Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

Mid-voltage

NP0/X7R

100 V TO 630 V

0.47 pF to 2.2 µF

RoHS compliant & Halogen Free



YAGEO

Product Specification – December 08, 2022 V.25



SCOPE

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

APPLICATIONS

PCs, Hard disk, Game PCs
Power supplies, Charger
LCD panel
ADSL, Modem

FEATURES

Supplied in tape on reel
Nickel-barrier end termination
RoHS compliant
MSL class MSL 1
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)

0201 (0603) / 0402 (1005) / 0603 (1608) / 0805 (2012) / 1206 (3216) / 1210 (3225)
1808 (4520) / 1812 (4532) / 2220 (5750)

(2) TOLERANCE

C = ±0.25 pF
D = ±0.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%

(3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch
K = Blister taping reel; Reel 7 inch
P = Paper/PE taping reel; Reel 13 inch
F = Blister taping reel; Reel 13 inch

(4) TC MATERIAL

NPO
X7R

(5) RATED VOLTAGE

0 = 100 V
A = 200 V
Y = 250 V
B = 500 V
Z = 630 V

(6) PROCESS

N = NP0
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 x 10^1 = 120 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.

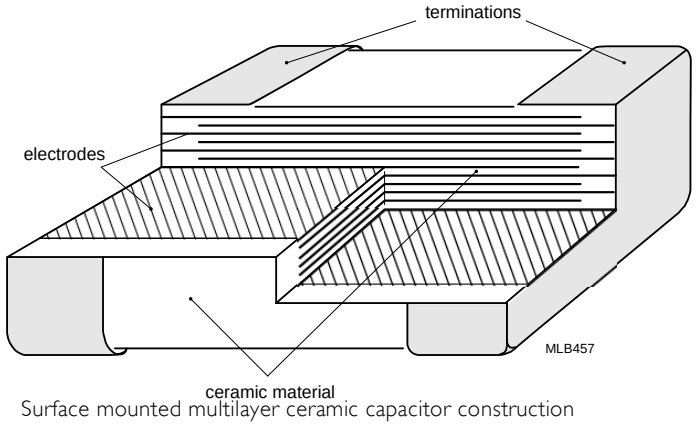


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table 1 For outlines see fig. 2

TYPE	L_1 (mm)	W (mm)	T (MM)	L_2 / L_3 (mm)		L_4 (mm)
				min.	max.	min.
0201	0.6 ±0.03	0.3±0.03	0.3±0.03	0.10	0.20	0.20
0402	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15	0.35	0.30
0603	1.6 ±0.10	0.8 ±0.10	0.8 ±0.10	0.20	0.60	0.40
0805	2.0 ±0.10	1.25 ±0.10	0.6 ±0.10	0.25	0.75	0.70
	2.0 ±0.20	1.25 ±0.20	0.85 ±0.10			
			1.25 ±0.20			
1206	3.2 ±0.15	1.6 ±0.15	0.6 ±0.10	0.25	0.75	1.40
			0.85 ±0.10			
	3.2 ±0.30	1.6 ±0.20	1.25 ±0.20			
			1.6 ±0.20			
	3.2 ±0.30	1.6 ±0.30	1.6 ±0.30	0.3	0.9	1.4
1210	3.2 ±0.20	2.5 ±0.20	0.85 ±0.10	0.25	0.75	1.40
	3.2 ±0.40	2.5 ±0.30	1.25 ±0.20			
			1.6 ±0.20			
			2.0 ±0.20			
1808	4.5 ±0.40	2.0 ±0.30	1.25 ±0.20	0.25	0.75	2.20
1812	4.5 ±0.40	3.2 ±0.30	0.85 ±0.10	0.25	0.75	2.20
			1.25 ±0.20			
			1.60 ±0.20			
2020	5.7 ±0.40	5.0 ±0.30	2.0 ±0.20	0.25	0.75	3.40

OUTLINES

For dimension see Table 1

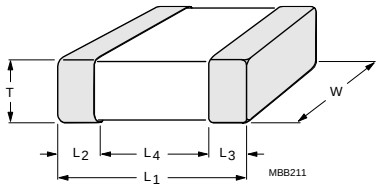


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 2 Sizes from 0201 to 0805

CAP.	0201	0402	0603			0805				
	100V	100V	100 V	200 V	250 V	100 V	200 V	250 V	500 V	630V
0.22 pF										
0.47 pF										
0.56 pF										
0.68 pF										
0.82 pF										
1.0 pF										
1.2 pF										
1.5 pF										
1.8 pF										
2.2 pF										
2.7 pF										
3.3 pF										
3.9 pF										
4.7 pF										
5.6 pF	0.3±0.03	0.5±0.05	0.8±0.1	0.8±0.1	0.8±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1
6.8 pF										
8.2 pF										
10 pF										
12 pF										
15 pF										
18 pF										
22 pF										
27 pF										
33 pF										
39 pF										
47 pF										
56 pF										
68 pF										
82 pF										
100 pF										

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 3 Sizes from 0603 to 0805 (continued)

CAP.	0402	0603			0805				
	100 V	100 V	200 V	250 V	100 V	200 V	250 V	500 V	630 V
120 pF	0.5± 0.05	0.8± 0.1	0.8± 0.1	0.8± 0.1	0.6± 0.1	0.6± 0.1	0.6± 0.1	0.6± 0.1	0.6± 0.1
150 pF									
180 pF									
220 pF						0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
270 pF									
330 pF									
390 pF									
470 pF									
560 pF								1.25±0.2	1.25±0.2
680 pF									
820 pF									
1.0 nF									
1.2 nF		0.8± 0.1			0.85±0.1	1.25±0.2	1.25±0.2		
1.5 nF									
1.8 nF									
2.2 nF					1.25±0.2				
2.7 nF									
3.3 nF									
3.9 nF									
4.7 nF									
5.6 nF									
6.8 nF									
8.2 nF									
10 nF									
12 nF									
15 nF									
18 nF									
22 nF									

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 1206 to 1210

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
0.47 pF	0.6±0.1	0.6±0.1	0.6±0.1							
0.56 pF										
0.68 pF										
0.82 pF										
1.0 pF										
1.2 pF										
1.5 pF										
1.8 pF										
2.2 pF										
2.7 pF										
3.3 pF										
3.9 pF										
4.7 pF										
5.6 pF										
6.8 pF										
8.2 pF										
10 pF				0.6±0.1	1.25±0.2					
12 pF										
15 pF										
18 pF										
22 pF										
27 pF										
33 pF										
39 pF										
47 pF						1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
56 pF										
68 pF										
82 pF										

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 (continued)

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630 V
100 pF	0.6±0.1	0.6±0.1	0.6±0.1	0.6±0.1	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2
120 pF										
150 pF										
180 pF										
220 pF										
270 pF										
330 pF										
390 pF										
470 pF										
560 pF										
680 pF										
820 pF		0.85±0.1	0.85±0.1	0.85±0.1						
1.0 nF										
1.2 nF										
1.5 nF										
1.8 nF		1.25±0.2	1.25±0.2	1.25±0.2						
2.2 nF										
2.7 nF										
3.3 nF	0.85±0.1									
3.9 nF										
4.7 nF										
5.6 nF										
6.8 nF					1.60±0.2					
8.2 nF	1.25±0.2									
10 nF					1.60±0.2					
12 nF										
15 nF										
18 nF						1.6±0.2				
22 nF										2.0±0.2

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 6 Sizes 1812

CAP.	1812				
	100 V	200 V	250 V	500 V	630V
10 pF					
12 pF					
15 pF					
18 pF					
22 pF					
27 pF					
33 pF					
39 pF					
47 pF					
56 pF					
68 pF					
82 pF					
100 pF					
120 pF					
150 pF					
180 pF					
220 pF					
270 pF					1.25±0.2
330 pF					
390 pF					
470 pF				1.25±0.2	
560 pF					
680 pF					
820 pF					
1 nF					
1.2 nF			1.25±0.2		
1.5 nF		1.25±0.2			
1.8 nF					
2.2 nF					
2.7 nF	1.25±0.2				
3.3 nF					
3.9 nF					
4.7 nF					
5.6 nF					
6.8 nF					
8.2 nF					
10 nF					
12 nF					
15 nF					
18 nF					
22 nF					1.6±0.2

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 7 Sizes from 0402 to 0805

CAP.	0402	0603		0805				
	100 V	100 V	200V/250V	100 V	200 V	250 V	500 V	630 V
100 pF	0.5±0.05	0.8±0.1	0.8±0.1	0.6±0.1	0.85±0.1	0.85±0.1	0.85±0.1	0.85±0.1
150 pF								
220 pF								
330 pF								
470 pF								
680 pF								
1.0 nF								
1.5 nF								
2.2 nF								
3.3 nF								
4.7 nF								
6.8 nF					1.25±0.2	1.25±0.2		
10 nF								1.25±0.2
15 nF				0.85±0.1			1.25±0.2	
22 nF								
33 nF				1.25±0.2				
47 nF								
68 nF								
100 nF								
150 nF								
220 nF								
330 nF								
470 nF								
1 µF								

NOTE

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

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 8 Sizes from 1206 to 1210

CAP.	1206					1210				
	100 V	200 V	250 V	500 V	630 V	100 V	200 V	250 V	500 V	630V
100 pF										
150 pF										
220 pF										
330 pF										
470 pF										
680 pF										
1.0 nF										
1.5 nF										
2.2 nF		0.85±0.1	0.85±0.1	1.25±0.2	1.25±0.2					
3.3 nF	0.85±0.1									
4.7 nF							0.85±0.1	0.85±0.1		
6.8 nF										1.25±0.2
10 nF									1.25±0.2	
15 nF						0.85±0.1				
22 nF					1.6±0.2					1.6±0.2
33 nF		1.25±0.2	1.25±0.2	1.6±0.2			1.25±0.2	1.25±0.2		2.0±0.2
47 nF										
68 nF									2.0±0.2	
100 nF	1.25±0.2	1.6±0.2	1.6±0.2							
150 nF										
220 nF						1.25±0.2				
330 nF										
470 nF										
680 nF	1.6±0.2									
1 µF						2.0±0.2				
2.2 µF										

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 9 Sizes from 1808 to 1812

CAP.	1812					2020
	100 V	200 V	250 V	500 V	630 V	630 V
100 pF						
150 pF						
220 pF						
330 pF						
470 pF						
680 pF						
1.0 nF	0.85±0.1	0.85±0.1	0.85±0.1	1.25±0.2	1.35±0.2	
1.5 nF						
2.2 nF						
3.3 nF						
4.7 nF						
6.8 nF						
10 nF						
15 nF						
22 nF						
33 nF					1.6±0.2	
47 nF		1.25±0.2	1.25±0.2			
68 nF						
100 nF	1.25±0.2			1.6±0.2		
150 nF						2.0±0.2
220 nF		1.6±0.2	1.6±0.2			
330 nF						
470 nF	1.6±0.2					
680 nF						
1 µF						

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 10

SIZE CODE	THICKNESS CLASSIFICATION	PACKING CODE. 7 INCH	PACKING CODE. 13 INCH	TAPE WIDTH	QUANTITY PER REEL Ø180 MM / 7 INCH Paper	Ø180 MM / 7 INCH Blister	Ø330 MM / 13 INCH Paper	Ø330 MM / 13 INCH Blister
0201	0.3 ±0.03 mm	R	P	8 mm	15,000	---	50,000	---
0402	0.5 ±0.05 mm	R	P	8 mm	10,000	---	50,000	---
0603	0.8 ±0.1 mm	R	P	8 mm	4,000	---	15,000	---
0805	0.6 ±0.1 mm	R	P	8 mm	4,000	---	20,000	---
	0.8 / 0.85 ±0.1 mm	R	P	8 mm	4,000	---	15,000	---
	1.25 ±0.2 mm	K	F	8 mm	---	3,000	---	10,000
1206	0.6 ±0.1 mm	R	P	8 mm	4,000	---	20,000	---
	0.8 / 0.85 ±0.1 mm	R	P	8 mm	4,000	---	15,000	---
	1.00 / 1.15 ±0.1 mm	K	F	8 mm	---	3,000	---	10,000
	1.25 ±0.2 mm	K	F	8 mm	---	3,000	---	10,000
	1.6 ±0.15 mm	K	F	8 mm	---	2,500	---	10,000
	1.6 ±0.2 mm	K	F	8 mm	---	2,000	---	8,000
1210	0.6 / 0.7 ±0.1 mm	K	F	8 mm	---	4,000	---	15,000
	0.85 ±0.1 mm	K	F	8 mm	---	4,000	---	10,000
	1.15 ±0.1 mm	K	F	8 mm	---	3,000	---	10,000
	1.15 ±0.15 mm	K	F	8 mm	---	3,000	---	10,000
	1.25 ±0.2 mm	K		8 mm	---	3,000	---	---
	1.5 ±0.1 mm	K		8 mm	---	2,000	---	---
	1.6 / 1.9 ±0.2 mm	K		8 mm	---	2,000	---	---
	2.0 ±0.2 mm	K		8 mm	---	2,000 1,000	---	---
	2.5 ±0.2 mm	K		8 mm	---	1,000 500	---	---
1808	1.15 ±0.15 mm	K		12 mm	---	3,000	---	---
	1.25 ±0.2 mm	K		12 mm	---	3,000	---	---
	1.35 ±0.15 mm	K		12 mm	---	2,000	---	---
	1.5 ±0.1 mm	K		12 mm	---	2,000	---	---
	1.6 ±0.2 mm	K	F	12 mm	---	2,000	---	8,000
	2.0 ±0.2 mm	K		12 mm	---	2,000	---	---
1812	0.6 / 0.85 ±0.1 mm	K		12 mm	---	2,000	---	---
	1.15 ±0.1 mm	K		12 mm	---	1,000	---	---
	1.15 ±0.15 mm	K		12 mm	---	1,000	---	---
	1.25 ±0.2 mm	K		12 mm	---	1,000	---	---
	1.35 ±0.15 mm	K		12 mm	---	1,000	---	---
	1.5 ±0.1 mm	K		12 mm	---	1,000	---	---
	1.6 ±0.2 mm	K		12 mm	---	1,000	---	---
	2.0 ±0.2 mm	K		12 mm	---	1,000	---	---
	2.5 ±0.2 mm	K		12 mm	---	500	---	---
2220	2.0 ±0.2 mm	K		12 mm	---	1000	---	---

PAPER/PE TAPE SPECIFICATION

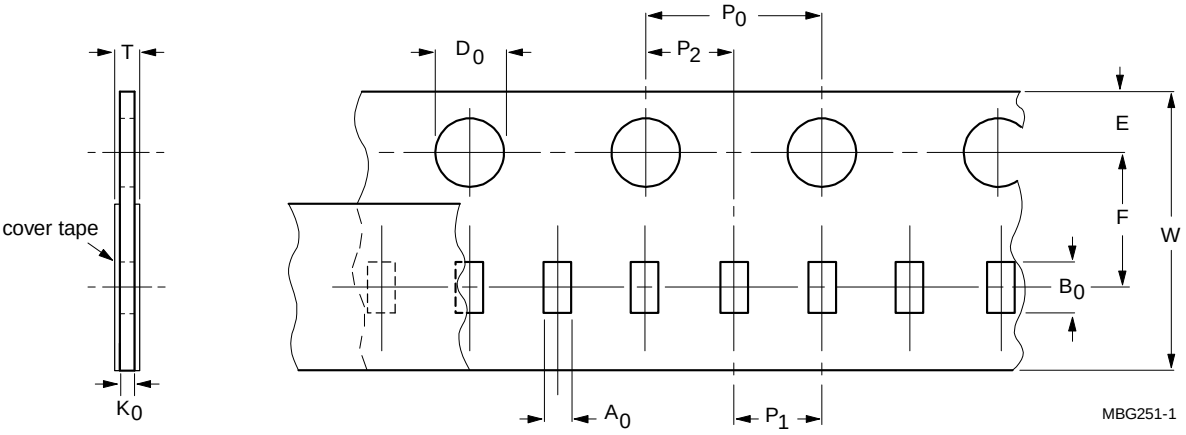


Fig. 3 Paper/PE tape

Table 11 Dimensions of paper/PE tape for relevant chip size; see Fig.3

Unit: mm

SIZE CODE	SYMBOL A_0	B_0	W	E	F	P_0 (1)	P_1	P_2	$\varnothing D_0$	K_0	T
0201	0.39 ± 0.06	0.70 ± 0.06	8.0 ± 0.20	1.75 ± 0.1	3.50 ± 0.05	4.0 ± 0.05	2.0 ± 0.05	2.0 ± 0.05	1.55 ± 0.03	0.38 ± 0.05	(0.47 / 0.55)±0.10
0402	0.70 ± 0.15	1.21 ± 0.12	8.0 ± 0.20	1.75 ± 0.1	3.50 ± 0.05	4.0 ± 0.05	2.0 ± 0.05	2.0 ± 0.05	1.50 +0.1 /-0	(0.75 / 0.60)±0.10	(0.85 / 0.70)±0.10
0603	1.05 ± 0.14	1.86 ± 0.13	8.0 ± 0.20	1.75 ± 0.1	3.50 ± 0.05	4.0 ± 0.10	4.0 ± 0.10	2.0 ± 0.05	1.50 +0.1 /-0	(1.05 / 0.95 / 0.75)±0.10	(1.15 / 1.05 / 0.85)±0.10
0805	1.50 ± 0.15	2.26 ± 0.20	8.0 ± 0.20	1.75 ± 0.1	3.50 ± 0.05	4.0 ± 0.10	4.0 ± 0.10	2.0 ± 0.05	1.50 +0.1 /-0	(1.05 / 0.95 / 0.75)±0.10	(1.15 / 1.05 / 0.85)±0.10
1206	1.90 ± 0.15	3.50 ± 0.20	8.0 ± 0.20	1.75 ± 0.1	3.50 ± 0.05	4.0 ± 0.10	4.0 ± 0.10	2.0 ± 0.05	1.50 +0.1 /-0	(0.95 / 0.75)±0.10	(1.05 / 0.85)± 0.10

NOTE

1. P_0 pitch tolerance over any 10 pitches is ±0.2 mm

BLISTER TAPE SPECIFICATION

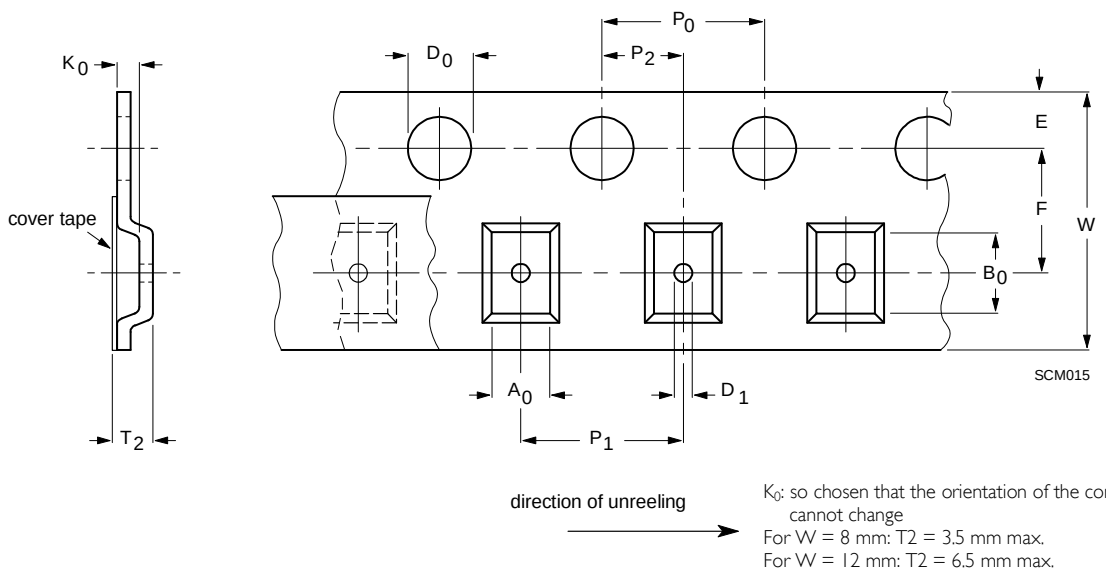


Fig. 4 Blister tape

Table 12 Dimensions of blister tape for relevant chip size; see Fig.4

SIZE CODE	SYMBOL															Unit: mm
	A_0		B_0		K_0		W	E	F	$ØD_0$	$ØD_1$	P_0 (2)	P_1	P_2	T2	
	Min.	Max.	Min.	Max.	Min.	Max.					Min.				Min.	Max.
0805	1.29	1.65	2.09	2.60	1.25	1.62	8.1 ±0.20	1.75 ±0.1	3.5 ±0.05	1.5 +0.1/-0.0	1 +0.1/-0.0	4.0 ±0.10	4.0 ±0.10	2.0 ±0.05	1.30	1.67
1206	1.65	2.12	3.30	3.75	1.22	2.15	8.1 ±0.20	1.75 ±0.1	3.5 ±0.05	1.5 +0.1/-0.0	1 +0.1/-0.0	4.0 ±0.10	4.0 ±0.10	2.0 ±0.05	1.27	2.20
1210	2.55	3.02	3.31	3.88	0.97	2.92	8.1 ±0.20	1.75 ±0.1	3.5 ±0.05	1.5 +0.1/-0.0	1 +0.1/-0.0	4.0 ±0.10	4.0 ±0.10	2.0 ±0.05	1.02	2.97
1808	2.05	2.55	4.80	5.45	1.30	2.45	12.1 ±0.20	1.75 ±0.1	5.5 ±0.05	1.5 +0.1/-0.0	1.5 +0.1/-0.0	4.0 ±0.10	4.0 ±0.10	2.0 ±0.05	1.35	2.50
1812	3.35	3.75	4.70	5.33	0.70	2.40	12.1 ±0.20	1.75 ±0.1	5.5 ±0.05	1.5 +0.1/-0.0	1.5 +0.1/-0.0	4.0 ±0.10	8.0 ±0.10	2.0 ±0.05	0.75	2.45

NOTE

1. Typical capacitor displacement in pocket
2. P_0 pitch tolerance over any 10 pitches is ±0.2 mm

REEL SPECIFICATION

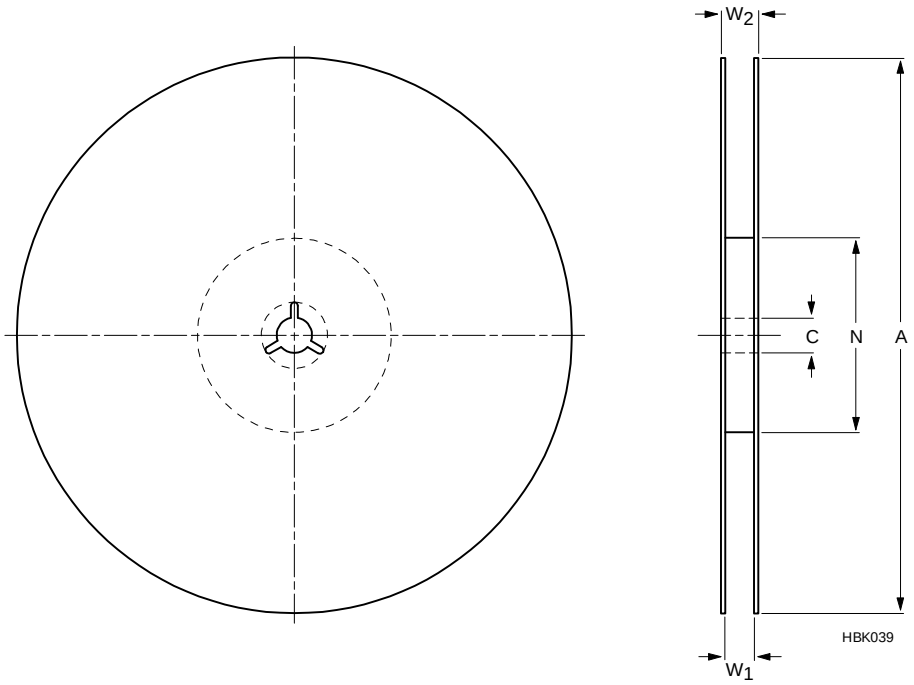


Fig. 5 Reel

Table13 Reel dimensions; see Fig.5

TAPE WIDTH	SYMBOL				Unit: mm
	A	N	C	W_1	$W_{2max.}$
8 (Ø178 mm/7")	178 ±1.0	60 ±1.0	13 +0.50/-0.20	9.4 ±1.5	14.4
8 (Ø330 mm/13")	330 ±1.0	100 ±1.0	13 +0.50/-0.20	9.0 ±0.2	14.4
12 (Ø178 mm/7")	178 ±1.0	60 ±1.0	13 +0.50/-0.20	13.4 ±1.5	18.4

PROPERTIES OF REEL

Material: polystyrene

Surface resistance: $<10^{10}$ Ω/sq.

ELECTRICAL CHARACTERISTICS

NP0/X7R 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 14

DESCRIPTION			VALUE
Capacitance range			0.47 pF to 2.2 μF
Capacitance tolerance			
NP0	C < 10 pF		±0.25 pF, ±0.5 pF
	C ≥ 10 pF		±2%, ±5%, ±10%
X7R			±5% (1), ±10%, ±20%
Dissipation factor (D.F.)			
NP0	C < 30 pF		≤ 1 / (400 + 20C)
	C ≥ 30 pF		≤ 0.1 %
X7R	General		≤ 2.5 %
	Exception	1206/100V/ 560nF to 1uF, 1210/100V/1uF and 2.2uF	≤ 3.5%
		0603/100V/12nF to 100nF, 0805/100V/560nF to 1uF, 1206/100V/2.2uF	≤ 5%
Insulation resistance after 1 minute at U_r (DC)		R_{ins} ≥ 10 GΩ or R_{ins} × C ≥ 500Ω·F whichever is less R_{ins} × C ≥ 100Ω·F (2)	
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. Capacitance tolerance ±5% doesn't available for X7R full product range, please contact local sales force before order
2. 1210/ X7R/ 630V/ 27nF to 47nF
   1210/ X7R/ 500V/ 56nF to 100nF
   1812/ X7R/ 630V/ 39nF to 100nF

SOLDERING RECOMMENDATION

Table 15

SOLDERING METHOD	SIZE 0201	0402	0603	0805	1206	≥ 1210
Reflow	Reflow only	> 100 nF	> 1.0 μF	> 2.2 μF	> 2.2 μF	Reflow only
Reflow/Wave		≤ 100 nF	≤ 1.0 μF	≤ 2.2 μF	≤ 2.2 μF	---

TESTS AND REQUIREMENTS

Table 13 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	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 (in Table 14)
Insulation Resistance		4.5.3	U_r ≤ 500 V: At Ur for 1 minute U_r > 500 V: At 500 V for 1 minute	In accordance with specification (in Table 14)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature coefficient	4.6	Capacitance shall be measured by the steps shown in the following table. The capacitance change should be measured after 5 min at each specified temperature stage. Step / Temperature(°C): a 25±2; b Lower temperature±3°C; c 25±2; d Upper Temperature±2°C; e 25±2 (1) NP0 Temperature Coefficient shall be calculated from the formula as below $\text{Temp, Coefficient} = \frac{C2 - C1}{C1 \times \Delta T} \times 10^6$ [ppm/°C] C1: Capacitance at step c C2: Capacitance at 125°C ΔT: 100°C (=125°C -25°C) (2) X7R 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	<General purpose series> NP0: Δ C/C: ±30ppm/°C X7R: Δ C/C: ±15% <High Capacitance series> Class2: X7R: Δ C/C: ±15%
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 ≥ 0603: 5N size = 0402: 2-5N size = 0201: 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 1: NP0: within ±1% or 0.5 pF, whichever is greater Class2: X7R: ±10%

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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	Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned ΔC/C Class 1: NP0: within ±0.5% or 0.5 pF, whichever is greater Class2: X7R: ±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. 1. Temperature: 235±5°C / Dipping time: 2 ±0.5 s 2. Temperature: 245±5°C / Dipping time: 3 ±0.5 s (lead free) Depth of immersion: 10mm	The solder should cover over 95% of the critical area of each termination
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 ΔC/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

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Damp Heat		4.13	3. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp 4. Initial measure: Spec: refer initial spec C, D, IR 5. Damp heat test: 500 ±12 hours at 40 ±2 °C; 90 to 95% R.H. 6. Recovery: Class 1: 6 to 24 hours Class 2: 24 ±2 hours 7. 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 ΔC/C Class 1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class 1: NP0: ≤ 2 x specified value Class2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class 1: NP0: ≥ 2,500 MΩ or $R_{ins} \times C_r \geq 25\Omega \cdot F$ whichever is less Class2: X7R: ≥ 500 MΩ or $R_{ins} \times C_r \geq 25\Omega \cdot F$ whichever is less
Endurance	IEC 60384-21/22	4.14	1. Preconditioning, X7R 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: 4. High voltage series follows with below stress condition: Voltage / NPO / X7R ≤ 100V / 2.0 x Ur / 2.0 x Ur 200/250V / 1.5 x Ur / 1.5 x Ur 500/630V / 1.3 x Ur / 1.2 x Ur ≥ 1KV / 1.2 x Ur / 1.1 x Ur * NPO, 0603, 100V, 5.1nF to 10nF, apply voltage : 1.5 x Ur 5. Recovery time: 24 ±2 hours 6. 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 ΔC/C Class1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15% D.F. Class1: NP0: ≤ 2 x specified value Class2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class1: NP0: ≥ 4,000 MΩ or $R_{ins} \times C_r \geq 40\Omega \cdot F$ whichever is less Class2: X7R: ≥ 1,000 MΩ or $R_{ins} \times C_r \geq 50\Omega \cdot F$ whichever is less
Voltage Proof		4.6	Specified stress voltage applied for 1~5 seconds 100 V < Ur ≤ 200 V series applied (1.5 Ur + 100) 200 V < Ur ≤ 500 V series applied (1.3 Ur + 100) Ur > 500 V: 1.3 Ur Ur ≥ 1000 V: 1.2 Ur Charge/Discharge current is less than 50 mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 25	Dec. 08, 2022	-	- 0805 / 1210 dimension spec updated
Version 24	Jun. 11, 2021	-	- Add X7R : 1812/630V/ 39nF to100nF - R_{ins} revised to R_{ins} × C ≥ 100 Ω·F X7R : 1210/630V/27nF to 47nF 1210/500V/56nF to 100nF
Version 23	Mar. 25, 2021	-	- Add NPO : 1206/630V 6.8nF/10nF 1210/630V/22nF 1812/630V/22nF X7R : 2220/630V/150nF to 220nF
Version 22	Jun. 10, 2020	-	- Add NPO : 0603/100V/1.8nF to 10nF, 1206/250V/3.3nF to 3.9nF 1206/630V/2.2nF X7R : 0805/100V330nF to 1μF, 0805/250V/68nF to 100nF 1206/100V/680nF, 1210/500V/68nF to 100nF, 1210/630V/47nF - Modify NPO :1210/100V/12nF to 15nF thickness to 1.25mm X7R :1210/630V/22nF thickness to 1.6mm 1210/630V/27nF to 33nF thickness to 2.0mm
Version 21	Jul. 13, 2018	-	- Add NPO : 0402/120pF to 1nF/100V, 0603/1.2nF to 1.5nF/100V, 1206/1.8nF/630V, 1210/12nF to 22nF/100V X7R : 0805/33nF to 47nF/200 to 250V
Version 20	Sep. 14, 2017	-	- Dimension outlines updated
Version 19	Mar 7, 2017	-	- 0805 L4 spec updated
Version 18	Dec 9, 2016	-	- Soldering recommendation update
Version 17	Aug 16, 2016	-	- Capacitance range & thickness update
Version 16	Apr. 16, 2015	-	- Capacitance range & thickness
Version 15	Apr. 16, 2015	-	- Electrical characteristics update
Version 14	Sep. 25, 2014	-	- Electrical characteristics update
Version 13	Apr. 21, 2014	-	- Electrical characteristics update
Version 12	Dec. 12, 2013	-	- Electrical characteristics update
Version 11	Jun. 17, 2013	-	- Test method and procedure updated
Version 10	Nov 22, 2012	-	- Test method and procedure updated
Version 9	Feb 02, 2012	-	- Test method and procedure updated
Version 8	Apr 22, 2011	-	- NP0 0402 100V added
Version 7	Mar 01, 2011	-	- Dimension updated

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 6	Sep 30, 2010	-	- Update the thickness of 0805 100V
Version 5	Sep 28, 2010	-	- Product range updated - Thickness classes and packing quantity table updated
Version 4	Jun 17, 2010	-	- Update the dimension of 0805, 1206 and 1812
Version 3	Mar 25, 2010	-	- Product range update
Version 2	Mar 15, 2010	-	- Product range update
Version 1	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, NP0_50-to-500V_10, X7R_16-to-500V_9 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

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