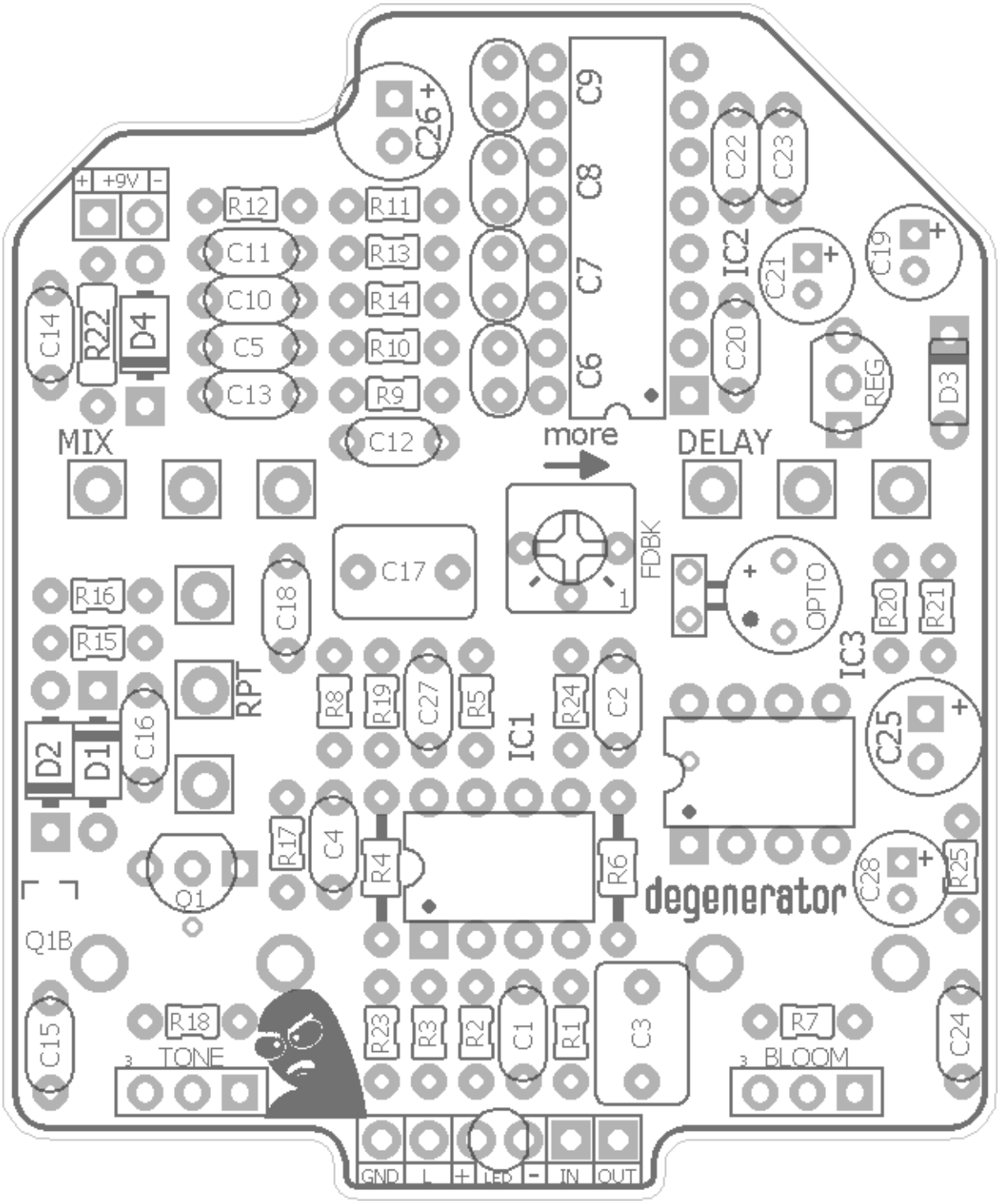
The Dengenerator was created with envelope driven modulation in mind. The delay circuit itself is pretty straight-forward and the real fun is in modulating that delay with picking dynamics. A simple “sound to light” style circuit was utilized via an LM386N-3. This lights up an LED in proportion to the 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!

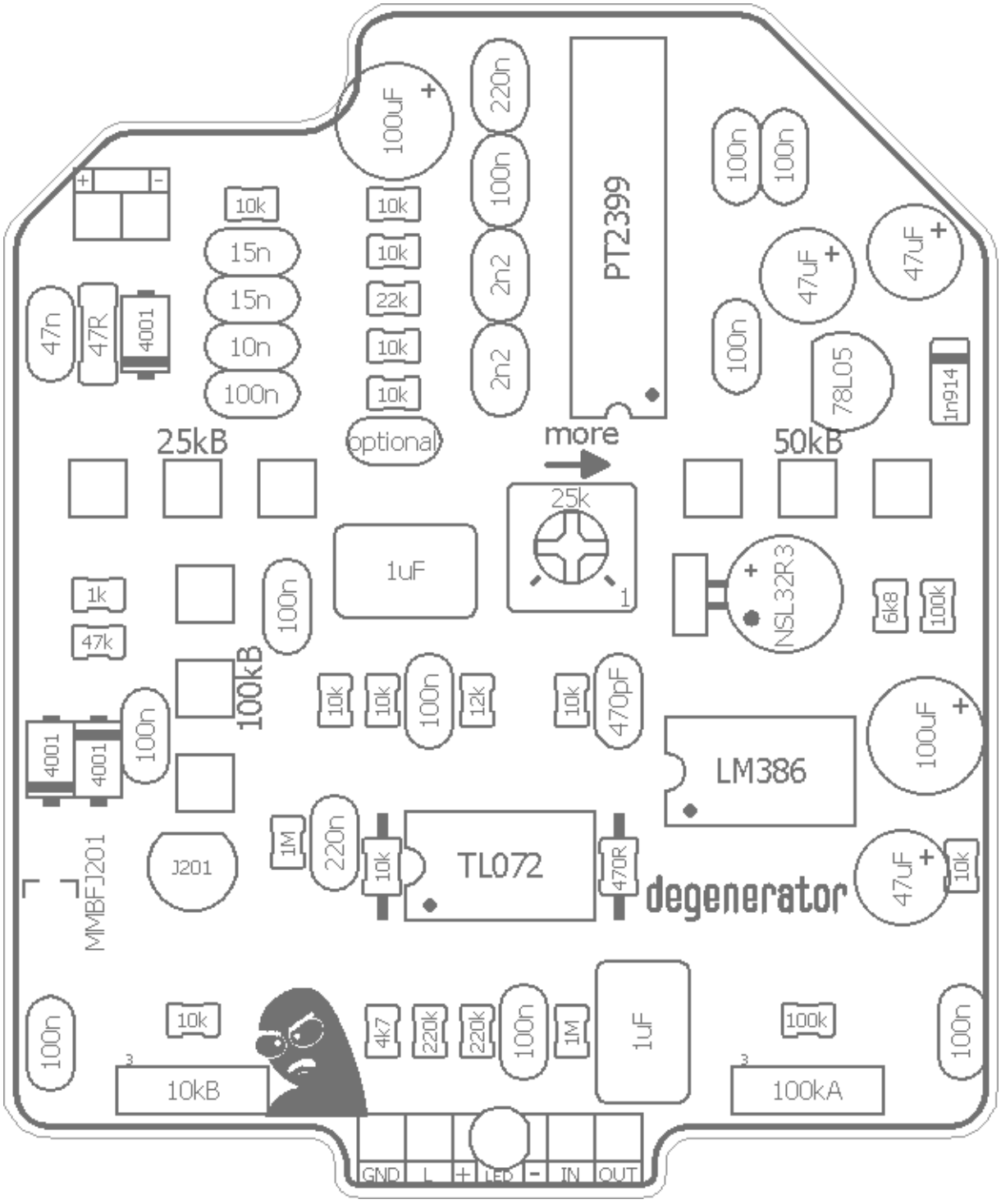
Controls

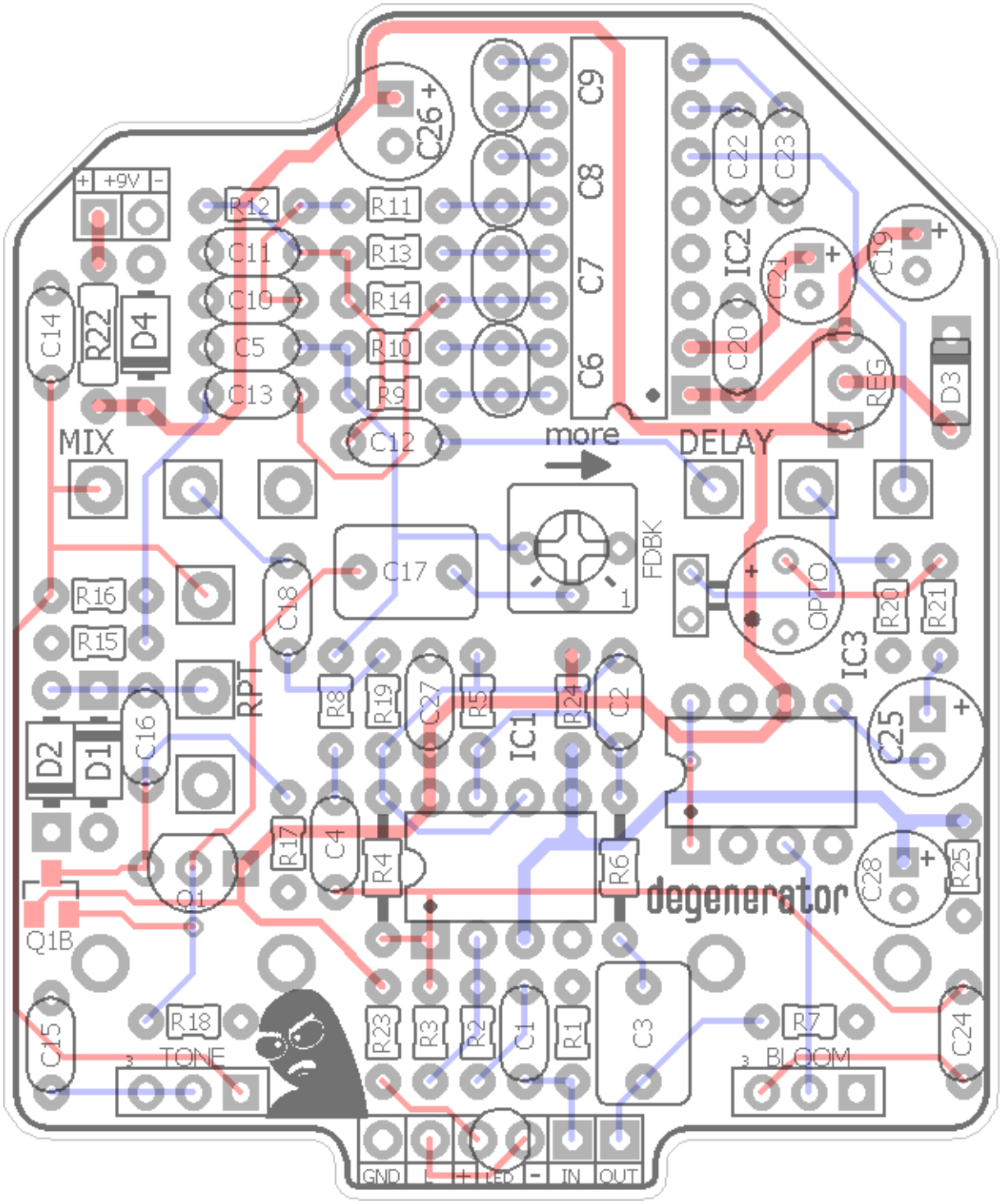
- **DELAY -** The delay range is around 50ms to 600ms.
- **RPT -** Delay repeats from 1 to “infinity” or self-oscillation.
- **MIX -** Delay signal volume.
- **TONE -** CCW: treble roff-off on the delayed signal. CW: full brightness.
- **BLOOM -** Sensitivity of the envelope driven modulation. CCW: no 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.

Technical assistance for your build(s) is available via the madbeanpedals forum. Please go there rather than emailing me for assistance on builds. This is because (1) I’m not always available to respond via email in a timely and continuous manner, and (2) posting technical problems and solutions in the forum creates a record from which other members may benefit.



C6-C9 must be 2.5mm spaced MLCC. This was the only way to fit the design in a 1590B. See Notes for suggested parts.


100uF
220n
100n
2n2
2n2
PT2399
100n
100n
47uF
47uF
100n
78L05
1n914
10k
15n
15n
10n
100n
10k
10k
22k
10k
10k
47n
47R
4001
25kB
optional
more
50kB
25k
1uF
1k
47k
100n
100kB
NSL32R3
6k8
100k
10k
10k
100n
12k
10k
470pF
LM386
100uF
4001
4001
100n
1M
220n
10k
TL072
470R
degenerator
47uF
10k
MMBFJ201
J201
100n
10k
10kB
4k7
220k
220k
100n
1M
1uF
100k
100kA
100n
GND
L
+
LED
-
IN
OUT


+9V
MIX
more
DELAY
RPT
TONE
BLOOM
FDBK
OPTO
REG
IC1
IC2
IC3
Q1
Q1B
degenerator
GND
LED
IN
OUT

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	Regulators	
R8	10k	C8	100n	REG	LM78L05
R9	10k	C9	220n	ICs	
R10	10k	C10	15n	IC1	TL072
R11	10k	C11	15n	IC2	PT2399
R12	10k	C12	optional	IC3	LM386
R13	10k	C13	100n	Optical	
R14	22k	C14	47n	OPTO	NSL32R3
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	BLOOM	100kA
R20	6k8	C20	100n	MIX	25kB
R21	100k	C21	47uF	DELAY	50kB
R22	47R	C22	100n	RPT	100kB
R23	4k7	C23	100n		
R24	10k	C24	100n		
R25	10k	C25	100uF		
		C26	100uF		
		C27	100n		
		C28	47uF		

Values	QTY	Type	Rating
47R	1	Metal / Carbon Film	1/4W
470R	1	Metal / Carbon Film	1/8W
1k	1	Metal / Carbon Film	1/8W
4k7	1	Metal / Carbon Film	1/8W
6k8	1	Metal / Carbon Film	1/8W
10k	11	Metal / Carbon Film	1/8W
12k	1	Metal / Carbon Film	1/8W
22k	1	Metal / Carbon Film	1/8W
47k	1	Metal / Carbon Film	1/8W
100k	2	Metal / Carbon Film	1/8W
220k	2	Metal / Carbon Film	1/8W
1M	2	Metal / Carbon Film	1/8W
2n2	2	MLCC, 2.5mm spacing	16v. Min
100n	1	MLCC, 2.5mm spacing	16v. Min
220n	1	MLCC, 2.5mm spacing	16v. Min
470pF	1	Ceramic / MLCC	16v. Min
10n	1	Film	16v. Min
15n	2	Film	16v. Min
47n	1	Film	16v. Min
100n	10	Film	16v. Min
220n	1	Film	16v. Min
1uF	2	Film	16v. Min
47uF	3	Electrolytic	16v. Min
100uF	2	Electrolytic	16v. Min
1n914	1		
1n4001	3		
J201	1	or, MMBFJ201	
LM78L05	1		
TL072	1		
PT2399	1		
LM386	1	N-3 version	
NSL32R3	1		
25k	1	Bourns 3362p	
10kB	1	PCB Right Angle, Plastic Shaft	9mm
100kA	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

PT2399:
https://smallbear-electronics.mybigcommerce.com/ic-pt2399/
https://stompboxparts.com/semiconductors/pt2399-digital-delay-ic/

LM386N-3:
https://smallbear-electronics.mybigcommerce.com/ic-lm386-n3/
https://stompboxparts.com/semiconductors/lm386n-3-power-amplifier-ic/

I also tested the LM386N-1 (low power version). The N-3 seems to respond slightly better to picking dynamics, for whatever reason, so that's what I recommend. I did not have any LM386D to test.

J201:
https://smallbear-electronics.mybigcommerce.com/transistor-fet-fairchild-j201/
Sub MPF102: https://stompboxparts.com/semiconductors/mpf102-jfet-nos-fairchild/

MMBFJ201:
https://smallbear-electronics.mybigcommerce.com/fairchild-on-semi-jfet-mmbfj201/
https://www.mouser.com/ProductDetail/512-MMBFJ201

NSL32R3:
https://smallbear-electronics.mybigcommerce.com/photocoupler-silonex-nsl-32sr3/

Bourns 3362p trimmer 25k:
https://stompboxparts.com/pots/trim-pot-3362p/
Sub - 20k: https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/20k-ohm-trimmer-potentiometer-cermet-1-turn-3362p.html

9mm Plastic Shaft Pots:
https://smallbear-electronics.mybigcommerce.com/alpha-single-gang-9mm-right-angle-pc-mount-w-knurled-plastic-shaft/

https://www.taydaelectronics.com/potentiometer-variable-resistors/rotary-potentiometer/logarithmic/100k-ohm-logarithmic-taper-potentiometer-round-knurled-plastic-shaft-pcb-9mm.html

https://www.taydaelectronics.com/potentiometer-variable-resistors/rotary-potentiometer/linear/10k-ohm-linear-taper-potentiometer-round-knurled-plastic-shaft-pcb-9mm.html

16mm Right Angle PCB mount pots:
https://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-right-angle-pc-mount/
https://stompboxparts.com/pots/16mm-potentiometer-short-pcb-leg/
https://lovemyswitches.com/16mm-potentiometers-1-4-smooth-shaft-right-angle-pcb-mount/

DC Jacks:
https://smallbear-electronics.mybigcommerce.com/2-1-mm-all-plastic-round/
https://stompboxparts.com/power-connections/dc-power-jack-2-1mm-low-profile/
https://lovemyswitches.com/thinline-lumberg-dc-power-jack-2-1mm/

1/4" jacks:
https://smallbear-electronics.mybigcommerce.com/1-4-in-mono-nys229/
https://smallbear-electronics.mybigcommerce.com/1-4-in-mono-switchcraft-11/
https://lovemyswitches.com/1-4-mono-jack-lumberg-klbm-3/
https://lovemyswitches.com/1-4-mono-jack-neutrik-rean-nys229/

My preferred 3PDT switch:
https://lovemyswitches.com/pro-3pdt-latched-foot-switch-solder-lugs-feather-soft-click/

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

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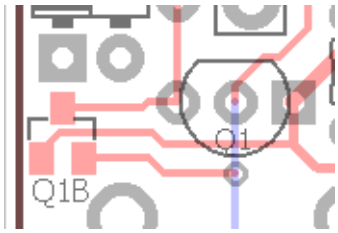
- You'll need to solder the two wires for the 9v connection before soldering in the MIX pot, since they overlap.

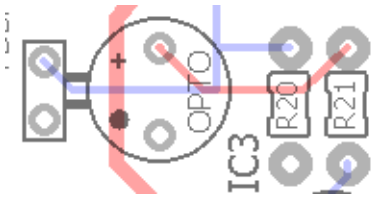
- I went with a fairly large current limiting resistor (R22, 47 Ohm) on the power supply in an effort to keep any noise at minimum. This probably could be dropped to 22 Ohm but I don't see any reason to do that. The operating voltage of the PT2399 is already limited to about 5.6v as is and the internal reference voltage is about half the supply.

- 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.

- For Q1 you can use a through-hole J201 if you have one, or the surface mount equivalent (MMBFJ201) in the Q1B spot. Just don't use both!



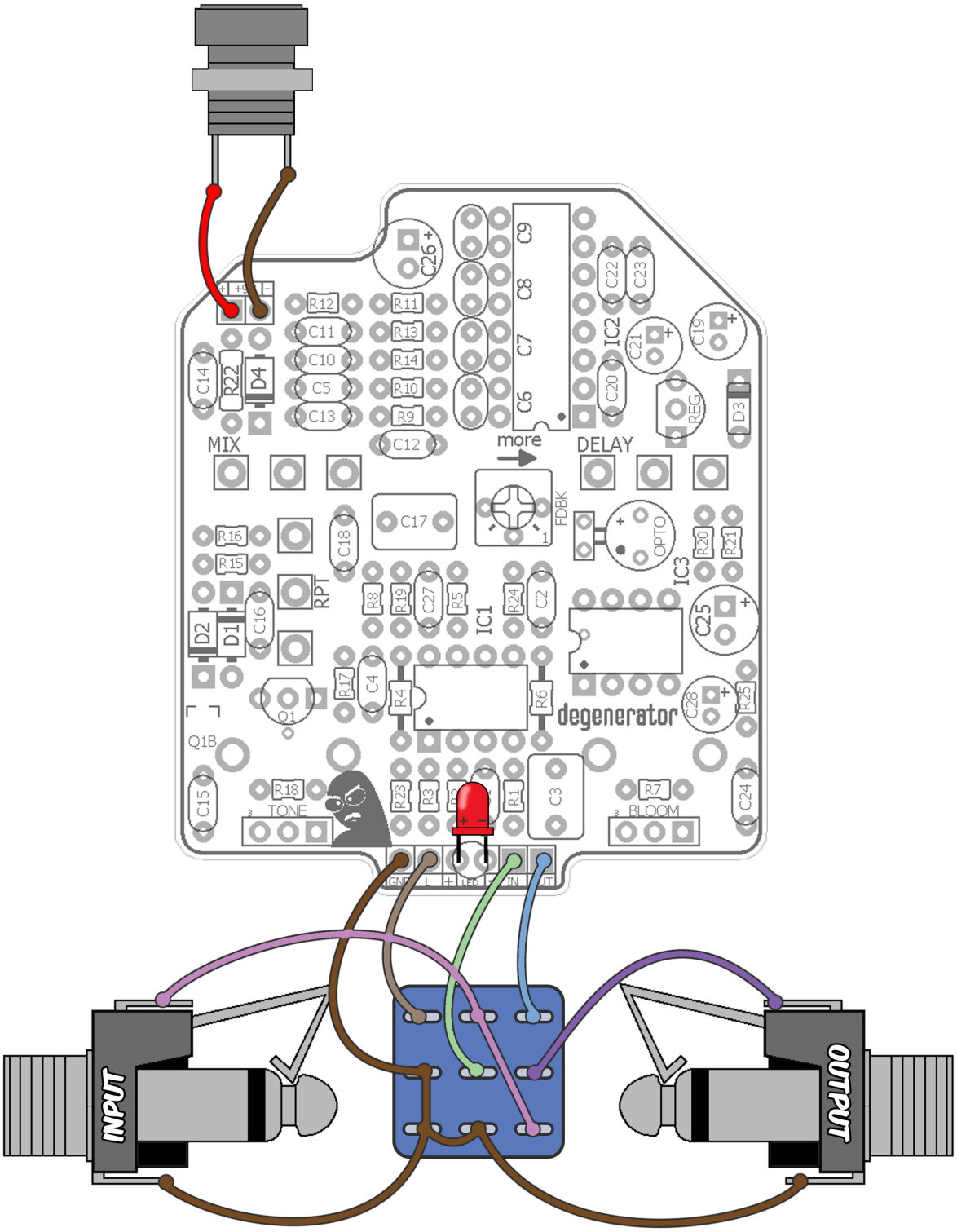
- I picked the NSL32R3 for the optical device because of its small footprint (something needed for this 1590B design). If you do not have one, you can roll your own with an LED and LDR. Any decent LDR will probably work fine since its only performing a very limited action. For the LED, use 3mm yellow 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.



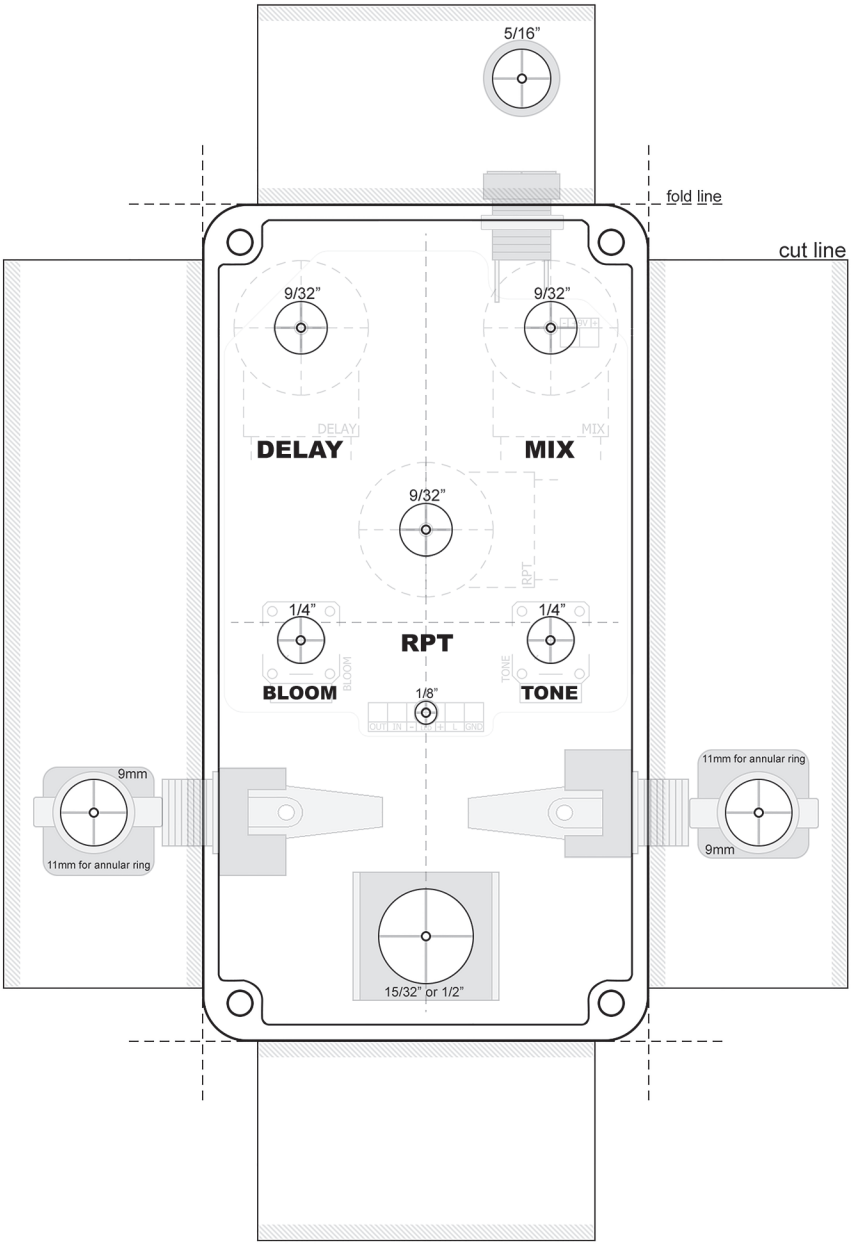
Note the orientation of the Opto device. "+" is the LED anode, and the dot is the LED cathode. The two pads on the left are for the LDR. One end connects to R20 and the other end to ground, putting both resistances in parallel.

- 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 whacky!


INPUT
OUTPUT
MIX
DELAY
more
TONE
BLOOM
degenerator
IC1
IC2
IC3
RPT
FDBK
OPTO
REG
LED

Note: *Drill Guides are approximate and may require tweaking depending on the types of jacks, switches and pots you use.*



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

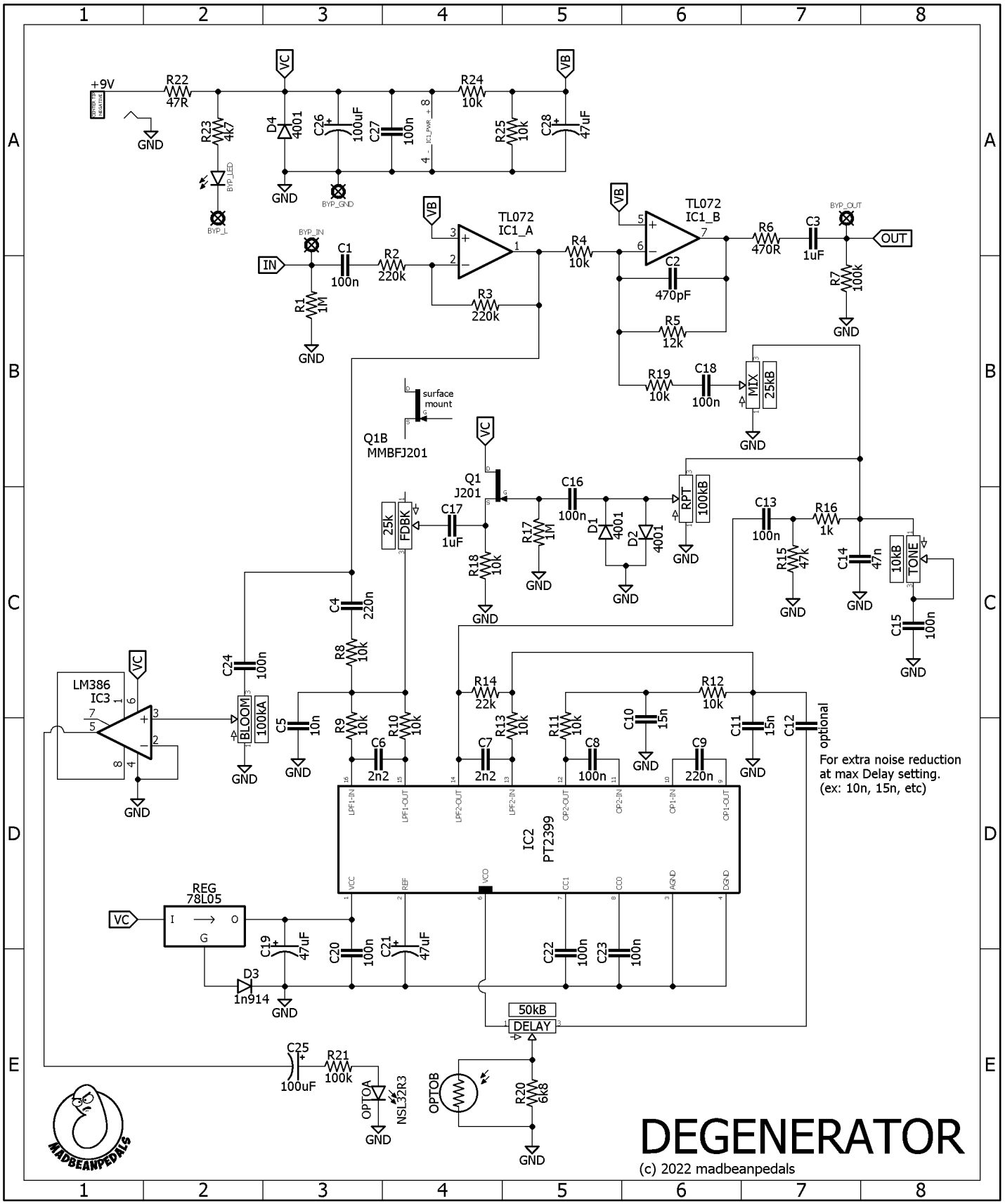
IC2	PT2399
1	5.68
2	2.85
3	0
4	0
5	3.21
6	2.85
7	0.71
8	0.72
9	2.85
10	2.85
11	2.85
12	2.85
13	2.85
14	2.85
15	2.85
16	2.85

	78L05
In	8.06
G	0.65
Out	5.68

Q1	J201
D	8.06
S	0.67
G	88mV

- 9.42vDC One Spot
- Current Draw: 38mA
- Testing Conditions: all knobs at 12 o’clock

When I drilled the enclosure for my build, I forgot the DC jack needed to be offset. So, I covered the extra hole with a rubber grommet and added a second LED that turns on with power.


DEGENERATOR
(c) 2022 madbeanpedals
+9V
R22 47R
R23 4k7
D4 4001
C26 100uF
C27 100n
R24 10k
R25 10k
C28 47uF
VC
VB
GND
BYP_LED
BYP_J
BYP_GND
BYP_IN
BYP_OUT
IN
OUT
C1 100n
R2 220k
R1 1M
R3 220k
TL072 IC1_A
R4 10k
TL072 IC1_B
R6 470R
C3 1uF
C2 470pF
R5 12k
R7 100k
R19 10k
C18 100n
MIX 25kB
surface mount
Q1B MMBFJ201
Q1 J201
C16 100n
D1 4001
D2 4001
RPT 100kB
25k
FDBK
C17 1uF
R17 1M
R18 10k
C13 100n
R16 1k
R15 47k
C14 47n
10kB TONE
C15 100n
C4 220n
R8 10k
C24 100n
LM386 IC3
BLOOM 100kA
C5 10n
R9 10k
R10 10k
C6 2n2
C7 2n2
R14 22k
R13 10k
R11 10k
C8 100n
C10 15n
R12 10k
C11 15n
C12 optional
C9 220n
For extra noise reduction at max Delay setting. (ex: 10n, 15n, etc)
IC2 PT2399
LPF1-IN
LPF1-OUT
LPF2-OUT
LPF2-IN
OP2-OUT
OP2-IN
OP1-IN
OP1-OUT
VCC
REF
VCO
CC1
CC0
AGND
DGND
REG 78L05
C19 47uF
C20 100n
C21 47uF
C22 100n
C23 100n
D3 1n914
50kB DELAY
C25 100uF
R21 100k
OPTOA
NSL32R3
OPTOB
R20 6k8