
Thomas Henry's X-4046 VCO

(doc rev2 – see change bars)

Back in 2009 Thomas Henry contacted me and Scott Stites to do a beta test build of his new cool X-4046 VCO. As soon as I built it on breadboard I was stunned by the features, especially the hard sync: blew me away... Scott Stites did an awesome job on testing and documentating the circuit, and you will find all the information at his site:



http://www.birhofasynth.com/Thomas_Henry/Pages/X-4046.html
(Schematics, Calibration Notes, Sounds, Scope Screen Shots)

I am proud that Thomas Henry allowed me to do a PCB run for the boards that I originally made for my own test purposes. I hope you enjoy this VCO as much as I do!

In general the lables on the PCBs follow Thomas Henry's original schematic. I only added some additional parts, nevertheless you will be able to use the original schematic from Scott's site for your build.

There is a parts-kit available from <http://www.thesonicworkshop.com>



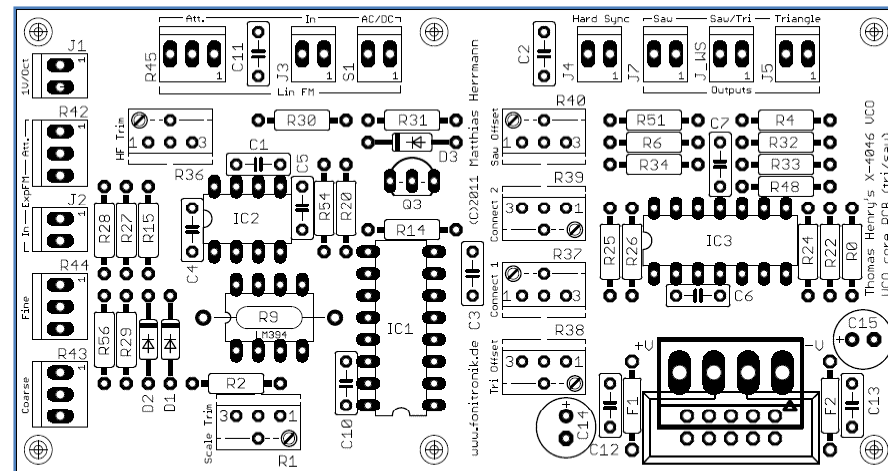
Qty	Value	Parts
2	22R or ferrite	F1, F2
1	100R (Trimmer)	R1
1	390R	R2
2	1k	R4, R6
1	2k +3500ppm/C	R9 (PTC)
1	4.7k	R14
1	10k	R15
1	12k	R20
1	33k	R22
3	75k	R24, R25, R26
8	100k	R27, R28, R29, R30, R31, R32, R33, R34
5	100k (Trimmer)	R36, R37, R38, R39, R40
4	100k (Potentiometer)	R42, R43, R44, R45
1	120k	R48
2	220k	R0, R51
1	1.5M	R54
1	3.3M	R56
1	100pF	C1
1	470pF	C2
5	10n	C3, C4, C5, C6, C7
3	100n	C10, C12, C13
1	220n	C11
2	10uF/35V	C14, C15
3	1N4148	D1, D2, D3
1	2N3904	Q3
1	Q1 / Q2	LM394 (or other matched pairs)
1	CD4046	IC1 (see notes)
1	TL072	IC2
1	TL074	IC3
1	Lin FM AC/DC	S1 (SPST on-off)
1	to Waveshaper PCB	J_WS
1	1V/oct	J1
1	Exp FM	J2
1	Lin FM	J3
1	Hard Sync	J4
1	Triangle out	J5
1	Saw out	J7

In general the labels on the PCBs follow Thomas Henry's original schematic. I only added some additional parts, nevertheless you will be able to use the original schematic for your build.

I cannot emphasize enough that it is crucial which brand of 4046 pll you use. Known working ICs are:

- National CD4046**
- Fairchild CD4046**
- Motorola MC14046**
- NXP HEF4046**

For the transistors in the expo I used a matched pair (LM394 or SSM2210). If you want to use manually matched transistors: Watch the pinout!

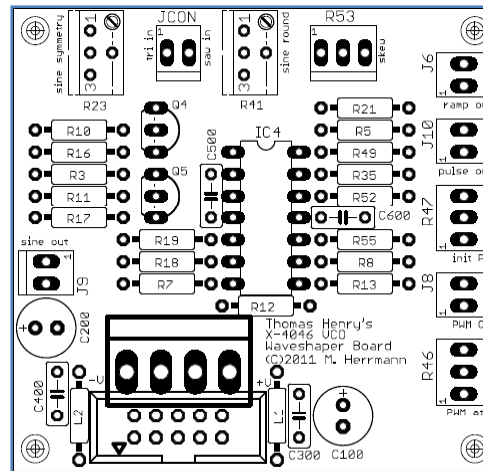


Qty	Value	Parts
2	22R/ferrite	L1, L2
1	390R	R3
2	1k	R5, R7
1	1.8k	R8
3	2.2k	R10, R11, R12
1	3k	R13
4	10k	R16, R17, R18, R19
1	18k	R21
1	100k	R35
2	100k (Trimmer)	R23, R41
2	100k (Potentiometer)	R46, R47
1	120k	R49
1	330k	R52
1	500k (Potentiometer)	R53
1	2.2M	R55
2	10n	C500, C600
2	100n	C300, C400
2	10uF/35V	C100, C200
2	2N3904	Q4, Q5
1	TL074	IC4
1	From Core PCB	JCON
1	Rampoid out	J6
1	PWM in	J8
1	Sine out	J9
1	Pulse out	J10

This PCB takes a triangle wave and shapes it to sine, and to a pulse with PWM.

Since it is primarily meant as add-on to the X-4046 PCB there is an input for a ramp wave, too. And a control that mixes triangle and ramp to a rampoid, using a potentiometer.

Nevertheless you can use this board as stand alone waveshaper, however, to get a nice sine from it you will have to feed it with a nice balanced triangle wave.



NOTE: The mounting holes of the PCBs match in a special way. You can mount the waveshaper and core PCBs back to back. The power connectors and the connector for the triangle/ramp waves are mirrored. This way you can easily connect both boards.

Potentiometers/Trimmers Core PCB:

Function	Value	Parts
Scale trim	100R (Trimmer)	R1
HF trim	100k (Trimmer)	R36
Connect 1	100k (Trimmer)	R37
Tri Offset	100k (Trimmer)	R38
Connect 2	100k (Trimmer)	R39
Saw Offset	100k (Trimmer)	R40
Exp. FM attenuation	100k (Potentiometer)	R42
Coarse (frequency)	100k (Potentiometer)	R43
Fine (frequency)	100k (Potentiometer)	R44
Lin. FM attenuation	100k (Potentiometer)	R45

Potentiometers/Trimmers Waveshaper PCB:

Function	Value	Parts
Sine symmetry	100k (Trimmer)	R23
Sine round	100k (Trimmer)	R41
PWM attenuation	100k (Potentiometer)	R46
Initial PW	100k (Potentiometer)	R47
Skew (rampoid)	500k (Potentiometer)	R53

Connector pinouts:

