

DATA SHEET

SURFACE-MOUNT CERAMIC
MULTILAYER CAPACITORS

Mid-voltage

NP0/X7R

100 V TO 630 V

0.47 pF to 1 μ 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
- LCD panel
- ADSL, Modem

FEATURES

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

ORDERING INFORMATION-GLOBAL PART NUMBER, PHYCOMP

CTC & I2NC

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

YAGEO BRAND ordering code

GLOBAL PART NUMBER (PREFERRED)

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

(1) SIZE – INCH BASED (METRIC)

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

(2) TOLERANCE

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

(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 = 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 × 10¹ = 120 pF

PHYCOMP BRAND ordering codes

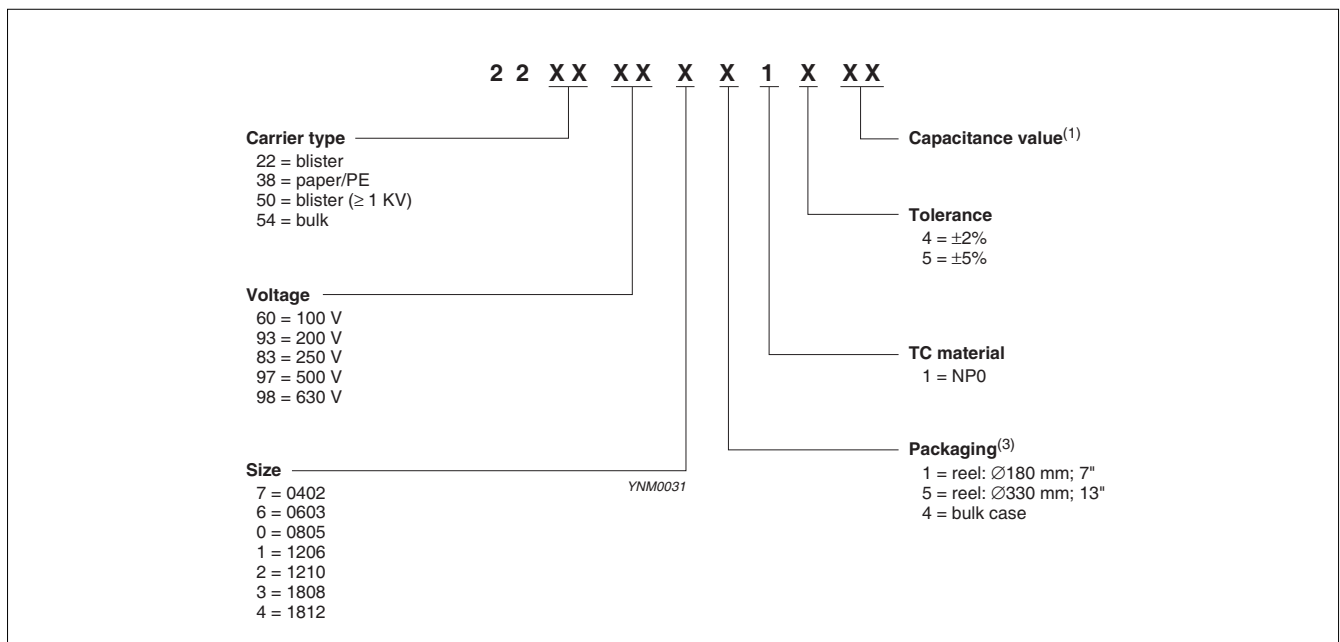
GLOBAL PART NUMBER (preferred), PHYCOMP CTC (for North America) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

GLOBAL PART NUMBER (PREFERRED)

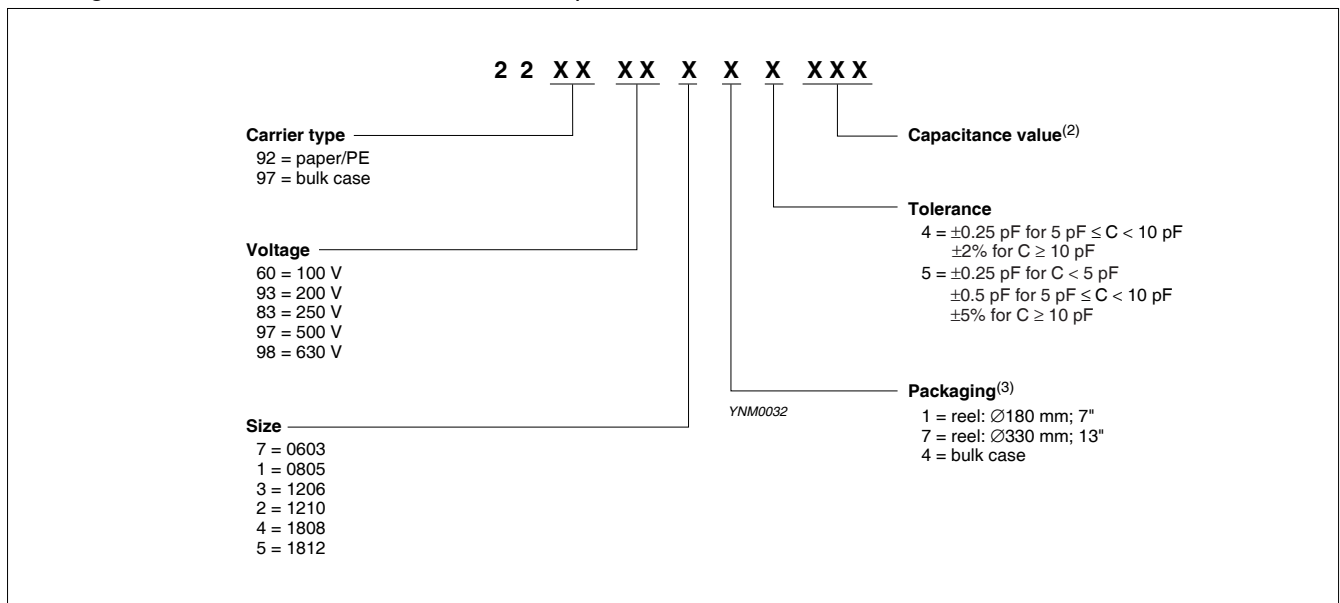
For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

I2NC CODE

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

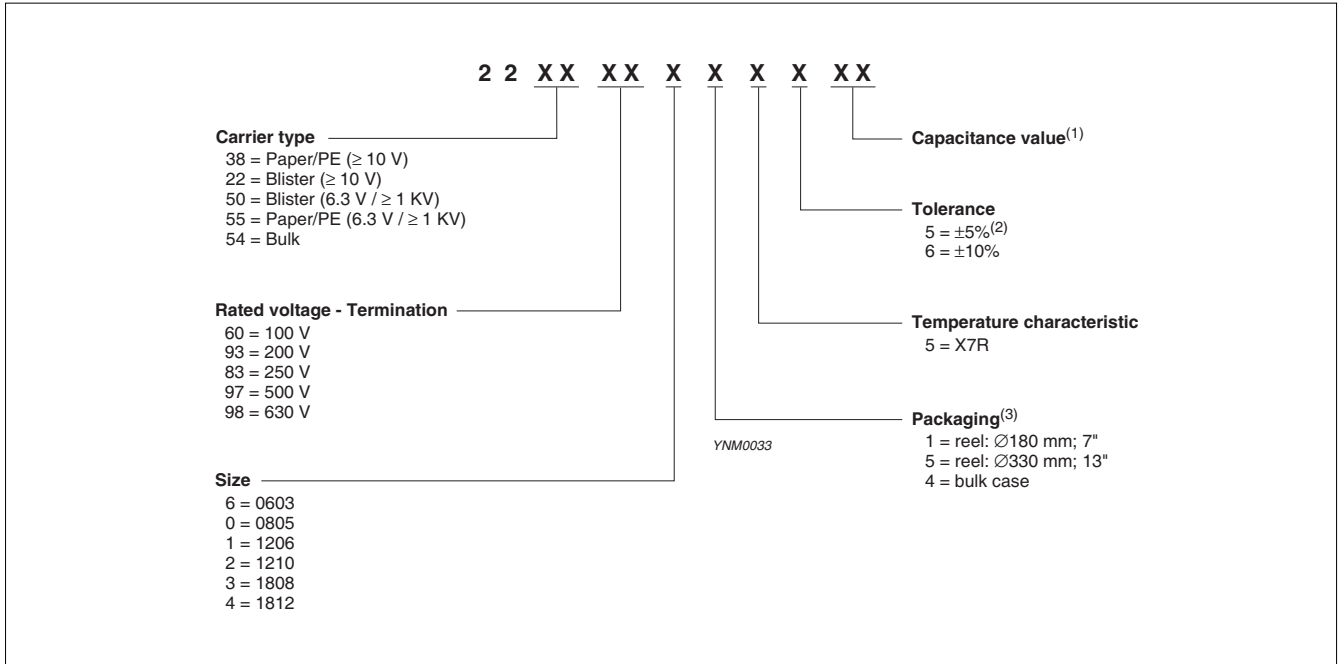


Ordering information for NP0 100 V to 630 V, C < 10 pF



- (1) Please refer to "Last 2-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0"
- (2) Please refer to "Last 3-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR NP0"
- (3) Quantity on reel depends on thickness classification; see table I4

Ordering information for X7R 100 V to 630 V



- (1) Please refer to "Last 2-digit of I2NC" in "CAPACITANCE RANGE & THICKNESS FOR X7R"
- (2) Tolerance $\pm 5\%$ doesn't available for full product range, please contact local sales force before order
- (3) Quantity on reel depends on thickness classification; see table I4

PHYCOMP CTC CODE (FOR NORTH AMERICA)

🔗 Example: 0603CG101J0B200

| 0603 | CG | 101 | J | 0 | B | 2 | 0 | 0 |
|-----------|-------------|---|-------------------|-----------|-------------|---------------|----------------|-------------------|
| Size code | Temp. Char. | Capacitance in pF | Tolerance | Voltage | Termination | Packing | Marking | Range identifier |
| 0402 | CG = NP0 | 101 = 100 pF; the third digit signifies the multiplying factor: | C = ± 0.25 pF | 0 = 100 V | B = NiSn | 2 = 180 mm | 0 = no marking | 0 = conv. Ceramic |
| 0603 | 2R = X7R | | D = ± 0.5 pF | B = 200 V | | 7" Paper/PE | | D = Class 2 MLCC |
| 0805 | | | G = $\pm 2\%$ | C = 250 V | | 3 = 330 mm | | |
| 1206 | | 0 = $\times 1$ | J = $\pm 5\%$ | D = 500 V | | 13" Paper/PE | | |
| 1210 | | 1 = $\times 10$ | K = $\pm 10\%$ | Z = 630 V | | B = 180 mm | | |
| 1808 | | 2 = $\times 100$ | | | | 7" Blister | | |
| 1812 | | 3 = $\times 1,000$ | | | | F = 330 mm | | |
| | | | | | | 13" Blister | | |
| | | | | | | P = Bulk case | | |

CONSTRUCTION

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

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

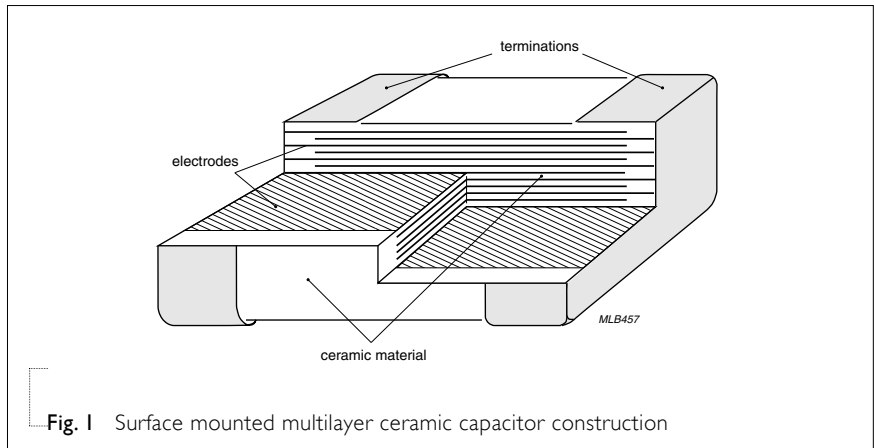


Fig. 1 Surface mounted multilayer ceramic capacitor construction

DIMENSION

Table I For outlines see fig. 2

| TYPE | L ₁ (mm) | W (mm) | T (MM) | L ₂ / L ₃ (mm) | | L ₄ (mm) |
|------|---------------------|------------|---------------------------|--------------------------------------|------|---------------------|
| | | | | min. | max. | min. |
| 0402 | 1.0 ±0.10 | 0.5 ±0.05 | Refer to table 2 to 13 | 0.15 | 0.30 | 0.40 |
| 0603 | 1.6 ±0.10 | 0.8 ±0.10 | | 0.20 | 0.60 | 0.40 |
| 0805 | 2.0 ±0.20 | 1.25 ±0.20 | | 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 ±0.30 | | 0.25 | 0.75 | 2.20 |

OUTLINES

For dimension see Table I

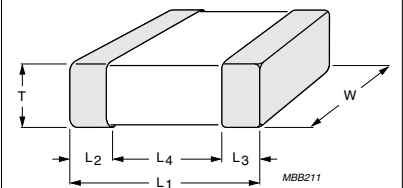


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 2 Sizes from 0603 to 0805

| CAP. | Last 3-digit of I2NC | 0603 | | | 0805 | | | | |
|---------|-------------------------|---------|-------|-------|-------|---------|---------|---------|---------|
| | | 100 V | 200 V | 250 V | 100 V | 200 V | 250 V | 500 V | |
| 0.47 pF | 477 | 0.8±0.1 | | | | | | | |
| 0.56 pF | 567 | | | | | | | | |
| 0.68 pF | 687 | | | | | | | | |
| 0.82 pF | 827 | | | | | | | | |
| 1.0 pF | 108 | | | | | | | | |
| 1.2 pF | 128 | | | | | | | | |
| 1.5 pF | 158 | | | | | | | | |
| 1.8 pF | 188 | | | | | | | | |
| 2.2 pF | 228 | | | | | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 2.7 pF | 278 | | | | | | | | |
| 3.3 pF | 338 | | | | | | | | |
| 3.9 pF | 398 | | | | | | | | |
| 4.7 pF | 478 | | | | | | | | |
| 5.6 pF | 568 | | | | | | | | |
| 6.8 pF | 688 | | | | | | | | |
| 8.2 pF | 828 | | | | | | | | |

Table 3 Sizes from 0402 to 0805

| CAP. | Last 2-digit of I2NC | 0402 | 0603 | | 0805 | | | | | |
|-------|-------------------------|----------|-------|---------|---------|---------|---------|---------|---------|---------|
| | | 100 V | 100 V | 200 V | 250 V | 100 V | 200 V | 250 V | 500 V | |
| 10 pF | 23 | 0.5±0.05 | | | | | | | | |
| 12 pF | 24 | | | | | | | | | |
| 15 pF | 25 | | | | | | | | | |
| 18 pF | 26 | | | | | | | | | |
| 22 pF | 27 | | | | | | | | | |
| 27 pF | 28 | | | | | | | | | |
| 33 pF | 29 | | | 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 |
| 39 pF | 31 | | | | | | | | | |
| 47 pF | 32 | | | | | | | | | |
| 56 pF | 33 | | | | | | | | | |
| 68 pF | 34 | | | | | | | | | |
| 82 pF | 35 | | | | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 4 Sizes from 0402 to 0805 (continued)

| CAP. | Last 2-digit of 12NC | 0402 | | 0603 | | 0805 | | | |
|--------|-------------------------|----------|---------|---------|---------|----------|----------|----------|----------|
| | | 100 V | 100 V | 200 V | 250 V | 100 V | 200 V | 250 V | 500 V |
| 100 pF | 36 | 0.5±0.05 | | | | | | | |
| 120 pF | 37 | | | | | | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 150 pF | 38 | | | | | | | | |
| 180 pF | 39 | | | | | | | | |
| 220 pF | 41 | | | 0.8±0.1 | 0.8±0.1 | | | | |
| 270 pF | 42 | | | | | | | | |
| 330 pF | 43 | | 0.8±0.1 | | | 0.6±0.1 | | | 0.85±0.1 |
| 390 pF | 44 | | | | | | | | |
| 470 pF | 45 | | | | | | 0.85±0.1 | 0.85±0.1 | |
| 560 pF | 46 | | | | | | | | |
| 680 pF | 47 | | | | | | | | |
| 820 pF | 48 | | | | | | | | 1.25±0.2 |
| 1.0 nF | 49 | | | | | | | | |
| 1.2 nF | 51 | | | | | | | | |
| 1.5 nF | 52 | | | | | | 1.25±0.2 | 1.25±0.2 | |
| 1.8 nF | 53 | | | | | | | | |
| 2.2 nF | 54 | | | | | | | | |
| 2.7 nF | 55 | | | | | | | | |
| 3.3 nF | 56 | | | | | | | | |
| 3.9 nF | 57 | | | | | 1.25±0.2 | | | |
| 4.7 nF | 58 | | | | | | | | |
| 5.6 nF | 59 | | | | | | | | |
| 6.8 nF | 61 | | | | | | | | |
| 8.2 nF | 62 | | | | | | | | |
| 10 nF | 63 | | | | | | | | |
| 12 nF | 64 | | | | | | | | |
| 15 nF | 65 | | | | | | | | |
| 18 nF | 66 | | | | | | | | |
| 22 nF | 67 | | | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 5 Sizes from 1206 to 1210

| CAP. | Last 3-digit of | 1206 | | | | | 1210 | | | | | |
|---------|-----------------|---------|---------|---------|---------|----------|-------|-------|-------|-------|-------|----------|
| | | 12NC | 100 V | 200 V | 250 V | 500 V | 630 V | 100 V | 200 V | 250 V | 500 V | 630 V |
| 0.47 pF | 477 | | | | | | | | | | | |
| 0.56 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 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 | | | | | | 1.25±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 | | | | | | | | | | | |

Table 6 Sizes from 1206 to 1210

| CAP. | Last 2-digit of | 1206 | | | | | 1210 | | | | | |
|-------|-----------------|---------|---------|---------|---------|----------|----------|-------|-------|-------|----------|----------|
| | | 12NC | 100 V | 200 V | 250 V | 500 V | 630 V | 100 V | 200 V | 250 V | 500 V | 630 V |
| 10 pF | 23 | | | | | | | | | | | |
| 12 pF | 24 | | | | | | | | | | | |
| 15 pF | 25 | | | | | | | | | | | |
| 18 pF | 26 | | | | | | | | | | | |
| 22 pF | 27 | | | | | | | | | | | |
| 27 pF | 28 | | | | | | | | | | | |
| 33 pF | 29 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | | | 1.25±0.2 |
| 39 pF | 31 | | | | | | | | | | | |
| 47 pF | 32 | | | | | | | | | | | |
| 56 pF | 33 | | | | | | | | | | | |
| 68 pF | 34 | | | | | | 1.25±0.2 | | | | 1.25±0.2 | |
| 82 pF | 35 | | | | | | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 7 Sizes from 1206 to 1210 (continued)

| CAP. | Last 2-digit of | 1206 | | | | | 1210 | | | | | |
|--------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|----------|
| | | 12NC | 100 V | 200 V | 250 V | 500 V | 630 V | 100 V | 200 V | 250 V | 500 V | 630 V |
| 100 pF | 36 | | | | | | | | | | | |
| 120 pF | 37 | | | | | | | | | | | |
| 150 pF | 38 | | | | | | | | | | | |
| 180 pF | 39 | | | | | | | | | | | |
| 220 pF | 41 | | | | | | | | | | | |
| 270 pF | 42 | | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | | | | | | | |
| 330 pF | 43 | | | | | 1.25±0.2 | | | | | | 1.25±0.2 |
| 390 pF | 44 | | | | | | | | | | | |
| 470 pF | 45 | 0.6±0.1 | | | | | | | | 1.25±0.2 | | |
| 560 pF | 46 | | | | | | | | | | | |
| 680 pF | 47 | | | | | | | | | | | |
| 820 pF | 48 | | | | | | | | | | | |
| 1.0 nF | 49 | | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | | | 1.25±0.2 | 1.25±0.2 | | | |
| 1.2 nF | 51 | | | | | | 1.25±0.2 | | | | | 1.6±0.2 |
| 1.5 nF | 52 | | | | | | | | | | | |
| 1.8 nF | 53 | | | | | | | | | | | |
| 2.2 nF | 54 | | | | | 1.25±0.2 | | | | | | |
| 2.7 nF | 55 | | 1.25±0.2 | 1.25±0.2 | | | | | | | | |
| 3.3 nF | 56 | | | | | | | | | | | |
| 3.9 nF | 57 | | | | | | | | | | | |
| 4.7 nF | 58 | 0.85±0.1 | | | | | | | | | | |
| 5.6 nF | 59 | | | | | | | | | | | |
| 6.8 nF | 61 | | | | | | | | | | | |
| 8.2 nF | 62 | | | | | | | | | | | |
| 10 nF | 63 | 1.25±0.2 | | | | | | | | | | |
| 12 nF | 64 | | | | | | | | | | | |
| 15 nF | 65 | | | | | | | | | | | |
| 18 nF | 66 | | | | | | | | | | | |
| 22 nF | 67 | | | | | | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 8 Sizes from 1808 to 1812

| CAP. | Last 2-digit of | 1808 | | | | | 1812 | | | | |
|-------|-----------------|------|-------|-------|-------|----------|-------|-------|-------|----------|----------|
| | | 12NC | 100 V | 200 V | 250 V | 500 V | 630 V | 100 V | 200 V | 250 V | 500 V |
| 10 pF | 23 | | | | | | | | | | |
| 12 pF | 24 | | | | | | | | | | |
| 15 pF | 25 | | | | | | | | | | |
| 18 pF | 26 | | | | | | | | | | |
| 22 pF | 27 | | | | | | | | | | |
| 27 pF | 28 | | | | | | | | | | |
| 33 pF | 29 | | | | | 1.25±0.2 | | | | | |
| 39 pF | 31 | | | | | | | | | | |
| 47 pF | 32 | | | | | | | | | 1.25±0.2 | |
| 56 pF | 33 | | | | | | | | | | |
| 68 pF | 34 | | | | | | | | | | |
| 82 pF | 35 | | | | | | | | | | 1.25±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 9 Sizes from 1808 to 1812 (continued)

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

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-12 series is on request

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 10 Sizes from 0603 to 0805

| CAP. | Last 2-digit of I2NC | 0603 100 V | 0805 100 V | 200 V | 250 V | 500 V | |
|--------|-------------------------|---------------|---------------|-------------------------|----------|----------|----------|
| 100 pF | 09 | 0.8±0.1 | | | | | |
| 150 pF | 12 | | | | | | |
| 220 pF | 14 | | | | | | |
| 330 pF | 16 | | | | | | |
| 470 pF | 18 | | | | | | |
| 680 pF | 21 | | | | | | |
| 1.0 nF | 23 | | | | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 |
| 1.5 nF | 25 | | | 0.6±0.1 (3) 0.85±0.1 | | | |
| 2.2 nF | 27 | | | | | | |
| 3.3 nF | 29 | | | | | | |
| 4.7 nF | 32 | | | | | | |
| 6.8 nF | 34 | | | | | | |
| 10 nF | 36 | | | | | | 1.25±0.2 |
| 15 nF | 38 | | | | 1.25±0.2 | 1.25±0.2 | |
| 22 nF | 41 | | | 0.85±0.1 | | | |
| 33 nF | 43 | | | | | | |
| 47 nF | 45 | | 1.25±0.2 | | | | |
| 68 nF | 47 | | | | | | |
| 100 nF | 49 | | | | | | |
| 150 nF | 52 | | | | | | |
| 220 nF | 54 | | | | | | |
| 330 nF | 56 | | | | | | |
| 470 nF | 58 | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For 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 11 Sizes from 1206 to 1210

| CAP. | Last 2-digit of | 1206 | | | | | 1210 | | | | |
|--------|-----------------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|
| | | 12NC | 100 V | 200 V | 250 V | 500 V | 630 V | 100 V | 200 V | 250 V | 500 V |
| 100 pF | 09 | | | | | | 0.85±0.1 | | | | |
| 150 pF | 12 | | | | | | | | | | |
| 220 pF | 14 | | | | | | | | | | |
| 330 pF | 16 | | | | | | | | | | |
| 470 pF | 18 | | | | | | | | | | |
| 680 pF | 21 | | | | | | | | | | |
| 1.0 nF | 23 | | | | | | | | | | |
| 1.5 nF | 25 | | | | | | | | | | |
| 2.2 nF | 27 | | 0.85±0.1 | 0.85±0.1 | | 1.25±0.2 | 1.25±0.2 | | | | |
| 3.3 nF | 29 | 0.85±0.1 | | | | | | | | | |
| 4.7 nF | 32 | | | | | | | | 0.85±0.1 | 0.85±0.1 | |
| 6.8 nF | 34 | | | | | | | | | | |
| 10 nF | 36 | | | | | | | | | | 1.25±0.2 |
| 15 nF | 38 | | | | | | | 0.85±0.1 | | | |
| 22 nF | 41 | | | | | | 1.6±0.2 | | | | |
| 33 nF | 43 | | 1.25±0.2 | 1.25±0.2 | | 1.6±0.2 | | | | | |
| 47 nF | 45 | | | | | | | | 1.25±0.2 | 1.25±0.2 | |
| 68 nF | 47 | | | | | | | | | | |
| 100 nF | 49 | | 1.25±0.2 | 1.6±0.2 | 1.6±0.2 | | | | | | |
| 150 nF | 52 | | | | | | | 1.25±0.2 | | | |
| 220 nF | 54 | | | | | | | | | | |
| 330 nF | 56 | | | | | | | | | | |
| 470 nF | 58 | 1.6±0.2 | | | | | | | | | |
| 680 nF | 61 | | | | | | | | | | |
| 1 µF | 63 | | 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-6 series is on request
3. For product with 5% tolerance, please contact local sales force before order

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 12 Sizes from 1808 to 1812

| CAP. | Last 2-digit of 12NC | 1808 | | | | 1812 | | | | |
|--------|-------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | | 100 V | 200 V | 250 V | 500 V | 100 V | 200 V | 250 V | 500 V | 630 V |
| 100 pF | 09 | | | | | | | | | |
| 150 pF | 12 | | | | | | | | | |
| 220 pF | 14 | | | | | | | | | |
| 330 pF | 16 | | | | | | | | | |
| 470 pF | 18 | | | | | | | | | |
| 680 pF | 21 | | | | | | | | | |
| 1.0 nF | 23 | | | | | | | | | |
| 1.5 nF | 25 | | | | | | | | | |
| 2.2 nF | 27 | | | | | | | | | |
| 3.3 nF | 29 | | | | | | | | | |
| 4.7 nF | 32 | | | | | | | | | 1.25±0.2 |
| 6.8 nF | 34 | | | | | | | | | |
| 10 nF | 36 | | | | 1.25±0.2 | | 0.85±0.1 | 0.85±0.1 | | |
| 15 nF | 38 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 0.85±0.1 | | | 1.25±0.2 | |
| 22 nF | 41 | | | | | | | | | |
| 33 nF | 43 | | | | | | | | | 1.6±0.2 |
| 47 nF | 45 | | | | | | | | | |
| 68 nF | 47 | | | | | | | | | |
| 100 nF | 49 | | | | | | 1.25±0.2 | 1.25±0.2 | | 1.6±0.2 |
| 150 nF | 52 | | | | | | | | | |
| 220 nF | 54 | | | | | 1.25±0.2 | | 1.6±0.2 | 1.6±0.2 | |
| 330 nF | 56 | | | | | | | 2.0±0.2 | 2.0±0.2 | |
| 470 nF | 58 | | | | | | | | | |
| 680 nF | 61 | | | | | | 1.6±0.2 | | | |
| 1 µF | 63 | | | | | | | | | |

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 13

| SIZE CODE | THICKNESS CLASSIFICATION | TAPE WIDTH QUANTITY PER REEL | Ø180 MM / 7 INCH | | Ø330 MM / 13 INCH | | QUANTITY PER BULK CASE |
|-------------|--------------------------|---------------------------------|------------------|----------------|-------------------|---------|------------------------|
| | | | Paper | Blister | Paper | Blister | |
| 0201 | 0.3 ±0.03 mm | 8 mm | 15,000 | --- | 50,000 | --- | --- |
| 0402 | 0.5 ±0.05 mm | 8 mm | 10,000 | --- | 50,000 | --- | 50,000 |
| 0603 | 0.8 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- | 15,000 |
| 0805 | 0.6 ±0.1 mm | 8 mm | 4,000 | --- | 20,000 | --- | 10,000 |
| | 0.8 / 0.85 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- | 8,000 |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | 10,000 | 5,000 |
| 1206 | 0.6 ±0.1 mm | 8 mm | 4,000 | --- | 20,000 | --- | --- |
| | 0.8 / 0.85 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- | --- |
| | 1.00 / 1.15 ±0.1 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.6 ±0.15 mm | 8 mm | --- | 2,500 | --- | 10,000 | --- |
| | 1.6 ±0.2 mm | 8 mm | --- | 2,000 | --- | 10,000 | --- |
| 1210 | 0.6 / 0.7 ±0.1 mm | 8 mm | --- | 4,000 | --- | 15,000 | --- |
| | 0.85 ±0.1 mm | 8 mm | --- | 4,000 | --- | 10,000 | --- |
| | 1.15 ±0.1 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.15 ±0.15 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | 8 mm | --- | 2,000 | --- | --- | --- |
| | 1.6 / 1.9 ±0.2 mm | 8 mm | --- | 2,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | 8 mm | --- | 2,000 1,000 | --- | --- | --- |
| 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 14

| DESCRIPTION | | VALUE |
|---|-----------|--|
| Capacitance range | | 0.47 pF to 1 μF |
| Capacitance tolerance | | |
| NP0 | C < 10 pF | ±0.25 pF, ±0.5 pF |
| | C ≥ 10 pF | ±2%, ±5% |
| X7R | | ±5% ⁽¹⁾ , ±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 _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

MID-VOLTAGE NP0

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

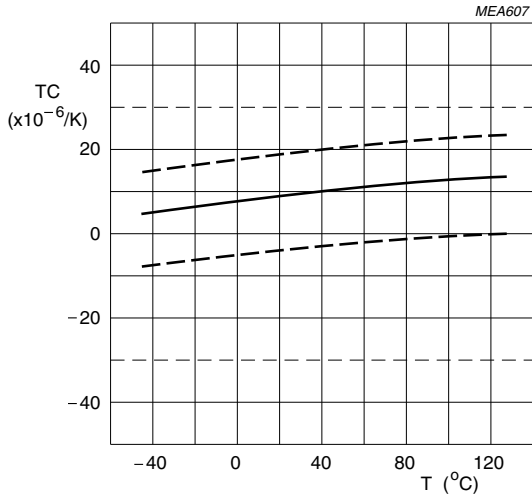


Fig. 3 Typical temperature coefficient as a function of temperature

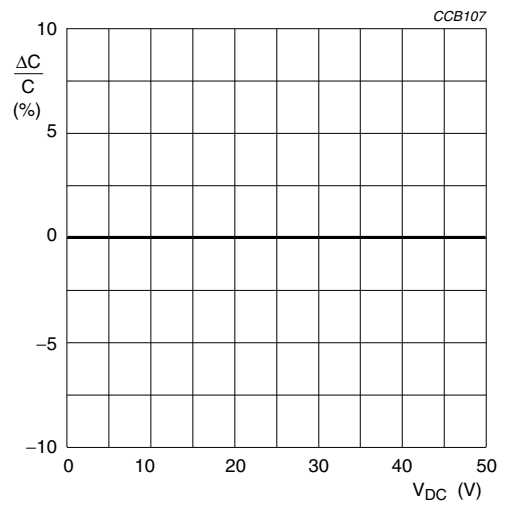


Fig. 4 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage

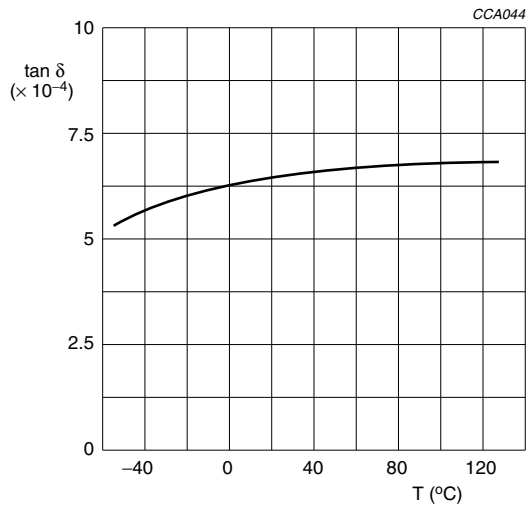
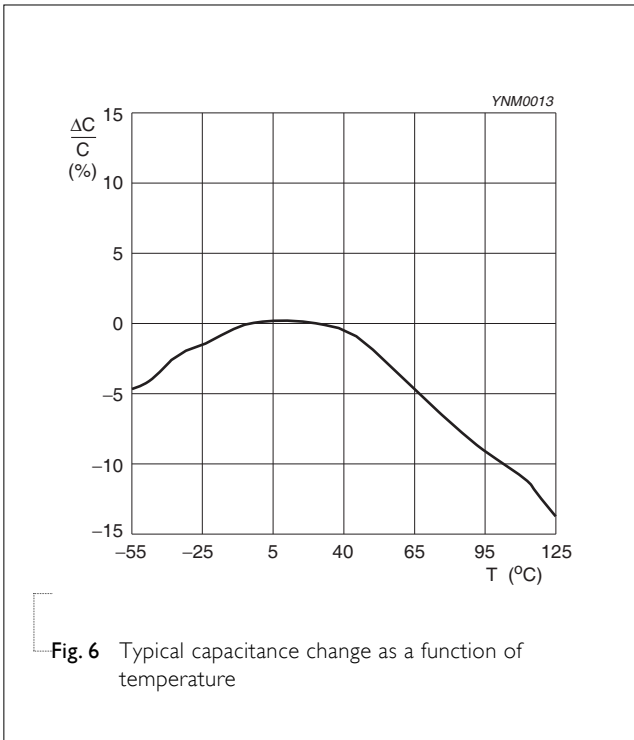


Fig. 5 Typical tan δ as a function of temperature

MID-VOLTAGE X7R



SOLDERING RECOMMENDATION

Table 15

| 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 16 Test procedures and requirements

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---------------------------------------|---------------------|---|--------------------------------------|
| Mounting | IEC 60384-21/22 4.3 | The capacitors may be mounted on printed-circuit boards or ceramic substrates | No visible damage |
| Visual Inspection and Dimension Check | 4.4 | Any applicable method using × 10 magnification | In accordance with specification |
| Capacitance | 4.5.1 | Class 1: f = 1 MHz for C ≤ 1 nF, measuring at voltage V _{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage V _{rms} at 20 °C Class 2: f = 1 KHz for C ≤ 10 μF, measuring at voltage V _{rms} at 20 °C | Within specified tolerance |
| Dissipation Factor (D.F.) | 4.5.2 | Class 1: f = 1 MHz for C ≤ 1 nF, measuring at voltage V _{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage V _{rms} at 20 °C Class 2: f = 1 KHz for C ≤ 10 μF, measuring at voltage V _{rms} at 20 °C | In accordance with specification |
| Insulation Resistance | 4.5.3 | U _r ≤ 500 V: At U _r for 1 minute U _r > 500 V: At 500 V for 1 minute | In accordance with specification |
| Temperature Coefficient | 4.6 | Class 1: Between minimum and maximum temperature NP0: -55 °C to +125 °C Normal Temperature: 20 °C | ΔC/C: Class 1: NP0: ±30 ppm/°C |
| Temperature Characteristic | | Class 2: Between minimum and maximum temperature X7R: -55 °C to +125 °C Normal Temperature: 20 °C | Class 2 X7R: ±15% |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|--------------------------------------|---------------------|--|--|
| Adhesion | 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 Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm | No visible damage $\Delta C/C$ Class 1: NP0: within $\pm 1\%$ or 0.5 pF, whichever is greater Class2: X7R: $\pm 10\%$ |
| Resistance to Soldering Heat | 4.9 | Precondition: 150 \pm 10 °C for 1 hour, then keep for 24 \pm 1 hours at room temperature Preheating: for size \leq 1206: 120 °C to 150 °C for 1 minute Preheating: for size $>$ 1206: 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute Solder bath temperature: 260 \pm 5 °C Dipping time: 10 \pm 0.5 seconds Recovery time: 24 \pm 2 hours | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned $\Delta C/C$ Class 1: NP0: within $\pm 0.5\%$ or 0.5 pF, whichever is greater Class2: X7R: $\pm 10\%$ D.F. within initial specified value R_{ins} within initial specified value |
| Solderability | 4.10 | Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds. Test conditions for lead containing solder alloy Temperature: 235 \pm 5 °C Dipping time: 2 \pm 0.2 seconds Depth of immersion: 10 mm Alloy Composition: 60/40 Sn/Pb Number of immersions: 1 Test conditions for leadfree containing solder alloy Temperature: 245 \pm 5 °C Dipping time: 3 \pm 0.3 seconds Depth of immersion: 10 mm Alloy Composition: SAC305 Number of immersions: 1 | The solder should cover over 95% of the critical area of each termination |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|-----------------------------|----------------------|--|---|
| Rapid Change of Temperature | IEC 60384-21/22 4.11 | <p>Preconditioning: 150 +0/-10 °C for 1 hour, then keep for 24 ± 1 hours at room temperature</p> <p>5 cycles with following detail: 30 minutes at lower category temperature 30 minutes at upper category temperature</p> <p>Recovery time 24 ± 2 hours</p> | <p>No visual damage</p> <hr/> <p>$\Delta C/C$ Class 1: NP0: within ±1% or 1 pF, whichever is greater Class2: X7R: ±15%</p> <hr/> <p>D.F. meet initial specified value R_{ins} meet initial specified value</p> |
| Damp Heat | 4.13 | <ol style="list-style-type: none"> Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ± 1 hour at room temp Initial measure: Spec: refer initial spec C, D, IR Damp heat test: 500 ± 12 hours at 40 ± 2 °C; 90 to 95% R.H. Recovery: Class 1: 6 to 24 hours Class 2: 24 ± 2 hours Final measure: C, D, IR <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>$\Delta C/C$ Class 1: NP0: within ±2% or 1 pF, whichever is greater Class2: X7R: ±15%</p> <p>D.F. Class 1: NP0: ≤ 2 × specified value Class2: X7R: ≥ 25 V: ≤ 5%</p> <p>R_{ins} Class 1: NP0: ≥ 2,500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less Class2: X7R: ≥ 500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less</p> |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|----------------------|----------------------|--|---|
| Endurance | IEC 60384-21/22 4.14 | <ol style="list-style-type: none"> Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp Initial measure: Spec: refer initial spec C, D, IR Endurance test: Temperature: NP0/X7R: 125 °C Specified stress voltage applied for 1,000 hours: Applied 2.0 × U_r for general product Applied 1.5 × U_r for high cap. Product High voltage series follows with below stress condition: Applied 2.0 × U_r for < 500 V series Applied 1.3 × U_r for 500 V, 630 V series Applied 1.2 × U_r for 1 KV, 2 KV, 3 KV series Recovery time: 24 ±2 hours Final measure: C, D, IR <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</p> <hr/> <p>ΔC/C</p> <p>Class1: NP0: within ±2% or 1 pF, whichever is greater</p> <p>Class2: X7R: ±15%</p> <p>D.F.</p> <p>Class1: NP0: ≤ 2 × specified value</p> <p>Class2: X7R: ≥ 25 V: ≤ 5%</p> <p>R_{ins}</p> <p>Class1: NP0: ≥ 4,000 MΩ or R_{ins} × C_r ≥ 40s whichever is less</p> <p>Class2: X7R: ≥ 1,000 MΩ or R_{ins} × C_r ≥ 50s whichever is less</p> |
| Voltage Proof | IEC 60384-1 4.6 | <p>Specified stress voltage applied for 1 minute</p> <p>U_r ≤ 100 V: series applied 2.5 U_r 100 V < U_r ≤ 200 V series applied (1.5 U_r + 100) 200 V < U_r ≤ 500 V series applied (1.3 U_r + 100) U_r > 500 V: 1.3 U_r</p> <p>I: 7.5 mA</p> | No breakdown or flashover |

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|-----------|--------------|---------------------|--|
| 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 - Thickness classes and packing quantity table updated |
| Version 4 | Jun 17, 2010 | - | - Update the dimension of 0805, 1206 and 1812 |
| Version 3 | Mar 25, 2010 | - | - Product range update |
| Version 2 | Mar 15, 2010 | - | - Product range update |
| Version 1 | Oct 30, 2009 | - | - Change to dual brand datasheet that describe Mid-voltage NP0/X7R series with RoHS compliant - Replace the "100V to 630V" part of pdf files: UP-NP0X7R_MV_100-to-500V_0, UY-NP0X7R_MV_100-to-500V_0, NP0_16V-to-100V_6, NP0_50-to-500V_10, X7R_16-to-500V_9 and X7R_16V-to-100V_9 - Define global part number - Description of "Halogen Free compliant" added - Test method and procedure updated |
| Version 0 | Sep 08, 2005 | - | - New |