### BS EN 60384-8:2015



## **BSI Standards Publication**

# Fixed capacitors for use in electronic equipment

Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1



BS EN 60384-8:2015 BRITISH STANDARD

#### **National foreword**

This British Standard is the UK implementation of EN 60384-8:2015. It is identical to IEC 60384-8:2015. It supersedes BS EN 60384-8:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/40X, Capacitors and resistors for electronic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

© The British Standards Institution 2015. Published by BSI Standards Limited 2015

ISBN 978 0 580 82518 7 ICS 31.060.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2015.

Amendments/corrigenda issued since publication

Date Text affected

## EUROPEAN STANDARD NORME EUROPÉENNE EUROPÄISCHE NORM

EN 60384-8

May 2015

ICS 31.060.20

Supersedes EN 60384-8:2005

#### **English Version**

Fixed capacitors for use in electronic equipment - Part 8:
Sectional specification: Fixed capacitors of ceramic dielectric,
Class 1
(IEC 60384-8:2015)

Condensateurs fixes utilisés dans les équipements électroniques - Partie 8: Spécification intermédiaire: Condensateurs fixes à diélectrique en céramique, Classe 1 (IEC 60384-8:2015) Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 8: Rahmenspezifikation - Keramik-Festkondensatoren, Klasse 1 (IEC 60384-8:2015)

This European Standard was approved by CENELEC on 2015-04-14. 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, 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

#### **Foreword**

The text of document 40/2338/FDIS, future edition 4 of IEC 60384-8, prepared by IEC TC 40, "Capacitors and resistors for electronic equipment" was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60384-8:2015.

The following dates are fixed:

•	latest date by which the document has	(dop)	2016-01-14
	to be implemented at national level by		
	publication of an identical national		
	standard or by endorsement		
•	latest date by which the national	(dow)	2018-04-14
	standards conflicting with the		
	document have to be withdrawn		

This document supersedes EN 60384-8:2005.

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

#### **Endorsement notice**

The text of the International Standard IEC 60384-8:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60384-14 NOTE Harmonized as EN 60384-14.

IEC 60384-21 NOTE Harmonized as EN 60384-21.

## Annex ZA (normative)

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

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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.

<u>Publication</u>	Year	<u>Title</u>	EN/HD	Year
IEC 60063	1963	Preferred number series for resistors and capacitors	-	-
+A1	1967		-	-
+A2	1977		-	-
IEC 60068-1	2013	Environmental testing Part 1: General and guidance	d EN 60068-1	2014
IEC 60384-1	2008	Fixed capacitors for use in electronic equipment Part 1: Generic specification	EN 60384-1	2009
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	1973	Preferred numbers; Series of preferred numbers	-	-

#### CONTENTS

FC	DREWC	PRD	6
1	Gene	eral	8
	1.1	Scope	8
	1.2	Object	8
	1.3	Normative references	8
	1.4	Information to be given in a detail specification	8
	1.4.1	General	8
	1.4.2	Outline drawing and dimensions	9
	1.4.3	Mounting	9
	1.4.4	Ratings and characteristics	9
	1.4.5	Marking	10
	1.5	Terms and definitions	10
	1.6	Marking	10
	1.6.1	General	10
	1.6.2	Marking for code of temperature coefficient	11
	1.6.3	Marking on the body	11
	1.6.4	Marking of the packaging	11
	1.6.5	Additional marking	11
2	Prefe	erred ratings and characteristics	11
	2.1	Preferred characteristics	11
	2.2	Preferred values of ratings	11
	2.2.1	Rated temperature	11
	2.2.2	Rated voltage ( $U_{R}$ )	12
	2.2.3	Category voltage ( $U_{f C}$ )	12
	2.2.4	Preferred values of nominal capacitance and associated tolerance values	12
	2.2.5	Temperature coefficient (α)	12
3	Qual	ity assessment procedures	16
	3.1	Primary stage of manufacture	16
	3.2	Structurally similar components	
	3.3	Certified test records of released lots	16
	3.4	Qualification approval	16
	3.4.1	General	16
	3.4.2	Qualification approval on the basis of the fixed sample size procedure	16
	3.4.3	B Tests	17
	3.5	Quality conformance inspection	22
	3.5.1	Formation of inspection lots	22
	3.5.2	Past schedule	23
	3.5.3	Delayed delivery	23
	3.5.4	Assessment levels	23
4	Test	and measurement procedures	24
	4.1	General	24
	4.2	Visual examination and check of dimensions	24
	4.3	Electrical tests	24
	4.3.1	Capacitance	24
	4.3.2	Pangent of loss angle (tan δ)	25

4.3.3	Insulation resistance (R <sub>i</sub> )	25
4.3.4	Voltage proof	26
4.4	Temperature coefficient ( $\alpha$ ) and temperature cyclic drift of capacitance	27
4.4.1	General	27
4.4.2	Preliminary drying	27
4.4.3	Measuring conditions	27
4.4.4	Requirements	27
4.5	Robustness of terminations	27
4.6	Resistance to soldering heat	27
4.6.1	General	27
4.6.2	Initial measurement	27
4.6.3	Test conditions	27
4.6.4	Final inspection, measurements and requirements	27
4.7	Solderability	28
4.7.1	General	28
4.7.2	Test conditions	28
4.7.3	Final inspection, measurements and requirements	28
4.8	Rapid change of temperature (if required)	28
4.8.1	General	28
4.8.2	Initial measurement	28
4.8.3	Test conditions	28
4.8.4	Recovery	28
4.9	Vibration	28
4.9.1	General	28
4.9.2	Test conditions	29
4.9.3	Final inspection, measurements and requirements	29
4.10	Bump (repetitive shock)	29
4.10.	1 General	29
4.10.	2 Initial measurements	29
4.10.	3 Test conditions	29
4.10.	4 Final inspection, measurements and requirements	29
4.11	Shock (non-repetitive shock)	29
4.11.	1 General	29
4.11.	2 Initial measurements	30
4.11.	3 Test conditions	30
4.11.	4 Final inspection, measurements and requirements	30
4.12	Climatic sequence	30
4.12.	1 General	30
4.12.	2 Initial measurements	30
4.12.	3 Dry heat	30
4.12.	4 Damp heat, cyclic, Test Db, first cycle	31
4.12.		
4.12.		
4.12.	·	
4.13	Damp heat, steady state	
4.13.		
4.13.		
4.13.		
4.13.		33

4.13.5	Final inspection, measurements and requirements	33
4.14 End	lurance	33
4.14.1	General	33
4.14.2	Initial measurement	
4.14.3	Test conditions	
4.14.4	Recovery	
4.14.5	Final inspection, measurements and requirements	
	nponent solvent resistance (if required)	
	vent resistance of the marking (if required)native) Figures with limits of variation of capacitance with temperature	34
for certain ten	perature coefficients and classes	35
Bibliography		43
Figure A.1 – a	γ: +100 (10 <sup>-6</sup> /K)	35
Figure A.2 – $a$	x: 0 (10 <sup>-6</sup> /K)	36
Figure A.3 – c	ı: −33 (10 <sup>−6</sup> /K)	36
Figure A.4 – o	ι: –75 (10 <sup>–6</sup> /K)	37
Figure A.5 – o	ι: –150 (10 <sup>–6</sup> /K)	37
Figure A.6 – c	ι: –220 (10 <sup>–6</sup> /K)	38
Figure A.7 – $\alpha$	x: –330 (10 <sup>-6</sup> /K)	38
•	x: –470 (10 <sup>-6</sup> /K)	
Figure A.9 – $a$	x: –750 (10 <sup>-6</sup> /K)	39
Figure A.10 –	α: -1 000 (10 <sup>-6</sup> /K)	40
Figure A.11 –	α: -1 500 (10 <sup>-6</sup> /K)	40
Figure A.12 –	α: -2 200 (10 <sup>-6</sup> /K)	41
•	α: –3 300 (10 <sup>-6</sup> /K)	
•	α: –4 700 (10 <sup>-6</sup> /K)	
•	α: –5 600 (10 <sup>-6</sup> /K)	
rigule A. 15 –	a. –5 000 (10 -7K)	42
Table 1 – Pre	ferred tolerances on nominal capacitance	12
	ninal temperature coefficient and tolerances	
	nbination of temperature coefficient and tolerance	
	apling plan together with numbers of permissible non-conforming items	
	on approval tests, assessment level EZ	18
Table 5 – Tes	t schedule for qualification approval	19
Table 6 – Lot-	by-lot inspection	23
Table 7 – Peri	odic tests	24
Table 8 – Tan	gent of loss angle	25
Table 9 – Inst	Ilation resistance requirements	26
Table 10 – Te	st voltages for single layer ceramic capacitors	26
Table 11 – Te	st voltages for leaded multilayer ceramic capacitors	26
	mperature cyclic drift limits	
	equirements	
	eferred severities (of non-repetitive shock)	

#### BS EN 60384-8:2015

IEC 60384-8:2015 © IEC 2015 - 5 -

_	
_	

Table 15 – Maximum capacitance change	. 30
Table 16 – Number of damp heat cycles	.31
Table 17 – Final inspection, measurements and requirements	.32
Table 18 – Test conditions for damp heat, steady state	.32
Table 19 – Final inspection, measurements and requirements	.33
Table 20 – Endurance test conditions	. 34
Table 21 – Final inspection, measurements and requirements	.34

#### INTERNATIONAL ELECTROTECHNICAL COMMISSION

#### FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT -

## Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1

#### **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.
- 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 60384-8 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This fourth edition cancels and replaces the third edition published in 2005. This fourth edition is a result of maintenance activities related to the previous edition. All changes that have been agreed upon can be categorized as minor revisions.

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

FDIS	Report on voting
40/2338/FDIS	40/2363/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60384 series, published 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 publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- · reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

#### FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT -

## Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1

#### 1 General

#### 1.1 Scope

This part of IEC 60384 is applicable to fixed capacitors of ceramic dielectric with a defined temperature coefficient (dielectric Class 1), intended for use in electronic equipment, including leadless capacitors but excluding fixed surface mount multilayer capacitors of ceramic dielectric, which are covered by IEC 60384-21 (Class 1).

Capacitors for electromagnetic interference suppression are not included, but are covered by IEC 60384-14.

#### 1.2 Object

The object of this standard is to prescribe preferred ratings and characteristics and to select from IEC 60384-1:2008, 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60063:1963, Preferred number series for resistors and capacitors

IEC 60063:1963/AMD1:1967 IEC 60063:1963/AMD2:1977

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

IEC 60384-1:2008, Fixed capacitors for use in electronic equipment – Part 1: Generic specification

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

ISO 3:1973, Preferred numbers – Series of preferred numbers

#### 1.4 Information to be given in a detail specification

#### 1.4.1 General

Detail specifications shall be derived from the relevant blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic, sectional or blank detail specification. When more severe requirements are included, they shall be