



**NSAI**  
Standards

Irish Standard  
I.S. EN 60384-15:2017

Fixed capacitors for use in electronic equipment - Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte

**I.S. EN 60384-15:2017**

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

*This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):*

*NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.*

*This document is based on:*

EN 60384-15:2017

*Published:*

2017-09-08

*This document was published under the authority of the NSAI and comes into effect on:*

2017-09-26

ICS number:

NOTE: If blank see CEN/CENELEC cover page

NSAI  
1 Swift Square,  
Northwood, Santry  
Dublin 9

T +353 1 807 3800  
F +353 1 807 3838  
E standards@nsai.ie  
W NSAI.ie

Sales:  
T +353 1 857 6730  
F +353 1 857 6729  
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

## National Foreword

I.S. EN 60384-15:2017 is the adopted Irish version of the European Document EN 60384-15:2017, Fixed capacitors for use in electronic equipment - Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

**Compliance with this document does not of itself confer immunity from legal obligations.**

*In line with international standards practice the decimal point is shown as a comma (,) throughout this document.*

This page is intentionally left blank

EUROPEAN STANDARD

**EN 60384-15**

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2017

ICS 31.060.40

English Version

Fixed capacitors for use in electronic equipment -  
Part 15: Sectional specification: Fixed tantalum capacitors with  
non-solid or solid electrolyte  
(IEC 60384-15:2017)

Condensateurs fixes utilisés dans les équipements  
électroniques - Partie 15: Spécification intermédiaire -  
Condensateurs fixes au tantale, à électrolyte non solide ou  
solide  
(IEC 60384-15:2017)

Festkondensatoren zur Verwendung in Geräten der  
Elektronik - Teil 15: Rahmenspezifikation - Tantal-Elektrolyt-  
Kondensatoren mit flüssigem oder festem Elektrolyten  
(IEC 60384-15:2017)

This European Standard was approved by CENELEC on 2017-06-26. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## **EN 60384-15:2017**

### **European foreword**

The text of document 40/2523/FDIS, future edition 2 of IEC 60384-15, prepared by IEC/TC 40 "Capacitors and resistors for electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60384-15:2017.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-03-26
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-06-26

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

### **Endorsement notice**

The text of the International Standard IEC 60384-15:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60068-2-54:2006                      NOTE      Harmonized as EN 60068-2-54:2006 (not modified).

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60063	-	Preferred number series for resistors and capacitors	EN 60063	-
IEC 60068-1	2013	Environmental testing - Part 1: General and guidance	EN 60068-1	2014
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-14	-	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	-
IEC 60384-1	2016	Fixed capacitors for use in electronic equipment - Part 1: Generic specification	EN 60384-1	2016
IEC 60417-DB	-	Graphical symbols for use on equipment	-	-
IEC 61193-2	2007	Quality assessment systems - Part 2: Selection and use of sampling plans for inspection of electronic components and packages	EN 61193-2	2007
ISO 3	-	Preferred numbers - Series of preferred numbers	-	-

This page is intentionally left blank





**IEC 60384-15**

Edition 2.0 2017-05

# **INTERNATIONAL STANDARD**

---

**Fixed capacitors for use in electronic equipment –  
Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or  
solid electrolyte**





**THIS PUBLICATION IS COPYRIGHT PROTECTED**

**Copyright © 2017 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, 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 either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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 corrigenda or an amendment might have been published.

**IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)**

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

**IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)**

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](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

**Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)**

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

**IEC Customer Service Centre - [webstore.iec.ch/csc](http://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: [csc@iec.ch](mailto:csc@iec.ch).



**IEC 60384-15**

Edition 2.0 2017-05

# **INTERNATIONAL STANDARD**

---

**Fixed capacitors for use in electronic equipment –  
Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or  
solid electrolyte**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 31.060.40

ISBN 978-2-8322-4319-0

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	5
1 General .....	7
1.1 Scope .....	7
1.2 Object.....	7
1.3 Normative references.....	7
1.4 Information to be given in a detail specification.....	8
1.4.1 General .....	8
1.4.2 Outline drawing and dimensions .....	8
1.4.3 Mounting .....	8
1.4.4 Ratings and characteristics.....	8
1.4.5 Marking .....	9
1.5 Terms and definitions.....	9
1.6 Marking.....	9
1.6.1 General .....	9
1.6.2 Information for marking.....	10
1.6.3 Marking on capacitors.....	10
1.6.4 Marking on packaging.....	10
2 Preferred ratings and characteristics .....	10
2.1 Preferred characteristics .....	10
2.2 Preferred values of ratings.....	10
2.2.1 Nominal capacitance ( $C_N$ ).....	10
2.2.2 Tolerance on nominal capacitance.....	11
2.2.3 Rated voltage ( $U_R$ ) .....	11
2.2.4 Category voltage ( $U_C$ ).....	11
2.2.5 Reverse voltage.....	11
2.2.6 Surge voltage ( $U_{RS}$ or $U_{CS}$ ) .....	11
2.2.7 Ripple (if required).....	11
2.2.8 Rated temperature.....	12
3 Quality assessment procedures .....	12
3.1 Primary stage of manufacture .....	12
3.2 Structurally similar components .....	12
3.3 Certified test records of released lots.....	12
3.4 Qualification approval procedures.....	12
3.4.1 General .....	12
3.4.2 Qualification approval on the basis of the fixed sample size procedure .....	12
3.4.3 Tests .....	13
3.5 Quality conformance inspection .....	20
3.5.1 Formation of inspection lots.....	20
3.5.2 Test schedule .....	21
3.5.3 Delayed delivery.....	21
3.5.4 Assessment levels.....	21
4 Test and measurement procedures.....	22
4.1 Visual inspection and check of dimensions .....	22
4.2 Electrical tests .....	22
4.2.1 Leakage current.....	22
4.2.2 Capacitance .....	22
4.2.3 Tangent of loss angle ( $\tan \delta$ ) .....	23

4.2.4	Impedance (if required).....	23
4.2.5	Insulation resistance of the external insulation (if required).....	24
4.2.6	Voltage proof of the external insulation (if required).....	24
4.3	Robustness of terminations.....	25
4.3.1	General .....	25
4.3.2	Initial inspection.....	25
4.3.3	Test Ua1, Ub and Uc applicable.....	25
4.3.4	Special bending test .....	25
4.4	Resistance to soldering heat.....	26
4.4.1	General .....	26
4.4.2	Conditions .....	26
4.4.3	Final inspections and requirements.....	26
4.5	Solderability.....	26
4.5.1	General .....	26
4.5.2	Test conditions .....	26
4.5.3	Final inspections and requirements.....	26
4.6	Rapid change of temperature.....	26
4.6.1	General .....	26
4.6.2	Initial inspection.....	27
4.6.3	Test conditions .....	27
4.6.4	Recovery .....	27
4.6.5	Final inspections and requirements.....	27
4.7	Vibration .....	27
4.7.1	General .....	27
4.7.2	Test condition .....	27
4.7.3	Final inspections and requirements.....	27
4.8	Bump.....	27
4.8.1	General .....	27
4.8.2	Mounting .....	28
4.8.3	Test conditions .....	28
4.8.4	Final inspections and requirements.....	28
4.9	Shock .....	28
4.9.1	General .....	28
4.9.2	Mounting .....	28
4.9.3	Test conditions .....	28
4.9.4	Final inspections and requirements.....	29
4.10	Climatic sequence.....	29
4.10.1	General .....	29
4.10.2	Initial inspection.....	29
4.10.3	Dry heat .....	29
4.10.4	Damp heat, cyclic, Test Db, first cycle .....	29
4.10.5	Cold.....	29
4.10.6	Low air pressure (if required).....	29
4.10.7	Damp heat, cyclic, Test Db, remaining cycles .....	29
4.10.8	Recovery .....	29
4.10.9	Sealing (if required).....	30
4.10.10	Final inspections and requirements.....	30
4.11	Damp heat, steady state .....	30
4.11.1	General .....	30

4.11.2	Initial inspection.....	30
4.11.3	Final inspections and requirements.....	30
4.12	Endurance .....	30
4.12.1	General .....	30
4.12.2	Initial inspection.....	30
4.12.3	Test conditions .....	30
4.12.4	Recovery .....	31
4.12.5	Final inspections and requirements.....	31
4.13	Surge voltage .....	31
4.13.1	General .....	31
4.13.2	Initial inspection.....	31
4.13.3	Test conditions .....	31
4.13.4	Final inspections and requirements.....	31
4.14	Reverse voltage (if required).....	32
4.14.1	General .....	32
4.14.2	Initial inspection.....	32
4.14.3	Test conditions .....	32
4.14.4	Final inspections and requirements.....	32
4.15	Characteristics at high and low temperature.....	32
4.15.1	General .....	32
4.15.2	Final inspections and requirements.....	32
4.16	Charge and discharge (if required).....	32
4.16.1	General .....	32
4.16.2	Initial inspection.....	32
4.16.3	Test conditions .....	33
4.16.4	Recovery .....	33
4.16.5	Final inspections and requirements.....	33
4.17	Component solvent resistance .....	33
4.18	Solvent resistance of the marking .....	33
4.19	High surge current (if required) .....	33
4.19.1	General .....	33
4.19.2	Initial inspection.....	33
4.19.3	Final inspections and requirements.....	33
	Bibliography.....	34
	Figure 1 – Apparatus of special bending test .....	25
	Table 1 – Rated, category and surge voltages .....	11
	Table 2 – Sampling plan for qualification approval tests .....	14
	Table 3 – Test schedule for qualification approval .....	15
	Table 4 – Lot-by-Lot inspection.....	21
	Table 5 – Periodic Inspection.....	22
	Table 6 – Vibration test frequencies.....	27
	Table 7 – Shock peak acceleration/pulse duration .....	28
	Table 8 – Test temperature.....	31

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –****Part 15: Sectional specification:  
Fixed tantalum capacitors with non-solid or solid electrolyte**

## 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.

International Standard IEC 60384-15 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, Amendment 1:1987 and Amendment 2:1992, and constitutes a technical revision.

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

- a) Revision of the structure in accordance with ISO/IEC Directives, Part 2:2016 (seventh edition) to the extent practicable, and harmonization between other similar kinds of documents.
- b) In addition, Clause 4 and all the tables have been reviewed in order to prevent duplications and contradictions.

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

FDIS	Report on voting
40/2523/FDIS	40/2535/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.

The list of all parts of the IEC 60384 series, under the general title *Fixed capacitors 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.

A bilingual version of this publication may be issued at a later date.



## **FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**

### **Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte**

## **1 General**

### **1.1 Scope**

This part of IEC 60384 applies to through-hole/leaded polar and bipolar tantalum electrolyte capacitors with solid and non-solid electrolyte for use in electronic equipment.

It includes capacitors for long-life applications and capacitors for general-purpose applications.

Capacitors for special purpose application may need additional requirements.

This document covers two basic sub-families:

- Sub-family 1: Fixed non-solid electrolyte tantalum capacitors with porous anode.
- Sub-family 2: Fixed solid electrolyte tantalum capacitors with porous anode.

### **1.2 Object**

The object of this document is to prescribe preferred ratings and characteristics and to select from IEC 60384-1:2016 the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements prescribed in detail specifications referring to this sectional specification shall be of equal or higher performance level, because lower performance levels are not permitted.

### **1.3 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 60063, *Preferred number series for resistors and capacitors*

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

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

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

IEC 60384-1:2016, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60417, *Graphical symbols for use on equipment*

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

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
  - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-