

INTERNATIONAL STANDARD

REDLINE VERSION

Semiconductor devices - Mechanical and climatic test methods -
Part 21: Solderability

ITeH Standards
(<https://standards.iteh.ai>)
Document Preview

IEC 60749-21:2025

<https://standards.iteh.ai/catalog/standards/iec/ce82b939-bb80-4644-9437-9026337ae9fb/iec-60749-21-2025>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2025 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search -

webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

[IEC 60749-21:2025](https://standards.iteh.ai/catalog/standards/iec/ce82b939-bb80-4644-9437-9026337ae9fb/iec-60749-21-2025)

<https://standards.iteh.ai/catalog/standards/iec/ce82b939-bb80-4644-9437-9026337ae9fb/iec-60749-21-2025>

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

CONTENTS

FOREWORD	3
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Test apparatus and materials	5
4.1 Solder bath	5
4.2 Dipping device	6
4.3 Optical equipment	6
4.4 Steam ageing equipment	6
4.5 Lighting equipment	6
4.6 Materials	6
4.6.1 Flux	6
4.6.2 Solder	7
4.7 SMD reflow equipment	7
4.7.1 Stencil or screen	7
4.7.2 Rubber squeegee or metal spatula	7
4.7.3 Test substrate	8
4.7.4 Solder paste	8
4.7.5 Reflow equipment	9
4.7.6 Flux removal solvent	9
5 Procedures	9
5.1 Lead-free backward compatibility	9
5.2 Preconditioning	9
5.2.1 General	9
5.2.2 Preconditioning by steam ageing	9
5.2.3 Preconditioning by high temperature storage	10
5.3 Dip and look solderability testing	10
5.3.1 General	10
5.3.2 Solder dip conditions	11
5.3.3 Procedure	11
5.4 Procedure for simulated board mounting reflow solderability testing of SMDs	16
5.4.1 General	16
5.4.2 Test equipment set-up	17
5.4.3 Specimen preparation and surface condition	18
5.4.4 Visual inspection	19
6 Summary	19
Bibliography	20
Figure 1 – Areas to be inspected for gullwing packages	14
Figure 2 – Areas to be inspected for J-lead packages	15
Figure 3 – Areas to be inspected in rectangular components (SMD method)	15
Figure 4 – Areas to be inspected in SOIC and QFP packages (SMD method)	16
Figure 5 – Flat peak type reflow profile	18
Table 1 – Steam ageing conditions	9

Table 2 – Altitude versus steam temperature	10
Table 3 – Solder dip test conditions	11
Table 4 – Maximum limits of solder bath contaminant	13

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60749-21:2025](https://standards.iteh.ai/catalog/standards/iec/ce82b939-bb80-4644-9437-9026337ae9fb/iec-60749-21-2025)

<https://standards.iteh.ai/catalog/standards/iec/ce82b939-bb80-4644-9437-9026337ae9fb/iec-60749-21-2025>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Semiconductor devices -
Mechanical and climatic test methods -
Part 21: Solderability**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60749-21:2011. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60749-21 has been prepared by IEC technical committee 47: Semiconductor devices. It is an International Standard.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) revision to certain operating conditions in line with current working practices.

The text of this International Standard is based on the following documents:

Draft	Report on voting
47/2961/FDIS	47/2982/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60749 series, published under the general title *Semiconductor devices - Mechanical and climatic test methods* 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

1 Scope

This part of IEC 60749 establishes a standard procedure for determining the solderability of device package terminations that are intended to be joined to another surface using tin-lead (SnPb) or lead-free (Pb-free) solder for the attachment.

This test method provides a procedure for “dip and look” solderability testing of through hole, axial and surface mount devices (SMDs) as well as an optional procedure for a board mounting solderability test for SMDs for the purpose of allowing simulation of the soldering process to be used in the device application. The test method also provides optional conditions for ageing.

This test is considered destructive unless otherwise detailed in the relevant specification.

~~NOTE 1 This test method is in general accord with IEC 60068, but due to specific requirements of semiconductors, the following text is applied.~~

NOTE 2¹ This test method does not assess the effect of thermal stresses which ~~may~~ can occur during the soldering process. ~~Reference should be made~~ More details can be found in IEC 60749-15 or IEC 60749-20.

NOTE 2 If a qualitative test method is preferred, the Wetting balance test method can be found in IEC 60068-2-69.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61190-1-2:20072014, *Attachment materials for electronic assembly - Part 1-2: Requirements for soldering pastes for high-quality interconnects in electronics assembly*

IEC 61190-1-3:20072017, *Attachment materials for electronic assembly - Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications* IEC 60749-21:2025

<https://standards.iteh.ai/catalog/standards/iec/ce82b939-bb80-4644-9437-9026337ae9fb/iec-60749-21-2025>

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 Test apparatus and materials

~~This test method requires the following equipment.~~

4.1 Solder bath

The solder bath shall be not less than 40 mm in depth and not less than 300 ml in volume such that it can contain at least 1 kg of solder. The apparatus shall be capable of maintaining the solder at the specified temperature within ± 5 °C. The solder in solder baths used for solderability testing shall be analysed or replaced to ensure that the composition complies with 4.6.2.