

# DATA SHEET

## SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

Class 2, X7R  
10 V



## Surface-mount ceramic multilayer capacitors

**Class 2, X7R**  
**10 V**

### FEATURES

- Four standard sizes
- For high frequency applications
- Supplied in tape on reel or in bulk case
- NiSn terminations.

### APPLICATIONS

- Consumer electronics for example
  - Tuners
  - Television receivers
  - Video recorders
  - All types of cameras.

### DESCRIPTION

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved metal electrodes are contained. This structure gives rise to a high capacitance per unit volume.

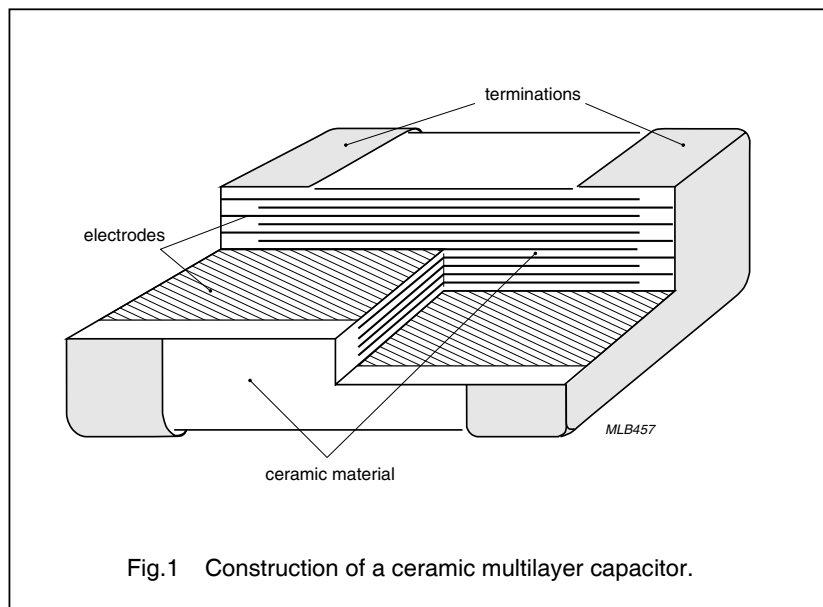
The inner electrodes are connected to the two terminations and finally covered with a layer of plated tin (NiSn). A cross section of the structure is shown in Fig.1.

### QUICK REFERENCE DATA

DESCRIPTION	VALUE
Rated voltage $U_R$ (DC)	10 V
Capacitance range (E6 series):	33 nF to 4.7 $\mu$ F
Tolerance on capacitance after 1000 hours	$\pm 10\%$
Test voltage (DC) for 1 minute:	$2.5 \times U_R$
Sectional specifications	IEC 60384-10, second edition 1989-04; also based on CECC 32 100
Detailed specification	based on CECC 32 101-801
Climatic category (IEC 60 068)	55/125/21

### Note

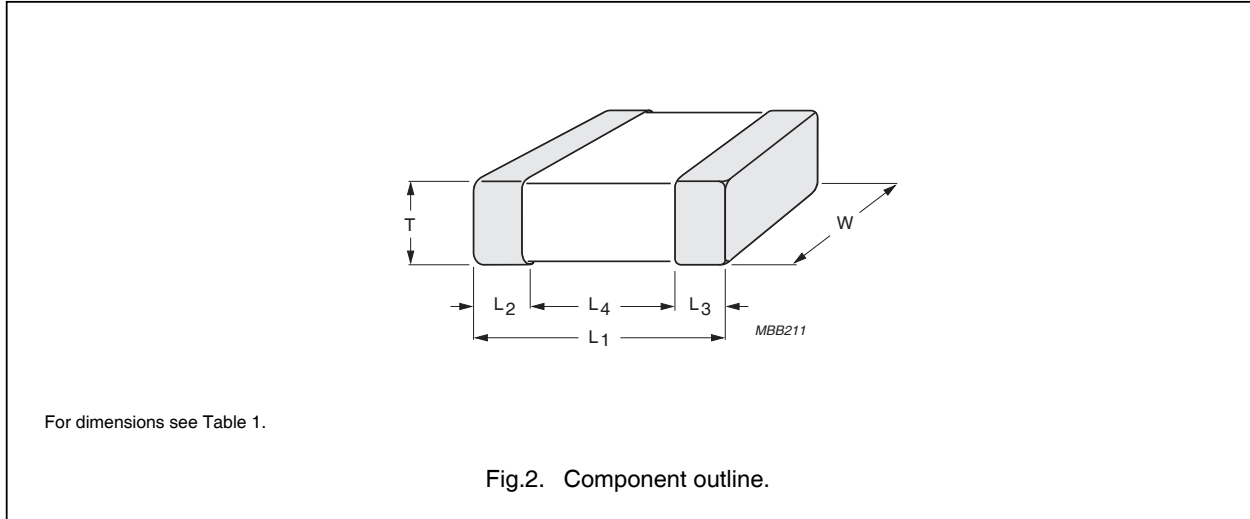
1. Measured at 20 °C, 1 V and 1 kHz, using a four-gauge method.



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### MECHANICAL DATA



### Physical dimensions

**Table 1** Capacitor dimensions; see Fig.2

CASE SIZE	L <sub>1</sub>	W	T		L <sub>2</sub> and L <sub>3</sub>		L <sub>4</sub> MIN.
			MIN.	MAX.	MIN.	MAX.	
<b>Dimensions in millimetres</b>							
0402	1.0 ±0.05	0.5 ±0.05	0.45	0.55	0.15	0.30	0.40
0603	1.6 ±0.10	0.8 ±0.07	0.73	0.87	0.25	0.65	0.40
0805	2.0 ±0.10	1.25 ±0.10	0.50	1.35	0.25	0.75	0.55
1206	3.2 ±0.20	1.6 ±0.15	0.50	1.75	0.25	0.75	1.40
<b>Dimensions in inches</b>							
0402	0.040 ±0.002	0.020 ±0.002	0.018	0.022	0.008	0.012	0.016
0603	0.063 ±0.004	0.032 ±0.003	0.029	0.035	0.010	0.026	0.016
0805	0.079 ±0.004	0.049 ±0.004	0.020	0.053	0.010	0.030	0.022
1206	0.126 ±0.008	0.063 ±0.006	0.020	0.069	0.010	0.030	0.056

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## SELECTION CHART FOR 10V

C (nF)	LAST TWO DIGITS OF 12NC	10V			
		0402	0603	0805	1206
33	43	0.5 ±0.05			
39	44				
47	45				
56	46				
68	47				
82	48				
100	49				
120	–		0.8 ±0.07		
150	52				
180	53				
220	54				0.6 ±0.10
270	55				
330	56				0.85 ±0.10
390	57				
470	58				
560	59			1.25 ±0.10	
680	61				
820	62				
1 000	63				0.85 ±0.10
1 200	64			1.25 ±0.10	
1 500	65				
1 800	66				
2 200	67				
3 300	69				1.6 ±0.15
4 700	72				

**Note**

1. Values in shaded cells indicate thickness class.

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**Thickness classification and packing quantities for 10 V**

THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH QUANTITY PER REEL				QUANTITY PER BULK CASE		
	Ø180 mm; 7"		Ø330 mm; 13"		0402	0603	0805
	PAPER	BLISTER	PAPER	BLISTER			
0.5 ±0.05	10 000	–	50 000	–	50 000	–	–
0.6 ±0.10	4 000	–	20 000	–	–	–	10 000
0.80 ±0.07	4 000	–	15 000	–	–	15 000	–
0.85 ±0.10	4 000	–	15 000	–	–	–	–
1.15 ±0.10	–	3 000	–	10 000	–	–	–
1.25 ±0.10	–	3 000	–	10 000	–	–	5 000
1.6 ±0.15	–	2 500	–	8 000	–	–	–

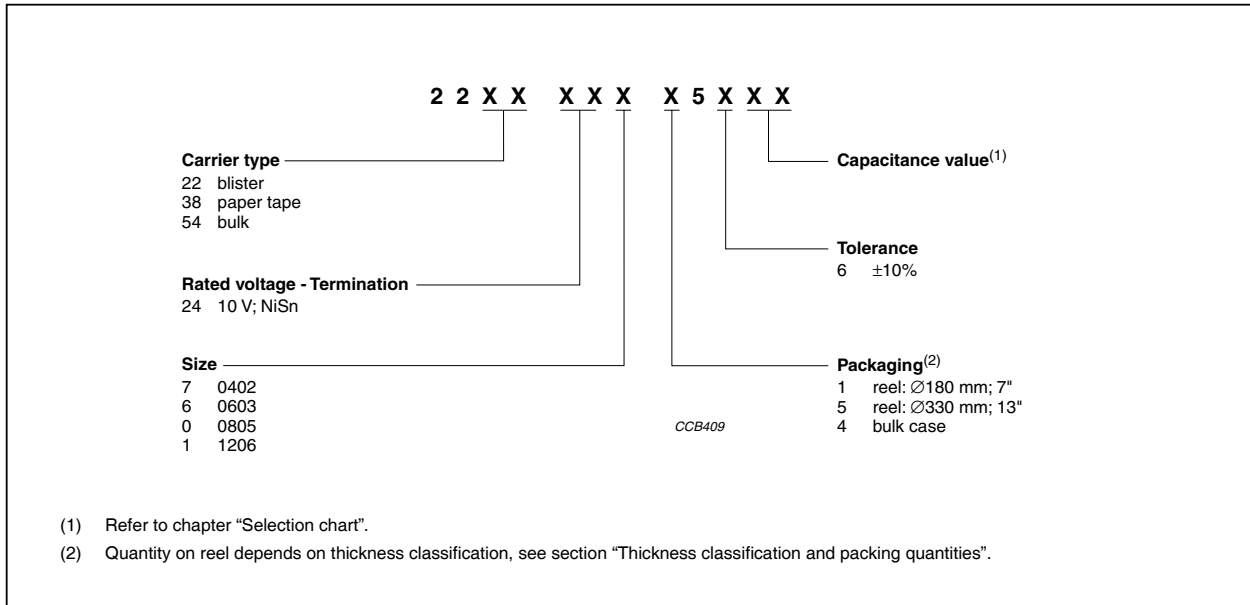
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### ORDERING INFORMATION FOR 10V

Components may be ordered by using either a Phycomp's unique 12NC or simple 15-digit clear text code.

#### Ordering code 12NC (preferred)



#### Clear text code

EXAMPLE: 06032R154K6BB0D

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	Termination	Packing	Marking	Series
0402 0603 0805 1206	2R = X7R	154 = 150 000 pF; the third digit signifies the multiplying factor: 4 = × 10 000 5 = × 100 000	K = ±10%	6 = 10 V	B = NiSn	2 = 180 mm; 7" paper 3 = 330 mm; 13" paper B = 180 mm; 7" blister F = 330 mm; 13" blister P = bulk case	0 = no marking	D = BME

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### ELECTRICAL CHARACTERISTICS

#### Class 2 capacitors; X7R dielectric; NiSn terminations

Unless otherwise stated all electrical values apply at an ambient temperature of  $20 \pm 1$  °C, an atmospheric pressure of 86 to 106 kPa, and a relative humidity of 63 to 67%.

DESCRIPTION	VALUE
Capacitance range (E6 series); note 1	33 nF to 4.7 $\mu$ F
Tolerance on capacitance after 1000 hours	$\pm 10\%$
Tan $\delta$ ; note 1	$\leq 5\%$
Insulation resistance after 1 minute at $U_R$ (DC)	$R_{ins} \times C \geq 500$ seconds
Maximum capacitance change as a function of temperature	$\pm 15\%$
Ageing	typical 3% per time decade
Resistance to soldering heat	260 °C; 10 seconds

#### Note

1. Measured at 20 °C, 1 V and 1 kHz, using a four-gauge method.

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## Class 2, X7R 10 V

### TESTS AND REQUIREMENTS

**Table 3** Test procedures and requirements

IEC 60384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.4		mounting	the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying wave soldering, reflow soldering (including vapour phase soldering) or conductive adhesive	no visible damage
4.5		visual inspection and dimension check	any applicable method using $\times 10$ magnification	in accordance with specification
4.6.1		capacitance	$f = 1$ kHz; measuring voltage $1 V_{rms}$ at $20$ °C	within specified tolerance
4.6.2		$\tan \delta$	$f = 1$ kHz; measuring voltage $1 V_{rms}$ at $20$ °C	in accordance with specification
4.6.3		insulation resistance	at $U_R$ (DC) for 1 minute	in accordance with specification
4.6.4		voltage proof	$2.5 \times U_R$ for 1 minute;	no breakdown or flashover
4.7.1		temperature characteristic	between minimum and maximum temperature	in accordance with specification
4.8		adhesion	a force of 5 N applied for 10 s to the line joining the terminations and in a plane parallel to the substrate	no visible damage
4.9		bond strength of plating on end face	mounted in accordance with CECC 32 100, paragraph 4.4	no visible damage
			conditions: bending 1 mm at a rate of 1 mm/s, radius jig. 340 mm	$\Delta C/C: \leq 10\%$
4.10	Tb	resistance to soldering heat	precondition: 120 to 150 °C for 1 minute; 260 $\pm 5$ °C for 10 $\pm 0.5$ s	the terminations shall be well tinned after recovery $\Delta C/C: \leq 10\%$
		resistance to leaching; jig clamps to the second component in the longitudinal line	260 $\pm 5$ °C for 30 $\pm 1$ s in a static solder bath	using visual enlargement of $\times 10$ , dissolution of the terminations shall not exceed 10%




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IEC 60384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.11	Ta	solderability	zero hour test, and test after storage (20 to 24 months) in original packing in normal atmosphere; unmounted chips completely immersed for $2 \pm 0.5$ s in a solder bath at $235 \pm 5$ °C	the terminations shall be well tinned
4.12	Na	rapid change of temperature	preconditioning; 5 cycles in the following sequence: 30 minutes at $-55$ °C, change within 30 minutes to $+125$ °C	no visible damage after 48 hours recovery: $\Delta C/C: \leq 15\%$
4.14	Ca	damp heat, steady state	initialization: 48 hours after $U_R$ at $40$ °C for 1 hour (for initial value measurement); $500 \pm 12$ hours at $40$ °C; 90 to 95% RH; $U_R$ applied	preconditioning: $U_R$ at $40$ °C for 1 hour after 48 hours recovery: $\Delta C/C: \pm 15\%$ $\tan \delta: 7\%$ $R_{ins}: 500 \text{ M}\Omega$ or $R_i C_R \geq 25$ s, whichever is less
4.15		endurance	preconditioning: $2 \times U_R$ at $125$ °C for 1 hour (initial value is measured after 48 hours, recovery at room temperature); 1000 hours at $125$ °C and $2 \times U_R$ applied	after 48 hours recovery: $\Delta C/C: \pm 20\%$ $\tan \delta: 7\%$ $R_{ins}: 2000 \text{ M}\Omega$ or $R_i C_R \geq 50$ s, whichever is less

**Surface-mount ceramic  
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<b>Revision</b>	<b>Date</b>	<b>Change Notification</b>	<b>Description</b>
Rev.9	2005 Jan 14	-	- Capacitance range extended
Rev.8	2003 Sep 26	-	- Size 1206 L1 dimensions revised. - Size 0402 and 0603 capacitance range expanded, refer to selection chart.
Rev.7	2003 Jun 26	-	-
Rev.6	2003 Mar 25	-	- Updated company logo.
Rev.5	2002 Jul 15	-	- Capacitance range changed from E6 into E12. - Capacitance range expanded to 4.7 $\mu$ F. - Figures 3 through 7 corrected.



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### Product Detail Information

Product Group	Multilayer Capacitor Chips and Arrays
Ordering Code	CC0402KRX7R6BB473
Ordering Code	223824715645
Unified CTC	C0402KRX7R6BB473
Additional Product Code	04022R473K6B20D
Description	General purpose, 0402, X7R, 47nF, $\pm 10\%$ , 10V, 7" paper
Status	Standard

Size Code	0402
Capacitance Tolerance	$\pm 10\%$
Packing Style	Paper Tape & 180mm (7") Reel
Dielectric Material (TC)	X7R
Rated Voltage	10V
Capacitance	47 nF

Related Data Sheets, Catalogs and Application Notes:

[Datasheet - X7R 10 V, Rev.9 \[211 kb\]](#)

[Product Selection Guide 2008 \(revision 1\) \[3.65 MB\]](#)

[Yageo Passive Components 2008 \[3.26 mb\]](#)

[Material declaration MLCCs type X7R, \[85 kb\]](#)

[Environmental declaration](#)

[Appl. note - DC, AC and Pulse load of Multilayer Ceramic Capacitors \[308 kb\]](#)

[MLCC sample kits \[177 kb\]](#)

[Appl. manual - MLCC application manual \[577 kb\]](#)

[Datasheet - MLCC introduction, Rev.9 \[98 kb\]](#)

[Datasheet - MLCC general data of packing, labelling, mounting, tests & requirements; Rev.7 \[159 kb\]](#)

[Flowchart - Quality Flowchart, Rev.4 \[80kb\]](#)

[Calculation tool - MLCC Spice Data](#)


[General info - Standard Values in a Decade \[8.39 kb\]](#)

[Requirements, Rev.7 \[158 kb\]](#)

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