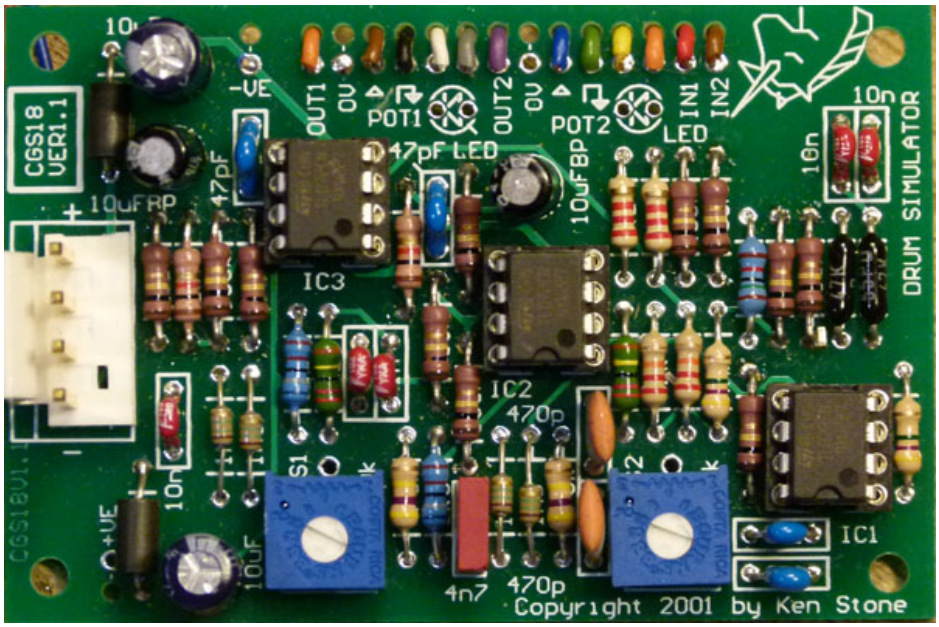
Drum Simulator

for music synthesizers.



The previous version can be found here.

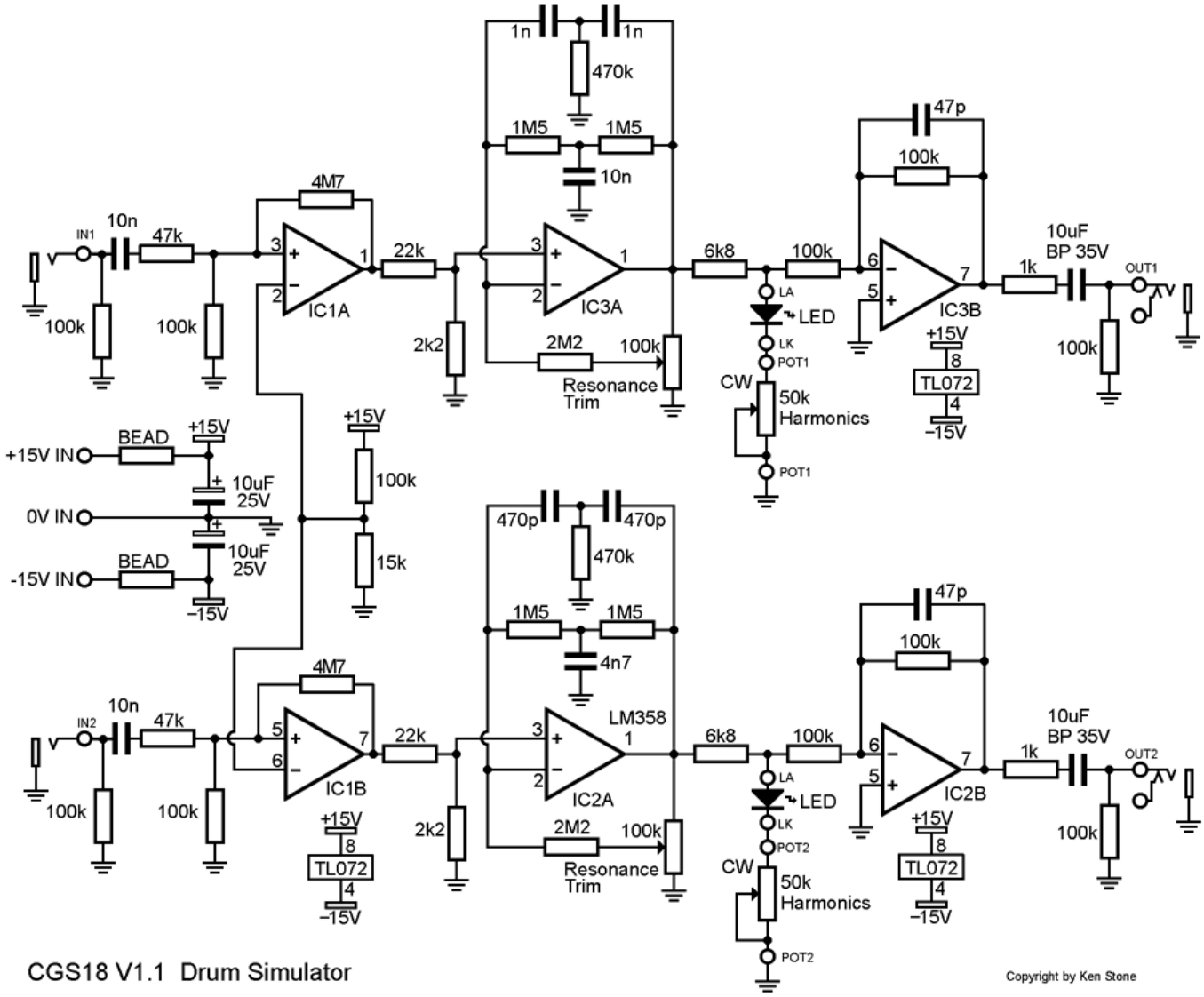
This module is the embodiment of the classic twin-T circuit in a form that is suitable for connection to modular synthesizers. It contains two separate drum sounds, each individually triggered, as well as something unique - adjustable harmonic content.

This updated version contains some minor changes. TL072 are used throughout. Hysteresis has been added to the trigger inputs. All connections are now in a single row, with strain-relief holes provided for the wires. See here for details on using the strain-relief holes.

How to use this module:

Connect the inputs to a LFO, a gate sequencer or some other rhythmic pulse source. Connect the outputs to a mixer, or feed them into some relevant part of the synthesizer. Adjust the harmonics from the basic sine tone to something rich in harmonics.

A little on how it works:



The schematic of the Drum simulator.

Each of the two drums consists of three distinct blocks, the trigger, the ringing oscillator and the buffer/distortion amp.

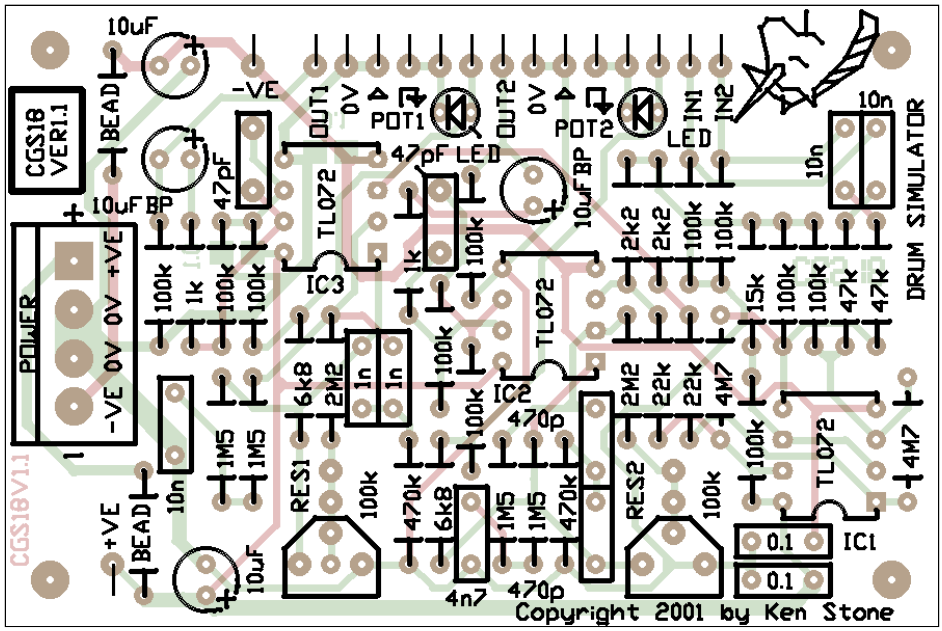
The trigger takes any positive going signal that goes over approximately 3 volts and converts it into a narrow positive going pulse. This pulse is fed to the reference ground of the ringing oscillator, de-stabilizing it, thus causing it to start oscillating.

Depending on the resonance setting, the ringing oscillator output will decay until the circuit again reaches stability with no audio output.

The output of the ringing oscillator is fed past a clipper consisting of a single LED, the current of which is limited by the series resistance of the 50k pot. The result is buffered by the inverting unity gain amplifier.

The 22k/2k2 resistor combination at pin 3 of IC2A and IC3A controls the amount of DC that makes it through to the output of the drum simulators, simulating the impact sound. Reducing the 2k2 resistors to 1k or even down to 680 ohms, will reduce the impact sound. It would be possible to replace the 2k2 resistors with a 1k linear pot (wired as a variable resistor) in series with a 680 ohm resistor so the level of the impact sound could be varied from the front panel.

Construction



The component overlay. Connections can be determined from the circuit diagram.

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.

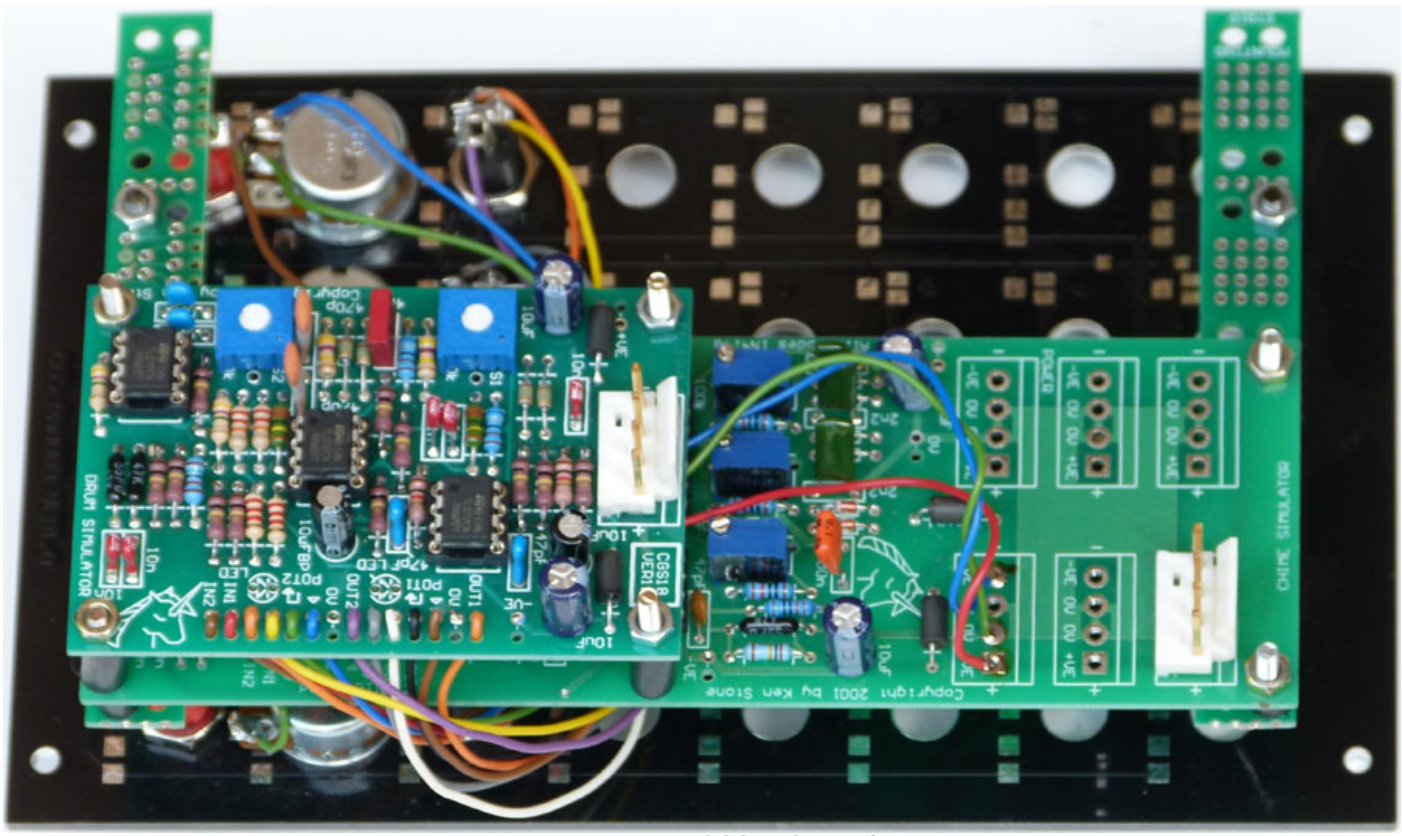
When you are happy with the printed circuit board, construction can proceed as normal, starting with the resistors first, followed by the IC sockets if used, then moving onto the taller components.

Take particular care with the orientation of the polarized components, the electrolytics, LEDs and ICs.

When inserting the ICs in their 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.

There are two 100n 1206 SMT decoupling capacitors on the rear of the board.

When you power it up for the first time, you will need to adjust the resonance trimpots until the oscillators just stop oscillating. Do this with no trigger inputs.



The board can be piggybacked on CGS19 Chime Simulator Version 2.

Notes:

- The LEDs used in this circuit are there specifically as "low voltage zeners". They are NOT meant for panel mounting. The way they are used they are not particularly bright. Can they be made brighter? Not if you are using a standard LED. The

only way to get more output would be to use a superbright, and in that case you would need to make sure the voltage drop across it was still only 1.6 volts. That rules out blue LEDs to start with, and probably a lot of others too. Red LEDs are your best bet. A couple of 1N4148 could be used in series.

- I have specified bipolar capacitors for the outputs. Ignore the polarity marked on the PCB for them. Bipolar capacitors are not polarity sensitive.
- There are several components that can be adjusted to change the basic pitch of each of the drums. These are all part of the twin-T filter that forms the feedback network for the oscillators. The 470p and 4n7 capacitors in one simulator, or 1n and 10n capacitors in the other can be changed. Try to keep the ratios near to 10 to 1. The 470k is probably the easiest component to change to shift the frequency by a small increment. Try putting 10k to 47k in series with it.
- If you are not able to get the drums to ring, reduce the value of the 2M2 feedback resistors to 1M8.
- Do NOT bring the resonance trimmers out to the front panels as controls. They are very much a "set and forget" adjustment.

  That being said, if you still want to bring them to the panel, first set the trimpot on the board to find out where the resonance point occurs. Measure the resistance of the two sides of the trimpot from the wiper. Remove the trimpot from the PCB. Pick two trimpots that have sufficient range to cover these values. Pick a pot with a small resistance value, say 1k to 5k, and solder it between the two trimpots, with the wiper going to where the wiper of the original trimpot went on the PCB. Wire the other ends of the trimpots to the remaining trimpot connections on the PCB, the result being that you have two trimpots in series with the panel mounted pot. It should now be possible to adjust the trimpots so that range of the panel mounted pot goes from the shortest possible output, to just before the oscillator starts free running.

- While untested, the module should work on +/-12 volts.
- A 10 to 22 ohm resistor can be used instead of the ferrite bead. If you don't care about power-rail noise, just use a link instead.
- 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.

Resistors (1% metal film)	
Ferrite Bead	2
1k	2
2.2k	2
6.8k	2
15k	1
22k	2
47k	2
100k trimmer	2
100k	11
470k	2
1.5M	4
2.2M	2
4.7M	2
Capacitors	
47pF	2
470pF	2
1000pF (=1n)	2
4.7nF (=0.0047uF)	1
10nF (=0.01uF)	3
100nF 1206 SMT (=0.1uF)	2
100nF (=0.1uF)	2
10uF electrolytic	4
Semi's	
LED LED	2
TL072	3
Misc.	
MTA-156 connector 4Pin	1
MTA-156 header 4Pin	1
cgs18 PCB	1

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