PD IEC TR 61189-5-506:2019

BSI Standards Publication

Test methods for electrical materials, printed boards and other interconnection structures and assemblies

Part 5-506: General test methods for materials and assemblies — An intercomparison evaluation to implement the use of fine-pitch test structures for surface insulation resistance (SIR) testing of solder fluxes in accordance with IEC 61189-5-501

bsi.

National foreword

This Published Document is the UK implementation of IEC TR 61189-5-506:2019.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic Assembly Technology.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2019

ISBN 978 0 539 00068 9

ICS 31.180

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 July 2019.

Amendments/corrigenda issued since publication

Date	Text affected

IEC TR 61189-5-506

Edition 1.0 2019-06

TECHNICAL REPORT

colour inside

Test methods for electrical materials, printed boards and other interconnection structures and assemblies –
Part 5-506: General test methods for materials and assemblies – An intercomparison evaluation to implement the use of fine-pitch test structures for surface insulation resistance (SIR) testing of solder fluxes in accordance with IEC 61189-5-501

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.180 ISBN 978-2-8322-7083-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

Part 5-506: General test methods for materials and assemblies – An intercomparison evaluation to implement the use of fine-pitch test structures for surface insulation resistance (SIR) testing of solder fluxes in accordance with IEC 61189-5-501

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC/TR 61189-5-506, which is a technical report, has been prepared by IEC technical committee 91: Electronics assembly technology.

The text of this Technical Report is based on the following documents:

Draft TR	Report on voting
91/1500/DTR	91/1530A/RVDTR

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61189 series, published under the general title *Test methods for electrical materials, printed boards and other interconnection structures and assemblies*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document addresses the development of IEC 61189-5-501 and the introduction of a fine-pitch test pattern. The introduction of this pattern is needed to meet the need for IEC 61189-5-501 to reflect current assembly technology. This document describes an intercomparison that tests a new test pattern and benchmarks it to existing test patterns. The work validates the introduction of the new fine-pitch test pattern.

It is well known that structures at fine pitches with flux residues are more susceptible to corrosion issues and electrochemical migration (ECM) problems. Characterization of flux residues in terms of ECM are commonly characterized using SIR testing. A key parameter of the SIR test is the comb pattern used and gap between the electrodes. The current B24 and B25 with their 500-µm and 318-µm gap patterns are not representative of fine pitches. It has been proposed to use a 200-µm gap pattern, and this document describes an intercomparison that validates the introduction of the 200-µm gap pattern.

This document describes an exercise that used a new test board that included the B24 and B25 patterns with an additional 200-µm pattern, with each pattern duplicated, giving six patterns in all on each test board. This work was motivated by an update to IEC 61189-5-501. A protocol for the testing was developed that took a standardised test rosin flux and defined the flux loading and thermal conditioning. Seven laboratories took part from five countries. The test boards were prepared centrally and then tested in the seven laboratories, and the results analysed to validate the usage of the 200-µm pattern. The document describes the intercomparison and the data analysis.

TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

Part 5-506: General test methods for materials and assemblies – An intercomparison evaluation to implement the use of fine-pitch test structures for surface insulation resistance (SIR) testing of solder fluxes in accordance with IEC 61189-5-501

1 Scope

This Technical Report is an intercomparison supporting the development of IEC 61189-5-501 in relation to the SIR method. This document sets out to validate the introduction of a new 200-µm gap SIR pattern, and was benched marked against existing SIR gap patterns of 318 µm and 500 µm.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Test board concept for intercomparison

4.1 The need for a fine-pitch SIR pattern

The pursuit of higher quality and reliability leads to the requirement of proving that electronic assemblies are not susceptible to electrochemical failure. Such robustness will lead to proven lifetime performance in the field. Electrochemical failure can occur at the surface or sub-surface, and in this paper we focus on surface failure phenomena and its characterisation. Electrochemical failure needs three factors to be present simultaneously for a failure to occur: a continuous water film, an applied electric filed, and soluble ionic material. Under condensing conditions, a macroscopic water film will form and in most instances an uncoated assembly will fail instantly. But for high humidity conditions, an invisible sub-micron water film will form that will support low levels of conduction, and certainly no fast dramatic loss of isolation. Applied electric fields can cause electrochemical failure, from 25V/mm and upwards, by driving ions down an electric field. Ionic material is needed as pure water has very high resistivity, hence dissolved ions increase conductivity and polarization at electrodes resulting in corrosion at anodes. Sources of contamination can appear on the surface of the assembly from the manufacturing process or the environment. If the contamination is water soluble and dissociates to form ionic species, these ions migrate under an electric field.

It is of course of interest as to what ionic materials are present, but more importantly, the question is what will be the impact of these residues or contamination. The industry many years ago developed the basis of the “Surface Insulation Resistance” test, which applies an