Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

General Purpose & High Capacitance

Class 2, X7R

6.3 V TO 50 V

100 pF to 22 µF

RoHS compliant & Halogen Free

YAGEO Phycomp

Product Specification – May 31, 2016 V.14

SCOPE

This specification describes X7R series chip capacitors with lead-free terminations.

APPLICATIONS

- PCs, Hard disk, Game PCs
- DVDs, Video cameras
- Mobile phones
- Data processing

FEATURES

- Supplied in tape on reel
- Nickel-barrier end termination
- RoHS compliant
- Halogen Free compliant

ORDERING INFORMATION - GLOBAL PART NUMBER, PHYCOMP CTC & 12NC

All part numbers are identified by the series, size, tolerance, TC material, packing style, voltage, process code, termination and capacitance value.

YAGEO BRAND ordering code

GLOBAL PART NUMBER (PREFERRED)

CC	XXXX	X	X	X7R	X	BB	XXX
	(1)	(2)	(3)		(4)		(5)

(1) SIZE – INCH BASED (METRIC)

0201 (0603)
0402 (1005)
0603 (1608)
0805 (2012)
1206 (3216)
1210 (3225)
1812 (4532)

(2) TOLERANCE

J = ±5% (1)
K = ±10%
M = ±20%

(3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch
K = Blister taping reel; Reel 7 inch
P = Paper/PE taping reel; Reel 13 inch
F = Blister taping reel; Reel 13 inch

(4) RATED VOLTAGE

5 = 6.3 V
6 = 10 V
7 = 16 V
8 = 25 V
9 = 50 V

(5) CAPACITANCE VALUE

2 significant digits+number of zeros
The 3rd digit signifies the multiplying factor, and letter R is decimal point
Example: 103 = 10×10^3 = 10,000 pF = 10 nF

NOTE

1. Tolerance ±5% is not available for full product range, please contact local sales force before ordering

CONSTRUCTION

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.

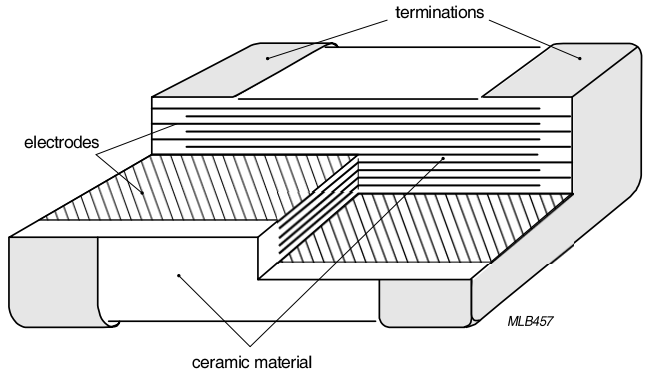


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table 1 For outlines see fig. 2

TYPE	L_1 (mm)	W (mm)	T (MM)	L_2 / L_3 (mm) min.	L_2 / L_3 (mm) max.	L_4 (mm) min.
0201	0.6 ±0.03	0.3 ±0.03	Refer to table 2 to 4	0.10	0.20	0.20
0402	1.0 ±0.05	0.5 ±0.05		0.15	0.30	0.40
0603	1.6 ±0.10 (1)	0.8 ±0.10 (1)		0.20	0.60	0.40
	1.6 ±0.15 (2)	0.8 ±0.15 (2)				
	1.6 ±0.20 (3)	0.8 ±0.20 (3)				
0805	2.0 ±0.10 (1)	1.25 ±0.10 (1)		0.25	0.75	0.55
	2.0 ±0.20 (2)	1.25 ±0.20 (2)				
1206	3.2 ±0.15 (1)	1.6 ±0.15 (1)		0.25	0.75	1.40
	3.2 ±0.20 (2)	1.6 ±0.20 (2)				
	3.2 ±0.30 (3)	1.6 ±0.30 (3)				
1210	3.2 ±0.20 (1)	2.5 ±0.20 (1)		0.25	0.75	1.40
	3.2 ±0.40 (2)	2.5 ±0.30 (2)				
1812	4.5 ±0.20 (1)	3.2 ±0.20 (1)		0.25	0.75	2.20
	4.5 ±0.40 (2)	3.2 ±0.40 (2)				

NOTE

1. Dimension for size 0603, C < 2.2 µF; 0805 to 1812, C ≤ 100nF
2. Dimension for size 0603, C = 1µF; 50V; 0805 to 1812, C > 100 nF
3. Dimension for size 0603, C = 4.7µF, 6.3V; 0603, C = 2.2 µF, 16V; 1206, C = 22 µF, 16V

OUTLINES

For dimension see Table 1

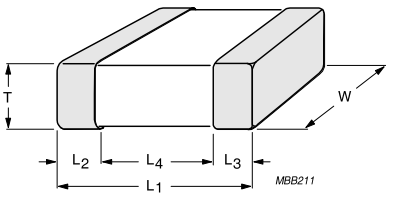


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 2 Sizes from 0201 to 0402

CAP.	0201					0402				
	6.3 V	10 V	16 V	25 V	50 V	6.3 V	10 V	16 V	25 V	50 V
100 pF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
150 pF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
220 pF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
330 pF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
470 pF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
680 pF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
1.0 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
1.5 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03		0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
2.2 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03		0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
3.3 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03		0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
4.7 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03		0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
6.8 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03		0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
10 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03		0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
15 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
22 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
33 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
47 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
68 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	
100 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05
150 nF										
220 nF						0.5±0.05	0.5±0.05	0.5±0.05		
330 nF										
470 nF						0.5±0.05	0.5±0.05			
680 nF										
1.0 µF						0.5±0.05				
2.2 µF										
4.7 µF										
10 µF										
22 µF										

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before ordering

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 3 Sizes from 0603 to 0805

CAP.	0603					0805				
	6.3 V	10 V	16 V	25 V	50 V	6.3 V	10 V	16 V	25 V	50 V
100 pF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1					
150 pF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1					
220 pF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
330 pF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
470 pF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
680 pF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
1.0 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
1.5 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
2.2 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
3.3 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
4.7 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
6.8 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
10 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
15 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
22 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
33 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
47 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
68 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
100 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
150 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
220 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.25±0.2
330 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1		1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
470 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
680 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1		1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
1.0 µF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.15	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
2.2 µF	0.8±0.1	0.8±0.1	0.8±0.2			1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
4.7 µF	0.8±0.2					1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	
10 µF						1.25±0.2	1.25±0.2	1.25±0.2		
22 µF										

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before ordering

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 4 Size 1206

CAP.	1206				
	6.3 V	10 V	16 V	25 V	50 V
100 pF					
150 pF					
220 pF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
330 pF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
470 pF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
680 pF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
1.0 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
1.5 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
2.2 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
3.3 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
4.7 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
6.8 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
10 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
15 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
22 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
33 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
47 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
68 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
100 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
150 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.15±0.1
220 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.15±0.1
330 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
470 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.0±0.1
680 nF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1	1.6±0.2
1.0 µF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1	1.6±0.2
2.2 µF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1	1.6±0.2
4.7 µF	1.6±0.2	1.6±0.2	1.6±0.2	1.6±0.2	1.6±0.2
10 µF	1.6±0.2	1.6±0.2	1.6±0.2	1.6±0.2	
22 µF	1.6±0.2	1.6±0.2	1.6±0.3		
47 µF					

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before ordering
4. Please contact local sales force for special ordering code before ordering

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 5 Sizes from 1210 to 1812

CAP.	1210					1812
	6.3 V	10 V	16 V	25 V	50 V	50 V
100 pF						
150 pF						
220 pF						
330 pF						
470 pF						
680 pF						
1.0 nF						
1.5 nF						
2.2 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	
3.3 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	
4.7 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
6.8 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
10 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
15 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
22 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
33 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
47 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
68 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
100 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.15±0.1
150 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.15±0.1	1.15±0.1
220 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.15±0.1	1.15±0.1
330 nF	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	1.15±0.1	1.15±0.1
470 nF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1	1.25±0.2	1.15±0.1
680 nF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1	1.25±0.2	1.6±0.2
1.0 µF	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.6±0.2
2.2 µF					1.9±0.2	
4.7 µF	1.9±0.2	1.9±0.2	1.9±0.2	1.9±0.2	2.5±0.3	
10 µF	1.9±0.2	1.9±0.2	1.9±0.2	1.9±0.2		
22 µF	2.5±0.2	2.5±0.2	2.5±0.2	2.5±0.2		
47 µF	2.5±0.2	2.5±0.2				

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before ordering
4. Please contact local sales force for special ordering code before ordering

THICKNESS CLASSES AND PACKING QUANTITY

Table 6

SIZE CODE	THICKNESS CLASSIFICATION	TAPE WIDTH QUANTITY PER REEL	Ø180 MM / 7 INCH		Ø330 MM / 13 INCH		QUANTITY PER BULK CASE
			Paper	Blister	Paper	Blister	
0201	0.3 ±0.03 mm	8 mm	15,000	---	50,000	---	---
0402	0.5 ±0.05 mm	8 mm	10,000	---	50,000	---	50,000
0603	0.8 ±0.1 mm	8 mm	4,000	---	15,000	---	15,000
0805	0.6 ±0.1 mm	8 mm	4,000	---	20,000	---	10,000
	0.85 ±0.1 mm	8 mm	4,000	---	15,000	---	8,000
	1.25 ±0.2 mm	8 mm	---	3,000	---	10,000	5,000
1206	0.6 ±0.1 mm	8 mm	4,000	---	20,000	---	---
	0.85 ±0.1 mm	8 mm	4,000	---	15,000	---	---
	1.00 / 1.15 ±0.1 mm	8 mm	---	3,000	---	10,000	---
	1.25 ±0.2 mm	8 mm	---	3,000	---	10,000	---
	1.6 ±0.15 mm	8 mm	---	2,500	---	10,000	---
	1.6 ±0.2 mm	8 mm	---	2,000	---	8,000	---
1210	0.6 / 0.7 ±0.1 mm	8 mm	---	4,000	---	15,000	---
	0.85 ±0.1 mm	8 mm	---	4,000	---	10,000	---
	1.15 ±0.1 mm	8 mm	---	3,000	---	10,000	---
	1.15 ±0.15 mm	8 mm	---	3,000	---	10,000	---
	1.25 ±0.2 mm	8 mm	---	3,000	---	---	---
	1.5 ±0.1 mm	8 mm	---	2,000	---	---	---
	1.6 / 1.9 ±0.2 mm	8 mm	---	2,000	---	---	---
	2.0 ±0.2 mm	8 mm	---	2,000 1,000	---	---	---
	2.5 ±0.2 mm	8 mm	---	1,000 500	---	---	---
1808	1.15 ±0.15 mm	12 mm	---	3,000	---	---	---
	1.25 ±0.2 mm	12 mm	---	3,000	---	---	---
	1.35 ±0.15 mm	12 mm	---	2,000	---	---	---
	1.5 ±0.1 mm	12 mm	---	2,000	---	---	---
	1.6 ±0.2 mm	12 mm	---	2,000	---	8,000	---
	2.0 ±0.2 mm	12 mm	---	2,000	---	---	---
1812	0.6 / 0.85 ±0.1 mm	12 mm	---	2,000	---	---	---
	1.15 ±0.1 mm	12 mm	---	1,000	---	---	---
	1.25 ±0.2 mm	12 mm	---	1,000	---	---	---
	1.5 ±0.1 mm	12 mm	---	1,000	---	---	---
	1.6 ±0.2 mm	12 mm	---	1,000	---	---	---
	2.0 ±0.2 mm	12 mm	---	1,000	---	---	---
	2.5 ±0.2 mm	12 mm	---	500	---	---	---

ELECTRICAL CHARACTERISTICS

X7R DIELECTRIC CAPACITORS; NISN TERMINATIONS

Unless otherwise specified, all test and measurements shall be made under standard atmospheric conditions for testing as given in 5.3 of IEC 60068-1:

- Temperature: 15 °C to 35 °C
- Relative humidity: 25% to 75%
- Air pressure: 86 kPa to 106 kPa

Before the measurements are made, the capacitor shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature.

The period as prescribed for recovery at the end of a test is normally sufficient for this purpose.

Table 7

DESCRIPTION								VALUE
Capacitance range								100 pF to 47 µF
Capacitance tolerance								±5%, ±10%, ±20%
Dissipation factor (D.F.)								
X7R		0201	0402	0603	0805	1206	1210	
	≤10V	100pF to 10nF	100pF to 100nF	100pF to 1uF	150pF to 2.2uF	220pF to 2.2uF	2.2nF to 2.2uF	≤5%
			220nF to 470nF	2.2uF to 4.7uF	4.7uF to 10uF	4.7uF to 22uF	4.7uF to 47uF	≤10%
			1uF					≤12.5%
	16V	100pF to 1.2nF	100pF to 22nF	100pF to 220nF	150pF to 470nF	220pF to 1µF	2.2nF to 1µF	≤ 3.5%
		1.5nF to 10nF	27nF to 100nF	470nF to 2.2uF	680 nF to 2.2µF	2.2uF	2.2uF to 10uF	≤ 5%
			220nF		4.7uF to 10uF	4.7uF to 22uF	22uF	≤10%
	25V	100pF to 470pF	100pF to 10nF	100pF to 39nF	150pF to 180nF	220pF to 680nF	2.2nF to 1µF	≤ 2.5%
			12 nF to 47nF	47nF to 220nF	220nF to 470nF	1uF		≤ 3.5%
		560pF to 10nF	56nF to 100nF		680nF to 1µF	2.2uF	2.2uF	≤ 5%
				270nF to 1uF	2.2uF to 4.7uF	4.7uF to 22uF	4.7uF to 22uF	≤10%
	50V	100pF to 1nF	100pF to 10nF	100pF to 39nF	150pF to 180nF	220pF to 470nF	2.2nF to 1µF	≤2.5%
			12 nF to 47nF	47nF to 220nF	220nF to 470nF	680nF to 1µF		≤ 3.5%
					680nF			≤ 5%
			100nF	470nF to 1uF	1uF to 2.2uF	2.2uF to 4.7uF	2.2uF to 10uF	≤10%
Insulation resistance after 1 minute at U_r (DC)					$R_{ins} \geq 10$ GΩ or $R_{ins} \times C_r \geq 500$(100) seconds whichever is less			
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):								±15%
Operating temperature range:								–55 °C to +125 °C

NOTE

Capacitance tolerance ±5% is not available for full product range, please contact local sales force before ordering

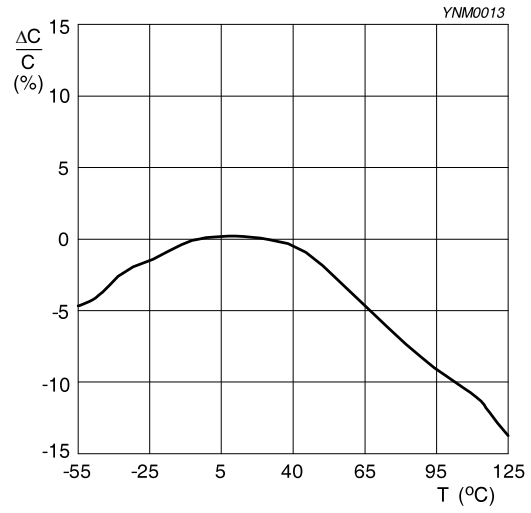


Fig. 3 Typical capacitance change as a function of temperature

Size 0201 10 nF / 16 V
Solid lines: Impedance / Dotted lines: ESR

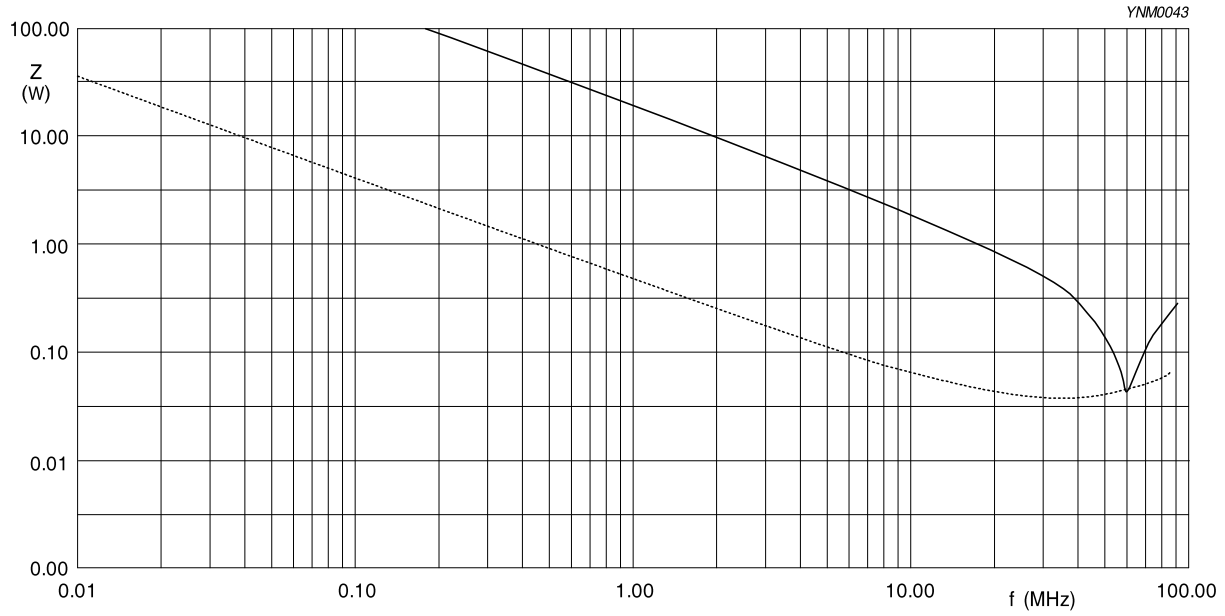


Fig. 4 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0402 100 nF / 16 V
Solid lines: Impedance / Dotted lines: ESR

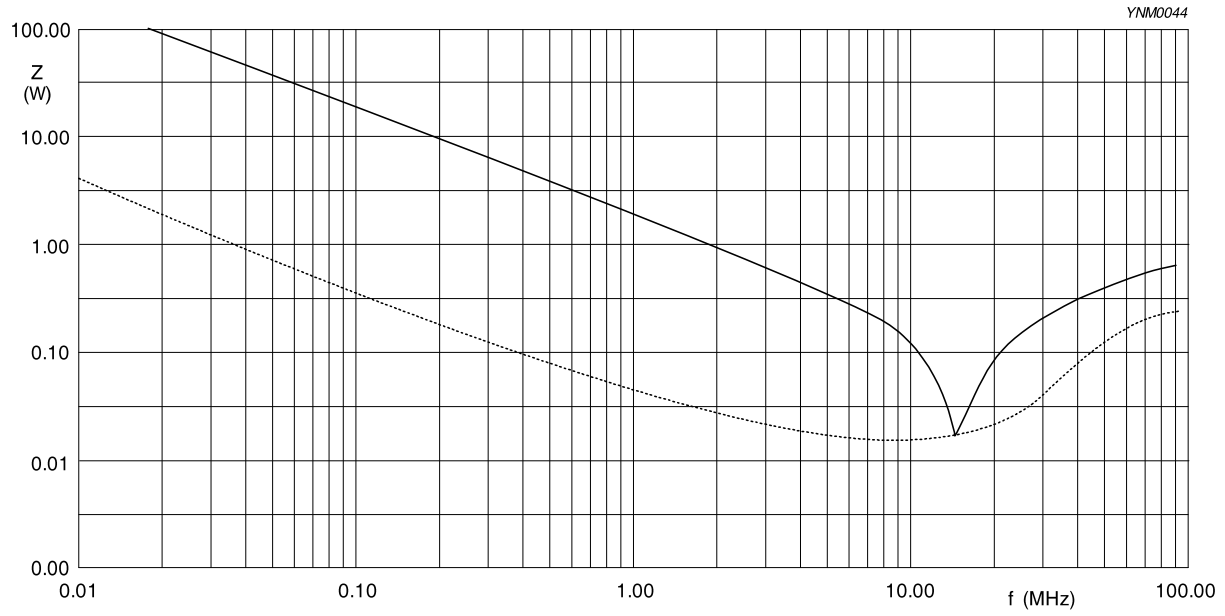


Fig. 5 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0603 1 µF / 16 V
Solid lines: Impedance / Dotted lines: ESR

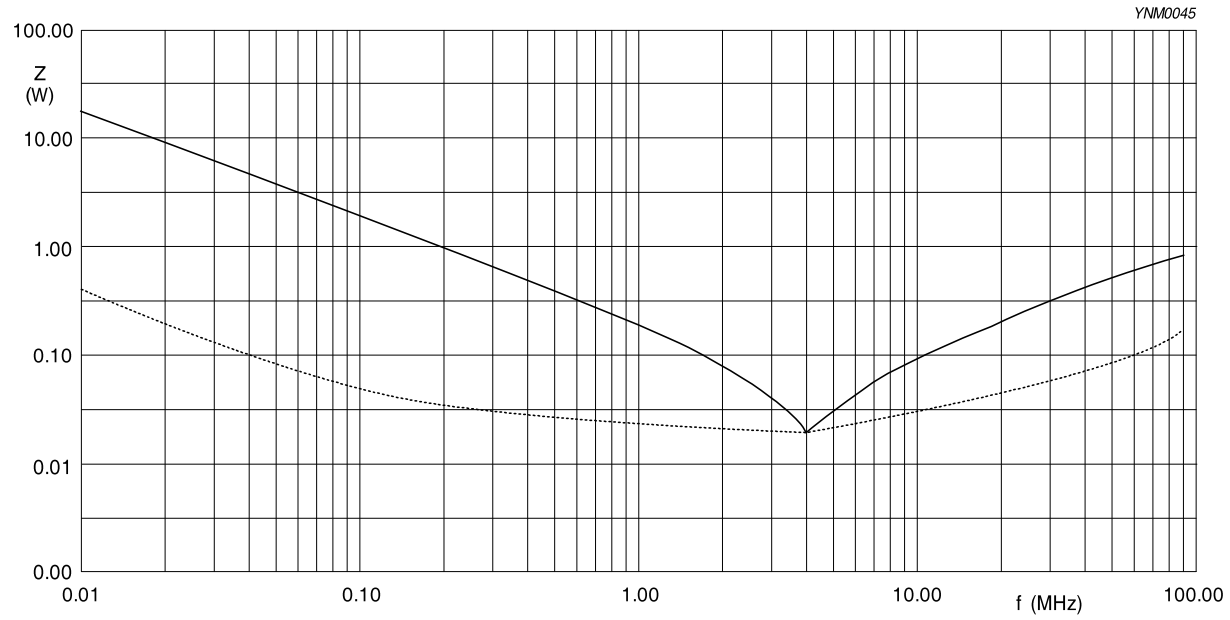


Fig. 6 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0805 1 µF / 16 V
Solid lines: Impedance / Dotted lines: ESR

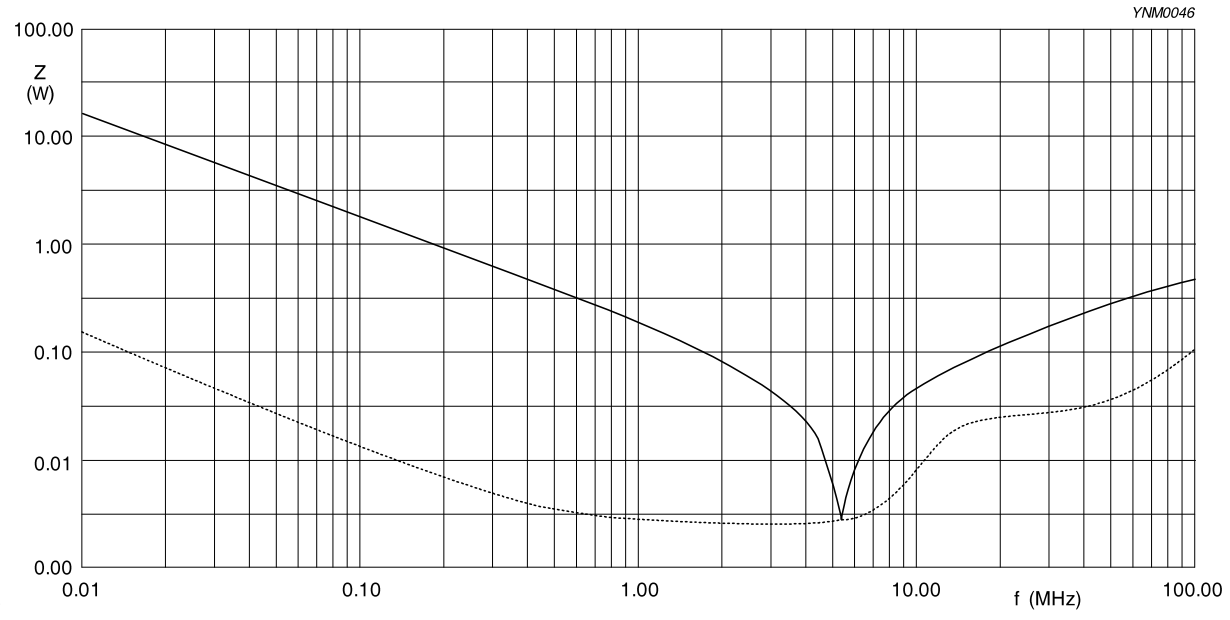


Fig. 7 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 1206 1 µF / 25 V
Solid lines: Impedance / Dotted lines: ESR

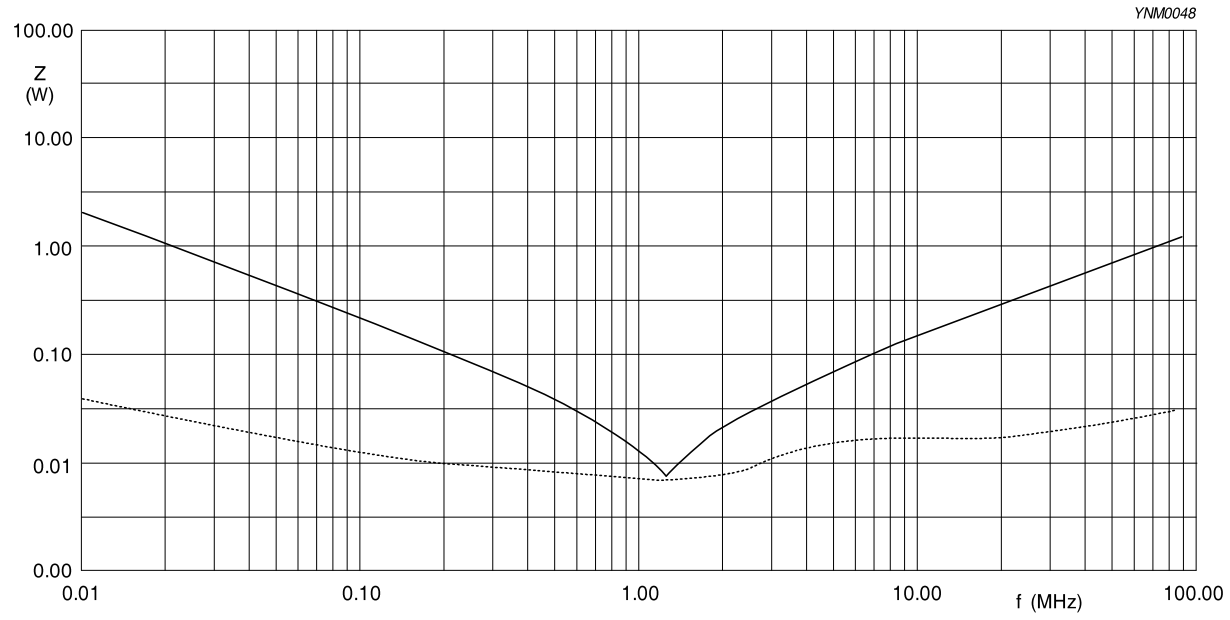


Fig. 8 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 1206 10 µF / 10 V
Solid lines: Impedance / Dotted lines: ESR

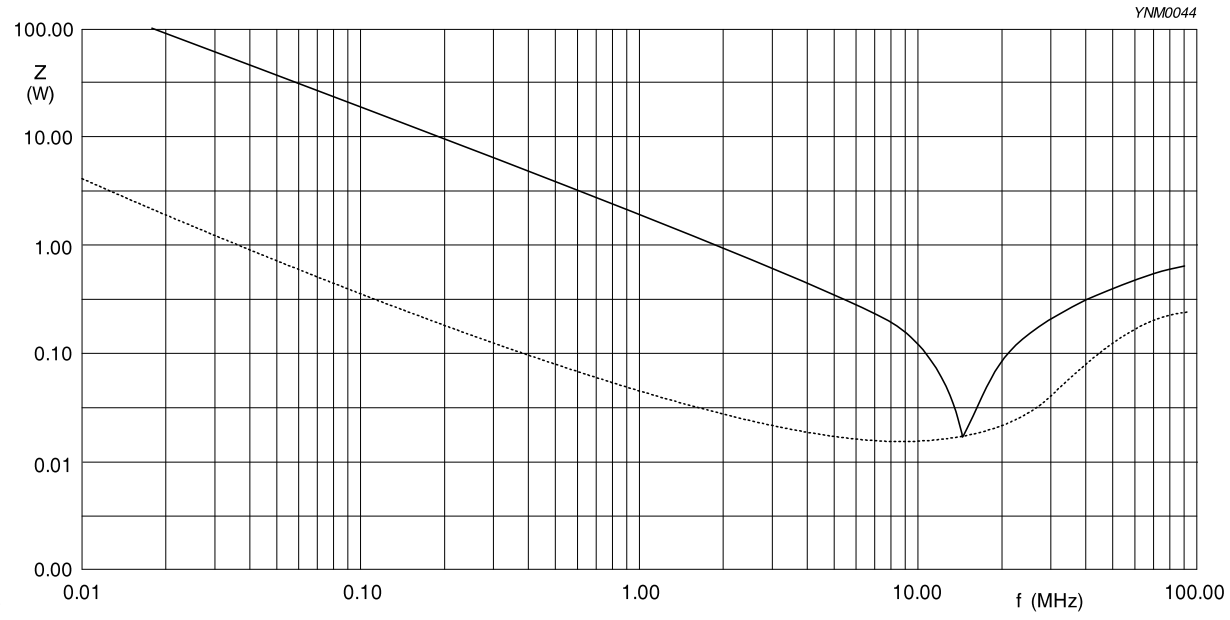


Fig. 9 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

SOLDERING RECOMMENDATION

Table 8

SOLDERING METHOD	SIZE 0402	0603	0805	1206	≥ 1210
Reflow	≥ 0.1 μF	≥ 1.0 μF	≥ 2.2 μF	≥ 4.7 μF	Reflow only
Reflow/Wave	< 0.1 μF	< 1.0 μF	< 2.2 μF	< 4.7 μF	---

TESTS AND REQUIREMENTS

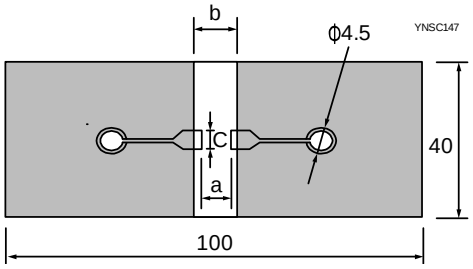
Table 9 Test procedures and requirements

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Mounting	IEC 60384-21/22	4.3	The capacitors may be mounted on printed-circuit boards or ceramic substrates	No visible damage
Visual Inspection and Dimension Check		4.4	Any applicable method using × 10 magnification	In accordance with specification
Capacitance (1)		4.5.1	Class 2: At 20 °C, 24 hrs after annealing f = 1 KHz for C ≤ 10 μF, rated voltage > 6.3 V, measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz, for C ≤ 10 μF, rated voltage ≤ 6.3 V, measuring at voltage 0.5 V_{rms} at 20 °C f = 120 Hz for C > 10 μF, measuring at voltage 0.5 V_{rms} at 20 °C	Within specified tolerance
Dissipation Factor (D.F.) (1)		4.5.2	Class 2: At 20 °C, 24 hrs after annealing f = 1 KHz for C ≤ 10 μF, rated voltage > 6.3 V, measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz, for C ≤ 10 μF, rated voltage ≤ 6.3 V, measuring at voltage 0.5 V_{rms} at 20 °C f = 120 Hz for C > 10 μF, measuring at voltage 0.5 V_{rms} at 20 °C	In accordance with specification
Insulation Resistance		4.5.3	At U_r (DC) for 1 minute	In accordance with specification

NOTE:

1. For individual product specification, please contact local sales.

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Characteristic	IEC 60384-21/22 4.6	Capacitance shall be measured by the steps shown in the following table. The capacitance change should be measured after 5 min at each specified temperature stage. Step / Temperature(℃) a / 25±2 b / Lower temperature±3℃ c / 25±2 d / Upper Temperature±2℃ e / 25±2 (1) Class I Temperature Coefficient shall be calculated from the formula as below Temp, Coefficient = $\frac{C2 - C1}{C1 \times \Delta T} \times 10^6$ [ppm/℃] C1: Capacitance at step c C2: Capacitance at 125℃ ΔT: 100℃(=125℃-25℃) (2) Class II Capacitance Change shall be calculated from the formula as below $\Delta C = \frac{C2 - C1}{C1} \times 100\%$ C1: Capacitance at step c C2: Capacitance at step b or d	<General purpose series> Class1: Δ C/C: ±30ppm Class2: X7R: Δ C/C: ±15% Y5V: Δ C/C: 22~-82% <High Capacitance series> Class2: X7R/X5R: Δ C/C: ±15% Y5V: Δ C/C: 22~-82%
Adhesion	4.7	A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate	Force size ≥ 0603: 5N size = 0402: 2.5N size = 0201: 1N

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Bond Strength	4.8	Mounting in accordance with IEC 60384-22 paragraph 4.3 Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 5 mm Test Substrate:  unit:mm	No visible damage <General Purpose series> ΔC/C Class2: X7R: ±10% <High Capacitance series> ΔC/C Class2: X7R: ±10% Dimension(mm) Type / a / b / c 0201 / 0.3 / 0.9 / 0.3 0402 / 0.4 / 1.5 / 0.5 0603 / 1.0 / 3.0 / 1.2 0805 / 1.2 / 4.0 / 1.65 1206 / 2.2 / 5.0 / 1.65 1210 / 2.2 / 5.0 / 2.0 1808 / 3.5 / 7.0 / 3.7
Resistance to Soldering Heat	4.9	Precondition: 150 +0/–10 °C for 1 hour, then keep for 24 ±1 hours at room temperature Preheating: for size ≤ 1206: 120 °C to 150 °C for 1 minute Preheating: for size >1206: 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute Solder bath temperature: 260 ±5 °C Dipping time: 10 ±0.5 seconds Recovery time: 24 ±2 hours	Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned <General Purpose series> ΔC/C Class2: X7R: ±10% <High Capacitance series> ΔC/C Class2: X7R: ±10% D.F. within initial specified value R_{ins} within initial specified value

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability	IEC 60384-21/22 4.10	Preheated to a temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds. Test conditions for lead containing solder alloy Temperature: 235 ±5 °C Dipping time: 2 ±0.2 seconds Depth of immersion: 10 mm Alloy Composition: 60/40 Sn/Pb Number of immersions: 1 Test conditions for lead-free containing solder alloy Temperature: 245 ±5 °C Dipping time: 3 ±0.3 seconds Depth of immersion: 10 mm Alloy Composition: SAC305 Number of immersions: 1	The solder should cover over 95% of the critical area of each termination
Rapid Change of Temperature	4.11	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 visual damage <General Purpose series> ΔC/C Class2: X7R: ±15% <High Capacitance series> ΔC/C Class2: X7R: ±15% D.F. meet initial specified value R_{ins} meet initial specified value

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Damp Heat with U_r Load	IEC 60384-21/22 4.13	1. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp 2. Initial measure: Spec: refer to initial spec C, D, IR 3. Damp heat test: 500 ±12 hours at 40 ±2 °C; 90 to 95% R.H. 1.0 U_r applied 4. Recovery: Class 2: 24 ±2 hours 5. Final measure: C, D, IR P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to *"IEC 60384 4.1"* and then the requirement shall be met.	No visual damage after recovery <General Purpose series> ΔC/C Class2: X7R: ±15% D.F. Class2: X7R: ≤ 16V: ≤ 7% ≥ 25V: ≤ 5% R_{ins} Class2: X7R: ≥ 500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less <High Capacitance series(≥ 1uF) and CC0402xRX7R9BB104> ΔC/C Class2: X7R: ±20% D.F. Class2: X7R: 2 x initial value max R_{ins} Class2: X7R: 500 MΩ or $R_{ins} \times C_r \geq 25(5)s$ whichever is less

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Endurance	IEC 60384-21/22 4.14	1. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp 2. Initial measure: Spec: refer to initial spec C, D, IR 3. Endurance test: Temperature: X7R: 125 °C Specified stress voltage applied for 1,000 hours: Applied 2.0 x U_r for general products Applied 1.5(1.0) x U_r for high cap. products 4. Recovery time: 24 ±2 hours 5. Final measure: C, D, IR P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to *"IEC 60384 4.1"* and then the requirement shall be met.	No visual damage <General Purpose series> ΔC/C Class2: X7R: ±15% D.F. Class2: X7R: ≤ 16V: ≤ 7% ≥ 25V: ≤ 5% R_{ins} Class2: X7R: ≥ 1,000 MΩ or R_{ins} x C_r ≥ 50s whichever is less <High Capacitance series(≥ 1uF) and CC0402xRX7R9BB104> ΔC/C Class 2: X7R: ±20% D.F. Class 2: X7R: 2 x initial value max R_{ins} Class 2: X7R: 1,000 MΩ or R_{ins} x C_r ≥ 50(10)s whichever is less
Voltage Proof	IEC 60384-1 4.6	Specified stress voltage applied for 1~5 seconds Ur ≦ 100 V: series applied 2.5 Ur Charge/Discharge current is less than 50 mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 13	Dec. 30, 2015	-	- Dimension on 0603 and 1206 case size updated
Version 12	May 26, 2015	-	- 1210, 25V dissipation factor updated
Version 11	Jan. 06, 2015	-	- 0402, 100nF, 50V Dissipation factor (D.F.) updated.
Version 10	Jul. 08, 2014	-	- Dimension updated
Version 9	Aug. 19, 2013	-	- Dimension updated
Version 8	Oct 13, 2011	-	- Dimension updated - 50V Dissipation factor(D.F) updated
Version 7	Jan 13, 2011	-	- Dimension updated
Version 6	Oct 13, 2010	-	- Rated voltage of 0201 extend to 50 V - Capacitance range of 0201 X7R 6.3V to 16V extend to 100 pF - Capacitance range of 0805 X7R 10V extend to 10 µF - Capacitance range of 0805 X7R 50V extend to 1 µF - Capacitance range of 1210 X7R 10V extend to 22 µF - Figures of impedance ESR updated
Version 5	Jul 27, 2010	-	- Dimension on 0603 and 1206 case size updated - 16V to 25V Dissipation factor(D.F) updated
Version 4	Apr 21, 2010	-	- The statement of "Halogen Free" on the cover added - Dimension updated
Version 3	Oct 26, 2009	-	- Capacitance range of 0402 X7R 25 V extend to 100 nF - 16V Dissipation factor updated
Version 2	May 11, 2009	-	- Product range updated
Version 1	Apr 24, 2009	-	- Ordering code updated
Version 0	Apr 15, 2009	-	- New datasheet for general purpose and high capacitance X7R series with RoHS compliant - Replace the "6.3V to 50V" part of pdf files: X7R_10V_9, X7R_16V-to-100V_9, X7R_16-to-500V_9, UP-X5R_X7R_HighCaps_6.3-to-25V_11, UY-X5R_X7R_HighCaps_6.3-to-25V_11 - Combine 0201 from pdf files: UP-NP0X5RX7RY5V_0201_6.3-to-50V_2 and UY-NPOX5RX7RY5V_0201_6.3-to-50V_2 - Define global part number - Description of "Halogen Free compliant" added - Test method and procedure updated