

# DATA SHEET

## SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

Mid-voltage

NP0/X7R

100 V TO 630 V

0.47 pF to 2.2  $\mu$ F

RoHS compliant & Halogen Free



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 I  
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 = NPO  
B = Class 2 MLCC

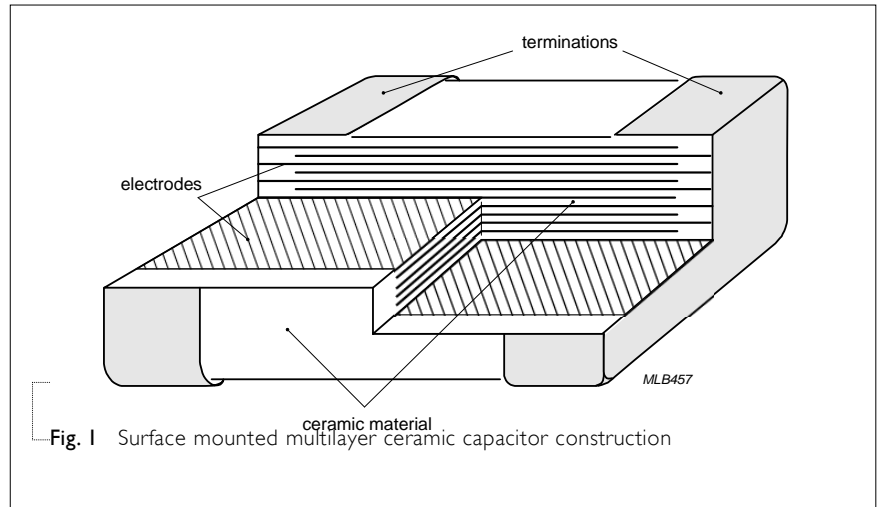
**(7) CAPACITANCE VALUE**

2 significant digits+number of zeros  
The 3rd digit signifies the multiplying factor, and letter R is decimal point  
Example: 121 = 12 × 10<sup>1</sup> = 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.

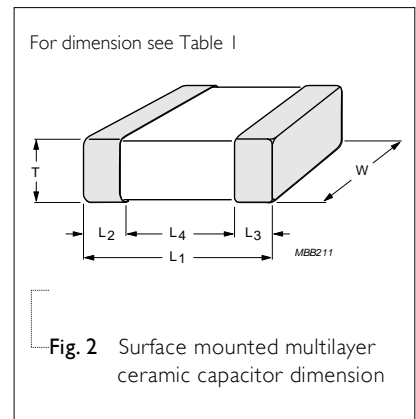


**DIMENSION**

Table 1 For outlines see fig. 2

| TYPE | L <sub>1</sub> (mm) | W (mm)     | T (MM)     | L <sub>2</sub> / L <sub>3</sub> (mm) |      | L <sub>4</sub> (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                                 | 0.30 | 0.40                |
| 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                |
|      |                     |            | 0.85 ±0.10 |                                      |      |                     |
|      | 2.0 ±0.20           | 1.25 ±0.20 | 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 |                                      |      |                     |
| 1210 | 3.2 ±0.20           | 2.5 ±0.20  | 1.6 ±0.20  | 0.25                                 | 0.75 | 1.40                |
|      |                     |            | 1.25 ±0.20 |                                      |      |                     |
|      | 3.2 ±0.30           | 2.5 ±0.20  | 1.6 ±0.20  |                                      |      |                     |
| 1808 | 4.5 ±0.40           | 2.0 ±0.30  | 1.25 ±0.20 | 0.25                                 | 0.75 | 2.20                |
|      |                     |            | 0.85 ±0.10 |                                      |      |                     |
| 1812 | 4.5 ±0.40           | 3.2 ±0.30  | 1.25 ±0.20 | 0.25                                 | 0.75 | 2.20                |
|      |                     |            | 1.60 ±0.20 |                                      |      |                     |
| 2020 | 5.7 ±0.40           | 5.0 ±0.30  | 2.0 ±0.20  | 0.25                                 | 0.75 | 3.40                |

**OUTLINES**



**CAPACITANCE RANGE & THICKNESS FOR NPO**

Table 2 Sizes from 0201 to 0805

| CAP.    | 0201     | 0402     | 0603    | 0805    |         | 0805    |         | 0805    |         | 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  |          |          |         |         |         |         |         |         |         |         |
| 6.8 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 |
| 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 |           |          |          |          |          |          |          |          |          |  |
| 150 pF |           |          |          |          |          | 0.6± 0.1 | 0.6± 0.1 | 0.6± 0.1 | 0.6± 0.1 |  |
| 180 pF |           |          |          |          |          |          |          |          |          |  |
| 220 pF |           |          |          |          |          |          |          |          |          |  |
| 270 pF |           |          | 0.8± 0.1 | 0.8± 0.1 |          |          |          |          |          |  |
| 330 pF | 0.5± 0.05 |          |          |          | 0.6± 0.1 |          |          | 0.85±0.1 | 0.85±0.1 |  |
| 390 pF |           |          |          |          |          |          |          |          |          |  |
| 470 pF |           |          |          |          |          | 0.85±0.1 | 0.85±0.1 |          |          |  |
| 560 pF |           |          |          |          |          |          |          |          |          |  |
| 680 pF |           |          |          |          |          |          |          | 1.25±0.2 | 1.25±0.2 |  |
| 820 pF |           |          |          |          |          |          |          |          |          |  |
| 1.0 nF |           | 0.8± 0.1 |          |          |          |          |          |          |          |  |
| 1.2 nF |           |          |          |          |          |          |          |          |          |  |
| 1.5 nF |           |          |          |          | 0.85±0.1 |          |          |          |          |  |
| 1.8 nF |           |          |          |          |          |          |          |          |          |  |
| 2.2 nF |           |          |          |          |          |          |          |          |          |  |
| 2.7 nF |           |          |          |          |          | 1.25±0.2 | 1.25±0.2 |          |          |  |
| 3.3 nF |           |          |          |          |          |          |          |          |          |  |
| 3.9 nF |           |          |          |          |          |          |          |          |          |  |
| 4.7 nF |           |          |          |          | 1.25±0.2 |          |          |          |          |  |
| 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-I2 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 |         |         |         |         |          |          |          |          |          |          |
| 0.56 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  | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |         |          |          |          |          |          |          |
| 8.2 pF  |         |         |         |         |          |          |          |          |          |          |
| 10 pF   |         |         |         |         |          |          |          |          |          |          |
| 12 pF   |         |         |         |         |          |          |          |          |          |          |
| 15 pF   |         |         |         |         |          |          |          |          |          |          |
| 18 pF   |         |         |         |         |          |          |          |          |          |          |
| 22 pF   |         |         |         |         |          |          |          |          |          |          |
| 27 pF   |         |         |         |         |          |          |          |          |          |          |
| 33 pF   |         |         |         | 0.6±0.1 | 1.25±0.2 |          |          |          |          |          |
| 39 pF   |         |         |         |         |          |          |          |          |          |          |
| 47 pF   |         |         |         |         |          |          |          |          |          |          |
| 56 pF   |         |         |         |         |          |          |          |          |          | 1.25±0.2 |
| 68 pF   |         |         |         |         |          | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |          |
| 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 |          |          |          |          |          |          |          |          |          |          |
| 120 pF |          |          |          |          |          |          |          |          |          |          |
| 150 pF |          |          |          |          |          |          |          |          |          |          |
| 180 pF |          |          |          |          |          |          |          |          |          |          |
| 220 pF |          |          |          |          |          |          |          |          |          |          |
| 270 pF |          | 0.6±0.1  | 0.6±0.1  | 0.6±0.1  |          |          |          |          |          |          |
| 330 pF |          |          |          |          |          |          |          |          |          | 1.25±0.2 |
| 390 pF |          |          |          |          |          |          |          |          |          |          |
| 470 pF | 0.6±0.1  |          |          |          | 1.25±0.2 |          |          |          |          |          |
| 560 pF |          |          |          |          |          |          |          |          |          |          |
| 680 pF |          |          |          |          |          |          | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |          |
| 820 pF |          |          |          |          |          |          |          |          |          |          |
| 1.0 nF |          | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 |          |          |          |          |          |          |
| 1.2 nF |          |          |          |          |          | 1.25±0.2 |          |          |          |          |
| 1.5 nF |          |          |          |          |          |          |          |          |          |          |
| 1.8 nF |          |          |          |          |          |          |          |          |          |          |
| 2.2 nF |          |          |          | 1.25±0.2 |          |          |          |          |          |          |
| 2.7 nF |          | 1.25±0.2 | 1.25±0.2 |          |          |          |          |          |          |          |
| 3.3 nF |          |          |          |          |          |          |          |          |          |          |
| 3.9 nF |          |          |          |          |          |          |          |          |          |          |
| 4.7 nF | 0.85±0.1 |          |          |          |          |          |          |          |          |          |
| 5.6 nF |          |          |          |          |          |          |          |          |          |          |
| 6.8 nF |          |          |          |          | 1.60±0.2 |          |          |          |          |          |
| 8.2 nF |          |          |          |          |          |          |          |          |          |          |
| 10 nF  | 1.25±0.2 |          |          |          | 1.60±0.2 |          |          |          |          |          |
| 12 nF  |          |          |          |          |          |          |          |          |          |          |
| 15 nF  |          |          |          |          |          |          |          |          |          |          |
| 18 nF  |          |          |          |          |          |          |          |          |          |          |
| 22 nF  |          |          |          |          |          | 1.6±0.2  |          |          |          | 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 |          |       |          |          |          |
| 330 pF |          |       |          |          | 1.25±0.2 |
| 390 pF |          |       |          |          |          |
| 470 pF |          |       |          |          |          |
| 560 pF |          |       |          | 1.25±0.2 |          |
| 680 pF |          |       |          |          |          |
| 820 pF |          |       |          |          |          |
| 1 nF   |          |       |          |          |          |
| 1.2 nF |          |       | 1.25±0.2 | 1.25±0.2 |          |
| 1.5 nF |          |       |          |          |          |
| 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      |          | 0805     |          | 0805     |          |
|--------|----------|---------|-----------|----------|----------|----------|----------|----------|
|        | 100 V    | 100 V   | 200V/250V | 100 V    | 200 V    | 250 V    | 500 V    | 630 V    |
| 100 pF |          |         |           |          |          |          |          |          |
| 150 pF |          |         |           |          |          |          |          |          |
| 220 pF |          |         |           |          |          |          |          |          |
| 330 pF |          |         |           |          |          |          |          |          |
| 470 pF |          |         |           |          |          |          |          |          |
| 680 pF |          |         |           |          |          |          |          |          |
| 1.0 nF | 0.5±0.05 |         |           |          | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 |
| 1.5 nF |          |         |           | 0.6±0.1  |          |          |          |          |
| 2.2 nF |          |         | 0.8±0.1   |          |          |          |          |          |
| 3.3 nF |          | 0.8±0.1 |           |          |          |          |          |          |
| 4.7 nF |          |         |           |          |          |          |          |          |
| 6.8 nF |          |         |           |          |          |          |          |          |
| 10 nF  |          |         |           |          |          |          |          | 1.25±0.2 |
| 15 nF  |          |         |           | 0.85±0.1 |          |          | 1.25±0.2 |          |
| 22 nF  |          |         |           |          | 1.25±0.2 | 1.25±0.2 |          |          |
| 33 nF  |          |         |           |          |          |          |          |          |
| 47 nF  |          |         |           |          |          |          |          |          |
| 68 nF  |          |         |           |          |          |          |          |          |
| 100 nF |          |         |           |          |          |          |          |          |
| 150 nF |          |         |           | 1.25±0.2 |          |          |          |          |
| 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  |
| 33 nF  |          |          |          | 1.6±0.2  | 1.6±0.2  |          |          |          |          |          |
| 47 nF  |          | 1.25±0.2 | 1.25±0.2 |          |          |          |          |          |          | 2.0±0.2  |
| 68 nF  |          |          |          |          |          |          | 1.25±0.2 | 1.25±0.2 |          |          |
| 100 nF |          | 1.6±0.2  | 1.6±0.2  |          |          |          |          |          | 2.0±0.2  |          |
| 150 nF | 1.25±0.2 |          |          |          |          |          |          |          |          |          |
| 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 |          |          |          |          |          |         |
| 1.5 nF |          |          |          |          |          |         |
| 2.2 nF |          |          |          |          |          |         |
| 3.3 nF |          |          |          |          |          |         |
| 4.7 nF |          |          |          |          | 1.35±0.2 |         |
| 6.8 nF |          | 0.85±0.1 | 0.85±0.1 |          |          |         |
| 10 nF  | 0.85±0.1 |          |          | 1.25±0.2 |          |         |
| 15 nF  |          |          |          |          |          |         |
| 22 nF  |          |          |          |          |          |         |
| 33 nF  |          |          |          |          |          |         |
| 47 nF  |          |          |          |          |          |         |
| 68 nF  |          |          |          |          | 1.6±0.2  |         |
| 100 nF |          | 1.25±0.2 | 1.25±0.2 |          | 1.6±0.2  |         |
| 150 nF |          |          |          |          |          |         |
| 220 nF | 1.25±0.2 |          |          |          |          | 2.0±0.2 |
| 330 nF |          | 1.6±0.2  | 1.6±0.2  |          |          |         |
| 470 nF |          |          |          |          |          |         |
| 680 nF | 1.6±0.2  |          |          |          |          |         |
| 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. |         | TAPE WIDTH | QUANTITY PER REEL |                |                   |         |
|-------------|--------------------------|---------------|---------|------------|-------------------|----------------|-------------------|---------|
|             |                          | 7 INCH        | 13 INCH |            | Ø180 MM / 7 INCH  |                | Ø330 MM / 13 INCH |         |
|             |                          |               |         |            | Paper             | Blister        | Paper             | 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            | ---     |
| 1206        | 1.25 ±0.2 mm             | K             | F       | 8 mm       | ---               | 3,000          | ---               | 10,000  |
|             | 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<br>1,000 | ---               | ---     |
| 1808        | 2.5 ±0.2 mm              | K             |         | 8 mm       | ---               | 1,000<br>500   | ---               | ---     |
|             | 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   |
| 1812        | 2.0 ±0.2 mm              | K             |         | 12 mm      | ---               | 2,000          | ---               | ---     |
|             | 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**

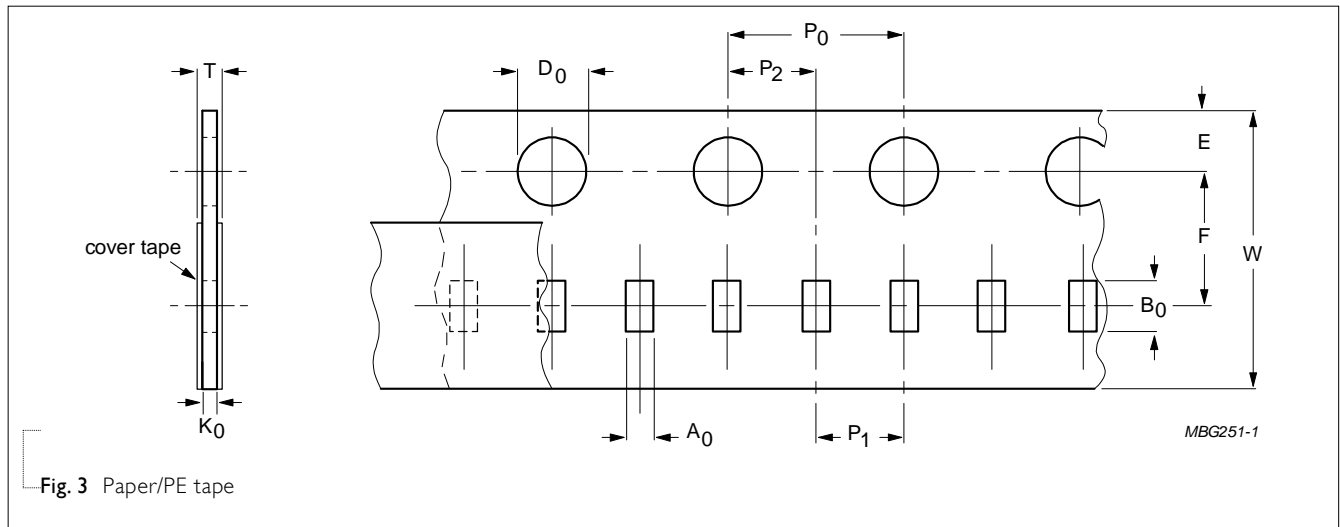


Fig. 3 Paper/PE tape

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

| SIZE | SYMBOL         |                |            |            |             |                               |                |                |                 |                           |                           | Unit: mm |
|------|----------------|----------------|------------|------------|-------------|-------------------------------|----------------|----------------|-----------------|---------------------------|---------------------------|----------|
| CODE | A <sub>0</sub> | B <sub>0</sub> | W          | E          | F           | P <sub>0</sub> <sup>(1)</sup> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | K <sub>0</sub>            | 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<sub>0</sub> pitch tolerance over any 10 pitches is ±0.2 mm

**BLISTER TAPE SPECIFICATION**

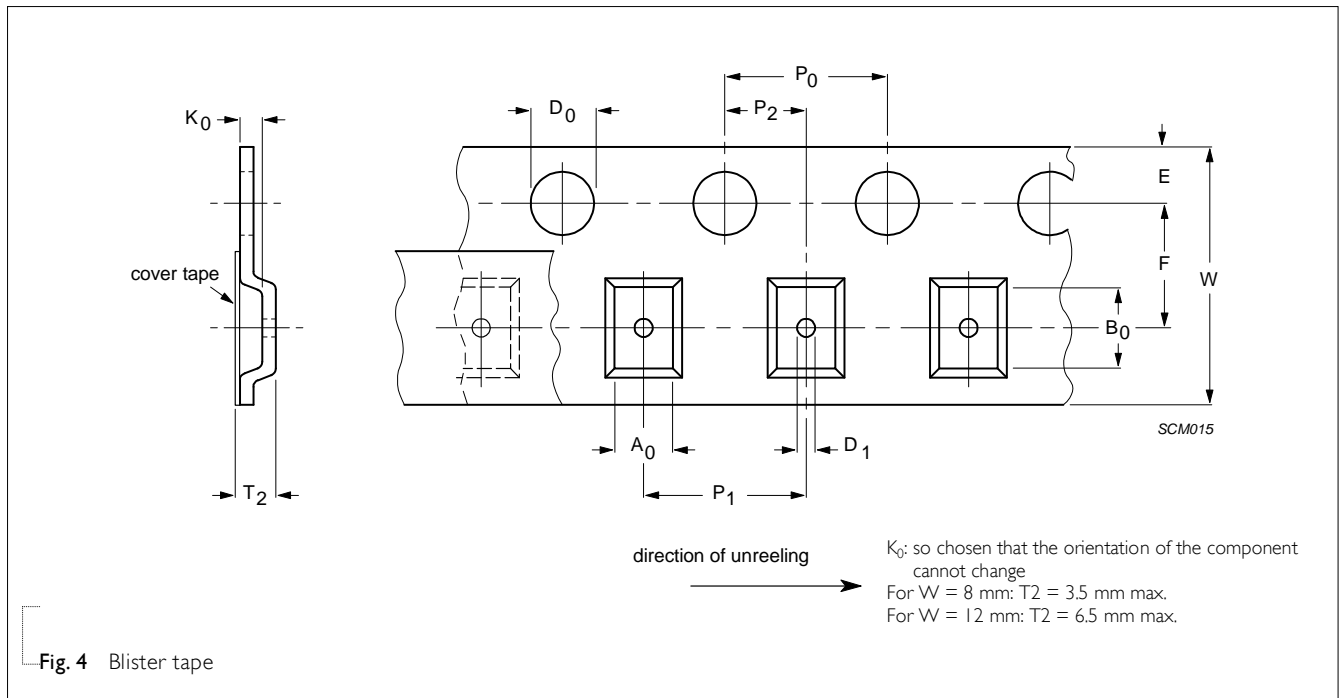


Fig. 4 Blister tape

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

| SIZE CODE | SYMBOL         |      |                |      |                |      |            |           |           |                 |                 |                               | Unit: mm       |                |                |      |
|-----------|----------------|------|----------------|------|----------------|------|------------|-----------|-----------|-----------------|-----------------|-------------------------------|----------------|----------------|----------------|------|
|           | A <sub>0</sub> |      | B <sub>0</sub> |      | K <sub>0</sub> |      | W          | E         | F         | ØD <sub>0</sub> | ØD <sub>1</sub> | P <sub>0</sub> <sup>(2)</sup> | P <sub>1</sub> | P <sub>2</sub> | T <sub>2</sub> |      |
|           | Min.           | Max. | Min.           | Max. | Min.           | Max. |            |           |           |                 |                 |                               |                |                | 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<sub>0</sub> pitch tolerance over any 10 pitches is ±0.2 mm

**REEL SPECIFICATION**

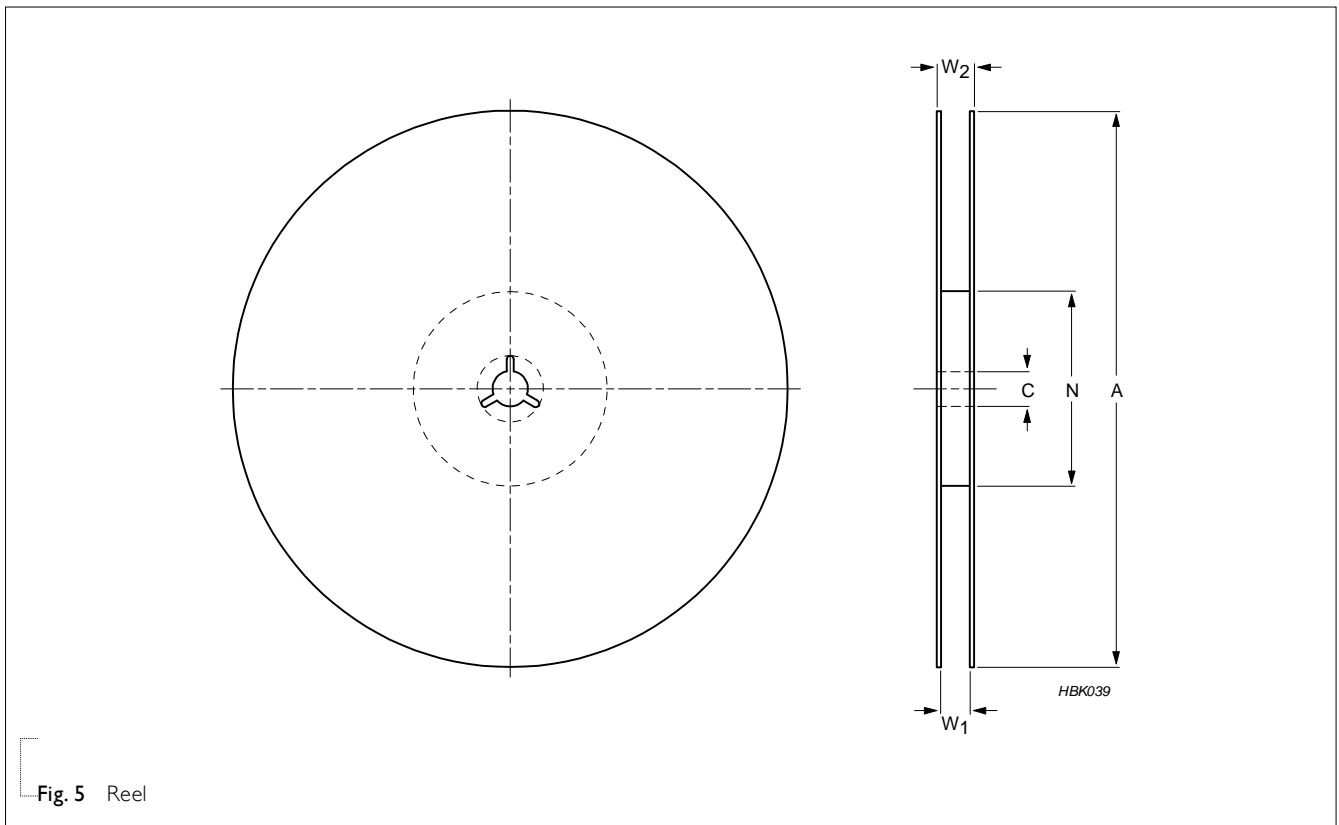


Fig. 5 Reel

Table 13 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:  $<10^{10} \text{ } \Omega/\text{sq.}$

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% <sup>(1)</sup> , ±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 1μF, 1210/100V/1μF and 2.2μF ≤ 3.5%<br>0603/100V/12nF to 100nF, 0805/100V/560nF to 1μF, 1206/100V/2.2μF ≤ 5% |
| Insulation resistance after 1 minute at U <sub>r</sub> (DC)  |           | R <sub>ins</sub> ≥ 10 GΩ or R <sub>ins</sub> × C ≥ 500Ω·F whichever is less<br>R <sub>ins</sub> × C ≥ 100Ω·F <sup>(2)</sup>      |
| Maximum capacitance change as a function of temperature<br>(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 Class 1:<br>f = 1 MHz for C ≤ 1 nF, measuring at voltage   V <sub>rms</sub> at 20°C<br>f = 1 KHz for C > 1 nF, measuring at voltage   V <sub>rms</sub> at 20°C<br>Class 2:<br>f = 1 KHz for C ≤ 10 μF, measuring at voltage   V <sub>rms</sub> at 20°C | Within specified tolerance                     |
| Dissipation Factor (D.F.)             |                 | 4.5.2 Class 1:<br>f = 1 MHz for C ≤ 1 nF, measuring at voltage   V <sub>rms</sub> at 20°C<br>f = 1 KHz for C > 1 nF, measuring at voltage   V <sub>rms</sub> at 20°C<br>Class 2:<br>f = 1 KHz for C ≤ 10 μF, measuring at voltage   V <sub>rms</sub> at 20°C | In accordance with specification (in Table 14) |
| Insulation Resistance                 |                 | 4.5.3 U <sub>r</sub> ≤ 500 V: At U <sub>r</sub> for 1 minute<br>U <sub>r</sub> > 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.<br>The capacitance change should be measured after 5 min at each specified temperature stage.  | <General purpose series><br>Class I:<br>$\Delta C/C: \pm 30\text{ppm}/^\circ\text{C}$<br><br>Class2:<br>X7R: $\Delta C/C: \pm 15\%$<br><br><High Capacitance series><br>Class2:<br>X7R: $\Delta C/C: \pm 15\%$ |      |                 |   |      |   |                       |   |      |   |
|                         |                       | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>(1) Class I<br/>Temperature Coefficient shall be calculated from the formula as below<br/> <math display="block">\text{Temp. Coefficient} = \frac{C2 - C1}{C1 \times \Delta T} \times 10^6 \text{ [ppm}/^\circ\text{C]}</math>                     C1: Capacitance at step c<br/>                     C2: Capacitance at 125°C<br/>                     ΔT: 100°C (=125°C -25°C)</p> <p>(2) Class II<br/>Capacitance Change shall be calculated from the formula as below<br/> <math display="block">\Delta C = \frac{C2 - C1}{C1} \times 100\%</math>                     C1: Capacitance at step c<br/>                     C2: Capacitance at step b or d</p> |  | Step | Temperature(°C) | a | 25±2 | b | Lower temperature±3°C | c | 25±2 | d |
| Step                    | Temperature(°C)       |   |  |      |                 |   |      |   |                       |   |      |   |
| a                       | 25±2                  |   |  |      |                 |   |      |   |                       |   |      |   |
| b                       | Lower temperature±3°C |   |  |      |                 |   |      |   |                       |   |      |   |
| c                       | 25±2                  |   |  |      |                 |   |      |   |                       |   |      |   |
| d                       | Upper Temperature±2°C |   |  |      |                 |   |      |   |                       |   |      |   |
| e                       | 25±2                  |   |  |      |                 |   |      |   |                       |   |      |   |
| 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<br>size = 0402: 2-5N<br>size = 0201: 1N  |      |                 |   |      |   |                       |   |      |   |
| Bending Strength        |                       | 4.8 Mounting in accordance with IEC 60384-22 paragraph 4.3<br><br>Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 5 mm   | No visible damage<br><br>$\Delta C/C$<br>Class I:<br>NP0: within ±1% or 0.5 pF, whichever is greater<br>Class2:<br>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: for size ≤ 1206: 120 °C to 150 °C for 1 minute</p> <p>Preheating: for size &gt; 1206: 100 °C to 120 °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><math>\Delta C/C</math></p> <p>Class 1:<br/>NP0: within ±0.5% or 0.5 pF, whichever is greater</p> <p>Class2:<br/>X7R: ±10%</p> <hr/> <p>D.F. within initial specified value</p> <p>R<sub>ins</sub> 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>1. Temperature: 235±5°C<br/>/ Dipping time: 2 ±0.5 s</p> <p>2. Temperature: 245±5°C<br/>/ Dipping time: 3 ±0.5 s (lead free)</p> <p>Depth of immersion: 10mm</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:<br/>150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>5 cycles with following detail:<br/>30 minutes at lower category temperature<br/>30 minutes at upper category temperature</p> <p>Recovery time 24 ±2 hours</p>  | <p>No visual damage</p> <hr/> <p><math>\Delta C/C</math></p> <p>Class 1:<br/>NP0: within ±1% or 1 pF, whichever is greater</p> <p>Class2:<br/>X7R: ±15%</p> <hr/> <p>D.F. meet initial specified value</p> <p>R<sub>ins</sub> meet initial specified value</p>   |

| TEST          | TEST METHOD     | PROCEDURE   | REQUIREMENTS  |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
|---------------|-----------------|---|---|-----|-----|--------|----------|----------|----------|----------|----------|----------|----------|----------|-------|----------|----------|--|
| Damp Heat     | 4.13            | <p>3. Preconditioning, class 2 only:<br/>150 +0/-10 °C /1 hour, then keep for<br/>24 ±1 hour at room temp</p> <p>4. Initial measure:<br/>Spec: refer initial spec C, D, IR</p> <p>5. Damp heat test:<br/>500 ±12 hours at 40 ±2 °C;<br/>90 to 95% R.H.</p> <p>6. Recovery:<br/>Class 1: 6 to 24 hours<br/>Class 2: 24 ±2 hours</p> <p>7. Final measure: C, D, IR</p> <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 after recovery</p> <hr/> <p><math>\Delta C/C</math><br/>Class 1:<br/>NP0: within ±2% or 1 pF, whichever is greater<br/>Class2:<br/>X7R: ±15%<br/>D.F.<br/>Class 1:<br/>NP0: ≤ 2 x specified value<br/>Class2:<br/>X7R: ≥ 25 V: ≤ 5%<br/><math>R_{ins}</math><br/>Class 1:<br/>NP0: ≥ 2,500 MΩ or <math>R_{ins} \times C_r \geq 25\Omega \cdot F</math><br/>whichever is less<br/>Class2:<br/>X7R: ≥ 500 MΩ or <math>R_{ins} \times C_r \geq 25\Omega \cdot F</math> whichever is less</p> |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
| Endurance     | IEC 60384-21/22 | <p>4.14</p> <p>1. Preconditioning, class 2 only:<br/>150 +0/-10 °C /1 hour, then keep for<br/>24 ±1 hour at room temp</p> <p>2. Initial measure:<br/>Spec: refer initial spec C, D, IR</p> <p>3. Endurance test:<br/>Temperature: NP0/X7R: 125 °C<br/>Specified stress voltage applied for 1,000 hours:</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Voltage</th> <th>NP0</th> <th>X7R</th> </tr> </thead> <tbody> <tr> <td>≤ 100V</td> <td>2.0 × Ur</td> <td>2.0 × Ur</td> </tr> <tr> <td>200/250V</td> <td>1.5 × Ur</td> <td>1.5 × Ur</td> </tr> <tr> <td>500/630V</td> <td>1.3 × Ur</td> <td>1.2 × Ur</td> </tr> <tr> <td>≥ 1KV</td> <td>1.2 × Ur</td> <td>1.1 × Ur</td> </tr> </tbody> </table> <p>* NP0, 0603, 100V, 5.1nF to 10nF, apply voltage :<br/>1.5 × Ur</p> <p>4. High voltage series follows with below stress condition:</p> <p>5. Recovery time: 24 ±2 hours</p> <p>6. Final measure: C, D, IR</p> <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> | Voltage   | NP0 | X7R | ≤ 100V | 2.0 × Ur | 2.0 × Ur | 200/250V | 1.5 × Ur | 1.5 × Ur | 500/630V | 1.3 × Ur | 1.2 × Ur | ≥ 1KV | 1.2 × Ur | 1.1 × Ur | <p>No visual damage</p> <hr/> <p><math>\Delta C/C</math><br/>Class 1:<br/>NP0: within ±2% or 1 pF, whichever is greater<br/>Class2:<br/>X7R: ±15%<br/>D.F.<br/>Class 1:<br/>NP0: ≤ 2 x specified value<br/>Class2:<br/>X7R: ≥ 25 V: ≤ 5%<br/><math>R_{ins}</math><br/>Class 1:<br/>NP0: ≥ 4,000 MΩ or<br/><math>R_{ins} \times C_r \geq 40\Omega \cdot F</math> whichever is less<br/>Class2:<br/>X7R: ≥ 1,000 MΩ or<br/><math>R_{ins} \times C_r \geq 50\Omega \cdot F</math> whichever is less</p> |
| Voltage       | NP0             | X7R   |   |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
| ≤ 100V        | 2.0 × Ur        | 2.0 × Ur  |   |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
| 200/250V      | 1.5 × Ur        | 1.5 × Ur  |   |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
| 500/630V      | 1.3 × Ur        | 1.2 × Ur  |   |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
| ≥ 1KV         | 1.2 × Ur        | 1.1 × Ur  |   |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |
| Voltage Proof | 4.6             | <p>Specified stress voltage applied for 1~5 seconds<br/>Ur ≤ 100 V: series applied 2.5 Ur<br/>100 V &lt; Ur ≤ 200 V series applied<br/>(1.5 Ur + 100)<br/>200 V &lt; Ur ≤ 500 V series applied<br/>(1.3 Ur + 100)<br/>Ur &gt; 500 V: 1.3 Ur<br/>Ur ≥ 1000 V: 1.2 Ur<br/>Charge/Discharge current is less than 50 mA</p>   | <p>No breakdown or flashover</p>  |     |     |        |          |          |          |          |          |          |          |          |       |          |          |  |

REVISION HISTORY

| REVISION   | DATE          | CHANGE NOTIFICATION | DESCRIPTION   |
|------------|---------------|---------------------|---|
| Version 24 | Jun. 11, 2021 | -                   | - Add<br>X7R : 1812/630V/ 39nF to 100nF<br>- $R_{ins}$ revised to $R_{ins} \times C \geq 100 \Omega \cdot F$<br>X7R : 1210/630V/27nF to 47nF<br>1210/500V/56nF to 100nF   |
| Version 23 | Mar. 25, 2021 | -                   | - Add<br>NPO : 1206/630V 6.8nF/10nF<br>1210/630V/22nF<br>1812/630V/22nF<br>X7R : 2220/630V/150nF to 220nF   |
| Version 22 | Jun. 10, 2020 | -                   | - Add<br>NPO : 0603/100V/1.8nF to 10nF, 1206/250V/3.3nF to 3.9nF<br>1206/630V/2.2nF<br>X7R : 0805/100V330nF to 1 $\mu$ F, 0805/250V/68nF to 100nF<br>1206/100V/680nF, 1210/500V/68nF to 100nF, 1210/630V/47nF<br>- Modify<br>NPO :1210/100V/12nF to 15nF thickness to 1.25mm<br>X7R :1210/630V/22nF thickness to 1.6mm<br>1210/630V/27nF to 33nF thickness to 2.0mm |
| Version 21 | Jul. 13, 2018 | -                   | - Add<br>NPO : 0402/120pF to 1nF/100V, 0603/1.2nF to 1.5nF/100V,<br>1206/1.8nF/630V, 1210/12nF to 22nF/100V<br>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  | -                   | - NPO 0402 100V added   |
| Version 7  | Mar 01, 2011  | -                   | - Dimension updated   |
| Version 6  | Sep 30, 2010  | -                   | - Update the thickness of 0805 100V   |
| Version 5  | Sep 28, 2010  | -                   | - Product range updated<br>- Thickness classes and packing quantity table updated   |

**REVISION HISTORY**

| REVISION  | DATE         | CHANGE NOTIFICATION | DESCRIPTION  |
|-----------|--------------|---------------------|--|
| Version 2 | Mar 15, 2010 | -                   | - Product range update   |
| Version 1 | Oct 30, 2009 | -                   | <ul style="list-style-type: none"> <li>- Change to dual brand datasheet that describe Mid-voltage NP0/X7R series with RoHS compliant</li> <li>- 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</li> <li>- Define global part number</li> <li>- Description of "Halogen Free compliant" added</li> <li>- Test method and procedure updated</li> </ul> |
| Version 0 | Sep 08, 2005 | -                   | - New  |