

Scanned keyboard activates eight-tone generator

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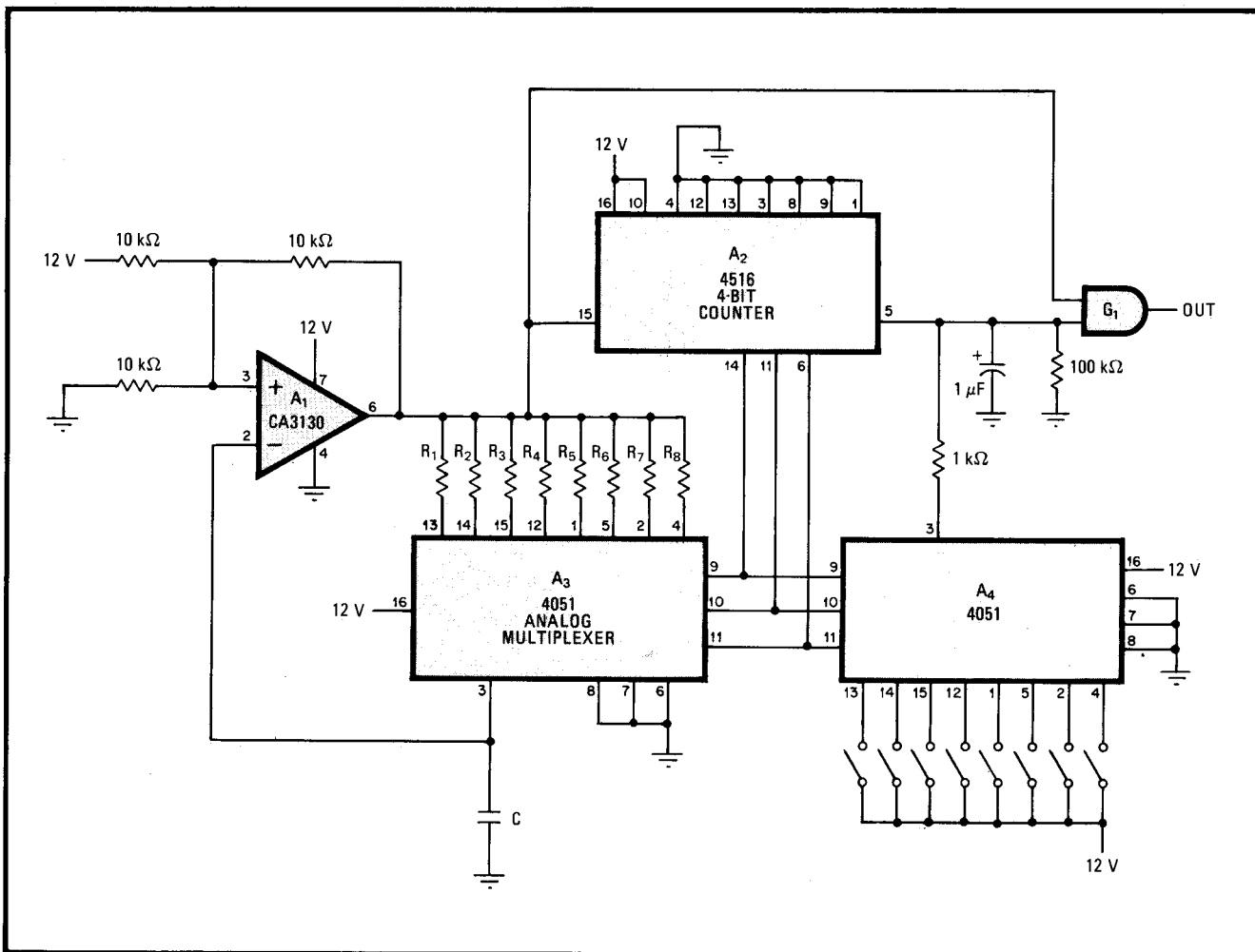
This keyboard-activated eight-tone generator owes its simplicity to a single oscillator, which makes possible the scanning of the keyboard and simultaneously functions as the tone generator. As a result, its device count is low and its cost is minimal.

Circuit operation is easily understood. The CA3130 operational amplifier, A_1 , is configured as a relaxation oscillator, its frequency controlled by R_1C . R_1 lies in the 100-to-500-kilohm range, and C is 0.01 microfarad or so for frequencies in the 1-to-10-kilohertz range. The oscil-

lator has excellent frequency stability as a result of the operational amplifier's extremely high input impedance and the complementary-metal-oxide-semiconductor output circuit.

A_1 drives the 4516 4-bit counter, A_2 . As the counter increments, it scans each input port of two analog multiplexers, A_3 and A_4 . A_3 sequentially places all resistors, R_1 through R_8 , in the oscillator circuit, enabling A_1 to generate exactly one cycle of each frequency determined by each R_1C combination. At no time is there any output from G_1 , however.

Meanwhile, multiplexer A_4 is scanned to determine whether any keyboard switches are closed. If any switch should be depressed, a logic 1 will emanate from pin 3 of A_4 , freezing the counter and enabling G_1 . A_1 will then oscillate at the frequency determined by the particular value of R that is in the oscillator circuit when the counter halts. Since the counter cannot advance while the key switch is closed, and simultaneously closing any



Scanned tones. Self-gating oscillator, A_1 , advances counter and with aid of multiplexer A_3 sequentially places R_1 - R_8 in series with C so as to control frequency. Op amp's high-input impedance and C-MOS output ensures high oscillator stability. No signal appears at output until a keyboard switch is closed, when A_4 freezes counter and activates G_1 , enabling generation of the single desired frequency.

each key will have no effect on the output frequency, the circuit has in effect a built-in lock-out feature.

The time required for the system to latch to any particular frequency is a function of both the number of frequencies that can be selected and the actual frequencies of oscillation. The maximum acquisition time works out to approximately:

$$t = \frac{1}{f_1} + \frac{1}{f_2} + \dots + \frac{1}{f_i}$$

where each f_i is equal to $1/0.69 R_i C$. For eight frequencies in the kilohertz range, t equals about 8 milliseconds, which is an acceptable period of time for manual key-stroke applications. □