Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-voltage SC type: NP0/X7R

X1/Y2 & X2/Y3

2 pF to 1.5 nF

YAGEO Phycomp

Product Specification – January 27, 2015 V.6

SCOPE

This specification describes safety certification NP0/X7R series chip capacitors with lead-free terminations.

APPLICATIONS

- PCs, Notebook
- Networking
- Power supplies

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.

Please note that 12 digits ordering code will expire at the end of 2010.

YAGEO BRAND ordering codes

GLOBAL PART NUMBER (PREFERRED)

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

(1) SIZE – INCH BASED (METRIC)

1808 (4520)
1812 (4532)

(2) TOLERANCE

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

(3) PACKING STYLE

K = Blister taping reel; Reel 7 inch

(4) TC MATERIAL

NPO
X7R

(5) IMPULSE VOLTAGE

T = X2/Y3 for TUV/UL
W= X1/Y2 for TUV/UL
U = X1 for UL (1812 X7R)

(6) PROCESS

N = NP0
B = Class 2 product

(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.

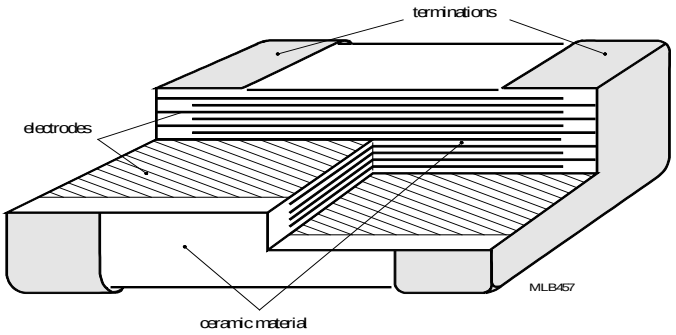

Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table 1 For outlines see fig. 2

TYPE	SC1808	SC1812
L_1 (mm)	4.8 ±0.30	4.8 ±0.30
W (mm)	2.0 ±0.30	3.2 ±0.30
T (mm)	Refer to table 2 to 3	
L_2/L_3 (mm) min.	0.25	0.25
L_2/L_3 (mm) max.	0.75	0.75

OUTLINES

For dimension see Table 1

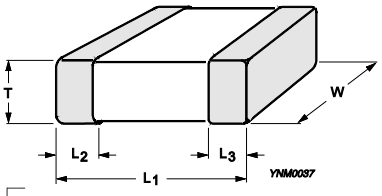

Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NP0 X1/Y2 AND X2/Y3

Table 2 Sizes from 1808 to 1812

CAPACITANCE	1808, X1/Y2 TUV	1808, X1/Y2 UL	1808, X2/Y3 TUV/UL	1812, X1/Y2 TUV/UL
15 pF	1.6±0.2	1.6±0.2	1.6±0.2	1.6±0.2
18 pF				
22 pF				
27 pF				
33 pF				
39 pF				
47 pF				
56 pF				
68 pF				
82 pF				
100 pF	2.0±0.2	2.0±0.2	2.0±0.2	2.0±0.2
120 pF				
150 pF				
180 pF				
220 pF				
240 pF				
270 pF				
330 pF				
390 pF				
430 pF				
470 pF				
560 pF				
680 pF				
820 pF				
1000 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 X7R X1/Y2 AND X2/Y3

Table 3 Sizes from 1808 to 1812

CAPACITANCE	1808, X1/Y2 TUV/UL	1808, X2/Y3 TUV/UL	1812, X1/Y2 TUV	1812, X1 UL
150 pF	1.6±0.2	1.6±0.2		
180 pF				
220 pF			1.6±0.2	1.6±0.2
240 pF	2.0±0.2			
270 pF				
330 pF				
390 pF			2.0±0.2	2.0±0.2
430 pF				
470 pF				
560 pF				
680 pF		2.0±0.2		
820 pF				
1.0 nF				
1.2 nF				
1.5 nF				

NOTE

THICKNESS CLASSES AND PACKING QUANTITY

Table 4

DESCRIPTION	SIZE CODE	THICKNESS CLASSIFICATION (mm)	12 mm TAPE WIDTH /AMOUNT PER REEL Ø180 mm, 7" Blister
Safety Certification Capacitor	1808	1.6 ±0.20	2,000
		2.0 ±0.20	2,000
	1812	1.6 ±0.20	1,000
		2.0 ±0.20	1,000

ELECTRICAL CHARACTERISTICS

NP0/X7R DIELECTRIC CAPACITORS; 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%.

Table 5

DESCRIPTION		VALUE
Capacitance range		2 pF to 1.5 nF
Capacitance tolerance		
NP0	C < 10 pF	±0.25 pF, ±0.5 pF
	C ≥ 10 pF	±5%
X7R		±10%
Dissipation factor (D.F.)		
NP0	C < 30 pF	≤ 1 / (400 + 20C)
	C ≥ 30 pF	≤ 0.1 %
X7R		≤ 2.5 %
Insulation resistance after 1 minute at U_r (DC)		R_{ins} ≥ 10 GΩ or R_{ins} × C ≥ 500 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

CAPACITOR REQUIREMENT

Table 6

SAFETY RATING	VOLTAGE RATING	WITHSTANDING VOLTAGE	IMPULSE VOLTAGE
X1	250 VAC	1,500 VAC	4,000 V
X2	250 VAC	1,500 VAC	2,500 V
Y2	250 VAC	1,500 VAC	5,000 V
Y3	250 VAC	1,500 VAC	---

SOLDERING RECOMMENDATION

Table 7

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

TESTS AND REQUIREMENTS

Table 8 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	NP0: 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 X7R: 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	NP0: 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 X7R: 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	To apply 500 V max for 60 seconds	In accordance with specification

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Characteristic	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 = $\frac{C2-C1}{C1x\Delta T}\times 10^6$ [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	4.15	a. A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate for size ≥ 0603 : a force of 5N applied b. A force applied until broken For size ≥ 0603: ≥ 5N	No visible damage
Bond Strength of Plating on End Face	IEC 60384-21/22 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 ΔC/C NP0: ≤ 1% or 0.5 pF whichever is greater X7R: ≤ 10%
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	The termination shall be well tinned ΔC/C NP0: ≤ 0.5% or 0.5 pF whichever is greater X7R: ≤ 10% D.F. within initial specified value R_{ins} within initial specified value

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Solderability		4.10	Unmounted chips completely immersed in a solder bath at 235 ±5 °C Dipping time: 2 ±0.5 seconds Depth of immersion: 10 mm	The termination shall be well tinned
Damp Heat with U_r Load		4.13	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; 1.0 Ur 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 NP0: ≤ 2% or 1 pF whichever is greater X7R: ≤ 15% D.F. NP0: ≤ 2 x specified value X7R: ≥ 100V: ≤ 5% Rins NP0: ≥ 2,500 MΩ or Rins x Cr ≥ 25s whichever is less X7R: ≥ 500 MΩ or Rins x Cr ≥ 25s whichever is less
Endurance	EN132400	4.14 SC	Perform shear test, substrate bending test, impulse voltage and then endurance test progressively Same as the above except for 1.25 Ur for X-capacitor and 1.7 Ur for Y-capacitor Once every hour the voltage shall be increased to 1000 VAC for 0.1 s Total time take to change over to 1000 VAC and back does not exceed 30 s	Visual examination DC/C < ± 20% Voltage proof IR > 3 x10E9 Ω
Impulse Voltage		4.13 SC IEC-60384-14	X1: 4.0 KV, X2: 2.5 KV Y2: 5.0 KV, Y3: None If any three successive impulses are shown by the oscilloscope monitor to have had a waveform indicating that no self-healing breakdowns or flashovers have taken place in the capacitor, then no further impulses shall be applied and the capacitor shall be counted as conforming. 24 impulses have been applied to the capacitor and 3 or more of them are of a waveform indicating that no self-heating breakdowns or flashovers have occurred. Time between impulses shall not be less than 10 s	No breakdown or flashover
Robustness of Termination (Pull Strength)		4.3 SC	a. A force applied for 10 sec to the line joining the terminations and in a plane parallel to the substrate. b. A force applied until broken	a. No visible damage b. Force size ≥ 0603: ≥ 5N
Voltage Proof		4.2.1 SC	X capacitor: Applied voltage 1.075K VDC (4.3 Ur) Y capacitor: Applied voltage 1.5K VAC	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 6	Jan. 27, 2015	-	- Capacitance range update
Version 5	Dec. 16, 2013	-	- impulse voltage update
Version 4	Apr 06, 2011	-	- X2/Y3 UL certification removed
Version 3	Oct 20, 2010	-	- Impulse voltage coding rule updated
Version 2	Feb 06, 2010	-	- The statement of "Halogen Free" on the cover added
Version 1	Oct 30, 2009	-	- Define global part number - Product range updated - Description of "Halogen Free compliant" added - Test method and procedure updated
Version 0	Mar 1, 2007	-	- New datasheet for high voltage NP0/X7R series with lead-free terminations