nonlinearcircuits

Dual LFO/VCO build & BOM

This is an upgrade for the NLC thru-hole dual LFO and the thru-hole dual VCO. Mainly it was designed for the WAMod synth DIY workshops, so new builders could start making fun noise after their 1st module is finished.

The circuit is based on the NLC thru-hole dual VCO but can be switched to operate in 3 ranges; 15Hz-10kHz, 1 minute per cycle to 25Hz (approx) and down to 20 minutes per cycle for the slowest.

Both have CV inputs with attenuating pots and sync inputs. The sync is quite hard and attempts to momentarily ground the timing capacitor, how successful this is depends on what else is going on. At slow LFO rates it works more like a wave-shaper.

The outputs are sine, stepped, square and triangle. The stepped outputs are S&H circuits sampling the sine-waves. They are clocked by the other oscillator; there is no external clock input.

There is provision to install 1k tempco resistors if you want to try for 1V/oct tracking. Don't expect good tracking over more than 2-3 octaves tho, there are no matched transistors onboard. If such niceties are not so important, simply leave off the 1k tempcos and install regular 1k 0805 resistors on the bottom of the engine PCB.

<mark>BOM</mark> — The Tayda & Mouser part numbers are given as examples

VALUE	QUANTITY	DETAILS
330pF	4	0805 Tayda: A-3505
1nF	4	0805 Tayda: A-3524
2n2 = 2.2nf	2	0805 COG/NPO Mouser Part No: 710-885012007065
100nF or 104	5	0805 Tayda: A-3511
1uF	2	0805 25V or higher voltage rating Mouser Part No: 80-C0805C105K3R
10uF	8	0805 25V or higher voltage rating Mouser Part No: 963-TMK212BBJ106MG-T
220R	2	0805
1k	6	0805
1k tempco	2	Thru-hole – see notes
3k3	4	0805
3k9	2	0805
10k	8	0805
15k	2	0805
33k	2	0805
39k	2	0805
47k	4	0805
51k	2	0805
68k	2	0805
100k	21	0805
120k	1	0805
180k	2	0805
220k	2	0805
RL	2	0805 choose to suit LED brightness, see notes
TL072 or TL082	8	Soic Tayda: A-1139
LM13700M	1	Mouser Part No 926-LM13700MX/NOPB
DG202 or DG212	1	Mouser Part No:781-DG202BDY-E3 **OR** 781-DG212BDY-E3 **OR** 781-DG212BDY-T1-E3
3mm LED	2	See notes
LL4148 diodes	6	SOD-80 Tayda: A-1213
BC847	2	Tayda: A-1339
BC857	2	Tayda: A-1345
Eurorack 10 pin power connector	1	Tayda: A-198 cut to size
S1JL, Schottky, power rectifier or 10R, optional - for reverse voltage protection...or not	2	SMD SEE NOTES #1. **dot on PCB indicates CATHODE (stripe on component).** My current fave is BAT54GWX, Mouser: 841-BAT54GWX
3.5MM SOCKET Kobiconn style	12	Tayda: A-865 or Thonkiconn Jacks (PJ301M-12) from Thonk, Synthcube or Modular Addict
10 Pin 2.54mm Single Row Pin Header Strip	3	Tayda: A-197 (cut to size)
10 Pin 2.54mm Single Row Female Pin Header	3	Tayda: A-1306
100k pot	4	Tayda: A-1848
10k trimpot	2	Tayda: A-586
On-off-on toggle switch	2	Tayda: A-3187
11mm m3 (or m2.5) stand-off	1	Optional, the holes are there.

Additional notes:

1. , Schottky (best option) **or** standard power rectifier diode 50-600V 1A or more, **or** use a resettable fuse **or** just a 10R. Examples: BAT54GWX, PMEG2005EGWX, AEC-Q101, 20V, SOD-123, PMEG2005EH DIODE, SCHOTTKY, 0.5A, 20V, 1N400x or S1JL or similar.

2. The chips, resistors, caps are cheapest from Tayda. Schottky diodes, CMOS & 1uF, 10uF 25V 0805 caps from Mouser/E14/Farnell/etc.

3. Join the Nonlinearcircuits Builders Guild on FB: https://www.facebook.com/groups/174583056349286/ and ask questions there if you have any. If you prefer not to FB then email is fine.
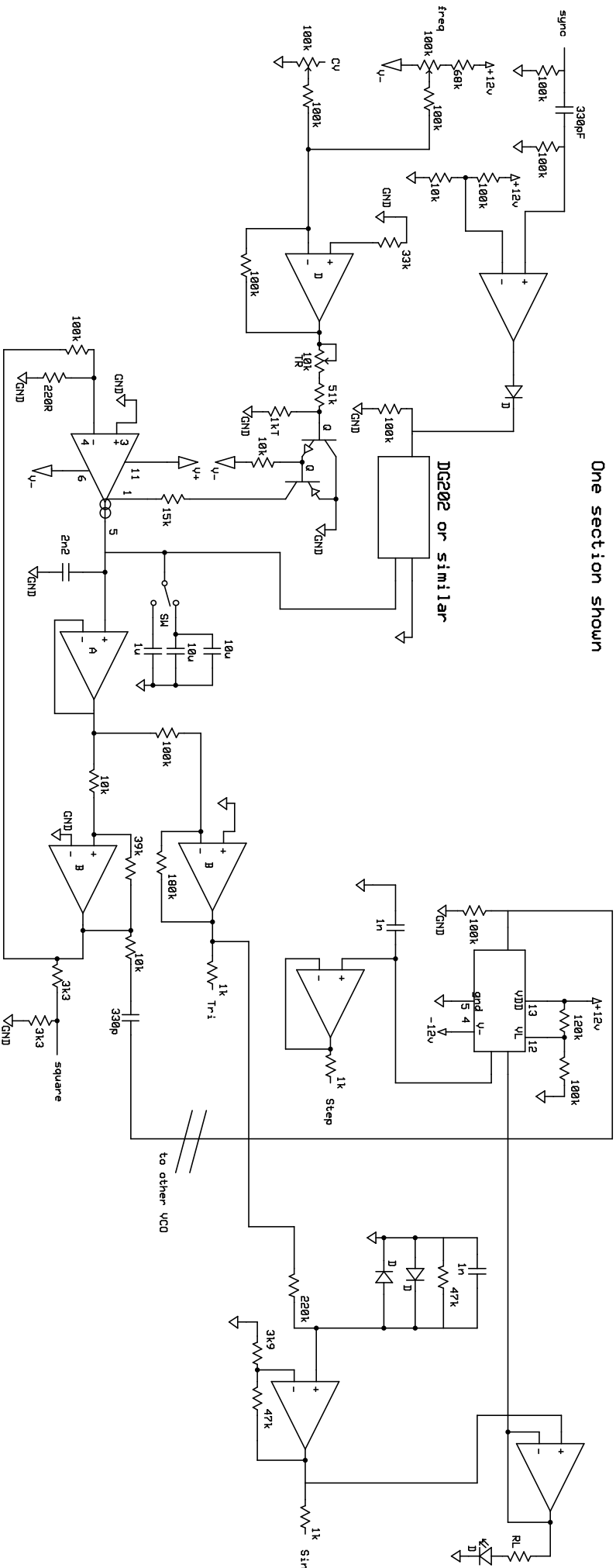
4. Use 3mm LEDs, bipolar ones look good. If red/green use 1k for RL. If red/blue use 4k7 for RL

5. The 1k tempco thru-hole resistors are mounted so the resistor body in contact with the BC847 and BC857 transistors. Goop it up with thermal paste once the circuit has been tested.

If you don't really care about 1V/oct tracking then you do not need to install 1k tempcos but you **must** install the 1k 0805 resistors on the bottom side of the PCB.

6. Use the trimpots to tune for 1V/oct. Still adjust these even if you did not use tempcos as the correct setting allows the VCO mode to get down to somewhere between 12-20 Hz. There are many methods for tuning VCOs. I usually use a Korg tuner and an oscilloscope with a Fluke precision voltage source. Simplest is to get 1V from somewhere (gate out via an attenuator?). Turn the CV pot to max. set the VCO frequency to say 100Hz. Patch in 1V and adjust the trimpot so the frequency doubles………or adjust the trimpot so you measure an 18mV change at the node of the 1k tempco/51k/base of BC847 for each 1V change at the CV input.

7. The PCB photos on the next pages show one VCO/LFO uses a 1k tempco and the other has the 1k 0805 resistor mounted on the bottom of the PCB along with a single turn trimpot. You can see the tempco body is touching both transistors, although the heatsink paste has not yet been applied.

One section shown

sync

freq

CV

100k

100k

100k

68k

+12v

v-

100k

100k

100k

100k

10k

+12v

330pF

10k

33k

GND

100k

+

-

D

100k

-

+

D

100k

10k
TR

51k

DG202 or similar

100k

1kT

GND

10k

v-

Q

Q

GND

100k

220R

GND

4

3

+

6

v-

11

1

5

15k

V+

2n2

GND

SW

10u
1u

10u

GND

A

-

+

100k

10k

B

-

GND

+

39k

100k

B

-

+

3k3

3k3

GND

square

10k

330p

1k
Tri

to other VCO

1n

GND

100k

-

+

1k
Step

1k

-

+

120k

100k
GND

13

12

VDD   VL

gnd   v-

5   4

+12v

-12v

220k

D

D

1n
47k

3k9

47k

-

+

1k
Sin

RL

D

-

+

2113462AP9-191004

DUAL LFO/VCO   V4

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10v   100n

S1/L

68k 68k 100K

S1/L   100K

10v

F2C -V   -V   GNDCV1C F1C

RED

51K   51K

BC847   BC847

100K   100K

134 101

33k 100k   100K   100K   33k

BC857   BC857

220R

10v   10v

15k   220R   15k

2n2 10v   2n2 10v

10k   220R   10k

120k   1v

1v   µP57AD   330p

LM13700M

100k   EDA   100k 100k

SINL   NC

SQR   STP

10k 100k   STP   TRI   10k 10k

330p   S3C   SINF   100k 100k

100k   TRI   SQR

100k

100k   39k

D62028DY   LF353

Q2C   Q1517AA   74M

M2705   A3FL

100k   100k   1k   100k 100k 10k   10k

10k   100k 1k   100k   330p 3k3

10k   100k   100k

3k3   330p 180k   180k   3k3

3k3

1k 220k   10v 10v   220k 1k   100n

47k   1k   47k   1k

3k3   3k3

1n   RL   1n

47k   100n   RL   47k   1n

DUAL LFO/VCO   V4

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RED

BAOTER
3296

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