IEC 60738-1

Edition 4.0 2022-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Thermistors – Directly heated positive temperature coefficient – Part 1: Generic specification

Thermistances – Coefficient de température positif à chauffage direct – Partie 1: Spécification générique

IEC 60738-1:2022-10(en-fr)

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COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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THERMISTORS – DIRECTLY HEATED POSITIVE TEMPERATURE COEFFICIENT –

Part 1: Generic specification

FOREWORD

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IEC 60738-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2006 and Amendment 1:2009. This edition constitutes a technical revision.

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

a) Restructured completely to comply with ISO/IEC Directives; categorization and reorganization of test methods into these categories;
b) Some wordings, figures and references have been revised.

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

Draft	Report on voting
40/2969/FDIS	40/2977/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.

A list of all parts in the IEC 60738 series, published under the general title *Thermistors – Directly heated positive temperature coefficient*, can be found on the IEC website.

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.

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- replaced by a revised edition, or
- amended.

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THERMISTORS – DIRECTLY HEATED POSITIVE TEMPERATURE COEFFICIENT –

Part 1: Generic specification

1 Scope

This part of IEC 60738 describes terms and methods of test for positive step-function temperature coefficient thermistors, insulated and non-insulated types, typically made from ferro-electric semi-conductor materials.

It establishes standard terms, inspection procedures and methods of test for use in detail specifications for qualification approval and for quality assessment systems for electronic components.

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 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)

IEC 60062, *Marking codes for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

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

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-11, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-13, *Environmental testing – Part 2-13: Tests – Test M: Low air pressure*

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

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

IEC 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12-hour cycle)*

IEC 60068-2-58, *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 60294, *Measurement of the dimensions of a cylindrical component with axial terminations*

IEC 60617, *Graphical symbols for diagrams* (available at http://std.iec.ch/iec60617)

IEC 60717*, Method for determination of the space required by capacitors and resistors with unidirectional terminations*

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

IEC 61249-2-7, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

IEC 61760-1*, Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

ISO 80000-1, *Quantities and units – Part 1: General*

3 Terms and definitions

For the purposes of this document and subordinate specifications, 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

3.1
type
group of components having similar design features and whose similar manufacturing techniques enable them to be grouped together either for qualification approval or for quality conformance inspection

Note 1 to entry: A type is generally covered by a single detail specification.

Note 2 to entry: Components described in several detail specifications can, in some cases, be considered as belonging to the same type, but they are generally covered by a single detail specification.

3.2
style
variation within a type having specific nominal dimensions and characteristics

3.3
thermistor
thermally sensitive semiconducting resistor which exhibits a significant change in electrical resistance with a change in body temperature

3.4
positive temperature coefficient thermistor
thermistor whose resistance increases with its increasing temperature throughout the useful part of its characteristic

3.5
positive step-function temperature coefficient thermistor
PTC
thermistor which shows a step-like increase in its resistance when the increasing temperature reaches a specific value

Note 1 to entry: A PTC thermistor will show secondary effects which are to be considered.

3.6
zero-power resistance
R_T
value of the resistance of a PTC thermistor, at a given temperature, under conditions such that the change in resistance due to the internal generation of heat is negligible with respect to the total error of measurement

Note 1 to entry: Any resistance value of a PTC thermistor is dependent on the value and the mode of the applied voltage (AC or DC) and, when an AC source is used, on the frequency (see 3.8 and 3.9).

3.7
nominal zero-power resistance
R_n
DC resistance value of a thermistor measured at a specified temperature, preferably at 25 °C, with a power dissipation low enough that any further decrease in power will result only in a negligible change in resistance

Note 1 to entry: Zero-power resistance can also be measured using AC if required by the detail specification.

3.8
voltage dependency
secondary effect exhibiting a decreasing resistance with increasing voltage across the thermistor when measured at a constant body temperature

3.9
frequency dependency
secondary effect exhibiting a substantial decrease of the positive temperature coefficient of the thermistor when the frequency increases

3.10
resistance/temperature characteristic
relationship between the zero-power resistance of a thermistor and the temperature of the thermo-sensitive element when measured under specified reference conditions (see Figure 1)

Note 1 to entry: PTC thermistors can have more than one resistance/temperature characteristic specified. The zero-power resistance of the resistance/temperature characteristics can be measured using a pulse voltage (U_{pulse}) higher than 1,5 V, which is specified in the detail specification. The right curve in Figure 1 shows the typical resistance/temperature characteristic when using the pulse voltage (U_{pulse}).

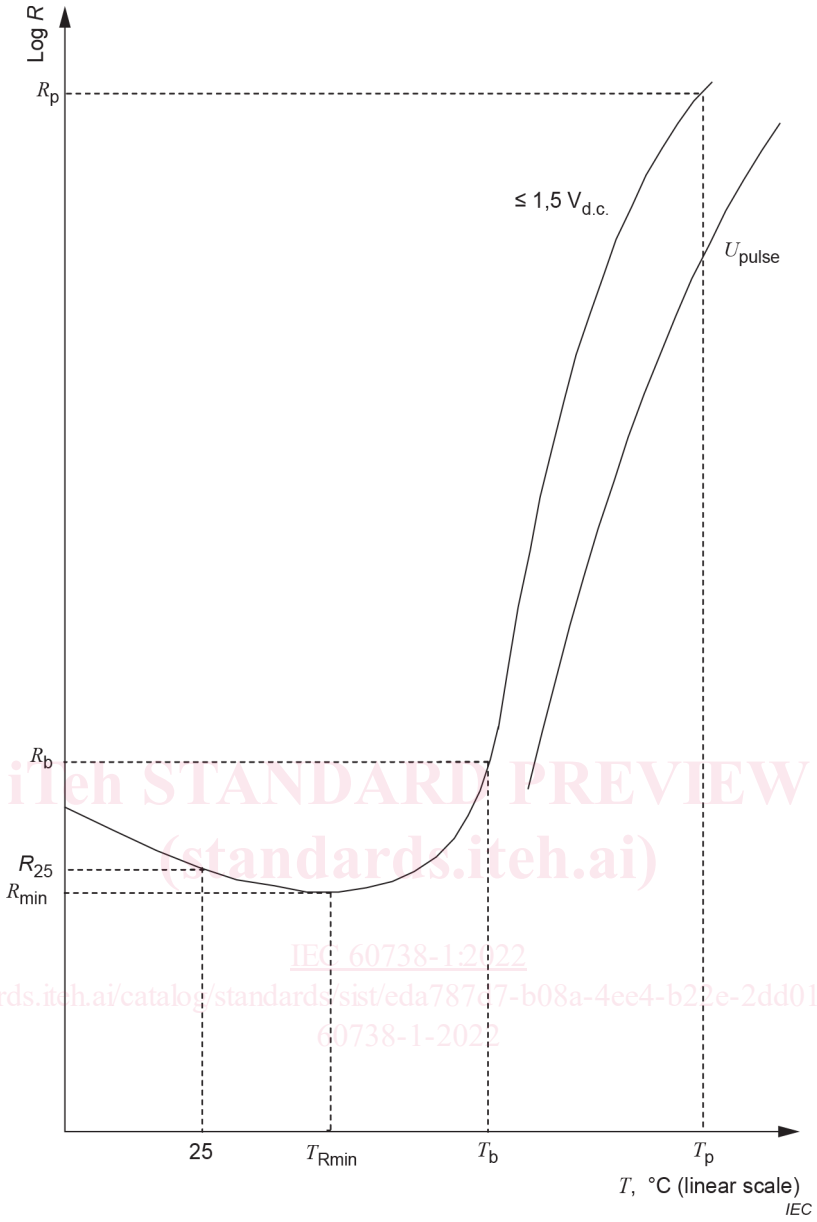

Figure 1 – Typical resistance-temperature characteristic and definitions for PTC thermistors (at zero power)

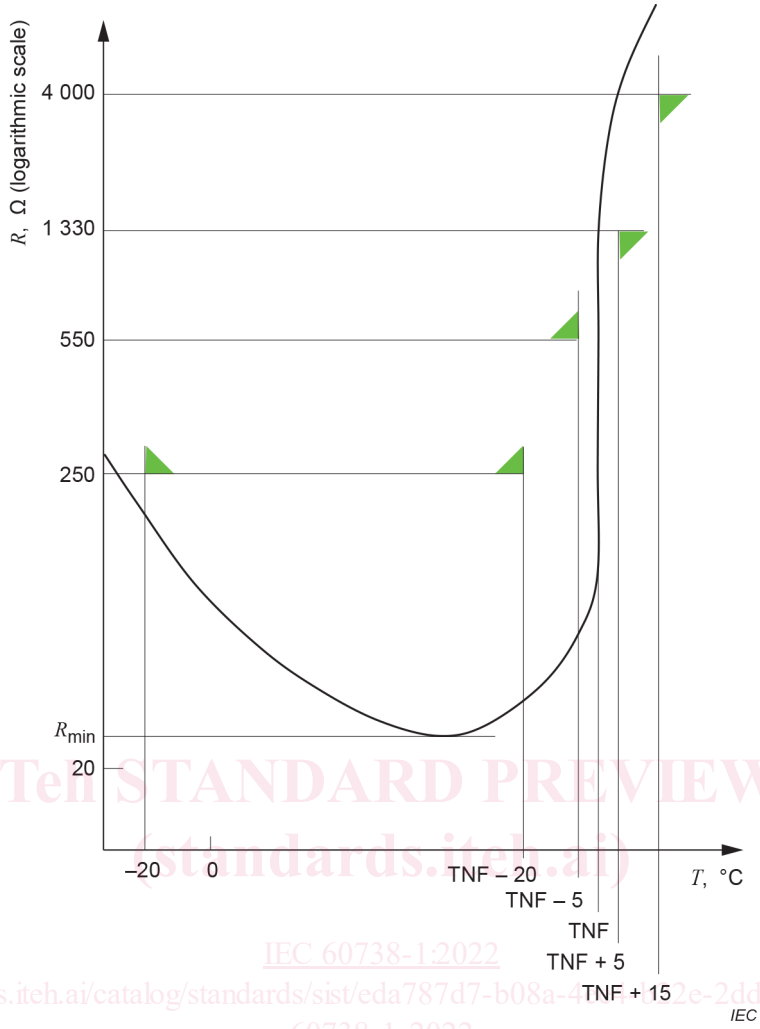

Figure 2 – Typical R-TNF characteristic for PTC thermistors in sensor applications

3.11
current/voltage characteristic
relationship in still air at 25 °C (unless otherwise stated) between the applied voltage (DC or AC) at the thermistor terminations and the current under steady-state conditions (see Figure 3)