

MICRO

Burn-in & Technology, Inc.

CAPACITOR LIFE TEST WITH MONITORED LEAKAGE CURRENT, I_R



The Model CE9051 from Micro Instrument Company introduces new dimensions in capacitor reliability testing. Previous capacitor testing methodology based time-of-failure data on series fuses opening in response to a rise in leakage current. The Model CE9051 continuously monitors and records leakage current for each DUT, providing accurate leakage current plots in addition to time of failure.

The Model CE9051 also features an electronic fuse circuit for each DUT position, an innovation which allows control of the test in minute detail. As an example, instead of testing the capacitor to destruction, the system may be set to preserve the failure site by stopping the test just prior to total failure.

For accurate temperature control, the system is housed in the ultrastable CH700 test chamber from Micro Instrument Company. The new system methodology pairs a microprocessor controlled instrument card with each device fixturing card inside the test chamber. A computer controlled bias supply of 50 to 6000 VDC is associated with each instrument card.

Each instrument card includes all the measurement and memory circuits necessary for the tests it performs. The DM511 Instrument Card for capacitor reliability testing has 100 solid-state current measurement circuits, one for each DUT position

Features

- ◆ *Monitors DC leakage current and time to failure*
- ◆ *1,200 test positions per chamber*
- ◆ *Adjustable stress voltage to 600 volts*
- ◆ *Resettable electronic fuses*
- ◆ *Operator-set test termination point*
- ◆ *Test to destruction or preserve failure region*
- ◆ *Computer controlled*
- ◆ *User calibrated*

Each circuit contains an electronic fuse and current read-back monitor to measure leakage current. An on-board micro-processor performs all measurements, signal multiplexing, and termination condition setting and monitoring. It also provides communications with the controller computer, including test result reporting.

The timing resolution of termination conditions is within milliseconds regardless of the number of independent instrument cards operating in the system. This is the feature that allows the test on any capacitor to be stopped just prior to destruction.

To do this, the operator sets the maximum leakage current to a level known to be catastrophic to the capacitor. Then, to establish the true failure current, the operator enters a number of capacitors allowed to fail. When this number of failures has occurred, the system can automatically create an alternate failure level just below the true catastrophic failure point indicated through monitoring.

Tests on all other capacitors may be individually terminated when the leakage current reaches the alternate failure point automatically created by the system.

The number used to determine how much below the catastrophic failure level the computer controller sets the new failure

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point is provided by the operator prior to test.

This capability allows the researcher to preserve the failure site so it may be analyzed by use of a scanning electron microscope or other failure analysis techniques.

Test parameters are entered in an on-screen test parameter form by the operator prior to test. Operators may select a test parameter form previously entered, or fill in a new form. New forms may be saved for future tests. Previously saved forms may be modified by operators as required.

Test parameter forms include maximum allowable leakage current level, nominal termination current, site preservation number for automatic set back, stress voltage level, and test temperature.

The Model CE9051 provides fixturing for up to twelve 100-position test cards per chamber and up to three chambers per computer controller. Each card may be operated as an independent test lot. Standard device fixturing materials provide a maximum test temperature of 150°C. Optional fixturing is available for 200°C testing.

Interconnecting cables are unnecessary. All instrument cards, stressing supplies, and digital supplies are mounted in an ambient temperature equipment rack built into the rear of the chamber. This provides greater measurement stability and accuracy.

Calibration modules are available allowing the system user to calibrate the instrument cards as required. The calibration procedure is carried out by the Model CE9051 computer controller and requires about 10 minutes for each instrument card.

DM511 Specifications

100-Position Card

- ◆ 100 Electronic fuse modules
- ◆ 100 current read-back monitors

Fuse Modules

- ◆ Micro Processor controlled
- ◆ Trip point accuracy of $\pm 2\%$ across the range of 100na to 500 μ a
- ◆ Automatic current limit a 1mA in less than 100 μ s
- ◆ Open circuit in 10ms
- ◆ Voltage compliance >600VDC
- ◆ Input impedance <50K Ω
- ◆ Line and load regulation <0.01% for input power within specified limits

Current Read-Back Monitor

- ◆ Measures current through structure
- ◆ Structures scanned by parameters selected through setup screens

Resolution and Accuracy

Range	10pA to 1,000 μ A
Max Input	1mA
Accuracy	$1 + \log(I_{in}/100e-9)\%$
Resolution	100fA

Bias Supply

Output range	50 to 600 VDC
Resolution	12.2mV
Accuracy	$\pm 0.2\% + 75mV$
Overshoot	<10mV
Settling Time	<100ms to within 1% of final value
Ripple	<5mV
Voltage Setup	adjustable by software
Ramp Time	100ms to 30 sec.

DUT Interface Module

- ◆ Provides connections to 100 structures
- ◆ Insulates instrument card from oven temperatures
- ◆ Provides power and RS485 connections

Control Interface

- ◆ Conforms to RS485 multi-port interface operating at 9600bps
- ◆ Proprietary protocol
- ◆ Error rate 1 in 10^{10} messages, correction method 16 bit CRC

Message Formulation

Generated by controller containing up to 250 ASCII characters. Up to 30 DM511's on a single RS485

Calibration

User may calibrate using a calibration module and the software resident in CE9051 computer controller

System Accuracy

Carefully selected common point grounding ensures maximum measurement accuracy

Computer communication lines are fully isolated to prevent measurement errors. Temperature controllers are also isolated

Instrument cards are multi-layer controlled impedance circuits

Operation Temperature

Ambient environment of 18°C to 28°C
Temperature for test devices may be to 200°C depending on which system incorporates the DM511 instrument card

