SMOOTHIE

FX Type: Phaser

Based on the MXR ® Phase 45™

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1.3" W x 1.95" H
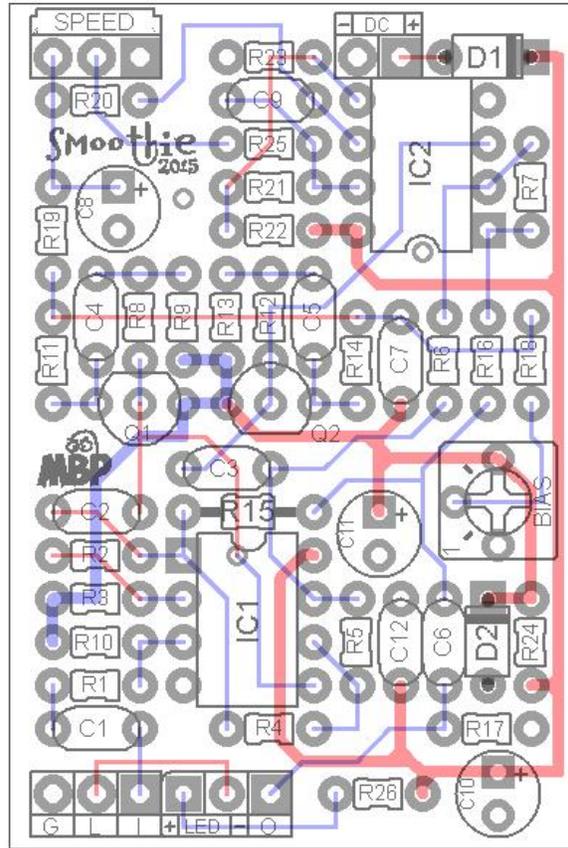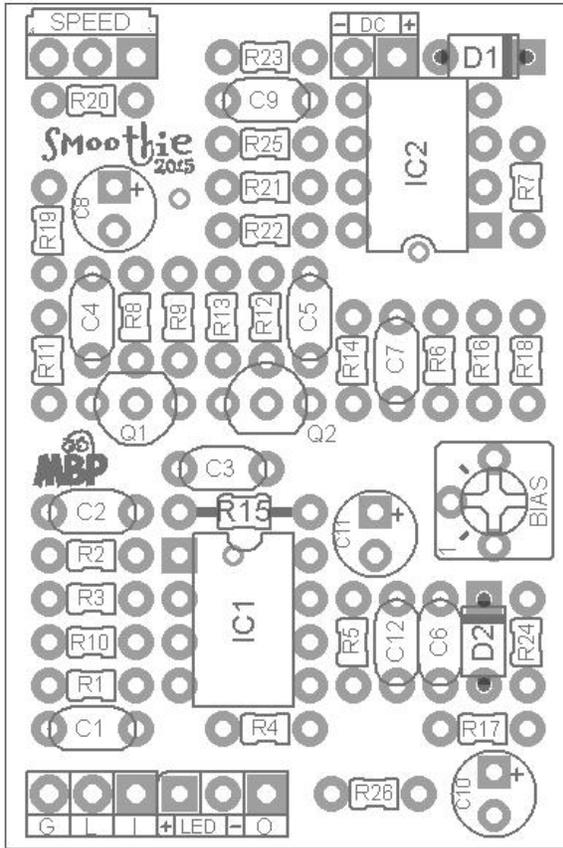
SMOOTHIE

based on the MXR Phase 45 (tm)
2015 ed. (c) madbeanpedals

VB

R24 10k

C11 10uF
D2 4.7v
IC2_PWR +8 4
IC1_PWR +8 4
C12 100n
C10 47uF
GND

D1 1N5817
+ DC
R26 4k7
GND
LED
L
R22 150k

R23 150k
GND

R21 150k
TL072 IC2_B
5 7
6

C7 47n

R9 10k
R11 470k
C4 10n
Q1 2N5457
R13 10k
R14 470k
C5 10n
Q2 2N5457

250k BIAS
3
2
1
GND

R18 1M
R19 3M9
R20 150k

C8 10uF
GND

C9 10n

VB

R10 470k
TL072 IC1_A
3
2
1

C2 47n

R8 10k
TL072 IC1_B
5
6
7

C3 47n

R12 10k
TL072 IC2_A
3
2
1

R16 10k

C6 47n
OUT

500kC SPEED
3
2
1

R25 7k5

IN
C1 10n
R1 10k

R2 10k
R4 10k
R5 10k
R6 10k
R7 10k

R3 20k
VB

R15 10k
R17 150k
GND

2

B.O.M.			
Resistors		**Caps**	
R1	10k	C1	10n
R2	10k	C2	47n
R3	20k	C3	47n
R4	10k	C4	10n
R5	10k	C5	10n
R6	10k	C6	47n
R7	10k	C7	47n
R8	10k	C8	10uF
R9	10k	C9	10n
R10	470k	C10	47uF
R11	470k	C11	10uF
R12	10k	C12	100n
R13	10k	**Diodes**	
R14	470k	D1	1N5817
R15	10k	D2	4.7v Zener
R16	10k	**Transistors**	
R17	150k	Q1	2N5457
R18	1M	Q2	2N5457
R19	3M9	**I.C.**	
R20	150k	IC1	TL072
R21	150k	IC2	TL072
R22	150k	**Trimmer**	
R23	150k	BIAS	250k
R24	10k	**Pot**	
R25	7k5	SPEED	500kC
R26	4k7		

| Shopping List			
Value	**QTY**	**Type**	**Rating**
4k7	1	Metal / Carbon Film	1/8W
7k5	1	Metal / Carbon Film	1/8W
10k	13	Metal / Carbon Film	1/8W
20k	1	Metal / Carbon Film	1/8W
150k	5	Metal / Carbon Film	1/8W
470k	3	Metal / Carbon Film	1/8W
1M	1	Metal / Carbon Film	1/8W
3M9	1	Metal / Carbon Film	1/8W
10n	4	Film	16v min
47n	4	Film	16v min
100n	1	Film	16v min
10uF	2	Electrolytic / Tantalum	16v min
47uF	1	Electrolytic / Tantalum	16v min
1N5817	1		
4.7v Zener	1		
2N5457	2		
TL072	2		
250k	1	Bourns 3362P	
500kC	1	Alpha 9mm	

- You can use a 6k8 or 8k2 for R25, if needed. LFO changes will be minimal.
- You must use matched 2n5457 transistors for the effect to work correctly. See notes.
- Remember that you will need to use low profile electrolytic caps for 1590A builds. Read the Baby Board Build Guide for more info on what types of parts to use for this project.
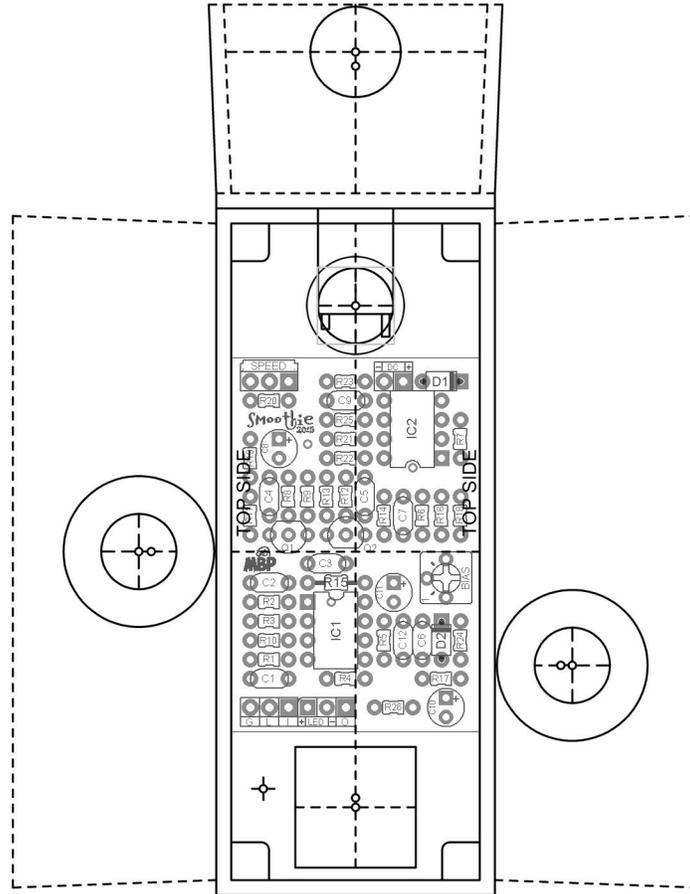
Wiring
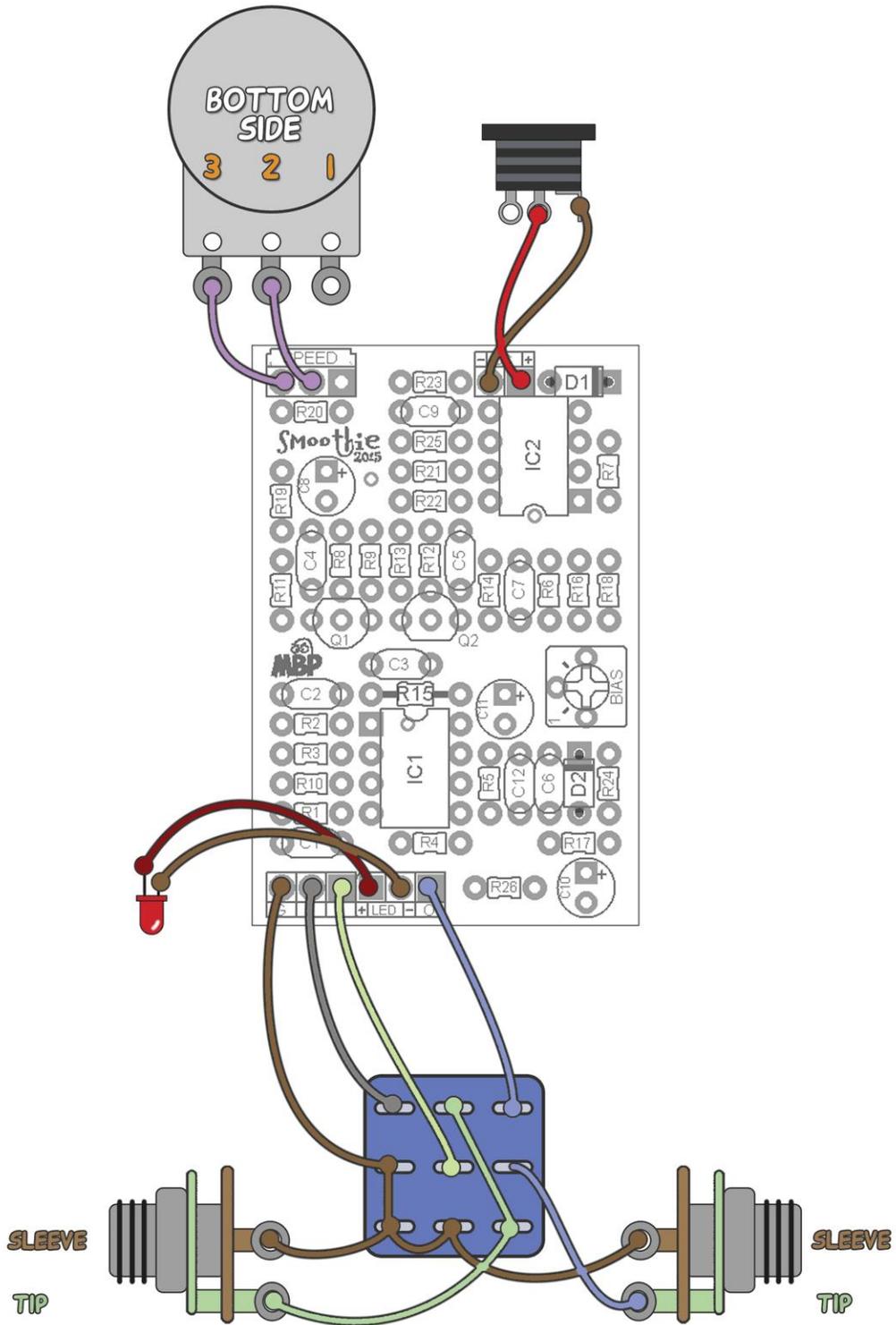
2015 Change Log

- Modified layout somewhat. No circuit changes other than replacing 1N4001 voltage protection with 1N5817,

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Overview

The **Smoothie** is based directly on the classic MXR Phase 45™. The Phase 45 is a two stage phaser driven by simple LFO. The input is fed through a filter network created by IC1B/C. The bias is supplied by the two JFET transistors that in turn are powered by the LFO generated by IC2B. Finally, the input signal is mixed via **R15** just before the output.

To learn more about how phasers function, please refer to **"The Technology of Phase Shifters and Flangers"** by R.G. Keen.

Speed – Sets the rate of the LFO that drives the phase shift.

Notes

The Phase 45 originally used 2N5952 JFETS. The **Smoothie** lists 2N5457 for **Q1** and **Q2** because they are more widely available and work just as well as the 2N5952. You may use either, but keep in mind that the pinout for the 2N5952 is opposite the 2N5457. This means you will need to rotate the transistors 180° on the PCB if you use 2N5952.

The **Smoothie** also requires the JFET transistors to be *matched*. While you may be able to stick a couple of random JFETS in there and get lucky, the best result comes from matching the cutoff voltages for the two transistors as closely as possible. This is actually very easy to do, provided you have a quantity of transistors available to work with.

The process involves placing individual transistors in a test circuit on a breadboard. Each device is then measured with a multimeter to read its gate/source cutoff voltage. This is the measurement you want to match with another transistor. The goal is to find two transistors whose Vgs are within just a couple of percent of one another. The closer the match, the better response one gets in the phase circuit. This process takes all of five minutes once you have the circuit ready to test the devices, so do not be discouraged…it is actually very straight-forward. The only caveat is that you generally want to have a decent pile of transistors available to match because the Vgs values can range widely between individual transistors. 25-50 transistors should be enough to find a match. You should be able to purchase that quantity relatively inexpensively. Plus, you will be left with many extra transistors for future projects!

If you wish to try matching your own JFETS, please refer to this excellent project posted by Jacob Kokura the madbeanpedals forum:

http://www.madbeanpedals.com/forum/index.php?topic=3098.0

More info about matching JFETs for phase shifters:
http://www.geofex.com/article_folders/fetmatch/fetmatch.htm

If you do not wish to match your own transistors, you can sometimes find matched pairs for sale. **GuitarPCB** has matched 2N5952 pairs for sale at the time of this writing.

Setup

Set the **Speed** control between 50-70% up. Adjust the **BIAS** trimpot to approximately the middle position. You should hear the phase sweep as you play. Now make minute adjustments to the trimpot until the rise and fall of the sweep are symmetrical. IOW, the rise and fall of the sweep should take about the same amount of time.