

INTERNATIONAL STANDARD

IEC
60738-1-1

QC 440001

Second edition
1998-12

**Thermistors –
Directly heated positive step-function
temperature coefficient –**

**Part 1-1:
Blank detail specification –
Current limiting application – Assessment level EZ**

*Thermistances à basculement à coefficient de température
positif à chauffage direct –*

*Partie 1-1:
Spécification particulière cadre –
Application pour limitation de courant –
Niveau d'assurance EZ*



Reference number
IEC 60738-1-1:1998(E)

Numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series.

Consolidated publications

Consolidated versions of some IEC publications including amendments are available. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Validity of this publication

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology.

Information relating to the date of the reconfirmation of the publication is available in the IEC catalogue.

Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is to be found at the following IEC sources:

- **IEC web site***
- **Catalogue of IEC publications**
Published yearly with regular updates
(On-line catalogue)*
- **IEC Bulletin**
Available both at the IEC web site* and as a printed periodical

Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment*, IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

INTERNATIONAL STANDARD

IEC 60738-1-1

QC 440001

Second edition
1998-12

**Thermistors –
Directly heated positive step-function
temperature coefficient –
Part 1-1:
Blank detail specification –
Current limiting application – Assessment level EZ**

*Thermistances à basculement à coefficient de température
positif à chauffage direct –*

*Partie 1-1:
Spécification particulière cadre –
Application pour limitation de courant –
Niveau d'assurance EZ*

© IEC 1998 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembé Geneva, Switzerland
e-mail: inmail@iec.ch

IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

L

For price, see current catalogue

INTERNATIONAL ELECTROTECHNICAL COMMISSION

THERMISTORS –

DIRECTLY HEATED POSITIVE STEP-FUNCTION TEMPERATURE COEFFICIENT –

Part 1-1: Blank detail specification –

Current limiting application – Assessment level EZ

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60738-1-1 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 1982.

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

FDIS	Report on voting
40/1081/FDIS	40/1097/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 QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

THERMISTORS –
DIRECTLY HEATED POSITIVE STEP-FUNCTION
TEMPERATURE COEFFICIENT –
Part 1-1: Blank detail specification –
Current limiting application – Assessment level EZ

INTRODUCTION

Blank detail specification

A blank detail specification is a supplementary document to the generic specification and contains requirements for style and layout and minimum content of detail specifications. Detail specifications not complying with these requirements shall not be considered as being in accordance with IEC specifications nor shall they so be described.

In the preparation of detail specifications the content of 1.4 of the generic specification shall be taken into account.

The numbers between brackets on the first page correspond to the following information which shall be inserted in the position indicated.

Identification of the detail specification

- [1] The "International Electrotechnical Commission" or the National Standards Organization under whose authority the detail specification is drafted.
- [2] The IEC or National Standards number of the detail specification, date of issue and any further information required by the national system.
- [3] The number and issue number of the IEC or national generic specification.
- [4] The IEC number of the blank detail specification.

Identification of the thermistor

- [5] A short description of the type of thermistor.
- [6] Information on typical construction (if applicable).

NOTE – When the thermistor is not designed for use on printed boards, this should clearly be stated in the detail specification in this position.

- [7] Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the national or international documents for outlines. Alternatively, this drawing may be given in an annex to the detail specification.
- [8] Application or group of applications covered and/or assessment level.
- [9] Reference data on the most important properties, to allow comparison between the various thermistor types.

[1]	IEC 60738-1-1-XXX QC 440001XXXXXX	[2]
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH:	IEC 60738-1-1 QC 440001	[4]
[3]	DIRECTLY HEATED POSITIVE STEP-FUNCTION TEMPERATURE COEFFICIENT THERMISTORS FOR CURRENT LIMITING APPLICATION	[5]
Outline drawing: [see 1.2] [... angle projection]	MODIFIED FERRO-ELECTRIC CERAMIC MATERIAL	[6]
[7] [Other shapes are permitted within the dimensions given]	Assessment level: EZ	[8]

Information on the availability of components qualified to this detail specification is given in the Register of Approvals.

[9]

1 General data

1.1 Method(s) of mounting (to be inserted)

(See 4.12.1 of IEC 60738-1.)

1.2 Dimensions

(All dimensions are in millimetres or inches and millimetres; it shall be stated which dimensions are suitable for gauging.)

Dimensioned drawing(s) shall be given in the detail specification. If necessary, the dimensions may be listed in tabular form with reference to styles or codes.

1.3 Coating

The detail specification shall state:

- a) whether the coating is insulating or non-insulating;
- b) the material;
- c) the colour, if applicable.

1.4 Terminations

The detail specification shall state whether the terminations are suitable for soldering. If they are not, suitable methods of connection shall be stated for example: welding, clamping or crimping.

1.5 Flammability

The detail specification shall state whether the thermistor is actively or passively flammable if applicable. The test method shall be given in the test schedule.

1.6 Resistance to solvents

The detail specification shall state whether the coating and the marking of the thermistor are solvent resistant if applicable. The test methods shall be given in the test schedule.

1.7 Packaging

The detail specification shall give the following information (if required):

- a) whether bulk packed or taped and if taped, drawing or references;
- b) the dimensions of the immediate packaging and the number of thermistors packed;
- c) the dimensions of the outer package and the number of immediate packages;
- d) methods of disposal of the packaging material.

1.8 Electrical data/Ratings and characteristics

The detail specification shall give units and tolerances or limiting values for the following parameters. If necessary, electrical data may be listed in tabular form, with reference to styles and codes.

Upper/Lower category temperatures (UCT/LCT);
Operating temperature range at maximum voltage;
Maximum voltage ($U_{max.}$);
Zero-power resistance (R_T);
Isolation voltage (insulated thermistors only);
Insulation resistance (insulated thermistors only);
Tripping current (I_t);
Maximum non-tripping current ($I_{max. nt}$);
Residual current at $U_{max.}$ (I_{res});
Maximum overload current (I_{mo});
Switching temperature (T_b) for information only.

1.9 Related documents

Generic specification

IEC 60738-1:1998, *Thermistors – Directly heated positive step-function temperature coefficient – Part 1: Generic specification*

1.10 Marking

The marking of the thermistors and package containing the thermistors shall be in accordance with the requirements of 2.4 of IEC 60738-1.

The details of the marking of the thermistors and package containing the thermistor shall be given in full in the detail specification.

1.11 Ordering information

Orders for thermistors covered by this specification shall contain, in clear or in coded form, the following minimum information:

- a) style reference;
- b) maximum continuous a.c. voltage;
- c) number and issue reference of the detail specification.

1.12 Additional information (not for inspection purposes)

1.13 Additional or increased severities or requirements to those specified in the generic sectional specification

NOTE – Additions or increased requirements should be specified only when essential.

2 Inspection requirements

2.1 Procedures

2.1.1 For qualification approval, the procedures shall be in accordance with the generic specification, IEC 60738-1, 3.5.

2.1.2 For quality conformance inspection, the test schedules (tables 1 and 2) include sampling, periodicity, severities and requirements. The formation of inspection lots is covered by 3.5.7 of the generic specification.

The following list applies to the test schedules developed in tables 1 and 2:

- 1) Subclause numbers of tests and performance requirements refer to the generic specification, IEC 60738-1, and clause 1 of this specification.
- 2) Number to be tested: sample size as directly allotted to the code letter for IL in table IIA of IEC 60410 (single sampling plan for normal inspection).
- 3) In these tables:
 - p is the periodicity (in months)
 - n is the sample size
 - c is the acceptance criterion (permitted number of non-conforming items)
 - D indicates a destructive test
 - ND indicates a non-destructive test
 - IL is the inspection level
- 4) The temperature at which the zero-power resistance shall be measured is the temperature specified in the detail specification. This temperature shall be stated, where required, in the test schedule.
- 5) The specimens used for this group may, at the discretion of the manufacturer, be used for any subsequent group which is identified as being "destructive".
- 6) The soldering – solderability and soldering – resistance to heat tests shall only be applied where the thermistor has terminations which are appropriate for soldering.
- 7) Where the terminations are stated to be suitable for printed wiring applications, the appropriate test conditions in IEC 60068 shall apply.
- 8) The thermistors shall be mounted by their normal means.
- 9) The bump test and the shock test are alternatives. The test selected in the detail specification shall be used.

- 10) The detail specification shall specify which of the endurance tests in groups C4, C5 and D1 respectively are appropriate to the construction and application of the thermistor.
- 11) Any deviation from annex B of the generic specification shall be given in the detail specification.
- 12) 100 % testing shall be followed by re-inspection by sampling in order to monitor outgoing quality level by non-conforming items per million (ppm). The sampling level shall be established by the manufacturer. For the calculation of $\times 10^{-6}$ values any parametric failure shall be counted as a non-conforming item. In case one or more non-conforming items occur in a sample, this lot shall be rejected.

Table 1 – Test schedule for quality conformance inspection: lot-by-lot

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	(see list item 3)			Performance requirements (see list item 1)
			IL	n	c	
GROUP A INSPECTION (lot-by-lot)						
Subgroup A0	ND			100 % (see list item 12)		As in 4.5.3
4.5 Zero-power resistance R_T		Temperature: ... °C Voltage: ... V Frequency: ... Hz (if applicable)				
Subgroup A1	ND		S-4	²⁾	0	As in 4.4.1
4.4.1 Visual examination						
Subgroup A2	ND		S-3	²⁾	0	As in 4.4.2
4.4.2 Marking						
4.4.3 Dimensions (gauging)						As specified in the detail specification
GROUP B INSPECTION (lot-by-lot)						
Subgroup B1	ND		S-2	²⁾	0	As in 4.24
4.24 Tripping current		See detail specification I_t : ... mA				$I_{res} \leq \dots$ mA
4.26 Residual current						
4.25 max. non-tripping current		See detail specification (I_{max-nt}):... mA				As in 4.25
Subgroup B2	ND		S-2	²⁾	0	As in 4.8.4
4.8 Voltage proof		(Insulated thermistors only) Method: ... Applied voltage: ... V a.c.				
4.16.1 Soldering - Solderability		(see list item 6 and 7) Solder bath method				The terminations shall be uniformly tinned

Table 2 – Test schedule for quantity conformance inspection: periodic

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and acceptance criterion (see list item 3)			Performance requirements (see list item 1)
			p	n	c	
GROUP C INSPECTION (periodic)						
Subgroup C1A						
Part of sample						
4.16.2 Soldering – resistance to soldering heat	D	Temperature: ... °C Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V)	6	5	0	As in 4.16.2 $\Delta R/R$: from ... % to ... %
4.15 Robustness of terminations		Tensile, bending and torsion tests as appropriate to type of terminations Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V)				As in 4.15.4 $\Delta R/R$: from ... % to ... %
<hr style="border-top: 1px dashed black;"/>						
Subgroup C1B						
Other part of sample						
4.17 Rapid change of temperature	D	$\theta_A =$ LCT $\theta_B =$ LCT Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V)	6	5		As in 4.17 $\Delta R/R$: from ... % to ... %
4.18 Vibration		Frequency range: ... Hz to ... Hz Amplitude: 0,75 mm or acceleration: 98 m/s ² (whichever is the less severe) Sweep endurance Total duration: 6 h Number of sweep cycles: see 2.3.4 Final measurements: Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V)				As in 4.18 $\Delta R/R$: from ... % to ... %
4.19 Bump (or shock, see list item 9)		Acceleration: ... m/s ² Number of bumps: ... (see list item 8) Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V)				As in 4.19 $\Delta R/R$: from ... % to ... %

Table 2 – Test schedule for quantity conformance inspection: periodic (continued)

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and acceptance criterion (see list item 3)			Performance requirements (see list item 1)
			p	n	c	
4.20 Shock (or bump, see list item 9)		Pulse shape: halfsine Acceleration: ... m/s ² (see list item 8) Pulse duration: ... ms Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V)				As in 4.20 $\Delta R/R$: from ... % to ... %
Subgroup C1 Combined sample of specimens of sub-groups C1A and C1B	D		6	10		
4.21 Climatic sequence - Dry heat - Damp heat, cyclic, first cycle - Cold - Damp heat, cyclic, remaining cycles - Final measurements		(Low air pressure test not applicable) Visual examination Zero-power resistance (Temperature: ... °C) (Voltage: ... V) Insulation resistance (Insulated thermistors only) Voltage proof (Insulated thermistors only)				As in 4.21.7 $\Delta R/R$: from ... % to ... % $R \geq \dots \text{ M}\Omega$ As in 4.21.7
Subgroup C2	ND		6	10	0	
4.14 Thermal time constant by cooling (if applicable)		Method: ... T_0 : ... °C T_3 : ... °C Thermal time constant				As specified in the detail specification
Subgroup C3	ND	(see list item 5)	6	10	0	
4.6 Temperature coefficient of resistance (if applicable)		T_p : ... °C T_b : ... °C Voltage: ... V				α_R : (from ... to ...) %/K
4.4.4 Dimensions (detail)						As specified in the detail specification
4.10 Dissipation factor at U_{\max} . (if specified) (see list item 11)		Dissipation factor				As specified in the detail specification