

DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

High-Voltage

NP0/X7R

500 V TO 3 KV

0.47 pF to 33 nF

RoHS compliant & Halogen Free



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.

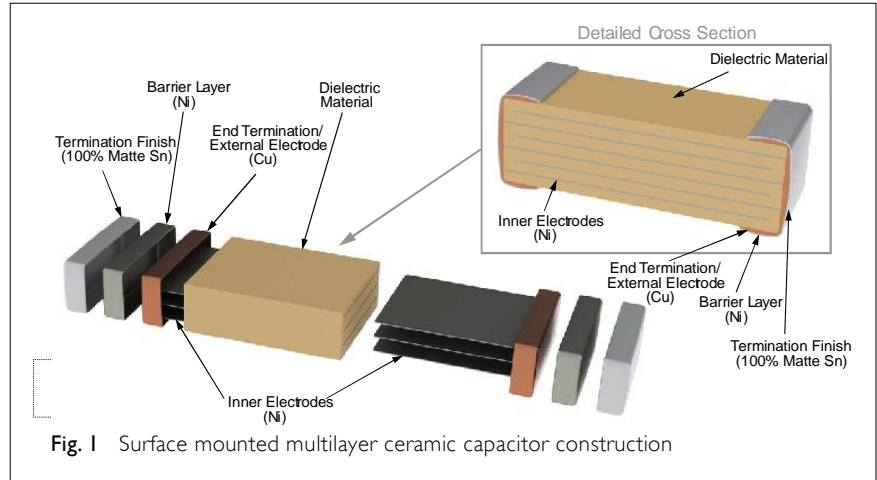


Fig. 1 Surface mounted multilayer ceramic capacitor construction

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. |
| 0805 | 2.0 ±0.10 | 1.25 ±0.10 | 0.60 ±0.10 | 0.25 | 0.75 | 0.70 |
| | | | 0.85 ±0.10 | | | |
| | | | 1.25 ±0.20 | | | |
| 1206 | 3.2 ±0.15 | 1.60 ±0.15 | 0.60 ±0.10 | 0.25 | 0.75 | 1.40 |
| | | | 0.85 ±0.10 | | | |
| | | | 1.25 ±0.20 | | | |
| 1210 | 3.2 ±0.30 | 1.60 ±0.20 | 1.60 ±0.20 | 0.25 | 0.75 | 1.40 |
| | | | 0.85 ±0.10 | | | |
| | | | 1.25 ±0.20 | | | |
| 1808 | 4.5 ±0.40 | 2.00 ±0.30 | 1.25 ±0.20 | 0.25 | 0.75 | 2.20 |
| | | | 1.35 ±0.15 | | | |
| | | | 1.60 ±0.20 | | | |
| 1812 | 4.5 ±0.40 | 3.20 ±0.20 | 2.00 ±0.20 | 0.25 | 0.75 | 2.20 |
| | | | 0.85 ±0.10 | | | |
| | | | 1.25 ±0.20 | | | |
| 2220 | 5.7 ±0.40 | 5.0 ±0.3 | 1.60 ±0.20 | 0.25 | 0.75 | 3.40 |
| | | | 2.00 ±0.20 | | | |
| | | | 1.25 ±0.20 | | | |

OUTLINES

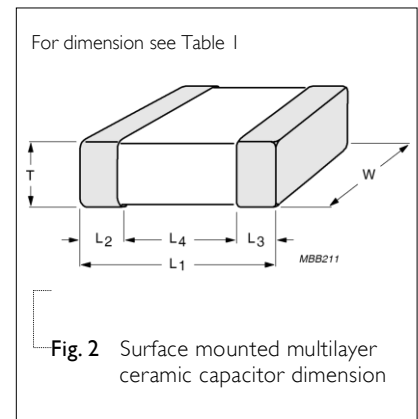


Fig. 2 Surface mounted multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 2 Sizes from 0805 to 1210

| CAP. | 0805 | | 1206 | | | | 1210 | | | | | |
|--------|---------|---------|----------|---------|----------|----------------------|----------|----------|----------|----------|----------|----------|
| | 500 V | 630 V | 1 KV | 500 V | 630 V | 1 KV | 2 KV | 3 KV | 500 V | 630 V | 1 KV | 2 KV |
| 1.0 pF | | | | | | | | | | | | |
| 1.2 pF | | | | | | | | | | | | |
| 1.5 pF | | | | | | | | | | | | |
| 1.8 pF | | | | | | | | | | | | |
| 2.2 pF | | | | | | | | | | | | |
| 2.7 pF | | | | | | | | | | | | |
| 3.3 pF | | | | | | 0.85±0.1 | | | | | | |
| 3.9 pF | | | | | | | | | | | | |
| 4.7 pF | | | | | | | | | | | | |
| 5.6 pF | | | | | | | | | | | | |
| 6.8 pF | | | | | | | | | | | | |
| 8.2 pF | | | | | | | | | | | | |
| 10 pF | | | | | | 0.85±0.1 1.25±0.2 | | | | | | |
| 12 pF | 0.6±0.1 | 0.6±0.1 | | | | | | | | | | |
| 15 pF | | | | | | | | | | | | |
| 18 pF | | | | | | | | | | | | |
| 22 pF | | | 0.85±0.1 | | | | | 1.25±0.2 | | | | |
| 27 pF | | | | | | | | | | | | |
| 33 pF | | | | | | | | | | | | |
| 39 pF | | | | 0.6±0.1 | 1.25±0.2 | | 1.25±0.2 | | | | | |
| 47 pF | | | | | | 1.25±0.2 | | | | | | |
| 56 pF | | | | | | | | | | | | |
| 68 pF | | | 1.25±0.2 | | | | | | | | | |
| 82 pF | | | | | | | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 100 pF | | | | | | | | | | | | |
| 120 pF | | | | | | | | | | | | |
| 150 pF | | | | | | | | | | | | |
| 180 pF | | | | | | | | | | | | |

NOTE

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

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 3 Sizes from 0805 to 1210 (continued)

| CAP. | 0805 | | | 1206 | | | | 1210 | | | | |
|--------|----------|----------|------|----------|----------|----------|----------|------|----------|----------|----------|----------|
| | 500 V | 630 V | 1 KV | 500 V | 630 V | 1 KV | 2 KV | 3 KV | 500 V | 630 V | 1 KV | 2 KV |
| 220 pF | | | | | | | 1.25±0.2 | | | | | 1.25±0.2 |
| 270 pF | | | | | | | | | | | | |
| 330 pF | 0.85±0.1 | 0.85±0.1 | | | | | | | | | | |
| 390 pF | | | | 0.6±0.1 | | | | | | | | |
| 470 pF | | | | | | 1.25±0.2 | | | | 1.25±0.2 | 1.25±0.2 | |
| 560 pF | | | | | | | | | 1.25±0.2 | | | |
| 680 pF | | | | | | | | | | | | |
| 820 pF | 1.25±0.2 | 1.25±0.2 | | | | | | | | | | |
| 1.0 nF | | | | | | | | | | | | |
| 1.2 nF | | | | 0.85±0.1 | 1.25±0.2 | | | | | | | |
| 1.5 nF | | | | | | | | | | | | |
| 2.2 nF | | | | | | | | | | | | |
| 2.7 nF | | | | | | | | | | | | |
| 3.3 nF | | | | | | | | | | | | |
| 3.9 nF | | | | 1.25±0.2 | | | | | | | | |
| 4.7 nF | | | | | | | | | | | | |
| 5.6 nF | | | | | | | | | | | | |
| 6.8 nF | | | | | | | | | | | | |
| 8.2 nF | | | | | | | | | | | | |
| 10 nF | | | | 1.6±0.2 | 1.6±0.2 | | | | | | | |

NOTE

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

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 4 Sizes from 1808 to 1812

| CAP. | 1808 | | | 1812 | | | | | |
|---------|----------|----------|---------|----------|----------|----------|----------|----------|--|
| | 1 KV | 2 KV | 3 KV | 500 V | 630 V | 1 KV | 2 KV | 3 KV | |
| 0.47 pF | | | | | | | | | |
| 0.56 pF | | | | | | | | | |
| 0.68 pF | | | | | | | | | |
| 0.82 pF | | | | | | | | | |
| 1.0 pF | | | | | | | | | |
| 1.2 pF | | | | | | | | | |
| 1.5 pF | | | | | | | | | |
| 1.8 pF | | | | | | | | | |
| 2.2 pF | | | | | | | | | |
| 2.7 pF | | | | | | | | | |
| 3.3 pF | | | | | | | | | |
| 3.9 pF | | | | | | | | | |
| 4.7 pF | | | | | | | | | |
| 5.6 pF | | | | | | | | | |
| 6.8 pF | | | | | | | | | |
| 8.2 pF | | | | | | | | | |
| 10 pF | | | | | | | | | |
| 12 pF | | | | | | | | | |
| 15 pF | | | | | | | | | |
| 18 pF | | | | | | | | | |
| 22 pF | | | | | | | | | |
| 27 pF | | | | | | | | | |
| 33 pF | | | | | | | | | |
| 39 pF | | | | | | | | | |
| 47 pF | | | | | | | | | |
| 56 pF | | | | | | | | | |
| 68 pF | | | | | | | | | |
| 82 pF | 1.25±0.2 | 1.25±0.2 | | | | | | | |
| 100 pF | | | | 1.25±0.2 | 1.25±0.2 | | | | |
| 120 pF | | | | | | | | | |
| 150 pF | | | | | | | | | |
| 180 pF | | | | | | | | | |
| | | | 1.6±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 NPO

Table 5 Sizes from 1808 to 1812 (continued)

| CAP. | 1808 | | | 1812 | | | | | |
|--------|----------|----------|------|----------|----------|----------|----------|----------|--|
| | 1 KV | 2 KV | 3 KV | 500 V | 630 V | 1 KV | 2 KV | 3 KV | |
| 220 pF | | | | | | | | 1.25±0.2 | |
| 270 pF | | | | | | | | | |
| 330 pF | | | | | | | | | |
| 390 pF | 1.25±0.2 | 1.25±0.2 | | | | | | | |
| 470 pF | | | | | | | 1.25±0.2 | | |
| 560 pF | | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | |
| 680 pF | | | | | | | | | |
| 820 pF | | | | | | | | | |
| 1.0 nF | | | | | | | | | |
| 1.2 nF | | | | | | | | | |
| 1.5 nF | | | | | | | | | |

NOTE

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

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 6 Sizes from 0805 to 1210

| CAP. | 0805 | | | 1206 | | | | 1210 | | | | |
|--------|----------|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|
| | 500 V | 630 V | 1 KV | 500 V | 630 V | 1 KV | 2 KV | 2.5KV | 500 V | 630 V | 1 KV | 2 KV |
| 100 pF | | | | | | | | | | | | |
| 150 pF | | | | | | | | | | | | |
| 220 pF | | | | | | | | | | | | |
| 330 pF | | | 0.85±0.1 | | | | | | | | | |
| 470 pF | | | | | | | | | | | | 1.25±0.2 |
| 680 pF | | | | | | | 1.25±0.2 | | | | | |
| 1.0 nF | 0.85±0.1 | 0.85±0.1 | | | | | | 1.6±0.2 | | | | |
| 1.5 nF | | | | | | 1.25±0.2 | | | | | 1.25±0.2 | |
| 2.2 nF | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | | | | | | | 1.60±0.2 |
| 3.3 nF | | | | | | | | | | | | |
| 4.7 nF | | | | | | | | | | | | |
| 6.8 nF | | | | | | | | | | 1.25±0.2 | | |
| 10 nF | | 1.25±0.2 | | | | | | | 1.25±0.2 | | | |
| 15 nF | 1.25±0.2 | | | | | | | | | | | |
| 22 nF | | | | | | | | | | 1.6±0.2 | 1.6±0.2 | |
| 33 nF | | | | 1.60±0.2 | 1.60±0.2 | | | | | | | |
| 47 nF | | | | | | | | | | 2.0±0.2 | | |
| 68 nF | | | | | | | | | 1.6±0.2 | | | |
| 100 nF | | | | | | | | | 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 products with 5% tolerance, please contact local sales force before ordering

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 7 Sizes from 1808 to 1812

| CAP. | 1808 | | | 1812 | | | 2020 | | |
|--------|-----------|-----------|---------|----------|-----------|-----------|-----------|---------|---------|
| | 1 KV | 2 KV | 3 KV | 500 V | 630 V | 1 KV | 2 KV | 3 KV | 630 V |
| 100 pF | | | | | | | | | |
| 150 pF | | | | | | | | | |
| 220 pF | | | | | | | | | |
| 330 pF | | | 1.6±0.2 | | | | | | |
| 470 pF | | | | | | | | | |
| 680 pF | | 1.35±0.15 | | | | | | | |
| 1.0 nF | | | 2.0±0.2 | | | | | 1.6±0.2 | |
| 1.5 nF | 1.35±0.15 | | | | | | | | |
| 2.2 nF | | 1.6±0.2 | | | | | 1.35±0.15 | | |
| 3.3 nF | | | | | | | | | |
| 4.7 nF | | | | | 1.35±0.15 | 1.35±0.15 | | | |
| 6.8 nF | | | | | | | | | |
| 10 nF | 1.6±0.2 | | | 1.25±0.2 | | | | | |
| 15 nF | | | | | | | | | |
| 22 nF | | | | | | | | | |
| 33 nF | | | | | | 1.6±0.2 | | | |
| 47 nF | | | | | 1.6±0.2 | | | | |
| 68 nF | | | | | | | | | |
| 100 nF | | | | 1.6±0.2 | 2.0±0.2 | | | | |
| 150 nF | | | | | | | | | |
| 220 nF | | | | | | | | | 2.0±0.2 |
| 330 nF | | | | | | | | | |
| 470 nF | | | | | | | | | |
| 680 nF | | | | | | | | | |
| 1 μF | | | | | | | | | |

NOTE

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

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%.

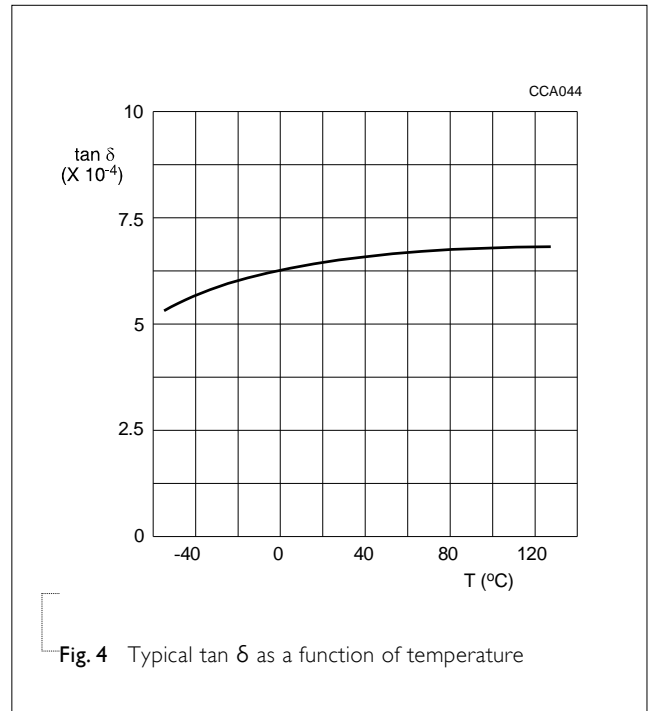
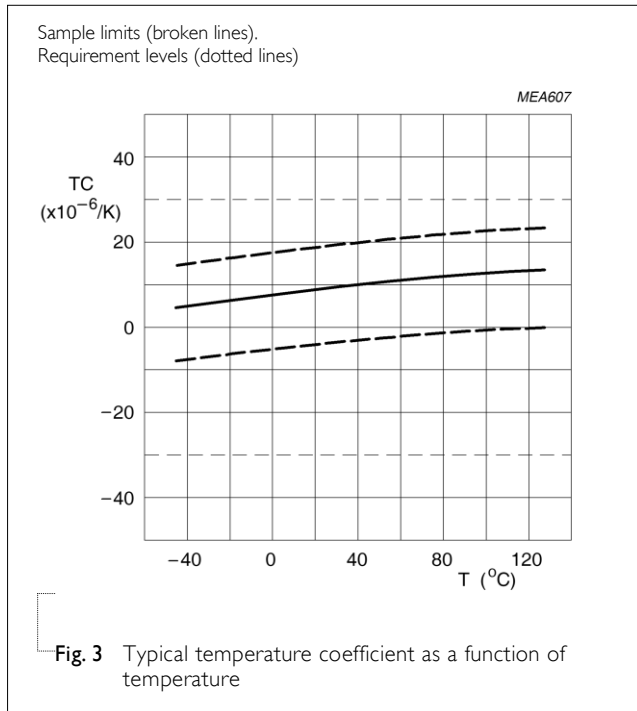
Table 8

| 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% ⁽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 R _{ins} × C ≥ 100 Ω.F ⁽²⁾ |
| 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 |

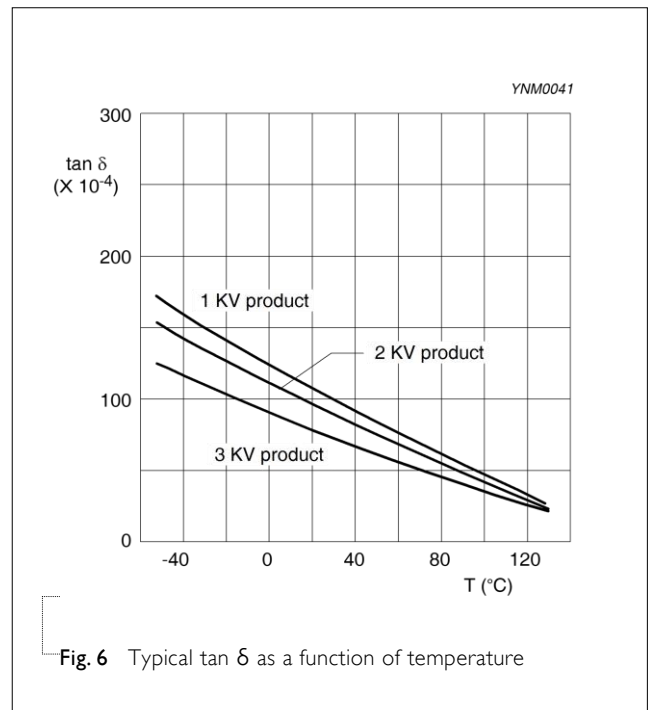
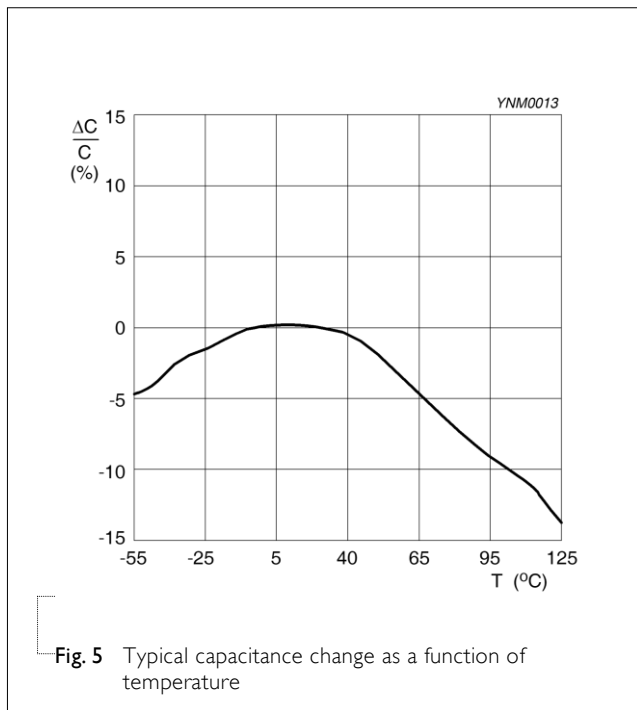
NOTE

- ±5% tolerance of capacitance value isn't available for X7R full product range, please contact local sales force before ordering
- X7R/0805/≥3.9nF
X7R/1206/≥12nF
X7R/1210/≥12nF
X7R/1808/≥18nF
X7R/1812/≥27nF
X7R/2220/≥150nF

HIGH-VOLTAGE NP0



HIGH-VOLTAGE X7R



SOLDERING RECOMMENDATION

Table 9

| 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 10 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 | NP0: f = 1 MHz for C ≤ 1 nF, measuring at voltage 1 V _{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage 1 V _{rms} at 20 °C X7R: f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V _{rms} at 20 °C | Within specified tolerance |
| Dissipation Factor (D.F.) | 4.5.2 | NP0: f = 1 MHz for C ≤ 1 nF, measuring at voltage 1 V _{rms} at 20 °C f = 1 KHz for C > 1 nF, measuring at voltage 1 V _{rms} at 20 °C X7R: f = 1 KHz for C ≤ 10 μF, measuring at voltage 1 V _{rms} at 20 °C | In accordance with specification |
| Insulation Resistance | 4.5.3 | U _r ≥ 500 V: At 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. | NP0: $\Delta C/C: \pm 30\text{ppm}$ X7R: $\Delta C/C: \pm 15\%$ | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>25±2</td> </tr> <tr> <td>b</td> <td>Lower temperature±3°C</td> </tr> <tr> <td>c</td> <td>25±2</td> </tr> <tr> <td>d</td> <td>Upper Temperature±2°C</td> </tr> <tr> <td>e</td> <td>25±2</td> </tr> </tbody> </table> | | 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 | | | | | | | | | | | |
| | | (1) NP0: 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 $\Delta T: 100^\circ\text{C} (=125^\circ\text{C} - 25^\circ\text{C})$ | | | | | | | | | | |
| | | (2) X7R: 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 | | | | | | | | | | |
| 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 $\geq 0603: 5\text{N}$ | | | | | | | | | |
| 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 $\Delta C/C$ NP0: within $\pm 1\%$ or 0.5 pF, whichever is greater X7R: $\pm 10\%$ | | | | | | | | | |

| 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>$\Delta C/C$ NP0: within ±0.5% or 0.5 pF, whichever is greater 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>$\Delta C/C$ NP0: within ±1% or 1 pF, whichever is greater 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: NP0: 6 to 24 hours X7R: 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>$\Delta C/C$ NP0: within ±2% or 1 pF, whichever is greater X7R: ±15%</p> <p>D.F. NP0: ≤ 2 × specified value X7R: ≥ 25 V: ≤ 5%</p> <p>R_{ins} NP0: ≥ 2,500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less 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, X7R 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/> $\Delta C/C$ NP0: within ±2% or 1 pF, whichever is greater X7R: ±15% D.F. NP0: ≤ 2 × specified value X7R: ≥ 25 V: ≤ 5% R_{ins} NP0: ≥ 4,000 MΩ or $R_{ins} \times C_r \geq 40s$ whichever is less 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>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 *Applied 1.2 × Ur for NP0/1206/2.2nF to 10nF/500V to 630V. 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 | 500/630V | 1.3 × Ur | 1.2 × Ur |
| Voltage | NP0 | X7R | | | | | | | |
| 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 Ur = 500 V series applied (1.3 Ur + 100) Ur > 500 V: 1.3 Ur Ur ≥ 1KV: 1.2 Ur Charge/Discharge current less than 50mA | No breakdown or flashover | | | | | | |

THICKNESS CLASSES AND PACKING QUANTITY

Table 11

| SIZE CODE | THICKNESS CLASSIFICATION | PACKING CODE. | | TAPE WIDTH | Ø180 MM / 7 INCH | | Ø330 MM / 13 INCH | | QUANTITY PER BULK CASE |
|-----------|--------------------------|---------------|---------|------------|------------------|----------------|-------------------|---------|------------------------|
| | | 7 INCH | 13 INCH | | Paper | Blister | Paper | Blister | |
| 0805 | 0.6 ±0.1 mm | R | P | 8 mm | 4,000 | --- | 20,000 | --- | 10,000 |
| | 0.85 ±0.1 mm | R | P | 8 mm | 4,000 | --- | 15,000 | --- | 8,000 |
| | 1.00 ±0.1 mm | K | F | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | K | F | 8 mm | --- | 3,000 | --- | 10,000 | 5,000 |
| 1206 | 0.6 ±0.1 mm | R | P | 8 mm | 4,000 | --- | 20,000 | --- | --- |
| | 0.85 ±0.1 mm | R | P | 8 mm | 4,000 | --- | 15,000 | --- | --- |
| | 1.00 / 1.15 ±0.1 mm | K | F | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | K | F | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.6 ±0.2 mm | K | F | 8 mm | --- | 2,000 | --- | 8,000 | --- |
| 1210 | 0.85 ±0.1 mm | K | F | 8 mm | --- | 4,000 | --- | 10,000 | --- |
| | 1.15 ±0.1 mm | K | F | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.15 ±0.15 mm | K | F | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | K | | 8 mm | --- | 3,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | K | | 8 mm | --- | 2,000 | --- | --- | --- |
| | 1.6 ±0.2 mm | K | | 8 mm | --- | 2,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | K | | 8 mm | --- | 2,000 1,000 | --- | --- | --- |
| | 2.5 ±0.2 mm | K | | 8 mm | --- | 1,000 500 | --- | --- | --- |
| 1808 | 1.15 ±0.15 mm | K | | 12 mm | --- | 3,000 | --- | --- | --- |
| | 1.25 ±0.2 mm | K | | 12 mm | --- | 3,000 | --- | --- | --- |
| | 1.35 ±0.15 mm | K | | 12 mm | --- | 2,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | K | | 12 mm | --- | 2,000 | --- | --- | --- |
| | 1.6 ±0.2 mm | K | | 12 mm | --- | 2,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | K | | 12 mm | --- | 2,000 | --- | --- | --- |
| | 0.6 / 0.85 ±0.1 mm | K | | 12 mm | --- | 2,000 | --- | --- | --- |
| 1812 | 1.15 ±0.1 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.15 ±0.15 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.25 ±0.2 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.35 ±0.15 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.6 ±0.2 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | K | | 12 mm | --- | 1,000 | --- | --- | --- |
| | 2.5 ±0.2 mm | K | | 12 mm | --- | 500 | --- | --- | --- |
| 2220 | 2.0 ±0.2 mm | K | | 12 mm | --- | 1000 | --- | --- | --- |

PAPER/PE TAPE SPECIFICATION

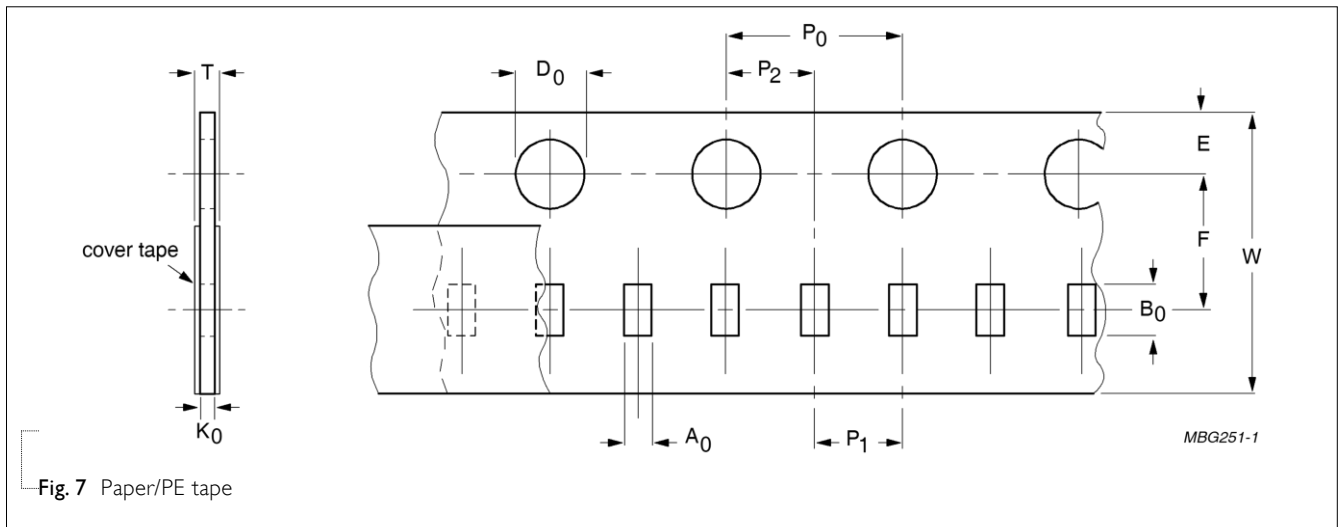


Fig. 7 Paper/PE tape

Table 12 Dimensions of paper/PE tape for relevant chip size; see Fig.3

| SIZE | SYMBOL | | | | | | | | | | | Unit: mm |
|------|----------------|----------------|-----------|-----------|------------|-------------------------------|----------------|----------------|-----------------|---------------------------|---------------------------|----------|
| CODE | A ₀ | B ₀ | W | E | F | P ₀ ⁽¹⁾ | P ₁ | P ₂ | ØD ₀ | K ₀ | T | |
| 0201 | 0.39 ±0.06 | 0.70 ±0.06 | 8.0 ±0.20 | 1.75 ±0.1 | 3.50 ±0.05 | 4.0 ±0.05 | 2.0 ±0.05 | 2.0 ±0.05 | 1.55 ±0.03 | 0.38 ±0.05 | (0.47 / 0.55)±0.10 | |
| 0402 | 0.70 ±0.15 | 1.21 ±0.12 | 8.0 ±0.20 | 1.75 ±0.1 | 3.50 ±0.05 | 4.0 ±0.05 | 2.0 ±0.05 | 2.0 ±0.05 | 1.50 +0.1 /-0 | (0.75 / 0.60)±0.10 | (0.85 / 0.70)±0.10 | |
| 0603 | 1.05 ±0.14 | 1.86 ±0.13 | 8.0 ±0.20 | 1.75 ±0.1 | 3.50 ±0.05 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.50 +0.1 /-0 | (1.05 / 0.95 / 0.75)±0.10 | (1.15 / 1.05 / 0.85)±0.10 | |
| 0805 | 1.50 ±0.15 | 2.26 ±0.20 | 8.0 ±0.20 | 1.75 ±0.1 | 3.50 ±0.05 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.50 +0.1 /-0 | (1.05 / 0.95 / 0.75)±0.10 | (1.15 / 1.05 / 0.85)±0.10 | |
| 1206 | 1.90 ±0.15 | 3.50 ±0.20 | 8.0 ±0.20 | 1.75 ±0.1 | 3.50 ±0.05 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.50 +0.1 /-0 | (0.95 / 0.75)±0.10 | (1.05 / 0.85)± 0.10 | |

NOTE

1. P₀ pitch tolerance over any 10 pitches is ±0.2 mm

BLISTER TAPE SPECIFICATION

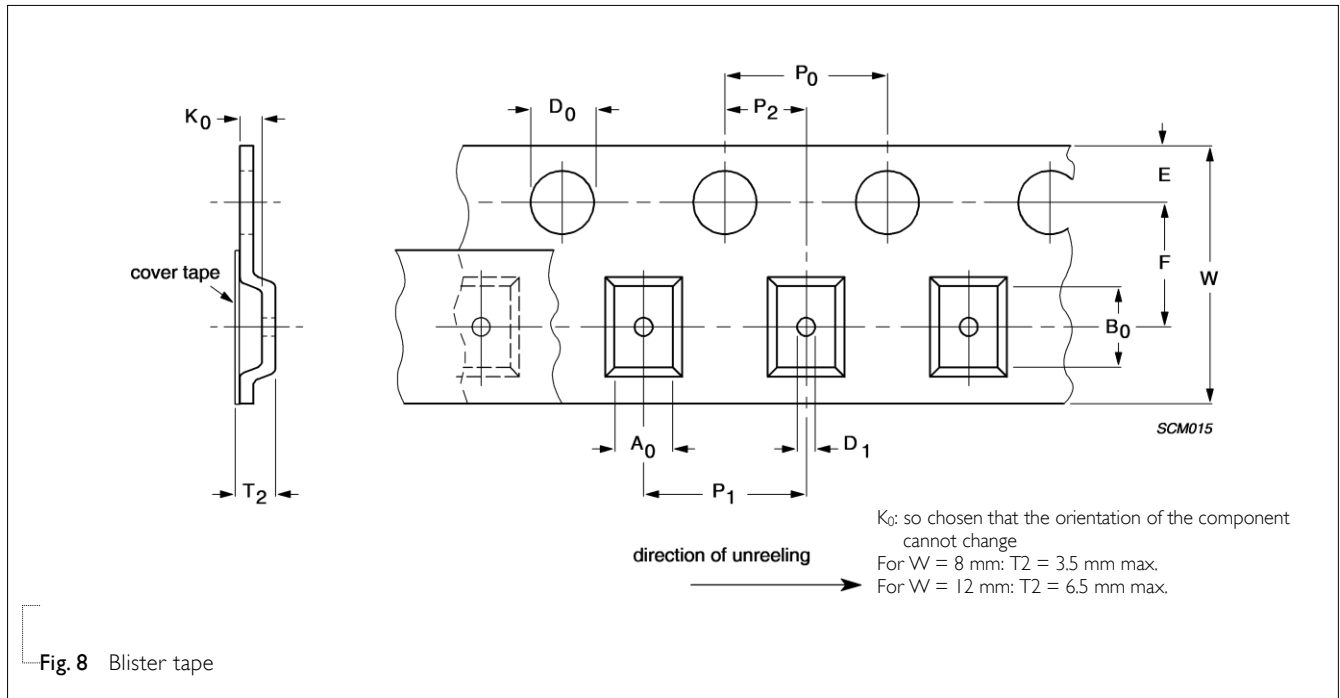


Table 13 Dimensions of blister tape for relevant chip size; see Fig.8

| SIZE CODE | SYMBOL | | | | | | | | | | | | Unit: mm | | | |
|-----------|----------------|------|----------------|------|----------------|------|------------|-----------|-----------|-----------------|-----------------|-------------------------------|----------------|----------------|----------------|------|
| | A ₀ | | B ₀ | | K ₀ | | W | E | F | ØD ₀ | ØD ₁ | P ₀ ⁽²⁾ | P ₁ | P ₂ | T ₂ | |
| | Min. | Max. | Min. | Max. | Min. | Max. | | | | | Min. | | | | Min. | Max. |
| 0805 | 1.29 | 1.65 | 2.09 | 2.60 | 1.25 | 1.62 | 8.1 ±0.20 | 1.75 ±0.1 | 3.5 ±0.05 | 1.5 +0.1/-0.0 | 1 +0.1/-0.0 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.30 | 1.67 |
| 1206 | 1.65 | 2.12 | 3.30 | 3.75 | 1.22 | 2.15 | 8.1 ±0.20 | 1.75 ±0.1 | 3.5 ±0.05 | 1.5 +0.1/-0.0 | 1 +0.1/-0.0 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.27 | 2.20 |
| 1210 | 2.55 | 3.02 | 3.31 | 3.88 | 0.97 | 2.92 | 8.1 ±0.20 | 1.75 ±0.1 | 3.5 ±0.05 | 1.5 +0.1/-0.0 | 1 +0.1/-0.0 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.02 | 2.97 |
| 1808 | 2.05 | 2.55 | 4.80 | 5.45 | 1.30 | 2.45 | 12.1 ±0.20 | 1.75 ±0.1 | 5.5 ±0.05 | 1.5 +0.1/-0.0 | 1.5 +0.1/-0.0 | 4.0 ±0.10 | 4.0 ±0.10 | 2.0 ±0.05 | 1.35 | 2.50 |
| 1812 | 3.35 | 3.75 | 4.70 | 5.33 | 0.70 | 2.40 | 12.1 ±0.20 | 1.75 ±0.1 | 5.5 ±0.05 | 1.5 +0.1/-0.0 | 1.5 +0.1/-0.0 | 4.0 ±0.10 | 8.0 ±0.10 | 2.0 ±0.05 | 0.75 | 2.45 |
| 2220 | 5.12 | 5.32 | 5.84 | 6.04 | 1.28 | 1.48 | 12.0 ±0.20 | 1.75 ±0.1 | 5.5 ±0.05 | 1.5 +0.1/-0.0 | 1.5 +0.1/-0.0 | 4.0 ±0.10 | 8.0 ±0.10 | 2.0 ±0.05 | 1.33 | 1.53 |

NOTE

1. Typical capacitor displacement in pocket
2. P₀ pitch tolerance over any 10 pitches is ±0.2 mm

REEL SPECIFICATION

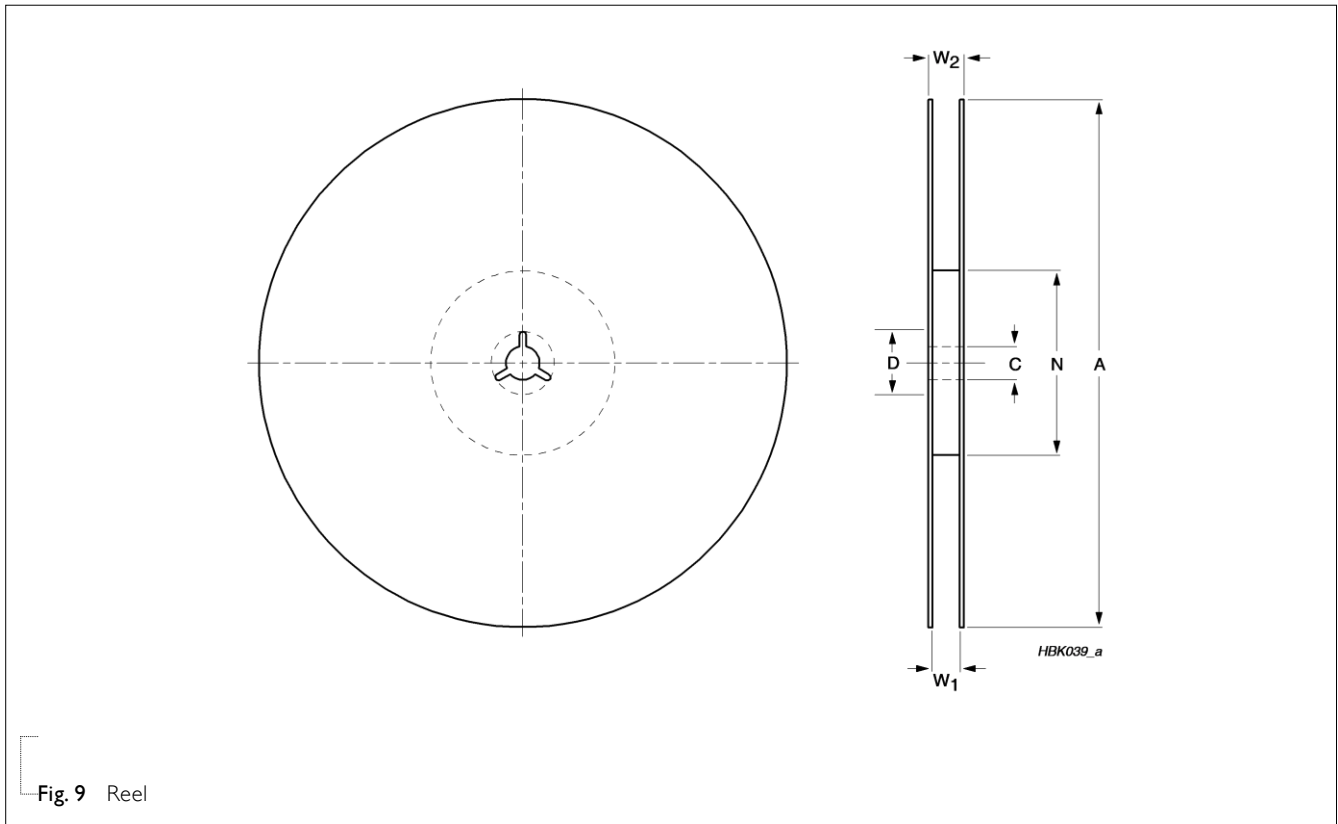


Fig. 9 Reel

Table 14 Reel dimensions; see Fig.9

| TAPE WIDTH | SYMBOL | | | | | Unit: mm |
|-----------------|----------|----------|----------------|-----------|------------|----------|
| | A | N | C | W_1 | W_{2max} | |
| 8 (Ø178 mm/7") | 178 ±1.0 | 60 ±1.0 | 13 +0.50/-0.20 | 9.4 ±1.5 | 14.4 | |
| 8 (Ø330 mm/13") | 330 ±1.0 | 100 ±1.0 | 13 +0.50/-0.20 | 9.0 ±0.2 | 14.4 | |
| 12 (Ø178 mm/7") | 178 ±1.0 | 60 ±1.0 | 13 +0.50/-0.20 | 13.4 ±1.5 | 18.4 | |

PROPERTIES OF REEL

Material: polystyrene

Surface resistance: $<10^{10} \text{ } \Omega/\text{sq.}$

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|------------|---------------|---------------------|--|
| Version 16 | May 10, 2023 | - | - Add NP0/1206/2.2nF to 10nF/500V to 630V |
| Version 15 | Dec. 15, 2021 | - | - I.R. Spec. updated X7R/0805/≥3.9nF X7R/1206/≥12nF X7R/1210/≥12nF X7R/1808/≥18nF X7R/1812/≥27nF X7R/2220/≥150nF - 0805 / 1206 / 1210 dimension updated |
| Version 14 | Oct. 26, 2021 | - | - Add 500V/630V |
| 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_1 and UY-NP0X7R_HV_1K-to-4KV_1 - 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 |

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