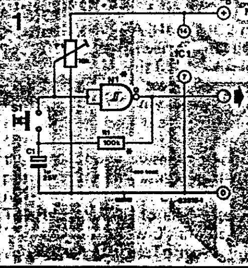
65 on/off with a single push button

A very useful function expressed in a simple circuit that is suitable for many applications. Basically the output of the Schmitt trigger N1 changes (toggles) when the switch is closed momentarily. This toggle function is achieved in such a simple circuit by the fact that the inputs of the trigger are held between the switching threshold levels. If we assume that the output *logic* level (Q) of the trigger is at logic 1, capacitor C1 will charge via R1. When switch S1 is closed the input of the trigger will now be taken to logic 1 (because the capacitor is fully charged) and the Q output will of course become logic '0'. The capacitor will now discharge but not completely because the closed switch will hold the level to that existing at the wiper of P1. However this drop in voltage at the input of the gate will not cause its output to change state again because the input level will still be above the lower switching threshold of the Schmitt trigger.

1



2

This 'intermediate' voltage level will remain while the switch is closed. When the switch is eventually released, C1 will then discharge completely. The 0 V across the capacitor will not affect the trigger since it is no longer connected to the capacitor (the switch is open). Now when the switch is closed the 0 V will reach the input of the gate and its output will once again change state. It is essential that P1 is set correctly for the circuit to function but it will be found in practice that this presents no problem.

Various types of Schmitt trigger are suitable for this circuit: 4093, 40106, 74LS14, 74LS132. If TTL ICs are used, the supply voltage must be 5 V ± 0.25 V; for CMOS ICs it should lie between 5 V and 15 V. ◄

66 inexpensive 45 MHz crystal filter

A receiver with an intermediate frequency, IF, which is higher than the highest received frequency, f_c, has the great advantage that the separation between the received frequency and the image frequencies, $f_c \pm 2IF$, is large. A filter with a high centre frequency and narrow pass-band which is eminently suitable for SSB reception can be built from relatively few components.

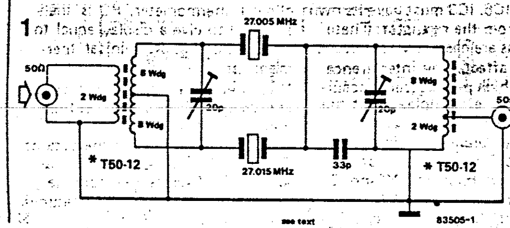
Oscillator crystals often have one or more spurious resonances and this makes their application in filters undesirable because of the risk of unwanted pass-bands. The broader the filter response, the greater this risk becomes. It is possible to use 27 MHz third-overtone crystals (standard in most CB equipment) in their fifth overtone mode. Figure 1 shows the circuit of a coarse 45 MHz filter using two 27 MHz crystals. The photo shows that the attenuation outside the passband is far from satisfactory: there is hardly any difference between the required and the unwanted passbands. With the use of more crystals, the pass-band of the filter becomes narrower and the likelihood of spurious frequencies coinciding becomes smaller.

Figure 2 shows the circuit of a ladderfilter using five crystals, which reduces the likelihood of spurious pass-bands greatly.

The 6 dB bandwidth of the filter of figure 2 is about 3 kHz, while that at the 40 dB points is only 5 kHz. The input impedance, Rg, lies between 150 Ω and 200 Ω and the output impedance is 50 Ω. Its insertion loss is 7 dB.

Coil L1 is a bifilar winding of 2 x 8 turns of enamelled copper wire of 0.2 mm diameter. As this coil is not critical, it may be wound on a ferrite bead. Moulded RF chokes may be used for L2 . . . L5. Coil L6 is again a bifilar winding, 2 x 8 turns, enamelled copper wire of 0.2 . . . 0.5 mm diameter on a T50-12 former. The filter can be built on a small piece of Vero board. The coils must be screened from one another by earthed screens. The crystal housings must also be earthed.

1



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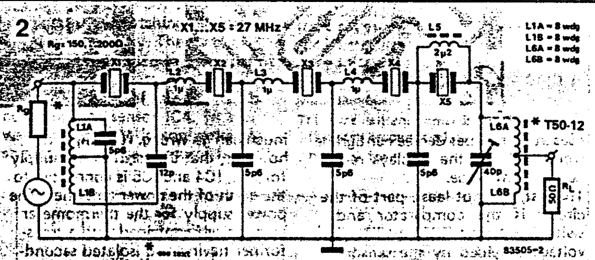
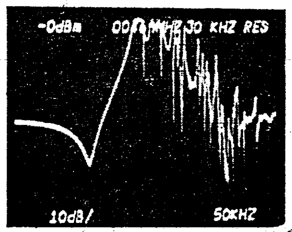


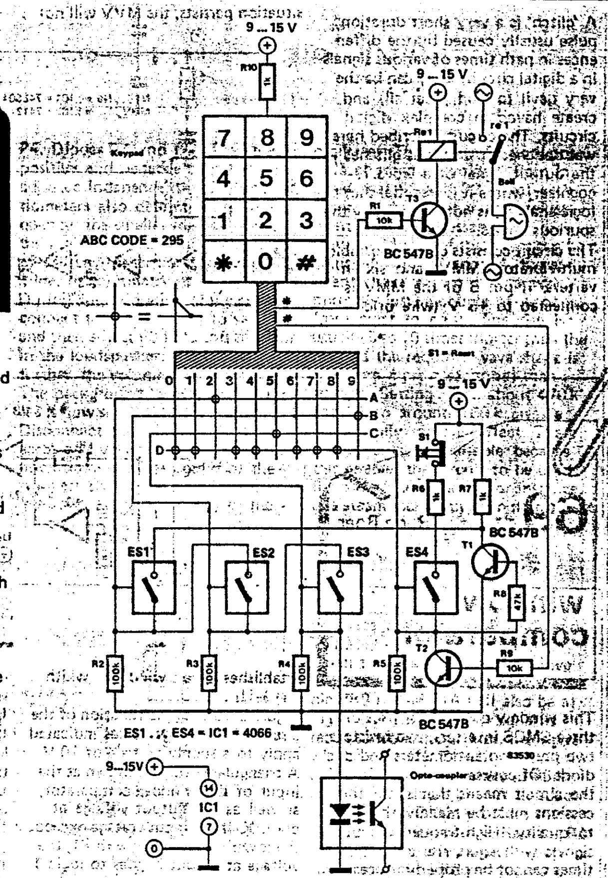


Further signal processing is best done at a much lower second IF of, say, 10 kHz, obtained by mixing the 45 MHz IF with the output of a crystal oscillator operating at 45 MHz ± IF2. The oscillator can also use a CB type third overtone crystal operating in its fifth overtone mode. ◄

67 low cost CMOS lock

A decimal keyboard, a CMOS IC, three transistors and an opto-coupler ... that is about all that is needed to make this electronic lock with a three digit combination. Locking is achieved by means of a cascade of analogue switches, each of which is connected, through a programming matrix, to one of the keys on the keypad. Suppose line A is connected to key 2, line B to key 9, and line C to key 5. If key 2 is now pressed ES1 closes and stays closed because of the current delivered to it through R7. If key 9 is then pressed ES2 closes and remains closed (because ES1 is already closed). Now all that is needed is to press key 5, whereupon ES3 closes thus activating the opto-coupler, whose transistor then conducts.

The keys not used in the ABC code must all be connected to the D line. When one of these keys is pressed, in error or in ignorance, line D sets ES4 to an active high logic level (which it keeps because of R6) and T1 conducts and thus disables the circuit completely; in fact even if ES1 is again activated, by the relevant key, it will not auto-hold as long as T1 is conducting. To start again, pushbutton S1 must first be pressed, thus opening ES4 and blocking T1. It is also useful to be able to reset the lock externally and this is achieved by means of T2, which is connected parallel to the reset circuit and controlled by the # key. Key * could be used as an ordinary bell push, activating relay Re through transistor T3; thus driving the bell transformer.



One further word about the operation of the lock: consider again our combination of 295, and assume that the first key pressed was not 2 but 9, which is not wrong, merely misplaced. The B-9 connection causes ES2 to close but it cannot remain closed when key 9 is released because ES1 is open.

An opto-coupler is used here in preference to other alternatives which might be chosen in other applications, and proves to be simple, inexpensive and effective in this circuit. ◄