Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-capacitance: Class 2, X5R and X7R

6.3 V TO 25 V

56 nF to 10 µF

Phycomp

Product Specification – Mar 02, 2004 V.3

Surface-mount ceramic multilayer capacitors

High-capacitance: Class 2, X5R and X7R 6.3 V to 25 V

FEATURES

- Five standard sizes
- Supplied in tape on reel
- Nickel-barrier end termination

APPLICATIONS

- PCs, hard disk, game PCs
- Power supplies
- DVDs, camcorders
- Mobile phones, PDAs

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 end terminations and finally covered with a layer of plated tin (NiSn). The terminations are lead-free. A cross section of the structure is shown in Fig.1.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Rated voltage U_r (DC)	6.3 V, 10 V, 16 V, and 25 V
Capacitance range 6.3 V 10 V 16 V 25 V	see note 1 1 μF to 10 μF 56 nF to 10 μF 56 nF to 10 μF 330 nF to 10 μF
Capacitance tolerance	±5%; ±10%; and ±20%
Sectional specifications	IEC 60384-22, first edition 2003
Detailed specification	based on IEC 60384-22-1
End termination	NiSn; lead-free
Climatic category (IEC 60 068): X5R X7R	 55/85/21 55/125/21

Note

1. Measured at 1.0 ±0.2 V and 1 kHz, using a four-gauge method.

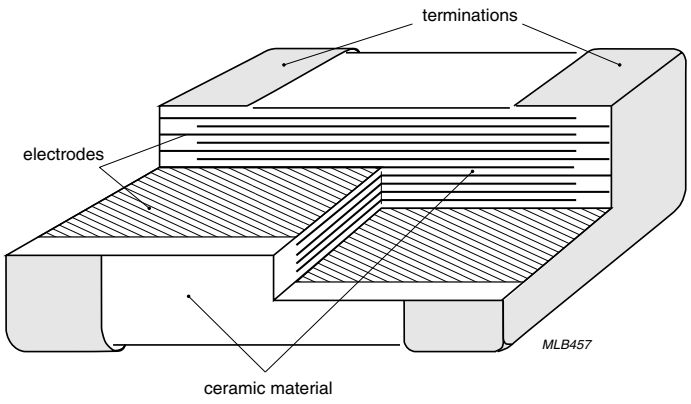
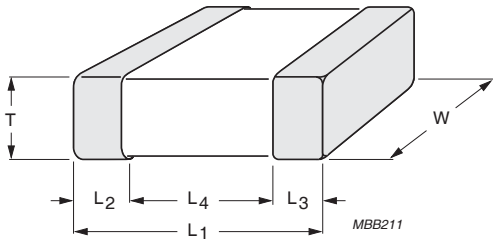


Fig.1 Construction of a ceramic multilayer capacitor.

MECHANICAL DATA



For dimensions see Table 1.

Fig.2. Component outline.

Physical dimensions

Table 1 Capacitor dimensions

CASE SIZE	L_1	W	T		L_2 and L_3		L_4 MIN.
			MIN.	MAX.	MIN.	MAX.	
Dimensions in millimetres							
0402	1.0 ±0.05	0.5 ±0.05	0.45	0.55	0.20	0.30	0.40
0603	1.6 ±0.10	0.8 ±0.10	0.73	0.87	0.15	0.65	0.35
0805	2.0 ±0.15	1.25 ±0.20	0.50	1.45	0.25	0.75	0.55
1206	3.2 ±0.20	1.6 ±0.20	0.75	1.80	0.25	0.75	1.40
1210	3.2 ±0.20	2.5 ±0.20	0.75	2.70	0.25	0.75	1.40
Dimensions in inches							
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 ±0.004	0.028	0.035	0.006	0.026	0.014
0805	0.079 ±0.006	0.049 ±0.006	0.020	0.057	0.010	0.030	0.022
1206	0.126 ±0.008	0.063 ±0.008	0.030	0.071	0.010	0.030	0.056
1210	0.126 ±0.008	0.098 ±0.008	0.030	0.106	0.010	0.030	0.056

Surface-mount ceramic multilayer capacitors

High-capacitance: Class 2, X5R and X7R 6.3 V to 25 V

SELECTION CHART FOR X5R/X7R 6.3 AND10 V

For additional 10 V products, please check our ”general purpose” datasheet.

C (µF)	LAST TWO DIGITS OF 12NC	6.3 V			10 V				
		0603	0805	1206	0402	0603	0805	1206	1210
0.056	46				0.5 ±0.05				
0.068	47								
0.082	48								
0.10	49				0.5 ±0.05				
0.15	52								
0.22	54				0.5 ±0.05				
0.27	55					0.8 ±0.07			
0.33	56								
0.39	57								
0.47	58								
0.56	59								
0.68	61								
1	63	0.8 ±0.07				0.8 ±0.07	1.25 ±0.1		
1.5	65								
2.2	67	0.8 ±0.07	1.25 ±0.1				1.25 ±0.1		
4.7	72		1.25 ±0.1	1.6 ±0.2				1.6 ±0.2	
10	76		1.25 ±0.2	1.6 ±0.2				1.6 ±0.2	1.9 ±0.2

Note

1. Values in shaded cells indicate thickness class in mm.
2. X5R: dark shading; X7R: light shading; both X5R and X7R: oblique line.

Surface-mount ceramic multilayer capacitors

High-capacitance: Class 2, X5R and X7R 6.3 V to 25 V

SELECTION CHART FOR X5R/X7R 16 V AND 25 V

For additional 16 V, 25 V, and 50 V products, please check our ”general purpose” datasheet.

C (µF)	LAST TWO DIGITS OF 12NC	16 V					25 V	
		0402	0603	0805	1206	1210	0603	1210
0.056	46	0.5 ±0.05						
0.068	47							
0.082	48							
0.10	49							
0.15	52		0.8 ±0.07					
0.22	54							
0.27	55							
0.33	56		0.8 ±0.07				0.8 ±0.07	
0.39	57		0.8 ±0.07					
0.47	58		0.8 ±0.07				0.8 ±0.07	
0.56	59							
0.68	61							
1	63			1.25 ±0.1				
1.5	65							
2.2	67							
4.7	72					1.9 ±0.2		1.9 ±0.2
10	76					2.5 ±0.2		2.5 ±0.2

Note

1. Values in shaded cells indicate thickness class in mm.
2. X5R: dark shading; X7R: light shading; both X5R and X7R: oblique line.

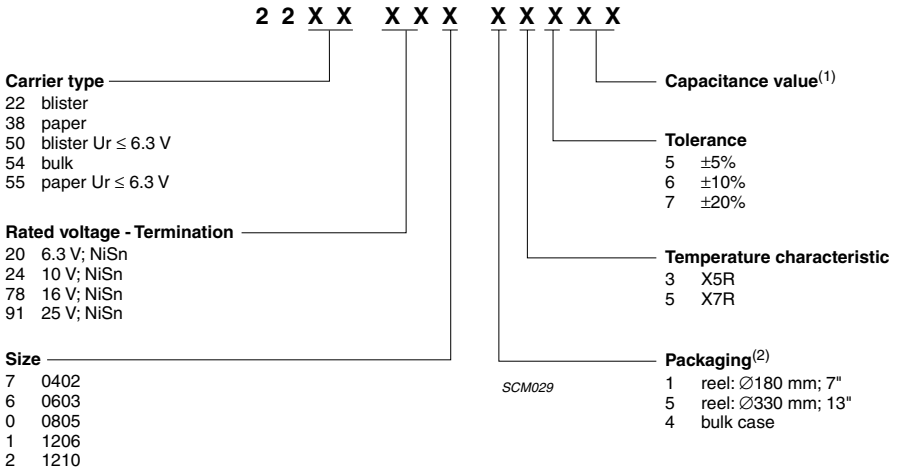
Thickness classification and packing quantities for 6.3 V to 25 V

THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH QUANTITY PER REEL				QUANTITY PER BULK CASE		
	∅180 mm; 7"		∅330 mm; 13"				
	PAPER	BLISTER	PAPER	BLISTER	0402	0603	0805
	8 mm	8 mm	8 mm	8 mm			
0.5 ±0.05	10,000	–	50,000	–	50,000	–	–
0.6 ±0.1	4,000	–	20,000	–	–	–	10,000
0.8 ±0.07	4,000	–	15,000	–	–	15,000	–
0.85 ±0.1	4,000	–	15,000	–	–	–	8,000
1.15 ±0.1	–	3,000	–	10,000	–	–	–
1.25 ±0.1	–	3,000	–	10,000	–	–	5,000
1.25 ±0.2	–	3,000	–	10,000	–	–	5,000
1.6 ±0.2	–	2,000	–	–	–	–	–
1.9 ±0.2	–	2,000	–	–	–	–	–
2.5 ±0.2	–	1,000	–	–	–	–	–

ORDERING INFORMATION FOR 6.3 V TO 25 V

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

Ordering code 12NC (preferred)



(1) Refer to chapters "Selection chart for X5R/X7R 6.3 and10 V" and "Selection chart for X5R/X7R 16 V and 25 V".

(2) Quantity on reel depends on thickness classification; see section "Thickness classification and packing quantities for 6.3 V to 25 V".

Phycomp clear text code

EXAMPLE: 06032B225M5B20D

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	Termination	Packing	Marking	Series
0402 0603 0805 1206 1210	2B = X5R 2R = X7R	225 = 2,200,000 pF; the third digit signifies the multiplying factor: 3 = × 1000 4 = × 10 000 5 = × 100 000 6 = × 1 000 000 7 = × 10 000 000	J = ±5% K = ±10% M = ±20%	5 = 6.3 V 6 = 10 V 7 = 16 V 8 = 25 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

Product specification, ordering and packaging information for 0402 to 1210 sizes

Table 2 For 0402 (1005 metric) size

TC	SIZE	CAP. VALUE (μF)	CAP. TOL. (%)	DC RATED VOLTAGE (V)	D.F. (%)	THICK-NESS (mm)	12NC ORDERING CODE (1)	PHYCOMP CLEAR TEXT CODE (2)	QUANTITY PER 7" REEL (3)
X7R	0402	0.056	±10; ±20	10	5.0	0.50	2238 247 15_46	04022R563_6B20D	10,000
X5R	0402	0.056	±10; ±20	16	5.0	0.50	2238 787 13_46	04022B563_7B20D	10,000
X7R	0402	0.056	±10; ±20	16	5.0	0.50	2238 787 15_46	04022R563_7B20D	10,000
X7R	0402	0.068	±10; ±20	10	5.0	0.50	2238 247 15_47	04022R683_6B20D	10,000
X5R	0402	0.068	±10; ±20	16	5.0	0.50	2238 787 13_47	04022B683_7B20D	10,000
X7R	0402	0.068	±10; ±20	16	5.0	0.50	2238 787 15_47	04022R683_7B20D	10,000
X7R	0402	0.082	±10; ±20	10	5.0	0.50	2238 247 15_48	04022R823_6B20D	10,000
X5R	0402	0.082	±10; ±20	16	5.0	0.50	2238 787 13_48	04022B823_7B20D	10,000
X7R	0402	0.082	±10; ±20	16	5.0	0.50	2238 787 15_48	04022R823_7B20D	10,000
X5R	0402	0.1	±10; ±20	10	5.0	0.50	2238 247 13_49	04022B104_6B20D	10,000
X7R	0402	0.1	±10; ±20	10	5.0	0.50	2238 247 15_49	04022R104_6B20D	10,000
X5R	0402	0.1	±10; ±20	16	5.0	0.50	2238 787 13_49	04022B104_7B20D	10,000
X7R	0402	0.1	±10; ±20	16	5.0	0.50	2238 787 15_49	04022R104_7B20D	10,000
X5R	0402	0.22	±10; ±20	10	7.0	0.50	2238 247 13_54	0402 2B224_5B20D	10,000

Note

1. Specify capacitance tolerance on position 10 of the 12NC: 6 = ±10%; 7 = ±20%.
   For ordering code of large reel packing (330 mm/13"), change position 8 of the 12NC: specify 5 instead of 1.
2. Specify capacitance tolerance on position 10 of the Phycomp clear text code: K = ±10%; M = ±20%.
   For ordering code of large reel packing (330 mm/13"), change position 13 of Phycomp clear text code: specify 3 instead of 2.
3. For quantity per reel for large reel (330 mm/13") packing, see section "Thickness classification and packing quantities".

Table 3 For 0603 (1608 metric) size

TC	SIZE	CAP. VALUE (μF)	CAP. TOL. (%)	DC RATED VOLTAGE (V)	D.F. (%)	THICK-NESS (mm)	12NC ORDERING CODE (1)	PHYCOMP CLEAR TEXT CODE (2)	QUANTITY PER 7'' REEL (3)
X7R	0603	0.22	±5; ±10; ±20	10	5.0	0.80	2238 246 15_54	04022R563_6B20D	4,000
X7R	0603	0.27	±5; ±10; ±20	10	5.0	0.80	2238 246 15_55	06032R224_6B20D	4,000
X7R	0603	0.27	±5; ±10; ±20	16	5.0	0.80	2238 786 15_55	06032R274_6B20D	4,000
X7R	0603	0.33	±5; ±10; ±20	10	5.0	0.80	2238 246 15_56	06032R274_7B20D	4,000
X5R	0603	0.33	±10; ±20	16	5.0	0.80	2238 786 13_56	06032R334_6B20D	4,000
X7R	0603	0.33	±5; ±10; ±20	16	5.0	0.80	2238 786 15_56	06032B334_7B20D	4,000
X5R	0603	0.33	±10; ±20	25	5.0	0.80	2238 916 13_56	06032R334_7B20D	4,000
X7R	0603	0.39	±5; ±10; ±20	10	5.0	0.80	2238 246 15_57	06032B334_8B20D	4,000
X7R	0603	0.39	±5; ±10; ±20	16	5.0	0.80	2238 786 15_57	06032R394_6B20D	4,000
X7R	0603	0.47	±5; ±10; ±20	10	5.0	0.80	2238 246 15_58	06032R394_7B20D	4,000
X5R	0603	0.47	±10; ±20	16	5.0	0.80	2238 786 13_58	06032R474_6B20D	4,000
X7R	0603	0.47	±5; ±10; ±20	16	5.0	0.80	2238 786 15_58	06032B474_7B20D	4,000
X5R	0603	0.47	±10; ±20	25	5.0	0.80	2238 916 13_58	06032R474_7B20D	4,000
X5R	0603	1	±10; ±20	6.3	7.0	0.80	2238 206 13_63	06032B474_8B20D	4,000
X5R	0603	1	±10; ±20	10	7.0	0.80	2238 246 13_63	06032B105_5B20D	4,000
X5R	0603	2.2	±10; ±20	6.3	10.0	0.80	2238 206 13_67	06032B105_6B20D	4,000

Note

1. Specify capacitance tolerance on position 10 of the 12NC: 5 = ±5%; 6 = ±10%; 7 = ±20%.
   For ordering code of large reel packing (330 mm/13''), change position 8 of the 12NC: specify 5 instead of 1.
2. Specify capacitance tolerance on position 10 of the Phycomp clear text code: J = ±5%; K = ±10%; M = ±20%.
   For ordering code of large reel packing (330 mm/13''), change position 13 of Phycomp clear text code: specify 3 instead of 2.
3. For quantity per reel for large reel (330 mm/13") packing, see section "Thickness classification and packing quantities".

Table 4 For 0805 (2012 metric) size

TC	SIZE	CAP. VALUE (μF)	CAP. TOL. (%)	DC RATED VOLTAGE (V)	D.F. (%)	THICK-NESS (mm)	12NC ORDERING CODE (1)	PHYCOMP CLEAR TEXT CODE (2)	QUANTITY PER 7" REEL (3)
X5R	0805	1	±10; ±20	10	5.0	1.25	2222 240 13_63	08052B105_6BB0D	3,000
X7R	0805	1	±10; ±20	10	5.0	1.25	2222 240 15_63	08052R105_6BB0D	3,000
X7R	0805	1	±10; ±20	16	5.0	1.25	2222 780 15_63	08052R105_7BB0D	3,000
X5R	0805	2.2	±10; ±20	6.3	7.0	1.25	2250 200 13_67	08052B225_5BB0D	3,000
X5R	0805	2.2	±10; ±20	10	7.0	1.25	2222 240 13_67	08052B225_6BB0D	3,000
X5R	0805	4.7	±10; ±20	6.3	7.0	1.25	2250 200 13_72	08052B475_5BB0D	3,000
X5R	0805	10	±10; ±20	6.3	10	1.25	2250 200 13_76	08052B106_5BB0D	3,000

Table 5 For 1206 (3216 metric) size

TC	SIZE	CAP. VALUE (μF)	CAP. TOL. (%)	DC RATED VOLTAGE (V)	D.F. (%)	THICK-NESS (mm)	12NC ORDERING CODE (1)	PHYCOMP CLEAR TEXT CODE (2)	QUANTITY PER 7" REEL (3)
X5R	1206	4.7	±10; ±20	6.3	7.5	1.6	2250 201 13_72	12062B475_5BB0D	2,000
X5R	1206	4.7	±10; ±20	10	5.0	1.6	2222 241 13_72	12062B475_6BB0D	2,000
X7R	1206	4.7	±10; ±20	10	5.0	1.6	2222 241 15_72	12062R475_6BB0D	2,000
X5R	1206	10	±10; ±20	6.3	7.5	1.6	2250 201 13_76	12062B106_5BB0D	2,000
X5R	1206	10	±10; ±20	10	7.5	1.6	2222 241 13_76	12062B106_6BB0D	2,000

Table 6 For 1210 (3225 metric) size

TC	SIZE	CAP. VALUE (μF)	CAP. TOL. (%)	DC RATED VOLTAGE (V)	D.F. (%)	THICK-NESS (mm)	12NC ORDERING CODE (1)	PHYCOMP CLEAR TEXT CODE (2)	QUANTITY PER 7" REEL (3)
X5R	1210	4.7	±10; ±20	16	3.5	1.9	2222 782 13_72	12102B475_7BB0D	2,000
X7R	1210	4.7	±10; ±20	16	3.5	1.9	2222 782 15_72	12102R475_7BB0D	2,000
X5R	1210	4.7	±10; ±20	25	2.5	1.9	2222 912 13_72	12102B475_8BB0D	2,000
X5R	1210	10	±10; ±20	10	3.5	1.9	2222 242 13_76	12102B106_6BB0D	2,000
X5R	1210	10	±10; ±20	16	3.5	2.5	2222 782 13_76	12102B106_7BB0D	1,000
X5R	1210	10	±10; ±20	25	2.5	2.5	2222 912 13_76	12102B106_8BB0D	1,000

Note

1. Specify capacitance tolerance on position 10 of the 12NC: 6 = ±10%; 7 = ±20%.
   For ordering code of large reel packing (330 mm/13"), change position 8 of the 12NC: specify 5 instead of 1.
2. Specify capacitance tolerance on position 10 of the Phycomp clear text code: K = ±10%; M = ±20%.
   For ordering code of large reel packing (330 mm/13"), change position 13 of Phycomp clear text code: specify F instead of B.
3. For quantity per reel for large reel (330 mm/13") packing, see section "Thickness classification and packing quantities".

ELECTRICAL CHARACTERISTICS

Class 2 capacitors; X5R/X7R dielectric; NiSn terminations

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

DESCRIPTION	VALUE
Capacitance range; note 1	56 nF to 10 μF
Capacitance tolerance; note 2	±5%, ±10%, and ±20%
Dissipation factor (D.F.); note 1	See table 2-7
Insulation resistance after 1 minute at U_r (DC)	$R_{ins} \geq 10$ GΩ or $R_{ins} \times C \geq 500$ seconds whichever is less
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient)	±15%
Operating temperature range:	
X5R	−55 °C to +85 °C
X7R	−55 °C to +125 °C

Note

1. Measured at 1.0 ±0.2 V and 1 kHz, using a four-gauge method.
2. ±5% for X7R 0603 only; others on request.

TESTS AND REQUIREMENTS

Table 8 Soldering method, test specification category and requirement details.

SIZE	CAP. VALUE (μF)	DC RATED VOLTAGE (V)	TC	SOLDERING METHOD	DISSIPATION FACTOR AFTER DAMP HEAT TEST	DISSIPATION FACTOR AFTER ENDURANCE TEST
					MAX.	MAX.
0402	0.056	10	X7R	reflow	2 × initial value	2 × initial value
0402	0.056	16	X5R	reflow	2 × initial value	2 × initial value
0402	0.056	16	X7R	reflow	2 × initial value	2 × initial value
0402	0.068	10	X7R	reflow	2 × initial value	2 × initial value
0402	0.068	16	X5R	reflow	2 × initial value	2 × initial value
0402	0.068	16	X7R	reflow	2 × initial value	2 × initial value
0402	0.082	10	X7R	reflow	2 × initial value	2 × initial value
0402	0.082	16	X5R	reflow	2 × initial value	2 × initial value
0402	0.082	16	X7R	reflow	2 × initial value	2 × initial value
0402	0.1	10	X5R	reflow	2 × initial value	2 × initial value
0402	0.1	10	X7R	reflow	2 × initial value	2 × initial value
0402	0.1	16	X5R	reflow	2 × initial value	2 × initial value
0402	0.1	16	X7R	reflow	2 × initial value	2 × initial value
0402	0.22	10	X5R	reflow	2 × initial value	2 × initial value
0603	0.27	10	X7R	wave/reflow	2 × initial value	2 × initial value
0603	0.27	16	X7R	wave/reflow	2 × initial value	2 × initial value
0603	0.33	10	X7R	wave/reflow	2 × initial value	2 × initial value
0603	0.33	16	X5R	wave/reflow	2 × initial value	2 × initial value
0603	0.33	16	X7R	wave/reflow	2 × initial value	2 × initial value
0603	0.33	25	X5R	wave/reflow	2 × initial value	2 × initial value
0603	0.39	10	X7R	wave/reflow	2 × initial value	2 × initial value
0603	0.39	16	X7R	wave/reflow	2 × initial value	2 × initial value
0603	0.47	10	X7R	reflow	2 × initial value	2 × initial value
0603	0.47	16	X5R	reflow	2 × initial value	2 × initial value
0603	0.47	16	X7R	reflow	2 × initial value	2 × initial value
0603	0.47	25	X5R	reflow	2 × initial value	2 × initial value
0603	1	6.3	X5R	reflow	2 × initial value	2 × initial value
0603	1	10	X5R	reflow	2 × initial value	2 × initial value
0603	2.2	6.3	X5R	reflow	2 × initial value	2 × initial value

Table 8 Soldering method, test specification category and requirement details (continued).

SIZE	CAP. VALUE (μF)	DC RATED VOLTAGE (V)	TC	SOLDERING METHOD	DISSIPATION FACTOR AFTER DAMP HEAT TEST	DISSIPATION FACTOR AFTER ENDURANCE TEST
					MAX.	MAX.
0805	1	10	X5R	wave/reflow	2 × initial value	2 × initial value
0805	1	10	X7R	wave/reflow	2 × initial value	2 × initial value
0805	1	16	X7R	wave/reflow	2 × initial value	2 × initial value
0805	2.2	6.3	X5R	reflow	2 × initial value	2 × initial value
0805	2.2	10	X5R	reflow	2 × initial value	2 × initial value
0805	4.7	6.3	X5R	reflow	2 × initial value	2 × initial value
0805	10	6.3	X5R	reflow	2 × initial value	2 × initial value
1206	4.7	6.3	X5R	reflow	2 × initial value	2 × initial value
1206	4.7	10	X5R	reflow	2 × initial value	2 × initial value
1206	4.7	10	X7R	reflow	2 × initial value	2 × initial value
1206	10	6.3	X5R	reflow	2 × initial value	2 × initial value
1206	10	10	X5R	reflow	2 × initial value	2 × initial value
1210	4.7	16	X5R	reflow	2 × initial value	2 × initial value
1210	4.7	16	X7R	reflow	2 × initial value	2 × initial value
1210	4.7	25	X5R	reflow	2 × initial value	2 × initial value
1210	10	10	X5R	reflow	2 × initial value	2 × initial value
1210	10	16	X5R	reflow	2 × initial value	2 × initial value
1210	10	25	X5R	reflow	2 × initial value	2 × initial value

Table 9 Test procedures and requirements.

IEC 60384-22 CLAUSE	TEST	PROCEDURE	REQUIREMENTS
4.3	mounting	the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying reflow soldering or also wave soldering as indicated in Table 8	no visible damage
4.4	visual inspection and dimension check	any applicable method using ×10 magnification	in accordance with specification indicated in table 1
4.5.1	capacitance	f = 1 kHz for $C \leq 10$ μF; measuring voltage 1 V_{rms} at 20 °C f = 120 Hz for $C > 10$ μF; measuring voltage 0.5 V_{rms} at 20 °C	within specified tolerance
4.5.2	dissipation factor (D.F.)	f = 1 kHz for $C \leq 10$ μF; measuring voltage 1 V_{rms} at 20 °C f = 120 Hz for $C > 10$ μF; measuring voltage 0.5 V_{rms} at 20 °C	in accordance with specification indicated in table 2-7
4.5.3	insulation resistance	at U_r (DC) for 1 minute	in accordance with specification
4.5.4.2	voltage proof	$2.5 \times U_r$ for 1 minute	no breakdown or flashover
4.6	temperature characteristic	between minimum and maximum temperature	in accordance with specification
4.15	adhesion	for size ≥ 0603: a force of 5 N applied for 10 s to the line joining the terminations and in a plane parallel to the substrate for size 0402: a force of 2.5 N applied	no visible damage
4.8	bond strength of plating on end face	mounted in accordance with IEC 60384-22 paragraph 4.3	no visible damage
		conditions: bending 1 mm at a rate of 1 mm/s, radius jig. 340 mm	$\lvert\Delta C/C\rvert$: ≤10%

IEC 60384-22 CLAUSE	TEST	PROCEDURE	REQUIREMENTS
4.9	resistance to soldering heat	preconditioning: 150 +0/−10 °C for 1 hour, then keep for 24 ±1 hours at room temperature preheating: for size≤1206: 120 to 150 °C for 1 minute; preheating: for size>1206: 100 to 120 °C for 1 minute and 170 to 200 °C for 1 minute; solder bath temperature: 260 ±5 °C; dipping time 10 ±0.5 s; recovery time 24 ±2 hours	the terminations shall be well tinned; $\lvert\Delta C/C\rvert$: ≤10% D.F.: within initial specified value R_{ins}: within initial specified value
4.10	solderability	preheating: 80 to 140 °C for 30 seconds; unmounted chips completely immersed in a solder bath at 235 ±5 °C dipping time: 2 ±0.5 s	the terminations shall be well tinned
4.11	rapid change of temperature	preconditioning: 150 +0/−10 °C for 1 hour, then keep for 24 ±1 hours at room temperature 5 cycles with following detail: 30 minutes at lower Category Temperature; 30 minutes at upper Category Temperature recovery time 24 ±2 hours	no visible damage; $\lvert\Delta C/C\rvert$: ≤ 15%; D.F.: within initial specified value R_{ins}: within initial specified value
4.13	damp heat steady state	initial measurements: after 150 +0/−10 °C for 1 hour, then keep for 24 ±1 hours at room temperature duration and conditions: 500 ±12 hours at 40 ±2 °C; 90 to 95% RH final measurement: perform a heat treatment at 150 +0/−10 °C for 1 hour, final measurements shall be carried out 24 ±1 hours after recovery at room temperature without load	$\lvert\Delta C/C\rvert$: ≤ 20% D.F.: 2 × initial value max. R_{ins}: 1,000 MΩ or $R_i C_R \geq 50$ s, whichever is less

IEC 60384-22 CLAUSE	TEST	PROCEDURE	REQUIREMENTS
4.14	endurance	initial measurements: after 150 +0/−10 °C for 1 hour, then keep for 24 ±1 hours at room tempature duration and conditions: 1,000 ±12 hours at upper temperature category with 1.5 × U_r voltage applied final measurement: perform a heat treatment at 150 +0/−10 °C for 1 hour, final measurements shall be carried out 24 ±1 hours after recovery at room temperature without load	|ΔC/C|: ≤ 20% D.F.: 2 × initial value max. R_{ins}: 1,000 MΩ or R_iC_R ≥ 50 s, whichever is less
Tests in accordance with the schedule of IEC publication 60384-10			
4.10	resistance to leaching	solder bath temperature: 260 ±5 °C; dipping time 30 ±0.5 s	using visual enlargement of ×10, dissolution of the terminations shall not exceed 10%
4.14	damp heat, with U_r load	initial measurements: after 150 +0/−10 °C for 1 hour, then keep for 24 ±1 hours at room temperature duration and conditions: 500 ±12 hours at 40 ±2 °C; 90 to 95% RH; U_r applied final measurement: perform a heat treatment at 150 +0/−10 °C for 1 hour, final measurements shall be carried out 24 ±1 hours after recovery at room temperature without load	|ΔC/C|: ≤ 20% D.F.: 2 × initial value max. R_{ins}: 500 MΩ or R_iC_R ≥ 25 s, whichever is less

REVISION HISTORY

Revision	Date	Change Notification	Description
Rev. 0	2002 Aug 16	-	-
Rev.1	2003 Sep 16	-	- Updated company logo
Rev.2	2004 Feb 25	-	- Test and requirement revised.
Rev.3	2004 Mar 02	-	- Test and requirement revised.