

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

Mid-voltage

NP0/X7R

100 V TO 630 V

0.47 pF to 470 nF

RoHS compliant



SCOPE

This specification describes Mid-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
- 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)

0603 (1608) / 0805 (2012) / 1206 (3216) / 1210 (3225) / 1808 (4520) / 1812 (4532)

(2) TOLERANCE

C = ± 0.25 pF

D = ± 0.5 pF

G = $\pm 2\%$

J = $\pm 5\%$

K = $\pm 10\%$

(3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch

K = Blister taping reel; Reel 7 inch

P = Paper taping reel; Reel 13 inch

F = Blister taping reel; Reel 13 inch

C = Bulk case

(4) TC MATERIAL

NPO

X7R

(5) RATED VOLTAGE

O = 100 V

A = 200 V

Y = 250 V

B = 500 V

Z = 630 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 = $12 \times 10^1 = 120$ pF

PHYCOMP BRAND ordering codes

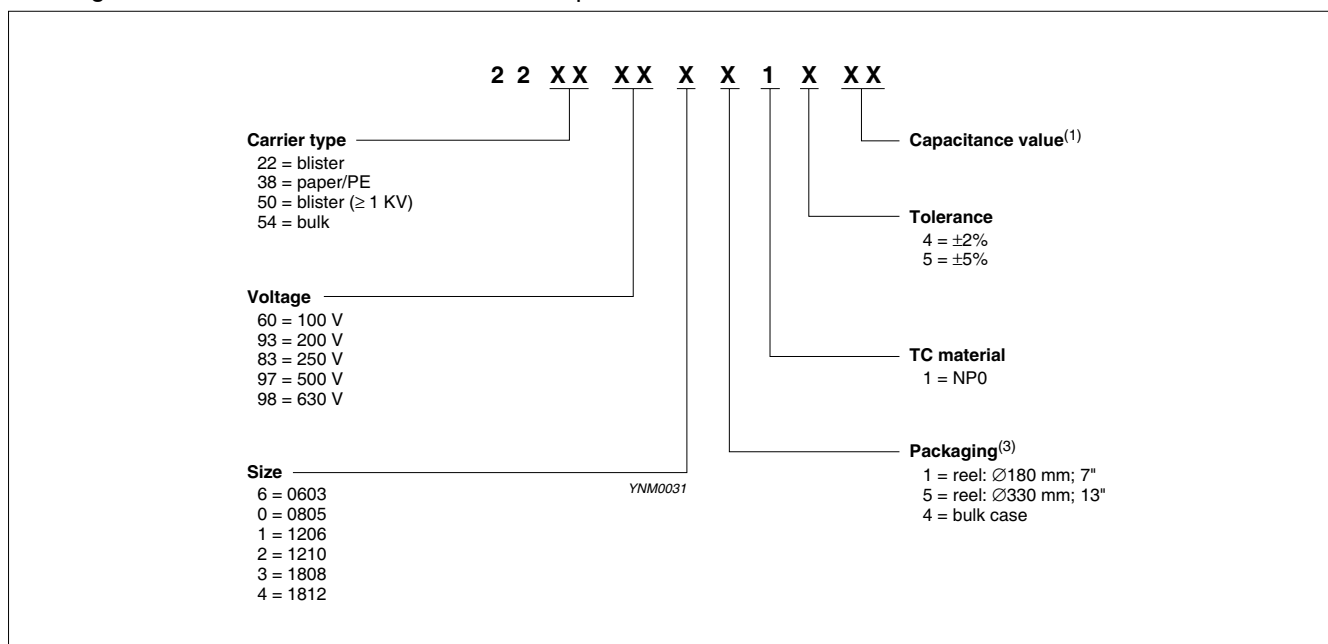
GLOBAL PART NUMBER (preferred), PHYCOMP CTC (for North America) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

GLOBAL PART NUMBER (PREFERRED)

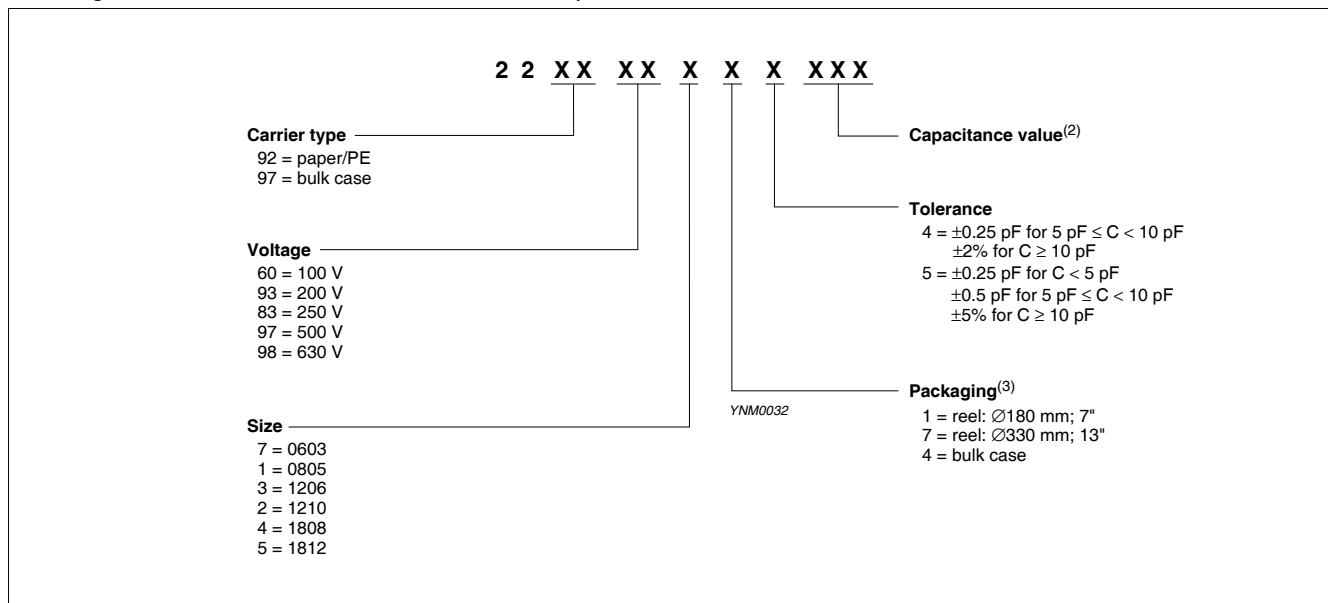
For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

I2NC CODE

Ordering information for NP0 100 V to 630 V, $C \geq 10$ pF



Ordering information for NP0 100 V to 630 V, $C < 10$ pF

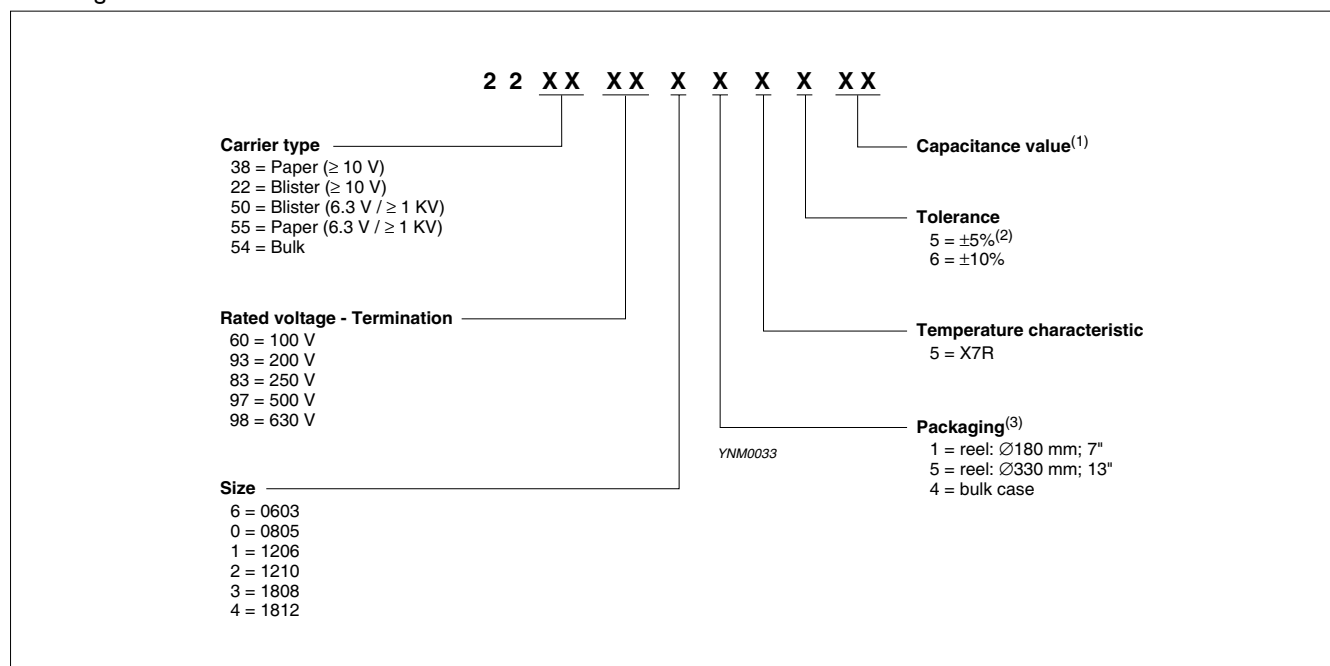


(1) Please refer to "Last 2-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0"

(2) Please refer to "Last 3-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0"

(3) Quantity on reel depends on thickness classification; see table I 4

Ordering information for X7R 100 V to 630 V



(1) Please refer to "Last 2-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR X7R"

(2) Tolerance $\pm 5\%$ doesn't available for full product range, please contact local sales force before order

(3) Quantity on reel depends on thickness classification; see table I 4

PHYCOMP CTC CODE (FOR NORTH AMERICA)

🔗 Example: 0603CG101J0B200

0603	CG	101	J	0	B	2	0	0
Size code	Temp. Char.	Capacitance in pF	Tolerance	Voltage	Termination	Packing	Marking	Range identifier
0603	CG = NP0	101 = 100 pF; the	C = ± 0.25 pF	0 = 100 V	B = NiSn	2 = 180 mm	0 = no marking	0 = conv. Ceramic
0805	2R = X7R	third digit signifies	D = ± 0.5 pF	B = 200 V		7" paper/PE		D = Class 2 MLCC
1206		the multiplying	G = $\pm 2\%$	C = 250 V		3 = 330 mm		
1210		factor:	J = $\pm 5\%$	D = 500 V		13" paper		
1808		0 = $\times 1$	K = $\pm 10\%$	Z = 630 V		B = 180 mm		
1812		1 = $\times 10$				7" blister		
		2 = $\times 100$				F = 330 mm		
		3 = $\times 1,000$				13" blister		
						P = Bulk case		

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.

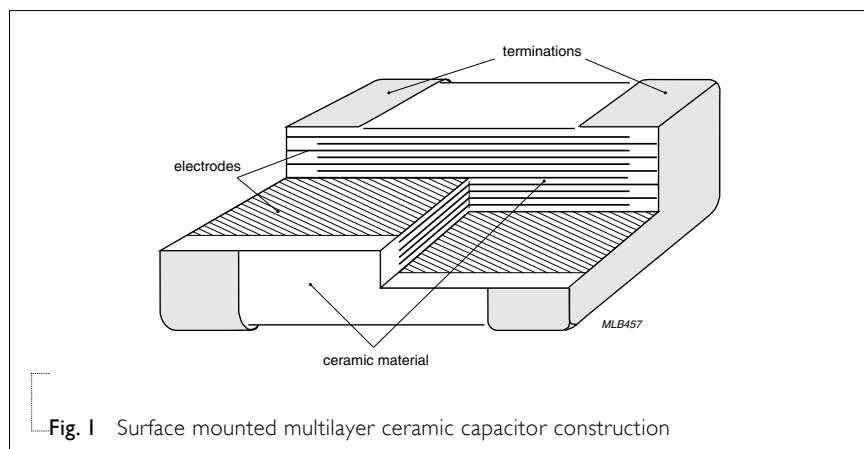


Fig. 1 Surface mounted multilayer ceramic capacitor construction

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.
0603	1.6 ±0.10	0.8 ±0.10	Refer to table 2 to 14	0.20	0.60	0.40
0805	2.0 ±0.10	1.25 ±0.10		0.25	0.75	0.55
1206	3.2 ±0.15	1.6 ±0.15		0.25	0.75	1.40
1210	3.2 ±0.30	2.5 ±0.20		0.25	0.75	1.40
1808	4.5 ±0.40	2.0 ±0.30		0.25	0.75	2.20
1812	4.5 ±0.40	3.2 ±0.20		0.25	0.75	2.20

OUTLINES

For dimension see Table I

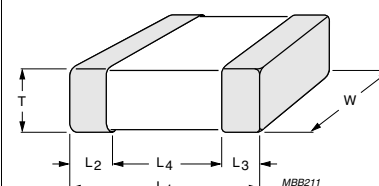


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NP0**Table 2** Sizes from 0603 to 0805

CAP.	Last 3-digit of I2NC	0603 100 V	200 V	250 V	0805 100 V	200 V	250 V	500 V
0.47 pF	477	0.8±0.1			0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
0.56 pF	567							
0.68 pF	687							
0.82 pF	827							
1.0 pF	108							
1.2 pF	128							
1.5 pF	158							
1.8 pF	188							
2.2 pF	228							
2.7 pF	278							
3.3 pF	338							
3.9 pF	398							
4.7 pF	478							
5.6 pF	568							
6.8 pF	688							
8.2 pF	828							

Table 3 Sizes from 0603 to 0805

CAP.	Last 2-digit of I2NC	0603 100 V	200 V	250 V	0805 100 V	200 V	250 V	500 V
10 pF	23	0.8±0.1	0.8±0.1	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
12 pF	24							
15 pF	25							
18 pF	26							
22 pF	27							
27 pF	28							
33 pF	29							
39 pF	31							
47 pF	32							
56 pF	33							
68 pF	34							
82 pF	35							

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 NP0**Table 4** Sizes from 0603 to 0805 (continued)

CAP.	Last 2-digit of	0603	0805					
	I2NC	100 V	200 V	250 V	100 V	200 V	250 V	500 V
100 pF	36							
120 pF	37							
150 pF	38							
180 pF	39							
220 pF	41		0.8±0.1	0.8±0.1				0.85±0.1
270 pF	42							
330 pF	43	0.8±0.1			0.85±0.1	0.85±0.1	0.85±0.1	
390 pF	44							
470 pF	45							
560 pF	46							
680 pF	47							
820 pF	48							1.25±0.2
1 nF	49							
1.2 nF	51							
1.5 nF	52					1.25±0.2	1.25±0.2	
1.8 nF	53							
2.2 nF	54				1.25±0.2			
2.7 nF	55							
3.3 nF	56							
3.9 nF	57							
4.7 nF	58							
5.6 nF	59							
6.8 nF	61							
8.2 nF	62							
10 nF	63							
12 nF	64							
15 nF	65							
18 nF	66							
22 nF	67							

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 NP0**Table 5** Sizes from 1206 to 1210

CAP.	Last 3-digit of	1206					1210					
		12NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
0.47 pF	477	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1						1.25±0.2
0.56 pF	567											
0.68 pF	687											
0.82 pF	827											
1.0 pF	108											
1.2 pF	128											
1.5 pF	158											
1.8 pF	188											
2.2 pF	228											
2.7 pF	278											
3.3 pF	338											
3.9 pF	398											
4.7 pF	478											
5.6 pF	568											
6.8 pF	688											
8.2 pF	828											

Table 6 Sizes from 1206 to 1210

CAP.	Last 2-digit of	1206					1210					
		12NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
10 pF	23	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1						1.25±0.2
12 pF	24											
15 pF	25											
18 pF	26											
22 pF	27											
27 pF	28											
33 pF	29											
39 pF	31											
47 pF	32											
56 pF	33						1.25±0.2					
68 pF	34						1.25±0.2					
82 pF	35											

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 NP0**Table 7** Sizes from I206 to I210 (continued)

CAP.	Last 2-digit of	I206					I210					
		I2NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
100 pF	36	0.85±0.1										
120 pF	37											
150 pF	38											
180 pF	39											
220 pF	41											
270 pF	42											
330 pF	43											
390 pF	44											
470 pF	45											
560 pF	46											
680 pF	47											
820 pF	48											
1 nF	49											
1.2 nF	51											
1.5 nF	52											
1.8 nF	53											
2.2 nF	54											
2.7 nF	55											
3.3 nF	56											
3.9 nF	57											
4.7 nF	58											
5.6 nF	59											
6.8 nF	61											
8.2 nF	62											
10 nF	63											
12 nF	64											
15 nF	65											
18 nF	66											
22 nF	67											

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 NP0**Table 8** Sizes from 1808 to 1812

CAP.	Last 3-digit of	1808					1812					
		12NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
0.47 pF	477						1.25±0.2					
0.56 pF	567											
0.68 pF	687											
0.82 pF	827											
1.0 pF	108											
1.2 pF	128											
1.5 pF	158											
1.8 pF	188											
2.2 pF	228											
2.7 pF	278											
3.3 pF	338											
3.9 pF	398											
4.7 pF	478											
5.6 pF	568											
6.8 pF	688											
8.2 pF	828											

Table 9 Sizes from 1808 to 1812

CAP.	Last 2-digit of	1808					1812					
		12NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
10 pF	23						1.25±0.2					
12 pF	24											
15 pF	25											
18 pF	26											
22 pF	27											
27 pF	28											
33 pF	29											
39 pF	31											
47 pF	32											
56 pF	33											
68 pF	34											
82 pF	35											

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 NP0**Table 10** Sizes from I808 to I812 (continued)

CAP.	Last 2-digit of	1808					1812				
		12NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V
100 pF	36										
120 pF	37										
150 pF	38										
180 pF	39										
220 pF	41										
270 pF	42										
330 pF	43	1.25±0.2				1.25±0.2				1.25±0.2	
390 pF	44										
470 pF	45										
560 pF	46										
680 pF	47								1.25±0.2		
820 pF	48										
1 nF	49								1.25±0.2		
1.2 nF	51										
1.5 nF	52										
1.8 nF	53										
2.2 nF	54				1.25±0.2		1.25±0.2	1.25±0.2		1.6±0.2	
2.7 nF	55										
3.3 nF	56										
3.9 nF	57										
4.7 nF	58						1.6±0.2	1.6±0.2			
5.6 nF	59										
6.8 nF	61										
8.2 nF	62										
10 nF	63										
12 nF	64										
15 nF	65										
18 nF	66										
22 nF	67										

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**Table 11** Sizes from 0603 to 0805

CAP.	Last 2-digit of I2NC	0603 100 V	0805 100 V	200 V	250 V	500 V
100 pF	09	0.8±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
150 pF	12					
220 pF	14					
330 pF	16					
470 pF	18					
680 pF	21					
1.0 nF	23					
1.5 nF	25					
2.2 nF	27					
3.3 nF	29					
4.7 nF	32					
6.8 nF	34					
10 nF	36					
15 nF	38					
22 nF	41					
33 nF	43	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
47 nF	45					
68 nF	47					
100 nF	49	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
150 nF	52					
220 nF	54					
330 nF	56					
470 nF	58					

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before order

CAPACITANCE RANGE & THICKNESS FOR X7R**Table 12** Sizes from I206 to I210

CAP.	Last 2-digit of	I206					I210								
		I2NC	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V				
100 pF	09						0.85±0.1								
150 pF	12														
220 pF	14	0.85±0.1		0.85±0.1		1.25±0.2	1.25±0.2								
330 pF	16														
470 pF	18														
680 pF	21														
1.0 nF	23														
1.5 nF	25														
2.2 nF	27								0.85±0.1	0.85±0.1	1.25±0.2	1.25±0.2	0.85±0.1	0.85±0.1	1.25±0.2
3.3 nF	29														
4.7 nF	32														
6.8 nF	34														
10 nF	36														
15 nF	38						0.85±0.1								
22 nF	41														
33 nF	43		1.25±0.2	1.25±0.2		1.6±0.2									
47 nF	45							1.25±0.2	1.25±0.2						
68 nF	47														
100 nF	49	1.25±0.2													
150 nF	52														
220 nF	54						1.25±0.2								
330 nF	56	1.6±0.2													
470 nF	58														

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before order

CAPACITANCE RANGE & THICKNESS FOR X7R**Table 13** Sizes from 1808 to 1812

CAP.	Last 2-digit of	1808					1812				
		12NC	100 V	200 V	250 V	500 V	100 V	200 V	250 V	500 V	630 V
100 pF	09										
150 pF	12										
220 pF	14										
330 pF	16										
470 pF	18										
680 pF	21										
1.0 nF	23										
1.5 nF	25										
2.2 nF	27										
3.3 nF	29										
4.7 nF	32										
6.8 nF	34										
10 nF	36										
15 nF	38										
22 nF	41										
33 nF	43										
47 nF	45										
68 nF	47										
100 nF	49										
150 nF	52										
220 nF	54										
330 nF	56										
470 nF	58										

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For product with 5% tolerance, please contact local sales force before order

THICKNESS CLASSES AND PACKING QUANTITY

Table 14

SIZE CODE	THICKNESS CLASSIFICATION	TAPE WIDTH QUANTITY PER REEL	Ø180 MM / 7 INCH		Ø330 MM / 13 INCH		QUANTITY PER BULK CASE
			Paper	Blister	Paper	Blister	
0201	0.3 ±0.03 mm	8 mm	15,000	---	50,000	---	---
0402	0.5 ±0.05 mm	8 mm	10,000	---	50,000	---	50,000
0603	0.8 ±0.1 mm	8 mm	4,000	---	15,000	---	15,000
0805	0.6 ±0.1 mm	8 mm	4,000	---	20,000	---	10,000
	0.8 / 0.85 ±0.1 mm	8 mm	4,000	---	15,000	---	8,000
	1.25 ±0.2 mm	8 mm	---	3,000	---	10,000	5,000
1206	0.6 ±0.1 mm	8 mm	4,000	---	20,000	---	---
	0.8 / 0.85 ±0.1 mm	8 mm	4,000	---	15,000	---	---
	1.00 / 1.15 ±0.1 mm	8 mm	---	3,000	---	10,000	---
	1.25 ±0.2 mm	8 mm	---	3,000	---	10,000	---
	1.6 ±0.15 mm	8 mm	---	2,500	---	10,000	---
	1.6 ±0.2 mm	8 mm	---	2,000	---	10,000	---
1210	0.6 / 0.7 ±0.1 mm	8 mm	---	4,000	---	15,000	---
	0.85 ±0.1 mm	8 mm	---	4,000	---	10,000	---
	1.15 ±0.1 mm	8 mm	---	3,000	---	10,000	---
	1.15 ±0.15 mm	8 mm	---	3,000	---	10,000	---
	1.25 ±0.2 mm	8 mm	---	3,000	---	---	---
	1.5 ±0.1 mm	8 mm	---	2,000	---	---	---
	1.6 / 1.9 ±0.2 mm	8 mm	---	2,000	---	---	---
	2.0 ±0.2 mm	8 mm	---	2,000 1,000	---	---	---
	2.5 ±0.2 mm	8 mm	---	1,000 500	---	---	---
1808	1.15 ±0.15 mm	12 mm	---	3,000	---	---	---
	1.25 ±0.2 mm	12 mm	---	3,000	---	---	---
	1.35 ±0.15 mm	12 mm	---	2,000	---	---	---
	1.5 ±0.1 mm	12 mm	---	2,000	---	---	---
	1.6 ±0.2 mm	12 mm	---	2,000	---	---	---
	2.0 ±0.2 mm	12 mm	---	2,000	---	---	---
1812	0.6 / 0.85 ±0.1 mm	12 mm	---	2,000	---	---	---
	1.15 ±0.1 mm	12 mm	---	1,500	---	---	---
	1.15 ±0.15 mm	12 mm	---	1,500	---	---	---
	1.25 ±0.2 mm	12 mm	---	1,000	---	---	---
	1.35 ±0.15 mm	12 mm	---	1,000	---	---	---
	1.5 ±0.1 mm	12 mm	---	1,000	---	---	---
	1.6 ±0.2 mm	12 mm	---	1,000	---	---	---
	2.0 ±0.2 mm	12 mm	---	1,000	---	---	---
	2.5 ±0.2 mm	12 mm	---	500	50,000	---	---

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 15

DESCRIPTION		VALUE
Capacitance range		0.47 pF to 470 nF
Capacitance tolerance		
NP0	$C < 10$ pF	± 0.25 pF, ± 0.5 pF
	$C \geq 10$ pF	$\pm 2\%$, $\pm 5\%$
X7R		$\pm 5\%$ ⁽¹⁾ , $\pm 10\%$
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)		$R_{ins} \geq 10$ G Ω 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

NOTE

1. Capacitance tolerance $\pm 5\%$ doesn't available for X7R full product range, please contact local sales force before order

MID-VOLTAGE NP0

Sample limits (broken lines).
Requirement levels (dotted lines)

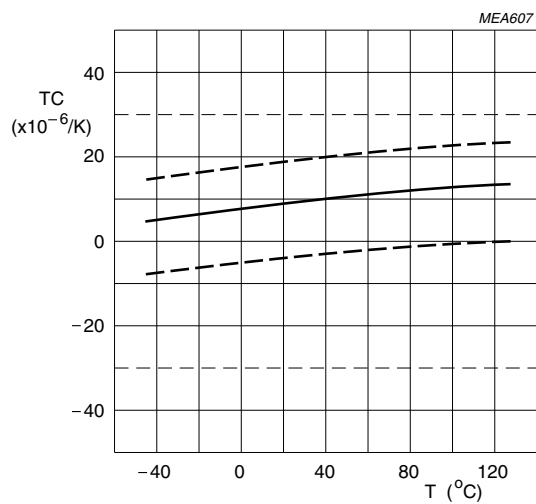


Fig. 3 Typical temperature coefficient as a function of temperature

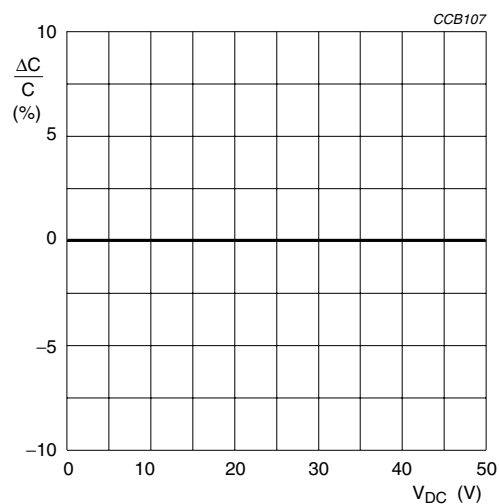


Fig. 4 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage

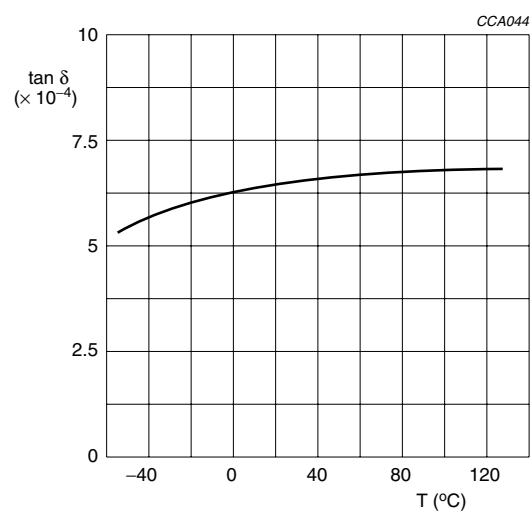


Fig. 5 Typical tan δ as a function of temperature

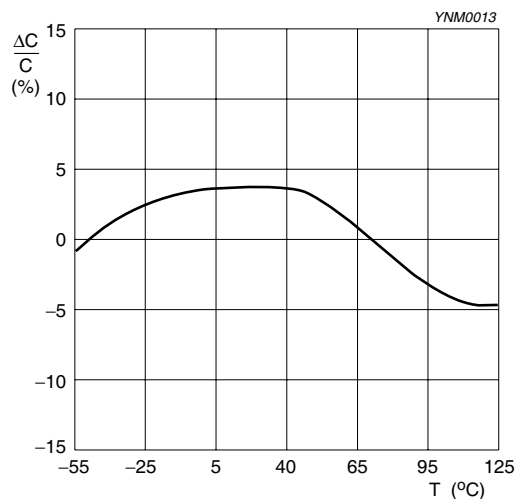
MID-VOLTAGE X7R


Fig. 6 Typical capacitance change as a function of temperature

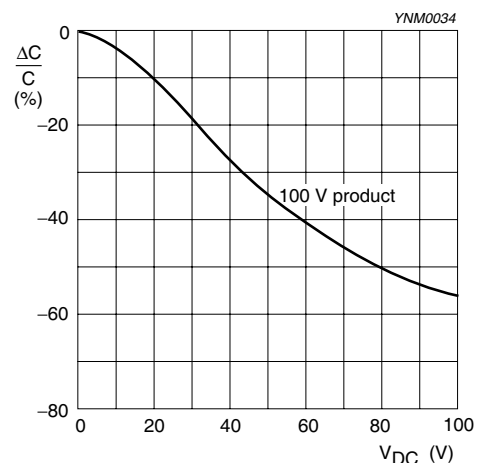


Fig. 7 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C

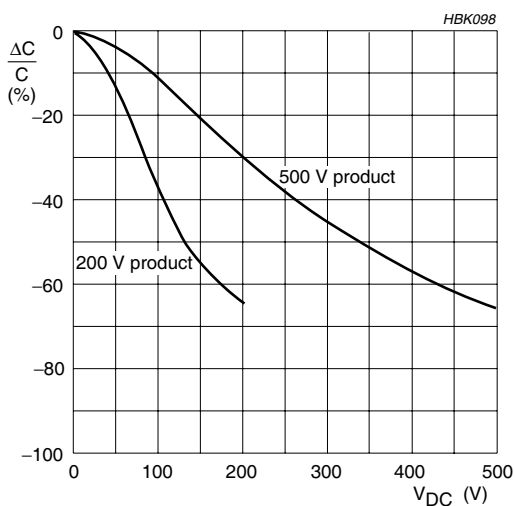


Fig. 8 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C

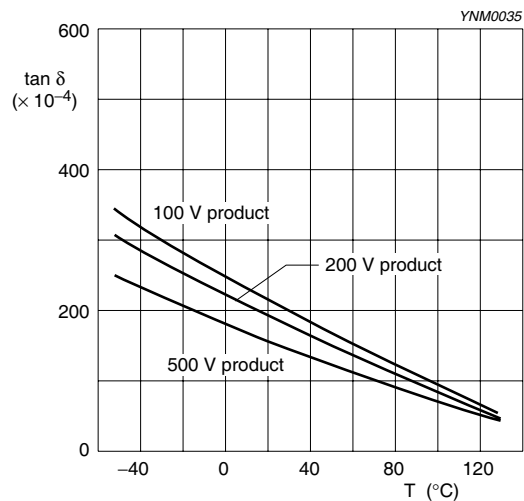


Fig. 9 Typical tan δ as a function of temperature

SOLDERING RECOMMENDATION

Table 16

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

TESTS AND REQUIREMENTS

Table 17 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	Class 1: 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 Class 2: 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	Class 1: 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 Class 2: 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	U _r ≤ 500 V: At U _r for 1 minute U _r > 500 V: At 500 V for 1 minute	In accordance with specification
Temperature coefficient	4.6	Class 1: Between minimum and maximum temperature NP0: -55 °C to +125 °C Normal Temperature: 20 °C	ΔC/C: Class 1: NP0: ±30 ppm/°C
Temperature characteristic		Class 2: Between minimum and maximum temperature X7R: -55 °C to +125 °C Normal Temperature: 20 °C	Class 2 X7R: ±15%

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Adhesion	4.7	A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate	Force size $\geq$ 0603: 5N
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 $\Delta C/C$ Class 1: NP0: within $\pm 1\%$ or 0.5 pF, whichever is greater Class2: X7R: $\pm 10\%$
Resistance to soldering heat	4.9	Precondition: 150 $\pm 0/-10$ °C for 1 hour, then keep for 24 ± 1 hours at room temperature Preheating: for size $\leq$ 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	Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned $\Delta C/C$ Class 1: NP0: within $\pm 0.5\%$ or 0.5 pF, whichever is greater Class2: X7R: $\pm 10\%$ D.F. within initial specified value R_{ins} within initial specified value
Solderability	4.10	Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds. Test conditions for lead containing solder alloy Temperature: 235 ± 5 °C Dipping time: 2 ± 0.2 seconds Depth of immersion: 10 mm Alloy Composition: 60/40 Sn/Pb Number of immersions: 1 Test conditions for leadfree containing solder alloy Temperature: 245 ± 5 °C Dipping time: 3 ± 0.3 seconds Depth of immersion: 10 mm Alloy Composition: SAC305 Number of immersions: 1	The solder should cover over 95% of the critical area of each termination

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Rapid change of temperature	IEC 60384-21/22	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 $\Delta C/C$ Class 1: NP0: within ±1% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. meet initial specified value R_{ins} meet initial specified value
Damp heat with U_r 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 U_r 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 $\Delta C/C$ Class 1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class 1: NP0: $\leq 2 \times$ specified value Class2: X7R: $\geq 25V: \leq 5\%$ R_{ins} Class 1: NP0: $\geq 2,500 M\Omega$ or $R_{ins} \times C_r \geq 25s$ whichever is less Class2: X7R: $\geq 500 M\Omega$ or $R_{ins} \times C_r \geq 25s$ whichever is less

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Endurance	IEC 60384-21/22 4.14	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. Endurance test: Temperature: NP0/X7R: 125 °C Specified stress voltage applied for 1,000 hours: High voltage series follows with below stress condition: Applied $2.0 \times U_r$ for < 500 V series Applied $1.3 \times U_r$ for 500 V, 630 V series Applied $1.2 \times U_r$ for 1 KV, 2 KV, 3 KV series 4. Recovery time: 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 $\Delta C/C$ Class1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class1: NP0: $\leq 2 \times$ specified value Class2: X7R: $\geq 25V: \leq 5\%$ R_{ins} Class1: NP0: $\geq 4,000 M\Omega$ or $R_{ins} \times C_r \geq 40s$ whichever is less Class2: X7R: $\geq 1,000 M\Omega$ or $R_{ins} \times C_r \geq 50s$ whichever is less
Voltage proof	IEC 60384-1 4.6	Specified stress voltage applied for 1 minute $U_r \leq 100 V$: series applied $2.5 U_r$ $100 V < U_r \leq 200 V$ series applied $(1.5 U_r + 100)$ $200 V < U_r \leq 500 V$ series applied $(1.3 U_r + 100)$ $U_r > 500 V$: $1.3 U_r$ I: 7.5 mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version I	Oct 30, 2009	-	- Change to dual brand datasheet that describe Mid-voltage NP0/X7R series with RoHS compliant - Replace the "100V to 630V" part of pdf files: UP-NP0X7R_MV_100-to-500V_0, UY-NP0X7R_MV_100-to-500V_0, NP0_16V-to-100V_6 and X7R_16V-to-100V_9 - Define global part number - Description of "Halogen Free compliant" added - Test method and procedure updated
Version 0	Sep 08, 2005	-	- New