SDSV drum synthesizer DIY project





Poland, Poznań, 16.06.2014

1. Introduction

If You're reading this, You probably have now a beautiful, shiny SDSV PCB in front of You. So, lets begin.

What's interesting in this project:

- very versatile drum simulation circuit bass, snare, toms, metallic sounds end effects,
- no "boring" controls (like click tone),
- resonating filter can be used as second oscillator, f.e. to spice up bass drum or create "cowbell-like" sounds (and possibly more), also makes "boomy" bass like 808 easely,
- SSM2044 filter can be used separately,
- noise source can be replaced by other source, also you can use filter output as filtered noise output,
- lot of mods possible.

2. General information

There are more complex drum voices out there, but this one has quite tricky topology. VCO generates triangle waveform, which passes thru passive lowpass filter resulting in "something similar to sine" wave. The VCO pitch can be modified by LFO, envelope generator EG1 or EG2 or rimshot EG, also set manually. On the other side of circut, noise generator is feeding SSM2044 lowpass filter – its output is used as body sound (for snare f.e.) or click sound. Noise color (filter cutoff frequency) is modulated manually, form LFO or envelope generator. One part of a signal from filter goes thru VCA to form click sound, the other is mixed with tone generated by VCO. Mixed noise/tone signal (body sound) passes VCA and is added to click sound, then both signals passes another VCA. Module topology is shown on illustration 1.

Topology:

- 4x EG,
- 3x VCA CA3080 based,
- 1x VCO triangle and filtered triangle outputs,
- 1x LFO triangle core,
- 1x noise generator,
- 1x VCF SSM2044 based.

SDSV voice board block diagram by SyntherJack



Illustration 1: SDSV voice board block diagram

Controls:

- decay,
- VCO tone,
- VCO sweep (EG ->VCO pitch modulation),
- LFO \rightarrow VCO pitch modulation depth,
- noise tone (filter cutoff),
- noise sweep (EG → filter cutoff modulation),
- LFO \rightarrow filter cutoff modulation depth,
- filter resonance,
- tone / noise balance (VCO / filtered noise balance),
- drum / click balance (drum volume),
- output level,
- rimshot modulation on/off,
- VCO output filter on/off switch between triangle / "sine" (filtered triangle) waveform,
- noise sweep range.

I/O:

- trigger in,
- filter in (replaces noise source),
- filter out / noise out,
- drum out,
- trigger LED.

Power consumption - maximum:

- 50mA @ -12V, 70mA @ +12V
- 40 mA @ +15V, 60mA @ +15V

3. PCB information

PCB size is 80x100mm. Looking at part count I would say, project is advanced. Something like 75% of basic MFOS SoundLab. There are no additional panel-mounted parts - only pots, switches, jacks and one LED. The PCB is double sided. For proper operation only thru-hole parts are needed. There are additional SMD pads on the bottom side on PCB – you can solder 0805 size capacitors for additinal decoupling (it's not nesessary).

PCB is designed for some more modifications:

- LFO speed,
- LFO speed CV in,
- VCF cutoff CV in (not V/oct),
- passive output filter for "hi-hat" sounds,
- VCO modulation source EG1 or EG2.



Illustration 2: SDSV PCB TOP side view, vector graphics

The following table contains all wire soldering points available on PCB with short description. MDx are modification points.

Point on PCB	Description	Notes	
MD1	LFO control voltage input mod	If used, additional ~150k resistor needed	
MD2	LFO control voltage input mod		
MD3	SSM2044 filter input		
MD4	Noise generator output		
MD5	Optional passive hipass output filter	Connected together if not used, capacitor between if used	
MD6	Optional passive hipass output filter		
Q	Filter resonance control input		
NP	Noise Pitch (filter cutoff freqency control input)		
FCV	Filter CV (additional filter cutoff freqency control input)		
NBD	Noise Bend (filter cutoff modulation input from envelope gen.)		
SR1	Shunt Resistor on/off (changes filter cutoff modulation range)	Connected by switch	
SR2	Shunt Resistor on/off (changes filter cutoff modulation range)		
LFO	LFO output	More then one solder point	
LFM	LFO Modulation (input for VCO frequency modulation from LFO)		
TP	Tone Pitch (input for VCO frequency setting)		
RI1	Rimshot on/off	Connected by switch	
RI2	Rimshot on/off	-	
TBD	Tone BenD (input for VCO frequency modulation from envelope gen.)		
TB1	Tone Bend 1 (beat independant envelope output)	By default <i>TB1</i> is used, feel free to use <i>TB1/TB2</i> switch	
TB2	Tone Bend 2 (beat dependant envelope output)		
VCU	VCO Unfiltered output		
VCO	VCO filtered output	VCO=VCU+RC lowpass filter	
NOISE	Filtered NOISE output	It's the same point, different names	
FO	Filter Output		
DRUM	Input to VCA		
TRG	TriGger input		
DEC	DECay potentiometer connection		
LED	Trigger LED output	tput Anode	

Table 1. Wire pads on PCB

Ουτυ	Unbuffered module OUTput Pot between them		
AMP	Input to OUTput amplifier		
OUT	Module output		
GND	Signal GROUND	More then one solder point	
+V	Positive power supply		
-V	Negative power supply		
CN1	CompeNsation "capacitor" for noise generator IC – twisted wire pair	About 8 tight twists, look at	
CN2	CompeNsation "capacitor" for noise generator IC – twisted wire pair	photos	



Illustration 3: TOP and BOTTOM view of the PCB, photo

Below picture of soldered SDSV PCB in shown. What you should notice:

- in "default" version, wire solder points *MD5* and *MD6* are connected with wire (on picture below those point are not connected, they should, if you don't use output hipass filter),
- twisted wire pair in noise generator circuit (8 tight turns),
- "ECB" noise transistor socket it is not necessary, i've just wanted to check different types of noisy ones,
- in "basic" version *TB2* will not be used (output from beat dependant envelope),
- *MD1, MD2* (LFO VC mod, left bottom of PCB) wire points will also not be used in "basic" module version,
- two small holes in top and bottom left corner are "mod holes" if you solder wire to the bottom of PCB and want lead it to front panel, you can pass thru this hole to secure it,
- the only germanium diode is marked with "*",
- R15 (top left) is shorted,
- blue potentiometer (R71) sets noise generator output level,
- all ICs in a row go in the same direction.



Illustration 4: Soldered SDSV PCB YOP side view, final version 1.0

The following table shows parts numbers and corresponding values.

Qty	Value	Description	Part no.
2	L-EU0207/10	"Bead" inductor	L1, L2
1	MTA04-156	Connector 1x4	MOTM_CON
1	PINHD-2X5	Connector 2x5	EURO_CON
1	0R	Clamp / wire	R15
3	1M	Resistor 1/4 Watt 5%	R1, R83, R99
3	1k	Resistor 1/4 Watt 5%	R76, R113, R120
2	2k2	Resistor 1/4 Watt 5%	R79, R92
1	3k9	Resistor 1/4 Watt 5%	R93
1	5k	Resistor 1/4 Watt 5%	R72
5	5k6	Resistor 1/4 Watt 5%	R80, R96, R98, R103, R104
8	10k	Resistor 1/4 Watt 5%	R4, R12, R13, R46, R53, R60, R69, R74
2	22k	Resistor 1/4 Watt 5%	R90, R110
2	33k	Resistor 1/4 Watt 5%	R9, R11
2	47k	Resistor 1/4 Watt 5%	R3, R10
1	68R	Resistor 1/4 Watt 5%	R14
10	68k	Resistor 1/4 Watt 5%	R19, R55, R56, R58, R61, R64, R66, R68, R86, R89
10	100k	Resistor 1/4 Watt 5%	R2, R52, R63, R70, R77, R94, R95, R97, R100, R109
15	150k	Resistor 1/4 Watt 5%	R6, R7, R8, R16, R45, R50, R51, R54, R65, R67, R101, R105, R107, R108, R117
2	220R	Resistor 1/4 Watt 5%	R73, R75
3	270k	Resistor 1/4 Watt 5%	R91, R102, R118
2	390k	Resistor 1/4 Watt 5%	R87, R114
2	470k	Resistor 1/4 Watt 5%	R84, R106
1	820R	Resistor 1/4 Watt 5%	R115
2	1n	Film capacitor	C15, C16
3	10n	Film capacitor	C9, C10, C11
1	22n	Film capacitor	C23
6	100n	Film capacitor	C1, C2, C6, C18, C19, C48
1	220n	Film capacitor	C7
1	820p	Film capacitor	C12
1	2u2	Capacitor Electrolytic	C17
1	4u7	Capacitor Electrolytic	C8
2	10u	Capacitor Electrolytic	C13, C14
2	100n	Capacitor Ceramic	C5, C21
24	100n	Capacitor Ceramic (optional)	C24 C47
1	820p	Capacitor Ceramic	C20
3	470n	Capacitor Tantalum Electrolytic	C3, C4, C22
2	1N4004	Silicon diode	D1, D2
5	1N4148	Silicon diode	D10, D11, D12, D13, D16
1	2N5172	Noise transistor of choice	TR6
3	BC546	NPN transistor	TR3, TR7, TR8
3	BC556	PNP transistor	TR1, TR2, TR4
3	LF353	Opamp, DIP8	IC7, IC8, IC12
1	LM301	Opamp, DIP8	IC13
4	LM1458	Opamp, DIP8	IC1, IC14, IC16, IC17
3	LM3080	OTA, DIP8	IC9, IC10, IC11
1	SSM2044	VCF IC, DIP16	IC15
1	Germanium diode	Generic germanium diode	D15
1	1M	PCB trimmer potentiometer	R71
9	100k linear pot	Potentiometer Linear taper	Panel mount
1	100k audio pot	Potentiometer Audio taper	Panel mount
1	1M linear pot	Potentiometer Linear taper	Panel mount
3	Jack socket	Without switch, 2/3 pin	Panel mount
1	Jack socket	With switch, for filter injection	Panel mount
1	LED	LED Colour of choice	Panel mount
3	SPST Switch	ON-OFF, 1 section	Panel mount

Remarks on BOM:

- all resistors are 1/4 Watt, 5%
- R72 (5k) sets maksium noise output level and can be raplaced with 5k6,
- R15 is just wire (0R),
- C24...C47 are SMT 0805 decoupling capacitors (bottom side of PCB, 2 for IC), you don't need to solder them,
- D1, D2 are for protection, 1N4004, 1N4007 or similar will work,
- look out for C3, C4, C22 polarity!
- TR6 is a noise transistor use the one you like (I love 2SC828, more noisy then my cat),
- use 1x4 or 2x5 EURO connector,
- the only Jack socket with switch is used for filter external signal input.



Illustration 5: PCB on its place, wired and checked

4. Front panel wiring (view from behind)



Remarks on front panel wiring:

- on front panel, *P1* (TONE/NOISE LEVEL) is connected with *P1* (VCO SHAPE), and *P2* (TONE/NOISE LEVEL) is connected with *P2* (DRUM/CLICK LEVEL) points are marked green on wiring diagram,
- by default, "beat independend" (*TB1*) envelope is used to VCO pitch bend; alternatively you can use "beat dependant" envelope (*TB2*) or use switch to choose between *TB1* and *TB2*, then connect it to VCO PITCH BEND potentiometer,
- if filter will be not used as separate unit (no FILTER IN and FILTER OUT jacks on front panel), leave FO unconnected and connect MD3 and MD4 together,
- DRUM / CLICK LEVEL controls only drum level, click level is always the same.



Illustration 6: SDSV front panel view

5. Useful information

It's always a good practice to check voltages before inserting IC's. The following diagram can help.



Illustration 7: SDSV voice board voltages

Pay attention:

- in "default" version, wire solder points *MD5* and *MD6* are connected with wire; if you want, feel free to add some capacitor between them to hi-pass the outcoming signal,
- on front panel, *P1* (TONE/NOISE LEVEL) is connected with *P1* (VCO SHAPE), and *P2* (TONE/NOISE LEVEL) is connected with *P2* (DRUM/CLICK LEVEL) points are marked green on wiring diagram,
- polarity of transistors double check if You solder them properly. 3 of them are in CA3080 control circuit, if You somehow solder them backwards, CA will die,
- check the polarity of tantalum capacitors !,
- in extreme cases, voltages in this circuit can be deadly, please be careful.