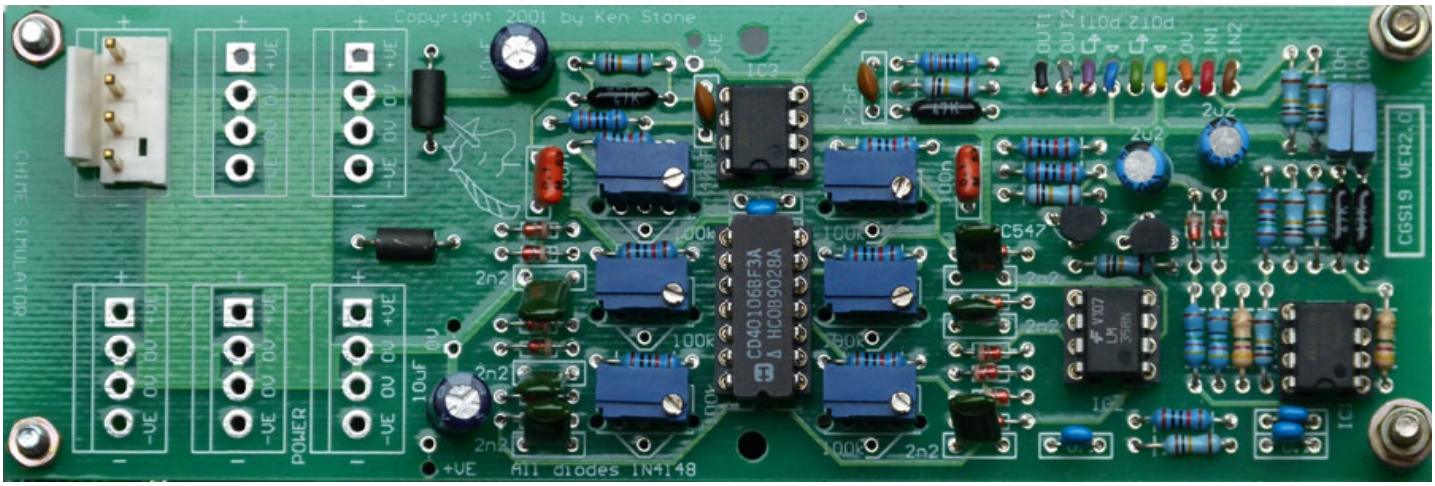


Chime Simulator

for music synthesizers.

The previous version can be found here.

This module contains a pair of two or three tone chimes that are suitable for connection to modular synthesizers. Each chime sound is created by modulating two or three square wave oscillators together, and applying an envelope to the result. Each chime is individually triggered.

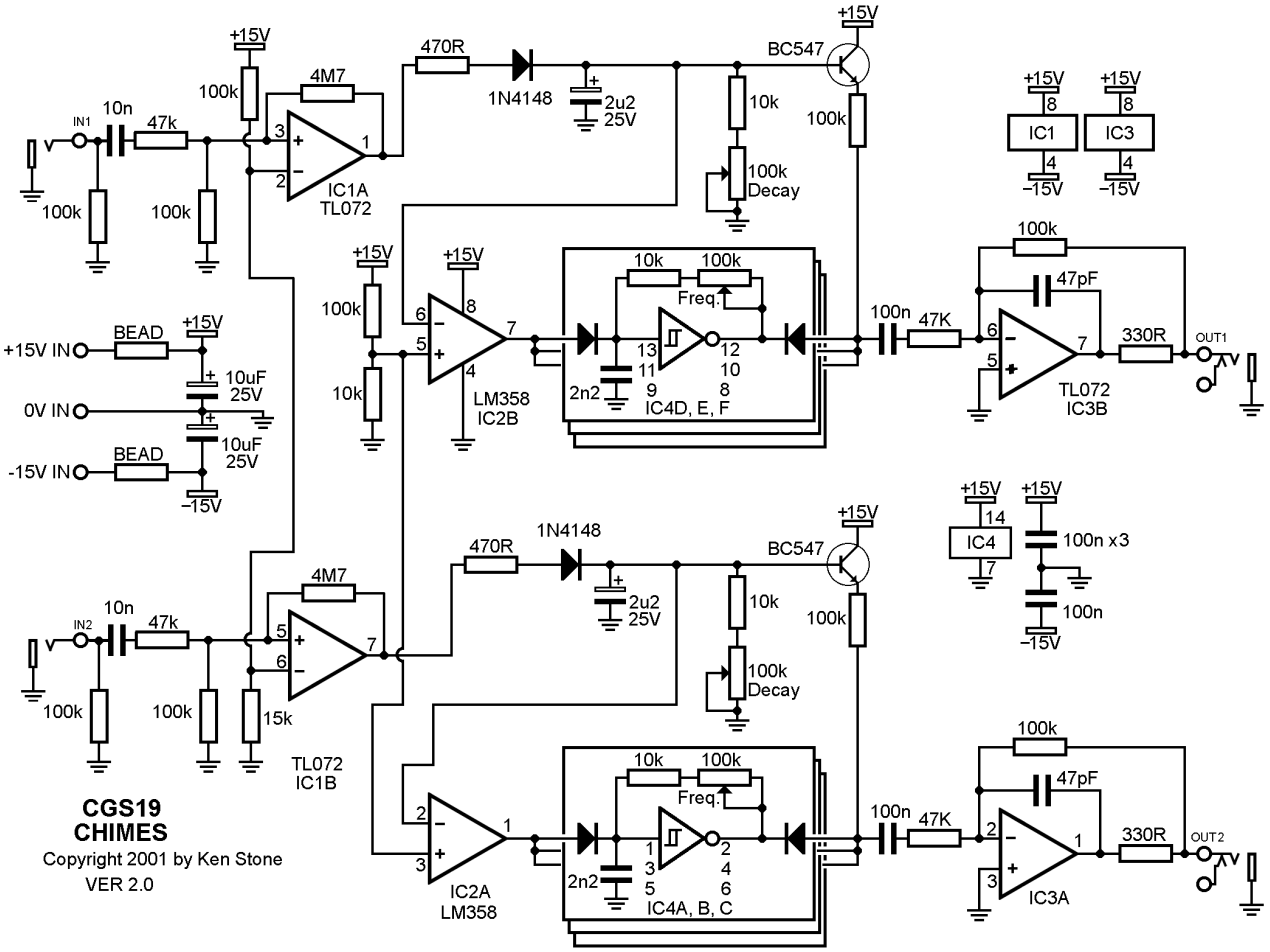
A simple modulator is used to mix the sounds, resulting in secondary tones that while similar to those generated by a ring modulator, are not as extreme. Two square wave oscillators per chime are quite adequate for producing a good range of tones, though provision had been made to add a third oscillator to each chime. Decay times are adjustable, and if really required, the pitches of the oscillators could be controlled via panel mounted controls, though the PCB is set up to take multi-turn trim-pots.

While some frequency settings of the oscillators will give convincing bell or chime sounds, there are many frequency settings that will give discordant sounds. Experiment with it.

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 trim pots (or panel mounted frequency controls) to suitable frequencies. Adjust the decay time to give various bell or chime effects.

A little on how it works:



The schematic of the Chime simulator Ver 2.0/2.1.

Each of the two chimes consists of several distinct blocks, the trigger, the oscillators, the dampers, the envelope generator, the modulator and the buffer amp. We will consider only one channel as both function identically.

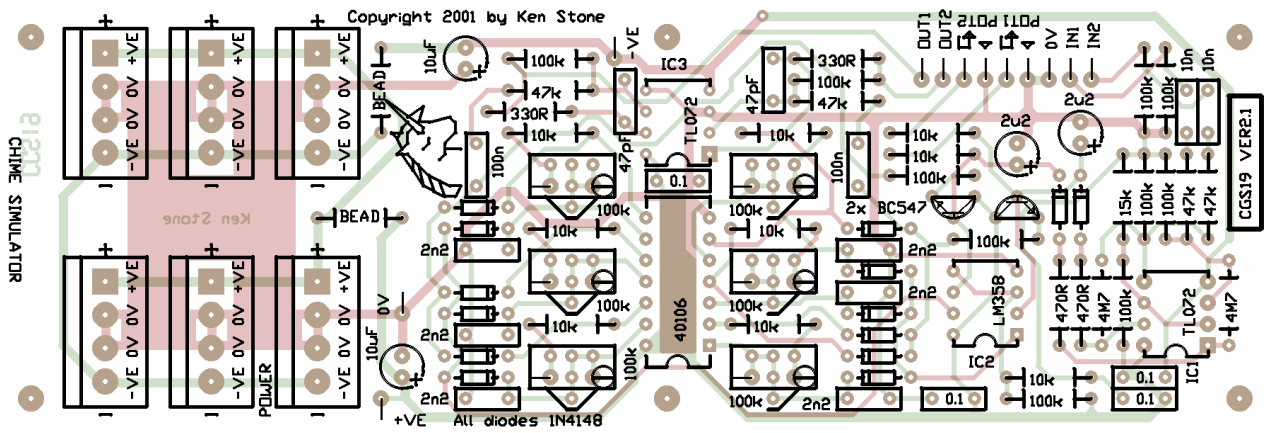
The trigger (IC1 and associated components) takes any positive going signal that goes over approximately 3 volts and converts it into a narrow positive going pulse. This pulse is fed to the envelope generator, charging the 2u2 capacitor via the diode and 470R resistor. The capacitor is then slowly discharged via the 10k resistor and 100k Decay pot. The result is a positive going percussive envelope.

This voltage is buffered by the transistor, which is wired an emitter follower. This voltage is also fed to the inverting input of a comparator (IC2, the damper). When this voltage goes over a minimum preset value, the output of the comparator will go low, enabling all three square wave oscillators.

The outputs of these oscillators is crudely ANDed together using diodes an a pull-up resistor. This pull-up resistor is connected to the output of the emitter follower, so the output of the AND gate also has the envelope imposed on it. The result is capacitively coupled to the output buffer.

When the envelope has decayed to the minimum preset value mentioned above, the damper again kicks in disabling the oscillators. The purpose of the damper is to stop any signal from the oscillators from leaking to the output when the module is meant to be silent.

Construction



The component overlay. Connections can be determined from the circuit diagram. Note that POT1 and POT2 are swapped on the Version 2.0 PCB. This artwork shows them in the correct positions.

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, diodes, transistors 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. The 40106/74C14 is a static sensitive device, so use appropriate handling precautions.

There is provision on the board for five extra power connectors, allowing the board to be used as a local power distribution point. If you do not need this, omit five of the sockets. It does not matter where you install the single connector.

Setup and Notes:

- To adjust the frequencies of the oscillators, feed a fast running LFO into the trigger input, and turn the bell duration to maximum. This will result in a near constant tone, which will help with adjusting. Due to the nature of the modulator, some settings of the oscillators will result in silence. As adjustments affect sum and difference tones, the frequency adjustment is very sensitive, even when 25 turn trim-pots are used. If you are using panel mounted pots, consider using big knobs, or have a high value pot (100k) in series with a low value pot (1k) to allow fine tuning.
- As chime tones tend to have a distinct pitch, it is advisable to tune them either well away from, or exactly to the key in which you are playing, or otherwise you may find yourself with unpleasant discords.
- The oscillators are temperature sensitive, as well as very sensitive to changes in capacitance (e.g. when a screwdriver is in contact with a trim pot), again due to the nature of the modulator, which emphasizes any change in frequency. If using front panel pots, you may need to earth the pot cases to the 0V (GND) connection on the PCB.
- For the two oscillator per chime version, omit the components for one oscillator as per the outlined box on the schematic, and place a link in place of the capacitor.
- You can use MKS or MKT capacitors instead of the ceramic monolithic capacitors, if you wish.
- If you find the damper kicks in too soon, replace the 100k on pin 5 of IC2B with something higher, e.g. 220 or 330k.
- The module will 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
330Ω	2
470Ω	2
10k	9
15k	1
47k	4
100k	10
100k trimmer	6
4.7M	2
Capacitors	
47pF	2
2.2nF (=0.0022uF)	6
10nF (=0.01uF)	2
100nF (=0.1uF)	6
2.2uF electrolytic	2
10uF electrolytic	2
Semi's	
1N4148	14
40106	1
BC547	2
LM358	1
TL072	2
Misc.	
MTA-156 connector 4Pin	6
MTA-156 header 4Pin	6

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