

# Line-frequency converter transforms 50 Hz into 60 Hz

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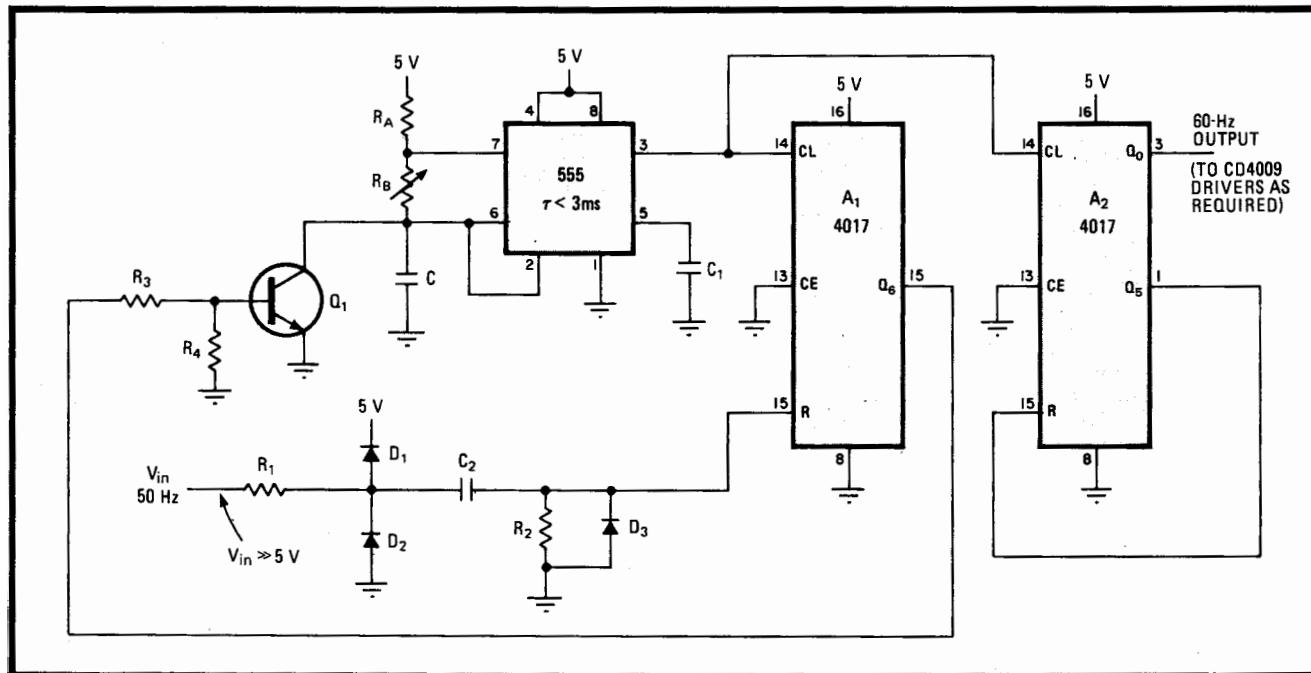
Low-power equipment driven from the 60-hertz power line can usually be expected also to work properly at 50 Hz—that is, except for electric clocks and other time-keeping devices, to which many a traveler outside North America will attest. For such devices, a circuit that provides a multiplication ratio of 6:5 for generating a 60-Hz output from a 50-Hz input is required. Such a low-cost, low-power circuit is shown here.

The 555 timer, operating as an astable multivibrator at 300 Hz, provides the 4017 counter,  $A_1$ , with six

count-pulses for every reset pulse from the 50-Hz line. The timer's period of oscillation—about 3 milliseconds—is not critical as long as six of its cycles are completed in less than 20 ms, the period of the 50-Hz line frequency.

On the sixth pulse,  $Q_6$  of  $A_1$  moves high and disables the timer through transistor  $Q_1$  by shorting capacitor  $C$ . Thus, independent of the period set for the 555, its average frequency is  $50 \times 6 = 300$  Hz. At the positive zero-crossing of the line voltage that occurs shortly after the sixth pulse,  $A_1$  is reset through  $R_1$ — $R_2$ ,  $C_2$ , and  $D_1$ — $D_2$ , and the process repeats.

Counter  $A_2$  provides a divide-by-five function at 300 Hz, thereby generating an output frequency of 60 Hz. C-MOS drivers or transistors can provide increased current capability as required. □



**On time.** Three-chip multiplier converts 50-Hz power-line frequency into 60 Hz for devices used in the U. S.  $A_1$  generates six pulses for every 50-Hz cycle, forcing 555 timer to generate average frequency of 300 Hz.  $A_2$  provides divide-by-five function on 555 waveform.