Pulsed-voltage measurements check LED quality

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The suitability of a light-emitting diode for high-pulse-current applications can be easily determined by a test that measures the voltage drop across the LED at high currents. The use of a pulsed constant-current source to drive the diode and determine its high-current capacity subjects neither it nor the user to the "smoke test," yet the resulting voltage drop across the LED may point up the existence of an internal fault, such as a high-resistance pn junction, a substrate fracture, or a shunt path around the junction. The results of the measurement are independent of LED optical properties.

As shown in the figure, a Darlington amplifier using a MPSU95 device provides a current to a test LED through the AD7510DIKN quad analog switch. The current source is adjustable from 0 to 100 milliamperes. A 555 timer configured as an astable multivibrator drives a second timer, and the combination provides adjustable duration time and repetition rates for switching all analog gates simultaneously.

The outputs of three of the analog gates, each having an on resistance of 75 ohms, are tied together to reduce the equivalent impedance to 25 Ω, to minimize the voltage drop across the gates during conduction. Capacitor C_1 is connected across the LED when the gates are on; thus the voltage across the capacitor is the peak voltage of the diode under test.

This voltage is applied to the noninverting input of the 741 operational amplifier. The op amp is a unity-gain buffer, so that even low-impedance voltmeters may be placed across its output for measuring the LED's voltage (a digital voltmeter is preferable, however).

Once the user knows the test specifications of the diode, he makes a one-time adjustment of the duration time and repetition rate with an oscilloscope (for many tests, this could be 30 microseconds at 1 kilohertz). The next step is to calibrate the current source by placing an ammeter in series with the calibrating terminals. The resultant voltage across the LED can be measured with a DVM set at its fastest sampling mode.

Diodes likely to fail in an actual circuit from high resistance, substrate fracture, or die-casting faults might produce much higher voltages than expected. Low voltage drops across the LED for a specified current could be the result of shunt paths surrounding the pn junction.

If care is taken in minimizing circuit ground-point differences, and if the 741's output voltage is trimmed to zero after shorting the op amp's socket terminals during pulsed measurements (to zero out the effects of lead drop), this method of measuring the voltage across an LED easily yields an accuracy greater than 1%. □

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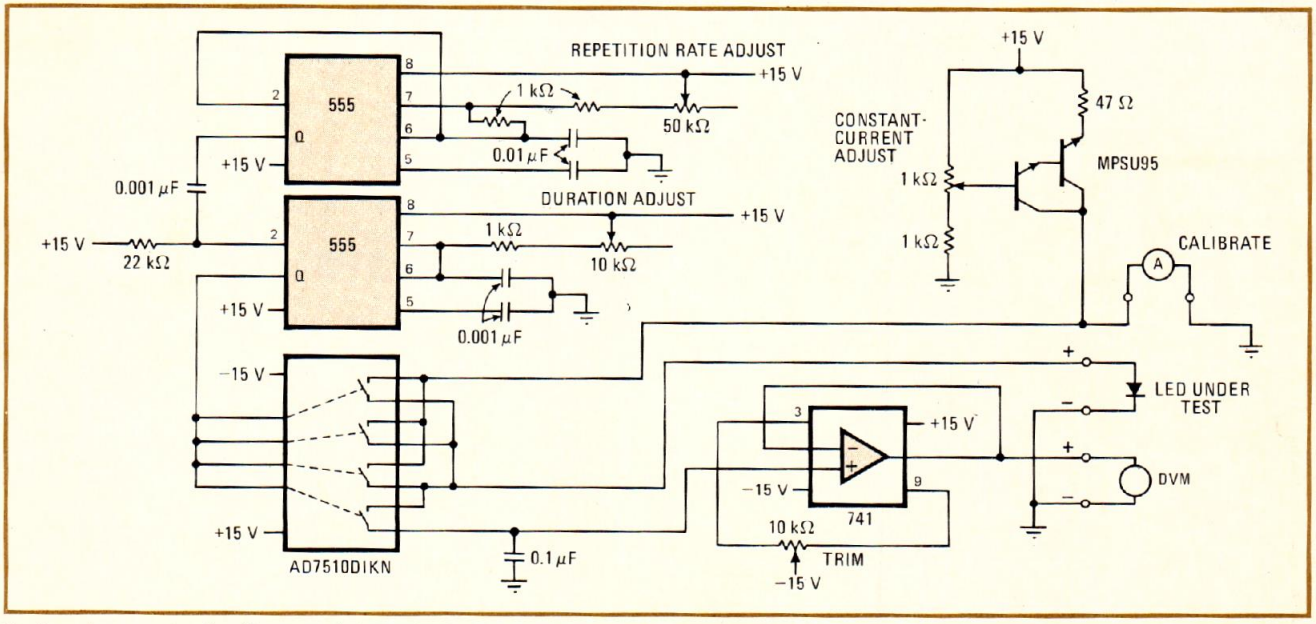

Fast and accurate. Quality-control determination is obtained at low cost by observing DVM directly in lieu of time-wasting oscilloscope measurements, which are subject to errors of judgment by the observer. DVM reading may indicate faults in diode's pn junction.