



MULTILAYER CERAMIC CAPACITORS  
Middle & High Voltage Series (200V to 3kV)  
0603 to 1812 Sizes  
NP0, X7R & Y5V Dielectrics  
RoHS compliance

\*Contents in this sheet are subject to change without prior notice.

## 1. INTRODUCTION

HVC middle and high voltage series MLCC is designed by a special internal electrode pattern, which can reduce voltage concentrations by distributing voltage gradients throughout the entire capacitor. This special design also affords increased capacitance values in a given case size and voltage rating.

Chips size 1206 and larger to use on reflow soldering process only. Capacitors with X7R dielectrics are not intended for AC line filtering applications. Capacitors may require protective surface coating to prevent external arcing.

## 2. FEATURES

- High voltage in a given case size.
- High stability and reliability.

## 3. APPLICATIONS

- Snubbers in high frequency power converters.
- High voltage coupling/DC blocking.
- DC-DC converters.
- Back-lighting inverters

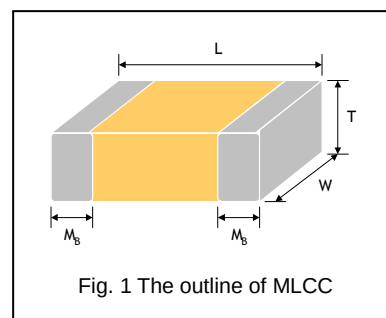
## 4. HOW TO ORDER

| <u>1808</u>                                                                                                                                   | <u>N</u>                                                 | <u>100</u>                                                                                                                                                 | <u>J</u>                                                                                                                                                               | <u>202</u>                                                                                                                                                                                                                                                                                                   | <u>C</u>                                          | <u>I</u>                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------|
| <u>Size</u>                                                                                                                                   | <u>Dielectric</u>                                        | <u>Capacitance</u>                                                                                                                                         | <u>Tolerance</u>                                                                                                                                                       | <u>Rated voltage</u>                                                                                                                                                                                                                                                                                         | <u>Termination</u>                                | <u>Packaging</u>                            |
| Inch (mm)<br><b>0603</b> (1608)<br><b>0805</b> (2012)<br><b>1206</b> (3216)<br><b>1210</b> (3225)<br><b>1808</b> (4520)<br><b>1812</b> (4532) | <b>N</b> =NP0<br>(C0G)<br><b>B</b> =X7R<br><b>F</b> =Y5V | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>100=10x10 <sup>0</sup> =10pF | <b>B</b> =±0.1pF<br><b>C</b> =±0.25pF<br><b>D</b> =±0.5pF<br><b>F</b> =±1%<br><b>G</b> =±2%<br><b>J</b> =±5%<br><b>K</b> =±10%<br><b>M</b> =±20%<br><b>Z</b> =-20/+80% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br><b>201</b> =200 VDC<br><b>251</b> =250 VDC<br><b>501</b> =500 VDC<br><b>631</b> =630 VDC<br><b>102</b> =1000 VDC<br><b>152</b> =1500 VDC<br><b>202</b> =2000 VDC<br><b>252</b> =2500 VDC<br><b>302</b> =3000 VDC | <b>C</b> =Cu/Ni/Sn (for NP0, X7R, Y5V dielectric) | <b>T</b> =7" reeled<br><b>G</b> =13" reeled |

\* Partial NP0 items are with Ag/Ni/Sn terminations, please ref to below product range of NP0 dielectric for detail.

## 5. EXTERNAL DIMENSIONS

| Size<br>Inch (mm) | L (mm)              | W (mm)              | T (mm)/Symbol       | Remark | M <sub>B</sub> (mm)      |
|-------------------|---------------------|---------------------|---------------------|--------|--------------------------|
| 0603(1608)        | 1.60±0.10           | 0.80±0.10           | 0.80±0.07           | S      | 0.40±0.15                |
|                   | 1.60<br>+0.15/-0.10 | 0.80<br>+0.15/-0.10 | 0.80<br>+0.15/-0.10 | X      |                          |
| 0805 (2012)       | 2.00±0.15           | 1.25±0.10           | 0.60±0.10           | A      | 0.50±0.20                |
|                   |                     |                     | 0.80±0.10           | B      |                          |
|                   |                     |                     | 1.25±0.10           | D #    |                          |
| 1206 (3216)       | 3.20±0.15           | 1.60±0.15           | 0.80±0.10           | B      | 0.60±0.20<br>(0.5±0.25)* |
|                   |                     |                     | 0.95±0.10           | C      |                          |
|                   |                     |                     | 1.25±0.10           | D #    |                          |
|                   | 3.20±0.20           | 1.60±0.20           | 1.60±0.20           | G #    |                          |
| 1210 (3225)       | 3.20±0.30           | 2.50±0.20           | 0.95±0.10           | C #    | 0.75±0.25                |
|                   |                     |                     | 1.25±0.10           | D #    |                          |
|                   | 3.20±0.40           | 2.50±0.30           | 1.60±0.20           | G #    |                          |
|                   |                     |                     | 2.00±0.20           | K #    |                          |
|                   |                     |                     | 2.50±0.30           | M #    |                          |
| 1808 (4520)       | 4.50±0.5/-0.3       | 2.03±0.25           | 1.25±0.10           | D #    | 0.50±0.25                |
|                   |                     |                     | 2.00±0.20           | K #    |                          |
| 1812 (4532)       | 4.50±0.5/-0.3       | 3.20±0.30           | 1.25±0.10           | D #    | 0.50±0.25                |
|                   |                     |                     | 1.60±0.20           | G #    |                          |
|                   |                     |                     | 2.00±0.20           | K #    |                          |
|                   |                     | 3.20±0.40           | 2.50±0.30           | M #    |                          |
|                   |                     |                     | 2.80±0.30           | U #    |                          |



# Reflow soldering only is recommended.

\* For 1206\_1000V ~3000V products.

## 6. GENERAL ELECTRICAL DATA

| Dielectric                                 | NP0                                                                                                                  | X7R | Y5V                    |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----|------------------------|
| Size                                       | 0603, 0805, 1206, 1210, 1808, 1812                                                                                   |     | 0805, 1206, 1210, 1812 |
| Capacitance*                               | 0.5pF to 0.01μF                                                                                                      |     | 0.01μF to 0.68μF       |
| Capacitance tolerance***                   | Cap≤5pF: C (±0.25pF)<br>5pF<Cap<10pF: D (±0.5pF)<br>Cap≥10pF: F (±1%), G (±2%),<br>J (±5%), K (±10%)                 |     | Z (-20/+80%)           |
| Rated voltage (WVDC)                       | 200V to 3kV                                                                                                          |     | 200V, 250V             |
| Q/DF*                                      | Cap<30pF: Q≥400+20C<br>Cap≥30pF: Q≥1000                                                                              |     | DF≤5%                  |
| Insulation resistance at U <sub>r</sub> ** | U <sub>r</sub> =200~630V: ≥10GΩ or R <sub>x</sub> C≥100Ω·F whichever is smaller<br>U <sub>r</sub> =1000~3000V: ≥10GΩ |     |                        |
| Dielectric strength                        | 200~300V: ≥2 x WVDC<br>500~999V: ≥1.5 x WVDC<br>1000~3000V: ≥1.2 x WVDC                                              |     |                        |
| Operating temperature                      | -55 to +125°C                                                                                                        |     | -25 to +85°C           |
| Capacitance characteristic                 | ±30ppm                                                                                                               |     | +30/-80%               |
| Termination                                | Ni/Sn (lead-free termination)                                                                                        |     |                        |

\* Measured at the condition of 30~70% related humidity.

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap&gt;1000pF, 25°C at ambient temperature

X7R, X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

\*\* Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

## 7. CAPACITANCE RANGE (MIDDLE VOLTAGE - 200V to 630V)

### 7-1 NP0 Dielectric

| DIELECTRIC          |               | NP0  |     |      |     |     |     |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|---------------------|---------------|------|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|------|-----|-----|-----|
| SIZE                |               | 0603 |     | 0805 |     |     |     | 1206 |     |     |     | 1210 |     |     |     | 1808 |     | 1812 |     |     |     |
| RATED VOLTAGE (VDC) |               | 200  | 250 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 500  | 630 | 200  | 250 | 500 | 630 |
| Capacitance         | 0.5pF (0R5)   | S    | S   | A    | A   | A   | A   |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|                     | 1.0pF (1R0)   | S    | S   | A    | A   | A   | A   |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|                     | 1.2pF (1R2)   | S    | S   | A    | A   | A   | A   |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|                     | 1.5pF (1R5)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     |      |     |      |     |     |     |
|                     | 1.8pF (1R8)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 2.2pF (2R2)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 2.7pF (2R7)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 3.3pF (3R3)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 3.9pF (3R9)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 4.7pF (4R7)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 5.6pF (5R6)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 6.8pF (6R8)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 8.2pF (8R2)   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 10pF (100)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 12pF (120)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 15pF (150)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 18pF (180)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 22pF (220)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 27pF (270)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 33pF (330)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 39pF (390)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 47pF (470)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 56pF (560)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 68pF (680)    | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 82pF (820)    | S    | S   | A    | A   | B   | B   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 100pF (101)   | S    | S   | A    | B   | B   | B   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 120pF (121)   | S    | S   | A    | B   | D   | D   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 150pF (151)   | S    | S   | B    | D   | D   | D   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 180pF (181)   | S    | S   | B    | D   | D   | D   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 220pF (221)   | S    | S   | D    | D   | D   | D   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 270pF (271)   | X    | X   | D    | D   | D   | D   | B    | C   | C   | C   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 330pF (331)   | X    | X   | D    | D   | D   | D   | B    | C   | C   | C   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 390pF (391)   | X    | X   | D    | D   | D   | D   | B    | C   | C   | C   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 470pF (471)   | X    | X   | D    | D   | I   | I   | C    | C   | C   | C   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 560pF (561)   |      |     | D    | D   | I   | I   | C    | D   | D   | D   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 680pF (681)   |      |     | D    | D   | I   | I   | C    | D   | D   | D   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 820pF (821)   |      |     | D    | D   | I   | I   | C    | G   | G   | G   | C    | C   | C   | C   | K    | K   | D    | D   | D   | D   |
|                     | 1,000pF (102) |      |     | D    | D   | I   | I   | C    | G   | G   | G   | D    | D   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 1,200pF (122) |      |     | D    | D   |     |     | C    | G   | G   | G   | D    | D   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 1,500pF (152) |      |     | D    | D   |     |     | D    | G   | G   | G   | D    | D   | D   | D   | K    | K   | D    | D   | D   | D   |
| 1,800pF (182)       |               |      | D   | D    |     |     | D   | G    | G   | G   | D   | D    | D   | D   | K   | K    | D   | D    | D   | D   |     |
| 2,200pF (222)       |               |      | D   | D    |     |     | D   | G    | G   | G   | D   | D    | D   | D   | K   | K    | D   | D    | D   | D   |     |
| 2,700pF (272)       |               |      |     |      |     |     | D   | G    |     |     | D   | D    | D   | D   |     |      | D   | D    | D   | D   |     |
| 3,300pF (332)       |               |      |     |      |     |     | D   | G    |     |     | D   | D    | D   | D   |     |      | D   | D    | D   | D   |     |
| 3,900pF (392)       |               |      |     |      |     |     | D   | G    |     |     | D   | D    | D   | D   |     |      | D   | D    |     |     |     |
| 4,700pF (472)       |               |      |     |      |     |     | D   | G    |     |     | G   | G    |     |     |     |      | D   | D    |     |     |     |
| 5,600pF (562)       |               |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      | D   | D    |     |     |     |
| 6,800pF (682)       |               |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      | D   | D    |     |     |     |
| 8,200pF (822)       |               |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      |     |      |     |     |     |
| 0.01μF (103)        |               |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      |     |      |     |     |     |

1. The letter in cell is expressed the symbol of product thickness.

## 7-2 X7R Dielectric

| DIELECTRIC          |               | X7R  |     |      |     |     |     |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|---------------------|---------------|------|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|------|-----|-----|-----|
| SIZE                |               | 0603 |     | 0805 |     |     |     | 1206 |     |     |     | 1210 |     |     |     | 1808 |     | 1812 |     |     |     |
| RATED VOLTAGE (VDC) |               | 200  | 250 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 500  | 630 | 200  | 250 | 500 | 630 |
| Capacitance         | 100pF (101)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     |      |     |      |     |     |     |
|                     | 120pF (121)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     |      |     |      |     |     |     |
|                     | 150pF (151)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 180pF (181)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 220pF (221)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 270pF (271)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 330pF (331)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 390pF (391)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 470pF (471)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 560pF (561)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 680pF (681)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 820pF (821)   | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 1,000pF (102) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 1,200pF (122) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 1,500pF (152) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 1,800pF (182) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 2,200pF (222) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 2,700pF (272) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 3,300pF (332) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 3,900pF (392) | X    | X   | B    | B   | B   | B   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 4,700pF (472) | X    | X   | B    | B   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | D    | D   | D    | D   | D   | D   |
|                     | 5,600pF (562) | X    | X   | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 6,800pF (682) | X    | X   | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 8,200pF (822) | X    | X   | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 0.010μF (103) | X    | X   | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 0.012μF (123) |      |     | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 0.015μF (153) |      |     | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 0.018μF (183) |      |     | D    | D   | D   | D   | D    | D   | D   | D   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 0.022μF (223) |      |     | D    | D   | D   | D   | D    | D   | G   | G   | C    | C   | D   | D   | K    | K   | D    | D   | D   | D   |
|                     | 0.027μF (273) |      |     | D    | D   |     |     | D    | D   | G   | G   | C    | C   | G   | G   | K    | K   | D    | D   | D   | D   |
|                     | 0.033μF (333) |      |     | D    | D   |     |     | G    | G   | G   | G   | C    | C   | G   | G   | K    | K   | D    | D   | D   | D   |
|                     | 0.039μF (393) |      |     | D    | D   |     |     | G    | G   | G   | G   | C    | C   | G   | G   | K    | K   | D    | D   | D   | D   |
|                     | 0.047μF (473) |      |     | D    | D   |     |     | G    | G   | G   | G   | D    | D   | G   | G   | K    | K   | D    | D   | D   | D   |
|                     | 0.056μF (563) |      |     | D    | D   |     |     | G    | G   | G   | G   | D    | D   | G   | G   | K    | K   | D    | D   | K   | K   |
|                     | 0.068μF (683) |      |     | D    | D   |     |     | G    | G   |     |     | G    | G   | G   | G   | K    | K   | D    | D   | K   | K   |
|                     | 0.082μF (823) |      |     | D    |     |     |     | G    | G   |     |     | G    | G   | K   | K   |      |     | D    | D   | K   | K   |
|                     | 0.10μF (104)  |      |     | D    |     |     |     | G    | G   |     |     | G    | G   | K   | K   |      |     | D    | D   | K   | K   |
|                     | 0.12μF (124)  |      |     |      |     |     |     |      |     |     |     | G    | G   |     |     |      |     | D    | D   | M   | M   |
|                     | 0.15μF (154)  |      |     |      |     |     |     |      |     |     |     | M    | M   |     |     |      |     | K    | K   | M   | M   |
|                     | 0.18μF (184)  |      |     |      |     |     |     |      |     |     |     | M    | M   |     |     |      |     | K    | K   | M   | M   |
| 0.22μF (224)        |               |      |     |      |     |     |     |      |     |     | M   | M    |     |     |     |      | K   | K    | M   | M   |     |
| 0.27μF (274)        |               |      |     |      |     |     |     |      |     |     | M   | M    |     |     |     |      | K   | K    |     |     |     |
| 0.33μF (334)        |               |      |     |      |     |     |     |      |     |     | M   | M    |     |     |     |      | K   | K    |     |     |     |
| 0.39μF (394)        |               |      |     |      |     |     |     |      |     |     | M   | M    |     |     |     |      | K   | K    |     |     |     |
| 0.47μF (474)        |               |      |     |      |     |     |     |      |     |     | M   | M    |     |     |     |      | K   | K    |     |     |     |
| 0.56μF (564)        |               |      |     |      |     |     |     |      |     |     |     |      |     |     |     |      | M   | M    |     |     |     |
| 0.68μF (684)        |               |      |     |      |     |     |     |      |     |     |     |      |     |     |     |      | M   | M    |     |     |     |
| 0.84μF (844)        |               |      |     |      |     |     |     |      |     |     |     |      |     |     |     |      | M   | M    |     |     |     |
| 1.0μF (105)         |               |      |     |      |     |     |     |      |     |     |     |      |     |     |     |      | M   | M    |     |     |     |

1. The letter in cell is expressed the symbol of product thickness.

### 7-3 Y5V Dielectric

| DIELECTRIC          |                     | Y5V  |     |      |     |      |     |      |     |
|---------------------|---------------------|------|-----|------|-----|------|-----|------|-----|
| SIZE                |                     | 0805 |     | 1206 |     | 1210 |     | 1812 |     |
| RATED VOLTAGE (VDC) |                     | 200  | 250 | 200  | 250 | 200  | 250 | 200  | 250 |
| Capacitance         | 0.010 $\mu$ F (103) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.015 $\mu$ F (153) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.022 $\mu$ F (223) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.033 $\mu$ F (333) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.047 $\mu$ F (473) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.068 $\mu$ F (683) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.10 $\mu$ F (104)  |      |     | B    | B   | C    | C   | D    | D   |
|                     | 0.15 $\mu$ F (154)  |      |     | C    | C   | C    | C   | D    | D   |
|                     | 0.22 $\mu$ F (224)  |      |     |      |     |      |     | D    | D   |
|                     | 0.33 $\mu$ F (334)  |      |     |      |     |      |     | D    | D   |
|                     | 0.47 $\mu$ F (474)  |      |     |      |     |      |     | D    | D   |
|                     | 0.68 $\mu$ F (684)  |      |     |      |     |      |     | D    | D   |
|                     | 1.0 $\mu$ F (105)   |      |     |      |     |      |     |      |     |

1. The letter in cell is expressed the symbol of product thickness.

## 8. CAPACITANCE RANGE (HIGH VOLTAGE - 1kV to 3kV)

### 8-1 NP0 Dielectric

| DIELECTRIC    |               | NP0  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| SIZE          |               | 0805 | 1206 |      |      | 1210 |      |      | 1808 |      |      |      | 1812 |      |      |      |
| RATED VOLTAGE |               | 1000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 3000 | 1000 | 1500 | 2000 | 3000 |
| Capacitance   | 0.5pF (0R5)   | D    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|               | 1.0pF (1R0)   | D    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|               | 1.2pF (1R2)   | D    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|               | 1.5pF (1R5)   | D    | B    | B    | B    |      |      |      |      |      |      |      |      |      |      |      |
|               | 1.8pF (1R8)   | D    | B    | B    | B    |      |      |      |      |      |      |      |      |      |      |      |
|               | 2.0pF (2R0)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 2.2pF (2R2)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 2.7pF (2R7)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 3.3pF (3R3)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 3.9pF (3R9)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 4.7pF (4R7)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 5.6pF (5R6)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 6.8pF (6R8)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 8.2pF (8R2)   | D    | B    | B    | B    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 10pF (100)    | D    | B    | B    | B    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 12pF (120)    | D    | B    | B    | B    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 15pF (150)    | D    | B    | B    | B    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 18pF (180)    | D    | B    | B    | B    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 22pF (220)    | D    | B    | B    | B    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 27pF (270)    | D    | B    | B    | B    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 33pF (330)    | D    | B    | C    | C    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 39pF (390)    | D    | B    | C    | C    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 47pF (470)    | D    | C    | C    | C    | C    | C    | C    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 56pF (560)    | D    | C    | D    | D    | C    | D    | D    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 68pF (680)    | D    | C    | D    | D    | C    | D    | D    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 82pF (820)    | D    | D    | D    | D    | C    | D    | D    | D    | D    | D    | D    | D    | D    | D    | D    |
|               | 100pF (101)   | D    | D    | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | D    |
|               | 120pF (121)   | D    | D    | G    | G    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | D    |
|               | 150pF (151)   | D    | D    | G    | G    | D    | G    | G    | D    | K    | K    | K    | D    | D    | D    | D    |
|               | 180pF (181)   | D    | G    | G    | G    | D    | G    | G    | D    | K    | K    | K    | D    | D    | K    | K    |
|               | 220pF (221)   | D    | G    | G    | G    | G    | G    | G    | D    | K    | K    | K    | D    | D    | K    | K    |
|               | 270pF (271)   | D    | G    |      |      | G    |      |      | K    | K    | K    | K    | D    | K    | K    | K    |
|               | 330pF (331)   | D    | G    |      |      | G    |      |      | K    | K    | K    | K    | D    | K    | K    | K    |
|               | 390pF (391)   | D    | G    |      |      | G    |      |      | K    | K    |      |      | D    | K    | K    | K    |
|               | 470pF (471)   |      | G    |      |      | G    |      |      | K    | K    |      |      | K    | K    | K    | K    |
|               | 560pF (561)   |      | G    |      |      | G    |      |      | K    | K    |      |      | K    | K    |      |      |
|               | 680pF (681)   |      | G    |      |      | G    |      |      | K    | K    |      |      | K    | K    |      |      |
|               | 820pF (821)   |      | G    |      |      | G    |      |      | K    |      |      |      | K    | K    |      |      |
|               | 1,000pF (102) |      | G    |      |      | G    |      |      | K    |      |      |      | K    | K    |      |      |
|               | 1,200pF (122) |      |      |      |      |      |      |      |      |      |      |      | K    |      |      |      |
|               | 1,500pF (152) |      |      |      |      |      |      |      |      |      |      |      | K    |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.

## 8-2 X7R Dielectric

| DIELECTRIC    |               | X7R  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| SIZE          |               | 0805 | 1206 |      |      |      | 1210 |      |      | 1808 |      |      |      | 1812 |      |      |      |
| RATED VOLTAGE |               | 1000 | 1000 | 1500 | 2000 | 2500 | 1000 | 1500 | 2000 | 1000 | 1500 | 2000 | 3000 | 1000 | 1500 | 2000 | 3000 |
| Capacitance   | 100pF (101)   | B    | D    | D    | D    | D    |      |      |      |      |      |      |      |      |      |      |      |
|               | 120pF (121)   | B    | D    | D    | D    | D    |      |      |      |      |      |      |      |      |      |      |      |
|               | 150pF (151)   | B    | D    | D    | D    | D    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 180pF (181)   | B    | D    | D    | D    | D    |      |      |      | D    | D    | D    | D    |      |      |      |      |
|               | 220pF (221)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | D    |      |      |      |      |
|               | 270pF (271)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | D    | D    | D    | D    |      |
|               | 330pF (331)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | K    | D    | D    | D    |      |
|               | 390pF (391)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | K    | D    | D    | D    |      |
|               | 470pF (471)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | K    | D    | D    | D    |      |
|               | 560pF (561)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | K    | D    | D    | D    |      |
|               | 680pF (681)   | B    | D    | D    | D    | D    |      | D    | D    | D    | D    | D    | K    | D    | D    | D    | K    |
|               | 820pF (821)   | B    | D    | G    | G    | D    |      | D    | D    | D    | D    | D    | K    | D    | D    | D    | K    |
|               | 1,000pF (102) | B    | D    | G    | D/G  | D    | D    | D    | D    | D    | K    | K    | K    | D    | D    | D    | K    |
|               | 1,200pF (122) | B    | D    | G    | G    |      | D    | M    | M    | D    | K    | K    | K    | D    | D    | D    | K    |
|               | 1,500pF (152) | D    | D    | G    | G    |      | D    | M    | M    | D    | K    | K    | K    | D    | D    | D    | K    |
|               | 1,800pF (182) | D    | D    | G    | G    |      | D    | M    | M    | D    | K    | K    | K    | D    | G    | G    | M    |
|               | 2,200pF (222) | D    | D    | G    | G    |      | D    | M    | M    | D    | K    | K    |      | D    | G    | G    | M    |
|               | 2,700pF (272) |      | D    | G    | G    |      | D    | M    | M    | D    | K    | K    |      | D    | G    | G    | M    |
|               | 3,300pF (332) |      | D    | G    | G    |      | D    | M    | M    | D    | K    | K    |      | D    | K    | K    | M    |
|               | 3,900pF (392) |      | D    | G    |      |      | G    | M    | M    | D    | K    | K    |      | D    | K    | K    |      |
|               | 4,700pF (472) |      | D    | G    |      |      | G    | M    | M    | D    | K    | K    |      | D    | K    | K    |      |
|               | 5,600pF (562) |      | D    | G    |      |      | G    |      |      | K    | K    | K    |      | D    |      |      |      |
|               | 6,800pF (682) |      | D    | G    |      |      | G    |      |      | K    |      |      |      | D    |      |      |      |
|               | 8,200pF (822) |      | D    |      |      |      | G    |      |      | K    |      |      |      | D    |      |      |      |
|               | 0.010μF (103) |      | D    |      |      |      | G    |      |      | K    |      |      |      | D    |      |      |      |
|               | 0.012μF (123) |      | G    |      |      |      | G    |      |      | K    |      |      |      | K    |      |      |      |
|               | 0.015μF (153) |      | G    |      |      |      | G    |      |      | K    |      |      |      | K    |      |      |      |
|               | 0.018μF (183) |      |      |      |      |      | G    |      |      | K    |      |      |      |      |      |      |      |
|               | 0.022μF (223) |      |      |      |      |      | G    |      |      | K    |      |      |      |      |      |      |      |
|               | 0.033μF (333) |      |      |      |      |      |      |      |      | K    |      |      |      |      |      |      |      |
|               | 0.047μF (473) |      |      |      |      |      |      |      |      | K    |      |      |      |      |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.

## 9. PACKAGING DIMENSION AND QUANTITY

| Size | Thickness/Symbol (mm) |   | Paper tape |          | Plastic tape |          |
|------|-----------------------|---|------------|----------|--------------|----------|
|      |                       |   | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0603 | 0.80±0.07             | S | 4k         | 15k      | -            | -        |
|      | 0.80 +0.15/-0.10      | X | 4k         | 15k      |              |          |
| 0805 | 0.60±0.10             | A | 4k         | 15k      | -            | -        |
|      | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
| 1206 | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|      | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|      | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|      | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
| 1210 | 1.60±0.20             | G | -          | -        | 2k           | 10k      |
|      | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|      | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|      | 1.60±0.20             | G | -          | -        | 2k           | -        |
|      | 2.00±0.20             | K | -          | -        | 1k           | 6k       |
| 1808 | 2.50±0.30             | M | -          | -        | 1k           | 6k       |
|      | 1.25±0.10             | D | -          | -        | 2k           | 10k      |
|      | 2.00±0.20             | K | -          | -        | 1k           | 6k       |
| 1812 | 1.25±0.10             | D | -          | -        | 1k           | 5k       |
|      | 1.60±0.20             | G | -          | -        | 1k           | -        |
|      | 2.00±0.20             | K | -          | -        | 1k           | -        |
|      | 2.50±0.30             | M | -          | -        | 0.5k         | 3k       |



**10. RELIABILITY TEST CONDITIONS AND REQUIREMENTS**

| No.  | Item                             | Test Condition                                                                                                                                                                                                                                                                                                                                      |                                                | Requirements                                                                                                                                                                                                                                                                             |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
|------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----|-------------------|-----|-------------------|-----|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|--------------------|-----|------------------|-----|-------------|-----|------------------|
| 1.   | Visual and Mechanical            | ---                                                                                                                                                                                                                                                                                                                                                 |                                                | * No remarkable defect.<br>* Dimensions to conform to individual specification sheet.                                                                                                                                                                                                    |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 2.   | Capacitance                      | Class I: (NP0)                                                                                                                                                                                                                                                                                                                                      |                                                | * Shall not exceed the limits given in the detailed spec.                                                                                                                                                                                                                                |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 3.   | Q/ D.F.<br>(Dissipation Factor)  | Cap≤1000pF, 1.0±0.2Vrms, 1MHz±10%<br>Cap>1000pF, 1.0±0.2Vrms, 1KHz±10%<br>Class II: (X7R, Y5V)<br>1.0±0.2Vrms, 1kHz±10%                                                                                                                                                                                                                             |                                                | NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C<br>X7R: ≤2.5%<br>Y5V: ≤5.0%                                                                                                                                                                                                                   |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 4.   | Dielectric Strength              | * To apply voltage:<br>200V~300V ≥2 times VDC<br>500V~999V ≥1.5 times VDC<br>1000V~3000V ≥1.2 times VDC<br>* Cut-off, set at 10mA<br>* TEST= 15 sec.<br>* RAMP=0                                                                                                                                                                                    |                                                | * No evidence of damage or flash over during test.                                                                                                                                                                                                                                       |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 5.   | Insulation Resistance            | Rated voltage: 200~630V                                                                                                                                                                                                                                                                                                                             | To apply rated voltage (500V max.) for 60 sec. | ≥10GΩ or RxC≥100Ω·F whichever is smaller                                                                                                                                                                                                                                                 |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
|      |                                  | Rated voltage: ≥630V                                                                                                                                                                                                                                                                                                                                | To apply 500V for 60 sec.                      | ≥10GΩ                                                                                                                                                                                                                                                                                    |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 6.   | Temperature Coefficient          | With no electrical load. <table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>NP0</td><td>-55~125°C at 25°C</td></tr><tr><td>X7R</td><td>-55~125°C at 25°C</td></tr><tr><td>Y5V</td><td>-25~85°C at 20°C</td></tr></table>                                                                                                                   |                                                | T.C.                                                                                                                                                                                                                                                                                     | Operating Temp | NP0 | -55~125°C at 25°C | X7R | -55~125°C at 25°C | Y5V | -25~85°C at 20°C | <table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>NP0</td><td>Within ±30ppm/°C</td></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>Y5V</td><td>Within +30%/-80%</td></tr></table> |  | T.C. | Capacitance Change | NP0 | Within ±30ppm/°C | X7R | Within ±15% | Y5V | Within +30%/-80% |
| T.C. | Operating Temp                   |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| NP0  | -55~125°C at 25°C                |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| X7R  | -55~125°C at 25°C                |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| Y5V  | -25~85°C at 20°C                 |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| T.C. | Capacitance Change               |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| NP0  | Within ±30ppm/°C                 |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| X7R  | Within ±15%                      |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| Y5V  | Within +30%/-80%                 |                                                                                                                                                                                                                                                                                                                                                     |                                                |                                                                                                                                                                                                                                                                                          |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 7.   | Adhesive Strength of Termination | * Pressurizing force :<br>5N (≤0603) and 10N (>0603)<br>* Test time: 10±1 sec.                                                                                                                                                                                                                                                                      |                                                | * No remarkable damage or removal of the terminations.                                                                                                                                                                                                                                   |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 8.   | Vibration Resistance             | * Vibration frequency: 10~55 Hz/min.<br>* Total amplitude: 1.5mm<br>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                            |                                                | * No remarkable damage.<br>* Cap change and Q/D.F.: To meet initial spec.                                                                                                                                                                                                                |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 9.   | Solderability                    | * Solder temperature: 235±5°C<br>* Dipping time: 2±0.5 sec.                                                                                                                                                                                                                                                                                         |                                                | 95% min. coverage of all metalized area.                                                                                                                                                                                                                                                 |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 10.  | Bending Test                     | * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                              |                                                | * No remarkable damage.<br>* Cap change :<br>NP0: within ±5.0% or ±0.5pF whichever is larger.<br>X7R: within ±12.5%<br>Y5V: within ±30%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |
| 11.  | Resistance to Soldering Heat     | * Solder temperature: 260±5°C<br>* Dipping time: 10±1 sec<br>* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.<br>* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. |                                                | * No remarkable damage.<br>* Cap change:<br>NP0: within ±2.5% or ±0.25pF whichever is larger.<br>X7R: within ±7.5%<br>Y5V: within ±20%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.<br>* 25% max. leaching on each edge.                                     |                |     |                   |     |                   |     |                  |                                                                                                                                                                                                       |  |      |                    |     |                  |     |             |     |                  |

| No. | Item                              | Test Condition                                                                                                                                                                                                                                                                                                                                                                           | Requirements                                                                                               |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|-----|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------|-------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|-----------------------|
| 12. | Temperature Cycle                 | * Conduct the five cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table> | Step                                                                                                       | Temp. (°C)  | Time (min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | No remarkable damage. |
|     |                                   | Step                                                                                                                                                                                                                                                                                                                                                                                     | Temp. (°C)                                                                                                 | Time (min.) |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 1   | Min. operating temp. +0/-3        | 30±3                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 2   | Room temp.                        | 2~3                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 3   | Max. operating temp. +3/-0        | 30±3                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 4   | Room temp.                        | 2~3                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.                                                                                                                                                                                                                                                                       | Cap change :<br>NP0: within ±2.5% or ±0.25pF whichever is larger.<br>X7R: within ±7.5%<br>Y5V: within ±20% |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                                                                       | * Q/D.F., I.R. and dielectric strength: To meet initial requirements.                                      |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 13. | Humidity (Damp Heat) Steady State | * Test temp.: 40±2°C                                                                                                                                                                                                                                                                                                                                                                     | * No remarkable damage.                                                                                    |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Humidity: 90~95% RH                                                                                                                                                                                                                                                                                                                                                                    | * Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger.                                             |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Test time: 500+24/-0hrs.                                                                                                                                                                                                                                                                                                                                                               | X7R: within ±12.5%<br>Y5V: within ±30%                                                                     |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | *Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.                                                                                                                                                                                                                                                                        | * Q/D.F. value:                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                                                                       | NP0: Cap≥30pF, Q≥350; 10pF≤Cap<30pF, Q≥275+2.5C<br>Cap<10pF; Q≥200+10C<br>X7R: ≤3.0%<br>Y5V: ≤7.5%         |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   |                                                                                                                                                                                                                                                                                                                                                                                          | * I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 14. | Humidity (Damp Heat) Load         | * Test temp.: 40±2°C                                                                                                                                                                                                                                                                                                                                                                     | * No remarkable damage.                                                                                    |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Humidity: 90~95%RH                                                                                                                                                                                                                                                                                                                                                                     | * Cap change: NP0: within ±7.5% or ±0.75pF whichever is larger.                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Test time: 500+24/-0 hrs.                                                                                                                                                                                                                                                                                                                                                              | X7R: within ±12.5%<br>Y5V: within ±30%                                                                     |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * To apply voltage : rated voltage (Max. 500V)                                                                                                                                                                                                                                                                                                                                           |                                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.                                                                                                                                                                                                                                                              | * Q/D.F. value:                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                                                                       | NP0: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C<br>X7R: ≤3.0%<br>Y5V: ≤7.5%                                    |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   |                                                                                                                                                                                                                                                                                                                                                                                          | * I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.                                                          |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
| 15. | High Temperature Load (Endurance) | * Test temp.:<br>NP0, X7R: 125±3°C<br>Y5V: 85±3°C                                                                                                                                                                                                                                                                                                                                        | * No remarkable damage.                                                                                    |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * To apply voltage:<br>(1) <500V: 200% of rated voltage.<br>(2) 500V: 150% of rated voltage.<br>(3) ≥630V: 120% of rated voltage.<br>(4) 1206/NP0 (3kV) ≥1.5pF: 100% of rated voltage.                                                                                                                                                                                                   | * Cap change: NP0: within ±3.0% or ±0.3pF whichever is larger.<br>X7R: within ±12.5%<br>Y5V: within ±30%   |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | * Test time: 1000+24/-0 hrs.                                                                                                                                                                                                                                                                                                                                                             | * Q/D.F. value:                                                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | *Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.                                                                                                                                                                                                                                                         | NP0: Cap≥30pF, Q≥350<br>10pF≤Cap<30pF, Q≥275+2.5C<br>Cap<10pF, Q≥200+10C<br>X7R: ≤3.0%<br>Y5V: ≤7.5%       |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |
|     |                                   | *Measurement to be made after keeping at room temp. for 24±2 hrs                                                                                                                                                                                                                                                                                                                         | * I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.                                                            |             |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                       |

## APPENDIXES

### ■ Tape & reel dimensions

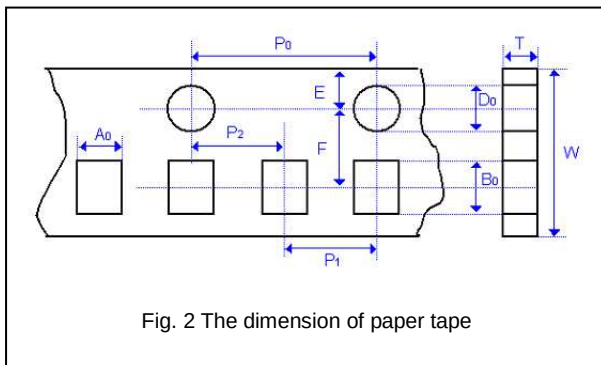


Fig. 2 The dimension of paper tape

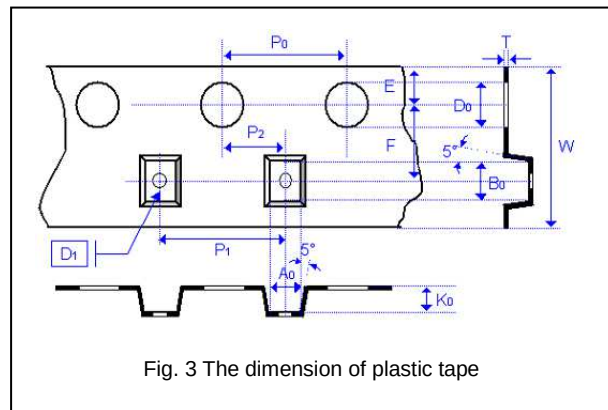


Fig. 3 The dimension of plastic tape

| Size              | 0603      | 0805      |           | 1206      |           |           | 1210       |           |           | 1808      |           | 1812      |           |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Thickness         | S, X      | B         | C, D, I   | B         | C, D      | G         | C, D       | F, G, K   | M         | D         | K         | D, K      | M         |
| A <sub>0</sub>    | 1.02±0.05 | 1.50±0.10 | <1.57     | 2.00±0.10 | <1.85     | <1.95     | <2.97      | <2.97     | <2.97     | <2.35     | <2.35     | <3.81     | <3.81     |
| B <sub>0</sub>    | 1.80±0.05 | 2.30±0.10 | <2.40     | 3.50±0.10 | <3.46     | <3.67     | <3.73      | <3.73     | <3.73     | <4.98     | <5.00     | <5.30     | <5.30     |
| T                 | 0.95±0.05 | 0.95±0.05 | 0.23±0.05 | 0.95±0.05 | 0.23±0.05 | 0.23±0.05 | 0.23±0.05  | 0.23±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 |
| K <sub>0</sub>    | -         | -         | <2.50     | -         | <2.50     | <2.50     | <2.50      | <2.50     | <3.0      | <2.50     | <2.50     | <2.50     | <3.00     |
| W                 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10  | 8.00±0.10 | 8.00±0.10 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 |
| P <sub>0</sub>    | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.100 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |
| 10xP <sub>0</sub> | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10  | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 | 40.0±0.10 |
| P <sub>1</sub>    | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10  | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 8.00±0.10 | 8.00±0.10 |
| P <sub>2</sub>    | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05  | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 |
| D <sub>0</sub>    | 1.55±0.05 | 1.55±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05  | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 | 1.50±0.05 |
| D <sub>1</sub>    | -         | -         | 1.00±0.10 | -         | 1.00±0.10 | 1.00±0.10 | 1.00±0.10  | 1.00±0.10 | 1.00±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 |
| E                 | 1.75±0.05 | 1.75±0.05 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10  | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 |
| F                 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05 | 3.50±0.05  | 3.50±0.05 | 3.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 |

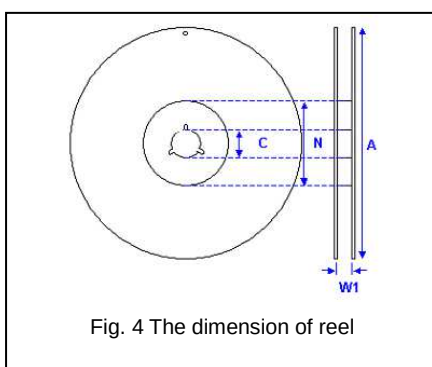


Fig. 4 The dimension of reel

| Size           | 0603, 0805, 1206, 1210 |               |               | 1808, 1812    |
|----------------|------------------------|---------------|---------------|---------------|
| Reel size      | 7"                     | 10"           | 13"           | 7"            |
| C              | 13.0+0.5/-0.2          | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 | 13.0+0.5/-0.2 |
| W <sub>1</sub> | 8.4+1.5/-0             | 8.4+1.5/-0    | 8.4+1.5/-0    | 12.4+2.0/-0   |
| A              | 178.0±0.10             | 250.0±1.0     | 330.0±1.0     | 178.0±0.10    |
| N              | 60.0+1/-0              | 100.0±1.0     | 100±1.0       | 60.5±1.0      |