

Keysight Technologies

Effective Electrolytic Capacitors Testing

Application Note

Introduction

With increased requirements for size reduction and higher reliability design, it is becoming necessary to evaluate electrolytic capacitors employed in electronic equipment. Production volume has been increasing for circuit applications. Manufacturing and QA now have to improve their testing of electrolytic capacitors. Here are the solutions offered by the Keysight Technologies, Inc. 4263B LCR Meter to meet these measurement requirements.

Current Problems in Electrolytic Capacitor Evaluation

When making electrolytic capacitor measurements using conventional LCR meters, there are quite a few shortcomings.

(1) Impedance value of the electrolytic capacitors is usually so low that an accurate measurement is hard to achieve. Some LCR meters cannot measure above 20 mF due to a limited measurement range.

(2) Electrolytic capacitors are currently tested at 100 Hz or 120 Hz. The measurement speed at those frequencies is quite slow, and higher throughput cannot be achieved by automatic measurement systems.

(3) When a charged capacitor is connected to the measurement terminals of the LCR meters, the circuit is easily damaged by the discharge energy.

(4) When a shorted device is measured, the internal circuit of a conventional LCR meter is latched up, and it needs a long recovery time.

(5) Some inexpensive LCR meters do not range up to 100 kHz, and the equivalent series resistance of the electrolytic capacitors need to be evaluated at 100 kHz.

(6) Most LCR meters cannot detect whether or not the contact between the fixture's electrodes and the device's electrode is good, thus decreasing the reliability of a measurement.

(7) There are no test fixtures for the terminals (for example, big screw electrodes) of the big electrolytic capacitors.

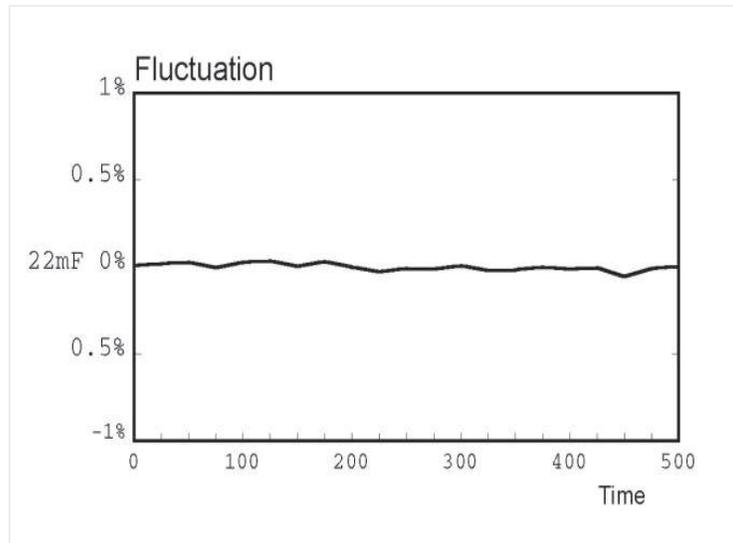


Figure 1. Fluctuation of the measurement value at SHORT

Keysight 4263B LCR Meter Solution

(1) Accurate Low Impedance Measurement

The 4263B LCR Meter employs a 4-terminal pair configuration and an advanced low noise design so that it makes accurate measurements up to 1 F. For example, when 10 mF is measured at 120 Hz, the 4263B's accuracy, 0.57% can be achieved. Also, the measurement cable can be extended up to 4 m while maintaining the measurement accuracy.

(2) High System Throughput

The measurement speed of the 4263B LCR Meter at 100 Hz/120 Hz is 25 ms (Meas.Time: SHORT). Figure 1 shows you the fluctuation of the 22 mF Aluminum Electrolytic Capacitor Measurement by SHORT mode, and 120 Hz of the 4263B.

In addition, the 4263B has the following features which allow easy system integration, and improve measurement throughput.

- GPIB Interface
- Handler Interface
- Built-in Comparator
- Trigger Delay Function

The 4263B has been miniaturized for system downsizing (320 (W) x 100 (H) x 300 mm (D), 4.5 kg).

(3) Input Protection

The 4263B input protection is improved over existing products. When a charged capacitor (250 V, 120 μ F) is connected to the UNKNOWN terminals, the 4263B can stand its discharge energy (4J) so that the front panel terminals are not damaged.

(4) Quick Recovery for shorts

The quick recovery system of the 4263B improves throughput. Normal operation is resumed the instant a shorted DUT is removed from the handler, so the handler can always be operated at its full speed and only good DUTs are retained.

(5) Wide Frequency Range

The 4263B has five selectable frequencies that allow you to simulate testing under the correct conditions: 100, 120, 1 k, 10 k, and 100 kHz. ESR can be evaluated at 100 kHz. A 20 kHz frequency might be required for testing aluminum electrolytic capacitors used in switching power supply circuits. When Option 002 is installed, 20 kHz is added to the other five test frequencies.

(6) Contact Check Function

The 4263B LCR meter has a contact check function which checks contact conditions between the test terminals and the electrodes of the device shown in Figure 2. This function ensures the reliability of the PASS/FAIL testing in the automatic handlers in production.

(7) Various Test Fixtures

The Keysight 16089A Kelvin Clip Leads have two large clips that can accept device electrodes with a diameter of 15 mm. Figure 3 shows a big capacitor measurement using the 16089A. The Keysight 4263B employs the 4-terminal pair configuration. You can choose from many types of the 4-terminal pair test fixtures shown in Figure 4.

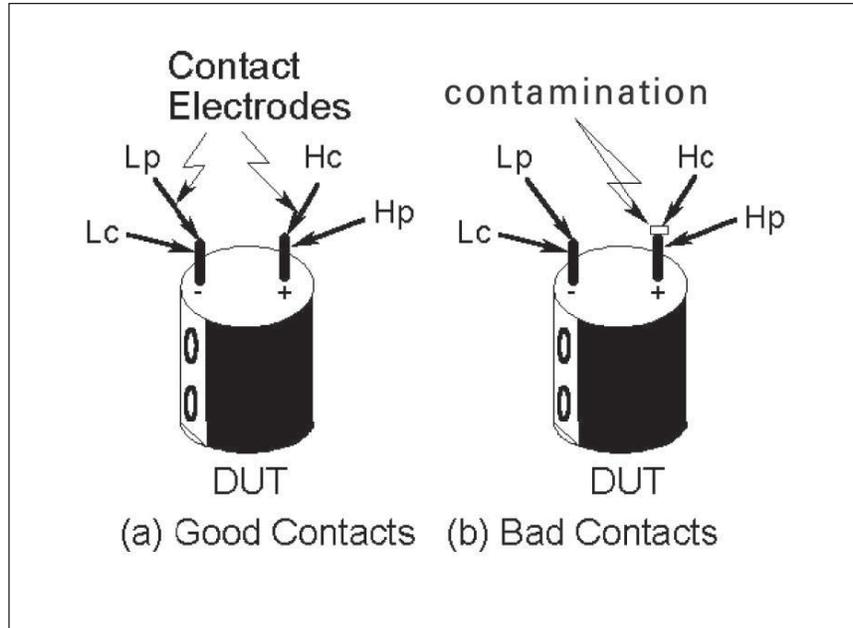


Figure 2. Contact Check Function



Figure 3. Big Electrodes Electrolytic Capacitors Measurement using the Keysight 16089A

Conclusion

The Keysight 4263B is a compact LCR meter that maintains a high measurement speed (25 ms) with high accuracy at 100 Hz/120 Hz. The input protection circuit prevents charged capacitors from damaging the front panel circuitry. Therefore, the 4263B offers more stable and reliable electrolytic capacitor testing.

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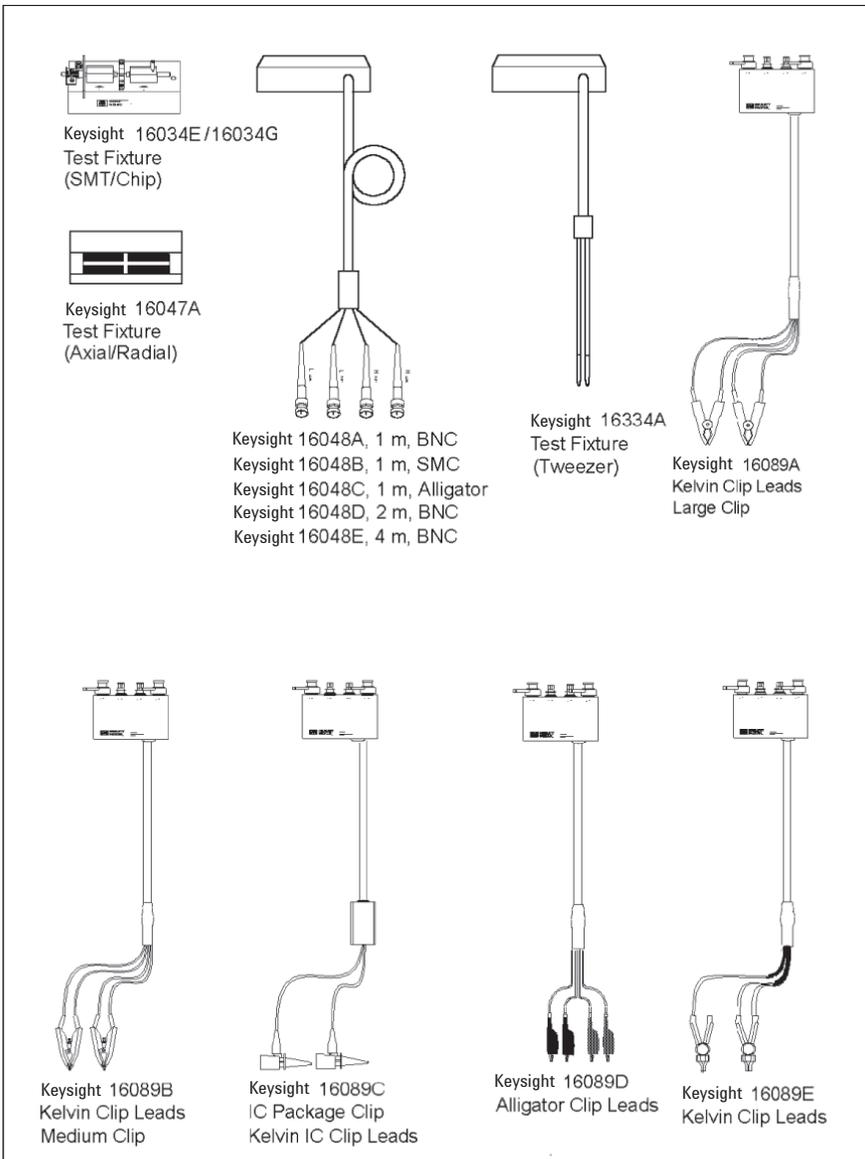


Figure 4. Major Four-Terminal-Pair fixtures

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