Innovative Service Around the Globe YAGEO

DATA SHEET

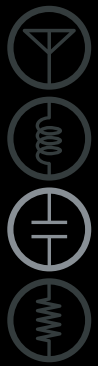
SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-voltage: NP0/X7R

(Pb Free & RoHS compliant)

1K V TO 4K V

10 pF to 33 nF



Phycomp

Product specification – Sep 30, 2005 V. 1

SCOPE

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

APPLICATIONS

- PCs, hard disk, game PCs
- Power supplies
- LCD panel
- ADSL, modem

FEATURES

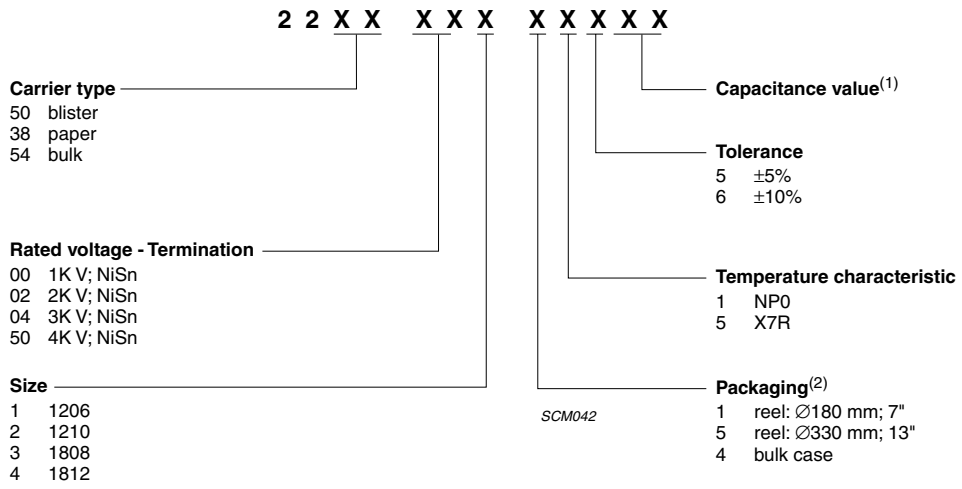
- Supplied in tape on reel
- Nickel-barrier end termination

ORDERING INFORMATION

Components may be ordered by using either a Phycomp's unique 12NC or Phycomp clear text code.

PHYCOMP ORDERING CODE

12NC CODE



(1) Refer to "Conversion table of capacitance & last 2 digits of 12NC"

(2) Quantity on reel depends on thickness classification; see section "Thickness classification and packing quantities for 1K V to 4K V".

Conversion table of capacitance & last 2 digits of 12NC for NP0

CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC
1.0	10	8.2	22	68	34	560	46	4,700	58
1.2	11	10	23	82	35	680	47	5,600	59
1.5	12	12	24	100	36	820	48	6,800	61
1.8	13	15	25	120	37	1,000	49	8,200	62
2.2	14	18	26	150	38	1,200	51	10,000	63
2.7	15	22	27	180	39	1,500	52	12,000	64
3.3	16	27	28	220	41	1,800	53	15,000	65
3.9	17	33	29	270	42	2,200	54	18,000	66
4.7	18	39	31	330	43	2,700	55	22,000	67
5.6	19	47	32	390	44	3,300	56		
6.8	21	56	33	470	45	3,900	57		

Conversion table of capacitance & last 2 digits of 12NC for X7R

CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC	CAP. (pF)	LAST 2 DIGITS OF 12NC
100	10	680	21	4,700	32	33,000	43	220,000	54
120	11	820	22	5,600	33	39,000	44	270,000	55
150	12	1,000	23	6,800	34	47,000	45	330,000	56
180	13	1,200	24	8,200	35	56,000	46	390,000	57
220	14	1,500	25	10,000	36	68,000	47	470,000	58
270	15	1,800	26	12,000	37	82,000	48	560,000	59
330	16	2,200	27	15,000	38	100,000	49	680,000	61
390	17	2,700	28	18,000	39	120,000	51	820,000	62
470	18	3,300	29	22,000	41	150,000	52		
560	19	3,900	31	27,000	42	180,000	53		

CTC CODE

Size code	Temp. Char.	Capacitance	Tolerance	Rated voltage	Termination	Packing	Marking	Series
1206 1210 1808 1812	CG = NP0 2R = X7R	225 = 2,200,000 pF; the third digit signifies the multiplying factor: 0 = × 1 1 = × 1,0 2 = × 1,00 3 = × 1,000 4 = × 10,000 5 = × 100,000 6 = × 1,000,000 8 = × 0.01 9 = × 0.1	J = ±5% K = ±10%	E = 1K V F = 2K V G = 3K V H = 4K V	B = NiSn	2 = 180 mm; 7" paper 3 = 330 mm; 13" paper B = 180 mm; 7" blister F = 330 mm; 13" blister P = Bulk case	0 = No marking	0 = conv. ceramic D = BME

Example: 1808CG100JGBB00

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.

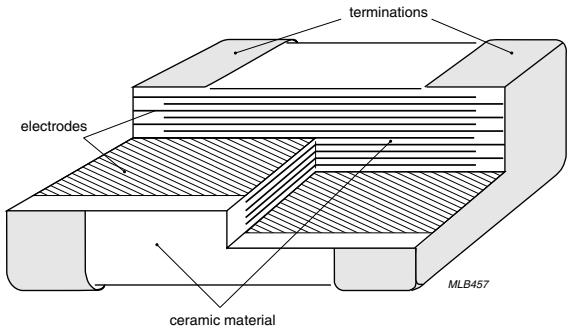


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

For dimension see Table 1

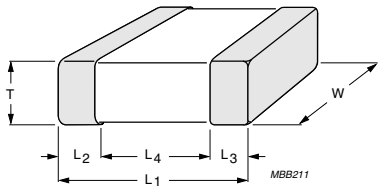


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

Table 1

TYPE		CC1206	CC1210	CC1808	CC1812
L_1 (mm)		3.2±0.20	3.2 ±0.20	4.5 ±0.30	4.5 ±0.30
W (mm)		1.6±0.20	2.5 ±0.20	2.0 ±0.30	3.2 ±0.30
T (mm)		Refer to table 2 to 4			
L_2/L_3 (mm)	min.	0.25	0.25	0.25	0.25
	max.	0.75	0.75	0.75	0.75
L_4 (mm)	min.	1.40	1.40	2.20	2.20

CAPACITANCE RANGE & THICKNESS FOR NP0 1K/2K V

Table 2 For NP0 1K/2K V sizes from 1206 to 1812

CAPACITANCE	1K V				2K V			
(pF)	1206	1210	1808	1812	1206	1210	1808	1812
10	0.8 ±0.10	1.25 ±0.20	1.25 ±0.20	1.25 ±0.20	1.00 ±0.10	1.25 ±0.20	1.25 ±0.20	1.25 ±0.20
12								
15								
18								
22								
27								
33								
39								
47								
56								
68								
82								
100								
120	1.00 ±0.10				0.8 ±0.10			
150								
180								
220					1.25 ±0.20			
270								
330				0.85 ±0.10				
390	1.15 ±0.15							
470	0.85 ±0.10							
560	1.15 ±0.15							
680								
820								
1,000				1.15 ±0.15				
1,200								
1,500				1.25 ±0.20				
1,800								
2,200								
2,700								
3,300								

NOTE

1. Values in shaded cells indicate thickness class in mm.
2. Capacitance range < 10 pF is on request.

CAPACITANCE RANGE & THICKNESS FOR NP0 3K/4K V

Table 3 For NP0 3K/4K V sizes from 1808 to 1812

CAPACITANCE	3K V		4K V	
(pF)	1808	1812	1808	1812
10	1.15 ±0.15	1.15 ±0.15	1.5 ±0.10	1.5 ±0.10
12				
15				
18				
22				
27				
33				
39				
47				
56			same	
68				
82				
100				
120				
150	1.6 ±0.20			
180	2.0 ±0.20			
220				
270		1.6 ±0.20		
330				
390				
470				
560				
680				

NOTE

1. Values in shaded cells indicate thickness class in mm.
2. Capacitance range < 10 pF is on request.

CAPACITANCE RANGE & THICKNESS FOR X7R 1K/2K/3K V

Table 4 For X7R 1K/2K/3K V sizes from 1206 to 1812

CAPACITANCE	1K V				2K V				3K V
(pF)	1206	1210	1808	1812	1206	1210	1808	1812	1808
470	0.8 ±0.10				1.25 ±0.20		1.35 ±0.15		1.6 ±0.20
680									
1,000	1.15 ±0.15		1.35 ±0.15			1.25 ±0.20		1.35 ±0.15	2.0 ±0.20
1,500									
2,200						1.6 ±0.20			
3,300				1.35 ±0.15					
4,700	1.25 ±0.20	1.25 ±0.20	1.25 ±0.20						
6,800			1.6 ±0.20					1.6 ±0.20	
10,000								2.0 ±0.20	
15,000				1.25 ±0.20					
22,000		1.6 ±0.20							
33,000		2.0 ±0.20		1.6 ±0.20					
47,000									

NOTE

1. Values in shaded cells indicate thickness class in mm.

THICKNESS CLASSES AND PACKING QUANTITY

Table 5

DESCRIPTION	SIZE CODE	THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH/AMOUNT PER REEL				12 mm TAPE WIDTH /AMOUNT PER REEL
			Ø180 mm, 7"		Ø330 mm, 13"		
			Paper	Blister	Paper	Blister	Ø180 mm, 7" Blister
Mid/High voltage	0603	0.8 ±0.10	4,000	---	---	---	---
	0805	0.6 ±0.10	4,000	---	---	---	---
		0.8 ±0.10	4,000	---	---	---	---
		0.85 ±0.10	4,000	---	---	---	---
		1.25 ±0.20	---	3,000	---	---	---
	1206	0.6 ±0.10	4,000	---	20,000	---	---
		0.8 ±0.10	4,000	---	---	---	---
		0.85 ±0.10	4,000	---	15,000	---	---
		1.00 ±0.10	---	3,000	---	10,000	---
		1.15 ±0.15	---	3,000	---	10,000	---
		1.25 ±0.20	---	3,000	---	---	---
	1210	0.6 ±0.10	---	4,000	---	15,000	---
		0.85 ±0.10	---	4,000	---	10,000	---
		1.15 ±0.15	---	3,000	---	10,000	---
		1.25 ±0.20	---	3,000	---	---	---
		1.6 ±0.20	---	2,000	---	---	---
	1808	1.15 ±0.15	---	---	---	---	1,500
		1.25 ±0.20	---	---	---	---	3,000
		1.35 ±0.15	---	---	---	---	1,000
		1.5 ±0.10	---	---	---	---	1,000
		1.6 ±0.20	---	---	---	---	2,000
		2.0 ±0.20	---	---	---	---	2,000
	1812	0.85 ±0.10	---	---	---	---	2,000
		1.15 ±0.15	---	---	---	---	1,500
		1.25 ±0.20	---	---	---	---	1,000
		1.35 ±0.15	---	---	---	---	1,000
		1.5 ±0.10	---	---	---	---	1,000
		1.6 ±0.20	---	---	---	---	1,000
		2.0 ±0.20	---	---	---	---	2,000

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 6

DESCRIPTION	VALUE
Capacitance range (1)	10 pF to 33 nF
Capacitance tolerance (1)	±5% and ±10%
Dissipation factor (D.F.) (1):	
NP0	≤ 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

NOTE

1. NP0: frequency = 1 MHz for C ≤ 1 nF, measuring at voltage 1 V_{rms}; frequency = 1 KHz for C > 1 nF, measuring at voltage 1 V_{rms}
   X7R: frequency = 1 KHz for C ≤ 10 µF, measuring at voltage 1 V_{rms}.

TESTS AND REQUIREMENTS

Table 7 Test condition, procedure 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	At U_r (DC) for 1 minute	In accordance with specification
Voltage proof		4.5.4.2	Test voltage (DC) applied for 1 minute U_r ≤ 100 V: 2.5 × U_r applied to NP0/X7R series 100 V < U_r ≤ 200 V: 1.5 × U_r +100 V applied to NP0/X7R series 200 V < U_r ≤ 500 V: 1.3 × U_r +100 V applied to NP0/X7R series U_r > 500 V: 1.3 × U_r applied to NP0/X7R series I: 7.5 mA	No breakdown or flashover
Temperature characteristic		4.6	Between minimum and maximum temperature	NP0: IΔC/CI: 30 ppm/°C X7R: IΔC/CI: 15%
Adhesion		4.15	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 5 N applied for size 0402: a force of 2.5 N applied	No visible damage

Table 7 Test condition, procedure and requirements (continued)

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 NP0: $\lvert\Delta C/C\rvert$: ≤ 1% or 0.5 pF whichever is greater X7R: $\lvert\Delta C/C\rvert$: ≤ 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 to 150 °C for 1 minute Preheating: for size >1206: 100 to 120 °C for 1 minute and 170 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 NP0: $\lvert\Delta C/C\rvert$: ≤ 0.5% or 0.5 pF whichever is greater X7R: $\lvert\Delta C/C\rvert$: ≤ 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.
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 NP0: $\lvert\Delta C/C\rvert$: ≤ 1% or 1 pF whichever is greater X7R: $\lvert\Delta C/C\rvert$: ≤ 15% D.F.: within initial specified value R_{ins}: within initial specified value
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; 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.	NP0: $\lvert\Delta C/C\rvert$: ≤ 2% or 1 pF whichever is greater X7R: $\lvert\Delta C/C\rvert$: ≤ 15% NP0: D.F.: 2 × initial value max. X7R ≥ 100 V: D.F. ≤ 5% NP0: R_{ins} ≥ 2,500 MΩ or $R_{ins} \times C_r$ ≥ 25 seconds, whichever is less X7R: R_{ins} ≥ 500 MΩ or $R_{ins} \times C_r$ ≥ 25 seconds, whichever is less

Table 7 Test condition, procedure and requirements (continued)

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Endurance	IEC 60384-21/22	4.14	Preconditioning; Initial measurements; after 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature Duration and conditions: 1,000 ±12 hours at upper category temperature with 1.5 × U_r voltage 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.	NP0: IΔC/CI: ≤ 2% or 1 pF whichever is greater X7R: IΔC/CI: ≤ 15% NP0: D.F.: 2 × initial value max. X7R ≥ 100 V: D.F. ≤ 5% NP0: R_{ins} ≥ 4,000 MΩ or R_{ins} × C_r ≥ 40 seconds, whichever is less X7R: R_{ins} ≥ 1,000 MΩ or R_{ins} × C_r ≥ 50 seconds, whichever is less

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 1	Sep 30, 2005	-	- Thickness revised
Version 0	Sep 12, 2005	-	- New