

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

General Purpose & High Capacitance

Class 2, X7R

6.3 V TO 50 V

100 pF to 22 μ F

RoHS compliant & Halogen Free



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 = $\pm 5\%$ ⁽¹⁾
 K = $\pm 10\%$
 M = $\pm 20\%$

(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
 C = Bulk case

(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 = $10 \times 10^3 = 10,000 \text{ pF} = 10 \text{ nF}$

NOTE

I. Tolerance $\pm 5\%$ 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.

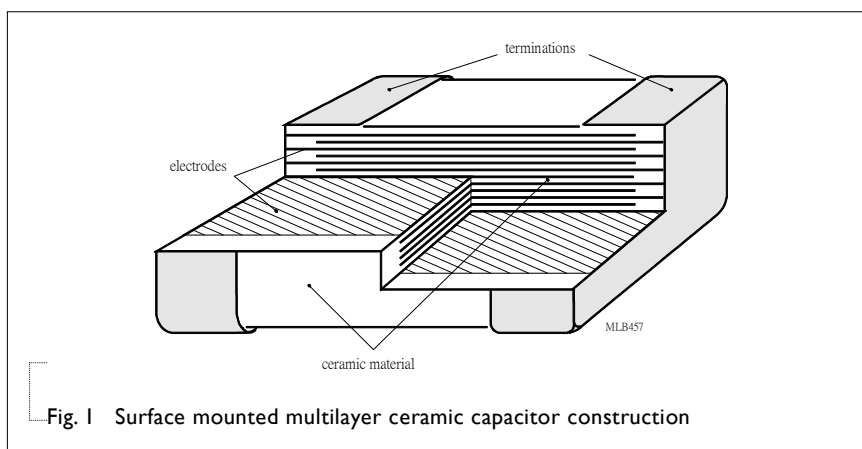


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table I For outlines see fig. 2

TYPE	L ₁ (mm)	W (mm)	T (MM)	L ₂ / L ₃ (mm)		L ₄ (mm)
				min.	max.	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⁾				
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 ±0.30 ⁽²⁾	1.6 ±0.20 ⁽²⁾				
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 = 1 µF; 50V; 0805 to 1812, C > 100 nF

OUTLINES

For dimension see Table I

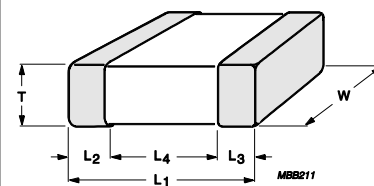


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

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										
150 pF										
220 pF										
330 pF					0.3±0.03					
470 pF										
680 pF										
1.0 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03						
1.5 nF										
2.2 nF										0.5±0.05
3.3 nF						0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05	
4.7 nF										
6.8 nF										
10 nF										
15 nF										
22 nF										
33 nF										
47 nF										
68 nF										
100 nF										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										
150 pF										
220 pF										
330 pF										
470 pF										
680 pF										
1.0 nF										
1.5 nF										
2.2 nF						0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
3.3 nF										
4.7 nF					0.8±0.1					
6.8 nF										
10 nF	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1						
15 nF										
22 nF										
33 nF										
47 nF										
68 nF						0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
100 nF										
150 nF										
220 nF										
330 nF										
470 nF										
680 nF										
1.0 µF					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										
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 4 Size 1206

CAP.	1206								
	6.3 V	10 V	16 V	25 V	50 V				
100 pF	0.85±0.1		0.85±0.1						
150 pF									
220 pF									
330 pF									
470 pF									
680 pF									
1.0 nF									
1.5 nF									
2.2 nF									
3.3 nF									
4.7 nF				0.85±0.1					
6.8 nF				0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1		
10 nF									
15 nF									
22 nF									
33 nF									
47 nF									
68 nF									
100 nF									
150 nF									
220 nF									
330 nF									
470 nF									
680 nF									
1.0 μF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1	0.85±0.1 / 1.15±0.1				
2.2 μF					1.6±0.2				
4.7 μF					1.6±0.2				
10 μF	1.6±0.2	1.6±0.2	1.6±0.2	1.6±0.2					
22 μF									
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 6.3 V	10 V	16 V	25 V	50 V	1812 50 V
100 pF						
150 pF						
220 pF						
330 pF						
470 pF						
680 pF						
1.0 nF						
1.5 nF						
2.2 nF						
3.3 nF						
4.7 nF						
6.8 nF						
10 nF						
15 nF					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		
33 nF						
47 nF						
68 nF						
100 nF						
150 nF						
220 nF					1.15±0.1	1.15±0.1
330 nF						
470 nF	1.15±0.1	1.15±0.1	1.15±0.1	1.15±0.1		
680 nF					1.25±0.2	
1.0 µF	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		
10 µF					2.5±0.3	
22 µF			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	---	---	---
1808	2.5 ±0.2 mm	8 mm	---	1,000 500	---	---	---
	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	---
1812	2.0 ±0.2 mm	12 mm	---	2,000	---	---	---
	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 μ F			
Capacitance tolerance	$\pm 5\%$, $\pm 10\%$, $\pm 20\%$			
Dissipation factor (D.F.)				
≤ 10 V	47pF $\leq$ 0201 $\leq$ 10nF 150pF $\leq$ 0805 $\leq$ 2.2 μ F Exception: 220nF $\leq$ 0402 $\leq$ 470nF 1206 $\geq$ 4.7 μ F 0402 = 1 μ F	100pF $\leq$ 0402 $\leq$ 100nF 220 pF $\leq$ 1206 $\leq$ 2.2 μ F 0603 = 2.2 μ F 4.7 μ F $\leq$ 1210 $\leq$ 47 μ F	100pF $\leq$ 0603 $\leq$ 1 μ F 2.2nF $\leq$ 1210 $\leq$ 2.2 μ F 0805 $\geq$ 4.7 μ F 0201 $\geq$ 12 nF	$\leq 5\%$ $\leq 10\%$ $\leq 12.5\%$
16 V	47 pF $\leq$ 0201 $\leq$ 1.2nF 150 pF $\leq$ 0805 $\leq$ 560nF Exception: 1.5 nF $\leq$ 0201 $\leq$ 10nF 1206 = 2.2 μ F 0402 = 220 nF 1210 = 22 μ F	100 pF $\leq$ 0402 $\leq$ 22nF 220pF $\leq$ 1206 $\leq$ 1 μ F 27nF $\leq$ 0402 $\leq$ 100nF 2.2 μ F $\leq$ 1210 $\leq$ 10 μ F 4.7 μ F $\leq$ 0805 $\leq$ 10 μ F	100 pF $\leq$ 0603 $\leq$ 470nF 2.2nF $\leq$ 1210 $\leq$ 1 μ F 680 nF $\leq$ 0805 $\leq$ 2.2 μ F 470 nF $\leq$ 0603 $\leq$ 1 μ F 4.7 μ F $\leq$ 1206 $\leq$ 10 μ F	$\leq 3.5\%$ $\leq 5\%$ $\leq 10\%$
25 V	47pF $\leq$ 0201 $\leq$ 470pF 150pF $\leq$ 0805 $\leq$ 180nF Exception: 12 nF $\leq$ 0402 $\leq$ 47nF 1206 = 1 μ F 560pF $\leq$ 0201 $\leq$ 10nF 1206 = 2.2 μ F 270nF $\leq$ 0603 $\leq$ 1 μ F 1210 $\geq$ 4.7 μ F	100pF $\leq$ 0402 $\leq$ 10nF 220pF $\leq$ 1206 $\leq$ 680nF 47nF $\leq$ 0603 $\leq$ 220nF 56 nF $\leq$ 0402 $\leq$ 100 nF 1210=2.2 μ F 2.2 μ F $\leq$ 0805 $\leq$ 4.7 μ F	100pF $\leq$ 0603 $\leq$ 39nF 2.2nF $\leq$ 1210 $\leq$ 1 μ F 220nF $\leq$ 0805 $\leq$ 560 nF 680nF $\leq$ 0805 $\leq$ 1 μ F 1206 $\geq$ 4.7 μ F	$\leq 2.5\%$ $\leq 3.5\%$ $\leq 5\%$ $\leq 10\%$
≥ 50 V	Exception: 0201 $\geq$ 47pF 0603 $\geq$ 47nF 0805=680 nF 0402=100nF 1206 $\geq$ 2.2 μ F	1 μ F $\geq$ 1206 $\geq$ 680nF 47nF $\geq$ 0402 $\geq$ 12 nF 0603 $\geq$ 1 μ F 1210 $\geq$ 2.2 μ F	470nF $\geq$ 0805 $\geq$ 330 nF 0805 $\geq$ 1 μ F	$\leq 2.5\%$ $\leq 3.5\%$ $\leq 3.0\%$ $\leq 5\%$ $\leq 10\%$
Insulation resistance after 1 minute at U_r (DC)	$R_{ins} \geq 10$ G Ω or $R_{ins} \times C_r \geq 500(100)$ seconds whichever is less			
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):	$\pm 15\%$			
Operating temperature range:	-55 °C to $+125$ °C			

NOTE

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

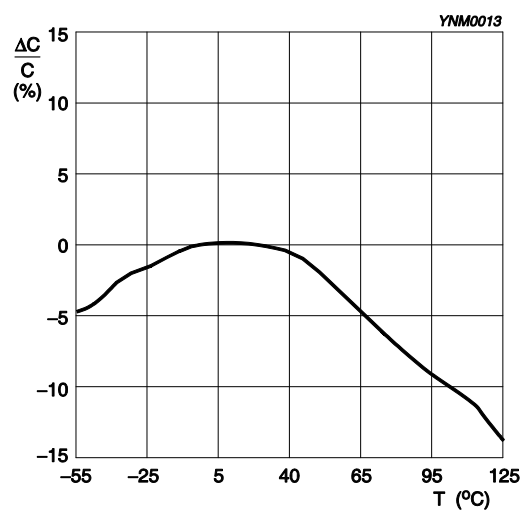


Fig. 3 Typical capacitance change as a function of temperature

Size 0201 10 nF / 16 V

Solid lines: Impedance / Dotted lines: ESR

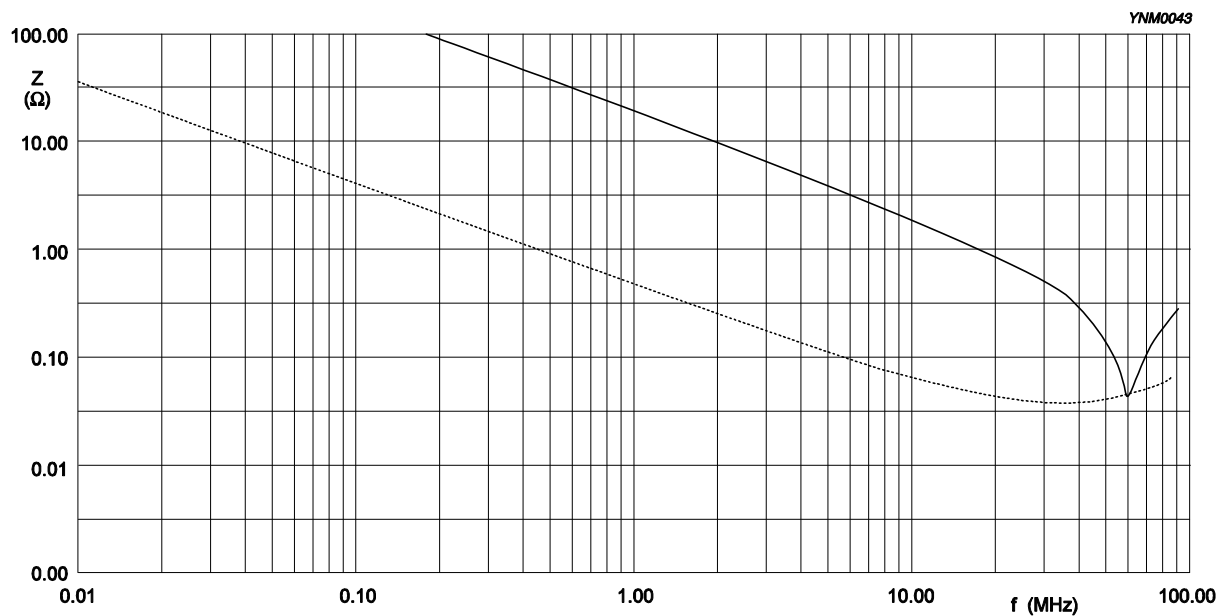


Fig. 4 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0402 100 nF / 16 V

Solid lines: Impedance / Dotted lines: ESR

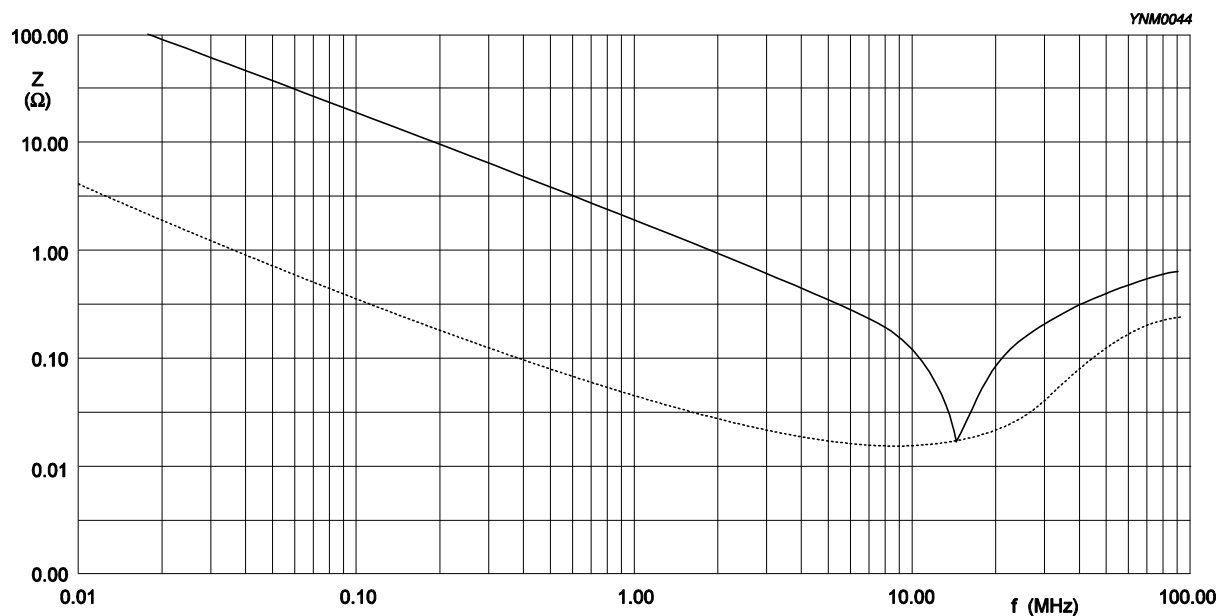


Fig. 5 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0603 1 μ F / 16 V

Solid lines: Impedance / Dotted lines: ESR

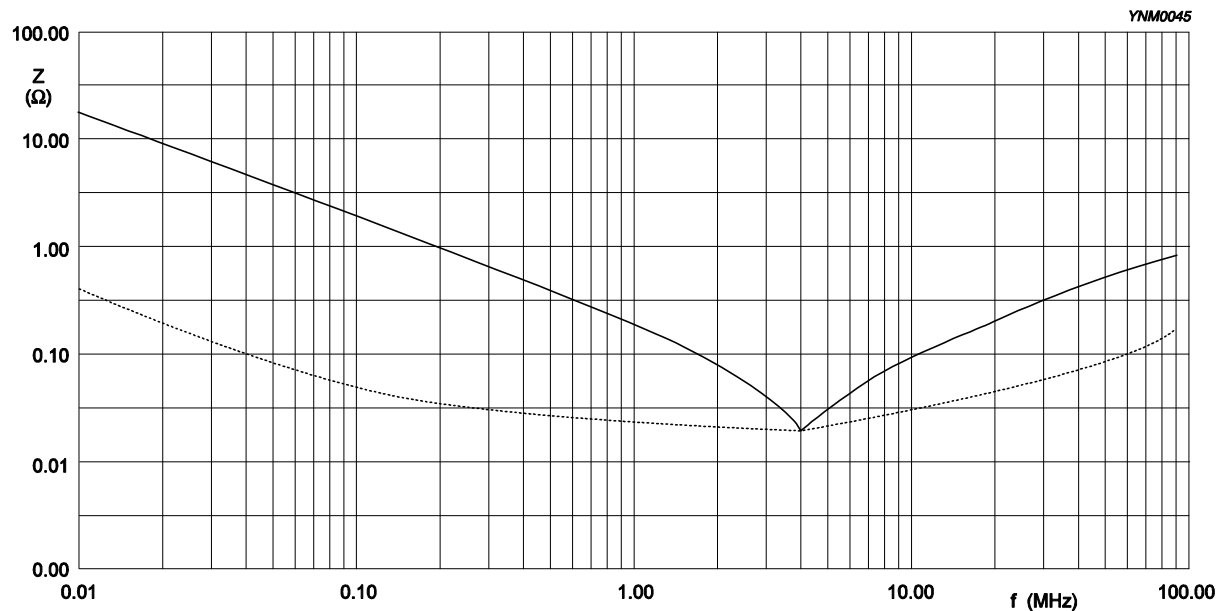


Fig. 6 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

 Size 0805 1 μ F / 16 V

Solid lines: Impedance / Dotted lines: ESR

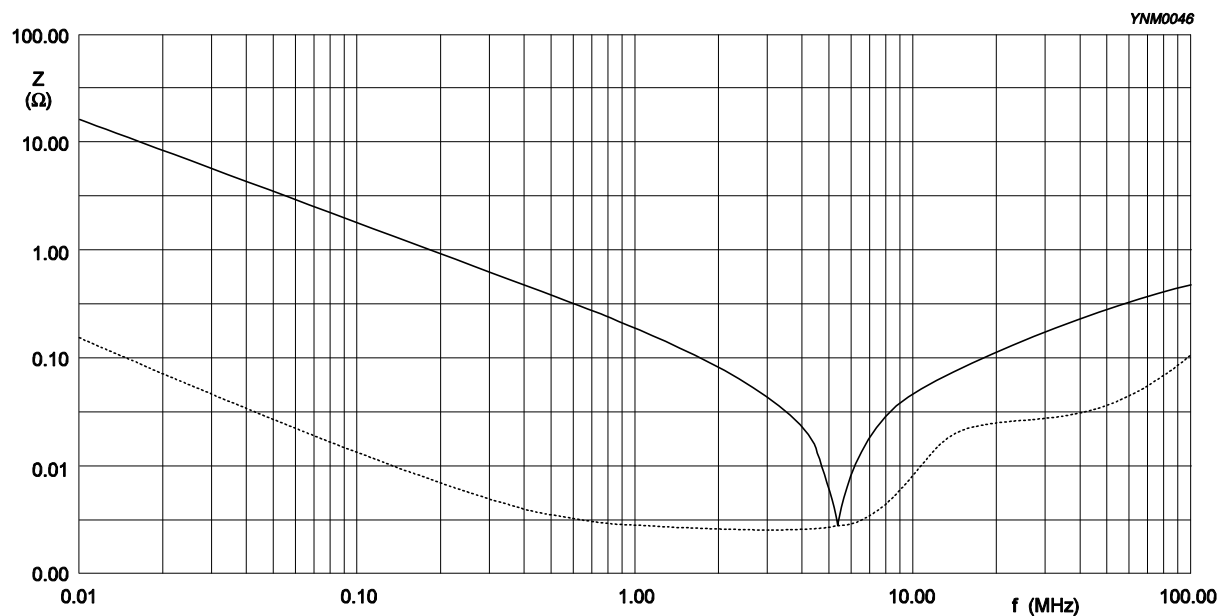


Fig. 7 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size I206 1 μ F / 25 V

Solid lines: Impedance / Dotted lines: ESR

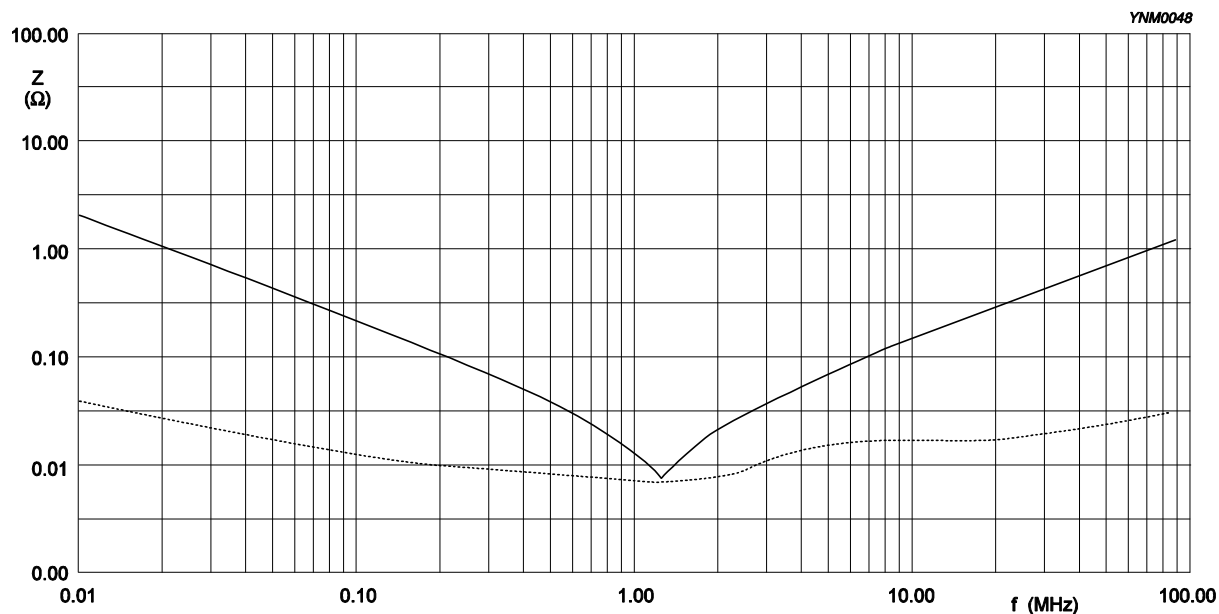


Fig. 8 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

 Size I206 10 μ F / 10 V

Solid lines: Impedance / Dotted lines: ESR

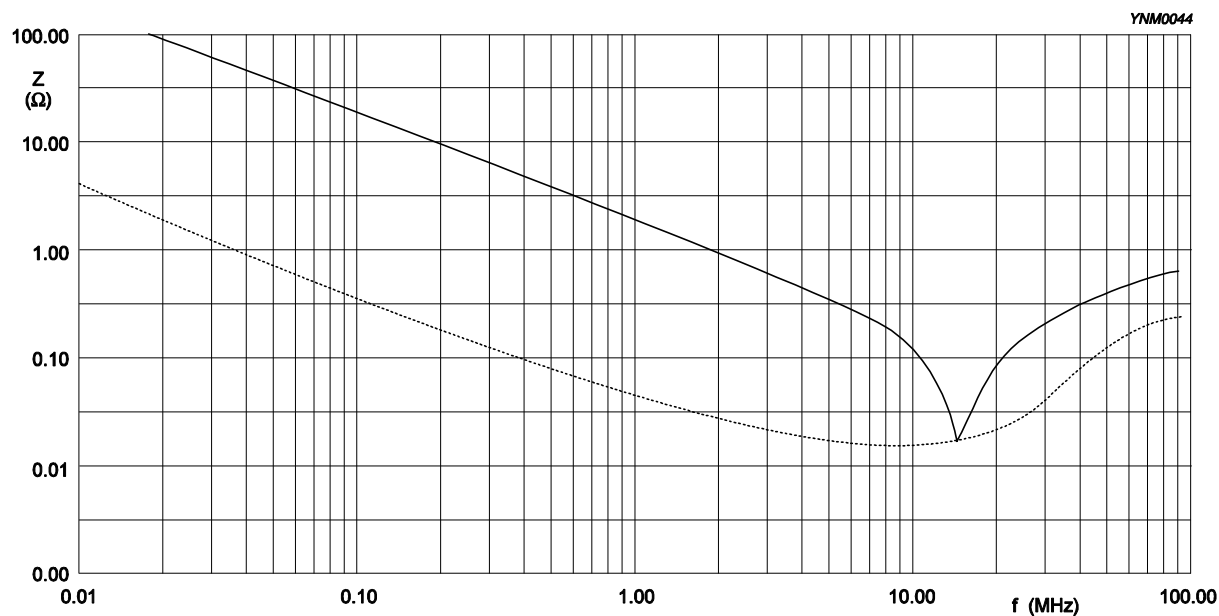


Fig. 9 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

SOLDERING RECOMMENDATION

Table 8

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

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 $\times 10$ magnification	In accordance with specification
Capacitance ⁽¹⁾	4.5.1	Class 2: At 20 °C, 24 hrs after annealing $f = 1$ KHz for $C \leq 10 \mu$ F, rated voltage > 6.3 V, measuring at voltage $1 V_{rms}$ at 20 °C $f = 1$ KHz, for $C \leq 10 \mu$ F, rated voltage ≤ 6.3 V, measuring at voltage $0.5 V_{rms}$ at 20 °C $f = 120$ Hz for $C > 10 \mu$ F, 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 $C \leq 10 \mu$ F, rated voltage > 6.3 V, measuring at voltage $1 V_{rms}$ at 20 °C $f = 1$ KHz, for $C \leq 10 \mu$ F, rated voltage ≤ 6.3 V, measuring at voltage $0.5 V_{rms}$ at 20 °C $f = 120$ Hz for $C > 10 \mu$ F, 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:

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

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS												
Temperature Characteristic	IEC 60384-21/224.6	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. <table><tr><th>Step</th><th>Temperature(°C)</th></tr><tr><td>a</td><td>25±2</td></tr><tr><td>b</td><td>Lower temperature±3°C</td></tr><tr><td>c</td><td>25±2</td></tr><tr><td>d</td><td>Upper Temperature±2°C</td></tr><tr><td>e</td><td>25±2</td></tr></table> (1) Class I Temperature Coefficient shall be calculated from the formula as below $\text{Temp, Coefficient} = \frac{C2 - C1}{C1 \times \Delta T} \times 10^6 \text{ [ppm/°C]}$ C1: Capacitance at step c C2: Capacitance at 125°C ΔT: 100°C(=125°C-25°C) (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	Step	Temperature(°C)	a	25±2	b	Lower temperature±3°C	c	25±2	d	Upper Temperature±2°C	e	25±2	<General purpose series> Class I: 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%
Step	Temperature(°C)														
a	25±2														
b	Lower temperature±3°C														
c	25±2														
d	Upper Temperature±2°C														
e	25±2														
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												
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 340 mm	No visible damage <General Purpose series> ΔC/C Class2: X7R: ±10% <High Capacitance series> ΔC/C Class2: X7R: ±10%												

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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> $\Delta C/C$ Class2: X7R: ±10% <High Capacitance series> $\Delta C/C$ Class2: X7R: ±10% D.F. within initial specified value R_{ins} within initial specified value
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> $\Delta C/C$ Class2: X7R: ±15% <High Capacitance series> $\Delta C/C$ 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 ± 10 °C / 1 hour, then keep for 24 ± 1 hour at room temp	No visual damage after recovery
		2. Initial measure: Spec: refer to initial spec C, D, IR	<General Purpose series> $\Delta C/C$ Class2:
		3. Damp heat test: 500 ± 12 hours at 40 ± 2 °C; 90 to 95% R.H. 1.0 U_r applied	X7R: $\pm 15\%$ D.F. Class2:
		4. Recovery: Class 2: 24 ± 2 hours	X7R: $\leq 16V: \leq 7\%$ $\geq 25V: \leq 5\%$
		5. Final measure: C, D, IR	R_{ins} Class2:
		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.	X7R: $\geq 500 M\Omega$ or $R_{ins} \times C_r \geq 25s$ whichever is less <High Capacitance series($\geq 1\mu F$) and CC0402xRX7R9BB104> $\Delta C/C$ Class2: X7R: $\pm 20\%$ D.F. Class2: X7R: 2 x initial value max R_{ins} Class2: X7R: 500 $M\Omega$ 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	No visual damage
		2. Initial measure: Spec: refer to initial spec C, D, IR	<General Purpose series> $\Delta C/C$ Class2: X7R: ±15%
		3. Endurance test: Temperature: X7R: 125 °C Specified stress voltage applied for 1,000 hours: Applied $2.0 \times U_r$ for general products Applied $1.5(1.0) \times U_r$ for high cap. products	D.F. Class2: X7R: $\leq 16V: \leq 7\%$ $\geq 25V: \leq 5\%$
		4. Recovery time: 24 ±2 hours	R_{ins}
		5. Final measure: C, D, IR	Class2: X7R: $\geq 1,000 M\Omega$ or $R_{ins} \times C_r \geq 50s$ whichever is less
		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.	<High Capacitance series($\geq 1 \mu F$) and CC0402xRX7R9BB104> $\Delta C/C$ Class 2: X7R: ±20% D.F. Class 2: X7R: 2 x initial value max R_{ins} Class 2: X7R: $1,000 M\Omega$ or $R_{ins} \times C_r \geq 50(10)s$ whichever is less
Voltage Proof	IEC 60384- I	4.6	
		Specified stress voltage applied for 1~5 seconds $U_r \leq 100 V$: series applied $2.5 U_r$ Charge/Discharge current is less than 50 mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 12	May 26, 2015	-	- I210, 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
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
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
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