CIRCUIT IDEAS

Autobiasing preamplifier

Resistor-based autobiasing circuits do not work well with low supply voltages. This general-purpose preamplifier uses active autobiasing and runs with supplies from 1.2 to at least 12V, taking about 0.5mA from a 2.4V supply.

Active autobiasing uses a transistor to compare mean output level with a reference voltage and feed back corrections even at low supply voltages. In most low-noise preamplifiers, V_{CE} is kept small to minimize shot noise. Here, the first transistor is kept almost saturated and the collector of the second is at mid-rail for maximum output-voltage swing.

Low-frequency roll-off is determined by the low-pass filter used to average output level and high-frequency performance depends on transistor characteristics. With the input open-circuit, the filter must give sufficient attenuation near d.c. to make the autobiasing stable.

Input-signal impedance should be less than about 1kΩ, and amplitude a few millivolts, so the amplifier is suitable for coil microphones and tape heads. In the prototype, $Tr_{1,2}$ had gains of about 500 and Tr_3 about 190.

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Half-wave rectifier

A basic LM324 non-inverting amplifier working from a single-rail supply can be considered as a precision half-wave rectifier. Note that the peak negative value of V_{in} must not exceed 300mV. For higher voltage, add a series resistor at the input to form a potential divider. A coupling capacitor may be used if necessary.

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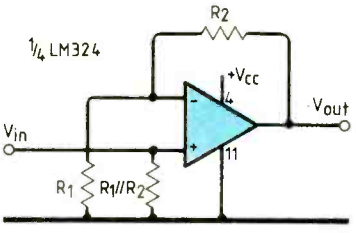

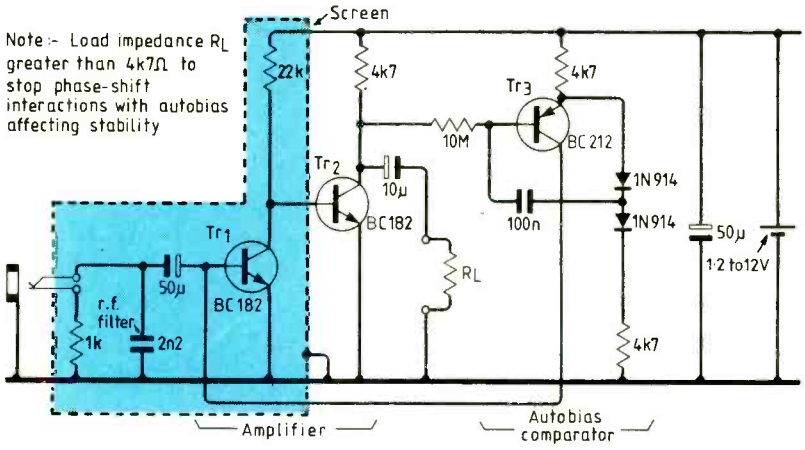

Compact digital echo unit ▶

Despite its simplicity, this compact sound-delay unit gives a repeating echo with a half-second period and good fidelity. Input and output are at line level and current consumption is about 65mA.

Two controls are provided; the delay-time control gives the period between echos and the recirculate control sets the fraction of the delayed signal fed back to give multiple echos. The unit's single 64K-bit ram i.c. gives a comparable memory to echo units with eight-bit converters and 8K-byte of storage.

Simplicity is achieved through use of a type of digital/analogue conversion known as delta-sigma modulation. As well as requiring few components, this type of converter produces only one output bit and so does not suffer from the same kind of clipping distortion that occurs when conventional converters are overdriven. Instead, over-large signals cause slew-rate distortion which is far less noticeable to the ear. This means that far less headroom needs to be allowed for sound peaks when setting up and the overall signal-to-noise ratio is correspondingly increased.

Each memory location is selected in turn; on each selection, old contents are read and new data is written. Time taken to cycle round all 65536 locations is the echo or delay time.

Counter IC_9 is constantly clocked at around 500kHz by the oscillator formed by $IC_{11a,b}$. This counter is used as a sequencer to control the rest of the digital electronics. It counts through four phases 00, 10, 01 and 11, performing the following actions.

In phase 00, IC_{11c} goes low, incrementing the main address counter $IC_{7,8}$. During the rest of this state, the address counter ripples through and settles down.

During phase 10, IC_{11d} pulls the memory RAS line low. This causes the memory to latch the low eight bits of the address counter and takes care of memory refresh. At about 30ns after RAS, the signal propagates through the delay section around IC_{10b}. This causes data selectors $IC_{5,6}$ to switch and present the high-order eight bits of data to the memory. At the same time, CAS is pulled low.

Phase 01 causes the memory device to recall its stored information for the current address and put it on pin 14. This data is latched into IC_{3b} on the transition to the next state.

The memory's WE line is held low during phase 11, causing data from IC_{3a} to overwrite the data that has just been read out. At the end of the state, CAS, RAS and WE all go high and IC_{3a} is clocked to fetch a new bit from the input.

I have built the unit into an existing commercial mixing desk between the echo-send and echo-return connections. It is wired so that it switches out when an external effects unit is plugged in. However the circuit can be used as a stand-alone unit without modification.

Using battery power only a single-pole on/off switch is needed. When the circuit is switched off, the diode prevents power drain from the −3V battery.

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DON'T WASTE GOOD IDEAS

We prefer circuit idea contributions with neat drawings and widely-spaced typescripts, but we would rather have scribbles on "the back of an envelope" than let good ideas be wasted.

Submissions are judged on originality and/or usefulness so these points should be brought to the fore, preferably in the first sentence.

Minimum payment of £35 is made for published circuits, normally early in the month following publication.