



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 60384-22:2023**  
**01-september-2023**

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**Fiksni kondenzatorji za uporabo v elektronski opremi - 22. del: Področna specifikacija - Fiksni večplastni kondenzatorji za površinsko namestitev s keramičnim dielektrikom, razred 2**

Fixed capacitors for use in electronic equipment - Part 22: Sectional specification - Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2

Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 22: Rahmenspezifikation - Oberflächenmontierbare Vielschichtkeramik-Festkondensatoren, Klasse 2

Condensateurs fixes utilisés dans les équipements électroniques - Partie 22: Spécification intermédiaire - Condensateurs multicouches fixes à diélectriques en céramique pour montage en surface, de classe 2

**Ta slovenski standard je istoveten z: prEN IEC 60384-22:2023**

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**ICS:**

31.060.10      Fiksni kondenzatorji      Fixed capacitors

**oSIST prEN IEC 60384-22:2023**      en





# 40/3056/CDV

## COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:

**IEC 60384-22 ED4**

DATE OF CIRCULATION:

**2023-06-23**

CLOSING DATE FOR VOTING:

**2023-09-15**

SUPERSEDES DOCUMENTS:

**40/2987/CD, 40/3044/CC**

IEC TC 40 : CAPACITORS AND RESISTORS FOR ELECTRONIC EQUIPMENT	
SECRETARIAT: Netherlands	SECRETARY: Mr Ronald Drenthen
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING <b>Attention IEC-CENELEC parallel voting</b> The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

**Fixed capacitors for use in electronic equipment - Part 22: Sectional specification - Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2**

PROPOSED STABILITY DATE: 2032

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –****Part 22: Sectional specification –  
Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2**

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- IEC 60384-22 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.
- This fourth edition cancels and replaces the third edition published in 2019, This edition constitutes a technical revision.
- This edition includes the following significant technical changes with respect to the previous edition:
- a) . The document has been completely restructured to comply with the ISO/IEC Directives, Part 2 and to make it more useable; tables, figures and references have been revised accordingly.
  - b) The requirements of reference temperature 25°C has been added in Table 5, Table 9, Table 10, Table 12, Table 14 and Table 17.
  - c) The table of temperature characteristics of capacitance for the reference temperature 25°C have been added in Table C.1, Table C.2 and Table C.3.

- 235 d) The requirement in 5.5.2(visual examination) has been repeated in 5.9.3, 5.10.6, 5.11.4, 5.12.6,  
236 5.13.8, 5.14.6 and 5.15.6.
- 237 e) The deflection D in the very robust designs has been added in 5.9.1.
- 238 f) Annex C has been changed informative into normative.
- 239 g) D.5(Test schedule for quality conformance inspection) has been newly added to withdraw the blank  
240 detail specification: IEC 60384-22-1.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

242  
243 Full information on the voting for its approval can be found in the report on voting indicated in the above  
244 table.

245 The language used for the development of this International Standard is English.

246 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance  
247 with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at  
248 [https://www.iec.ch/members\\_experts/refdocs](https://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are  
249 described in greater detail at <https://www.iec.ch/standardsdev/publications>.

250 The committee has decided that the contents of this document will remain unchanged until the stability  
251 date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document.  
252 At this date, the document will be

- 253 • reconfirmed,
  - 254 • withdrawn,
  - 255 • replaced by a revised edition, or
  - 256 • amended. <https://standards.iteh.ai/catalog/standards/sist/ccf414a0-4c14-4c92-89e1-267353242bc5/osist-pren-iec-60384-22-2023>
- 257  
258

## FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPEMENT –

### Part 22: Sectional specification – Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2

#### 1 Scope

This part of IEC 60384 is applicable to fixed unencapsulated surface mount multilayer capacitors of ceramic dielectric, Class 2, 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 specify preferred ratings and characteristics and to select from IEC 60384-1:2021 the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements specified in detail specifications referring to this sectional specification provide specific test severities and requirements of an equal or higher performance level. For further information on the conception of generic, sectional and detail specifications, see IEC 60384-1:2021, INTRODUCTION.

#### 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 60384-1:2021, *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*

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60384-1 and the following apply.

ISO and IEC maintain terminological 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>

298 **3.1**  
 299 **surface mount multilayer capacitor**  
 300 multilayer capacitor whose small dimensions and nature or shape of terminations make it suitable for  
 301 surface mounting in hybrid circuits and on printed boards

302 **3.2**  
 303 **capacitor of ceramic dielectric, Class 2**  
 304 capacitor that has a dielectric with a high permittivity and is suitable for by-pass and coupling  
 305 applications or for frequency-discriminating circuits where low losses and high stability of capacitance  
 306 are not of major importance

307 Note 1 to entry: The ceramic dielectric is characterized by a non-linear change of capacitance over the category temperature  
 308 range (see Table 3).

309 **3.3**  
 310 **subclass**  
 311 maximum percentage change of capacitance within the category temperature range with respect to the  
 312 capacitance at the reference temperature 20 °C or 25°C

313 Note 1 to entry: The subclass may be expressed in code form (see Table 3 and Annex C).

314 **3.4**  
 315 **category temperature range**  
 316 ambient temperature range for which the capacitor has been designed to operate continuously

317 Note 1 to entry: This is given by the lower and upper category temperature (see Table 3 and Annex C)

318 **3.5**  
 319 **rated temperature**  
 320  $T_R$   
 321 maximum ambient temperature at which the rated voltage can be continuously applied

322 **3.6**  
 323 **rated voltage**  
 324  $U_R$   
 325 maximum DC voltage that can be applied continuously to a capacitor at any temperature between the  
 326 lower category temperature and the rated temperature

327 Note 1 to entry: The maximum DC voltage is the sum of the DC voltage and peak AC voltage or peak pulse voltage applied  
 328 to the capacitor.

329 **3.7**  
 330 **category voltage**  
 331  $U_C$   
 332 maximum voltage that can be applied continuously to a capacitor at its upper category temperature

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## 334 **4 Preferred ratings and characteristics**

### 335 **4.1 Preferred characteristics**

336 Preferred climatic categories only shall be given in the preferred characteristics.

337 The capacitors covered by this document are classified into climatic categories in accordance with the  
 338 general rules given in IEC 60068-1:2013, Annex A.

339 For reference temperature 20 °C, the lower and upper category temperatures and the duration of the  
 340 damp heat, steady state test shall be chosen from the following:

- 341 – lower category temperature: –55 °C, –40 °C, –25 °C, –10 °C and +10 °C;
- 342 – upper category temperature: +70 °C, +85 °C, +100 °C, +125 °C and +150 °C;

343 – duration of the damp heat,  
344 steady state test (40 °C, 93 % RH): 4, 10, 21 and 56 days.

345 For reference temperature 25 °C, the lower and upper category temperatures shall be chosen from  
346 Table C.1 in Annex C.

347 The severities of the cold and dry heat tests are the lower and upper category temperatures respectively.

348 NOTE The resistance to humidity resulting from the above climatic category is for the capacitors in their unmounted state.  
349 The climatic performance of the capacitors after mounting is greatly influenced by the mounting substrate, the mounting method  
350 (see 5.4) and the final coating.

## 351 4.2 Preferred values of ratings

### 352 4.2.1 Rated temperature ( $T_R$ )

353 The rated temperature is equal to the upper category temperature for capacitors with the upper category  
354 temperature not exceeding 125 °C, unless otherwise stated in the detail specification.

### 355 4.2.2 Rated voltage ( $U_R$ )

356 The preferred values of the rated voltage are the values of the R5 series of ISO 3. If other values are  
357 needed they shall be chosen from the R10 series.

358 The sum of the DC voltage and the peak AC voltage or the peak to peak AC voltage, whichever is the  
359 greater, applied to the capacitor shall not exceed the rated voltage.

### 360 4.2.3 Category voltage ( $U_C$ )

361 The category voltage is equal to the rated voltage for capacitors with the upper category temperature  
362 not exceeding 125 °C. Any category voltages which are different from the rated voltage, for capacitors  
363 with the upper category temperature exceeding 125 °C or for high-voltage capacitors with rated voltages  
364 about 500 V, shall be given in the detail specification.

365 The preferred values of the category voltage at 125 °C upper category temperature for high volumetric  
366 capacitors with a rated voltage of 16 V and less and a rated temperature of 85 °C are given in Table 1.

367 <https://standards.iteh.ai/catalog/standards/sist/ccf414a0-4c14-4e92-89e1-2073332420c3/osist-pr-en-iec-60384-22-2023>  
**Table 1 – Preferred values of category voltages**

$U_R$	V	2,5	4	6,3	10	16
$U_C$	V	1,6	2,5	4	6,3	10
NOTE The numeric values of $U_C$ are calculated by the following: $U_C = 0,63 \times U_R.$						

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### 369 4.2.4 Preferred values of nominal capacitance and associated tolerance values

#### 370 4.2.4.1 Preferred values of nominal capacitance

371 Nominal capacitance values should be taken from the E3, E6 and E12 series given in IEC 60063.

#### 372 4.2.4.2 Preferred tolerances on nominal capacitance

373 See Table 2.

374

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**Table 2 – Preferred tolerances**

Preferred series	Tolerance %	Letter code
E3 and E6	–20/+80	Z
	–20/+50	S
E6	± 20	M
E6 and E12	± 10	K

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**4.2.5 Temperature characteristic of capacitance**

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Table 3 shows the temperature characteristic with and without DC voltage applied for the reference temperature 20 °C. The method of coding the subclass is also given; for example a dielectric with a percentage change of ±20 % without DC voltage applied over the temperature range from –55 °C to +125 °C will be defined as a dielectric of subclass 2C1. The temperature characteristics, category temperatures and corresponding codes for the reference temperature 25 °C are given in Annex C. The temperature range for which the temperature characteristic of the dielectric is defined is the same as the category temperature range.

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**Table 3 – Temperature characteristic of capacitance**

Sub-class letter code	Maximum capacitance change within the category temperature range with respect to the capacitance at 20 °C measured with and without a DC voltage applied %		Category temperature range and corresponding number code					
			–55/+150 °C	–55/+125 °C	–55/+85 °C	–40/+85 °C	–25/+85 °C	+10/+85 °C
	without DC voltage applied	with DC voltage applied (NOTE 1)	0	1	2	3	4	6
2B	±10	Requirements specified in the detail specification						
2C	±20							
2D	+20/–30							
2E	+22/–56							
2F	+30/–80							
2R	±15							
When the upper category temperature is above 125 °C, the limits of capacitance change, both with and without DC voltage applied, should be given in the detail specification.								
NOTE 1 DC voltage applied is either rated voltage or the voltage specified in the detail specification.								

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NOTE See Annex C for preferred values of the temperature characteristic for the reference temperature of 25 °C

**4.2.6 Dimensions**

Suggested rules for the specification and coding of dimensions are given in Annex A.

Specific dimensions shall be given in the detail specification.

**5 Test and measurement procedures****5.1 General**

This clause supplements the information given in IEC 60384-1:2021, Clause 5 to Clause 10.

## 394 5.2 Special preconditioning

395 Unless otherwise specified in the detail specification, the special preconditioning, when specified in this  
396 sectional specification before a test or a sequence of test, shall be carried out under the following  
397 conditions.

398 Exposure at upper category temperature or at such higher temperature as may be specified in the detail  
399 specification during 1 h, followed by recovery during  $(24 \pm 1)$  h under standard atmospheric conditions  
400 for testing.

401 NOTE Capacitors lose capacitance continuously with time in accordance with a logarithmic law (this is called ageing).  
402 However, if the capacitor is heated to a temperature above the Curie point of its dielectric, then "de-ageing" takes place, i.e.  
403 the capacitance lost through "ageing" is regained, and "ageing" recommences from the time when the capacitor recools. The  
404 purpose of special preconditioning is to bring the capacitor to a defined state regardless of its previous history (see Clause B.4  
405 for further information).

## 406 5.3 Measuring conditions

407 See IEC 60384-1:2021, 5.2.1.

## 408 5.4 Mounting

409 See IEC 60384-1:2021, 5.5.

## 410 5.5 Visual examination and check of dimensions

### 411 5.5.1 General

412 See IEC 60384-1:2021, 7.1, with the details of 5.5.2 and 5.5.3.

### 413 5.5.2 Visual examination

414 A visual examination shall be carried out with suitable equipment with approximately  $10\times$  magnification  
415 and lighting appropriate to the specimen under test and the quality level required. In case the specimen  
416 are very small components, the visual examination may be carried out with higher magnification.

417 The operator should have available facilities for incident or transmitted illumination as well as an  
418 appropriate measuring facility.

### 419 5.5.3 Requirements

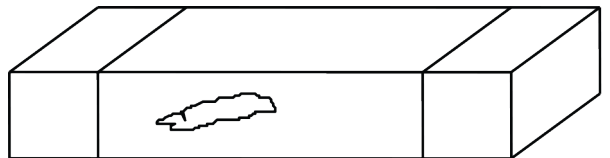
#### 420 5.5.3.1 General

421 Quantitative values for the requirements below may be given in the detail or in the manufacturer's  
422 specification.

#### 423 5.5.3.2 Requirements for the ceramic

424 Requirements for the ceramic are as follows:

425 a) Be free of cracks or fissures, except small damages on the surface, that do not deteriorate the  
426 performance of the capacitor (examples: see Figure 1 and Figure 2).



427

428

Figure 1 – Fault: crack or fissure