NEW IDEAS

Frequency-boundary detector

I'M SURE THAT EVERY ELECTRONICS EXperimenter or hobbyist, at one time or another, has needed a device that would indicate whether or not a signal was within a certain frequency range—I know I did when I was working with a switch-mode power supply. I got what I needed by building the frequency-boundary detector whose circuit is shown in Fig. 1. (The IC's supply and ground connections are shown in Fig. 2.)

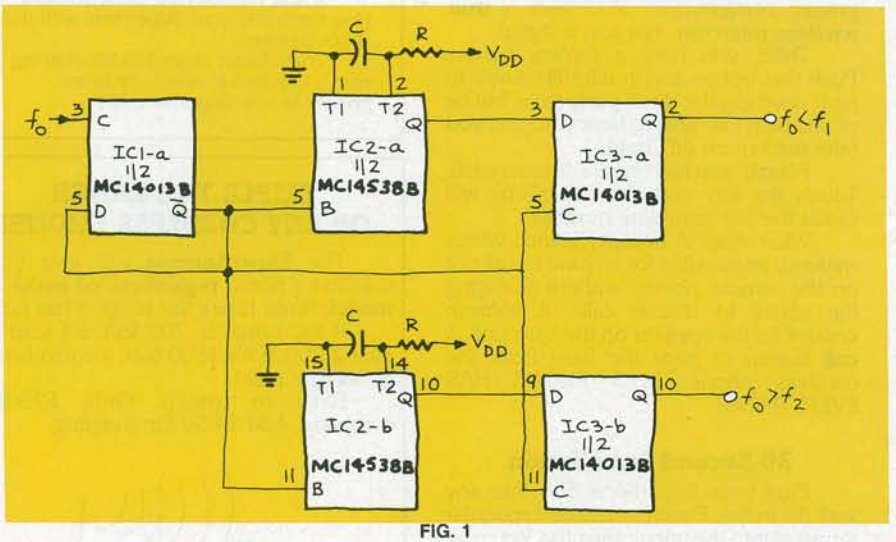

FIG. 1

IC	PINS TIED TO V_{DD}	PINS TIED TO GROUND
IC1	14	4,6,7,8,9, 10,11
IC2	3, 13, 16	1,4,8,12,15
IC3	14	4,6,7,8,10

FIG. 2

The circuit can be used (with LED's or other indicators) to tell you whether or not an input signal is within a certain frequency range. Because you may be hard-pressed to come up with applications for the circuit, I should point out that voltage-to-frequency converters can be used to make the number of applications almost limitless.

The device itself is rather easy to build. It consists of three IC's—a dual monostable multivibrator and two dual D-type flip flops. The signal whose frequency is in question is fed to the clock input of one of the flip-flops. The $\overline{Q}$ output of that flip-flop (IC1-a) is cross-coupled to its data input so that it acts like a divide-by-two counter. (See the timing diagram in Fig. 3.) The trailing edge of the $\overline{Q}$ output is used to trigger the one-shots formed by IC2.

The upper- and lower-frequency boundaries are determined by the two sections of IC2—the dual precision monostable multivibrator—and their external

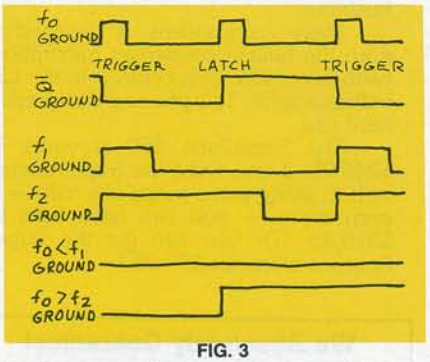

FIG. 3

resistor-capacitor networks. The upper-frequency boundary ($f1$) is set by the output of IC2-a, and the lower-frequency boundary ($f2$) is set by the output of IC2-b. The relationship that describes the periods of the outputs of IC2 is: $T = \frac{1}{2}RC$, where T is measured in seconds, R in ohms, and C in farads. However, because IC1-a is used as a divide-by-two counter, the formula used to determine the period of the upper- and lower-frequency boundaries becomes: $T = RC$.

The frequency of the input to the circuit can be anywhere from DC to 100 kHz. However, you can use the "extra" half of IC1 as another divide-by-two counter and increase the circuit's range to 200 kHz. Then the period of the outputs of IC2 would be represented by: $T = 2RC$.

The states of the outputs of IC2, which determine the upper- and lower-frequency boundaries, are latched by IC3-a and IC3-b respectively. As shown in the timing diagram of Fig. 3, the output of IC3-a (which is clocked by the output of IC1-a) will be high only when the input frequency is less than that of the output of IC2-a ($f1$). The output of IC3-b will be high only when the frequency of the input is greater than that of the output of IC2-b ($f2$). You can use appropriate logic gates to give an "in-bounds" or an "out-of-bounds" indication.—*Jim N. Kitchen*

NEW IDEAS

This column is devoted to new ideas, circuits, device applications, construction techniques, helpful hints, etc.

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