SHARKFIN

FX Type: Filter - Sample/Hold

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Download the document for the previous version here:
http://www.madbeanpedals.com/projects/Sharkfin/Sharkfin.zip
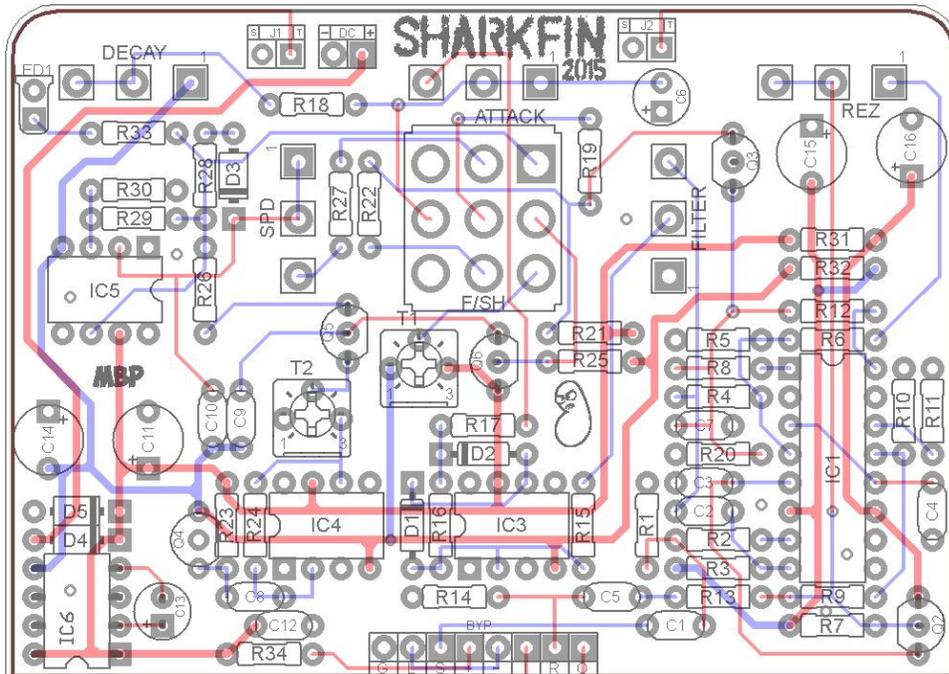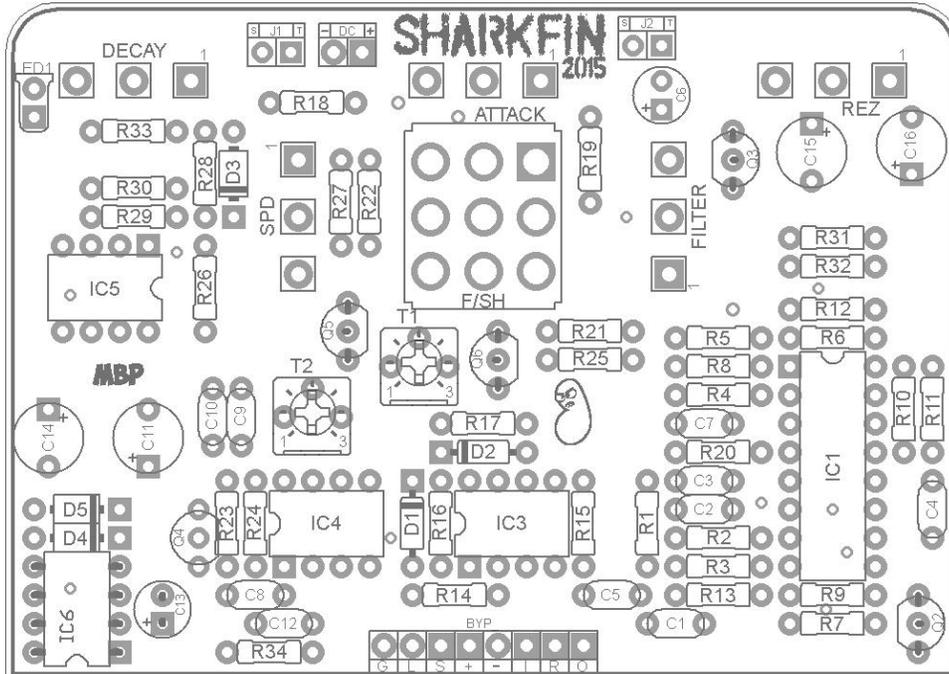
3.35" W x 2.375" H
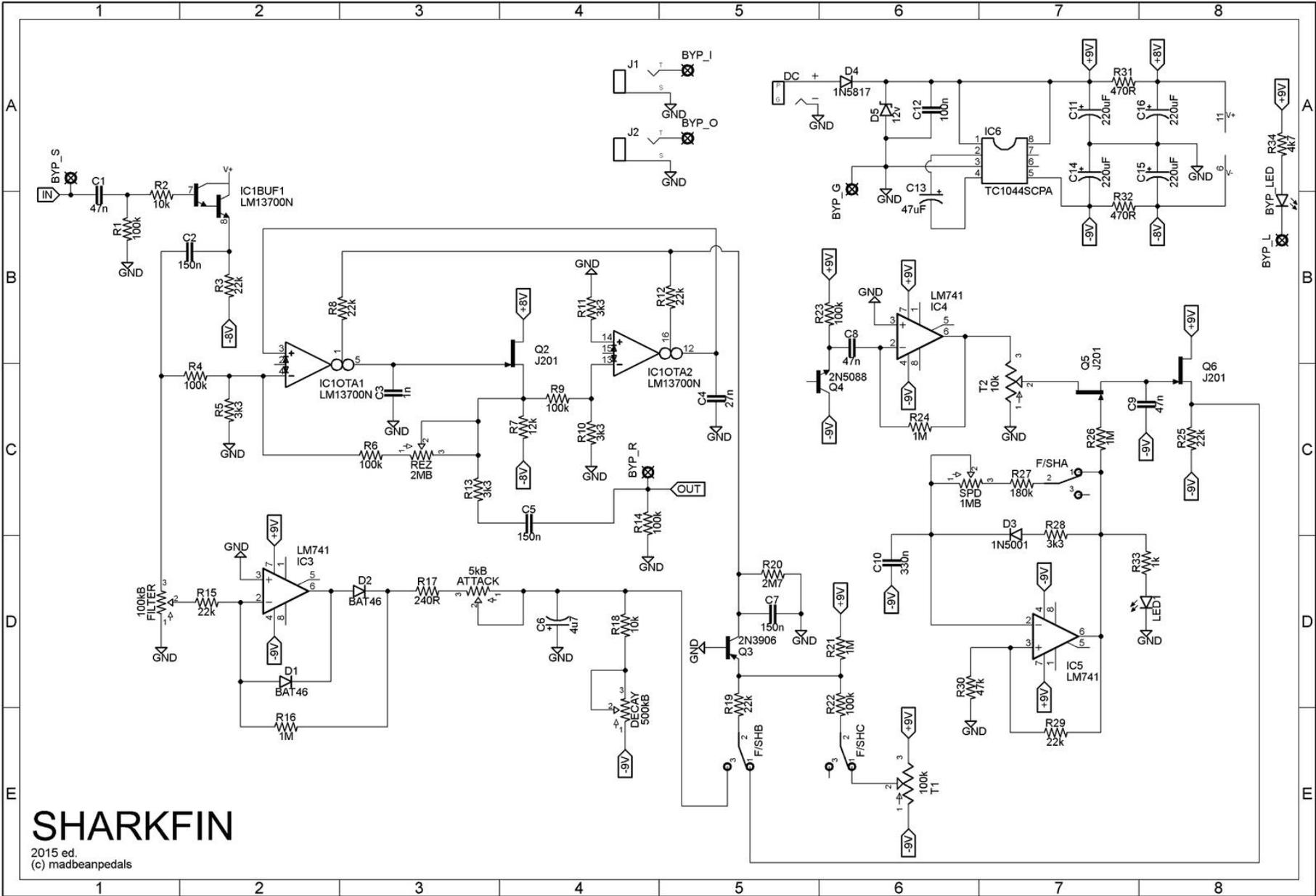
SHARKFIN

2015 ed.
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B.O.M.

Resistors		Caps		Diodes	
R1	100k	C1	47n	D1, D2	BAT46
R2	10k	C2	150n	D3	1N4001
R3	22k	C3	1n	D4	1N5817
R4	100k	C4	27n	D5	12v Zener
R5	3k3	C5	150n	**Transistors**	
R6	100k	C6	4u7	Q2	J201
R7	12k	C7	150n	Q3	2N3906
R8	22k	C8	47n	Q4	2N5088
R9	100k	C9	47n	Q5	J201
R10	3k3	C10	330n	Q6	J201
R11	3k3	C11	220uF	**I.C.**	
R12	22k	C12	100n	IC1	LM13700
R13	3k3	C13	47uF	IC3	LM741
R14	100k	C14	220uF	IC4	LM741
R15	22k	C15	220uF	IC5	LM741
R16	1M	C16	220uF	IC6	TC1044SCPA
R17	240R			**Trimpots**	
R18	10k			T1	100k
R19	22k			T2	10k
R20	2M7			**Switch**	
R21	1M			F/SH	3PDT
R22	100k			**Pots**	
R23	100k			REZ	2MB
R24	1M			SPD	1MB
R25	22k			ATTACK	5kB
R26	1M			DECAY	500kB
R27	180k			FILTER	100kB
R28	3k3				
R29	22k				
R30	47k				
R31	470R				
R32	470R				
R33	1k				
R34	4k7				

- MAX1044CPA or ICL7660SCPA should work for IC6. Tests were also done with the LT1054 (with pin1 lifted) and produced no discernable difference so you should be able to sub that, as well.

- BAT46 for D1, D2: I prefer these diodes here because they make the filter very responsive and dynamic. If you cannot get these, then either BAT41 or 1n914 will work fine.

Shopping List			
Value	QTY	Type	Rating
240R	1	Carbon / Metal Film	1/4W
470R	2	Carbon / Metal Film	1/4W
1k	1	Carbon / Metal Film	1/4W
3k3	5	Carbon / Metal Film	1/4W
4k7	1	Carbon / Metal Film	1/4W
10k	2	Carbon / Metal Film	1/4W
12k	1	Carbon / Metal Film	1/4W
22k	7	Carbon / Metal Film	1/4W
47k	1	Carbon / Metal Film	1/4W
100k	7	Carbon / Metal Film	1/4W
180k	1	Carbon / Metal Film	1/4W
1M	4	Carbon / Metal Film	1/4W
2M7	1	Carbon / Metal Film	1/4W
1n	1	Film	25v min.
27n	1	Film	25v min.
47n	3	Film	25v min.
100n	1	Film	25v min.
150n	3	Film	25v min.
330n	1	Film	25v min.
4u7	1	Electrolytic	25v min.
47uF	1	Electrolytic	25v min.
220uF	4	Electrolytic	25v min.
BAT46	2		
1N4001	1		
1N5817	1		
12v Zener	1		1W
J201	3		
2N3906	1		
2N5088	1		
LM13700	1		
LM741	3		
TC1044SCPA	1		
100k	1	Bourns 3362P	
10k	1	Bourns 3362P	
3PDT	1	Toggle, Solder Lug	
2MB	1	PCB Short Pin	16mm
1MB	1	PCB Short Pin	16mm
5kB	1	PCB Short Pin	16mm
500kB	1	PCB Short Pin	16mm
100kB	1	PCB Short Pin	16mm

1590BB Drill Guide

5.8" W x 6.8" H
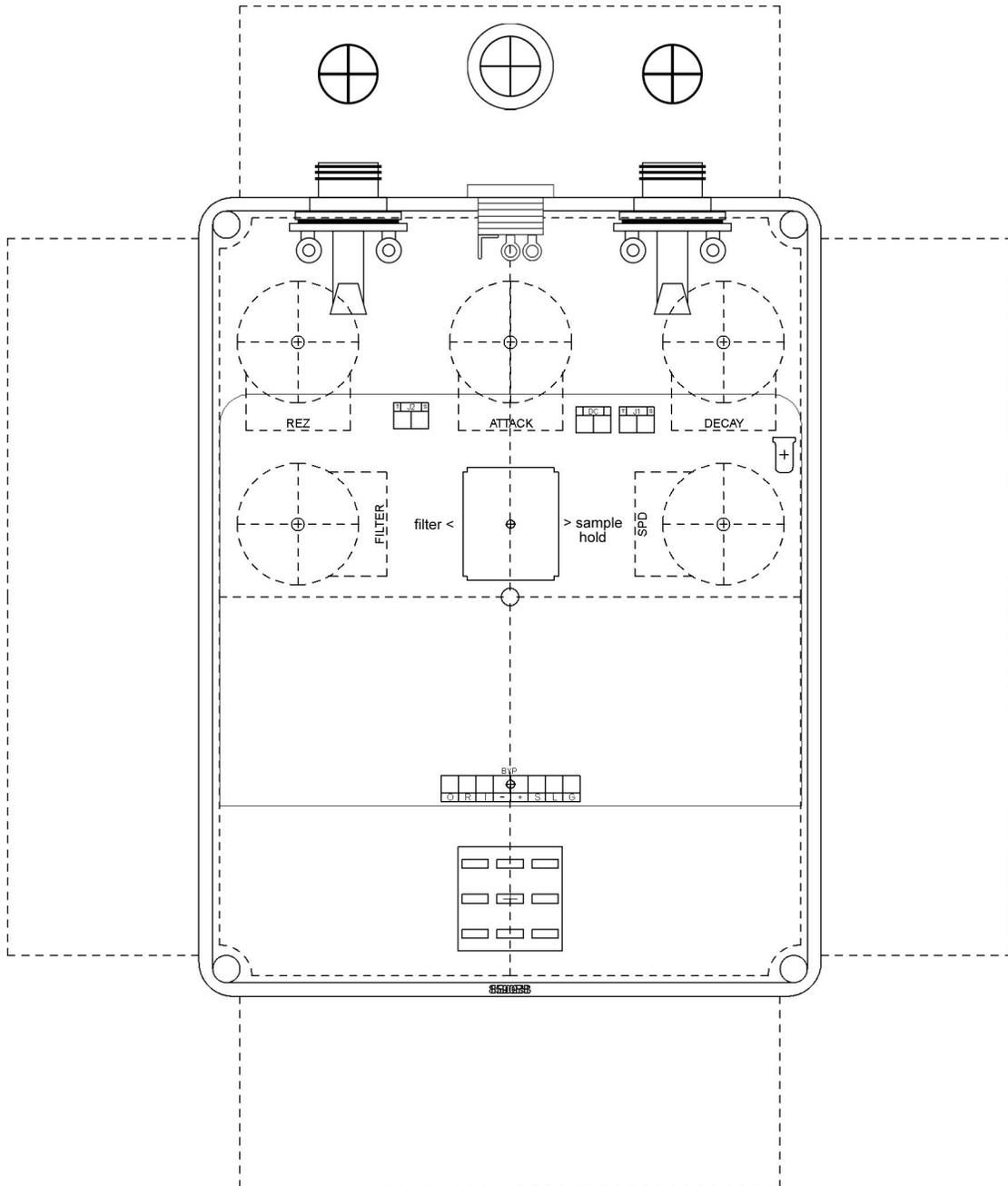
REZ

ATTACK

DECAY

FILTER

filter <

> sample
hold

SPD

BYP

O R I - + S L G

The F/S&H toggle is set so that the bat of the switch points toward the effect in use. IOW, left is Filter and right is S&H.

Wiring
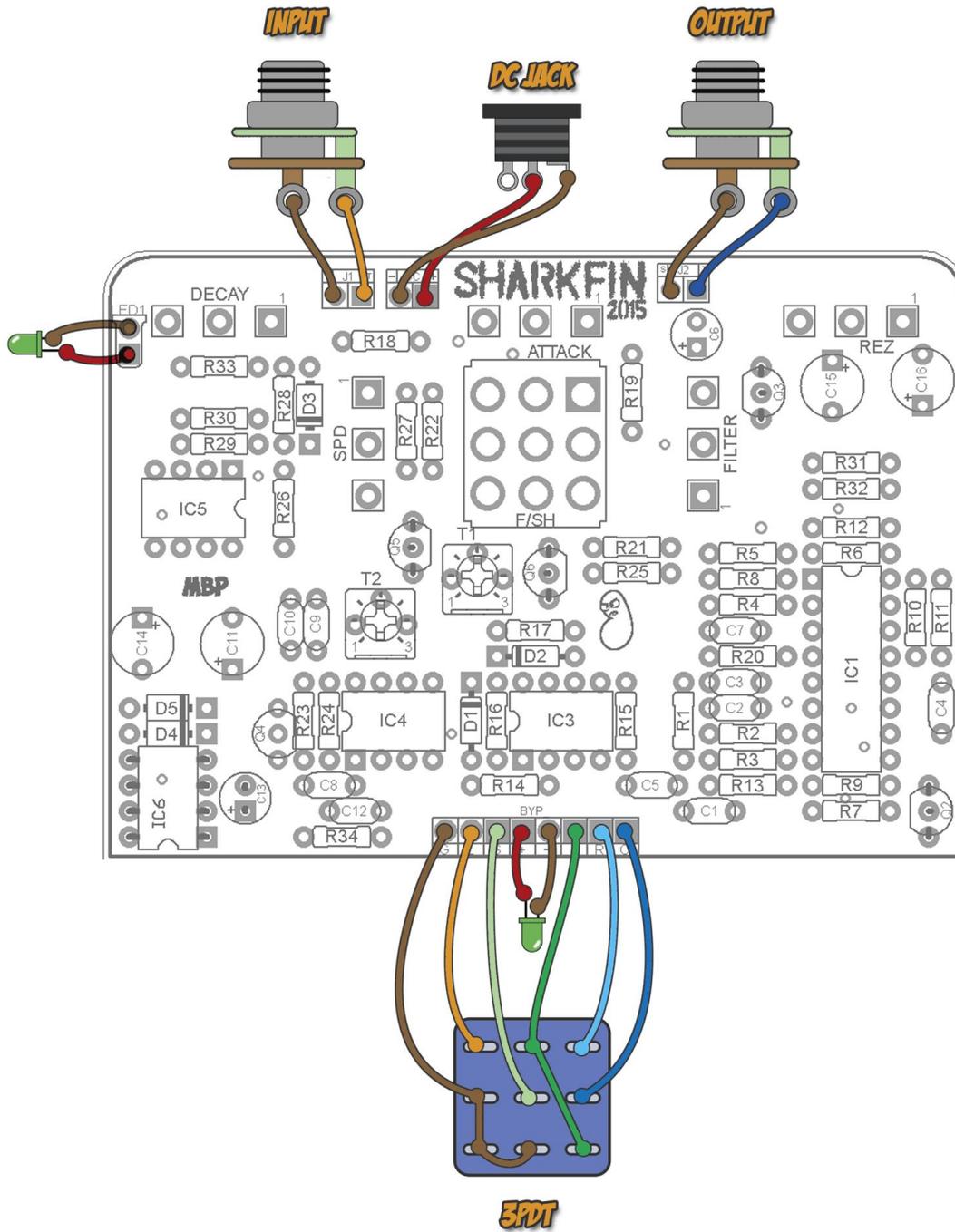
If you are a knob hound, you can use external pots for T1 and T2. This will offer some useful variations on the S&H effect. However, some settings will also cause it to stop working.

The LEDs can be wired as shown or directly mounted to the PCB. When mounting to the PCB, use the drill locations indicated on the board.

2015 Change Log

- Converted IC1 to LM13700 from CA3080. This was done because the LM13700 is widely available and less expensive. Tonal differences proved to be minimal / unnoticeable.
- Converted to a PCB mounted switch for the Filter/S&H toggle.
- Tied Decay pot to -9v instead of ground for wider control.

Overview

The **Sharkfin** is a Maestro Filter, Sample & Hold™ clone with a few modifications. It is really two effects in one: an envelope filter and a sample/hold. Most of you are probably already familiar with envelope filters (such as the Mutron III and the Q-Tron), but perhaps less so with sample and hold. Here's the Wikipedia definition (because, why not?)

> *In electronics, a sample and hold (S/H, also "follow-and-hold"[1]) circuit is an analog device that samples (captures, grabs) the voltage of a continuously varying analog signal and holds (locks, freezes) its value at a constant level for a specified minimal period of time.*

In the case of the FSH1, it uses a combination of an LFO, voltage supply, JFET sampler and buffers to rapidly sweep the filter section of the LM13700. The result is a periodic sweep in fixed steps with a random filter range. To get a better sense of what this sounds like, check out some YouTube videos, or the samples at Moosapotamus:
http://www.moosapotamus.net/fsh1a.html

The Sharkfin borrows a couple of modifications from the Tonepad project (Attack and Decay controls for the envelope filter) and adds a couple component tweaks and a little switching trick to disconnect the LFO when you are in Filter mode. It's a really unique effect and worthy of some attention for its weirdness, if nothing else!

This is a pretty difficult project, and there are many FSH1 clone projects in the "fail pail" for our unlucky building brothers (and sisters). Not to say that the existing projects out there are flawed in any way (they were very helpful in developing this project); rather it is just complicated. You probably should not take on this project if you are new to pedal building or short-tempered.

Controls

Filter: This controls the sensitivity of the envelope follower to picking dynamics as it is turned clockwise.
Attack: This controls the intensity of the envelope attack as it is turned clockwise.
Decay: This controls the time decay of the envelope/swept filter as it is turned clockwise.
Rez: This controls the filter resonance from dark and full to thin and resonant.
Spd: The rate of the LFO in Sample/Hold mode.
SW1: This switches between the Envelope Filter and Sample/Hold modes.
T1, T2: These trimmer are used to adjust the Sample and Hold function (more on that later).

The Attack, Filter and Decay controls work only in Filter mode. They have no influence on the Sample and Hold. However, the Rez control works in both modes. It is less influential in Sample/Hold, but it will produce a range of different resonant peaks as the S/H operates.

Notes

The original Maestro unit lists 2n3904 for Q4, and 2N4303 for Q5, Q6 and Q2. The Tonepad project also lists 2n3904 for the Q4 position, and BF245A for the other three. Based on a suggestion on diystompboxes, I found that 2n5088 in Q4 and J201 in Q5, Q6, and Q2 worked best. It's probably less important in the Q2 position, but in the sample & hold portion it made the steps between the filter changes smoother and more musical. I suggest socketing all four transistors if you want to experiment. *Keep in mind that the BF245A is the opposite pinout of J201, so flip those 180° if you try them.*

1N4001 are spec'd for D1 and D2 in the original Maestro unit. I picked BAT46 because it seems to give better response with the envelope filter. If you don't have BAT46, try the 1N4001. Or, try something else like the 1n914, BAT41 or 1n34a.

Setup

The envelope portion of the effect needs no calibration, but you do need to calibrate the sample and hold section. This is done with the T1 and T2 trimmers. There is no specific rule to follow that I know of…it's all about tweaking. Here are the general guidelines:

> *T2 sets the "intensity" of the S/H and T1 sets the "range". Start with the SPD and REZ controls about 2/3rd up and the switch set to S/H mode (the other knobs don't matter since they have no influence in this mode). T2 should be fully counter-clockwise and T1 about 1/3rd up. Adjust T2 clockwise until you hear the stepped filter sound. Now adjust T1 to alter the range of the steps. You will hear the filter sweep through a lot of up and down steps while this is going on. The key here is to adjust the trimmers until the number of up and down steps is about the same. IOW, they don't concentrate too heavily on the top or bottom end of the filter sweep.*
>
> *The two trimmers are interactive and you will probably find yourself dialing the S/H a few times as you get used to the sound of the effect. Don't be afraid to adjust it as much as you like. You can get some very interesting results with very subtle adjustments.*

Lastly, it is normal to hear the filter steps when you are not playing (this only happens in S/H mode). This may bother you or not (I actually like listening to it)…take comfort in the fact that this is how it is supposed to sound! AFAIK, there is no way to eliminate it.