Innovative Service Around the Globe YAGEO

DATA SHEET

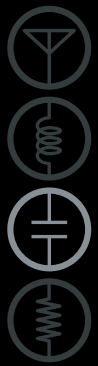
SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-voltage: NP0/X7R

(Pb Free & RoHS compliant)

1K V TO 4K V

10 pF to 33 nF



YAGEO

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

Part number is identified by the series, size, tolerance, packing style, TC material, rated voltage and capacitance value.

YAGEO ORDERING CODE

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

(1) SIZE – INCH BASED (METRIC)

1206 (3216)
1210 (3225)
1808 (4520)
1812 (4532)

(2) TOLERANCE

J = ±5%
K = ±10%

(3) PACKING STYLE

R = 7" paper tape
K = 7" blister tape
P = 13" paper tape
F = 13" blister tape
C = Bulk case

(4) TC MATERIAL

NP0
X7R

(5) RATED VOLTAGE

C = 1K V
D = 2K V
E = 3K V
H = 4K V

(6) PROCESS

B = BME
N = NME

(7) CAPACITANCE VALUE:

First two for significant figures and 3rd for number of zero
Letter "R" for decimal point

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.

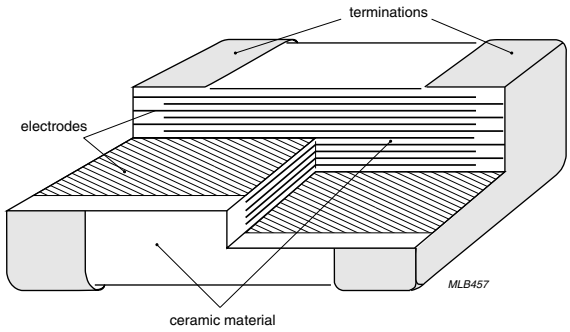


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

For dimension see Table 1

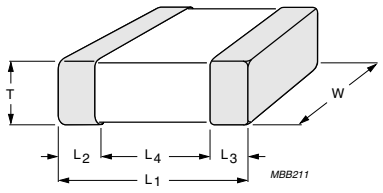


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

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				
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) :	
NP0	±5%
X7R	±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: |ΔC/C|: 30 ppm/°C X7R: |ΔC/C|: 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: $\lvert\Delta C/C\rvert$: ≤ 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} ≥ 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 and ordering code revised
Version 0	Sep 12, 2005	-	- New