Hyper-Fuzz

More distorted effects for your muscial instrument

By Charles Dancer

Distortion or fuzz units are used to make the sound of a musical instrument more 'interesting' by adding harmonics to it. This is usually achieved by using a non-linear amplifier of some kind to clip or round-off the peaks and troughs of the audio signal. The resultant distortion consists of a wide range of harmonics at multiples of the input frequency.

The input/output characteristic of the Hyper-fuzz is shown in Fig. 1. Each half-cycle of the audio signal is 'folded over' three times before being clipped. This gives rise to a narrow band of harmonics, the frequency of which is dependent on the amplitude of the input signal. When used with a guitar a filter-sweep effect is produced as each note dies away.

In addition, the circuit can produce conventional clipping distortion and an intermediate effect, selected by a three position toggle switch, SW1. These extra characteristics are also shown in Fig. 1.

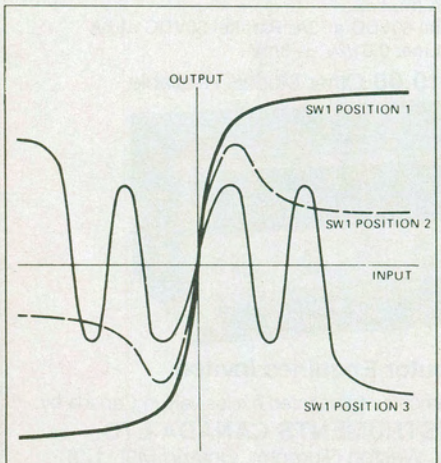


Fig. 1 The input/output characteristic of the circuit with the effect switch in each of its three positions.

The circuit board is mounted in a small diecast box fitted with a foot switch (SW2) which is used to switch between the effect and a 'straight through' signal. A metal box was chosen in preference to a ready-made foot switch case because of it's lower cost and better screening properties. The other controls on the unit are DEPTH (RV1) which varies the severity of the distortion, and LEVEL (RV2) which is used to match the distorted and straight-through signals in volume.

Power for the effect comes from a 9V battery, or from an external 9V supply, the current consumption being only about 2mA. The internal battery is connected when a jack is plugged into the input socket, so there is no need for an on/off switch.

Construction

If the recommended case is used, it should be drilled as accurately as possible as shown in Fig. 2. The positioning of the holes is fairly critical. The PCB should be assembled (Fig. 4) starting with the smaller components ensuring that all leads are cropped close to the board.

When the two pots are mounted, their spindle centres should be about 15mm above the top of the PCB.

If the jack sockets have break contacts fitted, the tags for these should either be cut off or bent under the socket. The sockets should then be attached to the board by 15mm lengths of flexible wire. The toggle switch and RV2 case can then be connected to the board along with the battery clip and six 45mm pieces of wire, for the foot switch.

The PCB spacer is a piece of 4mm thick perspex or wood 22 x 26mm, with a 1/2" central hole. To make assembly easier the spacer can be lightly glued to the track side of the PCB. Before the unit is assembled an insulating grommet should be fitted to the hole for the power connector.

The PCB assembly can then be inserted into the case. To do this, the output jack and the two pots should first be located in their respective holes (the pots may need to be bent back a little).

Once the pots are pushed through, the board should fit neatly inside the case and the other socket and toggle

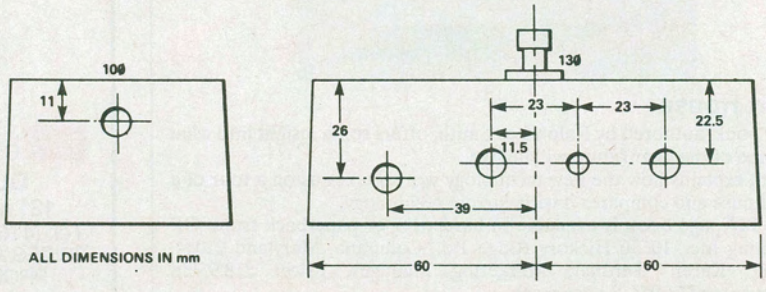


Fig. 2 Drilling the case for the Hyper-Fuzz.

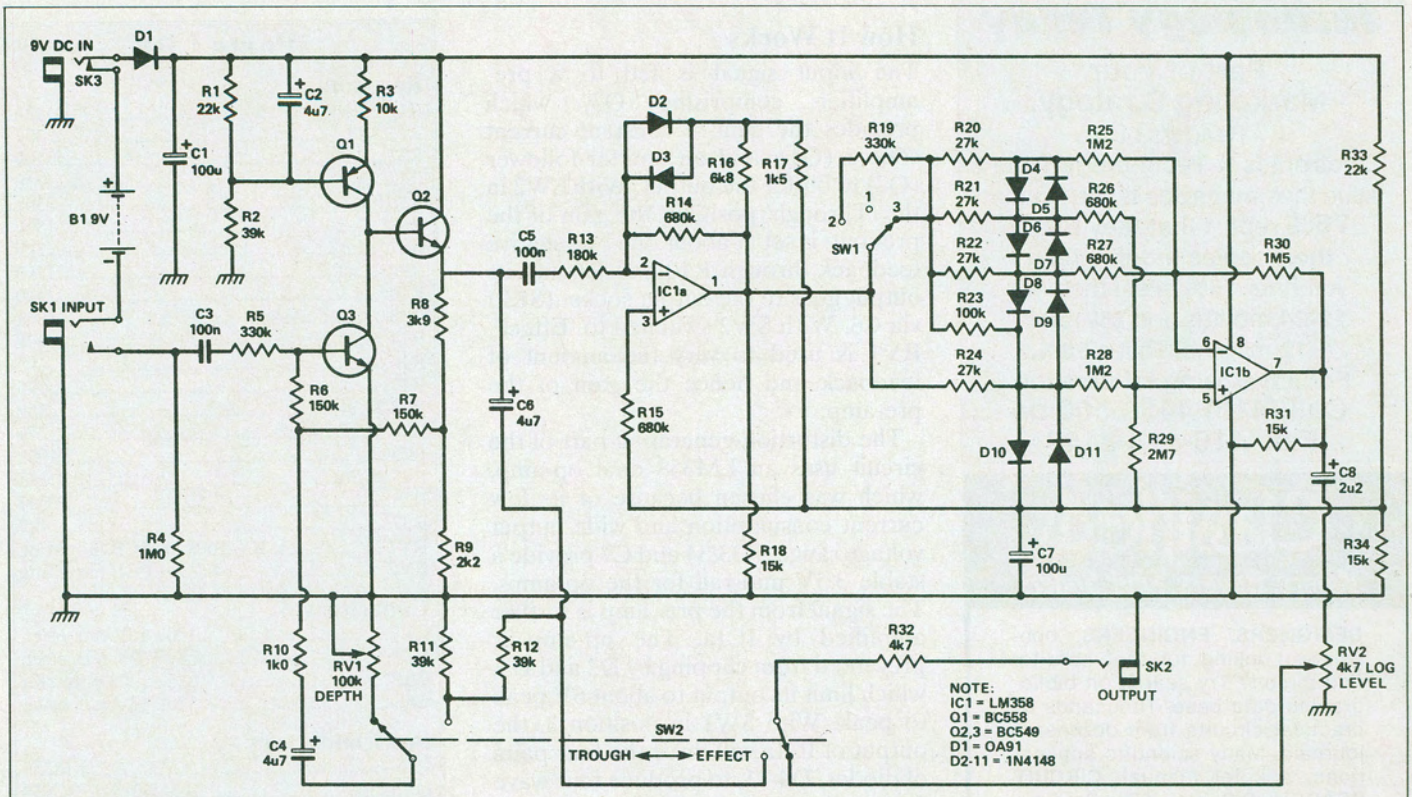


Fig. 3 The circuit diagram of th Hyper-Fuzz.

switch can then be fitted. The foot switch should be fitted through the holes in the board, spacer and case so that it holds them together, and it's leads soldered as shown on the component overlay.

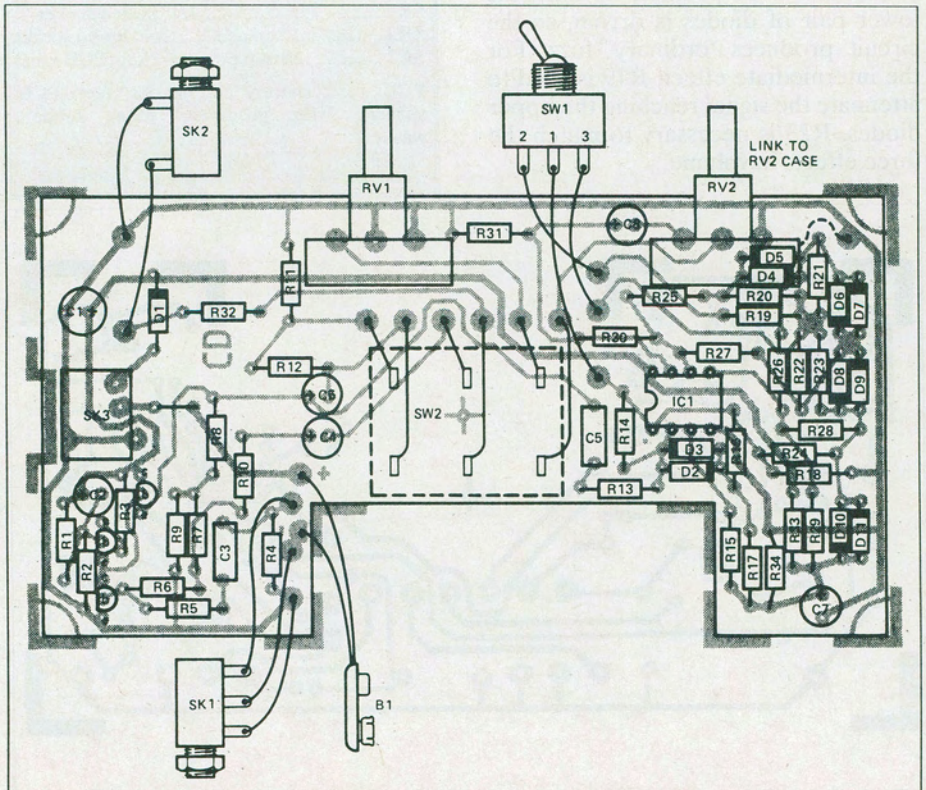


Fig. 4 The components overlay.

If you intend to drill the base plate to take screw- mounting feet, make sure that the screws will not interfere with the jack sockets. With care, they can be positioned so that the feet slightly overlap the retaining screws, thus preventing them getting lost. The battery can be cushioned using strips of foam weatherstripping stuck inside the case and on the side of the switch, and held in place by a piece of foam rubber glued to the base plate.

Operation

The unit should be set up in the same way as a standard distortion unit. Adjust RV1 and SW1 until the desired effect is heard, then adjust RV2 so that there is little change in volume when the foot switch is pressed. Because of the severity of the distortion the full Hyper-fuzz effect (Setting 3) works best with simple 'pure' signals. Playing chords produces harsh ring-modulator-like effects which are interesting but not exactly musical. Although the unit was designed for use with electric guitar and bass, it can also be used to alter the sound of keyboard instruments, drum synthesizers and even vocals.

How It Works

The input signal is fed to a pre-amplifier comprising Q3, which provides the gain, a constant current source (Q1), and an emitter-follower (Q2) to buffer the output. With SW2 in the 'Through' position, the gain of the pre-amp is set at about one by negative feedback through R10 and R6 and its output goes to the output socket (SK2) via C6. With SW2 switched to 'Effect', RV1 is used to vary the amount of feedback and hence the gain of the pre-amp.

The distortion-generating part of the circuit uses an LM358 dual op-amp, which was chosen because of its low current consumption and wide output voltage range. R33/34 and C7 provide a stable 3.5V mid-rail for the op-amps. The signal from the pre- amp is further amplified by IC1a. The op-amp is prevented from clipping by D2 and D3, which limit its output to about 6V peak to peak. With SW1 in position 3, the output of IC1a will drive the four pairs of diodes, D4-11, to produce four wave forms clipped at 0.5, 1, 1.5 and 2V. These are then fed to alternate inputs of a difference amplifier (IC1b). So, as each diode begins to conduct, the gain of the circuit reverses polarity.

With SW1 in position 1, only the lower pair of diodes is driven, so the circuit produces 'ordinary' fuzz. For the intermediate effect, R19 is used to attenuate the signal reaching the upper diodes. R23 is necessary to match the three effects in volume.

Parts List

Resistors

R1,33	22k
R2,22,12	39k
R3	10k
R4	1M0
R5,19	330k
R6,7	150k
R8	3k9
R9	2k2
R10	1k0
R13	180k
R14,15,26,27	680k
R16	6k8
R17	1k5
R18,31,34	15k
R20,21,22,24	27k
R23	100k
R25,28,30	1M5
R29	2M7
R32	4k7
RV1	100k lin PCB mounting
RV2	4k7 log PCB mounting

Capacitors

C1,7	100u 16V rad. elect.
C2,4,6	4u7 63V rad. elect.
C3,5	100n polyester
C8	2u2 63V rad. elect.

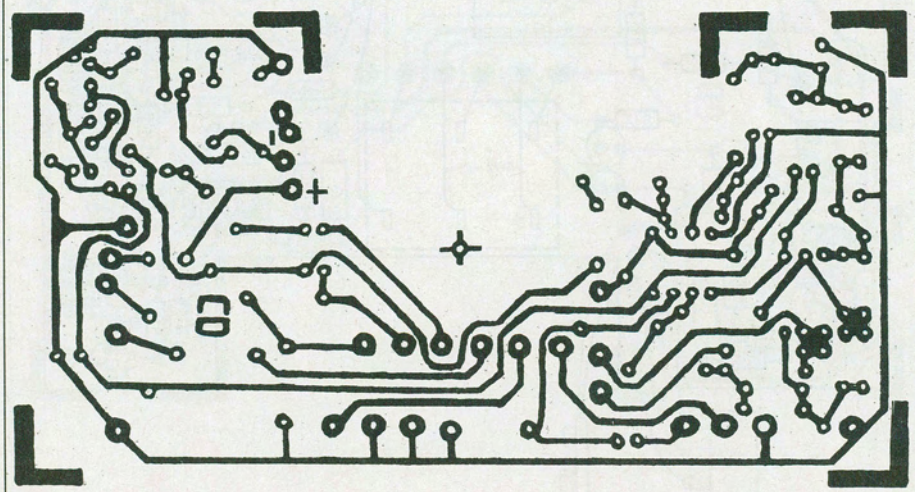
Semiconductors

IC1	LM358
Q1	2N6015 or BC558
Q2,3	2N5818 or BC549
D1	1N4001 or equiv
D2-11	1N4148

Miscellaneous

SW1	SPDT centre-off tog.
SW2	DPDT foot sw.
SK1	1/4" stereo socket
SK2	1/4" mono socket
SK3	2.1mm power socket (PCB mnt)

PCB; case; battery clip; knobs; feet; PCB spacer; 3/4in grommet; foam rubber, washers.



The printed circuit board artwork for the Hypr Fuzz.