

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

Middle & High Voltage Series (200V to 4kV)

0402 to 1812 Sizes

NP0, X7R & Y5V Dielectrics

Halogen Free & RoHS compliance



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

**Multilayer Ceramic Capacitors**

**1. INTRODUCTION**

WTC 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**

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

**3. APPLICATIONS**

- a. Snubbers in high frequency power converters.
- b. High voltage coupling/DC blocking.
- c. DC-DC converters.
- d. 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>0402</b> (1005)<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>401</b> =400 VDC<br><b>451</b> =450 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<br><b>402</b> =4000 VDC | <b>C</b> =Cu/Ni/Sn | <b>T</b> =7" reeled<br><b>G</b> =13" reeled |

Multilayer Ceramic Capacitors

**5. EXTERNAL DIMENSIONS**

| Size<br>Inch (mm) | L (mm)              | W (mm)              | T (mm)/Symbol       | Remark | M <sub>B</sub> (mm)      |
|-------------------|---------------------|---------------------|---------------------|--------|--------------------------|
| 0402 (1005)       | 1.00±0.05           | 0.50±0.05           | 0.50±0.05           | N #    | 0.25<br>+0.05/-0.10      |
| 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 #                 |                     |        |                          |
|                   | 2.00±0.20           | 1.25±0.20           | 1.25±0.20           | I #    |                          |
| 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 #                 |                     |        |                          |
| 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 #    |                          |
| 3.20±0.60**       | 2.50±0.50**         | 2.50±0.50**         | 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 #    |                          |
|                   |                     | 3.20±0.40           | 2.00±0.20           | K #    |                          |
|                   |                     |                     | 2.50±0.30           | M #    |                          |
|                   |                     |                     | 2.80±0.30           | U #    |                          |



# Reflow soldering only is recommended.

\* For 1206\_1000V ~3000V products.

\*\* For 1210\_100V: Cap > 1µF, 250V: Cap > 0.47µF, 400V~630V: Cap > 0.22µF.

**6. GENERAL ELECTRICAL DATA**

| Dielectric                                 | NP0                                                                                                                    | X7R                | Y5V                    |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------|
| Size                                       | 0402, 0603, 0805, 1206, 1210, 1808, 1812                                                                               |                    | 0805, 1206, 1210, 1812 |
| Capacitance*                               | 0.5pF to 0.033µF                                                                                                       | 100pF to 1.0µF     | 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%)                    | K (±10%), M (±20%) | Z (-20/+80%)           |
| Rated voltage (WVDC)                       | 200V to 4000V                                                                                                          |                    | 200V, 250V             |
| Q/DF*                                      | Cap<30pF: Q≥400+20C<br>Cap≥30pF: Q≥1000                                                                                | DF≤2.5%            | 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>400V~450V: ≥1.2 x WVDC<br>500~999V: ≥1.5 x WVDC<br>1000~3000V: ≥1.2 x WVDC<br>4000: ≥1.1 x WVDC |                    |                        |
| Operating temperature                      | -55 to +125°C                                                                                                          |                    | -25 to +85°C           |
| Capacitance characteristic                 | ±30ppm                                                                                                                 | ±15%               | +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>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 a mbient condition for 24±2 hours before measurement.

Multilayer Ceramic Capacitors

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

**7-1 NP0 Dielectric**

| DIELECTRIC          |               | NP0  |     |      |     |      |     |     |     |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|---------------------|---------------|------|-----|------|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|------|-----|-----|-----|
|                     |               | 0402 |     | 0603 |     | 0805 |     |     |     | 1206 |     |     |     | 1210 |     |     |     | 1808 |     | 1812 |     |     |     |
| SIZE                |               | 200  | 250 | 200  | 250 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 500  | 630 | 200  | 250 | 500 | 630 |
| RATED VOLTAGE (VDC) |               | 200  | 250 | 200  | 250 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 200  | 250 | 500 | 630 | 500  | 630 | 200  | 250 | 500 | 630 |
| Capacitance         | 0.5pF (0R5)   | N    | N   | S    | S   | A    | A   | A   | A   |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|                     | 1.0pF (1R0)   | N    | N   | S    | S   | A    | A   | A   | A   |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|                     | 1.2pF (1R2)   | N    | N   | S    | S   | A    | A   | A   | A   |      |     |     |     |      |     |     |     |      |     |      |     |     |     |
|                     | 1.5pF (1R5)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     |      |     |      |     |     |     |
|                     | 1.8pF (1R8)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 2.2pF (2R2)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 2.7pF (2R7)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 3.3pF (3R3)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 3.9pF (3R9)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 4.7pF (4R7)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 5.6pF (5R6)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 6.8pF (6R8)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 8.2pF (8R2)   | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   |      |     |     |     | D    | D   |      |     |     |     |
|                     | 10pF (100)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 12pF (120)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 15pF (150)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 18pF (180)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 22pF (220)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 27pF (270)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 33pF (330)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 39pF (390)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 47pF (470)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 56pF (560)    | N    | N   | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 68pF (680)    | N    |     | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 82pF (820)    | N    |     | S    | S   | A    | A   | A   | A   | B    | B   | B   | B   | C    | C   | C   | C   | D    | D   | D    | D   | D   | D   |
|                     | 100pF (101)   | N    |     | 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)   |      |     | X    | X   | 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    | G   | G   | D   | D    | D   | D   | K   | K    | D   | D    | D   | D   |     |
| 3,300pF (332)       |               |      |     |      |     |      |     |     | D   | G    | G   | G   | D   | D    | D   | D   | K   | K    | D   | D    | D   | D   |     |
| 3,900pF (392)       |               |      |     |      |     |      |     |     | D   | G    | G   | G   | D   | D    | D   | D   |     |      | D   | D    | D   | D   |     |
| 4,700pF (472)       |               |      |     |      |     |      |     |     | D   | G    | G   | G   | G   | G    |     |     |     |      | D   | D    | D   | D   |     |
| 5,600pF (562)       |               |      |     |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      | D   | D    | D   | D   |     |
| 6,800pF (682)       |               |      |     |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      | D   | D    | D   | D   |     |
| 8,200pF (822)       |               |      |     |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      |     |      | D   | D   |     |
| 0.010μF (103)       |               |      |     |      |     |      |     |     |     |      |     |     | G   | G    |     |     |     |      |     |      | D   | D   |     |
| 0.015μF (153)       |               |      |     |      |     |      |     |     |     |      |     |     |     | M    |     |     |     |      |     |      | G   | G   |     |
| 0.022μF (223)       |               |      |     |      |     |      |     |     |     |      |     |     |     | M    |     |     |     |      |     |      | K   | K   |     |
| 0.033μF (333)       |               |      |     |      |     |      |     |     |     |      |     |     |     |      |     |     |     |      |     |      |     |     |     |

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

Multilayer Ceramic Capacitors

7-2 X7R Dielectric

| DIELECTRIC          |      | X7R  |     |     |     |      |     |     |     |      |     |     |     |      |     |      |     |     |     |     |     |     |     |     |   |   |
|---------------------|------|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|---|---|
| SIZE                | 0603 | 0805 |     |     |     | 1206 |     |     |     | 1210 |     |     |     | 1808 |     | 1812 |     |     |     |     |     |     |     |     |   |   |
| RATED VOLTAGE (VDC) | 200  | 250  | 200 | 250 | 500 | 630  | 200 | 250 | 400 | 450  | 500 | 630 | 200 | 250  | 400 | 450  | 500 | 630 | 500 | 630 | 200 | 250 | 500 | 630 |   |   |
| 100pF (101)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   |     |     |     |     |     |     |   |   |
| 120pF (121)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   |     |     |     |     |     |     |   |   |
| 150pF (151)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 180pF (181)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 220pF (221)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 270pF (271)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 330pF (331)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 390pF (391)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 470pF (471)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 560pF (561)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | D   | D    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 680pF (681)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | D   | D   | D   |     |     |     |     |   |   |
| 820pF (821)         | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | 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   | D |   |
| 1,200pF (122)       | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | 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   | D |   |
| 1,800pF (182)       | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | 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   | D |   |
| 2,700pF (272)       | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | 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   | D |   |
| 3,900pF (392)       | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | D   | D   | D   | D   | D   | D   | D   | D |   |
| 4,700pF (472)       | X    | X    | B   | B   | B   | B    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | 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   | D |   |
| 6,800pF (682)       | X    | X    | D   | D   | D   | D    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | D   | K   | K   | D   | 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   | D |   |
| 0.010μF (103)       | X    | X    | D   | D   | D   | D    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | D   | K   | K   | D   | 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   | D |   |
| 0.015μF (153)       |      |      | D   | D   | D   | D    | D   | D   |     |      | D   | D   | C   | C    |     |      | D   | D   | K   | K   | D   | 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   | D |   |
| 0.022μF (223)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | C   | C    |     |      | D   | D   | K   | K   | D   | D   | D   | D   | D |   |
| 0.027μF (273)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | C   | C    |     |      | G   | G   | K   | K   | D   | D   | D   | D   | D |   |
| 0.033μF (333)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | C   | C    |     |      | G   | G   | K   | K   | D   | D   | D   | D   | D |   |
| 0.039μF (393)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | C   | C    |     |      | G   | G   | K   | K   | D   | D   | D   | D   | D |   |
| 0.047μF (473)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | D   | D    |     |      | G   | G   | K   | K   | D   | D   | D   | D   | D |   |
| 0.056μF (563)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | D   | D    |     |      | G   | G   | K   | K   | D   | D   | K   | K   | K |   |
| 0.068μF (683)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | G   | G    |     |      | G   | G   | K   | K   | K   | K   | D   | D   | K | K |
| 0.082μF (823)       |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | G   | G    |     |      | G   | G   | K   | K   | K   | K   | D   | D   | K | K |
| 0.10μF (104)        |      |      | D   | D   | D   | D    | D   | D   |     |      | G   | G   | G   | G    |     |      | G   | G   | K   | K   |     |     | D   | D   | K | K |
| 0.12μF (124)        |      |      |     |     |     |      | G   | G   |     |      |     |     | G   | G    | M   | M    |     |     |     |     |     |     | D   | D   | M | M |
| 0.15μF (154)        |      |      |     |     |     |      | G   | G   |     |      |     |     | M   | M    | M   | M    |     |     |     |     |     |     | K   | K   | M | M |
| 0.18μF (184)        |      |      |     |     |     |      | G   | G   |     |      |     |     | M   | M    | M   | M    |     |     |     |     |     |     | K   | K   | M | M |
| 0.22μF (224)        |      |      |     |     |     |      | G   | G   |     |      |     |     | M   | M    | M   | M    |     |     |     |     |     |     | K   | K   | M | M |
| 0.27μF (274)        |      |      |     |     |     |      |     |     |     |      |     |     | M   | M    | M   | M    |     |     |     |     |     |     | K   | K   | M | M |
| 0.33μF (334)        |      |      |     |     |     |      |     |     |     |      |     |     | M   | M    | M   | M    |     |     |     |     |     |     | K   | K   | M | M |
| 0.39μF (394)        |      |      |     |     |     |      |     |     |     |      |     |     | M   | M    |     |      |     |     |     |     |     |     | K   | K   | M | M |
| 0.47μF (474)        |      |      |     |     |     |      |     |     |     |      |     |     | M   | M    |     |      |     |     |     |     |     |     | K   | K   | M | M |
| 0.56μF (564)        |      |      |     |     |     |      |     |     |     |      |     |     | M   | M    |     |      |     |     |     |     |     |     | M   | M   |   |   |
| 0.68μF (684)        |      |      |     |     |     |      |     |     |     |      |     |     | M   | M    |     |      |     |     |     |     |     |     | M   | M   |   |   |
| 0.82μF (824)        |      |      |     |     |     |      |     |     |     |      |     |     |     |      |     |      |     |     |     |     |     |     | 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.



Multilayer Ceramic Capacitors

**8. CAPACITANCE RANGE (HIGH VOLTAGE - 1kV to 4kV)**

**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 | 4000 | 1000 | 1500 | 2000 | 3000 | 4000 |  |
| 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    | P    | P    | G    | K    | K    | G    | K    | K    | K    |      | D    | K    | K    | K    |  |
|               | 330pF (331) | D    | G    | P    | P    | G    | K    | K    | G    | K    | K    | K    |      | D    | K    | K    | K    |  |
| 390pF (391)   | D           | G    | P    | P    | G    | M    | M    | K    | K    | K    |      |      | D    | K    | K    | K    |      |  |
| 470pF (471)   |             | G    |      |      | G    | M    | M    | K    | K    | K    |      |      | K    | K    | K    | K    |      |  |
| 560pF (561)   |             | G    |      |      | G    |      |      | K    | K    | K    |      |      | K    | K    | K    |      |      |  |
| 680pF (681)   |             | G    |      |      | G    |      |      | K    | K    | K    |      |      | K    | K    | K    |      |      |  |
| 820pF (821)   |             | G    |      |      | G    |      |      | K    | D    | D    |      |      | K    | K    | K    |      |      |  |
| 1,000pF (102) |             | G    |      |      | G    |      |      | K    | G    | G    |      |      | K    | K    | K    |      |      |  |
| 1,200pF (122) |             |      |      |      | G    |      |      | G    |      |      |      |      | K    |      |      |      |      |  |
| 1,500pF (152) |             |      |      |      | K    |      |      | G    |      |      |      |      | K    |      |      |      |      |  |
| 1,800pF (182) |             |      |      |      | M    |      |      | K    |      |      |      |      | K    |      |      |      |      |  |
| 2,200pF (222) |             |      |      |      | M    |      |      | K    |      |      |      |      | K    |      |      |      |      |  |
| 2,700pF (272) |             |      |      |      | M    |      |      |      |      |      |      |      | K    |      |      |      |      |  |
| 3,300pF (332) |             |      |      |      | M    |      |      |      |      |      |      |      | K    |      |      |      |      |  |
| 3,900pF (392) |             |      |      |      | M    |      |      |      |      |      |      |      | M    |      |      |      |      |  |

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 | 4000 | 1000 | 1500 | 2000 | 3000 | 4000 |   |
| Capacitance   | 100pF (101)   | B    | D    | D    | D          | D    | D    | D    |      |      |      |      |      |      |      |      |      |      |   |
|               | 120pF (121)   | B    | D    | D    | D          | D    | D    | D    |      |      |      |      |      |      |      |      |      |      |   |
|               | 150pF (151)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    |      |      |      |      |      |   |
|               | 180pF (181)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    |      |      |      |      |      |   |
|               | 220pF (221)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    |      |      |      |      |      |   |
|               | 270pF (271)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | D    | D    | D    | K    | K    |   |
|               | 330pF (331)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | K    | K |
|               | 390pF (391)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | K    | K |
|               | 470pF (471)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | K    | K |
|               | 560pF (561)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | K    | K |
|               | 680pF (681)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | K    | K |
|               | 820pF (821)   | B    | D    | D    | D          | D    | D    | D    | D    | D    | D    | D    | K    | K    | D    | D    | D    | K    | K |
|               | 1,000pF (102) | B    | D    | D    | B/C<br>D/G | D    | D    | D    | D    | D    | K    | K    | K    | K    | D    | D    | D    | K    | K |
|               | 1,200pF (122) | B    | D    | G    | G          | G    | D    | M    | M    | D    | K    | K    | K    |      | D    | D    | D    | K    | M |
|               | 1,500pF (152) | D    | D    | G    | G          | G    | D    | M    | M    | D    | K    | K    | K    |      | D    | D    | D    | K    | M |
|               | 1,800pF (182) | D    | D    | G    | G          | G    | D    | M    | M    | D    | K    | K    | K    |      | D    | D    | D    | M    | M |
|               | 2,200pF (222) | D    | D    | G    | G          | G    | D    | M    | M    | D    | K    | K    |      |      | D    | D    | D    | M    |   |
|               | 2,700pF (272) | D    | D    | G    | G          |      | D    | M    | M    | D    | K    | K    |      |      | D    | D    | D    | M    |   |
|               | 3,300pF (332) | D    | D    | G    | G          |      | D    | M    | M    | D    | K    | K    |      |      | D    | K    | K    | M    |   |
|               | 3,900pF (392) | D    | D    | G    |            |      | G    | M    | M    | D    | K    | K    |      |      | D    | K    | K    | M    |   |
|               | 4,700pF (472) | D    | D    | G    |            |      | G    | M    | M    | D    | K    | K    |      |      | D    | K    | K    | M    |   |
|               | 5,600pF (562) | D    | D    | G    |            |      | G    | M    | M    | K    | K    | K    |      |      | D    | M    | M    | M    |   |
|               | 6,800pF (682) | D    | D    | G    |            |      | G    | M    | M    | K    | K    | K    |      |      | D    | M    | M    | M    |   |
|               | 8,200pF (822) | D    | D    | G    |            |      | G    | M    | M    | K    | K    | K    |      |      | D    | M    | M    |      |   |
|               | 0.010μF (103) | D    | D    | G    |            |      | G    | M    |      | K    | K    | K    |      |      | D    | M    | M    |      |   |
|               | 0.012μF (123) |      | G    |      |            |      | G    |      |      | K    |      |      |      |      | K    | M    | M    |      |   |
|               | 0.015μF (153) |      | G    |      |            |      | G    |      |      | K    |      |      |      |      | K    | M    | M    |      |   |
|               | 0.018μF (183) |      |      |      |            |      | G    |      |      | K    |      |      |      |      | M    | M    | M    |      |   |
|               | 0.022μF (223) |      |      |      |            |      | G    |      |      | K    |      |      |      |      | M    | M    | M    |      |   |
|               | 0.033μF (333) |      |      |      |            |      | G    |      |      | K    |      |      |      |      | M    |      |      |      |   |
| 0.039μF (393) |               |      |      |      |            | K    |      |      | K    |      |      |      |      | M    |      |      |      |      |   |
| 0.047μF (473) |               |      |      |      |            | M    |      |      | K    |      |      |      |      | M    |      |      |      |      |   |
| 0.056μF (563) |               |      |      |      |            |      |      |      | K    |      |      |      |      | M    |      |      |      |      |   |
| 0.068μF (683) |               |      |      |      |            |      |      |      |      |      |      |      |      | M    |      |      |      |      |   |
| 0.10μF (104)  |               |      |      |      |            |      |      |      |      |      |      |      |      | M    |      |      |      |      |   |

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 |
| 0402 | 0.50±0.05             | N | 10k        | 50k      | -            | -        |
| 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      | -            | -        |
|      | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|      | 1.25±0.20             | I | -          | -        | 3k           | 10k      |
| 1206 | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|      | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|      | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|      | 1.60±0.20             | G | -          | -        | 2k           | 10k      |
| 1210 | 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. (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%<br>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .                                                                                                                                                                | 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>400V~450V ≥1.2 times VDC<br>500V~999V ≥1.5 times VDC<br>1000V~3000V ≥1.2 times VDC<br>4000V ≥1.1 times VDC<br>* Duration: 1 to 5 sec.<br>* Charge & discharge current less than 50mA.                                                                                                                                                                         | No evidence of damage or flash over during test.                                                                                                                                                                                                                                       |                                          |     |                   |     |                   |     |                  |                                                                                                                                                                                                                                                                     |      |                    |     |                  |     |             |     |                  |                                                                                                                      |
| 5.   | Insulation Resistance            | Rated voltage: 200~630V<br>Rated voltage: ≥630V                                                                                                                                                                                                                                                                                                                                                                | To apply rated voltage (500V max.) for 60 sec.<br>To apply 500V for 60 sec.                                                                                                                                                                                                            | ≥10GΩ or RxC≥100Ω-F whichever is smaller |     |                   |     |                   |     |                  |                                                                                                                                                                                                                                                                     |      |                    |     |                  |     |             |     |                  |                                                                                                                      |
| 6.   | Temperature Coefficient          | With no electrical load.<br><table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <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> </tbody> </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 border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> </tbody> </table> | T.C. | Capacitance Change | NP0 | Within ±30ppm/°C | X7R | Within ±15% | Y5V | Within +30%/-80% | *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp . |
| 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>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .<br>*Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .                          | 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>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr 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 ±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): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .<br>*Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .            | * 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                 | <p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> | 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 | <p>No remarkable damage.</p> <p>Cap change :</p> <p>NP0: within ±2.5% or ±0.25pF whichever is larger.</p> <p>X7R: within ±7.5%</p> <p>Y5V: within ±20%</p> <p>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p> |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                                                         |
| 13.  | Humidity (Damp Heat) Steady State | <p>* Test temp.: 40±2°C</p> <p>* Humidity: 90~95% RH</p> <p>* Test time: 500+24/-0hrs.</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p>                                                                                                                                                                                                                                                                                                                                                                             | <p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger.</p> <p>X7R: within ±12.5%</p> <p>Y5V: within ±30%</p> <p>* Q/D.F. value:</p> <p>NP0: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥275+2.5C<br/>Cap&lt;10pF; Q≥200+10C</p> <p>X7R: ≤3.0%</p> <p>Y5V: ≤7.5%</p> <p>I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</p>    |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                                                         |
| 14.  | Humidity (Damp Heat) Load         | <p>* Test temp.: 40±2°C</p> <p>* Humidity: 90~95%RH</p> <p>* Test time: 500+24/-0 hrs.</p> <p>* To apply voltage : rated voltage (Max. 500V)</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p>                                                                                                                                                                                                                                                                                                                       | <p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±7.5% or ±0.75pF whichever is larger.</p> <p>X7R: within ±12.5%</p> <p>Y5V: within ±30%</p> <p>* Q/D.F. value:</p> <p>NP0: Cap≥30pF, Q≥200; Cap&lt;30pF, Q≥100+10/3C</p> <p>X7R: ≤3.0%</p> <p>Y5V: ≤7.5%</p> <p>I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.</p>                                |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                                                         |
| 15.  | High Temperature Load (Endurance) | <p>* Test temp.:</p> <p>NP0, X7R: 125±3°C</p> <p>Y5V: 85±3°C</p> <p>* To apply voltage:</p> <p>(1) 1206/NP0 (3kV) ≥1.5pF: 100% of rated voltage.</p> <p>(2) 200V~300V: 200% of rated voltage.</p> <p>(3) 400V~450V: 120% of rated voltage.</p> <p>(4) 500V: 150% of rated voltage.</p> <p>(5) 630V~3000V: 120% of rated voltage.</p> <p>(6) 4000V: 110% of rated voltage.</p> <p>* Test time: 1000+24/-0 hrs.</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p>                                                        | <p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±3.0% or ±0.3pF whichever is larger.</p> <p>X7R: within ±12.5%</p> <p>Y5V: within ±30%</p> <p>* Q/D.F. value:</p> <p>NP0: Cap≥30pF, Q≥350<br/>10pF≤Cap&lt;30pF, Q≥275+2.5C<br/>Cap&lt;10pF, Q≥200+10C</p> <p>X7R: ≤3.0%</p> <p>Y5V: ≤7.5%</p> <p>I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</p> |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                                                         |

Multilayer Ceramic Capacitors

**APPENDIXES**

▣ Tape & reel dimensions



Fig. 2 The dimension of paper tape



Fig. 3 The dimension of plastic tape

| Size              | 0201             | 0402             | 0603             | 0805             |                  |                  | 1206             |                  | 1210             |                  |                  | 1808             | 1812             |                  |                  |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Thickness         | L                | N,E              | S,H,X            | A,H              | B,T              | D,I              | B,T              | C,J,D            | G,P              | T                | C,D,G,K          | M                | D,F,G,K          | D,F,G,K          | M,U              |
| A <sub>0</sub>    | 0.40<br>+/-0.10  | 0.70<br>+/-0.20  | 1.05<br>+/-0.30  | 1.50<br>+/-0.20  | 1.50<br>+/-0.20  | < 1.80           | 1.90<br>+/-0.50  | < 2.00           | < 2.30           | < 3.05           | < 3.05           | < 3.20           | < 2.50           | < 3.90           | < 3.90           |
| B <sub>0</sub>    | 0.70<br>+/-0.10  | 1.20<br>+/-0.20  | 1.80<br>+/-0.30  | 2.30<br>+/-0.20  | 2.30<br>+/-0.20  | < 2.70           | 3.50<br>+/-0.50  | < 3.70           | < 4.00           | < 3.80           | < 3.80           | < 4.00           | < 5.30           | < 5.30           | < 5.30           |
| T                 | ≤ 0.55           | ≤ 0.80           | ≤ 1.20           | ≤ 1.15           | ≤ 1.20           | 0.23<br>+/-0.1   | ≤ 1.20           | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.23<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   |
| K <sub>0</sub>    | -                | -                | -                | -                | -                | < 2.50           | -                | < 2.50           | < 2.50           | < 1.50           | < 2.50           | < 3.20           | < 2.50           | < 2.50           | < 3.50           |
| W                 | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 |
| P <sub>0</sub>    | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  |
| 10xP <sub>0</sub> | 40.00<br>+/-0.10 | 40.00<br>+/-0.10 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 |
| P <sub>1</sub>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  |
| P <sub>2</sub>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  |
| D <sub>0</sub>    | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  |
| D <sub>1</sub>    | -                | -                | -                | -                | -                | 1.00<br>+/-0.10  | -                | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  |
| E                 | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  |
| F                 | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  |



Fig. 4 The dimension of reel

| Size           | 0402, 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±1.0                    | 250.0±1.0     | 330.0±1.0     | 178.0±1.0     |
| N              | 60.0+1.0/-0                  | 100.0±1.0     | 100±1.0       | 60.0+1.0/-0   |

Multilayer Ceramic Capacitors

☐ Description of customer label



- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

☐ Constructions

| No. | Name             | NPO                      | X7R, Y5V                 |
|-----|------------------|--------------------------|--------------------------|
| ①   | Ceramic material | CaZrO <sub>3</sub> based | BaTiO <sub>3</sub> based |
| ②   | Inner electrode  | Ni                       |                          |
| ③   | Termination      | Inner layer              | Cu                       |
| ④   |                  | Middle layer             | Ni                       |
| ⑤   |                  | Outer layer              | Sn                       |



Fig. 5 The construction of MLCC

☐ Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

Multilayer Ceramic Capacitors

Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N<sub>2</sub> within oven are recommended.



Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.



Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А