



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

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Surface Insulation Resistance Handbook

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1. Introduction

Surface Insulation Resistance (SIR) testing has been with the electronics industry since the advent of the transistor and printed circuit 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, in its various incarnations, has as many different meanings and interpretations as the individuals who might be asked to define it. Test conditions and techniques vary so widely, that this "science" has come to be viewed as voodoo or "black magic". SIR should be viewed as a tool, but one which needs refinement and understanding to use properly.

The IPC SIR Task Group was formed to undertake a mission of education and technical refinement of this testing into a better, more accurate, 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 Handbook primarily covers the test methods used in the United States. Future revisions of the Handbook will address more of the available international test methods.

1.2. Purpose

The purpose of this document is to educate individuals who must deal with temperature-humidity (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, to those individuals responsible for specifications and standards which may call out these tests.

As TH testing is a science in need of refinement, this document does not have "all the answers". The guidance presented here represents the experience and technical input from many of the most knowledgeable testers in the IPC. This handbook does not go into great depth on the underlying physics of many of the mechanisms found in SIR testing. This is best left to more theoretical texts.

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 Why do SIR testing?

In general, TH or THB testing is done to show evidence of the loss of integrity or reliability in a materials system. Loss of integrity may include: conformal coating or solder mask adhesion failure (less protection from the environment); decreases in dielectric strength; electrolytic corrosion; or electrochemical migration. Each of these may represent shortcomings in materials, manufacturing methods, or a susceptibility to a particular failure mechanism, which would not be desirable in the end product.

Various profiles are used to test specific failure mechanisms. The choice of cyclical or static environments, high temperature/humidity environments depends on what failure modes you are examining. Cyclical tests or TH tests examine materials properties and are often used to simulate an end-use storage environment. High-temperature/humidity tests are most often used to test for