

LEDs simulate sand hourglass

by Dan Baker
Percom Data Co., Dallas, Texas

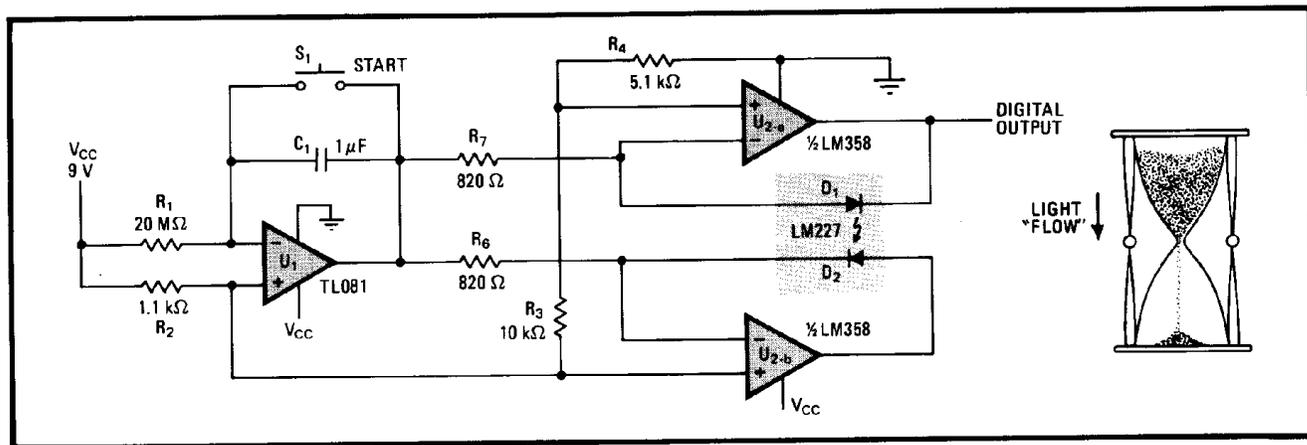
A simple operational-amplifier circuit and two light-emitting diodes can combine to simulate an hourglass that functions as a 3-minute timer. In addition, the circuit can be used to indicate other analog quantities, such as voltage or frequency deviation.

The LEDs D_1 and D_2 are mounted end to end, so that they look like an hourglass (see figure). Operational am-

plifier U_1 provides the timing, while dual bipolar op amp U_2 drives the diodes. Initially, when the start switch S_1 is opened, C_1 starts charging with a constant current and the output of U_1 falls proportionally. As a result, diode D_2 , which is off to begin with, starts receiving more and more drive current and thus gets steadily brighter.

Conversely, LED D_1 gets dimmer until the output of U_1 reaches $V_{cc}/4$. When D_1 is fully off, D_2 is fully on and the output of op amp U_{2a} switches from low to high, indicating time-out. Because a logarithmic relationship exists between brightness and LED drive current, the apparent flow of light from the upper LED D_1 to the lower LED D_2 accurately simulates a sand hourglass. □

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Hourglass. With Panasonic's two triangular light-emitting diodes, two op-amp chips, and a few discrete components, this circuit simulates an hourglass that functions as a 3-minute timer. To start the timer, switch S_1 is opened. This makes LED D_2 become brighter and D_1 dimmer until D_2 is fully on and D_1 off, indicating time-out. Under this condition, the digital output goes from low to high.