IEC 61051-2

Edition 2.0 2021-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors

Varistances utilisées dans les équipements électroniques – Partie 2: Spécification intermédiaire pour varistances pour limitations de surtensions transitoires

IEC 61051-2:2021-11(en-fr)

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Varistances utilisées dans les équipements électroniques – Partie 2: Spécification intermédiaire pour varistances pour limitations de surtensions transitoires

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

VARISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 2: Sectional specification for surge suppression varistors

FOREWORD

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IEC 61051-2 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 1991 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) revision for the structure in accordance with ISO/IEC Directives, Part 2) to the extent practicable, and for harmonizing with IEC 61051-1:2018;
b) Annex X has been added for comparison with the previous edition;
c) two lists of preferred voltage ratings for disk type and SMD type varistors have been added;
d) permissible numbers of non-conforming items have been set to zero (zero fault) in the test schedule in 8.4.3.

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

Draft	Report on voting
40/2877/FDIS	40/2895/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/standardsdev/publications.

A list of all parts in the IEC 61051 series, published under the general title *Varistors for use in electronic equipment*, 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,
- replaced by a revised edition, or
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VARISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 2: Sectional specification for surge suppression varistors

1 Scope

This part of IEC 61051 is a sectional specification and is applicable to metal oxide varistors with symmetrical voltage-current characteristics for use in electronic equipment connected to any AC or DC supply system.

These varistors are designed to protect electronic and other sensitive equipment from high transient surges. Varistors under the scope of this sectional specification are not intended to give primary protection against lightning surges.

These varistors have metallic connections and are intended to be mounted as through hole component or directly on to printed boards.

The object of this document is to prescribe preferred ratings and characteristics and to select from IEC 61051-1 the appropriate quality assessment procedures, tests and measuring methods, and to give general performance requirements for this type of varistors.

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 60062, *Marking codes for resistors and capacitors*

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

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

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

IEC 60068-2-27, *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 h cycle)*

IEC 60068-2-45, *Basic environmental testing procedures – Part 2-45: Tests – Test XA and guidance: Immersion in cleaning solvents*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

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IEC 61051-1:2018, *Varistors for use in electronic equipment – Part 1: Generic specification*

IEC 61051-2-2, *Varistors for use in electronic equipment – Part 2: Blank detail specification for zinc oxide surge suppression varistors. Assessment level E*

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 61051-1 apply.

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

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

4 Preferred characteristics

4.1 Climatic categories

The varistors covered by this specification are classified into climatic categories according to the general rules given in IEC 60068-1.

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 temperature and duration of the damp heat, steady state test

Lower category temperature [°C]	−55, −40, −25, −10
Upper category temperature [°C]	+70, +85, +100, +105, +125, +155
Duration of damp heat, steady state test [days] [a]	4, 10, 21, 56
[a] Not applicable to unprotected types which have a -/-/00 category.	

4.2 Voltage ratings

Table 2 and Table 3 provide preferred voltage ratings for disk type varistors and SMD type varistors.

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Table 2 – Preferred voltage ratings for disk type varistors

Varistor voltage U_V (V) [a]	Max. continuous voltage		Clamping voltage [b], U_{CLP} (V)
	U_{RMS} (V)	U_{DCM} (V)	8/20, U_{CLP}
18	11	14	36
22	14	18	43
27	17	22	53
33	20	26	65
39	25	31	77
47	30	38	93
56	35	45	110
68	40	56	135
82	50	65	135
100	60	85	165
120	75	100	200
150	95	125	250
180	115	150	300
200	130	170	340
220	140	180	360
240	150	200	395
275	175	225	455
300	195	250	505
330	210	270	545
360	230	300	595
390	250	320	650
430	275	350	710
470	300	385	775
510	320	410	845
560	350	450	930
620	385	505	1 025
680	420	560	1 120
715	440	585	1 180
750	460	615	1 240
820	510	670	1 355
910	550	745	1 500
1 000	625	825	1 650
1 100	680	895	1 815
1 200	750	970	2 000
1 600	1 000	1 280	2 650
1 800	1 100	1 465	2 970

[a] Unless otherwise specified, measured at 1 mA

[b] measured at class current which is given by detail specification

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Table 3 – Preferred voltage ratings for SMD types

Varistor Voltage U_V (V)	Maximum continuous voltage	
	U_{RMS} (V)	U_{DCM} (V)
(5,6 ± 20) %	2,5	4
(6,8 ± 20) %	3,5	4,5
(8,2 ± 20) %	4	5,5
(10 ± 20) %	5	7
(12 ± 20) %	6	8,5
(15 ± 20) %	7,5	10,5
(18 ± 20) %	9	13
(22 ± 10) %	14	18
(27 ± 10) %	17	22
(33 ± 10) %	20	26
(39 ± 10) %	25	31
(47 ± 10) %	30	38
(56 ± 10) %	35	45
(68 ± 10) %	40	56
(82 ± 10) %	50	65

4.3 Derating for metal oxide varistors

4.3.1 General

Derating is the intentional reduction of maximum ratings in the application of a device. For metal oxide varistors derating is of particular interest under the following conditions:

- derating at increased operating temperatures;
- derating for repetitive maximum peak current.

4.3.2 Derating at increased operating temperatures

For operating temperatures exceeding the maximum operating temperature as specified in the component specification, the following operating conditions of varistors may be derated as demonstrated in Figure 1:

- maximum continuous voltage;
- surge current;
- energy absorption;
- average power dissipation.

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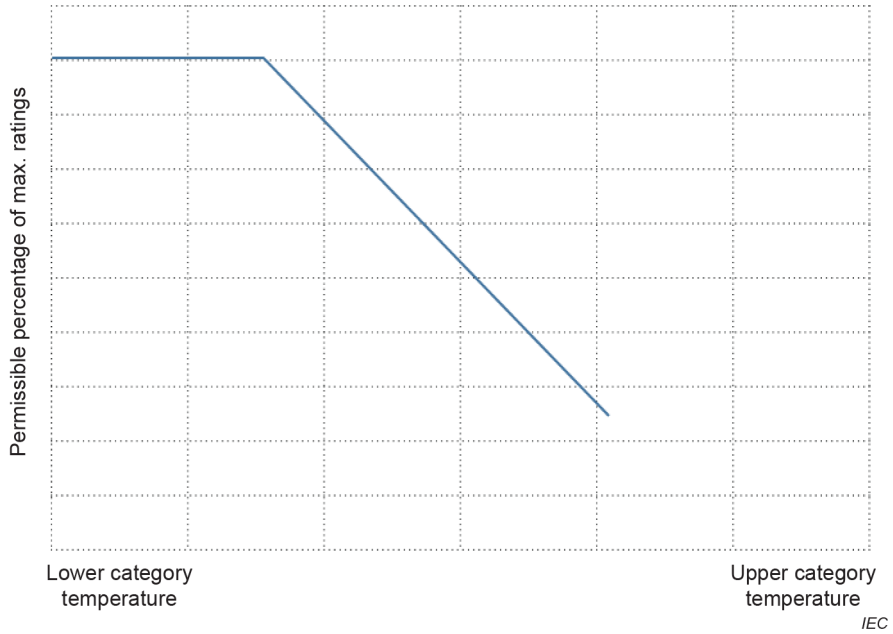

Figure 1 – Typical temperature derating curve for maximum continuous voltage, surge current, energy absorption and average power dissipation

4.3.3 Maximum peak current derating characteristic

A typical feature of metal oxide varistors is the dependence of the maximum permissible ratings for surge current, and thus for energy absorption, on the pulse shape, pulse duration, and the number of times this load is repeated during the overall lifetime of the varistor.

IEC 61051-1:2018, Clause C.2 applies.

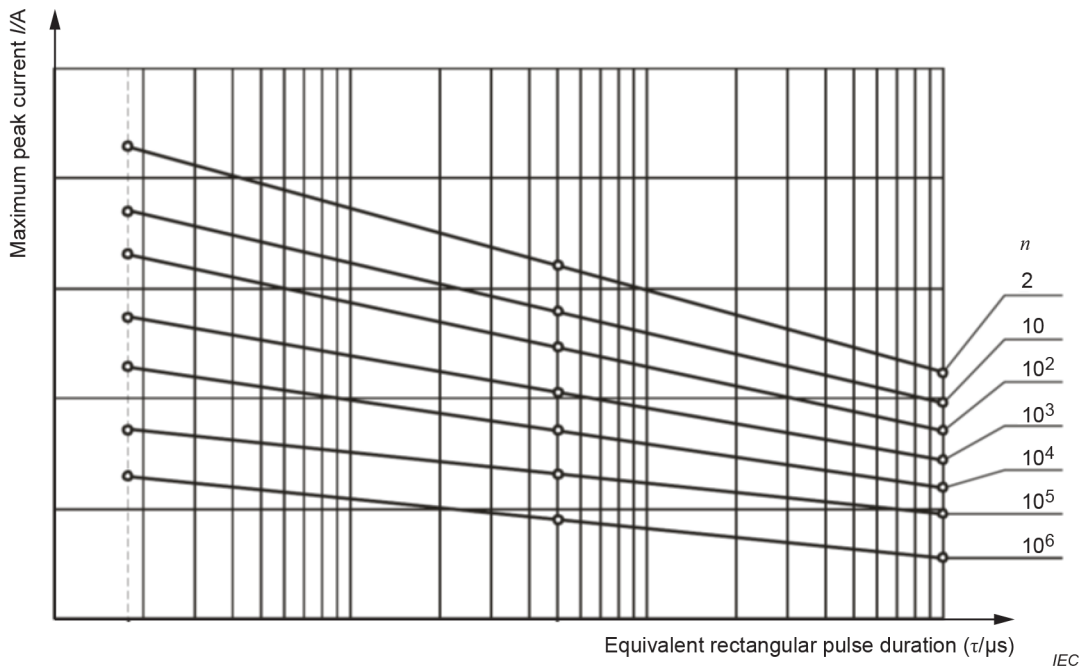

Figure 2 – Typical maximum peak current derating curve

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5 Test procedures, test severities and performance requirements

5.1 General

Test severities and requirements prescribed by detail specifications referring to this sectional specification shall be of equal or superior performance level. Inferior performance levels are not permitted.

The severities for the tests shall be prescribed by the detail specifications, following the prescriptions of the generic specification IEC 61051-1 and Clause 5 (Test procedures, test severities and performance requirements) of this sectional specification.

5.2 Visual examination and check of dimensions

IEC 61051-1:2018, 6.4 applies.

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.

5.3 Electrical tests

5.3.1 Varistor voltage

IEC 61051-1:2018, 6.6 applies.

Usually, the varistor voltage will be measured at a current of 1 mA. If conditions are different from IEC 61051-1:2018, 6.6, they shall be prescribed in the detail specification.

5.3.2 Leakage current

IEC 61051-1:2018, 6.7 applies.

5.3.3 Capacitance

IEC 61051-1:2018, 6.8 applies.

5.3.4 Voltage proof

IEC 61051-1:2018, 6.9 applies.

5.3.5 Clamping voltage

IEC 61051-1:2018, 6.11 applies.

5.3.6 Maximum peak current

IEC 61051-1:2018, 6.13 applies.

The pulse current test and the combination pulse test are considered to be alternative. The detail specification shall indicate which test is performed.

5.3.7 Rated energy

IEC 61051-1:2018, 6.15 applies.

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5.4 Soldering test

5.4.1 Resistance to soldering heat

IEC 61051-1:2018, 6.18 applies.

IEC 60068-2-20:2008, Test Tb, Method 1, solder bath conditions: (260 ± 5) °C, 10 s applies.

5.4.2 Solderability

IEC 61051-1:2018, 6.19 applies.

IEC 60068-2-20, Test Ta, Method 1 Soldering bath conditions: Pb- free solder: (245 ± 3) °C, 3 s applies.

5.5 Temperature and climate test

5.5.1 Damp heat, steady state

IEC 61051-1:2018, 6.24 applies.

5.5.2 Endurance at upper category temperature

IEC 61051-1:2018, 6.26 applies.

5.5.3 Rapid change of temperature

IEC 61051-1:2018, 6.20 applies.

5.5.4 Climatic sequence

IEC 61051-1:2018, 6.23 applies.

5.6 Robustness test

5.6.1 Robustness of terminations

IEC 61051-1:2018, 6.17 applies.

5.6.2 Shock testing

5.6.2.1 General

IEC 61051-1:2018, 6.21 applies.

There are two grades of severity which are considered to be alternative.

5.6.2.2 Shock

The following test conditions (shock) apply:
IEC 60068-2-27:2008, Test Ea, Pulse shape: half-sine, A = 500 m/s^2, D = 11 ms.

The following test severity applies:
3 successive shocks in each direction (6 × 3 shocks), with separate specimens to be used each direction.

The mounting shall be such that there shall be no parasitic vibration.

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