



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 60384-21:2023**  
**01-september-2023**

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**Fiksni kondenzatorji za uporabo v elektronski opremi - 21. del: Področna specifikacija - Fiksni večplastni kondenzatorji za površinsko namestitev s keramičnim dielektrikom, razred 1**

Fixed capacitors for use in electronic equipment - Part 21: Sectional specification - Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1

Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 21: Rahmenspezifikation - Oberflächenmontierbare Vielschichtkeramik-Festkondensatoren, Klasse 1

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

**Ta slovenski standard je istoveten z: prEN IEC 60384-21:2023**

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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	
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TITLE:

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

PROPOSED STABILITY DATE: 2032

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –****Part 21: Sectional specification –  
Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1**

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- IEC 60384-21 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  - b) The terms have been replaced by the letter symbols in Table 3.
  - c) Code of temperature coefficient and tolerance of C0G, U2J have been added in Table 4, Table 6, Table 8, Table 9, Table 11, Table 13, Table 16 and Annex B.



- 220 d) The requirement in 5.5.2(visual examination) has been repeated in 5.9.3, 5.10.5, 5.11.4, 5.11.5,  
221 5.13.7, 5.14.5 and 5.15.5.
- 222 e) The deflection D in the very robust designs has been added in 5.9.1.
- 223 f) Annex B has been changed informative into normative.
- 224 g) C.5(Test schedule for quality conformance inspection) has been newly added to withdraw the blank  
225 detail specification: IEC 60384-21-1.
- 226

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

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

228  
229 Full information on the voting for its approval can be found in the report on voting indicated in the above  
230 table.

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

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

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

- 239 • reconfirmed,
  - 240 • withdrawn,
  - 241 • replaced by a revised edition, or
  - 242 • amended.
- 243

244

## FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

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

252

#### 1 Scope

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This part of IEC 60384 is applicable to fixed unencapsulated surface mount multilayer capacitors of ceramic dielectric with a defined temperature coefficient (dielectric Class 1), intended 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.

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258

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

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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.

265

#### 2 Normative references

266

267

268

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.

269

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

270

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

271

272

273

274

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

275

IEC 60384-1:2021, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

276

277

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

278

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

279

280

#### 3 Terms and definitions

281

282

For the purposes of this document, the terms and definitions given in IEC 60384-1:2021 and the following apply.

283 ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- 284 • IEC Electropedia: available at <https://www.electropedia.org/>
- 285 • ISO Online browsing platform: available at <https://www.iso.org/obp>

### 286 3.1

#### 287 surface mount multilayer capacitor

288 multilayer capacitor whose small dimensions and nature or shape of terminations make it suitable for  
289 surface mounting in hybrid circuits and on printed boards

### 290 3.2

#### 291 capacitor of ceramic dielectric, Class 1

292 capacitor specially designed and suited for resonant circuit application where low losses and high  
293 stability of capacitance are essential or where a precisely defined temperature coefficient is required,  
294 for example for compensating temperature effects in the circuit

295 Note 1 to entry: The ceramic dielectric is defined by its nominal temperature coefficient ( $\alpha$ ).

### 296 3.3

#### 297 subclass

298 for a given nominal temperature coefficient, the subclass is defined by the tolerance on the temperature  
299 coefficient

300 Note 1 to entry: See Table 2.

301 Note 2 to entry: The nominal temperature coefficient value and its tolerance refer to the temperature interval from the  
302 reference temperature +20 °C or +25 °C to +85 °C, but because in practice TC curves are not strictly linear, it is necessary to  
303 define limiting capacitance deviation ( $\Delta C/C$ ) for other temperatures (see Table 3 and Annex B).

### 304 3.4

#### 305 category temperature range

306 ambient temperature range for which the capacitor has been designed to operate continuously

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

### 308 3.5

#### 309 rated temperature

310  $T_R$

311 maximum ambient temperature at which the rated voltage can be continuously applied

### 312 3.6

#### 313 rated voltage

314  $U_R$

315 maximum DC voltage that can be applied continuously to a capacitor at any temperature between the  
316 lower category temperature and the rated temperature

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

### 319 3.7

#### 320 category voltage

321  $U_C$

322 maximum voltage that can be applied continuously to a capacitor at its upper category temperature

## 323 4 Preferred ratings and characteristics

### 324 4.1 Preferred characteristics

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

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

328 For reference temperature 20 °C or 25 °C, the lower and upper category temperatures and the duration  
329 of the damp heat, steady state test shall be chosen from the following:

330

331 – lower category temperature: –55 °C, –40 °C, –25 °C, –10 °C and +10 °C;

332 – upper category temperature: +70 °C, +85 °C, +100 °C, +125 °C;

333 – duration of the damp heat,

334 steady state test (40 °C, 93 % RH): 4, 10, 21 and 56 days.

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

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

## 339 4.2 Preferred values of ratings

### 340 4.2.1 Rated temperature ( $T_R$ )

341 For capacitors covered by this sectional specification, the rated temperature is equal to the upper  
342 category temperature, unless the upper category temperature exceeds 125 °C.

### 343 4.2.2 Rated voltage ( $U_R$ )

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

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

### 348 4.2.3 Category voltage ( $U_C$ )

349 When the rated temperature is defined as the upper category temperature, the category voltage is equal  
350 to the rated voltage as defined in IEC 60384-1:2021, 3.5. If the upper category temperature exceeds  
351 125 °C, or the rated voltages exceed 500 V, the category voltage shall be given in the detail specification.

## 352 4.2.4 Preferred values of nominal capacitance and associated tolerance values

### 353 4.2.4.1 Preferred values of nominal capacitance

354 Nominal capacitance values should be taken from the E6, E12 and E24 series given in IEC 60063.

### 355 4.2.4.2 Preferred tolerances on nominal capacitance

356 See Table 1.

357

**Table 1 – Preferred tolerances on nominal capacitance**

Preferred series	Tolerance			
	$C_N \geq 10$ pF	Letter code	$C_N < 10$ pF	Letter code
E6	±20 %	M	±2 pF	G
E12	±10 %	K	±1 pF	F
E24	±5 %	J	±0,5 pF	D
	±2 %	G	±0,25 pF	C
	±1 %	F	±0,1 pF	B

358

359 **4.2.5 Temperature coefficient ( $\alpha$ )**360 **4.2.5.1 Nominal temperature coefficient and tolerance (for reference temperature 20 °C)**

361 Table 2 shows the nominal temperature coefficients for the reference temperature 20 °C, the associated  
 362 tolerances, expressed in parts per million per Kelvin ( $10^{-6}/K$ ), and the corresponding subclasses and  
 363 letter codes. The temperature coefficients, tolerances and letter codes for the reference temperature  
 364 25 °C are given in Annex B.

365 The detail specification shall specify for each temperature coefficient the minimum value of capacitance  
 366 for which the given tolerance of temperature coefficient can be verified, considering the accuracy of the  
 367 methods of capacitance measurement specified.

368 For values of capacitance lower than this minimum value:

- 369 a) the detail specification shall specify a multiplying factor for the tolerance on  $\alpha$ , as well as the  
 370 permissible changes of capacitance at the lower and upper category temperature;  
 371 a) special methods of measurement may be necessary and, if required, shall be stated in the detail  
 372 specification.

373 **Table 2 – Nominal temperature coefficient and tolerance (for reference temperature 20 °C)**

Nominal temperature coefficient( $10^{-6}/K$ )	Tolerance on temperature coefficient( $10^{-6}/K$ )	Subclass	Letter code for	
			$\alpha$	Tolerance
+100	$\pm 30$	1B	A	G
0	$\pm 30$	1B	C	G
-33	$\pm 30$	1B	H	G
-75	$\pm 30$	1B	L	G
-150	$\pm 30$	1B	P	G
-220	$\pm 30$	1B	R	G
-330	$\pm 60$	1B	S	H
-470	$\pm 60$	1B	T	H
-750	$\pm 120$	1B	U	J
-1 000	$\pm 250$	1F	Q	K
-1 500	$\pm 250$	1F	V	K
$+140 \geq \alpha \geq -1\ 000$	<sup>a</sup>	1C	SL	-

NOTE 1 The nominal temperature coefficients and their tolerances are defined using the capacitance change between the temperatures 20 °C and 85 °C.

NOTE 2 A capacitor with a temperature coefficient  $0 \times 10^{-6}/K$  and a tolerance on temperature coefficient of  $\pm 30 \times 10^{-6}/K$  is designated as a CG capacitor (subclass 1B).

<sup>a</sup> This temperature coefficient value is not subject to inspection, since no limits for relative capacitance variation are specified in Table 3.

374

375 **4.2.5.2 Permissible relative variation of capacitance**

376 Table 3 shows for each combination of temperature coefficient and tolerance the permissible relative  
 377 variation of capacitance expressed in parts per thousand at both the upper and lower category  
 378 temperatures. Temperature coefficients and tolerances are expressed in parts per million per Kelvin  
 379 ( $10^{-6}/K$ ). In case of reference temperature 25 °C, see Table B.1 for an explanation of the permissible  
 380 relative variation of capacitance.