

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.

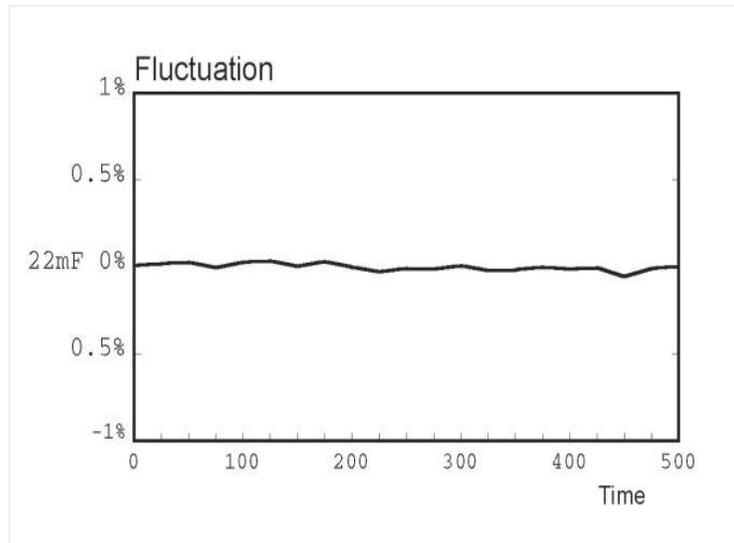


Figure 1. Fluctuation of the measurement value at SHORT

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.

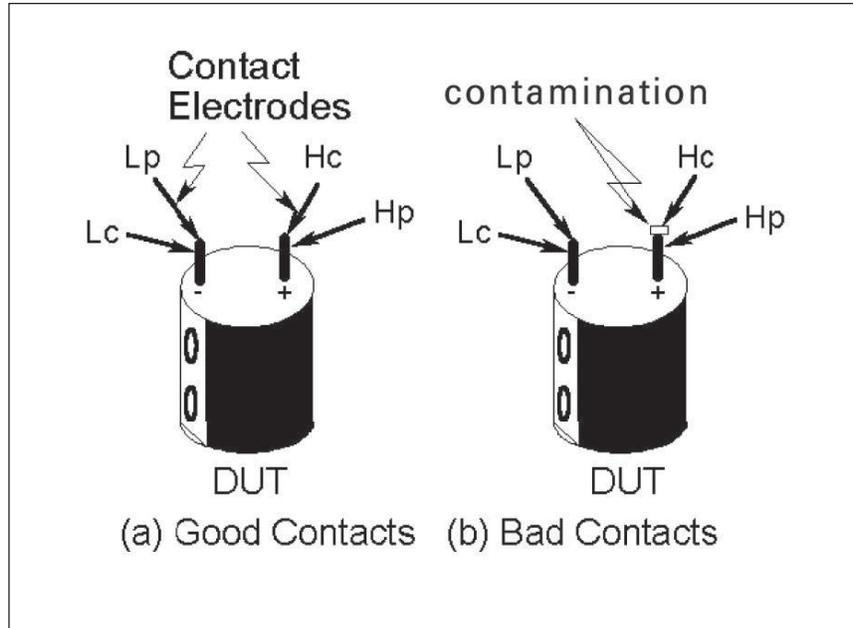


Figure 2. Contact Check Function



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.

Keysight's Test and Measurement Support, Services, and Assistance

Keysight aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need.

Our extensive support resources and services can help you choose the right Keysight products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Keysight's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

"Our Promise" means your Keysight test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Keysight equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

"Your Advantage" means that Keysight offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional services. Experienced Keysight engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Keysight instruments and systems, and obtain dependable measurement accuracy for the life of those products.

Get assistance with all your test and measurement needs at:
www.keysight.com/find/assist

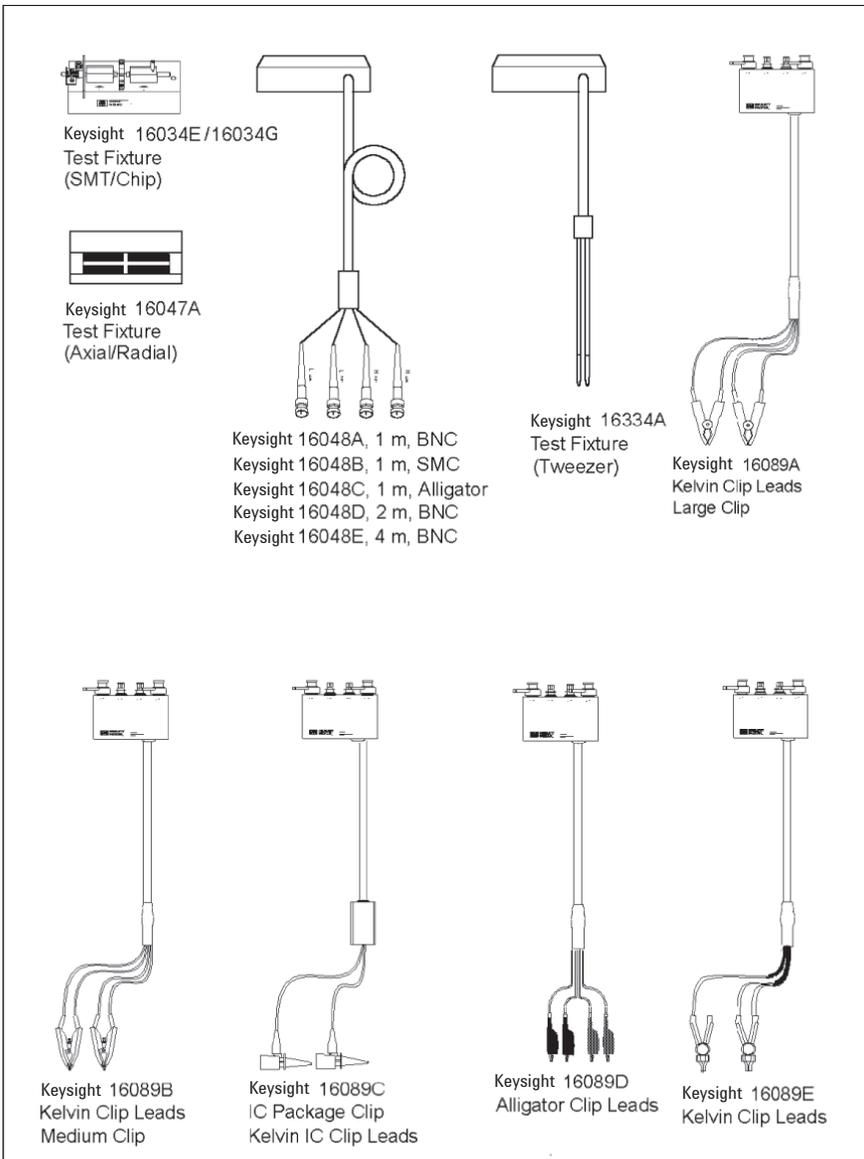


Figure 4. Major Four-Terminal-Pair fixtures

myKeysight

myKeysight

www.keysight.com/find/mykeysight

A personalized view into the information most relevant to you.



Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



Keysight Assurance Plans

www.keysight.com/find/AssurancePlans

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.



www.keysight.com/go/quality

Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Channel Partners

www.keysight.com/find/channelpartners

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

This document was formerly known as application note number 1305-4.

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-07-10-14)