IEC 63378-2-1

Edition 1.0 2024-10

INTERNATIONAL STANDARD

Thermal standardization on semiconductor packages – Part 2-1: 3D thermal simulation models of semiconductor packages for steady-state analysis – Discrete packages

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

IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024

IEC 63378-2-1:2024-10(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 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 Varembé
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 It also gives information on projects, replaced and withdrawn publications.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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024

IEC 63378-2-1

Edition 1.0 2024-10

INTERNATIONAL STANDARD

Thermal standardization on semiconductor packages – Part 2-1: 3D thermal simulation models of semiconductor packages for steady-state analysis – Discrete packages

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

IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.080.01

ISBN 978-2-8322-9816-9

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

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD ... 3
1 Scope ... 5
2 Normative references ... 5
3 Terms and definitions ... 5
4 Attributes of 3D thermal models ... 5
4.1 General ... 5
4.2 TO-243 ... 6
4.3 TO-252 ... 8
4.4 TO-263 ... 10
Annex A (normative) Contribution analysis in the case of TO-252 ... 12
A.1 Attributes of a sample package ... 12
A.2 Simulation validation ... 14
Bibliography ... 15

Figure 1 – Dimensions of TO-243 ... 6
Figure 2 – Dimensions of TO-252 ... 8
Figure 3 – Dimensions of TO-263 ... 10
Figure A.1 – Sample package of TO-252 ... 12
Figure A.2 – Results of contribution analysis ... 13
Figure A.3 – Accuracy comparison ... 14

Table 1 – Attributes for TO-243 ... 7
Table 2 – Attributes for TO-252 ... 9
Table 3 – Attributes for TO-263 ... 11
Table A.1 – Attributes and their range of a sample package ... 12

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4de3-84b3-11688e99e4d6/iec-63378-2-1-2024

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

THERMAL STANDARDIZATION ON SEMICONDUCTOR PACKAGES –

Part 2-1: 3D thermal simulation models of semiconductor packages for steady-state analysis – Discrete packages

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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4de3-84b3-11688e99e4d6/iec-63378-2-1-2024

IEC 63378-2-1 has been prepared by subcommittee 47D: Semiconductor devices packaging, of IEC technical committee 47: Semiconductor devices. It is an International Standard.

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

Draft	Report on voting
47D/976/FDIS	47D/982/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 63378 series, published under the general title *Thermal standardization on semiconductor packages*, 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.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

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

IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024

THERMAL STANDARDIZATION ON SEMICONDUCTOR PACKAGES –

Part 2-1: 3D thermal simulation models of semiconductor packages for steady-state analysis – Discrete packages

1 Scope

This part of IEC 63378 specifies three-dimensional (3D) thermal models of discrete semiconductor packages (TO-243, TO-252 and TO-263), utilized in the steady-state thermal analysis of electronic devices to estimate junction temperatures accurately.

This model is assumed to be made by semiconductor suppliers and to be used by assembly makers of electronic devices.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

For the purposes of this document, the following terms and definitions apply.

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

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

IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/...88e99e4d6/iec-63378-2-1-2024

3.1
detailed model
semiconductor package model which has both the structures of each portion, such as die or moulding or terminal, and the material properties for thermal analysis

Note 1 to entry: This model is often simplified to some extent.

4 Attributes of 3D thermal models

4.1 General

Clause 4 shows the attributes such as dimensions and thermal properties of three different type of TO-packages. These attributes are used to estimate junction temperatures.

4.2 TO-243

Figure 1 and Table 1 show the attributes which TO-243 thermal simulation models shall have.

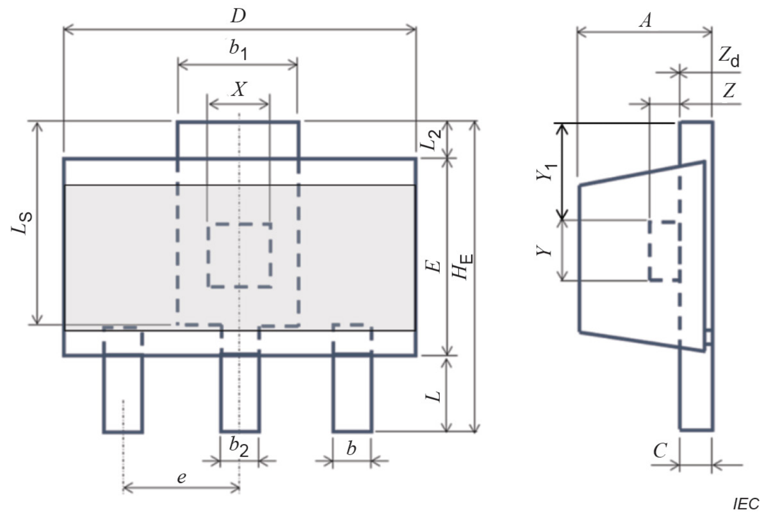

Figure 1 – Dimensions of TO-243

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024

Table 1 – Attributes for TO-243

	Attribute	Symbol	Value	Unit
Dimension	Package thickness	A		m
	Terminal width	b		m
	Heat spreader width	b_1		m
	Centre terminal width	b_2		m
	Terminal thickness	C		m
	Package width	D		m
	Package body length	E		m
	Terminal pitch	e		m
	Span	H_E		m
	Terminal length	L		m
	Exposed terminal length	L_2		m
	Heat spreader length	L_S		m
	Die width	X		m
	Die length	Y		m
	Die length offset	Y_1		m
	Die thickness	Z		m
	Die attach thickness	Z_d		m
Thermal conductivity	Thermal conductivity of die	k_d		W/(m × K)
	Thermal conductivity of die attach	k_{da}		W/(m × K)
	Thermal conductivity of molding	k_m		W/(m × K)
	Thermal conductivity of heat spreader	k_s		W/(m × K)

NOTE 1 The default thermal conductivity of molding is 0,6 W/(m·K) and that of heat spreader is 300 W/(m × K). The thermal conductivity of die and die attach varies a lot according to the material adopted.

NOTE 2 The thickness of molding is the same as package thickness "A".

NOTE 3 The length and width of the die attach are the same as those of die X and Y.

NOTE 4 The columns for "Value" shall be filled in.

iTeh Standards (https://standards.iteh.ai) Document Preview IEC 63378-2-1:2024 https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024

4.3 TO-252

Figure 2 and Table 2 show the attributes which TO-252 thermal simulation models shall have. (A contribution analysis in the case of TO-252 is given in Annex A.)

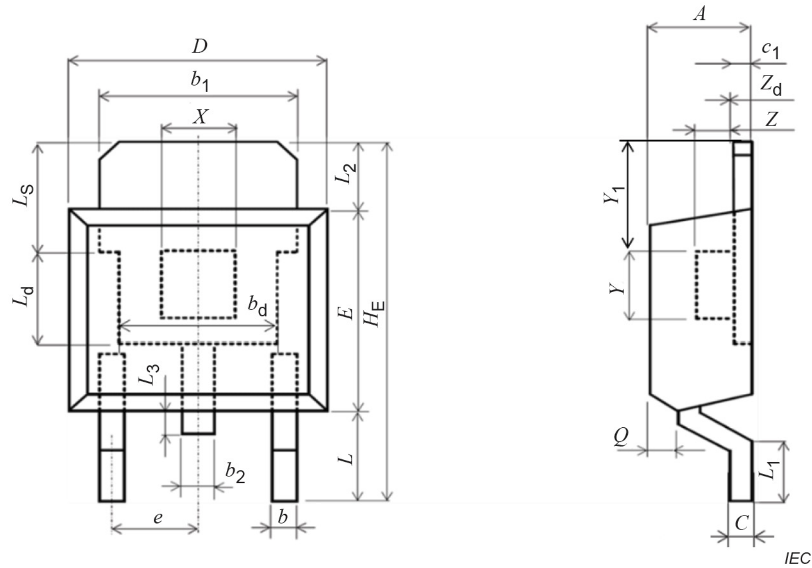

Figure 2 – Dimensions of TO-252

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 63378-2-1:2024
https://standards.iteh.ai/catalog/standards/iec/88828a52-4a92-4dc3-84b3-11688e99e4d6/iec-63378-2-1-2024