

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Directly heated negative temperature coefficient thermistors –
Part 2: Sectional specification – Surface mount negative temperature coefficient
thermistors**

**Thermistances à coefficient de température négatif à chauffage direct –
Partie 2: Spécification intermédiaire – Thermistances à coefficient de
température négatif pour montage en surface**

<https://standards.iteh.ai/standards/iec/60539-2-2003>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2003 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 la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
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 It also gives information on projects, withdrawn and replaced publications.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

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Directly heated negative temperature coefficient thermistors –
Part 2: Sectional specification – Surface mount negative temperature coefficient
thermistors**

**Thermistances à coefficient de température négatif à chauffage direct –
Partie 2: Spécification intermédiaire – Thermistances à coefficient de
température négatif pour montage en surface**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

S

ICS 31.040.30

ISBN 978-2-88912-044-4

CONTENTS

FOREWORD.....	4
1 General.....	6
1.1 Scope.....	6
1.2 Normative references.....	6
1.3 Information to be given in a detail specification.....	6
1.3.1 Outline drawing and dimensions.....	7
1.3.2 Mounting.....	7
1.3.3 Ratings and characteristics.....	7
1.4 Terminology.....	7
2 Preferred ratings and characteristics.....	7
2.1 Tolerances on rated zero-power resistance.....	7
2.2 Climatic categories.....	7
3 Quality assessment procedures.....	8
3.1 Primary stage of manufacture.....	8
3.2 Structurally similar components.....	8
3.3 Qualification approval procedures.....	8
3.3.1 The manufacturer shall comply with 3.4 of IEC 60539-1.....	8
3.4 Quality conformance inspection.....	8
3.4.1 Qualification approval on the basis of the fixed sample size procedure.....	8
3.5 Quality conformance inspection.....	10
3.5.1 Formation of inspection lots.....	10
3.5.2 Test schedule.....	11
3.5.3 Delayed delivery.....	11
3.5.4 Assessment level.....	11
4 Test and measurement procedures.....	12
4.1 Mounting.....	12
4.2 Drying and recovery.....	12
4.2.1 Drying.....	12
4.2.2 Recovery.....	12
4.3 Visual examination and check of dimensions.....	12
4.3.1 Visual examination.....	12
4.3.2 Requirements.....	12
4.3.3 Marking.....	14
4.3.4 Dimensions.....	14
4.4 Electrical tests.....	14
4.4.1 Zero-power resistance.....	14
4.4.2 <i>B</i> -value or resistance ratio.....	14
4.4.3 Resistance/temperature characteristic.....	15
4.5 Thermal tests.....	15
4.5.1 Dissipation factor (δ).....	15
4.5.2 Thermal time constant by cooling after self-heating (τ_c).....	15
4.6 Resistance to soldering heat.....	15
4.6.1 Initial measurement.....	15
4.6.2 Test conditions.....	15
4.6.3 Recovery.....	16

4.6.4	Final inspection, measurements and requirements	16
4.7	Solderability	16
4.7.1	Test conditions	16
4.7.2	Recovery	17
4.7.3	Final inspection, measurements and requirements	17
4.8	Rapid change of temperature	17
4.9	Thermal shock	17
4.10	Climatic sequence	18
4.10.1	Initial measurements	18
4.10.2	Dry heat	18
4.10.3	Damp heat (cyclic), first cycle	18
4.10.4	Cold	18
4.10.5	Damp heat (cyclic), remaining cycles	18
4.10.6	Final measurements	19
4.11	Damp heat, steady state	19
4.12	Endurance	19
4.12.1	Endurance at θ_3 and P_{max}	19
4.12.2	Endurance at upper category temperature	19
4.13	Shear (adhesion) test	20
4.14	Substrate bending test	20
4.15	Component solvent resistance	20
4.16	Solvent resistance of marking	20
Annex A (normative)	Guide for the specification and coding of dimensions of surface mount negative temperature coefficient thermistors	21
Figure 1	– Fault: fissure or defect	13
Figure 2	– Fault: crack	13
Figure 3	– Separation or delamination	13
Figure 4	– Exposed electrodes	13
Figure 5	– Principal faces	14
Figure A.1	– Dimensioning of surface mount thermistors	21
Table 1	– Upper and lower category temperatures and duration of the damp heat test	8
Table 2	– Fixed sample size test schedule for qualification approval of surface mount negative temperature coefficient thermistors Assessment level EZ	10
Table 3	– Lot-by-lot inspection	11
Table 4	– Periodic test	12
Table 5	– Number of cycles	18
Table A.1	– Dimensions	21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIRECTLY HEATED NEGATIVE TEMPERATURE
COEFFICIENT THERMISTORS –**

**Part 2: Sectional specification –
Surface mount negative temperature coefficient thermistors**

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 60539-2 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This bilingual version, published in 2010-07, corresponds to the English version.

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

FDIS	Report on voting
40/1346/FDIS	40/1368/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.

The French version of this standard has not been voted upon.

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

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.

iTech Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 60539-2:2003](https://standards.itih.ai/standards/iec/60539-2:2003)

<https://standards.itih.ai/standards/iec/60539-2:2003>

DIRECTLY HEATED NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS –

Part 2: Sectional specification – Surface mount negative temperature coefficient thermistors

1 General

1.1 Scope

This part of IEC 60539 is applicable to surface mount directly heated negative temperature coefficient thermistors, typically made from transition metal oxide materials with semiconducting properties. These thermistors have metallized connecting pads or soldering strips and are intended to be mounted directly on to substrates for hybrid circuits or on to printed boards.

1.2 Normative references

The following referenced documents are indispensable for the application 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 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*
Amendment 1 (1993)
Amendment 2 (1994)

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*
Amendment 1 (1986)

IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*
Amendment 1 (1985)

IEC 60068-2-58:1999, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-78: *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60539-1:2002, *Directly heated negative temperature coefficient thermistors – Part 1: Generic specification*

1.3 Information to be given in a detail specification

Detail specifications shall be derived from the relevant blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic, sectional or blank detail specification. When more severe requirements are included, they shall be listed in 1.9 of the detail specification and indicated in the test schedules, for example, by an asterisk.

NOTE The information given in 1.3.1 may for convenience, be presented in tabular form.

The following information shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this sectional specification.

1.3.1 Outline drawing and dimensions

There shall be an illustration of the thermistor as an aid to easy recognition and for comparison with others. Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification. All dimensions shall preferably be stated in millimetres; however, when the original dimensions are given in inches, the converted metric dimensions in millimetres shall be added.

Normally, the numerical values shall be given for the length, width and height of the body. When necessary, for example when a number of items are covered by a detail specification, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information as will adequately describe the thermistor.

1.3.2 Mounting

The detail specification shall give guidance on methods of mounting for normal use. Mounting for test and measurement purposes (when required) shall be in accordance with 4.27 of IEC 60539-1.

1.3.3 Ratings and characteristics

1.3.3.1 Particular characteristics

Additional characteristics may be listed when they are considered necessary to specify the component adequately for design and application purposes.

1.3.3.2 Marking

See 2.4 of IEC 60539-1.

1.4 Terminology

See 2.2 of IEC 60539-1.

2 Preferred ratings and characteristics

2.1 Tolerances on rated zero-power resistance

Preferred values of tolerances on zero-power resistance are:

$\pm 1\%$, $\pm 2\%$, $\pm 3\%$, $\pm 5\%$, $\pm 10\%$.

2.2 Climatic categories

The upper and lower category temperatures and the duration of the damp-heat steady-state test shall be selected from Table 1.

Table 1 – Upper and lower category temperatures and duration of the damp heat test

Lower category temperature °C	–55, –40, –25, –10, –5, +5
Upper category temperature °C	70, 85, 100, 105, 125, 150, 155
Damp heat, steady state days	21, 42, 56

The detail specification shall prescribe the appropriate category.

3 Quality assessment procedures

3.1 Primary stage of manufacture

The primary stage of manufacture is defined as the initial mixing process of ingredients.

3.2 Structurally similar components

Surface mount thermistors may be grouped as structurally similar for the purpose of forming inspection lots provided that the requirements of 3.1 of IEC 60539-1 are met, with the following addition.

For the shear test and the substrate bending test, devices may be grouped if they have been made on the same production line, have the same dimensions, internal structure and external finish.

3.3 Qualification approval procedures

3.3.1 The manufacturer shall comply with 3.4 of IEC 60539-1.

3.4 Quality conformance inspection

Blank detail specifications associated with this specification shall prescribe the test schedule for quality conformance inspection.

This schedule shall also specify the grouping, sampling and periodicity for the lot-by-lot and periodic inspection.

Inspection levels and sampling plans shall be selected from those given in IEC 60410.

If required, more than one test schedule may be specified.

3.4.1 Qualification approval on the basis of the fixed sample size procedure

a) Sampling

The sample shall be representative of the range of thermistors for which approval is sought. This may or may not be the complete range covered by the detail specification.

The sample shall consist of specimens having the lowest, highest and middle-rated zero-power resistance of each case size.

Per value, three spare specimens are permitted and may be used as replacements for specimens which are defective because of incidents not attributable to the manufacturer.

b) Tests

The complete series of tests specified in Table 2 are required for the approval of thermistors covered by one detail specification. The tests of each group shall be carried out in the order given.

The whole sample shall be subjected to the tests of Group "0" and then divided for the other groups.

Specimens found defective during the tests of Group "0" shall not be used for the other groups.

"One defective" is counted when a thermistor has not satisfied the whole or a part of the tests of a group.

Approval is granted when the number of non-conformances does not exceed the specified number of permissible defects for each group or subgroup.

The conditions of test and performance requirements for the fixed sample size schedule shall be identical to those described in the detail specification for quality conformance inspection.

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

[IEC 60539-2:2003](https://standards.iteh.ai/standards/iec/60539-2-2003)

<https://standards.iteh.ai/standards/iec/60539-2-2003>

WITKO

**Table 2 – Fixed sample size test schedule for qualification approval of surface mount negative temperature coefficient thermistors
Assessment level EZ**

Group No.	Test	Subclause of this publication	Conditions of test and requirements	n ^{a)}	c ^{b)}		
0	Visual examination	4.3.1	See 4.3.1 to 4.3.2	90	0		
	Marking	4.3.3					
	Dimensions (gauging)	4.3.4	For requirements, see Table A.1				
	Zero-power resistance	4.4.1					
1	Dimensions (detail)	4.3.4	For requirements, see Table A.1	10	0		
	B-value or resistance ratio	4.4.2	Choice to be made in the detail specification				
	Resistance/temperature characteristic	4.4.3	Measuring temperatures to be defined in the detail specification				
	Resistance to soldering heat – dissolution of metallization	4.6	See 4.6				
2	Solderability	4.7	See 4.7.1 to 4.7.3	10	0		
	Solvent resistance of marking	4.16					
3	Resistance to soldering heat – dewetting	4.6	See 4.6.1 to 4.6.4	10	0		
4	Mounting	4.1		60	0		
	Visual examination	4.3.1					
	Zero-power resistance	4.4.1					
	4.1	Dissipation factor		4.5.1	10	0	
		Thermal time constant by cooling after self-heating (τ_c)		4.5.2			
	4.2	Shear test		4.13	10	0	
		Rapid change of temperature		4.8			
		Climatic sequence		4.10			
	4.3	Damp heat, steady state		4.11	10	0	
	4.4	Endurance at θ_3 and P_{max}		4.12.1	10	0	
	4.5	Endurance at upper category temperature		4.12.2	10	0	
	5	Substrate bending test		4.14		10	0
	^{a)} Number of specimens to be tested.						
^{b)} Permissible numbers of non-conforming items.							

3.5 Quality conformance inspection

3.5.1 Formation of inspection lots

a) Groups A and B inspection

These tests shall be carried out on a lot-by-lot basis.

A manufacturer may aggregate the current production into inspection lots subject to the following safeguards:

a) the inspection lot shall consist of structurally similar thermistors (see 3.2);