

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

01005

NP0/X5R/X7R

4 V TO 25 V

0.5 pF to 470 nF

RoHS compliant & Halogen Free



SCOPE

This specification describes 01005 NP0/X5R series chip capacitors with lead-free terminations.

APPLICATIONS

- Mobile
- Module

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.

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)

0100(0402)

(2) TOLERANCE

B = $\pm 0.1\text{pF}$
C = $\pm 0.25\text{pF}$
D = $\pm 0.5\text{pF}$
J = $\pm 5\%$
K = $\pm 10\%$
M = $\pm 20\%$

(3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch

(4) TC MATERIAL

NPO
X5R
X7R

(5) RATED VOLTAGE

4 = 4 V
5 = 6.3 V
6 = 10 V
7 = 16 V
8 = 25 V

(6) PROCESS

N = NPO
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 = $12 \times 10^1 = 120\text{ pF}$

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.

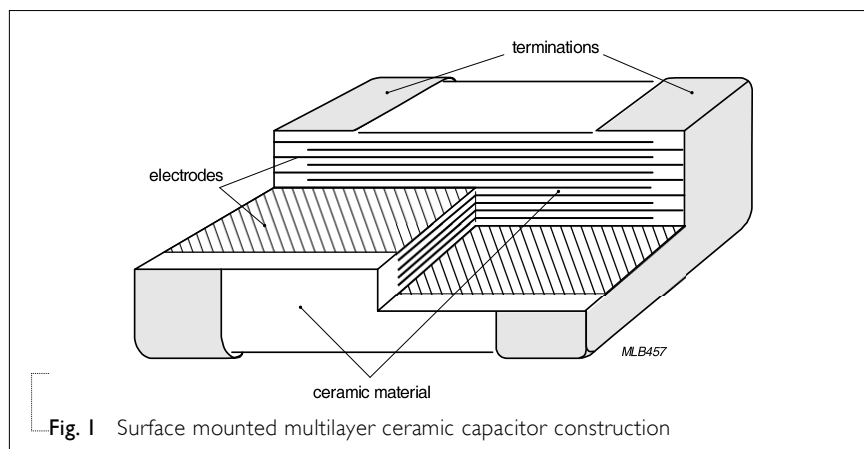


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table I For outlines see fig. 2

TYPE	L ₁ (mm)	W (mm)	T (mm)	L ₂ / L ₃ (mm)		L ₄ (mm)
				min.	max.	min.
01005	0.4 ±0.02	0.2 ±0.02	0.2 ±0.02	0.07	0.14	0.13

OUTLINES

For dimension see Table I

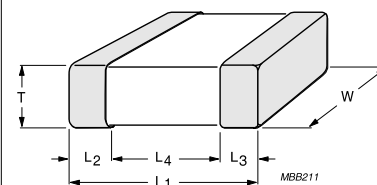


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS

Table 2 01005 Sizes

CAP. NP0		CAP. X5R				CAP. X7R		
16 V / 25 V		4V		6.3V	10V	6.3V / 10V		16V
0.5 pF	0.2±0.02	100 pF	0.2±0.02	0.2±0.02	0.2±0.02	100 pF	0.2±0.02	0.2±0.02
0.6 pF	0.2±0.02	150 pF	0.2±0.02	0.2±0.02	0.2±0.02	150 pF	0.2±0.02	0.2±0.02
0.7 pF	0.2±0.02	220 pF	0.2±0.02	0.2±0.02	0.2±0.02	220 pF	0.2±0.02	0.2±0.02
0.75 pF	0.2±0.02	330 pF	0.2±0.02	0.2±0.02	0.2±0.02	330 pF	0.2±0.02	0.2±0.02
0.8 pF	0.2±0.02	470 pF	0.2±0.02	0.2±0.02	0.2±0.02	470 pF	0.2±0.02	0.2±0.02
0.9 pF	0.2±0.02	680 pF	0.2±0.02	0.2±0.02	0.2±0.02	680 pF	0.2±0.02	0.2±0.02
1.0 pF	0.2±0.02	1 000 pF	0.2±0.02	0.2±0.02	0.2±0.02	1 000 pF	0.2±0.02	0.2±0.02
1.2 pF	0.2±0.02	2.2 nF	0.2±0.02	0.2±0.02	0.2±0.02	2.2 nF		
1.5 pF	0.2±0.02	4.7 nF	0.2±0.02	0.2±0.02	0.2±0.02	4.7 nF		
1.8 pF	0.2±0.02	10 nF	0.2±0.02	0.2±0.02	0.2±0.02	10 nF		
2.2 pF	0.2±0.02	22nF	0.2±0.02	0.2±0.02		22nF		
2.7 pF	0.2±0.02	47 nF	0.2±0.02	0.2±0.02		47 nF		
3.3 pF	0.2±0.02	100 nF	0.2±0.02	0.2±0.02	0.2±0.02	100 nF		
3.9 pF	0.2±0.02	220 nF	0.2±0.02	0.2±0.02		220 nF		
4.7 pF	0.2±0.02	470 nF	0.2±0.02	0.2±0.02				
5.6 pF	0.2±0.02	Tape width		8 mm				
6.8 pF	0.2±0.02							
8.2 pF	0.2±0.02							
10 pF	0.2±0.02							
12 pF	0.2±0.02							
15 pF	0.2±0.02							
18 pF	0.2±0.02							
22 pF	0.2±0.02							
27 pF	0.2±0.02							
33 pF	0.2±0.02							
39 pF	0.2±0.02							
47 pF	0.2±0.02							
56 pF	0.2±0.02							
68 pF	0.2±0.02							
82 pF	0.2±0.02							
100 pF	0.2±0.02							
Tape width				8 mm				

THICKNESS CLASSES AND PACKING QUANTITY

Table 3

SIZE CODE	THICKNESS CLASSIFICATION	TAPE WIDTH QUANTITY PER REEL	Ø180 MM / 7 INCH		Ø330 MM / 13 INCH		QUANTITY PER BULK CASE
			Paper/PE	Blister	Paper/	Blister	
01005	0.2 ±0.02 mm	8 mm	20,000	---	---	---	---

ELECTRICAL CHARACTERISTICS**NP0/X5R 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 4

DESCRIPTION		VALUE
Capacitance range		0.5 pF to 470 nF
Capacitance tolerance		
NP0	C < 10 pF	±0.1pF, ±0.25pF, ±0.5pF
	C ≥ 10 pF	±5%, ±10%
	X5R / X7R	±10%, ±20%
Dissipation factor (D.F.)		
NP0	C < 30 pF	≤ 1 / (400 + 20C)
	C ≥ 30 pF	≤ 0.1 %
	X5R / X7R	≤ 10 %
Insulation resistance after 1 minute at U _r (DC)		R _{ins} ≥ 10 GΩ or R _{ins} × C ≥ 500Ω · F whichever is less X5R/X7R > 10nF: R _{ins} × C ≥ 50Ω · F
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):		
NP0		±30 ppm/°C
X5R / X7R		±15%
Operating temperature range:		
NP0		-55 °C to +125 °C
X5R		-55 °C to +85 °C
X7R		-55 °C to +125 °C

SOLDERING RECOMMENDATION

Table 5

SOLDERING METHOD	SIZE 01005
Reflow	Reflow only
Reflow/Wave	---

TESTS AND REQUIREMENTS

Table 6 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 Class 1: $f = 1 \text{ MHz}$ for $C \leq 1 \text{ nF}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C $f = 1 \text{ KHz}$ for $C > 1 \text{ nF}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C Class 2: $C \leq 1 \text{ nF}$ $f = 1 \text{ KHz}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C $C > 1 \text{ nF}$ $f = 1 \text{ KHz}$, rated voltage $\leq 6.3 \text{ V}$, measuring at voltage $0.5 V_{\text{rms}}$ at 20°C $f = 1 \text{ KHz}$, rated voltage $> 10 \text{ V}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C	Within specified tolerance
Dissipation Factor (D.F.)		4.5.2 Class 1: $f = 1 \text{ MHz}$ for $C \leq 1 \text{ nF}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C $f = 1 \text{ KHz}$ for $C > 1 \text{ nF}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C Class 2: $C \leq 1 \text{ nF}$ $f = 1 \text{ KHz}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C $C > 1 \text{ nF}$ $f = 1 \text{ KHz}$, rated voltage $\leq 6.3 \text{ V}$, measuring at voltage $0.5 V_{\text{rms}}$ at 20°C $f = 1 \text{ KHz}$, rated voltage $> 10 \text{ V}$, measuring at voltage $1 V_{\text{rms}}$ at 20°C	In accordance with specification
Insulation Resistance		4.5.3 At U_r (DC) 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.	ΔC/C												
		The capacitance change should be measured after 5 min at each specified temperature stage.	Class I (NP0): ±30ppm												
		<table><tr><td>Step</td><td>Temperature(°C)</td></tr><tr><td>a</td><td>25±2</td></tr><tr><td>b</td><td>Lower temperature±3°C</td></tr><tr><td>c</td><td>25±2</td></tr><tr><td>d</td><td>Upper Temperature±2°C</td></tr><tr><td>e</td><td>25±2</td></tr></table>	Step	Temperature(°C)	a	25±2	b	Lower temperature±3°C	c	25±2	d	Upper Temperature±2°C	e	25±2	Class 2: (X7R/X5R): ±15%
		Step	Temperature(°C)												
a	25±2														
b	Lower temperature±3°C														
c	25±2														
d	Upper Temperature±2°C														
e	25±2														
(1) Class I Temperature Coefficient shall be calculated from the formula as below $\text{Temp. Coefficient} = \frac{C2 - C1}{C1 \times \Delta T} \times 10^6 \text{ [ppm/°C]}$ C1: Capacitance at step c C2: Capacitance at 125°C ΔT: 100°C(=125°C-25°C) Measuring Voltage: 0.5 to 5 Vrms	In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage. CC0100MRX5R4(5)BB104(224): 0.2V±0.1Vrms														
(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															
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 01005 : 1N												
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 I (NP0): within ±1% or 0.5 pF, whichever is greater Class2 (X5R/X7R): ±10%												

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Resistance to Soldering Heat	4.9	<p>Precondition: 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>Preheating: 120 °C to 150 °C for 1 minute and 170 °C to 200 °C for 1 minute.</p> <p>Solder bath temperature: 260 ±5 °C</p> <p>Dipping time: 10 ±0.5 seconds</p> <p>Recovery time: 24 ±2 hours</p>	<p>Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned</p> <hr/> <p>$\Delta C/C$</p> <p>Class 1 (NP0): within ±0.5% or 0.5 pF, whichever is greater</p> <hr/> <p>Class2 (X5R/X7R): ±10%</p> <hr/> <p>D.F. within initial specified value</p> <p>R_{ins} within initial specified value</p>
Solderability	4.10	<p>Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds.</p> <p>Test conditions for leadfree containing solder alloy</p> <p>Temperature: 245 ±5 °C</p> <p>Dipping time: 3 ±0.3 seconds</p> <p>Depth of immersion: 10 mm</p>	<p>The solder should cover over 95% of the critical area of each termination</p>
Rapid Change of Temperature	IEC 60384-21/22 4.11	<p>Preconditioning; 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>5 cycles with following detail: 30 minutes at lower category temperature 30 minutes at upper category temperature</p> <p>Recovery time 24 ±2 hours</p>	<p>No visual damage</p> <hr/> <p>$\Delta C/C$</p> <p>Class 1 (NP0): within ±2.5% or 0.25 pF, whichever is greater</p> <hr/> <p>Class2 (X5R/X7R): ±15%</p> <hr/> <p>D.F. meet initial specified value</p> <p>R_{ins} meet initial specified value</p>

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; 1.0 Ur applied. 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 Class 1 (NP0): $\Delta C/C$ within ±7.5% or 0.75 pF, whichever is greater D.F. ≤ 2 × specified value I.R. ≥ 2,500 MΩ or $R_{ins} \times Cr \geq 25\Omega \cdot F$ whichever is less Class2 (X5R/X7R): $C \leq 1nF$ $\Delta C/C$ ±15% D.F. ≤ 10% I.R. ≥ 500 MΩ $10nF \geq C > 1nF$ $\Delta C/C$ ±20% D.F. ≤ 10% I.R. ≥ 500 MΩ $C > 10nF$ $\Delta C/C$ ±25% D.F. ≤ 20% I.R. $R_{ins} \times Cr \geq 5\Omega \cdot F$

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Endurance	IEC 60384-21/22 4.14	<ol style="list-style-type: none"> Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp Initial measure: Spec: refer initial spec C, D, IR Endurance test: Temperature: NP0: 125 °C Specified stress voltage applied for 1,000 hours: Applied 2.0 × U_r for general product Temperature: X5R: 85°C, X7R: 125°C Specified stress voltage applied for 1,000 hours: Applied 1.5 × U_r for general product Recovery time: 24 ±2 hours Final measure: C, D, IR <p>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.</p>	<p>No visual damage</p> <hr/> <p>Class 1 (NP0): $\Delta C/C$ within ±3% or 0.3 pF, whichever is greater D.F. ≤ 2 × specified value I.R. ≥ 4,000 MΩ or R_{ins} × Cr ≥ 40Ω · F whichever is less</p> <p>Class2 (X5R/X7R): C ≤ 1nF $\Delta C/C$ ±15% D.F. ≤ 10% I.R. ≥ 1GΩ</p> <p>10nF ≥ C > 1nF $\Delta C/C$ ±15% D.F. ≤ 10% I.R. ≥ 1GΩ</p> <p>C > 10nF $\Delta C/C$ ±25% D.F. ≤ 20% I.R. R_{ins} × Cr ≥ 10Ω · F</p>
Voltage Proof	IEC 60384-1 4.5.4	<p>Specified stress voltage applied for 1~5 seconds</p> <p>U_r ≤ 100 V: series applied 2.5 U_r</p> <p>Charge/Discharge current is less than 50 mA</p>	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 10	May 5, 2017	-	- Rated voltage of NPO series extend to 25 V - Add X5R, 470nF, 4V to 6.3V and 100nF, 10V
Version 9	Jan. 17, 2017	-	- Test condition updated
Version 8	Jan. 12, 2016	-	- Capacitance range & thickness update
Version 7	Oct. 31, 2015	-	- Capacitance range & thickness update
Version 6	Jun. 29, 2015	-	- Test procedures and requirements
Version 5	Jun. 06, 2013	-	- Test procedures and requirements
Version 4	Mar. 27, 2013	-	- Change Tolerance
Version 3	Jan. 15, 2013	-	- Change Range
Version 2	Oct. 23, 2012	-	- Change Range
Version 1	July 03, 2012	-	- Change Range
Version 0	Apr 16, 2012	-	- New

Mouser Electronics

Authorized Distributor

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Yageo:

CC0100KRX5R5BB104	CC0100KRX5R5BB103	CC0100MRX5R5BB104	CC0100JRNPO7BN220
CC0100JRNPO6BN220	CC0100JRNPO7BN120	CC0100KRX5R5BB102	CC0100JRNPO6BN120
CC0100JRNPO6BN330	CC0100JRNPO6BN100	CC0100JRNPO6BN101	CC0100JRNPO7BN100
CC0100JRNPO7BN101	CC0100MRX5R5BB224	CC0100KRX5R5BB101	CC0100KRX5R5BB222
CC0100JRNPO7BN150	CC0100JRNPO7BN330	CC0100JRNPO7BN470	CC0100KRX5R6BB471
CC0100JRNPO7BN270	CC0100JRNPO8BN220	CC0100MRX5R5BB474	CC0100CRNPO7BN1R0
CC0100JRNPO8BN100	CC0100JRNPO8BN330	CC0100MRX5R5BB223	CC0100JRNPO8BN101
CC0100JRNPO8BN120	CC0100JRNPO8BN180	CC0100KRX5R5BB223	CC0100KRX5R6BB102
CC0100KRX7R6BB221	CC0100KRX5R6BB103	CC0100KRX5R6BB472	CC0100KRX7R6BB102
CC0100MRX5R4BB224	CC0100MRX5R5BB473	CC0100CRNPO7BN6R8	CC0100CRNPO7BN2R7
CC0100JRNPO6BN180	CC0100CRNPO7BN3R9	CC0100CRNPO7BN2R0	CC0100CRNPO7BN5R0
CC0100CRNPO7BN3R3	CC0100CRNPO7BN3R0	CC0100JRNPO7BN390	CC0100JRNPO6BN560
CC0100JRNPO7BN820	CC0100JRNPO6BN680	CC0100KRX5R5BB221	CC0100CRNPO7BN2R4
CC0100KRX5R5BB682	CC0100CRNPO7BN5R6	CC0100JRNPO6BN470	CC0100CRNPO7BN8R2
CC0100KRX5R5BB471	CC0100BRNPO7BNR75	CC0100JRNPO8BN390	CC0100JRNPO7BN680
CC0100JRNPO8BN560	CC0100KRX7R5BB101	CC0100JRNPO8BN470	CC0100KRX5R5BB331
CC0100CRNPO7BN7R0	CC0100CRNPO7BN2R2	CC0100JRNPO7BN180	CC0100JRNPO7BN560
CC0100CRNPO7BN4R0	CC0100BRNPO7BNR50	CC0100KRX7R5BB221	CC0100CRNPO7BN8R0
CC0100CRNPO7BN1R5	CC0100KRX5R6BB101	CC0100JRNPO6BN270	CC0100JRNPO7BN300
CC0100KRX5R5BB332	CC0100JRNPO6BN390	CC0100CRNPO7BN4R7	CC0100KRX5R5BB472
CC0100JRNPO6BN820	CC0100CRNPO7BN1R2	CC0100JRNPO6BN150	CC0100CRNPO7BN1R8