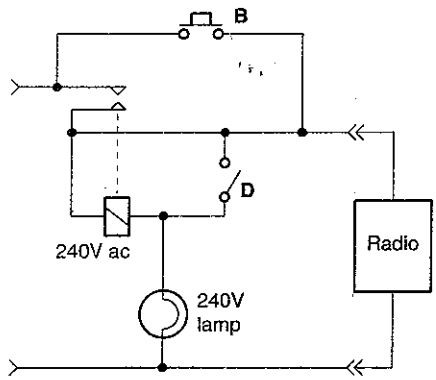
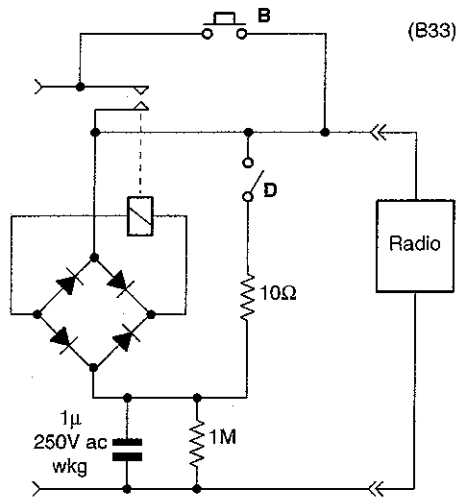
Underground radio or, "You thought you heard what?"

A medical friend wanted to listen to her mains-powered radio in her office between patient visits while coping with the paperwork, but didn't want it to be known – patients can be impatient. This circuit arrangement switches the radio off when the office door is opened, leaving an impression of industry and innocence

Door-mounted switch D has its contacts open when the door is closed, as in the type used for cupboard lights. As the door opens, the switch shorts the latching relay coil, opening the contacts and turning the radio off. When the coast is clear, the relay may be relatched and the Archers brought back by momentarily closing switch B, which can be anywhere convenient.



Clandestine radio switch switches off the radio as soon as the door opens, leaving a lot of very baffled people.



(B33)

The 240V ac, 15-100W lamp acts as a current limiter to prevent damage when the coil is shorted, flashing as the door opens. A 6-48V dc relay may be used with a series 400V dc (i.e. 250V ac) 1µF capacitor with a 1MΩ bleed resistor.

Switch B will need the 10Ω series resistor to limit inrush current. Take care with the switch wiring; both are at mains potential.

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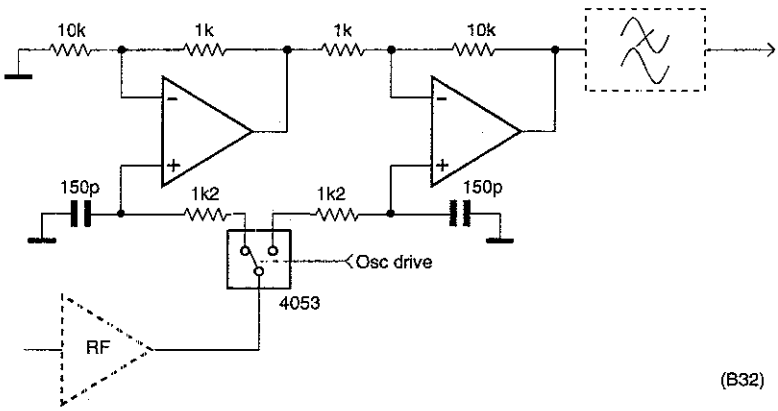
No-trim If balanced mixer



(B32)

For a low-frequency ssb cave radio, I wanted to use a pair of balanced mixers that needed no balance control without resorting to multiplex ics or analogue gates, which need trimming to reduce the effect of unbalanced inputs. This circuit is probably familiar to instrument engineers, but I have not seen it used in a radio design.

The right-hand op-amp's non-inverting input gain is 11 and its inverting input sees a gain of 10; the other amplifier has a gain of 1 1, so that the overall gain is 11 With 1% resistors, balance is excellent

Series 1 2kΩ resistors and capacitors perform the sample-and-hold at our 87kHz frequency Oscillator drive to this circuit and its partner is at 12V digital level in phase-quadrature.

Output is very pure and the circuit is difficult to overload.

John R Hey
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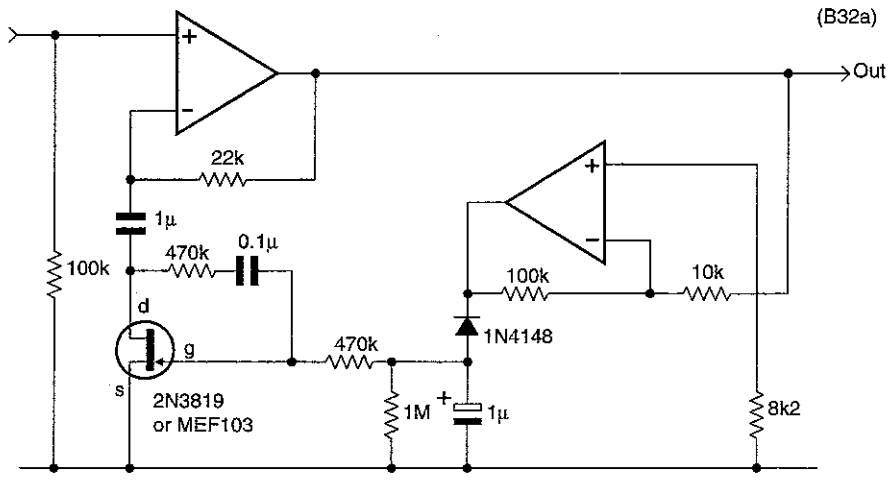
Alternative audio agc



(B32a)

Plessey's *6270* gain-controlled microphone preamp having been discontinued, I had to find a replacement for an audio agc system and have found other ics to be somewhat expensive This circuit works well and is cheap

Gain in the non-inverting op-amp is set by the 22kΩ feedback resistor and the return via the 1µF capacitor and fet, whose local feedback prevents waveform distortion Overall feedback comes from the other op-amp with a gain of 10, its output being rectified and smoothed

I have tried various fets, but have settled on the *3819* and *MEF103*, which work well: signal levels in the 4mV-4V range all output at about 200mV.

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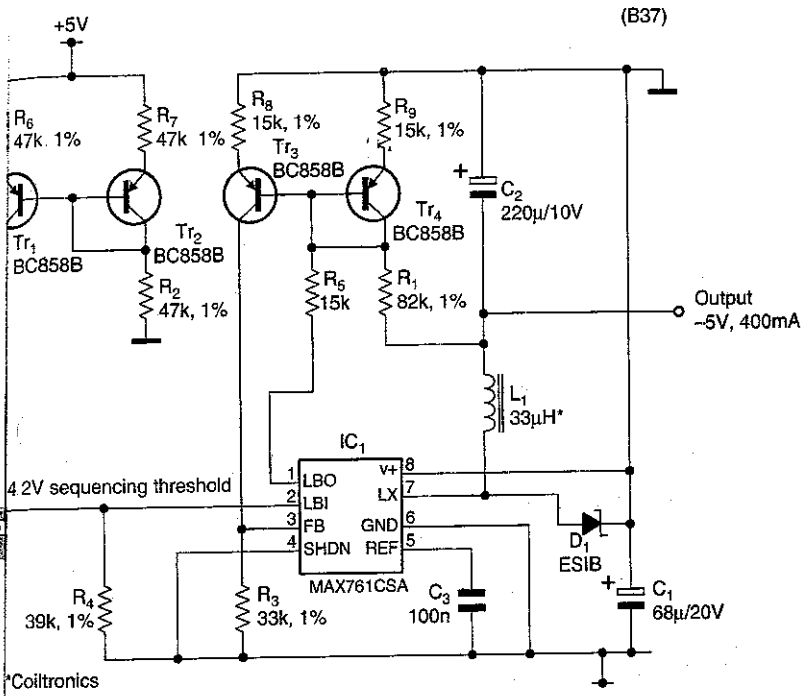

Maxim's MAX761CSA used as a negative buck regulator to provide –5V from a –12V supply, the –5V appearing in sequence with a separate +5V supply during switch-on and switch-off.

Sequenced step-down converter

This –12V to –5V converter only provides the –5V output when a separately regulated +5V has made its appearance, shutting down the 5V output if the +5V is not present. A-to-d and d-to-a converters often need this sequencing to avoid latch-up.

Regulator IC_1, a *MAX761CSA*, is an efficient, switching boost device used here as a negative buck regulator. The boost regulator arrangement is correct for the switching control. But the feedback, being referred to the positive rail and compared with a reference from the negative rail, needs a voltage level shift, which is provided by the current mirror $Tr_{3,4}$; emitter resistors $R_{8,9}$ reduce mismatch error.

An internal comparator and 1.5V reference in the *761*, which are intended for low-battery detection on the low-battery input and output pins, monitor the +5V rail. Current from the $Tr_{1,2}$ current mirror develops a voltage across R_4, proportional to the +5V rail, that is applied to LBI.

If this drops below a nominal 4.2V, LBO pulls R_5 to the negative rail, causing an increase in current through the diode-connected Tr_4; this is mirrored in Tr_3 and develops a voltage across R_3, applied to the feedback pin of the regulator. The action indicates that no further output is needed and the regulator shuts down, a minimum of 10kΩ load preventing D_1 leakage charging up C_2.

This buck-regulator arrangement delivers around 400mA at –5V, instead of the 150mA when used as intended as a boost converter, driven by +5V. Efficiency is 90% at 400mA, down to 85% at 100mA; ripple under 25mV at any load and accuracy dependent on the internal reference and tolerance of $R_{1,3,8,9}$.

Different V_{BE} in $Tr_{3,4}$ introduces more errors, but these can be greatly reduced and the need for $R_{6\text{-}9}$ eliminated, by substituting dual transistors such as the Rohm *UMT1N*.

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B37

Universal active filter

Switching a capacitor in the manner shown in **Fig. 1** simulates a resistance having the value $R_{eq}=1/f_cC_u$, f_c being the clock frequency. In this case, the simulated resistance is used to control the cut-off frequency and Q of a universal active filter.

Figure 2 shows the circuit, a low-pass filter of the second order with the possibility of interchanging the connections to pins 1 and 2 to make a band-pass filter, also of the second order.

In addition, with pin 2 grounded and pin 3 taken to pin 1 – shown by the dotted line – an all-pass filter is the outcome; adding C_2 turns the circuit into a band-stop filter. To get a high-pass filter, interchange C_1 and R_{eq}, place C_2 in parallel with R_{eq} to pin 4 and take the input to C_1.

For all versions, $f_0=f_cC_u/C_1$ and $Q=C_1/C_2$. Frequency range lies within the audio band, although the use of current-mode op-amps such as the *OPA 603* would extend the range into the megahertz region.

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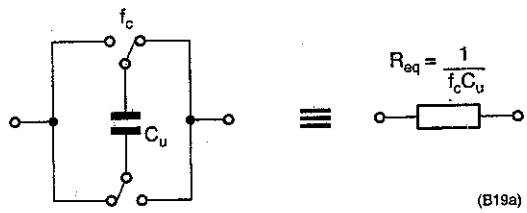

Fig. 1. Switched capacitor simulates a resistance, variable with switching frequency.

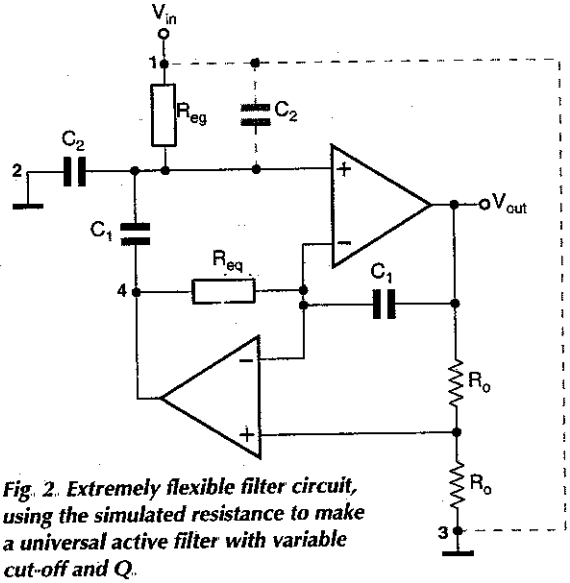

Fig. 2. Extremely flexible filter circuit, using the simulated resistance to make a universal active filter with variable cut-off and Q.