

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Semiconductor devices – Mechanical and climatic test methods –  
Part 13: Salt atmosphere**

**(standards.iteh.ai)**

**Dispositifs à semiconducteurs – Méthodes d'essais mécaniques et climatiques –  
Partie 13: Atmosphère saline**

<https://standards.iteh.ai/catalog/standards/sist/71843c72-a32a-4286-a66e-a71f46b3a3dd/iec-60749-13-2018>



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://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](http://webstore.iec.ch/justpublished)

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

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms, containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://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](mailto:sales@iec.ch).

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) 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 IEC

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

#### Catalogue IEC - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Semiconductor devices – Mechanical and climatic test methods –  
Part 13: Salt atmosphere** (standards.iteh.ai)

**Dispositifs à semiconducteurs – Méthodes d'essais mécaniques et climatiques –  
Partie 13: Atmosphère saline**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 31.080.01

ISBN 978-2-8322-5369-4

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

|  |    |
|--|----|
| FOREWORD.....  | 3  |
| 1 Scope.....   | 5  |
| 2 Normative references .....   | 5  |
| 3 Terms and definitions .....  | 5  |
| 4 Test apparatus .....   | 5  |
| 5 Procedure.....   | 6  |
| 5.1 Conditioning and maintenance of test chamber .....   | 6  |
| 5.2 Initial preconditioning of leads.....  | 6  |
| 5.3 Mounting of test specimens.....  | 6  |
| 5.4 Chamber operation .....  | 10 |
| 5.5 Length of test.....  | 10 |
| 5.6 Examination .....  | 11 |
| 5.7 Failure criteria.....  | 11 |
| 5.7.1 Finished product .....   | 11 |
| 5.7.2 Package elements .....   | 12 |
| 6 Summary .....  | 12 |
| Bibliography.....  | 14 |
| <b>iTeh STANDARD PREVIEW</b><br>(standards.iteh.ai)  |    |
| Figure 1 – Dual-in-line packages with leads attached to, or exiting from package sides (such as side-brazed packages and ceramic dual-in-line packages)..... | 7  |
| Figure 2 – Packages with leads attached to, or exiting from the opposite side of the lid .....   | 9  |
| Figure 3 – Packages with leads attached to, or exiting from package sides, parallel to lids (such as flatpacks) .....  | 9  |
| Figure 4 – Leadless and leaded chip carriers .....   | 10 |
| Figure 5 – Corrosion area charts.....  | 13 |
| Table 1 – Minimum duration of exposure.....  | 11 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SEMICONDUCTOR DEVICES –  
MECHANICAL AND CLIMATIC TEST METHODS –****Part 13: Salt atmosphere**

## 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 60749-13 has been prepared by IEC technical committee 47: Semiconductor devices.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

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

- a) alignment with MIL-STD-883J Method 1009.8, Salt Atmosphere (Corrosion), including information on conditioning and maintenance of the test chamber and mounting of test specimens (including explanatory figures).

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

| FDIS         | Report on voting |
|--------------|------------------|
| 47/2446/FDIS | 47/2455/RVD      |

Full information on the voting for the approval of this International Standard 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 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 "<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.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 60749-13:2018](#)

<https://standards.iteh.ai/catalog/standards/sist/71843c72-a32a-4286-a66e-a71f46b3a3dd/iec-60749-13-2018>

# SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

## Part 13: Salt atmosphere

### 1 Scope

This part of IEC 60749 describes a salt atmosphere test that determines the resistance of semiconductor devices to corrosion. It is an accelerated test that simulates the effects of severe sea-coast atmosphere on all exposed surfaces. It is only applicable to those devices specified for a marine environment.

The salt atmosphere test is considered destructive.

### 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 60749-14, *Semiconductor devices – Mechanical and climatic test methods – Part 14: Robustness of terminations (lead integrity)*

IEC 60749-13:2018

### 3 Terms and definitions

<https://standards.iteh.ai/catalog/standards/sist/71843c72-a32a-4286-a66e-a71f46b3a3dd/iec-60749-13-2018>

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 apparatus

The following items are required for performing the salt atmosphere test.

- a) Temperature-controlled chamber with suitable non-corrodible rack for supporting devices. All parts within the test chamber which come in contact with test specimens shall be of materials that will not cause electrolytic corrosion. The chamber shall be properly vented to prevent pressure build-up and allow uniform distribution of salt fog.
- b) Salt solution reservoir adequately protected from the surrounding ambient.

The salt concentration shall be 0,5 % to 3,0 % by weight in deionized or distilled water as required to achieve the deposition rates required by 5.4. The salt used shall be sodium chloride containing on the dry basis not more than 0,1 % by weight of sodium iodide and not more than 0,3 % by weight total impurities. The pH of the salt solution shall be maintained between 6,5 and 7,2 when measured at 35 °C ± 3 °C. Only CP grade (dilute solution) hydrochloric acid or sodium hydroxide shall be used to adjust the pH.

- c) Means for atomizing the salt solution, including suitable nozzles and compressed air supply or a 20 % oxygen, 80 % nitrogen mixture (the gas entering the atomizers shall be free from all impurities such as oil and dirt).
- d) Means for humidifying the air at a temperature above the chamber temperature.
- e) Air or inert gas dryer.
- f) Magnifier(s), 1× to 3×, 10× to 20× and 30× to 60×.

## 5 Procedure

### 5.1 Conditioning and maintenance of test chamber

The purpose of the cleaning cycle is to assure that all materials which could adversely affect the results of the subsequent tests are removed from the chamber. The chamber shall be cleaned by operating it at  $35\text{ °C} \pm 3\text{ °C}$  with deionized or distilled water as long as necessary. The chamber shall be cleaned each time the salt solution in the reservoir has been used up. Several test runs therefore could be run before cleaning, depending on the size of the reservoir and the specified test condition (see 5.5). When long duration conditions (test conditions C and D, see 5.5) are required, the reservoir may be refilled via auxiliary reservoirs so that the test cycle does not need to be interrupted. After the cleaning cycle, on restarting the chamber, the reservoir shall be filled with salt solution and the chamber shall be stabilized by operating it until the temperature comes to equilibrium, see 5.4. If operation of the chamber is discontinued for more than one week, the remaining salt solution, if any, shall be discarded. Cleaning shall then be performed prior to restarting the test chamber. Intermittent operation of the chamber is acceptable provided the pH and concentration of the salt solution are kept within the limits defined in item b) of Clause 4.

### 5.2 Initial preconditioning of leads

Unless otherwise specified, the test specimens shall not be preconditioned. When initial conditioning is specified, the device terminals shall be subjected to a stress in accordance with test condition B of the method specified in IEC 60749-14 before the specimens are mounted for the salt atmosphere test. When the sample devices being subjected to the salt atmosphere have already received the required initial conditioning, as part of another test employing the same sample devices, the terminal bend need not be repeated.

### 5.3 Mounting of test specimens

Test specimens shall be positioned so that they do not contact each other, so that they do not shield each other from the freely settling fog, and so that corrosion products and condensate from one specimen does not fall on another.

In cases where two orientations are required for testing, the specified sample size shall be divided in half (or as close to one-half as possible). In all cases, inspections following the test in accordance with 5.7 shall be performed on all package surfaces.

Precautions shall be used to prevent light induced photovoltaic electrolytic effects when testing windowed UV erasable devices.

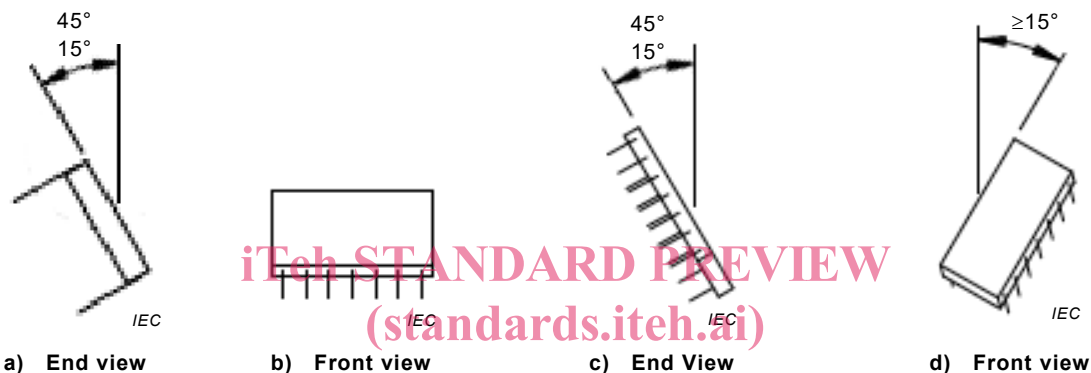
The test specimens shall be mounted on the holding fixtures (plexiglass rods, nylon or fiberglass screens, nylon cords, etc.) in accordance with the applicable orientation(s) below.

- a) Dual-in-line packages with leads attached to, or exiting from, package sides (such as side-brazed packages and ceramic dual-in-line packages): lid upwards  $15^\circ$  to  $45^\circ$  from vertical. One of the package sides on which the leads are located shall be oriented upwards at an angle greater than or equal to  $15^\circ$  from vertical (see Figure 1).
- b) Packages with leads attached to, or exiting from the opposite side of the lid (such as TO cans, solid sidewall packages, and metal platform packages): lid  $15^\circ$  to  $45^\circ$  from vertical. One-half of the samples shall be tested with the lid upwards; the remaining samples shall



be tested with the leads upwards (see Figure 2). For packages with leads attached to, or exiting from the same side as the lid, only one orientation (lid and leads upwards) is required.

- c) Packages with leads attached to, or exiting from package sides, parallel to the lid (such as flatpacks): Lid  $15^\circ$  to  $45^\circ$  from vertical. One of the package sides on which the leads are located shall be oriented upwards at an angle greater than or equal to  $15^\circ$  from vertical. For packages with a metal case, one-half of the samples shall be tested with the lid upwards; the remaining samples shall be tested with the case upwards. All other packages shall be tested with the lid upwards (Figure 3).
- d) Leadless and leaded chip carriers: lid  $15^\circ$  to  $45^\circ$  from vertical. One-half of the samples shall be tested with the lid upwards; the remaining samples shall be tested with the lid downwards (see Figure 4).
- e) Flat specimens (e.g., lids only and lead frames only):  $15^\circ$  to  $45^\circ$  from vertical.



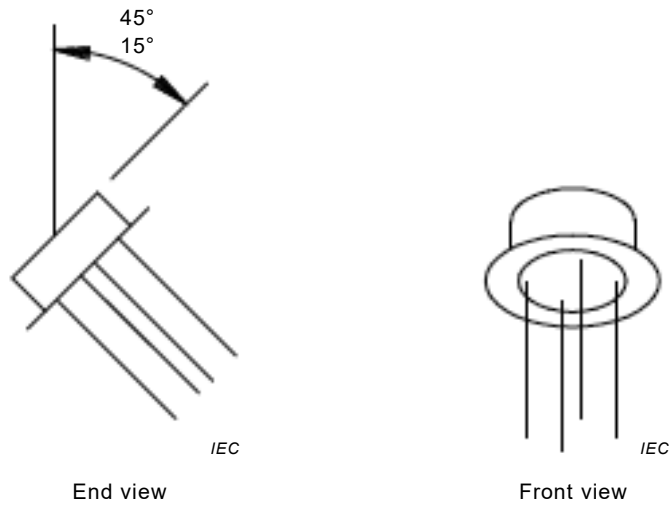
STANDARD PREVIEW  
 (standards.itech.ai)

IEC 60749-13:2018

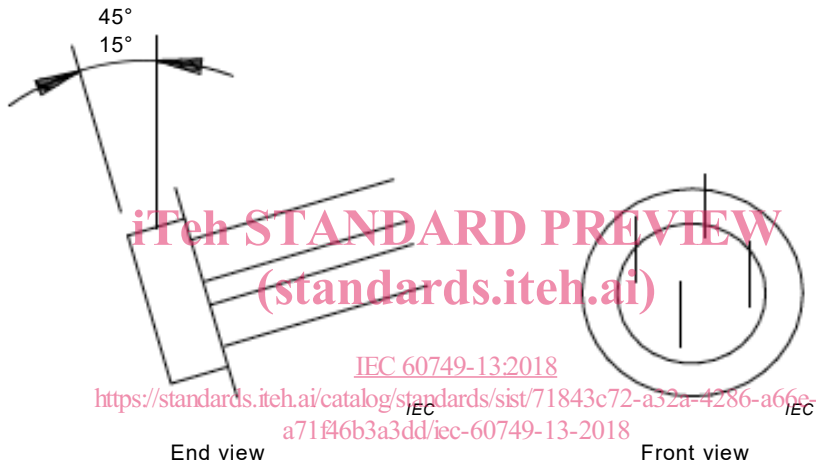
[https://standards.itech.ai/catalog/standards/sist/71843c72-a32a-4286-a66e-](https://standards.itech.ai/catalog/standards/sist/71843c72-a32a-4286-a66e-a7146b3a3dd/iec-60749-13-2018)

[a7146b3a3dd/iec-60749-13-2018](https://standards.itech.ai/catalog/standards/sist/71843c72-a32a-4286-a66e-a7146b3a3dd/iec-60749-13-2018)

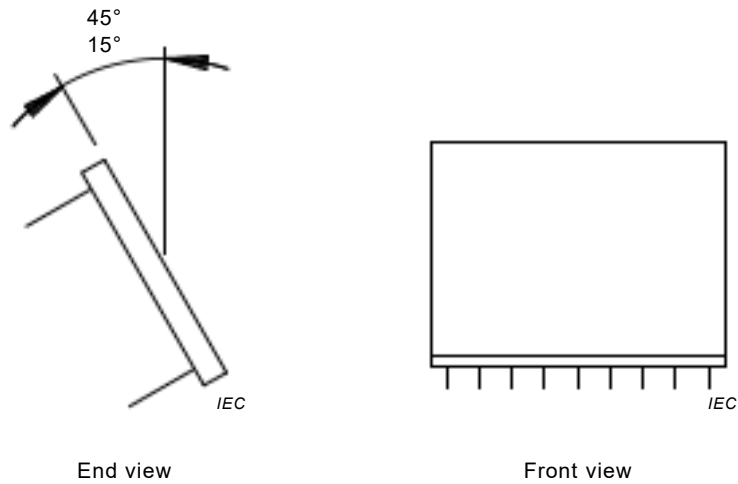
**Figure 1 – Dual-in-line packages with leads attached to, or exiting from package sides (such as side-brazed packages and ceramic dual-in-line packages)**



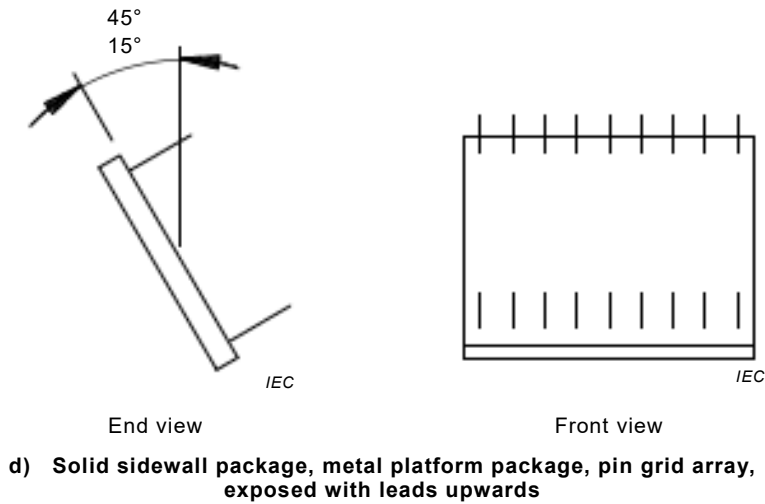
a) TO can exposed with cap upwards



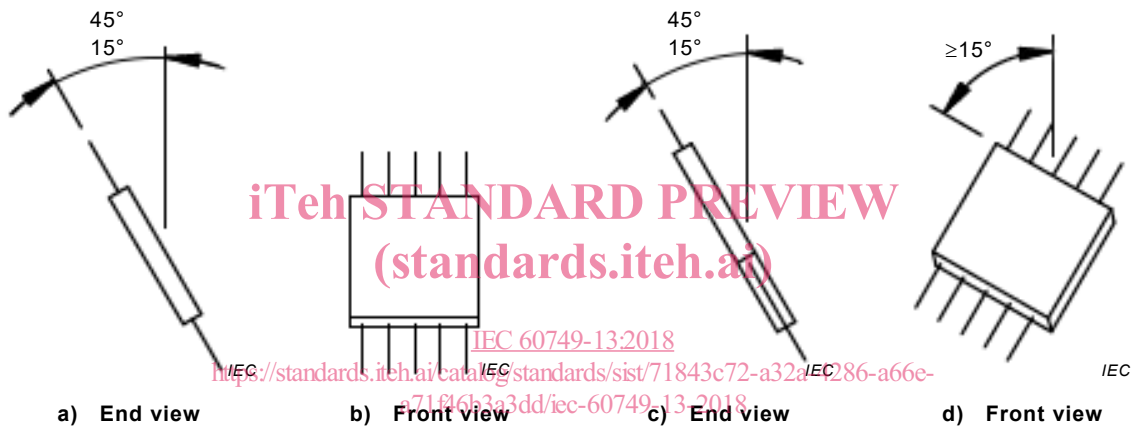
b) TO can exposed with leads upwards



c) Solid sidewall package, metal platform package, pin grid array, exposed with lid upwards

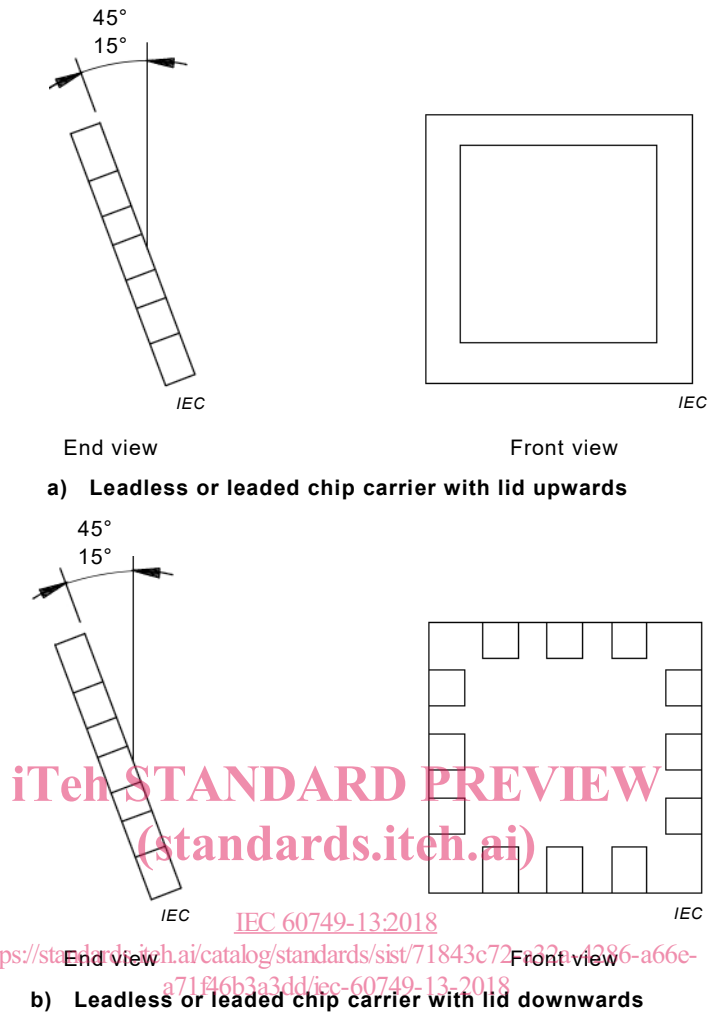


**Figure 2 – Packages with leads attached to, or exiting from the opposite side of the lid**



NOTE If the case is metal, one-half of the samples is tested with the lids exposed upward, the other one-half with the cases exposed upward.

**Figure 3 – Packages with leads attached to, or exiting from package sides, parallel to lids (such as flatpacks)**



iTeh STANDARD PREVIEW  
(standards.itech.ai)

IEC 60749-13:2018

<https://standards.itech.ai/catalog/standards/sist/71843c72-a32e-4386-a66e-a7146b3a3dd/iec-60749-13-2018>

#### 5.4 Chamber operation

After chamber conditioning in accordance with 5.1, the devices shall be placed in the test chamber in such a way that they do not contact each other or shield each other from the freely settling fog and that corrosion product and condensate from one specimen does not fall on another. A salt atmosphere fog shall be maintained in the test chamber for the time specified by the required test condition listed in 5.5. During the test, the chamber shall be held at a temperature of  $35\text{ °C} \pm 3\text{ °C}$ . The fog concentration and velocity shall be such that the rate of salt deposit in the test area is between  $20\text{ g/m}^2$  and  $50\text{ g/m}^2$  per 24 h.

#### 5.5 Length of test

The minimum duration of exposure of the salt atmosphere test shall be chosen from Table 1. Unless otherwise specified, test condition A shall apply.