

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)

(1) SIZE – INCH BASED (METRIC)

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%
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

C = 1 KV
D = 2 KV
S = 2.5KV
E = 3 KV

(6) PROCESS

N = NP0
B = Class 2 MLCC

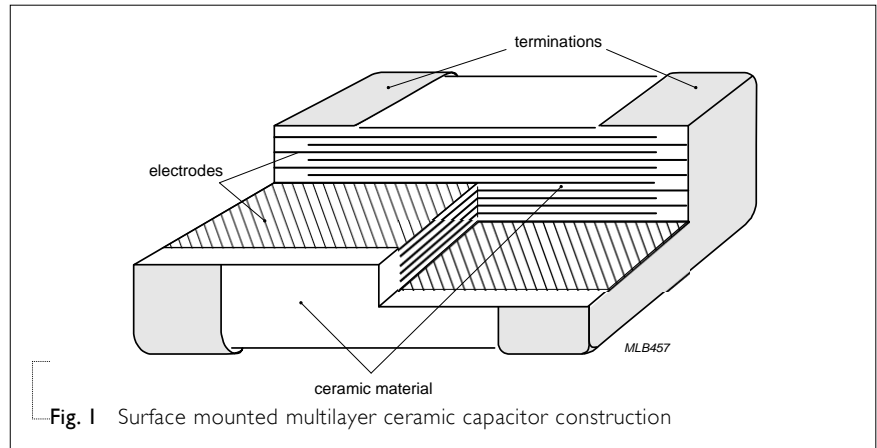
(7) CAPACITANCE VALUE

2 significant digits+number of zeros
The 3rd digit signifies the multiplying factor, and letter R is decimal point
Example: 121 = 12 × 10¹ = 120 pF

CONSTRUCTION

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

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

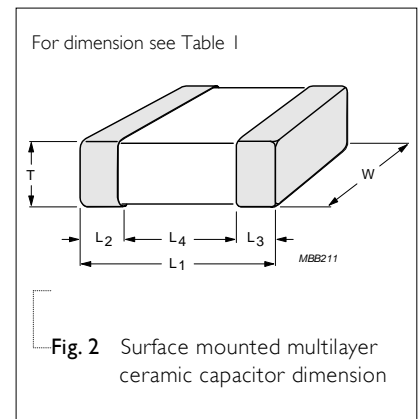


DIMENSION

Table 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. | | |
| 0805 | 2.0 ±0.10 | 1.25 ±0.10 | 0.60 ±0.10 0.85 ±0.10 | 0.25 | 0.75 | 0.70 | | |
| | 2.0 ±0.20 | 1.25 ±0.20 | 1.25 ±0.20 | | | | | |
| | 3.2 ±0.15 | 1.60 ±0.15 | 0.60 ±0.10 | | | | | |
| 1206 | 3.2 ±0.30 | 1.60 ±0.20 | 0.85 ±0.10 1.25 ±0.20 1.60 ±0.20 | 0.25 | 0.75 | 1.40 | | |
| | | | 3.2 ±0.30 | | | | 1.60 ±0.30 | 1.60 ±0.30 |
| | | | 3.2 ±0.20 | | | | 2.50 ±0.20 | 0.85 ±0.10 1.25 ±0.20 |
| 3.2 ±0.30 | 2.50 ±0.20 | 1.60 ±0.20 2.00 ±0.20 | | | | | | |
| 1808 | 4.5 ±0.40 | 2.00 ±0.30 | 1.25 ±0.20 1.35 ±0.15 1.60 ±0.20 2.00 ±0.20 | 0.25 | 0.75 | 2.20 | | |
| | | | 0.85 ±0.10 1.25 ±0.20 1.35 ±0.15 1.60 ±0.20 | | | | | |
| | | | 1.25 ±0.20 1.35 ±0.15 1.60 ±0.20 | | | | | |
| | | | 0.85 ±0.10 1.25 ±0.20 1.35 ±0.15 1.60 ±0.20 | | | | | |

OUTLINES



CAPACITANCE RANGE & THICKNESS FOR NP0

Table 2 Sizes from 0805 to 1812

| CAP. | 0805 | | 1206 | | 1210 | | 1808 | | | 1812 | | |
|---------|----------|----------------------|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|
| | 1 KV | 1 KV | 2 KV | 3 KV | 1 KV | 2 KV | 1 KV | 2 KV | 3 KV | 1 KV | 2 KV | 3 KV |
| 0.47 pF | | 0.85±0.1 | | | | | | | | | | |
| 0.56 pF | | 0.85±0.1 | | | | | | | | | | |
| 0.68 pF | | 0.85±0.1 | | | | | | | | | | |
| 0.82 pF | | 0.85±0.1 | | | | | | | | | | |
| 1.0 pF | | 0.85±0.1 | | | | | | | | | | |
| 1.2 pF | | 0.85±0.1 | | | | | | | | | | |
| 1.5 pF | | 0.85±0.1 | | | | | | | | | | |
| 1.8 pF | | 0.85±0.1 | | | | | | | | | | |
| 2.2 pF | | 0.85±0.1 | | | | | | | | | | |
| 2.7 pF | | 0.85±0.1 | | | | | | | | | | |
| 3.3 pF | | 0.85±0.1 | | | | | | | | | | |
| 3.9 pF | | 0.85±0.1 | | | | | | | | | | |
| 4.7 pF | | 0.85±0.1 | | | | | | | | | | |
| 5.6 pF | | 0.85±0.1 | | | | | | | | | | |
| 6.8 pF | | 0.85±0.1 | | | | | | | | | | |
| 8.2 pF | | 0.85±0.1 | | | | | | | | | | |
| 10 pF | 0.85±0.1 | 0.85±0.1 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 12 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 15 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 18 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 22 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 27 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 33 pF | 0.85±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 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 39 pF | 0.85±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 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 47 pF | 0.85±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 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 56 pF | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 68 pF | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 82 pF | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 100 pF | | 1.25±0.2 | 1.25±0.2 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 120 pF | | 1.25±0.2 | 1.25±0.2 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 150 pF | | 1.25±0.2 | 1.25±0.2 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 180 pF | | 1.25±0.2 | 1.25±0.2 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 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 3 Sizes from 0805 to 1812

| CAP. | 0805 | | 1206 | | 1210 | | 1808 | | 1812 | | | |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 1 KV | 1 KV | 2 KV | 3 KV | 1 KV | 2 KV | 1 KV | 2 KV | 3 KV | 1 KV | 2 KV | 3 KV |
| 220 pF | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 270 pF | 1.25±0.2 | | | | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 330 pF | 1.25±0.2 | | | | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 390 pF | 1.25±0.2 | | | | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 470 pF | 1.25±0.2 | | | | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 560 pF | 1.25±0.2 | | | | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 680 pF | 1.25±0.2 | | | | 1.25±0.2 | | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 820 pF | 1.25±0.2 | | | | 1.25±0.2 | | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 1.0 nF | 1.25±0.2 | | | | 1.25±0.2 | | | | 1.25±0.2 | 1.25±0.2 | | |
| 1.2 nF | | | | | | | | | 1.25±0.2 | | | |
| 1.5 nF | | | | | | | | | 1.25±0.2 | | | |

NOTE

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

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 4 Sizes from 0805 to 1812

| CAP. | 0805 | | 1206 | | 1210 | | 1808 | | | 1812 | | |
|--------|----------|----------|----------|---------|----------|----------|-----------|-----------|---------|-----------|-----------|---------|
| | 1 KV | 1 KV | 2 KV | 2.5KV | 1 KV | 2 KV | 1 KV | 2 KV | 3 KV | 1 KV | 2 KV | 3 KV |
| 100 pF | | | | | | | | | | | | |
| 150 pF | 0.85±0.1 | | | | | | | | 1.6±0.2 | | | |
| 220 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | | | 1.6±0.2 | | | |
| 330 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | | 1.35±0.15 | 1.6±0.2 | | | |
| 470 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.35±0.15 | 1.35±0.15 | 1.6±0.2 | | | |
| 680 pF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.35±0.15 | 1.35±0.15 | 1.6±0.2 | | | |
| 1.0 nF | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.6±0.2 | 1.25±0.2 | 1.25±0.2 | 1.35±0.15 | 1.35±0.15 | 2.0±0.2 | 1.35±0.15 | 1.35±0.15 | 1.6±0.2 |
| 1.5 nF | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | 1.25±0.2 | 1.25±0.2 | 1.35±0.15 | 1.35±0.15 | 2.0±0.2 | 1.35±0.15 | 1.35±0.15 | |
| 2.2 nF | 1.25±0.2 | 1.25±0.2 | | | 1.25±0.2 | 1.60±0.2 | 1.35±0.15 | 1.6±0.2 | | 1.35±0.15 | 1.35±0.15 | |
| 3.3 nF | 1.25±0.2 | 1.25±0.2 | | | 1.25±0.2 | | 1.35±0.15 | | | 1.35±0.15 | 1.35±0.15 | |
| 4.7 nF | | 1.25±0.2 | | | 1.25±0.2 | | 1.35±0.15 | | | 1.35±0.15 | 1.35±0.15 | |
| 6.8 nF | | 1.25±0.2 | | | 1.25±0.2 | | 1.6±0.2 | | | 1.35±0.15 | | |
| 10 nF | | 1.25±0.2 | | | 1.25±0.2 | | 1.6±0.2 | | | 1.35±0.15 | | |
| 15 nF | | | | | 1.25±0.2 | | | | | 1.35±0.15 | | |
| 22 nF | | | | | 1.6±0.2 | | | | | 1.35±0.15 | | |
| 33 nF | | | | | | | | | | 1.6±0.2 | | |
| 47 nF | | | | | | | | | | | | |
| 68 nF | | | | | | | | | | | | |
| 100 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 products with 5% tolerance, please contact local sales force before ordering

THICKNESS CLASSES AND PACKING QUANTITY

Table 5

| 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 |
| | 1.00 ±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 | --- | 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 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%.

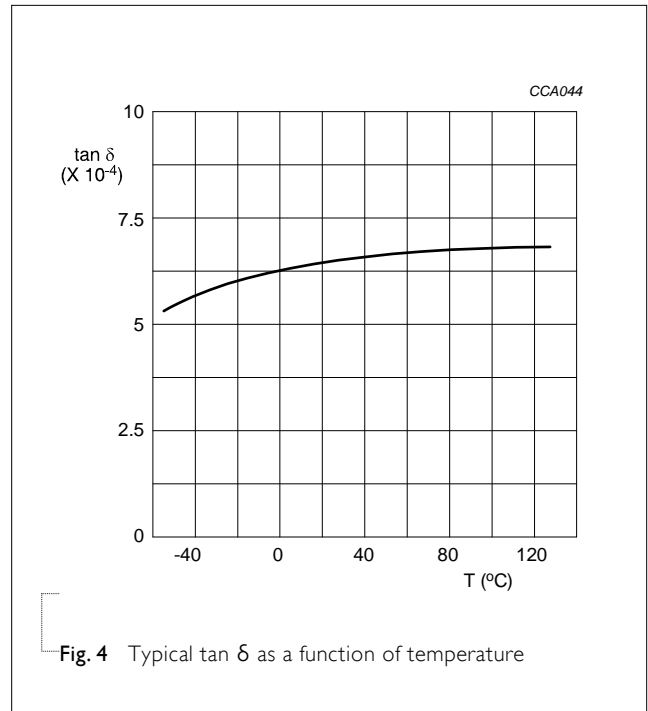
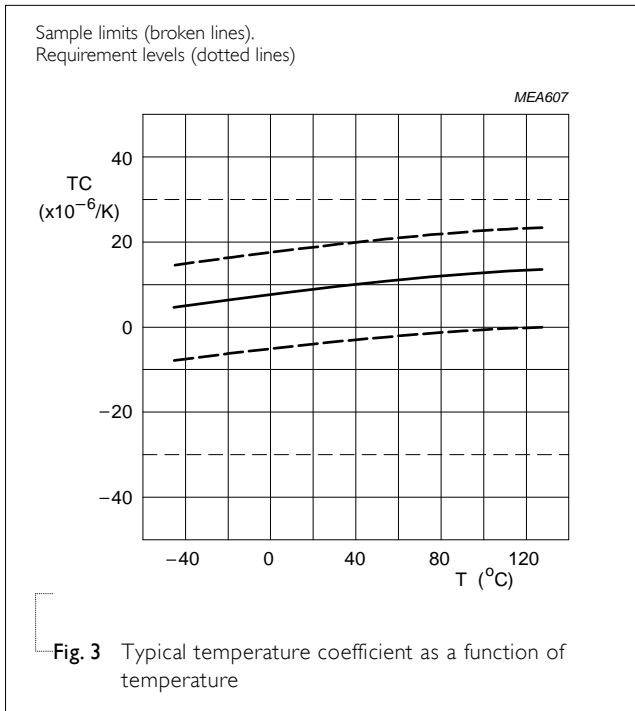
Table 6

| DESCRIPTION | | VALUE |
|---|-----------|--|
| Capacitance range | | 10 pF to 33 nF |
| 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 |

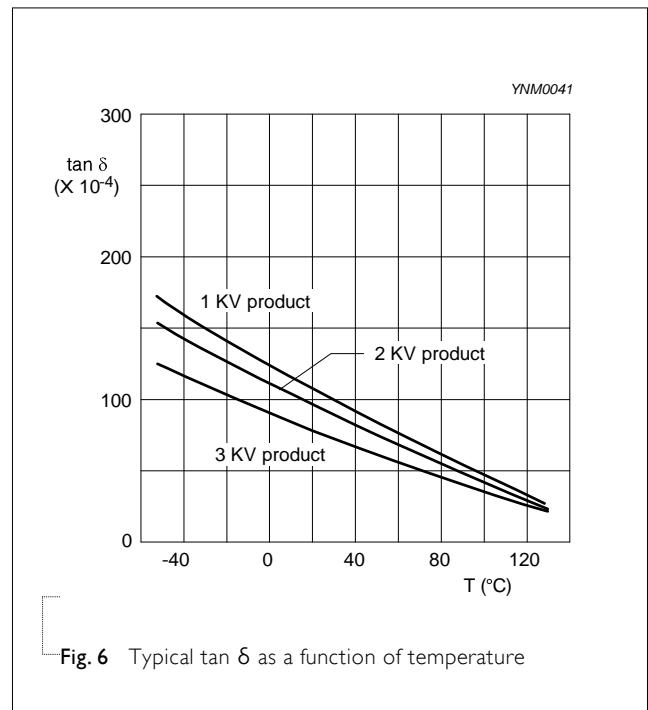
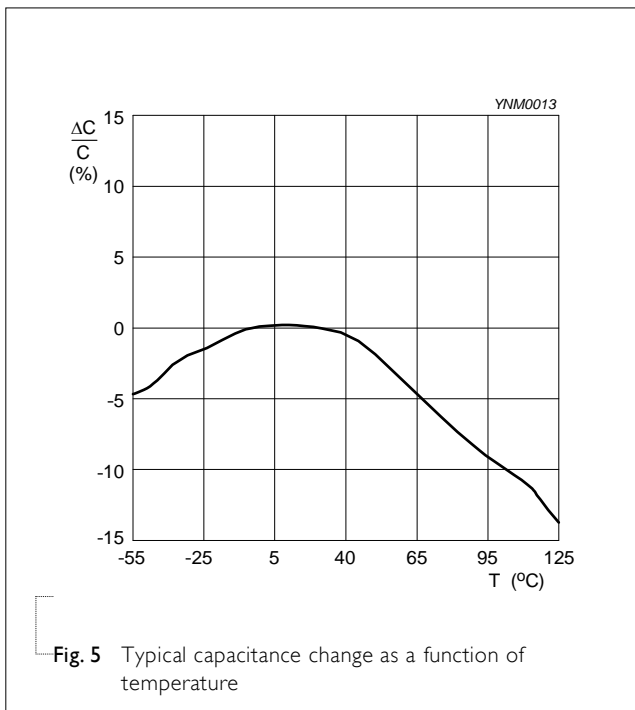
NOTE

1. ±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 | Reflow only | ≥ 1.0 μF | ≥ 2.2 μF | ≥ 4.7 μF | Reflow only |
| Reflow/Wave | --- | < 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: 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 |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS | | | | | | | | | |
|-------------------------|-----------------------|--|---|------|-----------------|---|------|---|-----------------------|---|------|---|
| Temperature Coefficient | 4.6 | Capacitance shall be measured by the steps shown in the following table. The capacitance change should be measured after 5 min at each specified temperature stage. | <General purpose series> Class I: $\Delta C/C: \pm 30\text{ppm}$ Class 2: X7R: $\Delta C/C: \pm 15\%$ Y5V: $\Delta C/C: 22\sim -82\%$ <High Capacitance series> Class 2: X7R/X5R: $\Delta C/C: \pm 15\%$ Y5V: $\Delta C/C: 22\sim -82\%$ | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>25±2</td> </tr> <tr> <td>b</td> <td>Lower temperature±3°C</td> </tr> <tr> <td>c</td> <td>25±2</td> </tr> <tr> <td>d</td> <td>Upper Temperature±2°C</td> </tr> <tr> <td>e</td> <td>25±2</td> </tr> </tbody> </table> <p>(1) Class I Temperature Coefficient shall be calculated from the formula as below $\text{Temp. Coefficient} = \frac{C2 - C1}{C1 \times \Delta T} \times 10^6 \text{ [ppm/°C]}$ C1: Capacitance at step c C2: Capacitance at 125°C $\Delta T: 100^\circ\text{C}(=125^\circ\text{C}-25^\circ\text{C})$</p> <p>(2) Class II Capacitance Change shall be calculated from the formula as below $\Delta C = \frac{C2 - C1}{C1} \times 100\%$ C1: Capacitance at step c C2: Capacitance at step b or d</p> | | Step | Temperature(°C) | a | 25±2 | b | Lower temperature±3°C | c | 25±2 | d |
| Step | Temperature(°C) | | | | | | | | | | | |
| a | 25±2 | | | | | | | | | | | |
| b | Lower temperature±3°C | | | | | | | | | | | |
| c | 25±2 | | | | | | | | | | | |
| d | Upper Temperature±2°C | | | | | | | | | | | |
| e | 25±2 | | | | | | | | | | | |
| Adhesion | IEC 60384-21/22 | 4.7 A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate | Force size ≥ 0603: 5N | | | | | | | | | |
| Bending Strength | | 4.8 Mounting in accordance with IEC 60384-22 paragraph 4.3 Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 5 mm | No visible damage $\Delta C/C$ Class 1: NP0: within ±1% or 0.5 pF, whichever is greater Class 2: X7R: ±10% | | | | | | | | | |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|------------------------------|----------------------|---|--|
| Resistance to Soldering Heat | 4.9 | <p>Precondition: 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>Preheating: for size ≤ 1206: 120 °C to 150 °C for 1 minute</p> <p>Preheating: for size >1206: 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute</p> <p>Solder bath temperature: 260 ±5 °C</p> <p>Dipping time: 10 ±0.5 seconds</p> <p>Recovery time: 24 ±2 hours</p> | <p>Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned</p> <hr/> <p>$\Delta C/C$ Class 1: NP0: within ±0.5% or 0.5 pF, whichever is greater Class2: X7R: ±10%</p> <hr/> <p>D.F. within initial specified value R_{ins} within initial specified value</p> |
| Solderability | 4.10 | <p>Preheated to a temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds.</p> <p>1. Temperature: 235±5°C / Dipping time: 2 ±0.5 s 2. Temperature: 245±5°C / Dipping time: 3 ±0.5 s (lead free)Depth of immersion: 10mm</p> | <p>The solder should cover over 95% of the critical area of each termination</p> |
| Rapid Change of Temperature | IEC 60384-21/22 4.11 | <p>Preconditioning: 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 | <p>1. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp</p> <p>2. Initial measure: Spec: refer to initial spec C, D, IR</p> <p>3. Damp heat test: 500 ±12 hours at 40 ±2 °C; 90 to 95% R.H.</p> <p>4. Recovery: Class 1: 6 to 24 hours Class 2: 24 ±2 hours</p> <p>5. Final measure: C, D, IR</p> <p>P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned 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% 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 | 1. Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp 2. Initial measure: Spec: refer to initial spec C, D, IR Endurance test: Temperature: NP0/X7R: 125 °C Specified stress voltage applied for 1,000 hours. High-Voltage series follows the stress conditions below: | No visual damage <hr/> $\Delta C/C$ Class 1: NP0: within ±2% or 1 pF, whichever is greater Class 2: X7R: ±15% D.F. Class 1: NP0: ≤ 2 × specified value Class 2: X7R: ≥ 25 V: ≤ 5% R_{ins} Class 1: NP0: ≥ 4,000 MΩ or $R_{ins} \times C_r \geq 40s$ whichever is less Class 2: X7R: ≥ 1,000 MΩ or $R_{ins} \times C_r \geq 50s$ whichever is less | | | | | | | | | | | | |
| | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Voltage</th> <th>NP0</th> <th>X7R</th> </tr> </thead> <tbody> <tr> <td>≤ 100V</td> <td>2.0 × Ur</td> <td>2.0 × Ur</td> </tr> <tr> <td>200/250V</td> <td>1.5 × Ur</td> <td>1.5 × Ur</td> </tr> <tr> <td>500/630V</td> <td>1.3 × Ur</td> <td>1.2 × Ur</td> </tr> <tr> <td>≥ 1KV</td> <td>1.2 × Ur</td> <td>1.1 × Ur</td> </tr> </tbody> </table> 3. Recovery time: 24 ±2 hours 4. Final measure: C, D, IR P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to "IEC 60384 4.1" and then the requirement shall be met. | | Voltage | NP0 | X7R | ≤ 100V | 2.0 × Ur | 2.0 × Ur | 200/250V | 1.5 × Ur | 1.5 × Ur | 500/630V | 1.3 × Ur | 1.2 × Ur |
| Voltage | NP0 | X7R | | | | | | | | | | | | | |
| ≤ 100V | 2.0 × Ur | 2.0 × Ur | | | | | | | | | | | | | |
| 200/250V | 1.5 × Ur | 1.5 × Ur | | | | | | | | | | | | | |
| 500/630V | 1.3 × Ur | 1.2 × Ur | | | | | | | | | | | | | |
| ≥ 1KV | 1.2 × Ur | 1.1 × Ur | | | | | | | | | | | | | |
| Voltage Proof | | Specified stress voltage applied for 1~5 seconds $U_r \leq 100V$: series applied 2.5 Ur $100V < U_r \leq 200V$ series applied (1.5 Ur + 100) $200V < U_r \leq 500V$ series applied (1.3 Ur + 100) $U_r > 500V$: 1.3 Ur $U_r \geq 1KV$: 1.2 Ur Charge/Discharge current less than 50mA | No breakdown or flashover | | | | | | | | | | | | |

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|------------|---------------|---------------------|--|
| Version 13 | Feb. 28, 2021 | - | - Add NP0/1206/0.47pF to 10pF with 0.85 mm |
| Version 12 | Dec. 01, 2020 | - | - Add X7R/0805/1.5nF to 3.3nF/1KV. NP0/0805/ 56pF to 82pF/1KV |
| Version 11 | Jul. 13, 2018 | - | - Add NP0/1206/10pF to 47pF/3KV |
| Version 10 | Mar. 7, 2017 | - | - 0805 L4 spec updated |
| Version 9 | Jan. 16, 2017 | - | - Product range updated |
| Version 8 | Oct. 12, 2015 | - | - Product range updated |
| Version 7 | May 21, 2014 | - | - Product range updated |
| Version 6 | Jun. 17, 2012 | - | - Product range updated |
| Version 5 | Sep 25, 2012 | - | - Product range updated |
| Version 4 | Aug 08, 2011 | - | - Product range updated |
| Version 3 | Jan 19, 2011 | - | - Dimension updated - Add NP0 0805 1KV |
| Version 2 | Feb 02, 2010 | - | - Change to dual brand datasheet that describe High-Voltage NP0/X7R series with RoHS compliant - Replace the high voltage part of pdf files: UP-NP0X7R_HV_1K-to-4KV_I and UY-NP0X7R_HV_1K-to-4KV_I - Description of "Halogen Free compliant" added - Product range updated - Define global part number - Test method and procedure updated |
| Version 1 | Sep 30, 2005 | - | - Thickness revised |
| Version 0 | Sep 12, 2005 | - | - New |

LEGAL DISCLAIMER

YAGEO, its distributors and agents (collectively, "YAGEO"), hereby disclaims any and all liabilities for any errors, inaccuracies or incompleteness contained in any product related information, including but not limited to product specifications, datasheets, pictures and/or graphics. YAGEO may make changes, modifications and/or improvements to product related information at any time and without notice.

YAGEO makes no representation, warranty, and/or guarantee about the fitness of its products for any particular purpose or the continuing production of any of its products. To the maximum extent permitted by law, YAGEO disclaims (i) any and all liability arising out of the application or use of any YAGEO product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for a particular purpose, non-infringement and merchantability.

YAGEO products are designed for general purpose applications under normal operation and usage conditions. Please contact YAGEO for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property: Aerospace equipment (artificial satellite, rocket, etc.), Atomic energy-related equipment, Aviation equipment, Disaster prevention equipment, crime prevention equipment, Electric heating apparatus, burning equipment, Highly public information network equipment, data-processing equipment, Medical devices, Military equipment, Power generation control equipment, Safety equipment, Traffic signal equipment, Transportation equipment and Undersea equipment, or for any other application or use in which the failure of YAGEO products could result in personal injury or death, or serious property damage. Particularly **YAGEO Corporation and its affiliates do not recommend the use of commercial, automotive, and/or COTS grade products for high reliability applications or manned space flight.**

Information provided here is intended to indicate product specifications only. YAGEO reserves all the rights for revising this content without further notification, as long as products are unchanged. Any product change will be announced by PCN.