Alignment-free FM Detector

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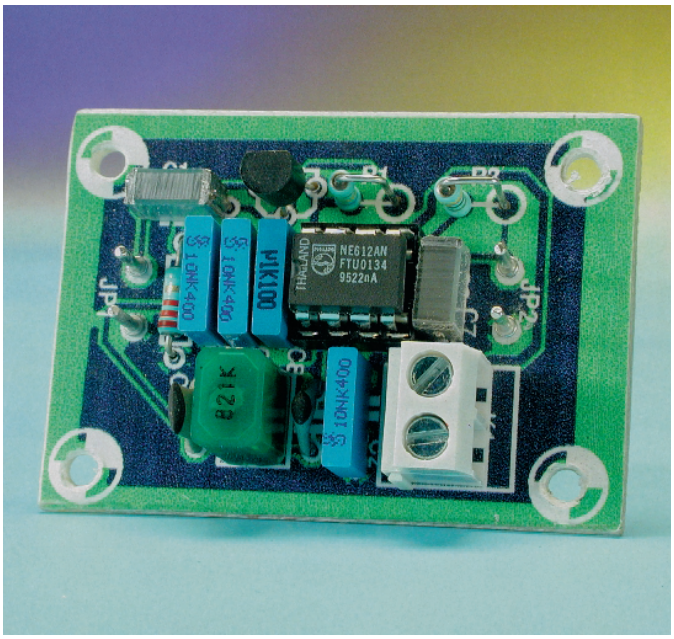

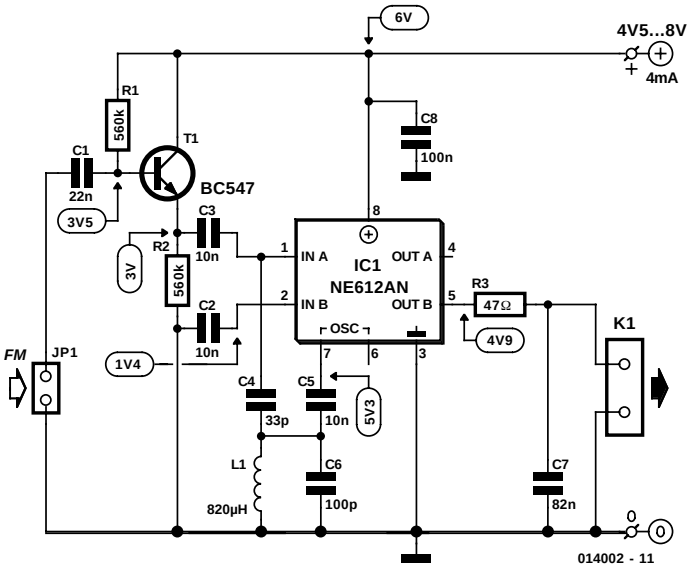

G.Baars

This 455-kHz quadrature detector for narrow-band FM signals boasts two important advantages: it is pleasantly simple and it does not require any alignment.

The heart of the circuit is formed by the well-known NE612 IC, which is a double-balanced mixer cum oscillator in an 8-pin DIL package.

The signal is first buffered by T1 and then fed to the input of the NE612. At the same time, a small portion of the signal is passed to the mixer via a low-value capacitor (C4). The operation of the circuit is such that when the input frequency matches the resonant frequency of the parallel L-C network, the signal on pin 7 has a phase lead of 90 degrees with respect to the signal on pin 2. The phase angle increases when the input frequency rises and decreases when the input frequency drops. Since the signals on pins 2 and 7 are multiplied together, the average output level is maximum when the signals are in phase and zero when they are anti-phase. This is the operating point of the detector. Consequently, an input signal with a varying frequency produces an output signal with a varying level. The operating range of the detector is inversely proportional to the *Q* factor of the parallel resonant network.

This circuit works best with an input signal level of 0.5–2 V_{pp}. Since it is linear over a very wide range (420–500 kHz), it does not need alignment, and normal tolerance variations in the values of the inductance and capacitance in the resonant circuit have little effect. The output level varies by approximately 1 V over the working range, so the detection sensitivity is around 13 mV/kHz. This is adequate for most narrow-band FM applications with an intermediate frequency of 455 kHz.

The supply voltage may lie between 4.5 and 8 V. The current consumption is limited to approximately 2.5 mA. Using the small printed circuit board shown here, you should have no difficulty assembling this FM detector in less than half an hour.

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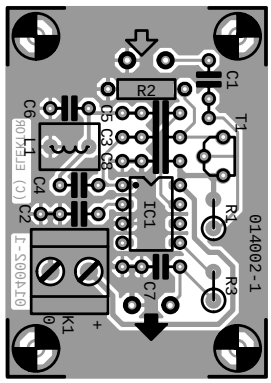

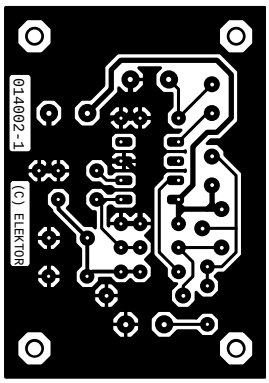

COMPONENTS LIST

Resistors:
R1,R2 = 560kΩ
R3 = 47Ω

Capacitors:
C1 = 22nF
C2,C3,C5 = 10nF
C4 = 33pF
C6 = 100pF
C7 = 82nF
C8 = 100nF

Inductors:
L1 = 820µH

Semiconductors:
T1 = BC547
IC1 = NE612AN