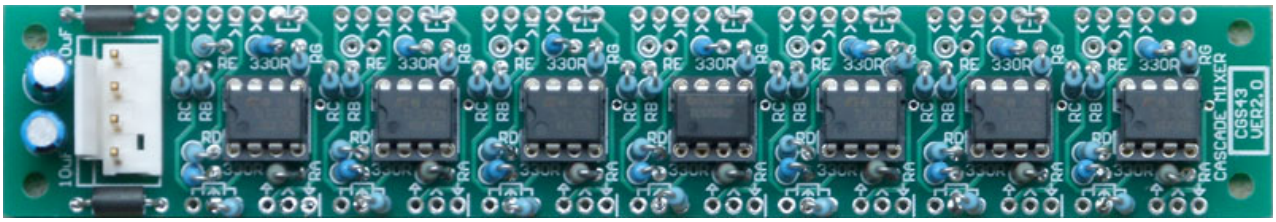


Cascade Mixer

for music synthesizers.

The previous version can be found here.

The Cascade Mixer is an experimental mixer that can be built in one of several ways. It grew out of the need for such a mixer in one of my projects. Others may find it useful too.

Some ideas on how to use this module:

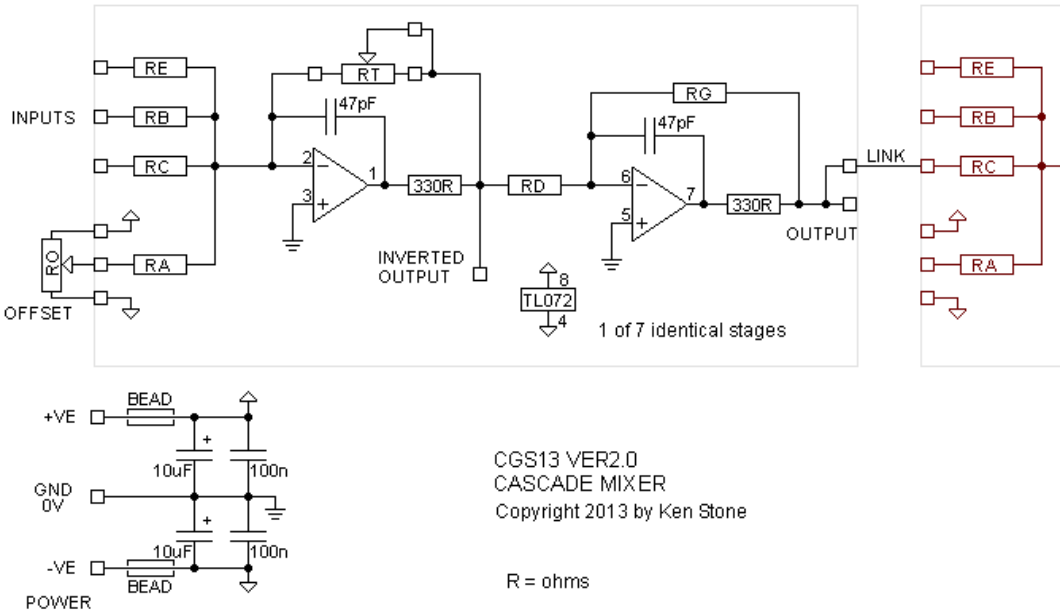
Depending on how it is built, this module can be used as a binary weighted (or similar scaled) mixer, or unity gain cascade mixer. It can also be used to convert square waves of descending octaves into "sawtooth" (staircase) waves, which is its original purpose. It is possible to use this module to convert the Sub oscillator to a staircase based unit, though I will leave the details of this to be worked out by the enthusiastic. Note that each successive input would need to be fed with a signal one octave below that of the previous input, and that each successive staircase output would have twice the resolution of the previous output.

When used as a unity gain cascade mixer, it is possible to sum a series of control or signal voltages, and have outputs that present the sum of all inputs up to that input. In other words, looking at the schematic/block diagram below, each output is the sum of all inputs to its left. A very simple example of use would be to feed a sequencer into the first input, and a vibrato signal into the second. The VCO connected to the first output would follow the sequence, while the VCO connected to the second output would follow the sequence, but with vibrato applied. The third output would be the same as the second, but with the addition of whatever was fed into the third input, and so on.

When used as a binary weighted cascade mixer, each output is halved as it is mixed into the successive summer. In other words the first output will equal the first input. The second output will equal half of the first output plus the second input, and so on.

If level pots are required, they easily be added. Use 100k pots, and wire them as shown for the CGS04 mixer.

A little on how it works:



The schematic of one stage of the Cascade Mixer. There are six identical stages, and one stage without RG and its associated input.

The circuit is extremely basic - just a row of standard op-amp summers based around the TL072, or any similar compatible dual op-amp, in the same configuration as the CGS04 mixer and various other summers used in CGS designs.

There are seven of these summers on the PCB, each with four inputs and two outputs (inverted and non-inverted), or three inputs in the case of the first stage. The board allows for easy inclusion of onboard trimming of gain (RT) , and offset (RO), at the expense of an input, and cascading at the expense of another.

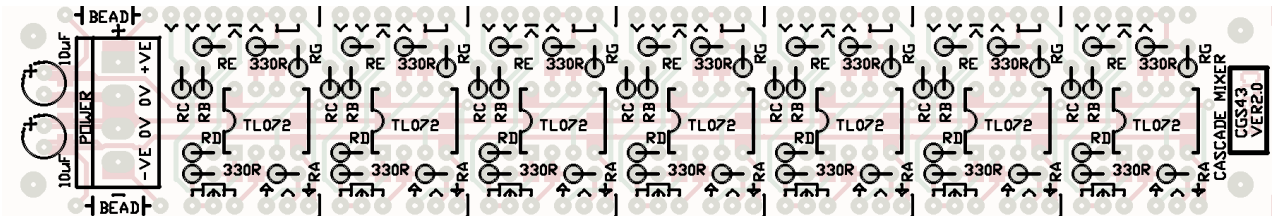
The gain of each mixer can be set using a fixed resistor instead of a trim pot if desired. The "default" value for all resistors apart from the 330R output resistors is 100k. Different values can be used for different scaling factors. It would be possible for example to use 20k instead of 100k for RT, resulting in a 5x amplification factor for each stage, though this would not be a good idea, as after only two or three stages the voltage swing would be beyond the common mode range of the op-amps, if not beyond the power rail voltages themselves, resulting in clipping or even latch-up.

If you are planning to drive the inputs directly from a CMOS chip or other device with near-full power rail swings, increase the corresponding input resistors to something like 1M.

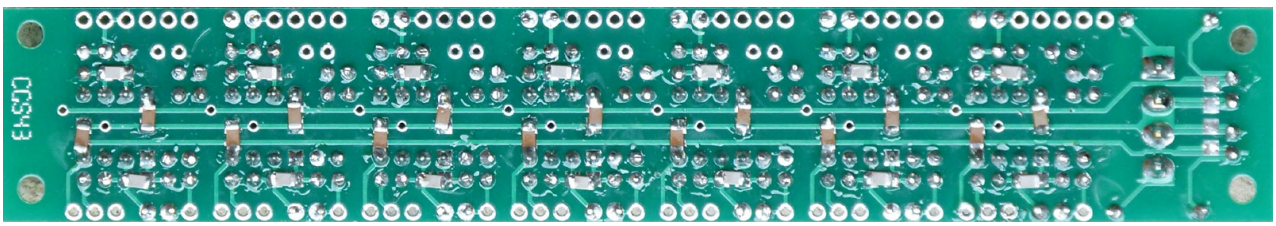
For high accuracy, a multi turn trimpot can be installed in the offset positions on the PCB, allowing any DC offsets within the op-amps to be trimmed out.

Resistor functions and values.		
RA	Input resistor	If using with an offset pot, 330k or greater. As an input: 100k.
RB	Input resistor	100k for unity gain.
RC	Input/Link resistor	This sets the interstage gain when mixers are linked. 100k for unity gain.
RD	Interstage resistor	100k.
RE	Input resistor	100k for unity gain.
RG	Feedback/Gain resistor	100k. Should equal RD.
RT	Feedback/Gain resistor/pot	100k for unity gain. 200k multiturn trimmer will give an adjustment range between 0 and 2.

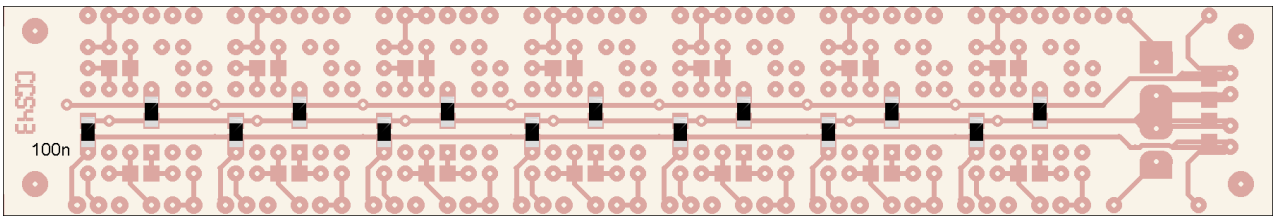
Construction



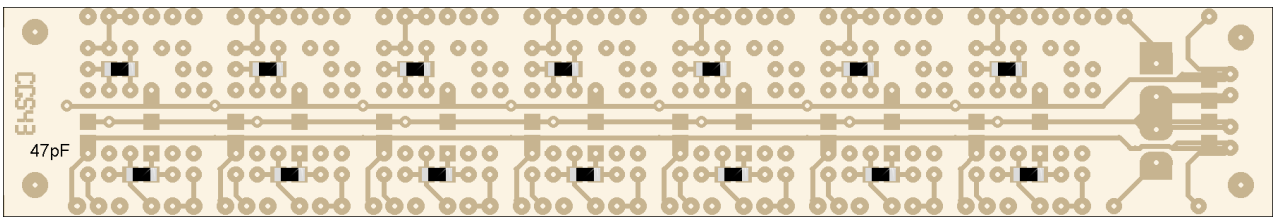
The component overlay for the VER1.0 PCB. Click here for an enlarged, printable version. Print at 300dpi.



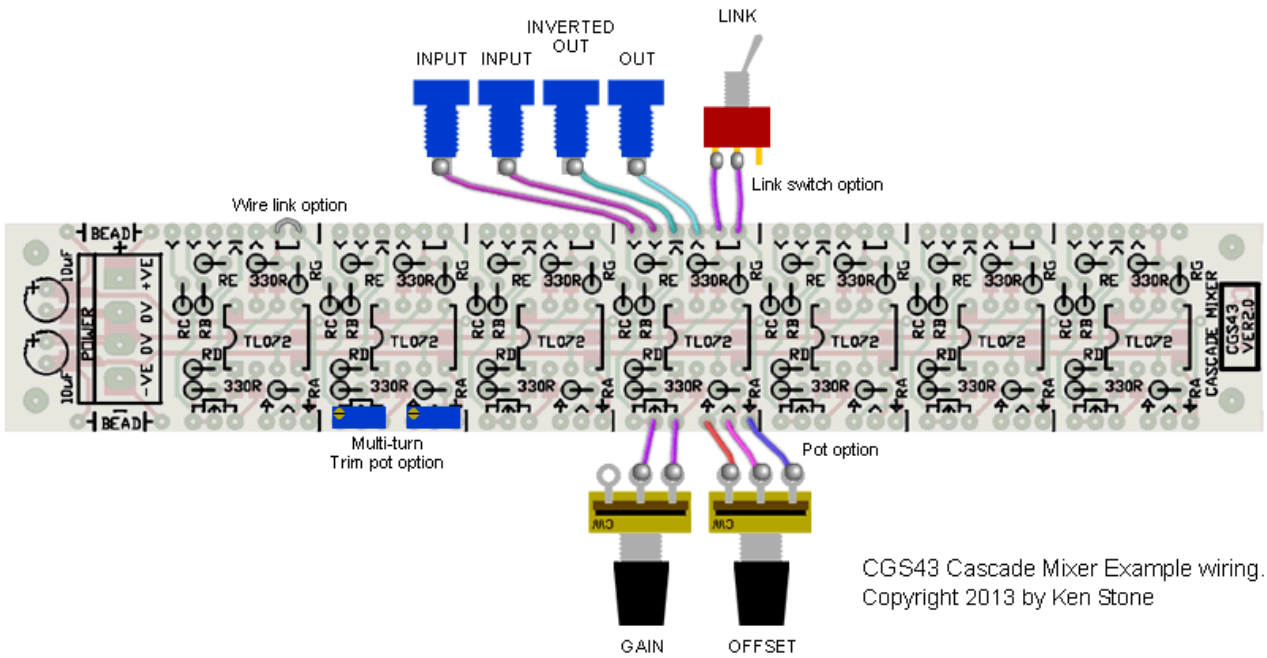
Locations of the surface mount capacitors. Click here for an enlarged version.



Locations of the 100nF surface mount capacitors. Click here for an enlarged version.



Locations of the 47pF surface mount capacitors. Click here for an enlarged version.



Example wiring diagram for a single stage showing several options, such as an interstage "join" switch. If you choose to use trimmers in both pot locations, you will need to find a small-body variant for at least one type, as they are spaced too snugly for full sized ones to be used. Alternatively, a regular trimmer could be used for the offset null, with a higher value resistor (e.g. 1M, or even 2M2) used for RA. The greater the value of RA, the less range, and greater accuracy the trimmer will have.

The first thing to do is decide what sort of mixer you need, and select the resistor values accordingly.

Before you start assembly, check the board for etching faults. Look for any shorts between tracks, or open circuits due to over etching. Take this opportunity to sand the edges of the board if needed, removing any splinters or rough edges.

When you are happy with the printed circuit board, construction can proceed as normal, starting with the resistors first, followed by the IC socket if used, then moving onto the taller components.

Take particular care with the orientation of the polarized components such as electrolytics, diodes, transistors and ICs.

When inserting ICs into sockets, take care not to accidentally bend any of the pins under the chip. Also, make sure the notch on the chip is aligned with the notch marked on the PCB overlay.

Notes:

- The module will work on +/-12 volts or +/-15 volts.
- **PCB info:** 6" x 1" with 3mm mounting holes 0.15" in from the edges.
- Please email me if you find any errors.

Parts list

This is a guide only. Parts needed will vary with individual constructor's needs.

If anyone is interested in buying these boards, please check the PCBs for Sale page to see if I have any in stock.

Can't find the parts? See the parts FAQ to see if I've already answered the question. Also see the CGS Synth discussion group.

Part	Quantity
Capacitors	
47pF 1206 SMT	14
100n 1206 SMT	14
10uF 25V	2
Resistors	
330R	14
100k 1%	42*
200k multiturn trimmer (for RT)	7*
	* see text
Semi's	
TL072	7
Misc.	
0.156 4 pin connector	1
Ferrite Bead	2
CGS43 VER2.0 PCB	1

Modular Synth Home

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