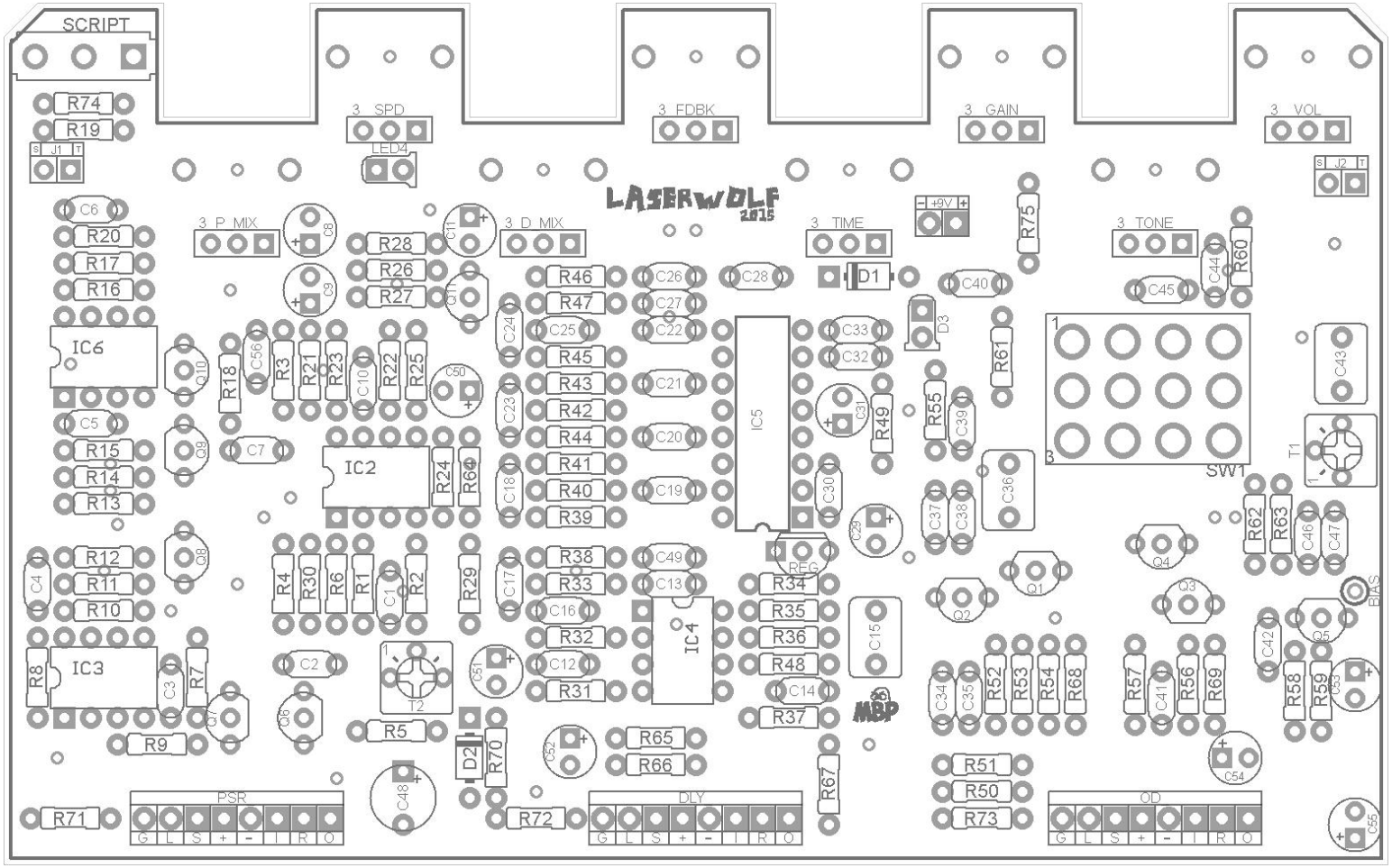
LASERWOLF

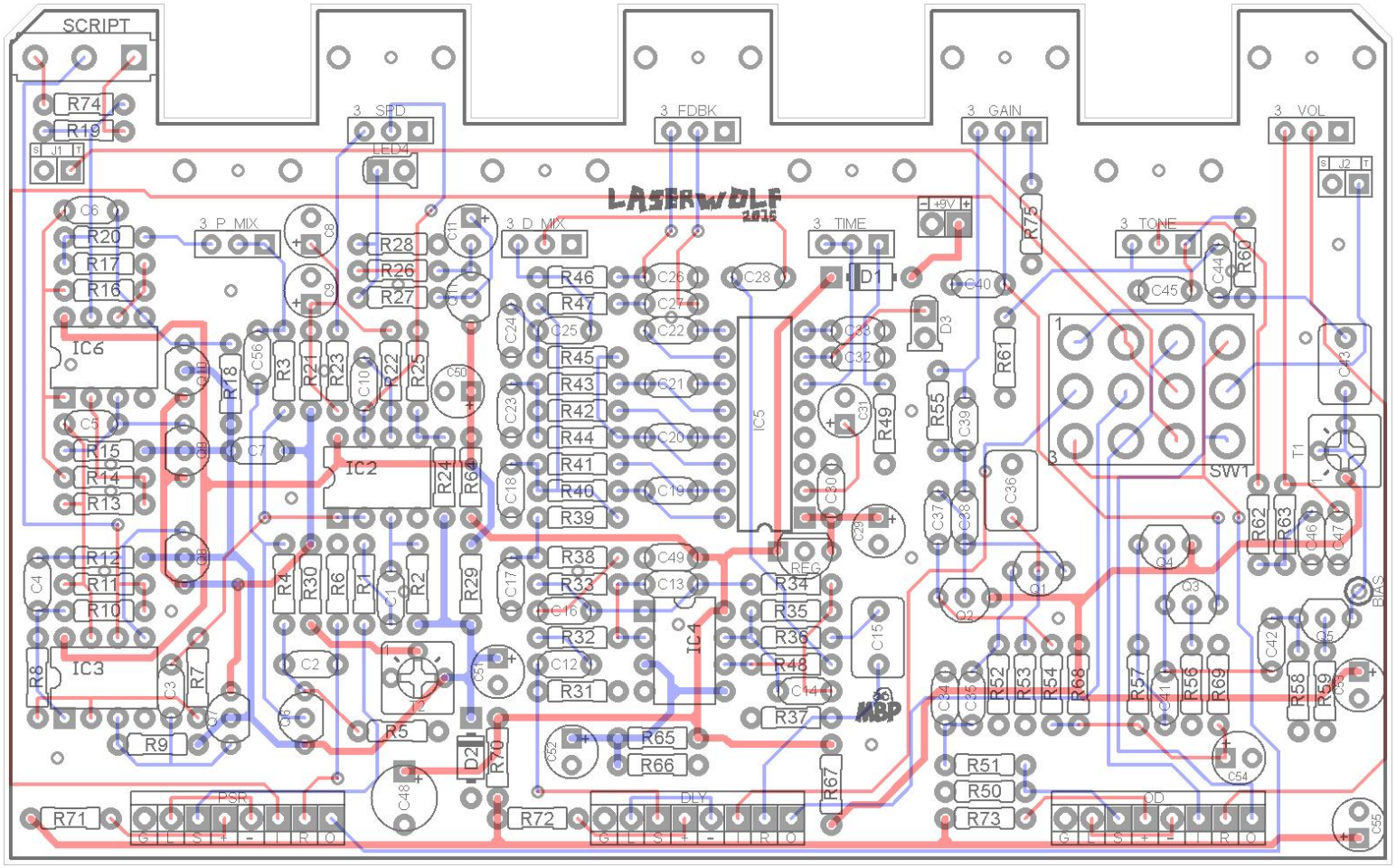
FX TYPE: Multi FX

2015 edition

Previous Version: http://www.madbeanpedals.com/projects/Laserwolf/Laserwolf_2014.pdf

5.2”W x 3.225“H





You can download the Photoshop template used for the drilling guide here:
www.madbeanpedals.com/projects/Laserwolf/Laserwolf_DRILL.zip

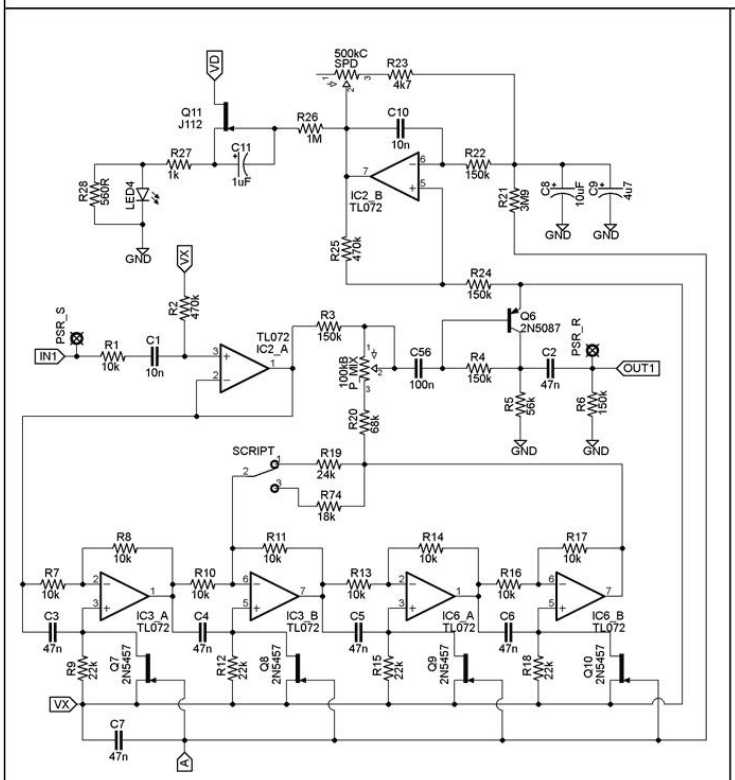
B.O.M.

Resistors		Resistors		Caps		Caps		IC	
R1	10k	R39	10k	C1	10n	C39	470pF	IC2	TL072
R2	470k	R40	10k	C2	47n	C40	150pF	IC3	TL072
R3	150k	R41	10k	C3	47n	C41	100n	IC4	TL072
R4	150k	R42	10k	C4	47n	C42	22n	IC5	PT2399
R5	56k	R43	10k	C5	47n	C43	1uF	IC6	TL072
R6	150k	R44	20k	C6	47n	C44	10n	Regulator	
R7	10k	R45	1k	C7	47n	C45	10n	REG	LM78L05
R8	10k	R46	1k	C8	10uF	C46	1n	Switches	
R9	22k	R47	12k	C9	4u7	C47	2n2	SW1	4PDT
R10	10k	R48	12k	C10	10n	C48	470uF	SCRIPT	SPDT
R11	10k	R49	1k5	C11	1uF	C49	100n	Trimmers	
R12	22k	R50	1M	C12	100n	C50	10uF	T1	100k
R13	10k	R51	470R	C13	10pF	C51	22uF	T2	250k
R14	10k	R52	1M	C14	100pF	C52	10uF	Pots	
R15	22k	R53	10k	C15	1uF	C53	10uF	TONE	100kA
R16	10k	R54	10M	C16	100n	C54	10uF	VOL	100kA
R17	10k	R55	470k	C17	4n7	C55	10uF	P_MIX	100kB
R18	22k	R56	10k	C18	4n7	C56	100n	TIME	25kB
R19	24k	R57	10M	C19	2n2	Diodes		GAIN	500kA
R20	68k	R58	82k	C20	2n2	D1	1N5817	SPD	500kC
R21	3M9	R59	4k7	C21	100n	D2	5.1v Zener	D_MIX	50kB
R22	150k	R60	47k	C22	100n	D3	GREEN 5MM	FDBK	50kB
R23	4k7	R61	82k	C23	4n7	Transistors			
R24	150k	R62	10k	C24	47n	Q1	2N5457		
R25	470k	R63	10k	C25	220n	Q2	2N5457		
R26	1M	R64	22R	C26	47n	Q3	2N5457		
R27	1k	R65	100k	C27	22n	Q4	2N5457		
R28	560R	R66	100k	C28	220n	Q5	J201		
R29	10k	R67	22R	C29	10uF	Q6	2N5087		
R30	1M	R68	10k	C30	100n	Q7	2N5457		
R31	1M	R69	10k	C31	47uF	Q8	2N5457		
R32	470k	R70	330R	C32	100n	Q9	2N5457		
R33	470k	R71	4k7	C33	100n	Q10	2N5457		
R34	22k	R72	4k7	C34	220pF	Q11	J112		
R35	20k	R73	4k7	C35	22n				
R36	470R	R74	18k	C36	1uF				
R37	100k	R75	2k2	C37	56n				
R38	10k			C38	22n				

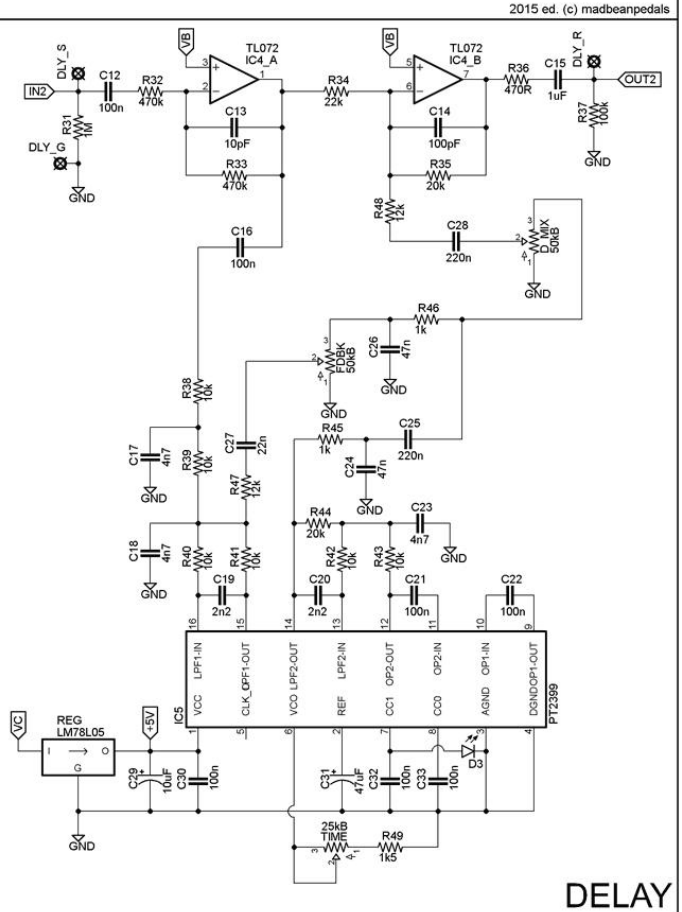
Shopping List							
Value	QTY	Type	Rating	Value	QTY	Type	Rating
22R	2	Metal / Carbon Film	1/4 W	1n	1	Film	16v min
330R	1	Metal / Carbon Film	1/4 W	2n2	3	Film	16v min
470R	2	Metal / Carbon Film	1/4 W	4n7	3	Film	16v min
560R	1	Metal / Carbon Film	1/4 W	10n	4	Film	16v min
1k	3	Metal / Carbon Film	1/4 W	22n	4	Film	16v min
1k5	1	Metal / Carbon Film	1/4 W	47n	8	Film	16v min
2k2	1	Metal / Carbon Film	1/4 W	56n	1	Film	16v min
4k7	5	Metal / Carbon Film	1/4 W	100n	10	Film	16v min
10k	22	Metal / Carbon Film	1/4 W	220n	2	Film	16v min
12k	2	Metal / Carbon Film	1/4 W	1uF	3	Film	16v min
18k	1	Metal / Carbon Film	1/4 W	1uF	1	Electrolytic	16v min
20k	2	Metal / Carbon Film	1/4 W	4u7	1	Electrolytic	16v min
22k	5	Metal / Carbon Film	1/4 W	10uF	7	Electrolytic	16v min
24k	1	Metal / Carbon Film	1/4 W	22uF	1	Electrolytic	16v min
47k	1	Metal / Carbon Film	1/4 W	47uF	1	Electrolytic	16v min
56k	1	Metal / Carbon Film	1/4 W	470uF	1	Electrolytic	16v min
68k	1	Metal / Carbon Film	1/4 W	TL072	4		
82k	2	Metal / Carbon Film	1/4 W	PT2399	1		
100k	3	Metal / Carbon Film	1/4 W	LM78L05	1	T0-92	
150k	5	Metal / Carbon Film	1/4 W	1N5817	1		
470k	5	Metal / Carbon Film	1/4 W	5.1v	1	Zener	
1M	5	Metal / Carbon Film	1/4 W	LED	1	Green Diffused	5mm
3M9	1	Metal / Carbon Film	1/4 W	4PDT	1	Solder Lug	
10M	2	Metal / Carbon Film	1/4 W	SPDT	1	On/Off/On PCB Mount	
10pF	1	Ceramic	16v min	100k	1	Bourns 3362P	
100pF	1	Ceramic	16v min	250k	1	Bourns 3362P	
150pF	1	Ceramic	16v min	100kB	1	PC Mount Right Angle	9mm
220pF	1	Ceramic	16v min	25kB	1	PC Mount Right Angle	9mm
470pF	1	Ceramic	16v min	100kA	2	PC Mount Right Angle	9mm
				50kB	2	PC Mount Right Angle	9mm
				500kA	1	PC Mount Right Angle	9mm
				500kC	1	PC Mount Right Angle	9mm

- Q7 – Q10 (2N5457) must be matched for the phaser section.
- You can sub a 2n5457 for the J112 transistor. This is only for the Phaser LFO indicator and is not essential to the operation of the circuit.

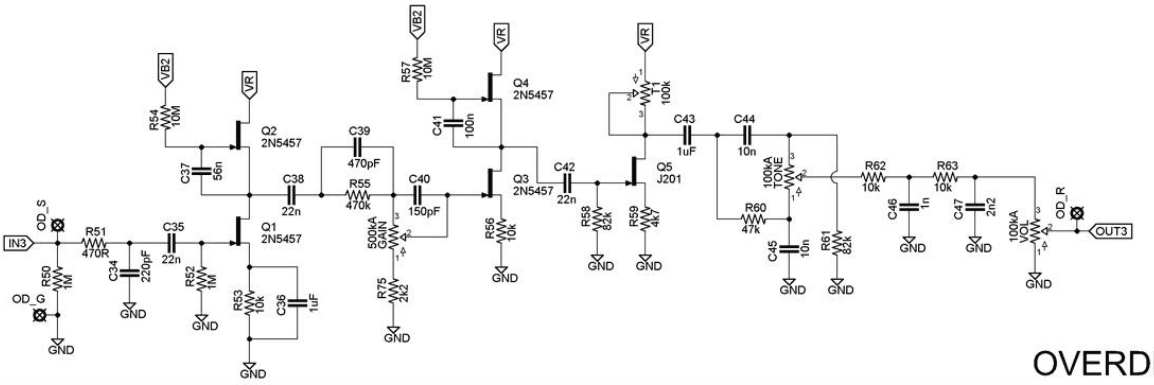
LASERWOLF



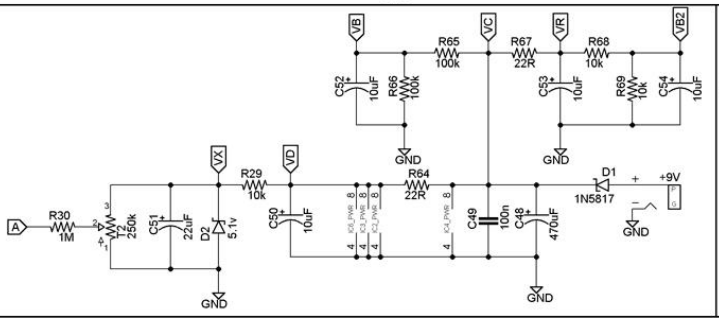
PHASER

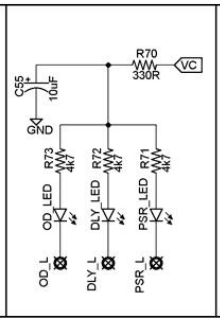


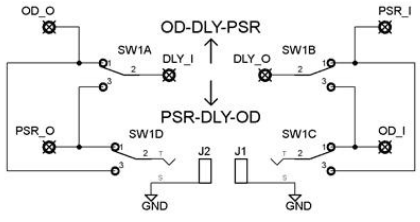
DELAY

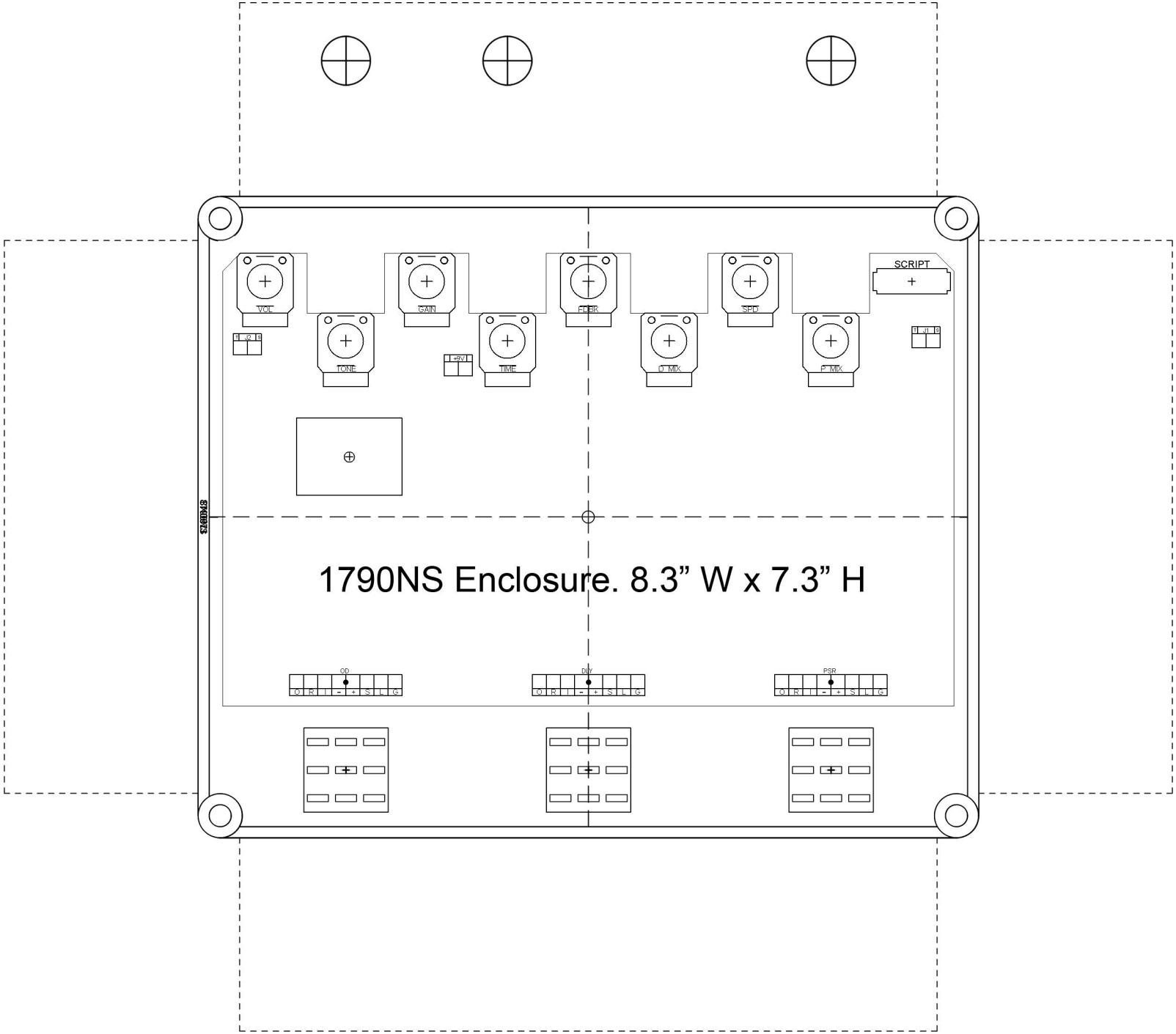


OVERDRIVE








VOL
TONE
GAIN
+9V
TIME
FDBK
D MIX
SPD
P MIX
SCRIPT
+
J2
J1
S246D9438
1790NS Enclosure. 8.3” W x 7.3” H
OD
DLY
PSR
O R T - + S L G

Overview

The **Laserwolf** is the first madbeanpedals multi-effect project. It is an attempt to replicate some of the coveted tones off the first few Van Halen albums. EVH famously used few effects straight into his Marshall amps to achieve what we all know as the “brown sound”. While I don’t claim the **Laserwolf** copies this sound exactly it will at least get you in the ballpark…probably the same inning, too!

The **Laserwolf** has three effect components: a phaser, a delay and an overdrive. The Phaser is a Phase 90 with a couple of extra mods. The delay is a standard PT2399-based delay voiced for degrading repeats. The overdrive is a mash-up of the BSIABII and the Wampler® Pinnacle™ (both being very similar).

The signal path can be altered via a 4PDT switch, as well. This offers the option of Phaser-Delay-Overdrive or Overdrive-Delay-Phaser (in series). Each effect can be turned on and off via the stomp switches. The reason for the order switching is that the Phaser-Delay-Overdrive option is most similar to how EVH used his effects; a Phase90 into an Echoplex into his amp. The second option, Overdrive-Delay-Phaser is closer to how guitar players arrange pedals on a pedalboard (overdrive before modulation or delay). Ideally, we might want a third option of Overdrive-Phaser-Delay but this would require yet another switch in an already complex build. However, the two existing options offer plenty of vareity and they do indeed sound different from one another.

Controls

OD Section: Vol, Tone and Gain.
Delay Section: Mix, Feedback and Delay.
Phaser Section: Speed, Mix and “Script”.

The OD and Delay controls are self-explanatory. The Feedback control on the delay will go into self-oscillation when turned up. You can modify where it does this by changing the value of R47. Lower values will result in earlier oscillation. A high enough value will prevent the delay from self-oscillating altogether.

The Phaser controls require explaining. The Speed control is obvious; down is slow and up is fast. You should use the C-Taper (reverse audio) listed. A B-taper will work but most of the speed changes will only happen in the last 1/3 of the rotation with it.

The Mix control is not standard. Fully counter-clockwise is the standard Phase 90 effect. As you turn the Mix control up, the effect slowly changes into vibrato instead of phase. The vibrato works best at medium speeds; too slow and you do not get much of an effect, and too fast the phase and vibrato sound pretty much the same.

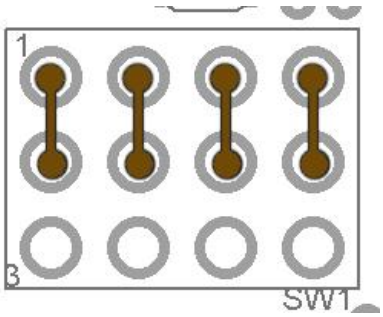
Finally, the “Scipt” switch gives three options: two levels of phase feedback or no feedback (middle position). R19 and R74 set the amount of feedback level. I just picked what I liked in this circuit, but feel free to socket those resistors and play with them. Don’t go too low on the resistor values or you will just get a noisy mess. If you do not want feedback options, simply leave the switch off. Or, if you prefer just one feedback option use an On/On SPDT instead and leave R74 empty.

4PDT

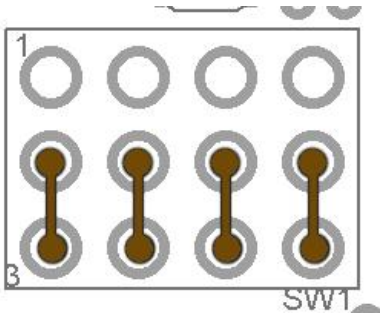
The general lack of a small profile PCB-mounted 4PDT makes for a less than ideal combination of component footprints in the Laserwolf. The 4PDT toggle is really tall which causes the 9mm pots to hang further away from the enclosure when everything is soldered onto the PCB. It will require you to put a bit of pressure on the PCB to get the threads of the pots to clear the drill holes on your enclosure; not very much…just a little. I would avoid over-tightening the nuts on the pots to keep the pressure to a minimum. Finger-tight plus a little more should be enough to hold everything in place.

Alternatively, you could simply not push the 9mm pots all the way flush to the PCB to give them some extra height to match the 4PDT. A simple spacer underneath the pots when soldering would make this a relatively straight-forward task.

You can omit the 4PDT if you do not want to have the order switching option by soldering jumpers between the middle row of pads to either of the outside rows.



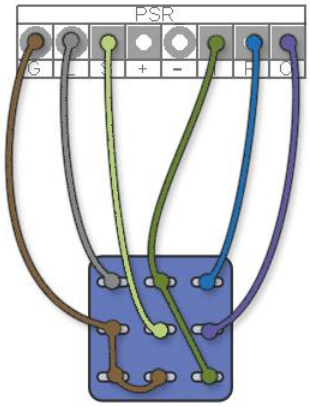
Phaser-Delay-Overdrive (Up Position)



Overdrive-Delay-Phaser (Down Position)

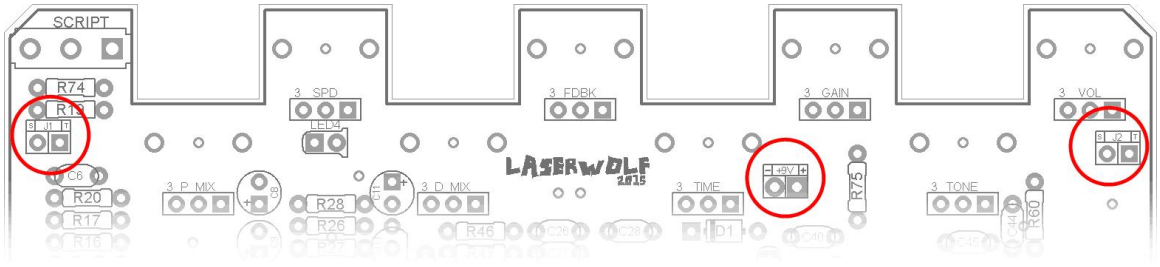
Wiring

Luckily, wiring the Laserwolf is incredibly easy!



This is the standard input-grounded scheme I use. You do not need to wire anything between the stomp switches, only to the bypass pads as shown. The + and – pads are for your indicator LED. These LEDs can be soldered directly to the PCB and do not require a bezel on the enclosure (unless you want one).

Near the top of the PCB, J1 is wired to your INPUT jack. J2 goes to the OUTPUT jack. And the +9v and Ground pads go to your DC jack.



LED4 is the speed indicator for the Phaser effect. It can be soldered directly to the PCB, or left off entirely, if you like. Regarding LED4: I would socket R28 (the 560R resistor). This was used to "pull down" the LED on the bottom part of its swing to make the flashing more obvious. But, it can make the LED pretty unsymmetrical in its cycle. If you don't like this, simply pull R28 from its socket.

Assembly Notes

Overdrive: There is one bias setting to perform. T1 sets the bias for the Q5 transistor. You can set this anywhere from 4.5 – 6.5v. I ended up with 6.5v on mine. You'll see there is a "Bias" pad right next to Q5 for your DMM.

Mods:
More gain – lower R53 to 1k. Use J201 instead of 2n5457.
More volume output – lower R59 to 1k5.

C40 is a treble bleed cap on the Gain pot. Its stock value is 150pF. I did not like this on my build…it just felt thin and weak at low gain settings. So, I omitted it from my build. YMMV.

Delay: This is pretty much plug and play. You can manipulate the self-oscillation point by altering the value of R47 as I described earlier in the doc. You can increase the dry signal output by lowering the value of R34. You can increase the delay output by lowering the value of R48. The stock setting is about unity output on the dry signal and the delays are slightly louder than dry when the Mix knob is all the way up. You can increase the signal degradation of the repeats by changing R46 to 2k and C23 to 15n (like the Deep Blue Delay™).

Phaser: The phaser requires matched transistors for Q7, Q8, Q9 and Q10 to work properly. You can match these yourself or purchase matched sets from some online vendors. For info on who to match them, check out the documentation for the **Nom Nom project.**

T2 sets the Vb bias for the phaser. It's easy to dial in; just set the Speed control about half way up and adjust T2 until you get proper phasing. You can use different Speed settings to zone in on the optimal setting for T2.

Testing

Take your time. This is a very complicated build. The combination of many parts, switching and just the shear size of it will make it one of the more challenging DIY projects you've attempted. The good news is if you follow all the instructions it will fire right up….mine worked the first time without any hassle. This is rare!

Since you are a thorough builder, I know you will be testing this thing out before wiring it all up and dropping it in an enclosure. I know this because you are a dedicated madbeaner and follow the "rock it before you box it" mantra like the religious doctrine it attempts to be. But, this project must be tested a little differently. You should check the functionality BEFORE soldering in the 4PDT switch. Once that switch it soldered in, you pretty much have to solder the stomp switches for it to work 100%. My suggestion is to assemble everything then wire up the +9v jack, and the S and R pads of each bypass. This is all you need to use on your testing rig. Connect the +9v/ground wires to your testing rig, then use the S (send) and R (return) wires on each effect to test them individually. Once you confirm each one is behaving, go ahead and solder that 4PDT and do the final assembly. As long as you follow the wiring instructions I do not think it is necessary to test it further before putting the entire rig in your enclosure (unless you really want to).

Voltage readings from a 9.4v One Spot supply									
IC5	V	IC4	V	IC2	V	IC3	V	IC6	V
1	4.98	1	4.56	1	4.13	1	4.13	1	4.13
2	2.5	2	4.56	2	4.13	2	4.13	2	4.13
3	0	3	4.54	3	3.94	3	4.13	3	4.13
4	0	4	0	4	0	4	0	4	0
5	2.82	5	4.54	5	varies	5	4.13	5	4.13
6	2.5	6	4.56	6	varies	6	4.13	6	4.13
7	0.61	7	4.57	7	varies	7	4.13	7	4.13
8	0.67	8	9.12	8	8.7	8	8.7	8	8.7
9	2.5								
10	2.5								
11	2.5								
12	2.5								
13	2.5								
14	2.5								
15	2.5								
16	2.5								

Q5 set to 6.5v bias point. You can set this lower for more output (down to 4.5v)
Slight flucations on pin8 of IC2, IC3 and IC6, but seems to be okay.

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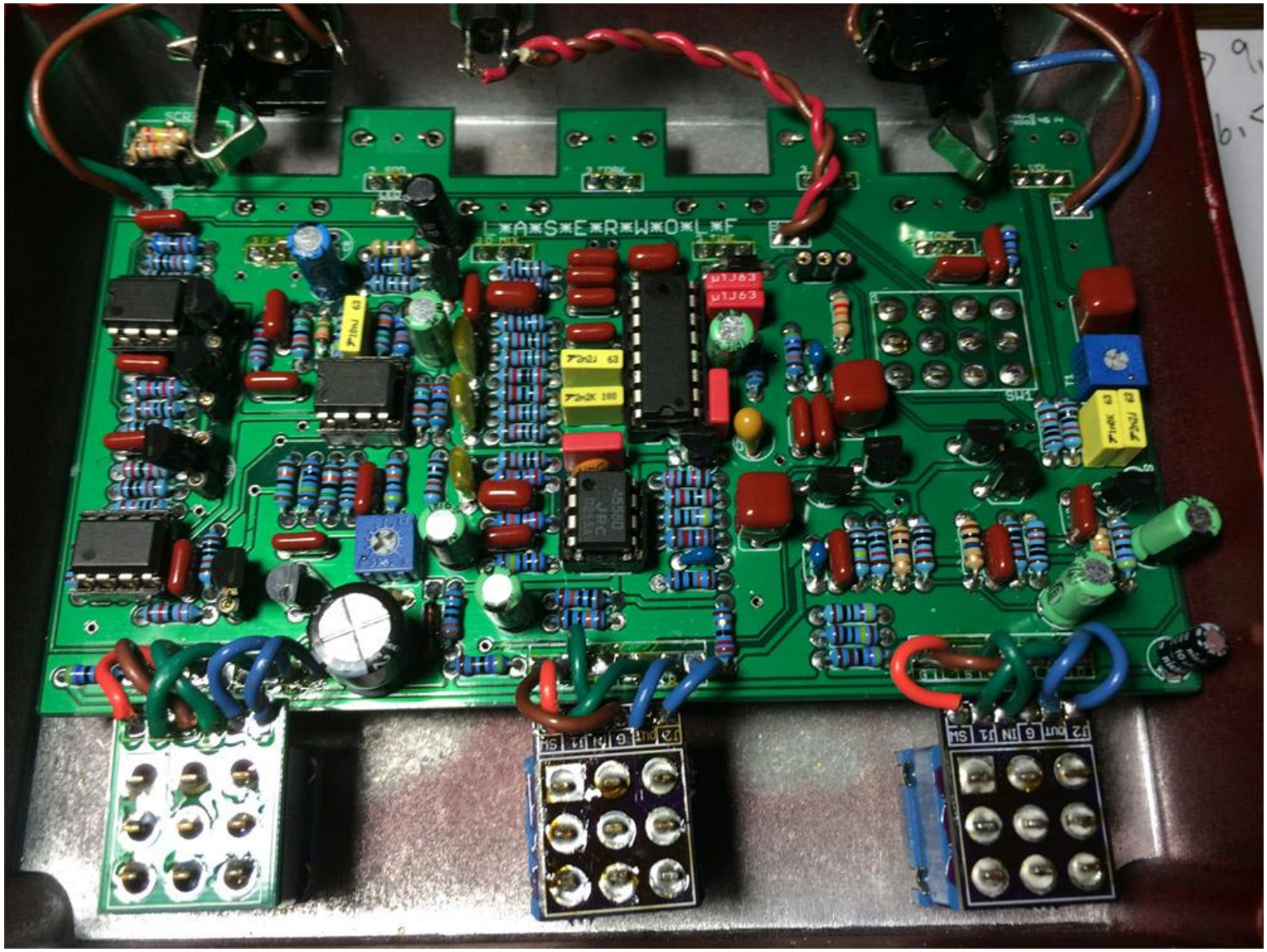

Those are not cold joints on that stomp switch. I swear. Damn Kester solder…grumble grumble.