IEC 60539-2

Edition 2.0 2019-07

INTERNATIONAL STANDARD

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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

IEC 60539-2:2019-07(en-fr)

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

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DIRECTLY HEATED NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS –

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

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

This second edition cancels and replaces the first edition published in 2003 and Amendment 1:2010. This edition constitutes a technical revision.

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

a) revision for the structure in accordance with ISO/IEC Directives, Part 2:2016 (seventh edition) to the extent practicable, and for harmonizing with IEC 60539-1:2016;
b) the upper category temperatures of 175 °C, 200 °C, 250 °C, 315 °C, 400 °C in Table 1 have been added;
c) the dimensions of 0402M in Annex A have been added.

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

FDIS	Report on voting
40/2672/FDIS	40/2680/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 60539 series, published under the general title *Directly heated negative temperature coefficient thermistors*, 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

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DIRECTLY HEATED NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS –

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

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.

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 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Tests B: Dry heat*

IEC 60068-2-14:2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-58:2015, *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 60068-2-58:2015/AMD1:2017

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

IEC 60539-1:2016, *Directly heated negative temperature coefficient thermistors – Part 1: Generic specification*

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60539-1 apply.

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- ISO Online browsing platform: available at http://www.iso.org/obp

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4 Information to be given in a detail specification

4.1 General

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.

The information given in 4.2 may for convenience, be presented in tabular form.

The information in 4.2 to 4.4 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.

4.2 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.

4.3 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 IEC 60539-1:2016, 5.4.

4.4 Ratings and characteristics

4.4.1 Particular characteristics

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

4.4.2 Marking

See IEC 60539-1:2016, 4.3.

5 Preferred ratings and characteristics

5.1 Tolerances on rated zero-power resistance

Preferred values of tolerances on zero-power resistance are:

±0,5 %, ±1 %, ±2 %, ±3 %, ±5 %, ±10 %.

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5.2 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, 175, 200, 250, 315, 400
Damp heat, steady state days	21, 42, 56

The detail specification shall prescribe the appropriate category.

6 Quality assessment procedures

See Annex B.

7 Test and measurement procedures

7.1 Mounting

See IEC 60539-1:2016, 5.4.

7.2 Drying and recovery

7.2.1 Drying

Where drying is called for in this specification, the thermistor shall be conditioned as follows.

For 96 h ± 4 h in an oven at a temperature of 100 °C ± 5 °C, the thermistor shall then be allowed to cool in a desiccator using a suitable desiccant, such as activated alumina or silicagel, and shall be kept therein from the time of removal from the oven to the beginning of the specified tests.

7.2.2 Recovery

Unless otherwise specified, recovery shall take place under the standard atmospheric conditions for testing (see IEC 60539-1:2016, 5.3.2).

7.3 Visual examination and check of dimensions

7.3.1 Visual examination

Visual examination shall be carried out with suitable equipment with approximately 10× magnification and lighting appropriate to the specimen under test and the quality level required.

The operator should have facilities available for incident or transmitted illumination as well as an appropriate measuring facility.

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7.3.2 Requirements

7.3.2.1 General

Quantitative values for the requirements below may be given in the detail or in the manufacturer's specification.

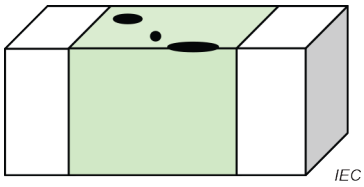
The thermistor shall conform to the following requirements.

7.3.2.2 Requirements for ceramic

Requirements for the ceramic are as follows:

1) Bulk type

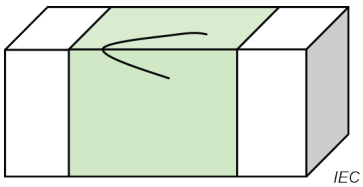
   a) It shall be free of fissures of coating glass longer than 25 % of dimension L_4 (see Annex A, Figure A.1) and defects of glass coating on each face greater than 10 % of the area of that face (see Figure 1).



NOTE Fissure on a corner and defect on one side.

Figure 1 – Fault: fissure or defect

   b) It shall be free of cracks, except for small damage on the surface, which does not impair the performance of the thermistor (see Figure 2).



NOTE Crack on one side or extending from one face to another over a corner.

Figure 2 – Fault: crack

2) Layered type

   a) It shall not exhibit visible separation or delamination between the layers of the thermistor (see Figure 3). Excluding the case when a few things which do not influence a characteristic of the surface implementation form an NTC thermistor, the surface shall not be cracked (see Figure 3).

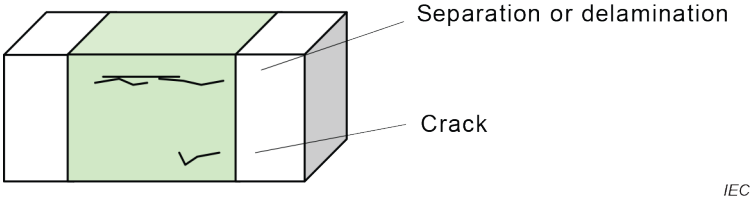


Figure 3 – Separation or delamination

   b) It shall not exhibit exposed electrodes between the two terminations (see Figure 4). It shall not exhibit any visible detachment of the metallized terminations nor any exposed electrodes (see Figure 4).

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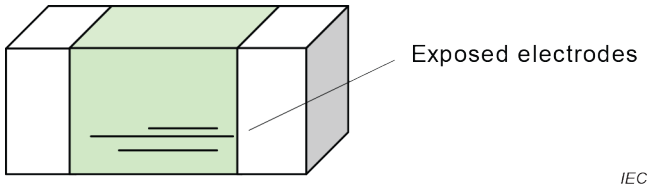

Figure 4 – Exposed electrodes

7.3.2.3 Requirements for the metallization

Requirements for the metallization are as follows:

The principal faces are those noted A, B, C, D and E (see Figure 5).

a) Termination on bottom is the principal face noted C.

b) Terminations on 3 sides are the principal faces noted A, B and C.

c) Terminations on 5 sides are the principal faces noted A, B, C, D and E.

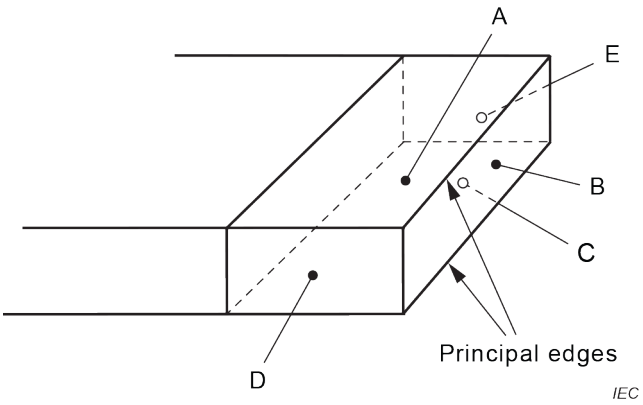

Figure 5 – Principal faces

The maximum area of gaps in metallization on each principal face shall not be greater than 15 % of the area of that face; these gaps shall not be concentrated in the same area. The gaps in metallization shall not affect the two principal edges of each extremity of the block (or four edges for square thermistors). Dissolution of the end-face plating (leaching) shall not exceed 25 % of the length of the edge concerned.

7.3.3 Marking

If there is marking on the body, it shall be legible as determined by visual examination.

a) Gull wing terminations are noted F in Figure 6.

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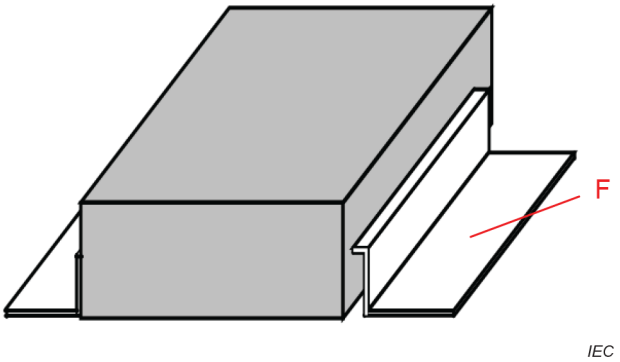

Figure 6 – Principal terminations – Gull wing

b) Round terminations are noted G in Figure 7.

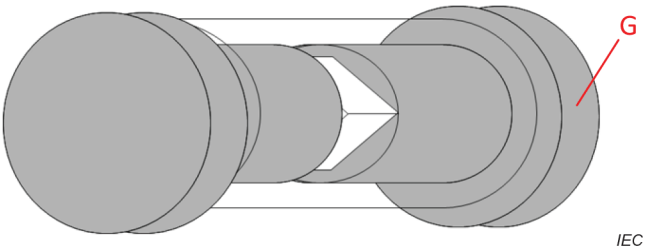

Figure 7 – Principal terminations – Round termination

The names of the structures of termination are in accordance with IEC 62137-3:2011.

7.3.4 Dimensions

The dimensions indicated in the detail specification shall be checked and shall comply with the values prescribed in Annex A.

7.4 Electrical tests

7.4.1 Zero-power resistance

See IEC 60539-1:2016, 5.6, with the following details.

The zero-power resistance shall be measured at the temperature given in the detail specification and shall be within the limits specified in the detail specification, taking into account the tolerance.

7.4.2 *B*-value or resistance ratio

See IEC 60539-1:2016, 5.7, with the following details:

– calculate the *B*-value or the resistance ratio using zero-power resistance values measured at 25 °C and 85 °C, unless otherwise specified in the detail specification;

– the *B*-value or the resistance ratio shall be within the tolerance specified in the detail specification.

7.4.3 Resistance/temperature characteristic

See IEC 60539-1:2016, 5.10, with the following details:

– the measuring temperature shall be selected from those given in IEC 60539-1:2016, Table 1;

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– the resistance/temperature characteristic shall be within the limits specified in the detail specification.

7.5 Thermal tests

7.5.1 Dissipation factor (δ)

See IEC 60539-1:2016, 5.11, with the following details:

– thermistors shall be mounted in accordance with 7.1;
– the zero-power resistance shall be measured at the temperature T_b, which is equivalent to 85 °C ± 0,1 °C unless otherwise prescribed in the detail specification;
– the dissipation factor shall be within the limits specified in the detail specification.

7.5.2 Thermal time constant by cooling after self-heating (τ_c)

See IEC 60539-1:2016, 5.13, with the following details:

– the thermistors shall be mounted in accordance with 7.1;
– the thermal time constant by cooling after self-heating shall be within the limits prescribed in the detail specification.

7.6 Resistance to soldering heat

7.6.1 General

See IEC 60068-2-58:2015 with the following details.

7.6.2 Initial measurement

The zero-power resistance shall be measured in accordance with 7.4.1.

7.6.3 Test conditions

7.6.3.1 Solder bath method

See IEC 60068-2-58:2015, 7.5, unless otherwise specified in the detail specification.

7.6.3.2 Reflow method

See IEC 60068-2-58:2015, 7.6, unless otherwise specified in the detail specification.

7.6.4 Recovery

The flux residues shall be removed with a suitable solvent.

7.6.5 Final inspection, measurements and requirements

After recovery, the surface mount thermistors shall be visually examined and measured and shall meet the following requirements.

Visual examination shall be specified in the detail specification with the following details:

– under normal lighting and approximately 10× magnification, there shall be no signs of damage such as cracks;
– dissolution of the end-face plating (leaching) shall not exceed 25 % of the length of the edge concerned.

The zero-power resistance shall be measured in accordance with 7.4.1 and the change shall not exceed ±5 %.

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