

# DATA SHEET

**SURFACE-MOUNT CERAMIC  
MULTILAYER CAPACITORS**

High-Voltage

NP0/X7R

1 KV TO 3 KV

0.47 pF to 33 nF

RoHS compliant & Halogen Free



SCOPE

This specification describes High-Voltage NP0/X7R series chip capacitors with lead-free terminations.

APPLICATIONS

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

FEATURES

- Supplied in tape on reel
- Nickel-barrier end termination
- RoHS compliant
- Halogen Free compliant

ORDERING INFORMATION-GLOBAL PART NUMBER, PHYCOMP

CTC & I2NC

All part numbers are identified by the series, size, tolerance, TC material, packing style, voltage, process code, termination and capacitance value.

**YAGEO BRAND ordering code**

**GLOBAL PART NUMBER (PREFERRED)**

**CC** xxxx x x xxx x **B** x xxx  
 (1) (2) (3) (4) (5) (6) (7)

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**(1) SIZE – INCH BASED (METRIC)**

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

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**(2) TOLERANCE**

C = ±0.25 pF  
 D = ±0.5 pF  
 G = ±2%  
 J = ±5%  
 K = ±10%

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**(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

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**(4) TC MATERIAL**

NPO  
 X7R

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**(5) RATED VOLTAGE**

C = 1 KV  
 D = 2 KV  
 E = 3 KV

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**(6) PROCESS**

N = NPO  
 B = Class 2 MLCC

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**(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

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**PHYCOMP BRAND ordering codes**

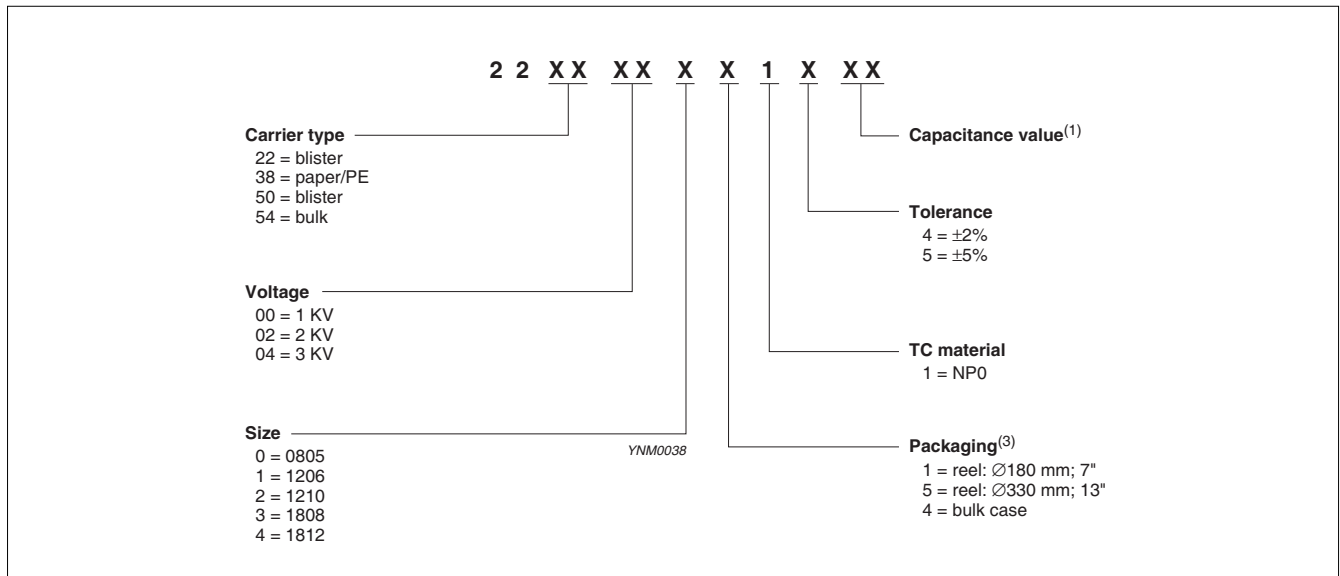
GLOBAL PART NUMBER (preferred), PHYCOMP CTC (for North America) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

**GLOBAL PART NUMBER (PREFERRED)**

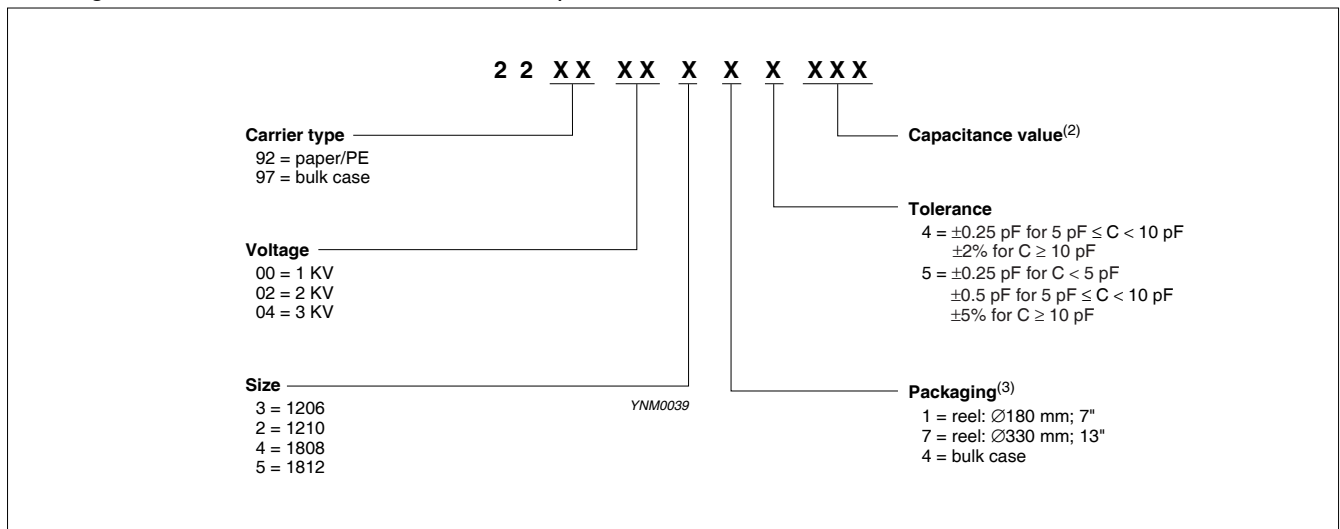
For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

**I2NC CODE**

Ordering information for NP0 | 1 KV to 3 KV, C ≥ 10 pF

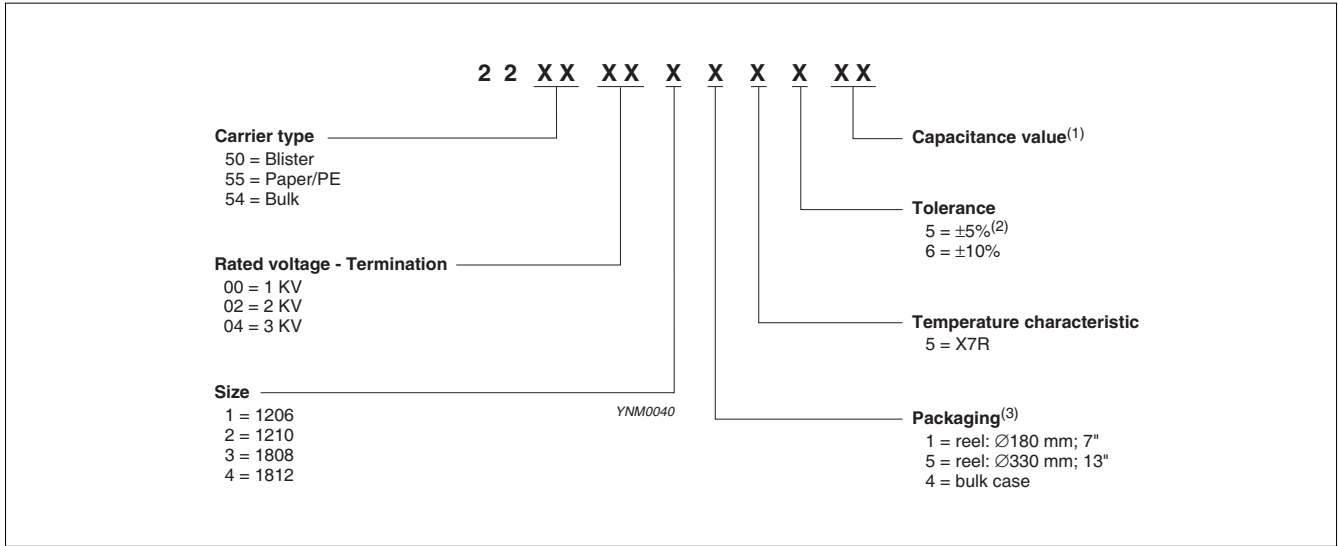


Ordering information for NP0 | 1 KV to 3 KV, C < 10 pF



- (1) Please refer to "Last 2-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0"
- (2) Please refer to "Last 3-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0"
- (3) Quantity on reel depends on thickness classification; see table 5

Ordering information for X7R 1 KV to 3 KV



- (1) Please refer to "Last 2-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR X7R"
- (2) Tolerance ±5% is not available for full product range, please contact local sales force before ordering
- (3) Quantity on reel depends on thickness classification; see table 5

**PHYCOMP CTC CODE (FOR NORTH AMERICA)**

🔗 Example: I2I02R102KFBB00

| 1210      | 2R          | I02   | K            | F        | B           | B             | 0              | 0                 |
|-----------|-------------|---|--------------|----------|-------------|---------------|----------------|-------------------|
| Size code | Temp. Char. | Capacitance in pF                                 | Tolerance    | Voltage  | Termination | Packing       | Marking        | Range identifier  |
| 0805      | CG = NP0    | 101 = 100 pF;                                     | C = ±0.25 pF | E = 1 KV | B = NiSn    | 2 = 180 mm    | 0 = no marking | 0 = conv. Ceramic |
| 1206      | 2R = X7R    | the third digit signifies the multiplying factor: | D = ±0.5 pF  | F = 2 KV |             | 7" Paper/PE   |                | D = Class 2 MLCC  |
| 1210      |             | 8 = × 0.01  | G = ±2%      | G = 3 KV |             | 3 = 330 mm    |                |                   |
| 1808      |             | 9 = × 0.1   | J = ±5%      |          |             | 13" Paper/PE  |                |                   |
| 1812      |             | 0 = × 1   | K = ±10%     |          |             | B = 180 mm    |                |                   |
|           |             | 1 = × 10  |              |          |             | 7" Blister    |                |                   |
|           |             | 2 = × 100   |              |          |             | F = 330 mm    |                |                   |
|           |             | 3 = × 1,000                                       |              |          |             | 13" Blister   |                |                   |
|           |             |   |              |          |             | P = Bulk case |                |                   |

**CONSTRUCTION**

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved metal electrodes are contained. This structure gives rise to a high capacitance per unit volume.

The inner electrodes are connected to the two end terminations and finally covered with a layer of plated tin (NiSn). The terminations are lead-free. A cross section of the structure is shown in Fig.1.

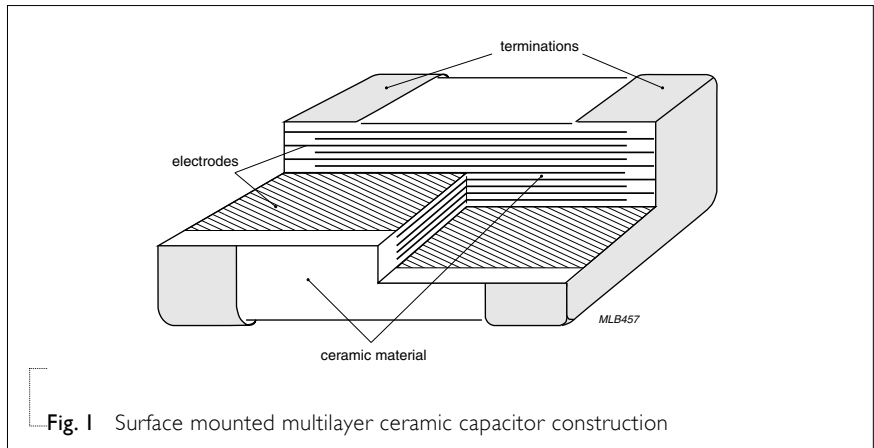


Fig. 1 Surface mounted multilayer ceramic capacitor construction

**DIMENSION**

Table I For outlines see fig. 2

| TYPE | L <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.                |
| 0805 | 2.0 ±0.20           | 1.25 ±0.20 | Refer to<br>table 2 to 4 | 0.25                                 | 0.75 | 0.55                |
| 1206 | 3.2 ±0.30           | 1.6 ±0.20  |                          | 0.25                                 | 0.75 | 1.40                |
| 1210 | 3.2 ±0.30           | 2.5 ±0.20  |                          | 0.25                                 | 0.75 | 1.40                |
| 1808 | 4.5 ±0.40           | 2.0 ±0.30  |                          | 0.25                                 | 0.75 | 2.20                |
| 1812 | 4.5 ±0.40           | 3.2 ±0.20  |                          | 0.25                                 | 0.75 | 2.20                |

**OUTLINES**

For dimension see Table I

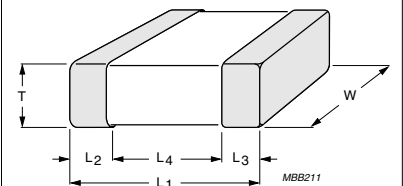


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

**CAPACITANCE RANGE & THICKNESS FOR NP0**

**Table 2** Sizes from 1206 to 1808

| CAP.    | Last 3-digit of<br>I2NC | 1206     |          | 1210     |          | 1808     |          |         |
|---------|-------------------------|----------|----------|----------|----------|----------|----------|---------|
|         |                         | 1 KV     | 2 KV     | 1 KV     | 2 KV     | 1 KV     | 2 KV     | 3 KV    |
| 0.47 pF | 477                     |          |          |          |          |          |          |         |
| 0.56 pF | 567                     |          |          |          |          |          |          |         |
| 0.68 pF | 687                     |          |          |          |          |          |          |         |
| 0.82 pF | 827                     |          |          |          |          |          |          |         |
| 1.0 pF  | 108                     |          |          |          |          |          |          |         |
| 1.2 pF  | 128                     |          |          |          |          |          |          |         |
| 1.5 pF  | 158                     |          |          |          |          |          |          |         |
| 1.8 pF  | 188                     |          |          |          |          |          |          |         |
| 2.2 pF  | 228                     | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.6±0.2 |
| 2.7 pF  | 278                     |          |          |          |          |          |          |         |
| 3.3 pF  | 338                     |          |          |          |          |          |          |         |
| 3.9 pF  | 398                     |          |          |          |          |          |          |         |
| 4.7 pF  | 478                     |          |          |          |          |          |          |         |
| 5.6 pF  | 568                     |          |          |          |          |          |          |         |
| 6.8 pF  | 688                     |          |          |          |          |          |          |         |
| 8.2 pF  | 828                     |          |          |          |          |          |          |         |

**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 0805 to 1812

| CAP.   | Last 2-digit of | 0805 |         |          | 1206     |          | 1210     |          | 1808     |         |          | 1812     |         |  |
|--------|-----------------|------|---------|----------|----------|----------|----------|----------|----------|---------|----------|----------|---------|--|
|        |                 | 12NC | 1 KV    | 1 KV     | 2 KV     | 1 KV     | 2 KV     | 1 KV     | 2 KV     | 3 KV    | 1 KV     | 2 KV     | 3 KV    |  |
| 10 pF  | 23              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 12 pF  | 24              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 15 pF  | 25              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 18 pF  | 26              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 22 pF  | 27              |      | 1.0±0.1 |          |          |          |          |          |          |         |          |          |         |  |
| 27 pF  | 28              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 33 pF  | 29              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 39 pF  | 31              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 47 pF  | 32              |      |         |          | 1.25±0.2 |          |          |          |          |         |          |          |         |  |
| 56 pF  | 33              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 68 pF  | 34              |      |         |          |          |          | 1.25±0.2 |          | 1.25±0.2 |         |          |          |         |  |
| 82 pF  | 35              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 100 pF | 36              |      |         | 1.25±0.2 |          | 1.25±0.2 |          |          |          |         |          | 1.25±0.2 |         |  |
| 120 pF | 37              |      |         |          |          |          |          | 1.25±0.2 |          |         |          |          |         |  |
| 150 pF | 38              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 180 pF | 39              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 220 pF | 41              |      |         |          |          |          |          |          |          | 2.0±0.2 | 1.25±0.2 |          |         |  |
| 270 pF | 42              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 330 pF | 43              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 390 pF | 44              |      |         |          |          |          |          |          |          |         |          |          | 1.6±0.2 |  |
| 470 pF | 45              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 560 pF | 46              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 680 pF | 47              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 820 pF | 48              |      |         |          |          |          |          |          |          |         |          |          | 2.0±0.2 |  |
| 1.0 nF | 49              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 1.2 nF | 51              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 1.5 nF | 52              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 1.8 nF | 53              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 2.2 nF | 54              |      |         |          |          |          |          |          |          |         |          |          |         |  |
| 2.7 nF | 55              |      |         |          |          |          |          |          |          |         |          | 1.6±0.2  |         |  |
| 3.3 nF | 56              |      |         |          |          |          |          |          |          |         |          |          |         |  |

**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 4 Sizes from 0805 to 1812

| CAP.   | Last 2-digit of | 0805 |      | 1206     |          |          | 1210     |         | 1808      |         |      | 1812      |         |  |
|--------|-----------------|------|------|----------|----------|----------|----------|---------|-----------|---------|------|-----------|---------|--|
|        |                 | I2NC | 1 KV | 1 KV     | 2 KV     | 1 KV     | 2 KV     | 1 KV    | 2 KV      | 3 KV    | 1 KV | 2 KV      | 3 KV    |  |
| 100 pF | 09              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 150 pF | 12              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 220 pF | 14              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 330 pF | 16              |      |      |          |          |          |          |         |           | 1.6±0.2 |      |           |         |  |
| 470 pF | 18              |      |      |          | 1.25±0.2 |          |          |         |           |         |      |           |         |  |
| 680 pF | 21              |      |      |          |          |          |          |         | 1.35±0.15 |         |      |           |         |  |
| 1.0 nF | 23              |      |      | 1.25±0.2 |          |          |          |         |           | 2.0±0.2 |      |           | 1.6±0.2 |  |
| 1.5 nF | 25              |      |      |          |          |          | 1.25±0.2 |         | 1.35±0.15 |         |      | 1.35±0.15 | 2.0±0.2 |  |
| 2.2 nF | 27              |      |      |          |          |          |          | 1.6±0.2 |           | 1.6±0.2 |      |           |         |  |
| 3.3 nF | 29              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 4.7 nF | 32              |      |      |          |          | 1.25±0.2 |          |         |           |         |      | 1.35±0.15 |         |  |
| 6.8 nF | 34              |      |      |          |          |          |          |         | 1.6±0.2   |         |      |           | 1.6±0.2 |  |
| 10 nF  | 36              |      |      |          |          |          |          |         |           |         |      | 2.0±0.2   |         |  |
| 15 nF  | 38              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 22 nF  | 41              |      |      |          |          |          | 1.6±0.2  |         |           |         |      |           |         |  |
| 33 nF  | 43              |      |      |          |          |          | 2.0±0.2  |         |           |         |      | 1.6±0.2   |         |  |
| 47 nF  | 45              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 68 nF  | 47              |      |      |          |          |          |          |         |           |         |      |           |         |  |
| 100 nF | 49              |      |      |          |          |          |          |         |           |         |      |           |         |  |

**NOTE**

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



**THICKNESS CLASSES AND PACKING QUANTITY**

Table 5

| SIZE CODE   | THICKNESS CLASSIFICATION | TAPE WIDTH<br>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                  |
|             | 1.00 ±0.1 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                    |
|             | 1.25 ±0.2 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | 5,000                  |
| 1206        | 0.6 ±0.1 mm              | 8 mm                            | 4,000            | ---            | 20,000            | ---     | ---                    |
|             | 0.8 / 0.85 ±0.1 mm       | 8 mm                            | 4,000            | ---            | 15,000            | ---     | ---                    |
|             | 1.00 / 1.15 ±0.1 mm      | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                    |
|             | 1.25 ±0.2 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                    |
|             | 1.6 ±0.15 mm             | 8 mm                            | ---              | 2,500          | ---               | 10,000  | ---                    |
|             | 1.6 ±0.2 mm              | 8 mm                            | ---              | 2,000          | ---               | 10,000  | ---                    |
| 1210        | 0.6 / 0.7 ±0.1 mm        | 8 mm                            | ---              | 4,000          | ---               | 15,000  | ---                    |
|             | 0.85 ±0.1 mm             | 8 mm                            | ---              | 4,000          | ---               | 10,000  | ---                    |
|             | 1.15 ±0.1 mm             | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                    |
|             | 1.15 ±0.15 mm            | 8 mm                            | ---              | 3,000          | ---               | 10,000  | ---                    |
|             | 1.25 ±0.2 mm             | 8 mm                            | ---              | 3,000          | ---               | ---     | ---                    |
|             | 1.5 ±0.1 mm              | 8 mm                            | ---              | 2,000          | ---               | ---     | ---                    |
|             | 1.6 / 1.9 ±0.2 mm        | 8 mm                            | ---              | 2,000          | ---               | ---     | ---                    |
|             | 2.0 ±0.2 mm              | 8 mm                            | ---              | 2,000<br>1,000 | ---               | ---     | ---                    |
| 1808        | 1.15 ±0.15 mm            | 12 mm                           | ---              | 3,000          | ---               | ---     | ---                    |
|             | 1.25 ±0.2 mm             | 12 mm                           | ---              | 3,000          | ---               | ---     | ---                    |
|             | 1.35 ±0.15 mm            | 12 mm                           | ---              | 2,000          | ---               | ---     | ---                    |
|             | 1.5 ±0.1 mm              | 12 mm                           | ---              | 2,000          | ---               | ---     | ---                    |
|             | 1.6 ±0.2 mm              | 12 mm                           | ---              | 2,000          | ---               | ---     | ---                    |
|             | 2.0 ±0.2 mm              | 12 mm                           | ---              | 2,000          | ---               | ---     | ---                    |
| 1812        | 0.6 / 0.85 ±0.1 mm       | 12 mm                           | ---              | 2,000          | ---               | ---     | ---                    |
|             | 1.15 ±0.1 mm             | 12 mm                           | ---              | 1,000          | ---               | ---     | ---                    |
|             | 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 stated all electrical values apply at an ambient temperature of 20±1 °C, an atmospheric pressure of 86 to 106 kPa, and a relative humidity of 63 to 67%.

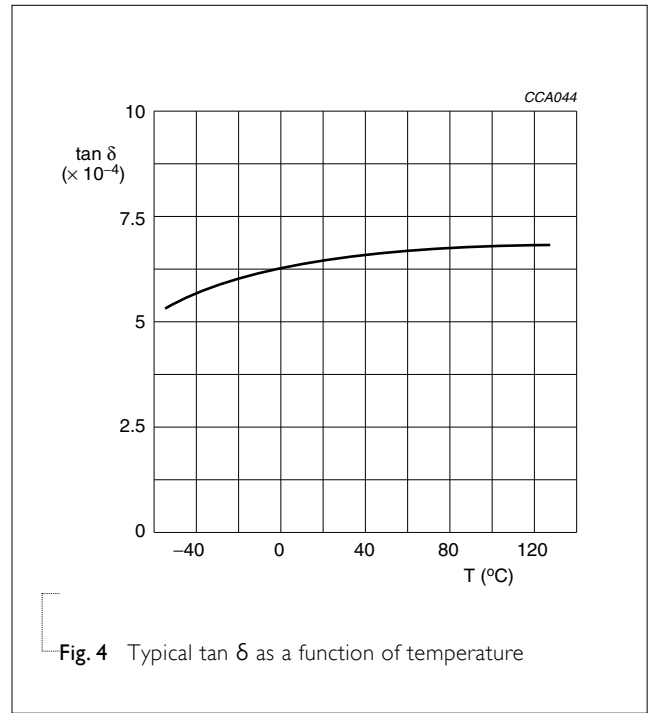
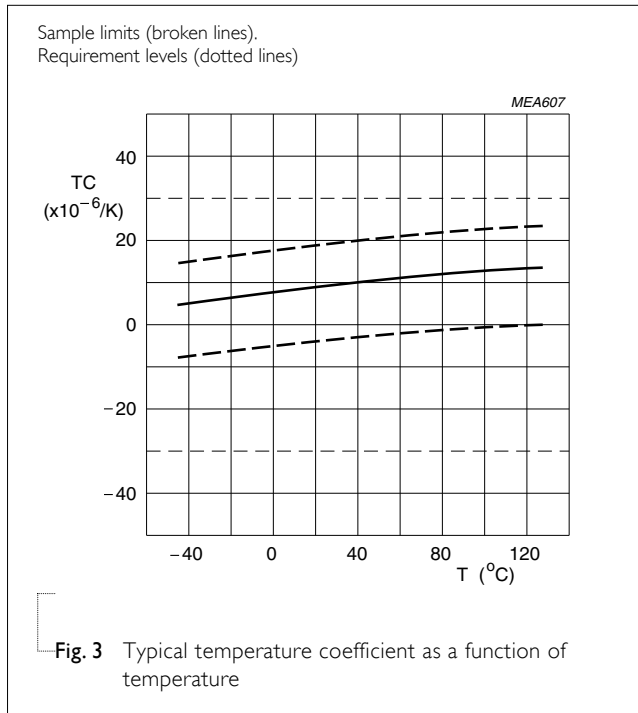
Table 6

| DESCRIPTION   | VALUE  |
|---|--|
| Capacitance range   | 0.47 pF to 33 nF   |
| Capacitance tolerance   |  |
| NP0     C < 10 pF   | ±0.25 pF, ±0.5 pF  |
| C ≥ 10 pF   | ±2%, ±5%   |
| X7R   | ±5% <sup>(1)</sup> , ±10%  |
| Dissipation factor (D.F.)   |  |
| NP0     C < 30 pF   | ≤ 1 / ( 400 + 20C )  |
| C ≥ 30 pF   | ≤ 0.1 %  |
| X7R   | ≤ 2.5 %  |
| Insulation resistance after 1 minute at U <sub>r</sub> (DC)                                       | R <sub>ins</sub> ≥ 10 GΩ or R <sub>ins</sub> × 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  |

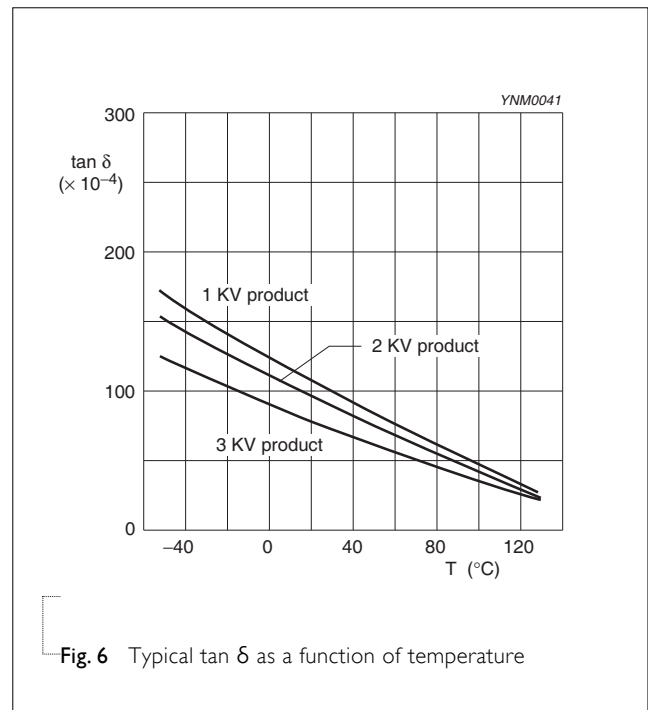
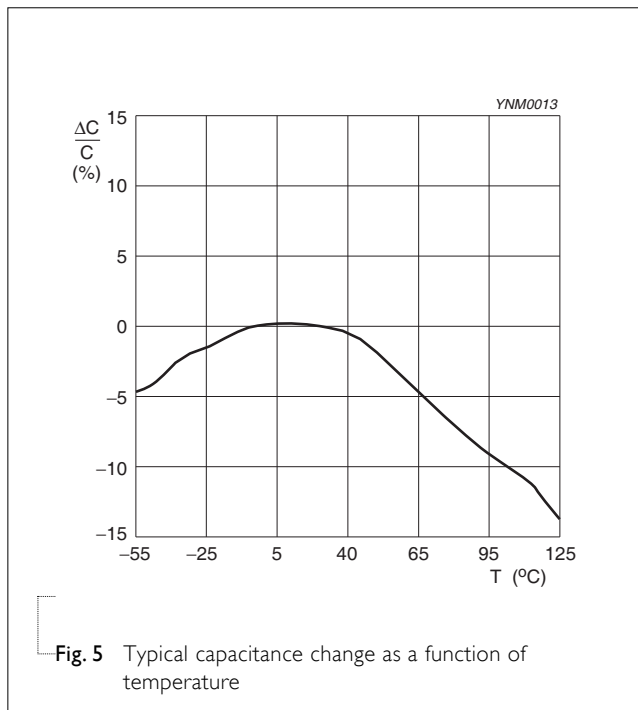
**NOTE**

1. ±5% tolerance of capacitance value isn't available for X7R full product range, please contact local sales force before ordering

**HIGH-VOLTAGE NP0**



**HIGH-VOLTAGE X7R**



**SOLDERING RECOMMENDATION**
**Table 7**

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

**TESTS AND REQUIREMENTS**
**Table 8** 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 <sub>rms</sub> at 20 °C<br>f = 1 KHz for C > 1 nF, measuring at voltage 1 V <sub>rms</sub> at 20 °C<br>Class 2:<br>f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 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 1 V <sub>rms</sub> at 20 °C<br>f = 1 KHz for C > 1 nF, measuring at voltage 1 V <sub>rms</sub> at 20 °C<br>Class 2:<br>f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V <sub>rms</sub> at 20 °C | In accordance with specification     |
| 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     |
| Temperature Coefficient               | 4.6                 | Class 1:<br>Between minimum and maximum temperature<br>NP0: -55 °C to +125 °C<br>Normal Temperature: 20 °C  | ΔC/C:<br>Class 1:<br>NP0: ±30 ppm/°C |
| Temperature Characteristic            |                     | Class 2:<br>Between minimum and maximum temperature<br>X7R: -55 °C to +125 °C<br>Normal Temperature: 20 °C  | Class 2<br>X7R: ±15%                 |

| TEST                                 | TEST METHOD         | PROCEDURE  | REQUIREMENTS   |
|--------------------------------------|---------------------|--|--|
| 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 $\geq$ 0603: 5N   |
| Bond Strength of Plating on End Face | 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 340 mm  | No visible damage<br><br>$\Delta C/C$<br>Class 1:<br>NP0: within $\pm 1\%$ or 0.5 pF, whichever is greater<br>Class2:<br>X7R: $\pm 10\%$   |
| Resistance to Soldering Heat         | 4.9                 | Precondition: 150 $\pm 10$ °C for 1 hour, then keep for 24 $\pm$ 1 hours at room temperature<br>Preheating: for size $\leq$ 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 $\pm$ 5 °C<br>Dipping time: 10 $\pm$ 0.5 seconds<br>Recovery time: 24 $\pm$ 2 hours  | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned<br><br>$\Delta C/C$<br>Class 1:<br>NP0: within $\pm 0.5\%$ or 0.5 pF, whichever is greater<br>Class2:<br>X7R: $\pm 10\%$<br><br>D.F. within initial specified value<br>$R_{ins}$ within initial specified value |
| Solderability                        | 4.10                | Preheated to a temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds.<br><br>Test conditions for lead containing solder alloy<br>Temperature: 235 $\pm$ 5 °C<br>Dipping time: 2 $\pm$ 0.2 seconds<br>Depth of immersion: 10 mm<br>Alloy Composition: 60/40 Sn/Pb<br>Number of immersions: 1<br><br>Test conditions for lead-free containing solder alloy<br>Temperature: 245 $\pm$ 5 °C<br>Dipping time: 3 $\pm$ 0.3 seconds<br>Depth of immersion: 10 mm<br>Alloy Composition: SAC305<br>Number of immersions: 1 | The solder should cover over 95% of the critical area of each termination  |

| TEST                        | TEST METHOD          | PROCEDURE   | REQUIREMENTS   |
|-----------------------------|----------------------|---|--|
| Rapid Change of Temperature | IEC 60384-21/22 4.11 | <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><br/>Class 1:<br/>NP0: within ±1% or 1 pF, whichever is greater<br/>Class2:<br/>X7R: ±15%</p> <hr/> <p>D.F. meet initial specified value<br/><math>R_{ins}</math> meet initial specified value</p>   |
| Damp Heat                   | 4.13                 | <ol style="list-style-type: none"> <li>Preconditioning, class 2 only:<br/>150 +0/-10 °C /1 hour, then keep for 24 ± 1 hour at room temp</li> <li>Initial measure:<br/>Spec: refer to initial spec C, D, IR</li> <li>Damp heat test:<br/>500 ± 12 hours at 40 ± 2 °C;<br/>90 to 95% R.H.</li> <li>Recovery:<br/>Class 1: 6 to 24 hours<br/>Class 2: 24 ± 2 hours</li> <li>Final measure: C, D, IR</li> </ol> <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 preconditioned 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%</p> <p>D.F.<br/>Class 1:<br/>NP0: <math>\leq 2 \times</math> specified value<br/>Class2:<br/>X7R: <math>\geq 25 V: \leq 5\%</math></p> <p><math>R_{ins}</math><br/>Class 1:<br/>NP0: <math>\geq 2,500 M\Omega</math> or <math>R_{ins} \times C_r \geq 25s</math> whichever is less<br/>Class2:<br/>X7R: <math>\geq 500 M\Omega</math> or <math>R_{ins} \times C_r \geq 25s</math> whichever is less</p> |

| TEST                 | TEST METHOD          | PROCEDURE  | REQUIREMENTS  |
|----------------------|----------------------|--|---|
| <b>Endurance</b>     | IEC 60384-21/22 4.14 | <ol style="list-style-type: none"> <li>Preconditioning, class 2 only:<br/>150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp</li> <li>Initial measure:<br/>Spec: refer to initial spec C, D, IR</li> <li>Endurance test:<br/>Temperature: NP0/X7R: 125 °C<br/>Specified stress voltage applied for 1,000 hours.<br/>High-Voltage series follows the stress conditions below:<br/>Applied 2.0 × U<sub>r</sub> for &lt; 500 V series<br/>Applied 1.3 × U<sub>r</sub> for 500 V, 630 V series<br/>Applied 1.2 × U<sub>r</sub> for 1 KV, 2 KV, 3 KV series</li> <li>Recovery time: 24 ±2 hours</li> <li>Final measure: C, D, IR</li> </ol> <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 preconditioned according to "IEC 60384 4.1" and then the requirement shall be met.</p> | <p>No visual damage</p> <hr/> <p>ΔC/C</p> <p><b>Class1:</b><br/>NP0: within ±2% or 1 pF, whichever is greater</p> <p><b>Class2:</b><br/>X7R: ±15%</p> <p>D.F.</p> <p><b>Class1:</b><br/>NP0: ≤ 2 × specified value</p> <p><b>Class2:</b><br/>X7R: ≥ 25 V: ≤ 5%</p> <p>R<sub>ins</sub></p> <p><b>Class1:</b><br/>NP0: ≥ 4,000 MΩ or<br/>R<sub>ins</sub> × C<sub>r</sub> ≥ 40s whichever is less</p> <p><b>Class2:</b><br/>X7R: ≥ 1,000 MΩ or<br/>R<sub>ins</sub> × C<sub>r</sub> ≥ 50s whichever is less</p> |
| <b>Voltage Proof</b> | IEC 60384-1 4.6      | <p>Specified stress voltage applied for 1 minute</p> <p>U<sub>r</sub> ≤ 100 V: series applied 2.5 U<sub>r</sub></p> <p>100 V &lt; U<sub>r</sub> ≤ 200 V series applied (1.5 U<sub>r</sub> + 100)</p> <p>200 V &lt; U<sub>r</sub> ≤ 500 V series applied (1.3 U<sub>r</sub> + 100)</p> <p>U<sub>r</sub> &gt; 500 V: 1.3 U<sub>r</sub></p> <p>I: 7.5 mA</p>  | No breakdown or flashover   |

**REVISION HISTORY**

| REVISION  | DATE         | CHANGE NOTIFICATION | DESCRIPTION  |
|-----------|--------------|---------------------|--|
| Version 4 | Aug 08, 2011 | -                   | - Product range updated  |
| Version 3 | Jan 19, 2011 | -                   | - Dimension updated<br>- Add NP0 0805 1KV  |
| Version 2 | Feb 02, 2010 | -                   | - Change to dual brand datasheet that describe High-Voltage NP0/X7R series with RoHS compliant<br>- Replace the high voltage part of pdf files:<br>UP-NP0X7R_HV_1K-to-4KV_I and UY-NP0X7R_HV_1K-to-4KV_I<br>- Description of "Halogen Free compliant" added<br>- Product range updated<br>- Define global part number<br>- Test method and procedure updated |
| Version 1 | Sep 30, 2005 | -                   | - Thickness revised  |
| Version 0 | Sep 12, 2005 | -                   | - New  |