MIDI DRUM SYNTH

Are you still hiding your creativity behind that all-encompassing maxi? Or is that skimpy mini revealing the inadequacies of your rhythm section? ETI unveils its Midi, the drum synth to be seen with!

We have published a number of drum synthesisers in the past, both full-featured, multi-voiced monsters (eg, June 80, April 1981) and simple, single-voiced modules (eg, November 1983), but so far, we have never featured anything which falls between these two extremes. As its name implies, the Midi Drum Synth is an attempt to put that right.

The Midi is a single-voiced unit which also has a sequencer input, allowing several to be used together. It has a variable decay rate, variable pitch, and a variable sweep facility which causes the pitch to fall sharply from its starting point. When not required, this can be switched out so that only a single tone is produced. Further variety of sound is provided by an active filter whose centre frequency and pass band are adjustable. The input device is a small transducer which triggers a drum beat when hit; the harder you hit it, the louder the sound produced. A level control is also provided, and the completed unit runs from an external battery or other 9-16 volt supply. The range of facilities allows the Midi to imitate everything from a bass drum to a triangle, as well as some less obviously percussive instruments, for example, a strummed guitar.

Construction

The complete unit is housed in an aluminium diecast box, and the drilling details for this are shown in Fig. 3. The only hole likely to cause any problems is the 23 mm diameter hole for the piezo transducer. The size is not too critical, but if you don't have a metal punch around that size you will either have to burr out a smaller hole or else drill a series of small holes in a circle and then link them up with a small file. It does not matter if the finished hole has a rough edge since it will be hidden by the pad of the transducer. The case should then be painted, the legends added using dry transfer lettering, and a coat of varnish applied to protect the lettering.

Start assembling the PCB by inserting the three wire links. Note that one of these is under IC2 and either use an insulated link on the underside of the board or choose an IC socket which allows room for the link to pass under it. IC sockets are recommended for all the ICs since three of them are MOS devices and the fourth is fairly expensive. Do not insert the ICs into their sockets yet but carry on soldering the resistors and capacitors into place, taking care to mount C1, 8 and 9 the right way around. Take care also with the two diodes.

It is best to tackle the wiring up in a methodical manner, perhaps working from one end of the PCB to the other. Using many different colours of wire will help, and it is a good idea to allocate each potentiometer its own colour so as to make sorting out the leads at the front panel easier. Cut the potentiometer shafts to their

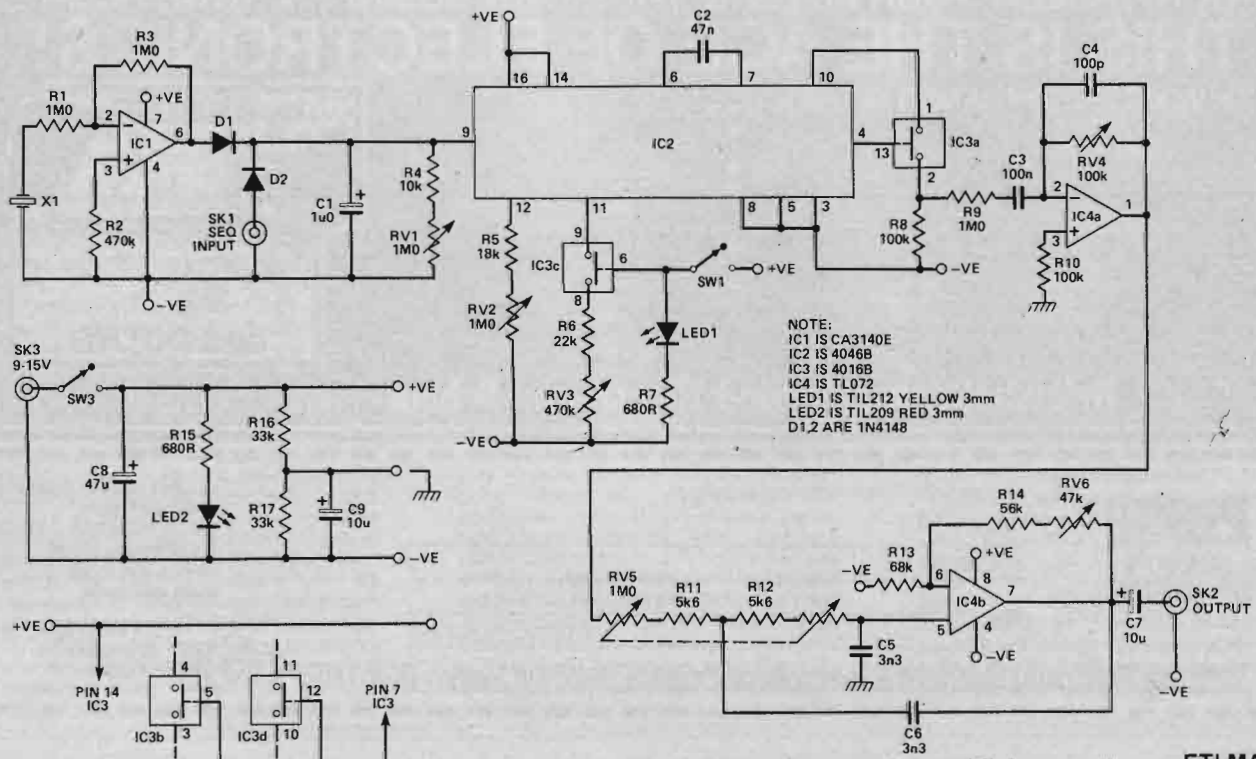


Fig. 1 Circuit diagram of the Midi drum synth.

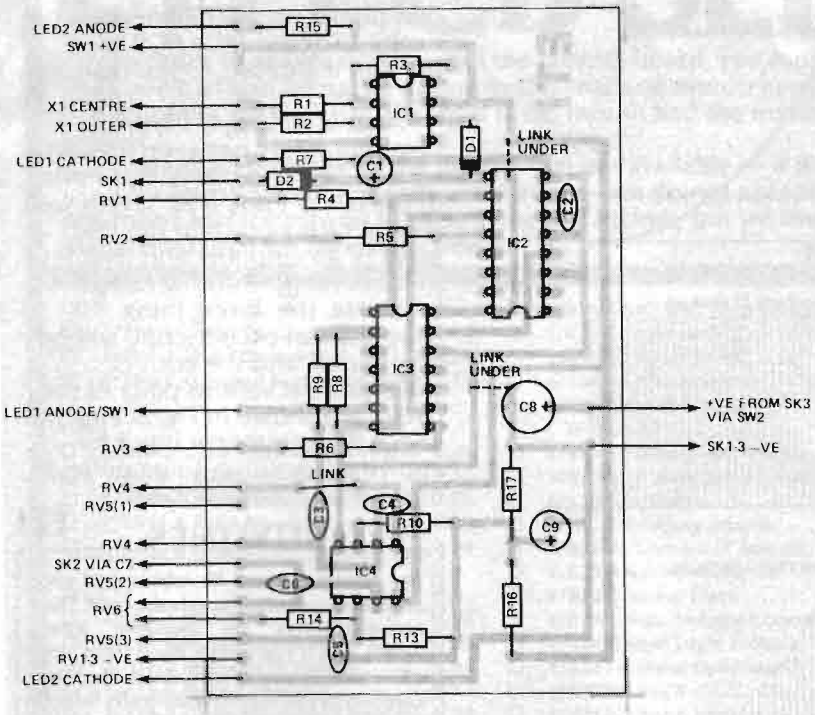


Fig. 2 Overlay diagram of the PCB.

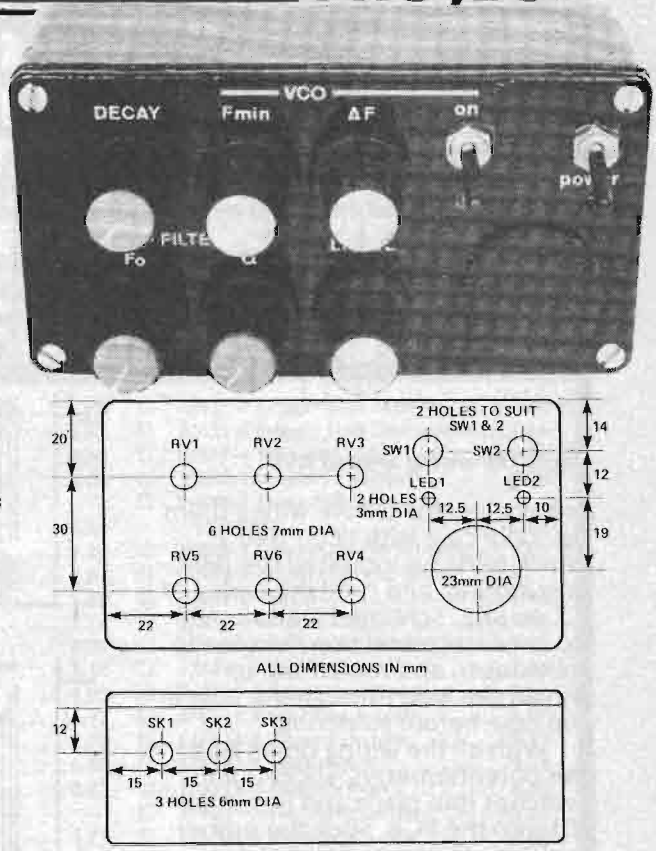


Fig. 3 Case drilling details.

PARTS LIST

RESISTORS (all ¼W, 5%)

R1, 3, 9	1M0
R2	470k
R4	10k
R5	18k
R6	22k
R7, 15	680R
R8, 10	100k
R11, 12	5k6
R13	68k
R14	56k
R16, 17	33k
RV1, 2	1M0*
RV3	470k*
RV4	100k*
RV5	1M0* dual gang
RV6	47k*

(*All potentiometers are miniature types with 7mm bushes)

CAPACITORS

C1	1μ0 25V radial electrolytic
C2	47n
C3	100n
C4	100p polystyrene
C5, 6	3n3 mylar
C7, 9	10μ 25V radial electrolytic
C8	47μ 25V radial electrolytic

SEMICONDUCTORS

IC1	CA3140E
IC2	4046B
IC3	4016B
IC4	TL072
D1, 2	1N4148
LED1	TIL212 yellow 3mm LED
LED2	TIL209 red 3mm LED

MISCELLANEOUS

SK1, 2, 3	3.5mm open jack socket
X1	PBN2720 piezo transducer and pad
SW1, 2	SPST toggle switch

PCB; knobs, 6 off; case, BIM5004 or similar; 2 off 8 pin DIL sockets, 1 off 14 pin and 1 off 16 pin; thin plastic or card to line box; screened and un-screened wire, etc.

HOW IT WORKS

When X1 is hit, a short, negative-going pulse is generated whose amplitude is proportional to the force of the hit. IC1 inverts and buffers this pulse and charges C1. D1 ensures that the only discharge path for C1 is via R4 and the decay control potentiometer, RV1. IC2 is a 4046 phase-locked loop which consists of a voltage controlled oscillator (VCO), a source follower, a zener diode and two phase comparators. The decaying voltage across C1 is taken to the input of the VCO and the source follower. C2 sets the VCO frequency in combination with the resistance networks connected between pins 11 and 12 and the negative supply rail. Pin 12 sets the frequency offset; placing a voltage on this pin compresses the frequency range of the VCO towards its maximum value, thus setting the minimum value. Pin 11 sets the frequency range; with SW1 open, IC3c presents what is effectively an open circuit, with the result that no frequency range is set and the VCO produces a single tone at its centre frequency regardless of the varying input voltage. With SW1 closed, IC3c connects RV3 and R6 into circuit and thus sets a frequency range, causing the VCO frequency to fall as the voltage on its input falls.

The outputs from the VCO and the source follower are combined by IC3a and R8 as shown in Fig. 5 (over page). The resulting waveform is fed to the buffer, IC4a, which incorporates the level control, RV4, and then to a second order Sallen and Key active filter configured around IC4b. The buffer ensures that the filter is driven by a low impedance source and by integrating the level control with it, an output potentiometer is not needed and the output impedance can also be kept low.

The power supply is perfectly straightforward; R16 and 17 set the earth rail halfway between the positive and negative supply rails, C9 decouples this rail from 0V and C8 provides decoupling for the two main supply rails.

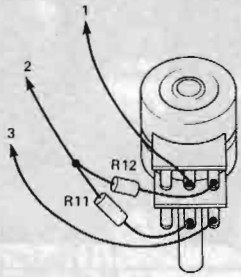


Fig. 4 The wiring around RV5.

correct lengths before wiring them up. Take care with LED1 and 2 which must be mounted the right way around, and note the wiring of C7 on SK2. Screened lead should be used to connect up the piezo transducer, and remember to thread the lead through the hole in the case before soldering.

With all the wiring done, bolt the potentiometers, sockets and switches into place and insert the ICs into the PCB. Stick the rubber pad onto the transducer and mount it over the large hole using a contact adhesive. It was not found necessary to secure the PCB inside the box. Instead, a sheet of thin plastic was folded and wrapped around the PCB to prevent it shorting to the case at any point.

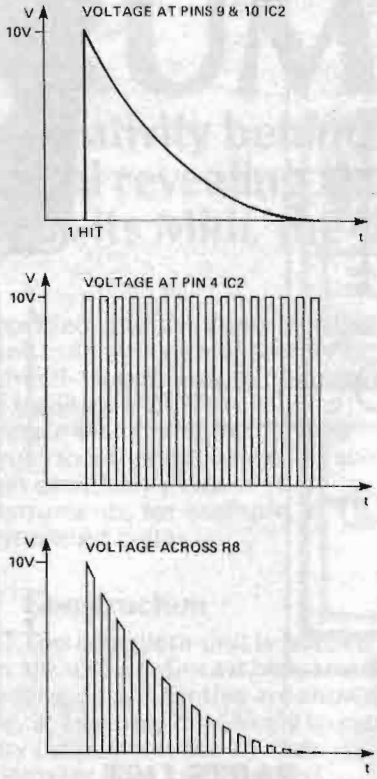
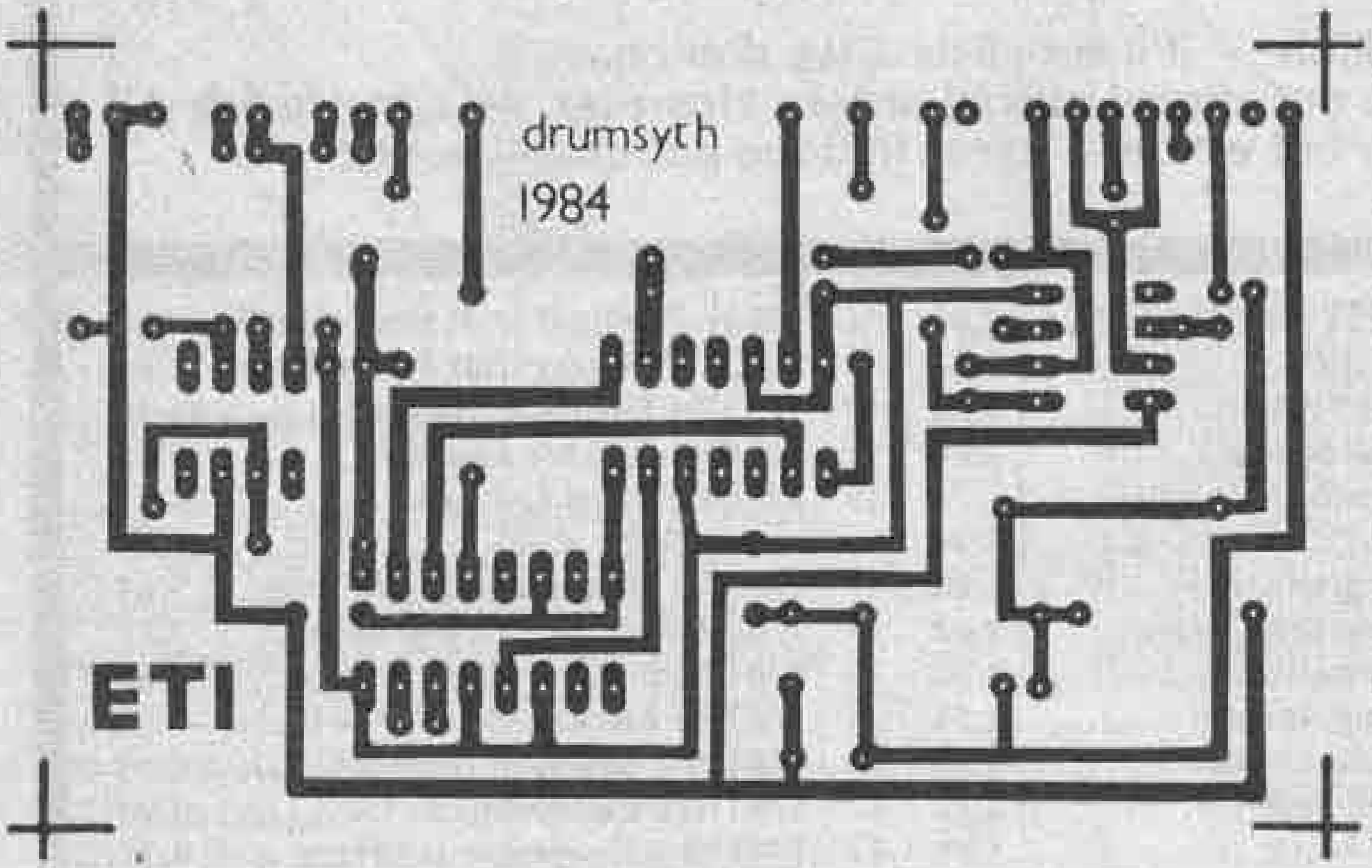


Fig. 5 Modulation of the VCO output by the decay voltage.

After checking everything carefully, apply between 9 and 16 volts to SK3 and check that none of the ICs get hot. If all seems well, connect the output to the line input of an amplifier and try a few practice hits. If nothing happens (or worse, the wrong thing happens), an oscilloscope will be very useful, and the correct waveforms at various parts of the circuit are shown in Fig. 5. Finally, check the sequencer input by applying a positive-going pulse at the supply potential to SK1.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