

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Elektronikkomponenter – Fasta kondensatorer – Del 21: Grupp-specifikation för fasta keramiska flerskikt-kondensatorer för ytmontering, Klass 1

Fixed capacitors for use in electronic equipment –

Part 21: Sectional specification –

Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1

Som svensk standard gäller europastandarden EN IEC 60384-21:2019. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60384-21:2019.

Nationellt förord

Europastandarden EN IEC 60384-21:2019

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60384-21, Third edition, 2019 - Fixed capacitors for use in electronic equipment - Part 21: Sectional specification - Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60384-21, utgåva 2, 2012, gäller ej fr o m 2022-03-05.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English Version

**Fixed capacitors for use in electronic equipment - Part 21:
Sectional specification - Fixed surface mount multilayer
capacitors of ceramic dielectric, Class 1
(IEC 60384-21:2019)**

Condensateurs fixes utilisés dans les équipements électroniques - Partie 21: Spécification intermédiaire - Condensateurs multicouches fixes à diélectriques en céramique pour montage en surface, de classe 1 (IEC 60384-21:2019)

Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 21: Rahmenspezifikation - Oberflächenmontierbare Vielschichtkeramik-Festkondensatoren, Klasse 1 (IEC 60384-21:2019)

This European Standard was approved by CENELEC on 2019-03-05. 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: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 40/2639/FDIS, future edition 3 of IEC 60384-21, 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 IEC 60384-21:2019.

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) 2019-12-05
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-03-05

This document supersedes EN 60384-21:2012.

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 60384-21:2019 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 60384-14 NOTE Harmonized as EN 60384-14

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.

<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 60068-2-58	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)	EN 60068-2-58	2015
+ A1	2017		+ A1	2018
IEC 60384-1	2016	Fixed capacitors for use in electronic equipment - Part 1: Generic specification	EN 60384-1	2016
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

FOREWORD.....	6
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	8
4 Information to be given in a detail specification.....	9
4.1 General.....	9
4.2 Outline drawing and dimensions	10
4.3 Mounting.....	10
4.4 Rating and characteristics.....	10
4.4.1 General	10
4.4.2 Nominal capacitance range.....	10
4.4.3 Particular characteristics	10
4.4.4 Soldering	10
4.5 Marking.....	11
5 Marking	11
5.1 General.....	11
5.2 Information for marking	11
5.3 Marking on the body	11
5.4 Requirements for marking	11
5.5 Marking of the packaging	11
5.6 Additional marking	11
6 Preferred ratings and characteristics	11
6.1 Preferred characteristics	11
6.2 Preferred values of ratings	12
6.2.1 Rated temperature (T_R)	12
6.2.2 Rated voltage (U_R)	12
6.2.3 Category voltage (U_C)	12
6.2.4 Preferred values of nominal capacitance and associated tolerance values.....	12
6.2.5 Temperature coefficient (α)	13
6.2.6 Dimensions.....	14
7 Quality assessment procedures	15
7.1 Primary stage of manufacture	15
7.2 Structurally similar components	15
7.3 Certified records of released lots	15
7.4 Qualification approval	15
7.4.1 General	15
7.4.2 Qualification approval on the basis of the fixed sample size procedures	15
7.4.3 Tests	16
7.5 Quality conformance inspection	21
7.5.1 Formation of inspection lots.....	21
7.5.2 Test schedule	21
7.5.3 Delayed delivery.....	21
7.5.4 Assessment levels	21
8 Test and measurement procedures.....	22
8.1 General.....	22

8.2	Preliminary drying	22
8.3	Measuring conditions	23
8.4	Mounting	23
8.5	Visual examination and check of dimensions	23
8.5.1	General	23
8.5.2	Visual examination	23
8.5.3	Requirements	23
8.6	Electrical tests	25
8.6.1	Capacitance	25
8.6.2	Tangent of loss angle ($\tan \delta$)	25
8.6.3	Insulation resistance	26
8.6.4	Voltage proof	26
8.7	Temperature coefficient (α) and temperature cycle drift	27
8.7.1	General	27
8.7.2	Preliminary drying	27
8.7.3	Measuring conditions	27
8.7.4	Requirements	27
8.8	Shear test	28
8.9	Substrate bending test	28
8.9.1	General	28
8.9.2	Initial measurement	28
8.9.3	Final inspection	28
8.10	Resistance to soldering heat	28
8.10.1	General	28
8.10.2	Initial measurement	28
8.10.3	Test conditions	28
8.10.4	Recovery	30
8.10.5	Final inspection, measurements and requirements	30
8.11	Solderability	30
8.11.1	General	30
8.11.2	Test conditions	30
8.11.3	Recovery	31
8.11.4	Final inspection, measurements and requirements	31
8.12	Rapid change of temperature	31
8.12.1	General	31
8.12.2	Initial measurement	31
8.12.3	Number of cycles	31
8.12.4	Recovery	32
8.12.5	Final inspection, measurements and requirements	32
8.13	Climatic sequence	32
8.13.1	General	32
8.13.2	Initial measurement	32
8.13.3	Dry heat	32
8.13.4	Damp heat, cyclic, Test Db, first cycle	32
8.13.5	Cold	32
8.13.6	Damp heat, cyclic, Test Db, remaining cycles	32
8.13.7	Final inspection, measurements and requirements	33
8.14	Damp heat, steady state	33
8.14.1	General	33

8.14.2	Initial measurement	33
8.14.3	Test conditions	33
8.14.4	Recovery	34
8.14.5	Final inspection, measurements and requirements.....	34
8.15	Endurance	34
8.15.1	General	34
8.15.2	Initial measurement	35
8.15.3	Test conditions	35
8.15.4	Recovery	35
8.15.5	Final inspection, measurements and requirements.....	35
8.16	Robustness of terminations (only for capacitors with strip termination).....	36
8.16.1	General	36
8.16.2	Test conditions	36
8.16.3	Final inspection and requirements	36
8.17	Component solvent resistance (if required)	36
8.18	Solvent resistance of the marking (if required)	36
8.19	Accelerated damp heat, steady state (if required)	36
8.19.1	General	36
8.19.2	Initial measurement	37
8.19.3	Conditioning	37
8.19.4	Recovery	37
8.19.5	Final measurements	37
Annex A (normative) Guidance for the specification and coding of dimensions of fixed surface mount multilayer capacitors of ceramic dielectric, Class 1		38
Annex B (informative) Combination of temperature coefficient and tolerance for the reference temperature of 25 °C		39
Annex X (informative) Cross-reference for reference to IEC 60384-21:2011.....		40
Bibliography.....		41
Figure 1 – Fault: crack or fissure.....		23
Figure 2 – Fault: crack or fissure.....		23
Figure 3 – Separation or delamination		24
Figure 4 – Exposed electrodes.....		24
Figure 5 – Principal faces		24
Figure 6 – Reflow temperature profile		29
Figure A.1 – Dimensions.....		38
Table 1 – Preferred tolerances on nominal capacitance		12
Table 2 – Nominal temperature coefficient and tolerance		13
Table 3 – Combination of temperature coefficient and tolerance		14
Table 4 – Fixed sample size test plan for qualification approval – Assessment level EZ.....		17
Table 5 – Tests schedule for qualification approval		18
Table 6 – Lot-by-lot inspection		22
Table 7 – Periodic tests		22
Table 8 – Tangent of loss angle limits		25
Table 9 – Test voltages.....		27

Table 10 – Temperature cyclic drift limits	28
Table 11 – Reflow temperature profiles for Sn-Ag-Cu alloy	29
Table 12 – Maximum capacitance change	30
Table 13 – Maximum capacitance change	32
Table 14 – Number of damp heat cycles	33
Table 15 – Final inspection, measurements and requirements	33
Table 16 – Test conditions for damp heat, steady state	34
Table 17 – Final inspection, measurements and requirements	34
Table 18 – Endurance test conditions ($U_C = U_R$)	35
Table 19 – Endurance test conditions ($U_C \neq U_R$)	35
Table 20 – Final inspection, measurements and requirements	36
Table 21 – Initial requirements	37
Table 22 – Conditioning	37
Table A.1 – Dimensions	38
Table B.1 – Combination of temperature coefficient and tolerance for the reference temperature of 25 °C	39
Table X.1 – Reference to IEC 60384-21 for clause/subclause	40
Table X.2 – Reference to IEC 60384-21 for figure/table	40

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**Part 21: Sectional specification –
Fixed surface mount multilayer 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.
- 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 60384-21 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 2011. This edition 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 to the extent practicable, and for harmonizing with IEC 60384-22;
- b) deletion of the description on the permissible reactive power in 6.2.2 because it is not appropriate for the purposes of this document;

c) the dimensions of 0201M in Annex A have been added.

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

FDIS	Report on voting
40/2639/FDIS	40/2651/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 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 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.

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 21: Sectional specification – Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1

1 Scope

This part of IEC 60384 is applicable to fixed unencapsulated surface mount multilayer capacitors of ceramic dielectric, Class 1, for use in electronic equipment. These capacitors have metallized connecting pads or soldering strips and are intended to be mounted on printed boards, or directly onto substrates for hybrid circuits.

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

The object of this document is to prescribe preferred ratings and characteristics and to select from IEC 60384-1 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 are of equal or higher performance levels; lower performance levels are not permitted.

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 60063, *Preferred number series for resistors and capacitors*

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

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 60068-2-58:2015/AMD1:2017

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

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

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