Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-voltage

NP0/X7R

100 V TO 3000 V

0.47 pF to 2.2 µF

RoHS compliant & Halogen Free

YAGEO Phycomp

Product Specification – August 19, 2014 V.13

SCOPE

This specification describes Mid-voltage NP0/X7R series chip capacitors with lead-free terminations.

APPLICATIONS

PCs, Hard disk, Game PCs
Power supplies
LCD panel
ADSL, Modem

FEATURES

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

ORDERING INFORMATION - GLOBAL PART NUMBER, PHYCOMP CTC

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	XXX	X	B	X	XXX
	(1)	(2)	(3)	(4) (5)		(6)	(7)	

(1) SIZE – INCH BASED (METRIC)

0402 (1005) / 0603 (1608) / 0805 (2012) / 1206 (3216) / 1210 (3225)
1808 (4520) / 1812 (4532)

(2) TOLERANCE

C = ±0.25 pF
D = ±0.5 pF
G= ±2%
J = ±5%
K = ±10%

(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) TC MATERIAL

NPO
X7R

(5) RATED VOLTAGE

0 = 100 V
A = 200 V
Y = 250 V
B = 500 V
Z = 630 V
C= 1kV
D= 2kV
E= 3kV

(6) PROCESS

N = NP0
B = Class 2 MLCC

(7) CAPACITANCE VALUE

2 significant digits+number of zeros
The 3rd digit signifies the multiplying factor, and letter R is decimal point
Example: 121 = 12 x 10^1 = 120 pF

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.

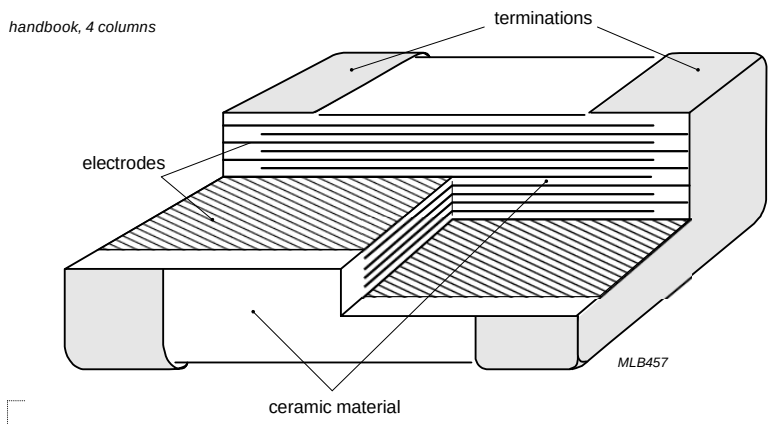

Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table 1 For outlines see fig. 2

TYPE	L_1 (mm)	W (mm)	T (MM)	L_2 / L_3 (mm)		L_4 (mm)
				min.	max.	min.
0402	1.0 ±0.10	0.5 ±0.05	Refer to table 2 to 13	0.15	0.30	0.40
0603	1.6 ±0.10	0.8 ±0.10		0.20	0.60	0.40
0805	2.0 ±0.20	1.25 ±0.20		0.25	0.75	0.55
1206	3.2 ±0.30	1.6 ±0.20		0.25	0.75	1.40
1210	3.2 ±0.30	2.5 ±0.20		0.25	0.75	1.40
1808	4.5 ±0.40	2.0 ±0.30		0.25	0.75	2.20
1812	4.5 ±0.40	3.2 ±0.30		0.25	0.75	2.20

OUTLINES

For dimension see Table 1

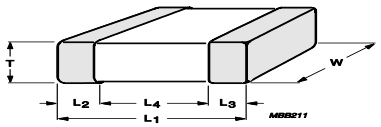

Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 2 Sizes from 0402 to 0805

CAP.	0402	0603			0805				
	100V	100 V	200 V	250 V	100 V	200 V	250 V	500 V	630V
0.47 pF	0.5±0.05	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
0.56 pF									
0.68 pF									
0.82 pF									
1.0 pF									
1.2 pF									
1.5 pF									
1.8 pF									
2.2 pF									
2.7 pF									
3.3 pF									
3.9 pF									
4.7 pF									
5.6 pF									
6.8 pF									
8.2 pF									

Table 3 Sizes from 0402 to 0805

CAP.	0402	0603			0805				
	100 V	100 V	200 V	250 V	100 V	200 V	250 V	500 V	630V
10 pF	0.5±0.05	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
12 pF									
15 pF									
18 pF									
22 pF									
27 pF									
33 pF									
39 pF									
47 pF									
56 pF									
68 pF									
82 pF									

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 4 Sizes from 0402 to 0805 (continued)

CAP.	0402	0603			0805				
	100 V	100 V	200 V	250 V	100 V	200 V	250 V	500 V	630 V
100 pF	0.5±0.05	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
120 pF									
150 pF									
180 pF									
220 pF						0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
270 pF									
330 pF									
390 pF									
470 pF									
560 pF								1.25±0.2	1.25±0.2
680 pF									
820 pF									
1.0 nF									
1.2 nF					0.85±0.1	1.25±0.2	1.25±0.2		
1.5 nF									
1.8 nF									
2.2 nF					1.25±0.2				
2.7 nF									
3.3 nF									
3.9 nF									
4.7 nF									
5.6 nF									
6.8 nF									
8.2 nF									
10 nF									
12 nF									
15 nF									
18 nF									
22 nF									

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 5 Sizes from 1206 to 1210

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
0.47 pF	0.6±0.1	0.6±0.1	0.6±0.1							
0.56 pF										
0.68 pF										
0.82 pF										
1.0 pF										
1.2 pF										
1.5 pF										
1.8 pF										
2.2 pF										
2.7 pF										
3.3 pF										
3.9 pF										
4.7 pF										
5.6 pF										
6.8 pF										
8.2 pF										

Table 6 Sizes from 1206 to 1210

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
10 pF	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	1.25±0.2					
12 pF										
15 pF										
18 pF										
22 pF										
27 pF										
33 pF										1.25±0.2
39 pF										
47 pF						1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	
56 pF										
68 pF										
82 pF										

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 7 Sizes from 1206 to 1210 (continued)

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
100 pF	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
120 pF										
150 pF										
180 pF										
220 pF										
270 pF										
330 pF										
390 pF										
470 pF										
560 pF										
680 pF										
820 pF		0.85±0.1	0.85±0.1	0.85±0.1						
1.0 nF										
1.2 nF										
1.5 nF										
1.8 nF		1.25±0.2	1.25±0.2	1.25±0.2						
2.2 nF										
2.7 nF										
3.3 nF	0.85±0.1									
3.9 nF										
4.7 nF										
5.6 nF										
6.8 nF										
8.2 nF	1.25±0.2									
10 nF										
12 nF										
15 nF										
18 nF										
22 nF										

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 8 Sizes 1812

CAP.	1812			
	100 V	200 V	500 V	630V
10 pF				
12 pF				
15 pF				
18 pF				
22 pF				
27 pF				
33 pF				
39 pF				
47 pF				
56 pF				
68 pF			1.25±0.2	1.25±0.2
82 pF				

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

Table 9 Sizes 1812 (continued)

CAP.	1812			
	100 V	200 V	500 V	630V
100 pF				
120 pF				
150 pF				
180 pF				
220 pF				
270 pF				
330 pF				
390 pF				1.25±0.2
470 pF				
560 pF				
680 pF			1.25±0.2	
820 pF				
1 nF				
1.2 nF	1.25±0.2	1.25±0.2		
1.5 nF				
1.8 nF				
2.2 nF				
2.7 nF				
3.3 nF				
3.9 nF				
4.7 nF				
5.6 nF				
6.8 nF				
8.2 nF				
10 nF				
12 nF				
15 nF				
18 nF				
22 nF				

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 10 Sizes from 0603 to 0805

CAP.	0402	0603	0805			
	100 V	100 V	100 V	200 V	250 V	500 V
100 pF	0.5±0.05	0.8±0.1				
150 pF						0.85±0.1
220 pF						
330 pF						
470 pF						
680 pF						
1.0 nF				0.85±0.1	0.85±0.1	
1.5 nF			0.6±0.1			
2.2 nF						
3.3 nF						
4.7 nF						
6.8 nF				1.25±0.2	1.25±0.2	
10 nF						1.25±0.2
15 nF			0.85±0.1			
22 nF						
33 nF			1.25±0.2			
47 nF						
68 nF						
100 nF						
150 nF						
220 nF						
330 nF						
470 nF						

NOTE

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

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 11 Sizes from 1206 to 1210

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630V
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	1.25±0.2	1.25±0.2					
3.3 nF	0.85±0.1									
4.7 nF							0.85±0.1	0.85±0.1		
6.8 nF										1.25±0.2
10 nF									1.25±0.2	
15 nF						0.85±0.1				
22 nF					1.6±0.2					
33 nF				1.6±0.2						
47 nF		1.25±0.2	1.25±0.2							
68 nF							1.25±0.2	1.25±0.2		
100 nF		1.6±0.2	1.6±0.2							
150 nF	1.25±0.2									
220 nF						1.25±0.2				
330 nF										
470 nF	1.6±0.2									
680 nF										
1 µF	1.6±0.2					2.0±0.2				
2.2 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 order

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 12 Sizes from 1808 to 1812

CAP.	1808				1812				
	100 V	200 V	250 V	500 V	100 V	200 V	250 V	500 V	630 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	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	0.85±0.1	0.85±0.1	0.85±0.1	1.25±0.2	1.35±0.2
4.7 nF									
6.8 nF									
10 nF									
15 nF									
22 nF									
33 nF									1.6±0.2
47 nF						1.25±0.2	1.25±0.2		
68 nF									
100 nF								1.6±0.2	
150 nF					1.25±0.2				
220 nF						1.6±0.2	1.6±0.2		
330 nF									
470 nF					1.6±0.2				
680 nF									
1 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 order

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 13 Sizes from 0805 to 1812

CAP.	0805	1206		1210		1808			1812		
	1 KV	1 KV	2 KV	1 KV	2 KV	1 KV	2 KV	3 KV	1 KV	2 KV	3 KV
10 pF	0.85±01	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.6±0.2	1.25±0.2	1.25±0.2	1.25±0.2
12 pF											
15 pF											
18 pF											
22 pF											
27 pF											
33 pF											
39 pF											
47 pF											
56 pF											
68 pF											
82 pF											
100 pF								2.0±0.2			
120 pF											
150 pF											
180 pF											
220 pF											
270 pF											
330 pF											
390 pF											
470 pF											
560 pF											
680 pF											
820 pF											
1.0 nF											
1.2 nF											
1.5 nF											
1.8 nF											
2.2 nF											
2.7 nF											
3.3 nF											

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 14 Sizes from 0805 to 1812

CAP.	0805	1206			1210		1808			1812		
	1 KV	1 KV	2 KV	2.5KV	1 KV	2 KV	1 KV	2 KV	3 KV	1 KV	2 KV	3 KV
100 pF												
150 pF	0.85±0.1								1.6±0.2			
220 pF		1.25±0.2	1.25±0.2									
330 pF								1.35±0.15				
470 pF				1.6±0.2	1.25±0.2	1.25±0.2	1.35±0.15		2.0±0.2	1.35±0.15	1.35±0.15	1.6±0.2
680 pF						1.60±0.2		1.6±0.2				
1.0 nF												
1.5 nF							1.6±0.2				1.6±0.2	
2.2 nF												
3.3 nF												
4.7 nF												
6.8 nF												
10 nF												
15 nF												
22 nF					1.6±0.2						2.0±0.2	
33 nF										1.6±0.2		
47 nF												
68 nF												
100 nF												

NOTE

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

THICKNESS CLASSES AND PACKING QUANTITY

Table 15

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
	0.8 / 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	---	---
	0.8 / 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	---	---	---
	1.15 ±0.15 mm	12 mm	---	1,000	---	---	---
	1.25 ±0.2 mm	12 mm	---	1,000	---	---	---
	1.35 ±0.15 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

NP0/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 16

DESCRIPTION		VALUE
Capacitance range		0.47 pF to 2.2 μF
Capacitance tolerance		
NP0	C < 10 pF	±0.25 pF, ±0.5 pF
	C ≥ 10 pF	±2%, ±5%
X7R		±5% (1), ±10%
Dissipation factor (D.F.)		
NP0	C < 30 pF	≤ 1 / (400 + 20C)
	C ≥ 30 pF	≤ 0.1 %
X7R		≤ 2.5 %
Exception	**X7R**/0603/100V, 12nF ≤ C ≤ 100nF	≤ 5%
	X7R/1206/100V, 1uF	≤ 3.5%
Insulation resistance after 1 minute at U_r (DC)	R_{ins} ≥ 10 GΩ or R_{ins} × C ≥ 500(100) seconds whichever is less	
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):		
NP0		±30 ppm/°C
X7R		±15%
Operating temperature range: NP0/X7R		–55 °C to +125 °C

NOTE

1. Capacitance tolerance ±5% doesn't available for X7R full product range, please contact local sales force before order

SOLDERING RECOMMENDATION

Table 17

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 18 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		4.5.1	Class 1: f = 1 MHz for C ≤ 1 nF, measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage 1 V_{rms} at 20 °C Class 2: f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V_{rms} at 20 °C	Within specified tolerance
Dissipation Factor (D.F.)		4.5.2	Class 1: f = 1 MHz for C ≤ 1 nF , measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage 1 V_{rms} at 20 °C Class 2: f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V_{rms} at 20 °C	In accordance with specification
Insulation Resistance		4.5.3	U_r ≤ 500 V: At Ur for 1 minute U_r > 500 V: At 500 V for 1 minute	In accordance with specification

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Temperature coefficient		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	IEC 60384-21/22	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
Bending 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	No visible damage ΔC/C Class 1: NP0: within ±1% or 0.5 pF, whichever is greater 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 ΔC/C Class 1: NP0: within ±0.5% or 0.5 pF, whichever is greater Class2: X7R: ±10% D.F. within initial specified value R_{ins} within initial specified value
Solderability		4.10	Preheated the 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 leadfree 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	IEC 60384-21/22	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 ΔC/C Class 1: NP0: within ±1% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. meet initial specified value R_{ins} meet initial specified value

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Damp Heat With Ur Load		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 initial spec C, D, IR 3. Damp heat test: 500 ±12 hours at 40 ±2 °C; 90 to 95% R.H. 4. Recovery: Class 1: 6 to 24 hours 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 precondition according to *"IEC 60384 4.1"* and then the requirement shall be met.	No visual damage after recovery ΔC/C Class 1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class 1: NP0: ≤ 2 x specified value Class2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class 1: NP0: ≥ 2,500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less Class2: X7R: ≥ 500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less
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 initial spec C, D, IR 3. Endurance test: Temperature: NP0/X7R: 125 °C Specified stress voltage applied for 1,000 hours: 4. High voltage series follows with below stress condition: Applied 2.0 x Ur for 100 V series Applied 1.5 x Ur for 200/250 V series Applied 1.3 x Ur for 500 V, 630 V series Applied 1.2 x U_r for 1 KV, 2 KV, 3 KV series 5. Recovery time: 24 ±2 hours 6. 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 precondition according to *"IEC 60384 4.1"* and then the requirement shall be met.	No visual damage ΔC/C Class1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class1: NP0: ≤ 2 x specified value Class2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class1: NP0: ≥ 4,000 MΩ or $R_{ins} \times C_r \geq 40s$ whichever is less Class2: X7R: ≥ 1,000 MΩ or $R_{ins} \times C_r \geq 50s$ whichever is less
Voltage Proof		4.6	Specified stress voltage applied for 1~5 seconds Ur ≤ 100 V: series applied 2.5 Ur 100 V < Ur ≤ 200 V series applied (1.5 Ur + 100) 200 V < Ur ≤ 500 V series applied (1.3 Ur + 100) Ur > 500 V: 1.3 Ur Ur ≧ 1000 V: 1.2 Ur Charge/Discharge current is less than 50 mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 0	Aug. 19, 2014	-	- New