IEC 60115-4

Edition 3.0 2022-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Fixed resistors for use in electronic equipment – Part 4: Sectional specification: Power resistors for through hole assembly on circuit boards (THT) or for assembly on chassis

Résistances fixes utilisées dans les équipements électroniques – Partie 4: Spécification intermédiaire: Résistances de puissance pour assemblage par trous traversants sur cartes de circuit imprimé (carte THT) ou pour assemblage sur châssis

IEC 60115-4:2022-11(en-fr)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, …). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 60115-4

Edition 3.0 2022-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Fixed resistors for use in electronic equipment – Part 4: Sectional specification: Power resistors for through hole assembly on circuit boards (THT) or for assembly on chassis

Résistances fixes utilisées dans les équipements électroniques – Partie 4: Spécification intermédiaire: Résistances de puissance pour assemblage par trous traversants sur cartes de circuit imprimé (carte THT) ou pour assemblage sur châssis

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 31.040.10

ISBN 978-2-8322-9858-9

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4: Sectional specification: Power resistors for through hole assembly on circuit boards (THT) or for assembly on chassis

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60115-4 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This third edition cancels and replaces the second edition published in 1982 and Amendment 1:1993. This edition constitutes a technical revision and includes test conditions and requirements for lead-free soldering and assessment procedures meeting the requirements of a "zero defect" approach.

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

a) the definitions of product technologies and product classification levels of the generic specification, IEC 60115-1:2020, have been adopted;
b) a basis for the optional specification of the lead eccentricity of axial leaded resistors has been amended in 4.2;

c) the 'period-pulse high-voltage overload test' of IEC 60115-1:2020, 8.3 has been adopted as default test method in 5.3.9, thereby replacing the legacy test 'periodic-pulse overload test of IEC 60115-1:2020, 8.4;

d) the revised solderability test of IEC 60115-1:2020, 11.1 has been adopted in 5.3.22 and 5.3.23;

e) the combined solvent resistance test of IEC 60115-1:2020, 11.3 has been adopted in 5.3.25;

f) the 'endurance at room temperature test' of IEC 60115-1:2020, 7.2 has been reworked and adopted in 5.3.5;

g) the 'single-pulse high-voltage overload test' of IEC 60115-1:2020, 8.2, applied with the pulse shape 10/700 in 5.3.8, is complemented with the optional alternative provided by the pulse shape 1,2/50 in 5.4.1.

h) climatic tests for 'operation at low temperature' of IEC 60115 1:2020, 10.2, and for 'damp heat, steady state, accelerated' of IEC 60115-1:2020, 10.5, have been adopted as optional tests in 5.4.5. and 5.4.6, respectively;

i) inclusion of an optional flammability test as 5.4.8;

j) new guidance is provided in 6.2 on the presentation of stability requirements with their permissible absolute and relative deviations;

k) acceptance criteria for the visual inspection have been added in 6.5 and in Annex B;

l) visual inspection for the primary and proximity packaging has been added in 6.5.3 and in 7.2;

m) the periodical evaluation of termination platings has been added as a new topic of quality assessment in 9.8;

n) the revised test clause numbering of IEC 60115-1:2020 has been applied;

o) a new Annex C has been added to summarize workmanship requirements for the assembly of leaded power resistors, e.g. as given in the prior IEC 61192 series of standards;

p) the informative Annex F on radial formed styles has been amended with details on a formed Z-bend style for surface-mount assembly;

q) furthermore, the informative Annex X has been added to show the cross-references to the prior edition of this document.

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

Draft	Report on voting
40/2920/CDV	40/2963/RVC

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 60115 series, published under the general title *Fixed resistors for use in electronic equipment*, 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.

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
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

FIXED RESISTORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4: Sectional specification: Power resistors for through hole assembly on circuit boards (THT) or for assembly on chassis

1 Scope

This part of IEC 60115 relates to resistors having a rated dissipation typically greater than 1 W up to and including 1 000 W for use in electronic equipment. This document is applicable to fixed power resistors with a maximum surface temperature (MET) higher than the preferred upper category temperature (UCT) of 200 °C.

NOTE Heat sink resistors, i.e. resistors which in their operation depend on being mounted on a dedicated heat sink, owing to their special temperature conditions, are covered by a special sectional specification (under consideration at the time of publication).

These resistors are typically described according to types (different geometric shapes) and styles (different dimensions), and product technology.

The resistive element of these resistors is typically

– protected by a conformal lacquer coating, or
– cement coating, or
– vitreous enamel, or
– a ceramic body, or
– any other housing, which is to be described in the relevant specification.

The electrical connection of these resistors is typically achieved by means of

– axial leads for through hole assembly (THT), or
– vertical or radial leads or punched terminals, or
– ferrules or lugs for chassis mount, or
– push on terminals, or
– screw terminals, or
– any other termination, which is to be described in the relevant specification.

In special cases, a heat sink can be applicable but not mandatory.

The object of this document is to define preferred ratings and characteristics and to select from IEC 60115-1 the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of resistor.

NOTE SMD resistors are covered by IEC 60115-8, regardless of their dissipation.

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 60062:2016, *Marking codes for resistors and capacitors*

IEC 60063:2015, *Preferred number series for resistors and capacitors*

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

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

IEC 60068-2-2, *Basic environmental testing procedures – Part 2-2: Tests – Tests B: Dry heat*

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

IEC 60068-2-20:2021, *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 60068-2-47, *Environmental testing – Part 2-47: Tests – Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60115-1:2020, *Fixed resistors for use in electronic equipment – Part 1: Generic specification*

IEC 60115-2:—[1], *Fixed resistors for use in electronic equipment – Part 2: Sectional specification: Low power film resistors with leads for through-hole assembly on circuit boards (THT)*

IEC 60286-1, *Packaging of components for automatic handling – Part 1: Tape packaging of components with axial leads on continuous tapes*

IEC 60286-2, *Packaging of components for automatic handling – Part 2: Tape packaging of components with unidirectional leads on continuous tapes*

IEC 60294:2012, *Measurement of the dimensions of a cylindrical component with axial terminations*

IEC 60301, *Preferred diameters of wire terminations of capacitors and resistors*

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

3 Terms, definitions, product types, product technologies and product classification

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 60115-1:2020, 3.1, as well as the following, 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

[1] Under development. Stage at the time of publication: IEC TPUB 60115-2:2022.

3.1.1
insulated resistor
resistor that is declared as being insulated by the relevant specification, which in order to support this has a specified insulating voltage and insulation resistance, and which is assessed for these properties with the suitable tests of this specification

[SOURCE: IEC 60115-1:2020, 3.1.7]

3.2 Product types

3.2.1 General

For each type of products there shall be detailed specifications describing the preferred technology and style of the products covered therein.

3.2.2 Axial type

Axial type designates the physical design of a component with leads for PCB mounting by bending and for through hole assembly (THT). The leads shall extend to both sides along the longitudinal axis of the components body. Figure 1 shows illustration of typical axial leaded power resistors.

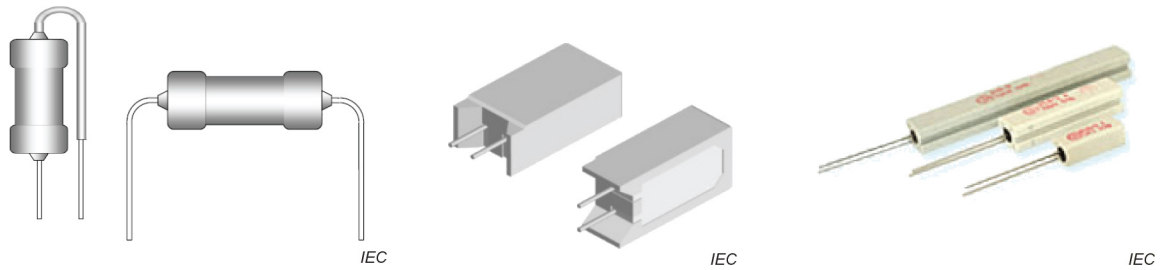
a) Axial leaded power film resistor **b) Axial leaded wire wound resistor** **c) Axial leaded ceramic housed wire wound resistor** **d) Axial leaded low ohm resistor**

Figure 1 – Illustrations of typical axial leaded power resistors

Axial type resistors can be suitable for forming the leads to a radial assembly style if the leads are long enough; see Annex F.

3.2.3 Radial type

"Radial type" designates the physical design of a component with leads extending to one side along the diagonal axis of the component body for PCB mounting. The leads of power resistors typically originate from inside the component body. Bent versions of axial resistors made by forming of one or both leads can be used. Figure 2 shows illustration of typical radial leaded power resistors.



a) Radial formed axial type **b) Radial leaded resistor, film or wire wound, inside a ceramic housing** **c) Radial leaded resistor, typical wire wound**

Figure 2 – Illustrations of typical radial leaded power resistors