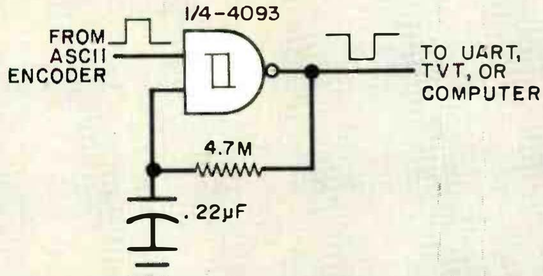
SIX CMOS CIRCUITS FOR EXPERIMENTERS

Using CMOS digital integrated circuits can simplify designs, cut costs, and reduce power supply requirements. Here are six basic examples of how the use of CMOS can "do more for less"—circuits every experimenter should have in his bag of tricks.

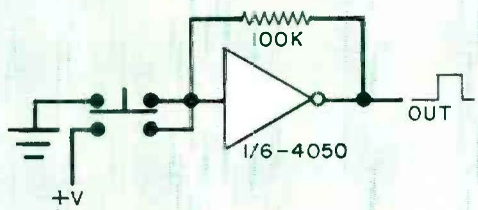
BY DON LANCASTER



Automatic Keyboard Repeat

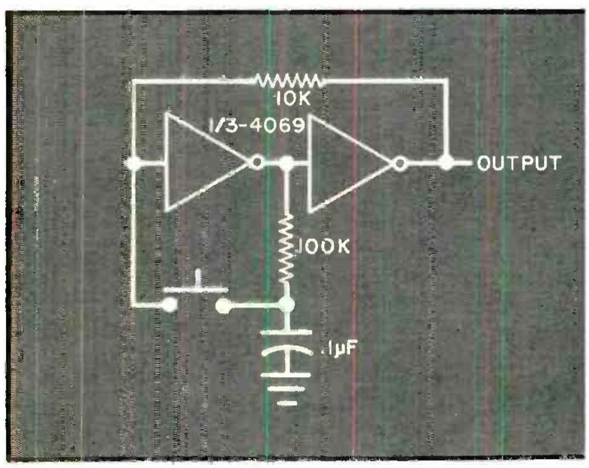
1 This circuit can be added to almost any ASCII keyboard and encoder to create a simple, low-cost repeat function. The circuit shown uses the positive output of a 2376 keyboard encoder IC to drive the negative-going input required by many UART's and TVT's.

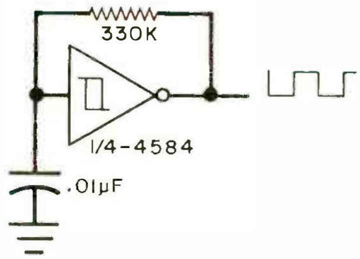
The signal from the keyboard encoder is normally low, thus this circuit has a high output. When a key is depressed, the positive-going pulse from the encoder drives this circuit output low for as long as the key is depressed. However, if the key is held down, the circuit will deliver outputs that repeat as long as you want. This is handy for cursor motions, adding spaces, etc. A one-second delay is provided between the first and second output pulses, and after that, the pulses will be repeated at a three-per-second rate. This built-in delay is created by the longer initial charging time of the capacitor, followed by the faster motion between the Schmitt trigger upper and lower trip points. You can use the other NAND triggers in the package to shorten pulses, or invert input or output.



Contact Debouncer

2 Pushbuttons and switch contacts must be debounced when used with clocked logic. Otherwise, contact noise and bounce will produce multiple "hits". The feedback resistor in this noninverting buffer circuit will hold the output in either the high or low state. The spdt pushbutton forces the circuit into one state or the other, while the latching holds the circuit in that state, during the debounce interval. Actually, the resistor can be eliminated and replaced with a short between the input and output, but this may add some current "glitches" to the power supply line. Six switches may be conditioned using the six buffers in the IC package.





Square-Wave Generator

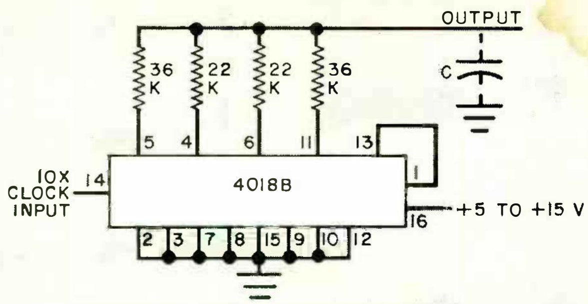
3 With the values shown, this circuit generates approximate 1-kHz square waves. When the Schmitt trigger output is high, the capacitor charges to the supply voltage through the resistor. When the voltage across the capacitor reaches the upper trip point of the Schmitt, the output drops low. The capacitor then discharges through the resistor, and when the capacitor voltage reaches the lower trip point, the Schmitt output snaps high and the cycle repeats.

The circuit is sure starting, and the output swings the full power supply level which can be anything between 5 and 15 volts. Supply current is typically 10 microamperes. Since the capacitor voltage always remains between the two trip points, no input protection is required. The frequency can be altered by selection of the resistor and/or capacitor value.

Alternate Action Pushbutton

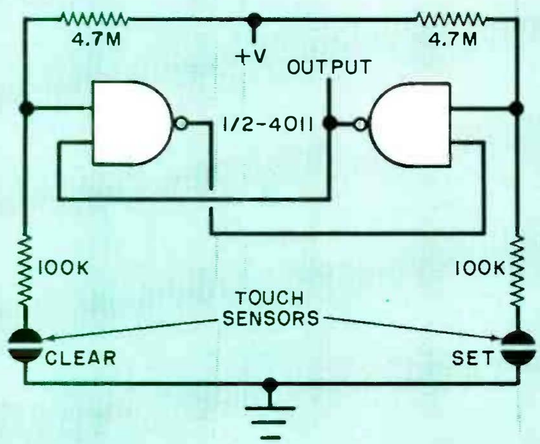
4 Each time the pushbutton switch is operated, the circuit shown here changes its output state. On one depression, the output is high; and on the next depression, the output is low. Operation is reliable and the pushbutton is fully debounced.

Despite its apparent simplicity, this is a full-fledged master-slave flip-flop with the RC network being the "master" that remembers where the output is to go. The two inverters form the "slave" latch.



Digital Sine-Wave Generator

5 This circuit uses a clock frequency 10 times the required output frequency. The walking-ring counter and resistor summing network will produce a "chunky" waveform at the output. However, you can filter this waveform since it is basically a sine wave with a little of the 9th and 11th harmonics present. You can either ignore the harmonics or use a capacitor (shown dotted on the schematic) as a filter. If desired, an active filter can be used. The unfiltered output swings the full supply voltage which can range from 3 to 15 volts.



Touch-Controlled Latch

6 Short the SET contacts with your fingertip and the output goes high. Later on, if you touch the CLEAR contacts, the output goes low. In this simple set-reset flip-flop, the 4.7-megohm resistors hold the NAND gates inputs high, and are disabled when the 200,000 ohms or so of finger resistance provides the "low impedance" path to ground, to force the circuit to change states.

The touch sensors may be any type of conductive material with a slight gap between the two elements.