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REDLINE VERSION



Varistors for use in electronic equipment – Part 1: Generic specification

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

VARISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

FOREWORD

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This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 61051-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This third edition cancels and replaces the second edition published in 2007. This edition constitutes a technical revision.

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

- a) 10 new terms and definitions – leaded varistors, surface mount varistors (SMV), electrostatic discharge (ESD), ESD clamping voltage, equivalent rectangular pulse duration, maximum peak current derating characteristic, rated average dissipation power, rated energy, abnormal overvoltage withstanding duration and temperature derating curve – have been added (see 3.6, 3.7, 3.14, 3.15, 3.19, 3.20, 3.23, 3.24, 3.25 and 3.29);
- b) General requirements for electrical tests and 7 new test items – clamping voltage, ESD clamping voltage, maximum peak current, rated average dissipation power, rated energy, electrostatic discharge (ESD), robustness of terminations of surface mount varistors – have been added (see 6.5, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16 and 6.17.8);
- c) In 6.6, 6.7, 6.8, 6.9.3, 6.23.2, 6.23.4 and 6.26, following test items have been revised:
 - Varistor voltage, leakage current and capacitance: more detailed requirements and information have been added;
 - Voltage proof – foil method: the space between the edge of the foil and each termination has been changed from 1 mm ~ 1,5 mm to 3 mm ~ 3.5 mm for testing varistors not having axial terminations and the minimum space between the foil and the termination has been changed from 1 mm to 3 mm for testing varistors having axial terminations;
 - Climatic sequence – dry heat: the method has been changed from Ba to Bb;
 - Climatic sequence – cold: the method has been changed from Aa to Ab;
 - Endurance at upper category temperature: the method of "applying test voltages in cycles of 1,5 h on and 0,5 h off" has been changed to the method of applying test voltages continuously throughout the test lasting for 1 000 h;
- d) The test items of pulse current, voltage under pulse condition and bump have been deleted from the section of test and measurement procedures;
- e) Annex A and the contents referring to the test fixture specified in Annex A have been deleted;
- f) All contents related to silicon carbide varistors have been deleted;
- g) A new normative annex entitled "Test pulses used in this specification" (Annex B) has been added;
- h) A new informative annex entitled "Recommended measurement/test methods for characteristics and parameters for application reference" (Annex C) has been added, in which guidelines of measuring/testing characteristics and parameters for application reference including voltage vs. current characteristic, maximum peak current derating characteristic, thermal resistance and abnormal overvoltage withstanding duration have been given.

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

FDIS	Report on voting
40/2621/FDIS	40/2625/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 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 "<http://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
- amended.

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VARISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

1 Scope

~~This part of IEC 61051 is applicable to varistors with symmetrical voltage-current characteristics for use in electronic equipment.~~

~~1.2 Object~~

~~The object of this standard is to establish standard terms, inspection procedures and methods of test for use in sectional and detail specifications for Qualification Approval and for Quality Assessment Systems for electronic components.~~

This part of IEC 61051 is a generic specification and is applicable to varistors with symmetrical voltage-current characteristics for use in electronic equipment.

It establishes standard terms, inspection procedures and methods of test for use in sectional and detail specifications for quality assessment or any other purpose.

NOTE Detail specifications can be specifications within the IEC system, another specification system linked to IEC, or specified by the manufacturer or user. The drafting of a complete detail specification by IEC technical committee 40, if required, follows the rules described in Annex A.

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)*

~~IEC 60060-2:1994, *High-voltage test techniques – Part 2: Measuring systems*~~

IEC 60062:2004, *Marking codes for resistors and capacitors*

IEC 60068-1:1988 2013, *Environmental testing – Part 1: General and guidance*
~~Amendment 1 (1992)~~

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

IEC 60068-2-2:1974 2007, *Environmental testing – Part 2-2: Tests – Tests B: Dry heat*
~~Amendment 1 (1993)~~
~~Amendment 2 (1994)~~

IEC 60068-2-6:1995 2007, *Environmental testing – Part 2-6: Tests – Test Fc*~~and guidance:~~
Vibration (Sinusoidal)

IEC 60068-2-13:1983, *Environmental testing – Part 2-13: Tests – Test M: Low air pressure*

IEC 60068-2-14:~~1984~~ 2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*
~~Amendment 1 (1986)~~

IEC 60068-2-20:~~1979~~ 2008, *Environmental testing – Part 2-20: Tests – Test T: ~~Soldering~~ Test methods for solderability and resistance to soldering heat of devices with leads*
~~Amendment 2 (1987)~~

IEC 60068-2-21:2006, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*
IEC 60068-2-21:2006/COR1:2012

IEC 60068-2-27:~~1987~~ 2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

~~IEC 60068-2-29:1987, Environmental testing – Part 2: Tests – Test Eb and guidance: Bump~~

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db ~~and guidance~~: Damp heat, cyclic (12 h + 12-hour cycle)*

IEC 60068-2-45:1980, *Environmental testing – Part 2-45: Tests – Test XA ~~and guidance~~ – Immersion in cleaning solvents*
IEC 60068-2-45:1980/AMD1:1993

~~IEC 60068-2-54:2005, Environmental testing – Part 2-54: Tests – Test Ta: Solderability testing of electronic components by the wetting balance method~~

IEC 60068-2-58:~~2004~~ 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 60068-2-69:~~1995~~ 2017, *Environmental testing – Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components ~~for surface mount technology~~ and printed boards by the wetting balance (force measurement) method*

IEC 60068-2-78:~~2001~~ 2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60294:~~1969~~, *Measurement of the dimensions of a cylindrical component having two axial terminations*

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

IEC 60617:~~2007~~, *Graphical symbols for diagrams*
(available at <http://std.iec.ch/iec60617>)

IEC 60695-11-5:~~2004~~ 2016, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60717:~~1981~~ 2012, *Method for the determination of the space required by capacitors and resistors with unidirectional terminations*

IEC 61000-4-2:2008, *Electromagnetic Compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

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

IEC 61249-2-7:2002, *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 QC 001002-3, see <http://www.iecq.org>~~

~~ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*
Amendment 1 (1998)~~

ISO 80000-1:2009, *Quantities and units – Part 1: General*

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Varistors for use in electronic equipment –
Part 1: Generic specification**

**Varistances utilisées dans les équipements électroniques –
Partie 1: Spécification générique**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

VARISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

FOREWORD

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International Standard IEC 61051-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This third edition cancels and replaces the second edition published in 2007. This edition constitutes a technical revision.

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

- a) 10 new terms and definitions – leaded varistors, surface mount varistors (SMV), electrostatic discharge (ESD), ESD clamping voltage, equivalent rectangular pulse duration, maximum peak current derating characteristic, rated average dissipation power, rated energy, abnormal overvoltage withstanding duration and temperature derating curve – have been added (see 3.6, 3.7, 3.14, 3.15, 3.19, 3.20, 3.23, 3.24, 3.25 and 3.29);
- b) General requirements for electrical tests and 7 new test items – clamping voltage, ESD clamping voltage, maximum peak current, rated average dissipation power, rated energy, electrostatic discharge (ESD), robustness of terminations of surface mount varistors – have been added (see 6.5, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16 and 6.17.8);
- c) In 6.6, 6.7, 6.8, 6.9.3, 6.23.2, 6.23.4 and 6.26, following test items have been revised:

- Varistor voltage, leakage current and capacitance: more detailed requirements and information have been added;
 - Voltage proof – foil method: the space between the edge of the foil and each termination has been changed from 1 mm ~ 1,5 mm to 3 mm ~ 3.5 mm for testing varistors not having axial terminations and the minimum space between the foil and the termination has been changed from 1 mm to 3 mm for testing varistors having axial terminations;
 - Climatic sequence – dry heat: the method has been changed from Ba to Bb;
 - Climatic sequence – cold: the method has been changed from Aa to Ab;
 - Endurance at upper category temperature: the method of "applying test voltages in cycles of 1,5 h on and 0,5 h off" has been changed to the method of applying test voltages continuously throughout the test lasting for 1 000 h;
- d) The test items of pulse current, voltage under pulse condition and bump have been deleted from the section of test and measurement procedures;
- e) Annex A and the contents referring to the test fixture specified in Annex A have been deleted;
- f) All contents related to silicon carbide varistors have been deleted;
- g) A new normative annex entitled "Test pulses used in this specification" (Annex B) has been added;
- h) A new informative annex entitled "Recommended measurement/test methods for characteristics and parameters for application reference" (Annex C) has been added, in which guidelines of measuring/testing characteristics and parameters for application reference including voltage vs. current characteristic, maximum peak current derating characteristic, thermal resistance and abnormal overvoltage withstanding duration have been given.

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

FDIS	Report on voting
40/2621/FDIS	40/2625/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 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 "<http://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
- amended.

VARISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

1 Scope

This part of IEC 61051 is a generic specification and is applicable to varistors with symmetrical voltage-current characteristics for use in electronic equipment.

It establishes standard terms, inspection procedures and methods of test for use in sectional and detail specifications for quality assessment or any other purpose.

NOTE Detail specifications can be specifications within the IEC system, another specification system linked to IEC, or specified by the manufacturer or user. The drafting of a complete detail specification by IEC technical committee 40, if required, follows the rules described in Annex A.

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)*

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 – Tests B: Dry heat*

IEC 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (Sinusoidal)*

IEC 60068-2-13:1983, *Environmental testing – Part 2-13: Tests – Test M: Low air pressure*

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

IEC 60068-2-20:2008, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-21:2006, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-21:2006/COR1:2012

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12-hour cycle)*

IEC 60068-2-45:1980, *Environmental testing – Part 2-45: Tests – Test XA – Immersion in cleaning solvents*
IEC 60068-2-45:1980/AMD1:1993

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 60068-2-69:2017, *Environmental testing – Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60294, *Measurement of the dimensions of a cylindrical component having two axial terminations*

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

IEC 60695-11-5:2016, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60717:2012, *Method for the determination of the space required by capacitors and resistors with unidirectional terminations*

IEC 61000-4-2:2008, *Electromagnetic Compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

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

IEC 61249-2-7:2002, *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*

ISO 80000-1:2009, *Quantities and units – Part 1: General*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

VARISTANCES UTILISÉES DANS LES ÉQUIPEMENTS ÉLECTRONIQUES –

Partie 1: Spécification générique

AVANT-PROPOS

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La Norme internationale IEC 61051-1 a été établie par le comité d'études 40 de l'IEC: Condensateurs et résistances pour équipements électroniques.

Cette troisième édition annule et remplace la deuxième édition parue en 2007. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) 10 nouveaux termes et définitions (varistances à fils, varistances montées en surface (VMS), décharge électrostatique (DES), tension d'écrêtage de DES, durée d'impulsion rectangulaire équivalente, caractéristique de réduction du courant maximal de crête, puissance de dissipation moyenne assignée, énergie assignée, durée de résistance à une surtension anormale et courbe de réduction de la température) ont été ajoutés (voir 3.6, 3.7, 3.14, 3.15, 3.19, 3.20, 3.23, 3.24, 3.25 et 3.29);

- b) des exigences générales pour les essais électriques et 7 nouveaux essais (tension d'écrêtage, tension d'écrêtage de DES, courant maximal de crête, puissance de dissipation moyenne assignée, énergie assignée, décharge électrostatique (DES), robustesse des sorties des varistances montées en surface) ont été ajoutés (voir 6.5, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16 et 6.17.8);
- c) en 6.6, 6.7, 6.8, 6.9.3, 6.23.2, 6.23.4 et 6.26, les essais suivants ont été révisés:
- Tension de la varistance, courant de fuite et capacité: des exigences et des informations plus détaillées ont été ajoutées;
 - Tenue en tension – méthode de la feuille métallique: l'espace entre le bord de la feuille et chaque sortie a été modifié de 1 mm ~ 1,5 mm à 3 mm ~ 3,5 mm pour soumettre à l'essai les varistances qui ne possèdent aucune sortie axiale et l'espace minimal entre le bord de la feuille et la sortie a été modifié de 1 mm à 3 mm pour soumettre à l'essai les varistances qui possèdent des sorties axiales;
 - Séquence climatique – chaleur sèche: la méthode a été modifiée (Ba en Bb);
 - Séquence climatique – froid: la méthode a été modifiée (Aa en Ab);
 - Endurance à la température maximale de catégorie: la méthode consistant à "appliquer des tensions d'essai par cycles de 1,5 h d'application et de 0,5 h de repos" a été modifiée au profit de la méthode consistant à appliquer des tensions d'essai en continu tout au long de l'essai qui dure 1 000 h;
- d) les essais de courant d'impulsion, de tension en condition d'impulsion et de secousses ont été supprimés de l'article concernant les procédures d'essai et de mesure;
- e) l'Annexe A et les contenus qui font référence aux appareils de montage d'essai spécifiés à l'Annexe A ont été supprimés;
- f) tous les contenus concernant les varistances au carbure de silicium ont été supprimés;
- g) une nouvelle annexe normative intitulée "Impulsions d'essai utilisées dans la présente spécification" (Annexe B) a été ajoutée;
- h) une nouvelle annexe informative intitulée "Méthodes de mesure/d'essai recommandées pour les caractéristiques et paramètres pour référence d'application" (Annexe C) a été ajoutée; elle donne des lignes directrices pour les caractéristiques et paramètres de mesure/d'essai et pour référence d'application (notamment la caractéristique tension-courant, la caractéristique de réduction du courant maximal de crête, la résistance thermique et la durée de résistance à une surtension anormale).

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
40/2621/FDIS	40/2625/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 61051, publiées sous le titre général *Varistances utilisées dans les équipements électroniques*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

VARISTANCES UTILISÉES DANS LES ÉQUIPEMENTS ÉLECTRONIQUES –

Partie 1: Spécification générique

1 Domaine d'application

La présente partie de l'IEC 61051 est une spécification générique applicable aux varistances à caractéristiques tension-courant symétriques, utilisées dans les équipements électroniques.

Elle établit les termes normalisés, les procédures de contrôle et les procédures d'essai utilisés dans les spécifications intermédiaires et particulières à des fins d'assurance de la qualité ou à toute autre fin.

NOTE Les spécifications particulières peuvent être des spécifications au sein du système de l'IEC, un autre système de spécifications lié à l'IEC, ou spécifiées par le fabricant ou l'utilisateur. La rédaction d'une spécification particulière complète par le comité d'études 40 de l'IEC, si elle est exigée, suit les règles décrites dans l'Annexe A.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60027 (toutes les parties), *Symboles littéraux à utiliser en électrotechnique*

IEC 60050 (toutes les parties), *Vocabulaire Electrotechnique International (IEV)*

IEC 60062, *Codes de marquage des résistances et des condensateurs*

IEC 60068-1:2013, *Essais d'environnement – Partie 1: Généralités et lignes directrices*

IEC 60068-2-1:2007, *Essais d'environnement – Partie 2-1: Essais – Essai A: Froid*

IEC 60068-2-2:2007, *Essais d'environnement – Partie 2-2: Essais – Essai B: Chaleur sèche*

IEC 60068-2-6:2007, *Essais d'environnement – Partie 2-6: Essais – Essai Fc: Vibrations (sinusoïdales)*

IEC 60068-2-13:1983, *Essais d'environnement – Partie 2-13: Essais – Essai M: Basse pression atmosphérique*

IEC 60068-2-14:2009, *Essais d'environnement – Partie 2-14: Essais – Essai N: Variation de température*

IEC 60068-2-20:2008, *Essais d'environnement – Partie 2-20: Essais – Essai T: Méthodes d'essai de la brasabilité et de la résistance à la chaleur de brasage des dispositifs à broches*

IEC 60068-2-21:2006, *Essais d'environnement – Partie 2-21: Essais – Essai U: Robustesse des sorties et des dispositifs de montage incorporés*
IEC 60068-2-21:2006/COR1:2012

IEC 60068-2-27:2008, *Essais d'environnement – Partie 2-27: Essais – Essai Ea et guide: Chocs*

IEC 60068-2-30:2005, *Essais d'environnement – Partie 2-30: Essais – Essai Db: Essai cyclique de chaleur humide (cycle de 12 h + 12 h)*

IEC 60068-2-45:1980, *Essais d'environnement – Partie 2-45: Essais – Essai XA – Immersion dans les solvants de nettoyage*
IEC 60068-2-45:1980/AMD1:1993

IEC 60068-2-58:2015, *Essais d'environnement – Partie 2-58: Essais – Essai Td: Méthodes d'essai de la soudabilité, résistance de la métallisation à la dissolution et résistance à la chaleur de brasage des composants pour montage en surface (CMS)*

IEC 60068-2-69:2017, *Essais d'environnement – Partie 2-69: Essais – Essai Te/Tc: Essai de brasabilité des composants électroniques et cartes imprimées par la méthode de la balance de mouillage (mesure de la force)*

IEC 60068-2-78:2012, *Essais d'environnement – Partie 2-78: Essais – Essai Cab: Chaleur humide, essai continu*

IEC 60294, *Mesure des dimensions d'un composant cylindrique à sorties axiales*

IEC 60617, *Graphical symbols for diagrams* (disponible en anglais seulement)
(adresse <http://std.iec.ch/iec60617>)

IEC 60695-11-5:2016, *Essais relatifs aux risques du feu – Partie 11-5: Flamme d'essai – Méthode d'essai au brûleur-aiguille – Appareillage, dispositif d'essai de vérification et lignes directrices*

IEC 60717:2012, *Méthode pour la détermination de l'encombrement des condensateurs et résistances à sorties unilatérales*

IEC 61000-4-2:2008, *Compatibilité électromagnétique (CEM) – Partie 4-2: Techniques d'essai et de mesure – Essai d'immunité aux décharges électrostatiques*

IEC 61193-2, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages* (disponible en anglais seulement)

IEC 61249-2-7:2002, *Matériaux pour circuits imprimés et autres structures d'interconnexion – Partie 2-7: Matériaux de base renforcés, plaqués et non plaqués – Feuille stratifiée tissée de verre E avec de la résine époxyde, d'inflammabilité définie (essai de combustion verticale), plaquée cuivre*

ISO 80000-1:2009, *Grandeurs et unités – Partie 1: Généralités*