IEC 60749-15

Edition 2.0 2010-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Semiconductor devices – Mechanical and climatic test methods –
Part 15: Resistance to soldering temperature for through-hole mounted devices

Dispositifs à semiconducteurs – Méthodes d'essai mécaniques et climatiques –
Partie 15: Résistance à la température de soudage pour dispositifs par trous traversants

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC 60749-15

Edition 2.0 2010-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Semiconductor devices – Mechanical and climatic test methods –
Part 15: Resistance to soldering temperature for through-hole mounted devices

Dispositifs à semiconducteurs – Méthodes d'essai mécaniques et climatiques –
Partie 15: Résistance à la température de soudage pour dispositifs par trous traversants

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

G

ICS 31.080.01

ISBN 978-2-88912-231-8

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 15: Resistance to soldering temperature for through-hole mounted devices

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.

International Standard IEC 60749-15 has been prepared by IEC technical committee 47: Semiconductor devices.

This second edition cancels and replaces the first edition published in 2003 and constitutes a technical revision. The significant changes with respect from the previous edition include:

– editorial change in the scope,
– addition of lead-free solder chemical composition specification.

The text of this standard is based on the following documents:

FDIS	Report on voting
47/2067/FDIS	47/2078/RVD

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

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

A list of all parts in the IEC 60749 series, 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 15: Resistance to soldering temperature for through-hole mounted devices

1 Scope

This part of IEC 60749 describes a test used to determine whether encapsulated solid state devices used for through-hole mounting can withstand the effects of the temperature to which they are subjected during soldering of their leads by using wave soldering or a soldering iron.

In order to establish a standard test procedure for the most reproducible methods, the solder dip method is used because of its more controllable conditions. This procedure determines whether devices are capable of withstanding the soldering temperature encountered in printed wiring board assembly operations, without degrading their electrical characteristics or internal connections.

This test is destructive and may be used for qualification, lot acceptance and as a product monitor.

This test is, in general, in conformity with IEC 60068-2-20 but, due to specific requirements of semiconductors, the clauses of this standard apply.

2 General

The heat is conducted through the leads into the device package from solder heat at the reverse side of the board. This procedure does not simulate wave soldering or reflow heat exposure on the same side of the board as the package body.

3 Test apparatus

3.1 Solder pot

A solder pot of sufficient size to contain at least 1 kg of solder shall be used. The solder pot dimensions shall allow full immersion of the leads without touching the bottom. The apparatus shall be capable of maintaining the solder at the temperature specified in Table 1.

3.2 Dipping device

A mechanical dipping device shall be used that is capable of controlling the rates of immersion and emersion of the leads and providing the dwell time as specified in Table 1.

3.3 Heatsinks or shielding

If applicable, heatsinks or shielding shall be attached to the devices prior to the test and shall be as specified in the relevant specification.

Table 1 – Parameters for solder dipping

Parameter		Condition A (for wave solder)	Condition B (for soldering iron)
Temperature of molten solder	°C	260 ± 5	350 ± 5
Number of immersions		≤2	≤2
Immersion rate	mm s^{-1}	25 ± 5	25 ± 5
Dwell time	s	10 ± 5	10 ± 5
Emersion rate	mm s^{-1}	25 ± 5	25 ± 5
Distance between solder bath and device body	mm	1,5 ± 0,5	1,5 ± 0,5

4 Materials

4.1 Solder

The solder specification shall be as follows.

Chemical composition

– for SnPb solder the composition in percentage by weight shall be as follows:

Tin: 59 % to 65 %;

Lead: the remainder.

Chemical composition

– for Pb-free solder the composition in percentage by weight shall be as follows:

Silver: 3 % to 4 %;

Copper: 0.5 % to 1 %;

Tin: the remainder.

The solder shall not contain impurities which will adversely affect its properties.

Other solders and their applicable bath temperatures may be used as specified in the relevant specification.

4.2 Flux

If flux is applied prior to solder dipping, the flux shall consist of 25 % by weight of colophony in 75 % by weight of isopropyl alcohol, unless otherwise detailed in the relevant specification.

5 Procedure

5.1 Pre-conditioning of specimens

Any special pre-conditioning of the specimens prior to testing shall be as specified in the relevant specification. This preparation may include operations such as bending or other relocation of leads, and the attachment of heat sinks or protective shielding prior to solder dipping.

5.2 Preparation of the solder bath

The molten solder shall be stirred to assure that the temperature is uniform. The dross shall be skimmed from the surface of the molten solder just prior to dipping the part.

5.3 Use of flux

Where detailed in the relevant specification, all leads of the specimen shall be dipped in flux prior to solder dip; excess flux shall be removed by draining for a suitable time.

5.4 Solder dip

The part shall be attached to the dipping device (see 3.2) and the leads immersed in the molten solder until the body of the device under test reaches the dimensions specified in Table 1. The parameters for solder temperature, dwell time, number of immersions and rates of immersion and emersion are defined in Table 1. Unless otherwise detailed in the procurement specification, Condition A shall be used. After the dipping process, the part shall be allowed to cool in air and, if flux has been used, residues shall be removed with isopropanol or ethanol.

5.5 Precautions

Prior to and after the solder immersion, precautionary measures shall be taken to prevent undue exposure of the part to the heat radiated by the solder bath.

5.6 Measurements

Hermeticity tests for hermetic devices, visual examination and electrical measurements that consist of parametric and functional tests, shall be made as specified in the relevant specification.

5.7 Failure criteria

A device shall be defined as a failure if hermeticity for hermetic devices cannot be demonstrated, if parametric limits are exceeded or if functionality cannot be demonstrated under nominal and worst-case conditions specified in the relevant specification. Mechanical damage such as cracking, chipping or breaking of the package (10× – 20× magnification) will also be considered a failure, provided such damage was not induced by fixturing or handling.

6 Summary

The following details shall be specified in the relevant specification:

a) use of heatsinks or shielding, if applicable (see 3.3);
b) flux composition if applicable (see 5.3);
c) older composition if other than detailed in this standard (see 4.1);
d) pre-conditioning of specimens, if applicable (see 5.1);
e) condition (A or B), time and depth of immersion, if other than as specified in Table 1;
f) method of hermeticity tests, visual examination and electrical measurements (see 5.6);
g) failure criteria of hermeticity tests, visual examination and electrical measurements (see 5.7);
h) sample size.

Bibliography

IEC 60068-2-20, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*