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Surface Insulation Resistance Handbook

Developed by the Surface Insulation Resistance Task Group (5-32b) of the Cleaning and Coating Committee (30) of IPC

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Users of this publication are encouraged to participate in the development of future revisions.

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Surface Insulation Resistance Handbook

1 SCOPE AND DESIGNATION

Surface Insulation Resistance (SIR) testing has been with the electronics industry since the advent of the transistor and the printed board. It has been used as a tool for incoming inspection, materials investigations and qualifications, quality conformance, prediction of long-term failure mechanisms and as a predictive tool for estimated service life.

SIR testing is a quantitative and not qualitative test method and should be viewed as an essential tool that requires understanding in order to use properly.

Electrochemical reactions at or below the surface of electronic circuits will affect their SIR. These reactions require the presence of humidity, electrical bias and ionic contaminants. The VENN diagram shown in Figure 1-1 illustrates how these reactions may be influenced.

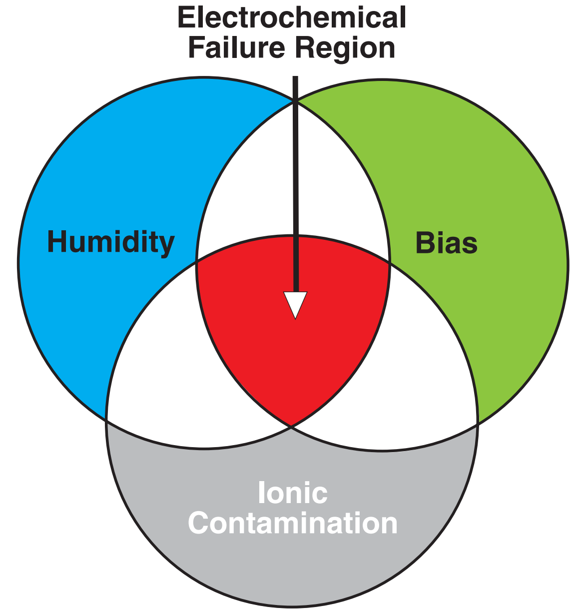

Figure 1-1 VENN Diagram Illustrating Variables Affecting Electrochemical Failure

Historically, SIR testing has been the subject of much technical argumentation; however recent science research has highlighted several significant issues that now demand modification to both this document and prevailing specifications. In particular, these are:

- Test conditions should be 40 °C, 93% Relative Humidity (RH) for no-clean regimes and 85 °C, 85% RH for other regimes.
- SIR Measurements should be taken at 20 minute intervals.
- The test voltage should be 5V.
- Voltage Gradient: 25V/mm.
- The test patterns should be 200 µm [0.0079 in] spacings and 400 µm [0.016 in] width.
- New Coupons should be employed for:
  Materials Characterization Testing.
- Process Characterization Testing.
- Current limiting resistors should be used by the measurement system so as to preserve any electrochemical reactions (dendrite formations) to aid any further analysis.

Furthermore, and resulting from the same research program, SIR can now be employed for process characterization as well as materials characterization testing.

The IPC 5-32b SIR Task Group was formed to undertake a mission of education and technical refinement of this testing into a better, more accurate and predictive tool.

1.1 Scope This document is intended to cover the broad spectrum of temperature-humidity (TH) testing, associated terminology, and suggested techniques for proper testing. This edition of the IPC-9201 has been revised in an attempt to reflect all international test specifications such as IEC and ISO.

1.2 Purpose The purpose of this document is to educate individuals who must deal with TH or temperature-humidity-bias (THB) testing. The target audience for this work ranges from the technicians running the test to engineers who must interpret the data, and those individuals responsible for specifications and standards that may call out these tests.

The guidance presented here represents the experience and technical input from many of the most knowledgeable testers in the IPC, and incorporates much of the science research that has been carried out since the document was first published. Although this handbook does not go into great depth on the underlying physics of many of the mechanisms found in SIR testing, there are references at the back of this document that may be helpful to those requiring substantiation of the issues involved.

TH and THB testing may also be related to other forms of testing, such as noise factor, corrosion testing, determination of bandwidth, characteristic impedance, etc.

1.3 How is SIR Testing Used? There are two ways in which this protocol may be used. The traditional use is in