

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-voltage SC type: NP0/X7R

X1/Y2 & X2/Y3

2 pF to 1.5 nF

RoHS compliant & Halogen Free



Product Specification – Apr 06, 2011 V.4



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 & I2NC**

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 = $\pm 5\%$
 K = $\pm 10\%$

(3) PACKING STYLE

K = Blister taping reel; Reel 7 inch

(4) TC MATERIAL

NPO
 X7R

(5) IMPULSE VOLTAGE

T = X2/Y3 for TUV
 W = X1 for TUV/UL
 U = Y2 for TUV/UL

(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 = $12 \times 10^1 = 120$ pF

PHYCOMP BRAND ordering codes

GLOBAL PART NUMBER (preferred), PHYCOMP CTC (for North America) and 12NC (traditional) codes are acceptable to order Phycomp brand products.

GLOBAL PART NUMBER (PREFERRED)

For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

12NC CODE

2 2 XX XX X X X X XX		Carrier type 50 = Blister	Capacitance value⁽¹⁾ Tolerance 5 = $\pm 5\%$ 6 = $\pm 10\%$
Carrier type			
Impulse voltage			
Size			
3 = 1808	YNM0036	Temperature characteristic 1 = NP0 5 = X7R	
4 = 1812		Packaging⁽²⁾ 1 = reel: Ø180 mm; 7"	

(1) Refer to "Last 2-digit of 12NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0/X7R X1/Y2 AND X2/Y3"
(2) Quantity on reel depends on thickness classification; see table 4

PHYCOMP CTC CODE (FOR NORTH AMERICA)

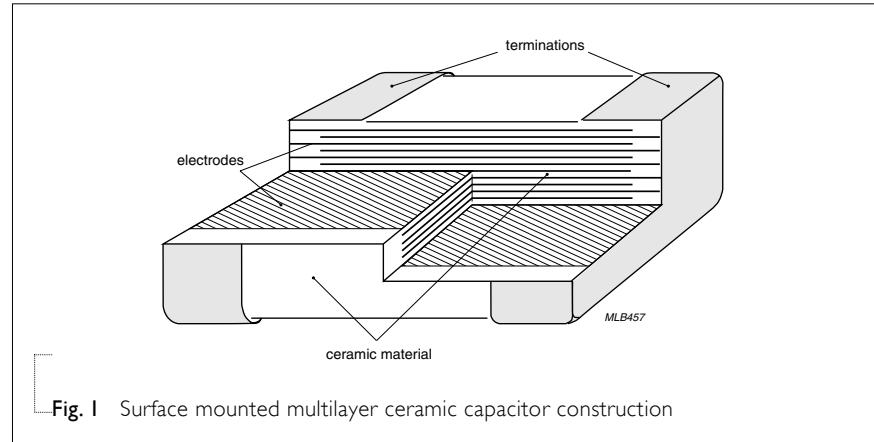
Example: 1808CG101JTBB0S

1808	CG	101	J	T	B	B	0	S
Size code	Temp. Char.	Capacitance in pF	Tolerance	Impulse voltage	Termination	Packing	Marking	Range identifier
1808	CG = NP0	101 = 100 pF; the third digit signifies the multiplying factor:	C = ± 0.25 pF	T = X2/Y3 for TUV	B = NiSn	B = 180 mm 7" blister	0 = no marking	S = Safety certification capacitance
1812	2R = X7R	0 = $\times 1$	D = ± 0.5 pF	J = $\pm 5\%$	W = X1 for TUV/UL			
		1 = $\times 10$	K = $\pm 10\%$		U = Y2 for TUV/UL			
		2 = $\times 100$						
		3 = $\times 1,000$						

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.



DIMENSION

Table I For outlines see fig. 2

TYPE	SCI808	SCI812
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 I

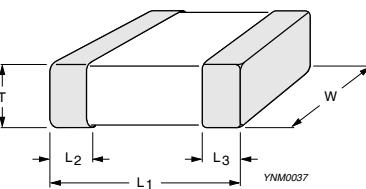


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NPO XI/Y2 AND X2/Y3

Table 2 Sizes from 1808 to 1812

CAPACITANCE	Last 2-digit of 12NC	1808, XI/Y2 TUV/UL	1808, X2/Y3 TUV	1812, XI/Y2 TUV/UL
2 pF	20			
4.7 pF	21			
5 pF	22			
10 pF	23			
12 pF	24			
15 pF	25			
18 pF	26			
22 pF	27	1.6±0.2		
27 pF	28			1.6±0.2
33 pF	29			
39 pF	31		1.6±0.2	
47 pF	32			
56 pF	33			
68 pF	34			
82 pF	35			
100 pF	36			
120 pF	37			
150 pF	38			
180 pF	39			2.0±0.2
220 pF	41	2.0±0.2	2.0±0.2	
270 pF	42			
330 pF	43			
390 pF	44			
470 pF	45			

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 XI/Y2 AND X2/Y3

Table 3 Sizes from 1808 to 1812

CAPACITANCE	Last 2-digit of 12NC	1808, XI/Y2 TUV/UL	1808, X2/Y3 TUV	1812, XI/Y2 TUV/UL
150 pF	12			
180 pF	13	1.6±0.2		
220 pF	14			
270 pF	15			1.6±0.2
330 pF	16		1.6±0.2	
390 pF	17			
470 pF	18	2.0±0.2		
560 pF	19			
680 pF	21			2.0±0.2
820 pF	22			
1.0 nF	23		2.0±0.2	
1.2 nF	24			
1.5 nF	25			

NOTE

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

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
	$C \geq 10$ pF	$\pm 5\%$
X7R		$\pm 10\%$
Dissipation factor (D.F.)		
NP0	$C < 30$ pF	$\leq 1 / (400 + 20C)$
	$C \geq 30$ pF	$\leq 0.1\%$
X7R		$\leq 2.5\%$
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):		
NP0		± 30 ppm/°C
X7R		$\pm 15\%$
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	$\geq 0.1\mu F$	$\geq 1.0\mu F$	$\geq 2.2\mu F$	$\geq 4.7\mu F$	Reflow only
Reflow/Wave	$< 0.1\mu F$	$< 1.0\mu F$	$< 2.2\mu F$	$< 4.7\mu F$	---

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 $\times 10$ magnification	In accordance with specification
Capacitance	4.5.1	NP0: $f = 1 \text{ MHz}$ for $C \leq 1 \text{ nF}$, measuring at voltage 1 V_{rms} at 20°C ; $f = 1 \text{ KHz}$ for $C > 1 \text{ nF}$, measuring at voltage 1 V_{rms} at 20°C X7R: $f = 1 \text{ KHz}$ for $C \leq 10 \mu\text{F}$, measuring at voltage 1 V_{rms} at 20°C	Within specified tolerance
Dissipation Factor (D.F.)	4.5.2	NP0: $f = 1 \text{ MHz}$ for $C \leq 1 \text{ nF}$, measuring at voltage 1 V_{rms} at 20°C ; $f = 1 \text{ KHz}$ for $C > 1 \text{ nF}$, measuring at voltage 1 V_{rms} at 20°C X7R: $f = 1 \text{ KHz}$ for $C \leq 10 \mu\text{F}$, 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
Temperature Characteristic	4.6	Between minimum and maximum temperature	$\Delta C/C$ NP0: 30 ppm/ $^\circ\text{C}$ X7R: $\pm 15\%$
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 : $\geq 5\text{N}$	No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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: $\leq 1\%$ or 0.5 pF whichever is greater X7R: $\leq 10\%$
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: $\leq 0.5\%$ or 0.5 pF whichever is greater X7R: $\leq 10\%$ D.F. within initial specified value R_{ins} within initial specified value
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 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 NP0: $\leq 2\%$ or 1 pF whichever is greater X7R: $\leq 15\%$ D.F. NP0: $\leq 2 \times$ specified value X7R: $\geq 100V: \leq 5\%$ R_{ins} NP0: $\geq 2,500 M\Omega$ or $R_{ins} \times C_r \geq 25s$ whichever is less X7R: $\geq 500 M\Omega$ or $R_{ins} \times C_r \geq 25s$ whichever is less

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Endurance	EN132400 4.14 SC	<p>Perform shear test, substrate bending test, impulse voltage and then endurance test progressively</p> <p>Same as the above except for $1.25 U_r$ for X-capacitor and $1.7 U_r$ for Y-capacitor</p> <p>Once every hour the voltage shall be increased to 1000 VAC for 0.1 s</p> <p>Total time take to change over to 1000 VAC and back does not exceed 30 s</p>	<p>Visual examination</p> <p>$DC/C < \pm 20\%$</p> <p>Voltage proof</p> <p>$IR > 3 \times 10^9 \Omega$</p>
Impulse Voltage	4.13 SC	<p>X1: 4.0 KV, X2: 2.5 KV Y2: 5.0 KV, Y3: None</p> <p>Apply 3 successive impulses.</p> <p>Time between impulses shall not be less than 10 s</p>	No breakdown or flashover
Robustness of Termination (Pull Strength)	4.3 SC	<p>a. A force applied for 10 sec to the line joining the terminations and in a plane parallel to the substrate.</p> <p>b. A force applied until broken</p>	<p>a. No visible damage</p> <p>b. Force size $\geq 0603: \geq 5N$</p>
Voltage Proof	4.2.1 SC	<p>X capacitor: Applied voltage 1.075K VDC ($4.3 U_r$) Y capacitor: Applied voltage 1.5K VAC</p>	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
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

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