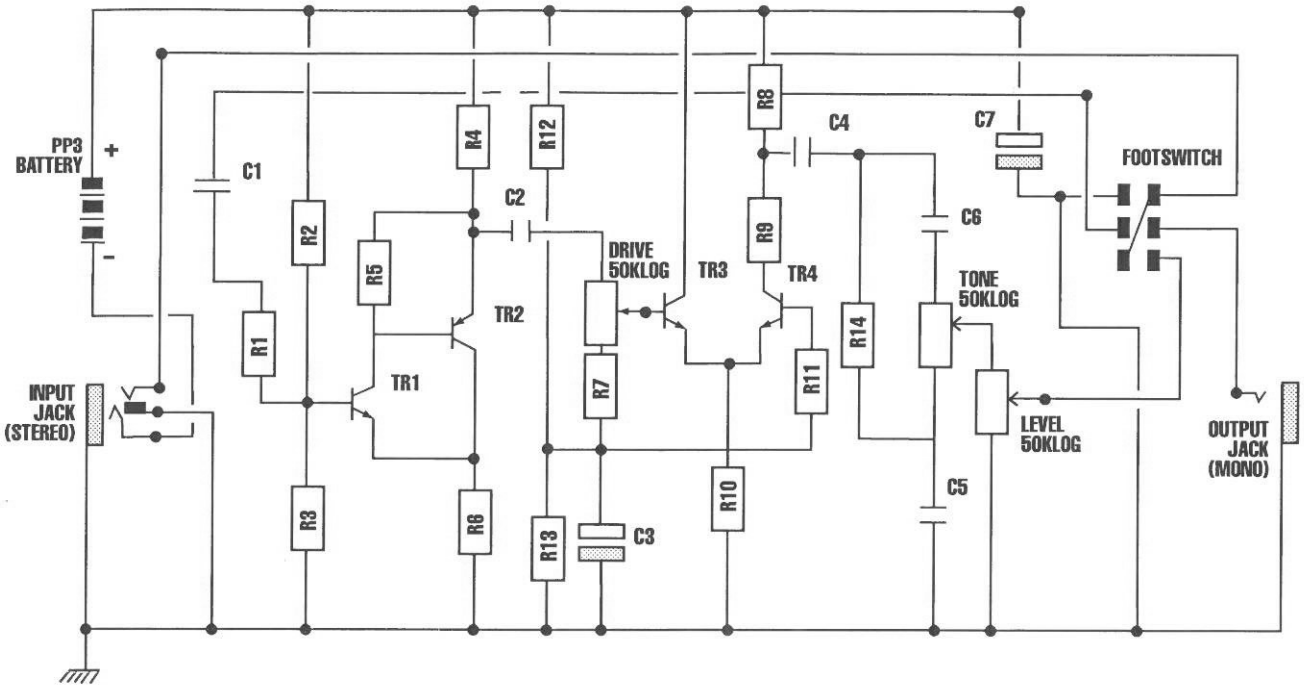
GUITAR MAGAZINE TUBE BENDER

CIRCUIT DIAGRAM



TUBE BENDER PARTS LIST :

Item	Quantity	PCB Flag
Diecast case	1	
Jack skt (Stereo)	1	
Jack skt (mono)	1	
Footswitch	1	
Potentiometer, 50K log	3	
Battery clip	1	
Printed circuit board	1	
Control knobs	3	
Control knob caps, blue	3	
Transistor BC549C	3	TR1, 3,4
Transistor BC307B	1	TR2
Capacitor, 47uF 16V	2	C3, C7
Capacitor, 4n7	1	C6
Capacitor, 10nF	2	C1, C5
Capacitor, 100nF	2	C2, C4
Resistor 150R 0.33W	1	R6
Resistor 1K2 0.33W	3	R1, R5, R7
Resistor 2K2 0.33W	2	R4, R9
Resistor 22K 0.33W	5	R8, R10, R11,R12, R13
Resistor 68K 0.33W	1	R14
Resistor 100K 0.33W	1	R3
Resistor 1 Meg 0.33W	1	R2

Sundries

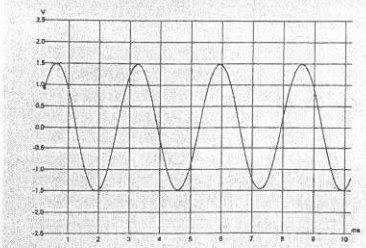
Connecting wire, 7/.02mm 1.2 metre

Idents & Colour Codes

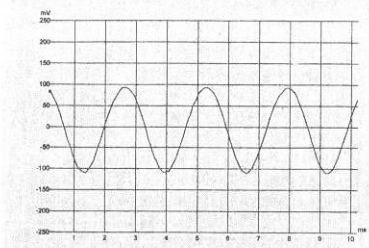
* Capacitors : 47uF 16v – value & polarity marked on sleeve
* 4n7 – yellow body marked '4n7'
* 10 nF – yellow body marked '10n'
* 100 nF – yellow body marked '100n'
* Resistors: 150R –brown/green/brown;
  1K2 – brown/red/red;
  2K2 – red/red/red;
  22K– red/red/orange;
  68K – blue/grey/orange;
  100K – brown/black/yellow;
  1 Meg – brown/black/green.

WAVEGRAMS

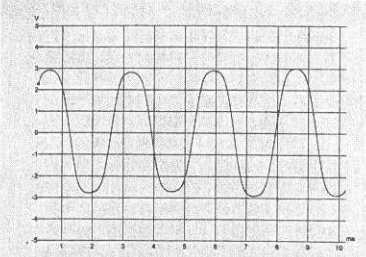
AC30 @ 10W>16Z



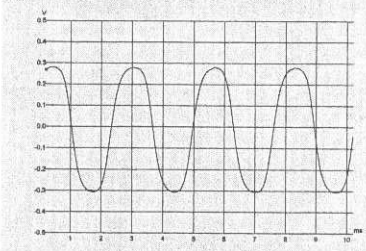
TBender/25 mv in/D2/T5/L10



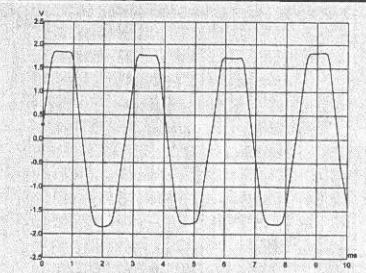
AC30 @ 36W>16Z



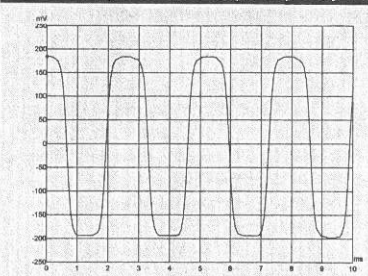
TBender/25 mV in/D7/T3/L8



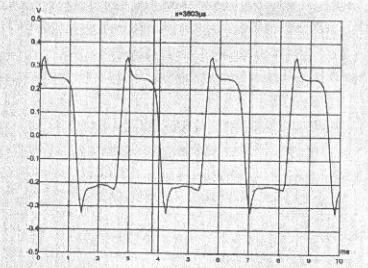
Fender Vibrolux 40W>4Z



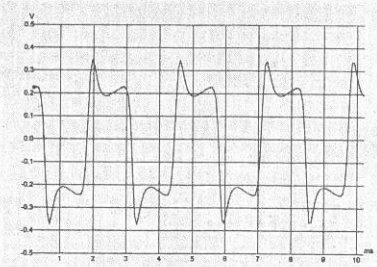
TBender/25 mV in/D7/T8/L9



Marshall JCM800 Drive Channel



TBender/25 mV in/D10/T10/L8



It's possible to set the Tube Bender's controls so that it gives approximate simulations of some classic overdriven amp sounds – although of course it isn't in the same league as the dedicated digital modelling amps out there. Much of the character of the classic amps is readable in their wavegram – a graphic two-dimensional representation of the behaviour of the amp's output voltage fed to the speakers when a single-frequency, constant level test-tone with no harmonic overtones (totally unlike your guitar!) is connected to its input. This tone is called a sine-wave, and looks exactly like the wave in the 'AC30 10W>16Z' wavegram. Its main use is in determining if the amp itself has added any harmonic overtones, which colour the sound and consequently change the shape of the waveform.

When a 30W class A amp is driven so far within its power rating that no harmonics are added to the waveform, a good likeness of the test-tone appears at its output. If you compare it to the wavegram of the same amp at 36W, you'll notice a change in the curve towards the outer limits of the wave caused by added harmonics – around 10 per cent of the total output. The waveform remains curved, and it can be shown by harmonic analysis (which consists of filtering out the original sine-wave and examining what's left) that this curvature results from second harmonic distortion. This means an overtone exactly double the frequency, or one octave above the original.

Compare it to the 'Fender Vibrolux @ 40W>4Z' wavegram, and it's obvious that this has a sharper, flatter waveform cutoff (known to techs as 'clipping'). The Fender is a class AB amplifier, which is, like the AC30, quite uncoloured at low levels, but all else being equal would add more distortion towards its output limit, due to the valves being driven near to 'current saturation'. This doesn't happen with a class A amp – the valve current stays within saturation levels until well after the rated output is delivered. To counter this excessive (and not very nice-sounding) colouration, the Fender circuits all use negative feedback, a circuit technique which uses amp gain to suppress distortion in a kind of pay-off arrangement. Negative feedback circuits exhibit a sharper clipping tendency than the Vox-type 'open-loop' arrangement, and analysis shows it to have a significant third harmonic content. This is harder and more discordant sounding, being an unrelated interval to the original frequency, but nonetheless useful in some styles of guitar.

◀ parallel diodes in the feedback loop of an op-amp, which is a type of limiter circuit. The Drive control alters the gain of the op-amp so the soft-clipping region is available at different signal levels, corresponding to different types of guitar. The Tube Bender uses a high-performance discrete amplifier to increase the input-signal level into a differential (long-tailed pair) amplifier, which has inherent soft clip characteristics, to create the saturated than the op-amp/diode circuit and has less obtrusive intermodulation products when chords are played. The Drive control simply alters the signal level between the two stages.

One effect of the 808's Drive control is to restrict the passband of the limiter stage at higher gain levels, which is desirable in itself. However, as more feedback-current is then forced through the diodes, they begin to produce flat-top (square) clipping. The resulting mix harsh at high Drive settings, with an impression of separation between the 'body' and the 'edge' of the sound. The saturation-amplifier passband in the Tube Bender is independent of the Drive setting and there are no diodes, so there's better integration between the two elements of the sound at high Drive settings.

Making Your Case