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**

Product Specification – July 13, 2018 V.21

YAGEO

Phycomp

## 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 & 12NC

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)

### (2) TOLERANCE

B = ±0.1 pF
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
C = Bulk case

### (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 = $12 \times 10^1$ = 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.

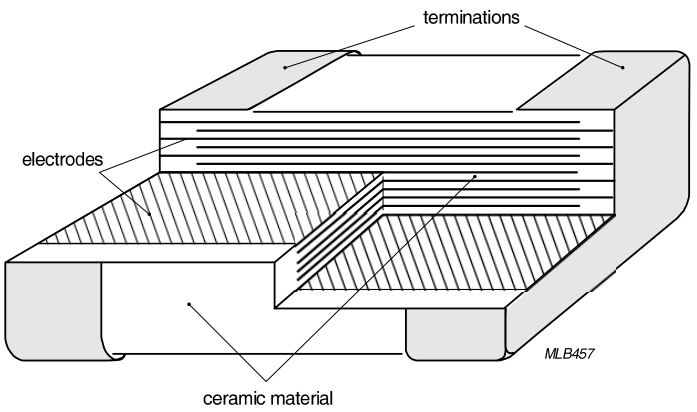


**Fig. 1** Surface mounted multilayer ceramic capacitor construction

## 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 | 0.30 | 0.40 |
| 0603 | 1.6 ±0.10 | 0.8 ±0.10 | 0.8 ±0.10 | 0.20 | 0.60 | 0.40 |
| 0805 | 2.0 ±0.20 | 1.25 ±0.20 | 0.6 ±0.10<br>0.85 ±0.10<br>1.25 ±0.20 | 0.25 | 0.75 | 0.70 |
| 1206 | 3.2 ±0.30 | 1.6 ±0.20 | 0.6 ±0.10<br>0.85 ±0.10<br>1.25 ±0.20<br>1.6 ±0.20 | 0.25 | 0.75 | 1.40 |
| | 3.2 ±0.30 | 1.6 ±0.30 | 1.6 ±0.30 | | | |
| 1210 | 3.2 ±0.30 | 2.5 ±0.20 | 0.85 ±0.10<br>1.25 ±0.20<br>2.0 ±0.20 | 0.25 | 0.75 | 1.40 |
| 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<br>1.25 ±0.20<br>1.6 ±0.20 | 0.25 | 0.75 | 2.20 |

## OUTLINES

For dimension see Table 1

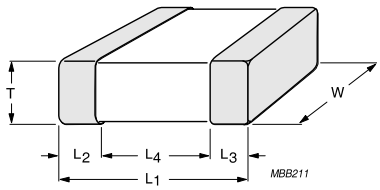


**Fig. 2** Surface mounted multilayer ceramic capacitor dimension

## 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 | | | | | | 1.25±0.2 | 1.25±0.2 | | |
| 1.5 nF | | | | | 0.85±0.1 | | | | |
| 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 | | | | | | | | | | |
| 0.56 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 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | | | | | | | |
| 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 | | | | | | | | | | 1.25±0.2 |
| 39 pF | | | | | | | | | | |
| 47 pF | | | | | | 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 | | | | | | | | | | |
| 8.2 nF | 1.25±0.2 | | | | | | | | | |
| 10 nF | | | | | | | | | | |
| 12 nF | | | | | | 1.6±0.2 | | | | |
| 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 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 | | | | | |

**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 | 250 V | 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 | 1.25±0.2 | 1.25±0.2 | |
| 22 nF | | | | | | | | |
| 33 nF | | | | | | | | |
| 47 nF | | | | | | | | |
| 68 nF | | | | 1.25±0.2 | | | | |
| 100 nF | | | | | | | | |
| 150 nF | | | | | | | | |
| 220 nF | | | | | | | | |
| 330 nF | | | | | | | | |
| 470 nF | | | | | | | | |

**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 | | | | | | | |
| 68 nF | | | | | | | 1.25±0.2 | 1.25±0.2 | | |
| 100 nF | | 1.6±0.2 | 1.6±0.2 | | | | | | | |
| 150 nF | 1.25±0.2 | | | | | | | | | |
| 220 nF | | | | | | | | | | |
| 330 nF | | | | | | 1.25±0.2 | | | | |
| 470 nF | 1.6±0.2 | | | | | | | | | |
| 680 nF | | | | | | | | | | |
| 1 µF | 1.6±0.2 | | | | | 2.0±0.2 | | | | |
| 2.2 µF | 1.6±0.3 | | | | | | | | | |

**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. | 1808 | | | | 1812 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 100 V | 200 V | 250 V | 500 V | 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 | | | | | | | | | |
| 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 | | | | 1.25±0.2 | | | | | |
| 22 nF | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | | |
| 33 nF | | | | | | | | | 1.6±0.2 |
| 47 nF | | | | | | | | | |
| 68 nF | | | | | | 1.25±0.2 | 1.25±0.2 | | |
| 100 nF | | | | | | | | 1.6±0.2 | |
| 150 nF | | | | | | | | | |
| 220 nF | | | | | 1.25±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 | 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 | --- | 8,000 | --- |
| 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<br>1,000 | --- | --- | --- |
| | 2.5 ±0.2 mm | 8 mm | --- | 1,000<br>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 | --- | 8,000 | --- |
| | 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 | --- | 1,000 | --- | --- | --- |
| | 1.15 ±0.15 mm | 12 mm | --- | 1,000 | --- | --- | --- |
| | 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 | --- | --- | --- |

## 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 11

| 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 | | ≤ 2.5 % |
| Exception | X7R/0603/100V, 12nF ≤ C ≤ 100nF, X7R/1206/2.2uF/100V | ≤ 5% |
| | X7R/1206/100V/1uF; X7R/1210/100V/1uF and 2.2uF; | ≤ 3.5% |
| Insulation resistance after 1 minute at $U_r$ (DC) | $R_{ins}$ ≥ 10 GΩ or $R_{ins}$ × C ≥ 500 seconds whichever is less | |
| Maximum capacitance change as a function of temperature (temperature characteristic/coefficient): | | |
| NP0 | | ±30 ppm/°C |
| X7R | | ±15% |
| Operating temperature range: NP0/X7R | | –55 °C to +125 °C |

**NOTE**

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

## SOLDERING RECOMMENDATION

Table 12

| 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 12 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 1 $V_{rms}$ at 20 °C<br>f = 1 KHz for C > 1 nF, measuring at voltage 1 $V_{rms}$ at 20 °C<br>Class 2:<br>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:<br>f = 1 MHz for C ≤ 1 nF , measuring at voltage 1 $V_{rms}$ at 20 °C<br>f = 1 KHz for C > 1 nF, measuring at voltage 1 $V_{rms}$ at 20 °C<br>Class 2:<br>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 Ur for 1 minute<br>$U_r$ > 500 V: At 500 V for 1 minute | In accordance with specification |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---|---|---|
| Temperature coefficient | 4.6 | Capacitance shall be measured by the steps shown in the following table.<br>The capacitance change should be measured after 5 min at each specified temperature stage.<br><br>Step: a, b, c, d, e<br>Temperature(℃): 25±2; Lower temperature±3℃; 25±2; Upper Temperature±2℃; 25±2<br><br>(1) Class I<br>Temperature Coefficient shall be calculated from the formula as below<br>$\text{Temp, Coefficient} = \frac{C2 - C1}{C1 \times \Delta T} \times 10^6$ [ppm/℃]<br>C1: Capacitance at step c<br>C2: Capacitance at 125℃<br>ΔT: 100℃(=125℃-25℃)<br><br>(2) Class II<br>Capacitance Change shall be calculated from the formula as below<br>$\Delta C = \frac{C2 - C1}{C1} \times 100\%$<br>C1: Capacitance at step c<br>C2: Capacitance at step b or d | <General purpose series><br>Class1:<br>Δ C/C: ±30ppm<br><br>Class2:<br>X7R: Δ C/C: ±15%<br>Y5V: Δ C/C: 22~-82%<br><br><High Capacitance series><br>Class2:<br>X7R/X5R: Δ C/C: ±15%<br>Y5V: Δ C/C: 22~-82% |
| 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<br>size ≥ 0603: 5N |
| 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>ΔC/C<br>Class 1:<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 | Precondition: 150 +0/–10 °C for 1 hour, then keep for 24 ±1 hours at room temperature<br>Preheating: for size ≤ 1206: 120 °C to 150 °C for 1 minute<br>Preheating: for size >1206: 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute<br>Solder bath temperature: 260 ±5 °C<br>Dipping time: 10 ±0.5 seconds<br>Recovery time: 24 ±2 hours | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned<br>ΔC/C<br>Class 1:<br>NP0: within ±0.5% or 0.5 pF, whichever is greater<br>Class2:<br>X7R: ±10%<br>D.F. within initial specified value<br>$R_{ins}$ within initial specified value |
| Solderability | | 4.10 | Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds.<br>1. Temperature: 235±5°C / Dipping time: 2 ±0.5 s<br>2. Temperature: 245±5°C / Dipping time: 3 ±0.5 s (lead free)<br>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;<br>150 +0/–10 °C for 1 hour, then keep for 24 ±1 hours at room temperature<br>5 cycles with following detail:<br>30 minutes at lower category temperature<br>30 minutes at upper category temperature<br>Recovery time 24 ±2 hours | No visual damage<br>ΔC/C<br>Class 1:<br>NP0: within ±1% or 1 pF, whichever is greater<br>Class2:<br>X7R: ±15%<br>D.F. meet initial specified value<br>$R_{ins}$ meet initial specified value |

| TEST | TEST METHOD | | PROCEDURE | REQUIREMENTS |
|---|---|---|---|---|
| Damp Heat | | 4.13 | 3. Preconditioning, class 2 only:<br>150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp<br>4. Initial measure:<br>Spec: refer initial spec C, D, IR<br>5. Damp heat test:<br>500 ±12 hours at 40 ±2 °C;<br>90 to 95% R.H.<br>6. Recovery:<br>Class 1: 6 to 24 hours<br>Class 2: 24 ±2 hours<br>7. Final measure: C, D, IR<br><br>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<br><br>ΔC/C<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>$R_{ins}$<br>Class 1:<br>NP0: ≥ 2,500 MΩ or $R_{ins} \times C_r$ ≥ 25s whichever is less<br>Class2:<br>X7R: ≥ 500 MΩ or $R_{ins} \times C_r$ ≥ 25s whichever is less |
| Endurance | IEC 60384-21/22 | 4.14 | 1. Preconditioning, class 2 only:<br>150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp<br>2. Initial measure:<br>Spec: refer initial spec C, D, IR<br>3. Endurance test:<br>Temperature: NP0/X7R: 125 °C<br>Specified stress voltage applied for 1,000 hours:<br>4. High voltage series follows with below stress condition:<br><br>Voltage / NPO / X7R<br>≤ 100V / 2.0 x Ur / 2.0 x Ur<br>200/250V / 1.5 x Ur / 1.5 x Ur<br>500/630V / 1.3 x Ur / 1.2 x Ur<br>≥ 1KV / 1.2 x Ur / 1.1 x Ur<br><br>5. Recovery time: 24 ±2 hours<br>6. Final measure: C, D, IR<br><br>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<br><br>ΔC/C<br>Class1:<br>NP0: within ±2% or 1 pF, whichever is greater<br>Class2:<br>X7R: ±15%<br>D.F.<br>Class1:<br>NP0: ≤ 2 x specified value<br>Class2:<br>X7R: ≥ 25 V: ≤ 5%<br>$R_{ins}$<br>Class1:<br>NP0: ≥ 4,000 MΩ or<br>$R_{ins} \times C_r$ ≥ 40s whichever is less<br>Class2:<br>X7R: ≥ 1,000 MΩ or<br>$R_{ins} \times C_r$ ≥ 50s whichever is less |
| Voltage Proof | | 4.6 | Specified stress voltage applied for 1~5 seconds<br>Ur ≤ 100 V: series applied 2.5 Ur<br>100 V < Ur ≤ 200 V series applied (1.5 Ur + 100)<br>200 V < Ur ≤ 500 V series applied (1.3 Ur + 100)<br>Ur > 500 V: 1.3 Ur<br>Ur ≥ 1000 V: 1.2 Ur<br>Charge/Discharge current is less than 50 mA | No breakdown or flashover |

## REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version 21 | Jul. 13, 2018 | - | - Add NPO/0402/120pF to 1nF/100V, NPO/0603/1.2nF to 1.5nF/100V, NPO/1206/1.8nF/630V, NPO/1210/12nF to 22nF/100V<br>- Add 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 |
| 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 |
| 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<br>- 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<br>- Define global part number<br>- Description of "Halogen Free compliant" added<br>- Test method and procedure updated |
| Version 0 | Sep 08, 2005 | - | - New |