

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

### Soft Termination Series

(SH\_6.3V to 4000V)

NP0, X7R & X5R Dielectrics

0402 to 2225 Sizes

Halogen Free & RoHS Compliance

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

## 1. INTRODUCTION

WTC soft termination series MLCC is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.

## 2. FEATURES

- MLCC's termination are with a soft & flexible polymer layer to withstand high bending stress in SMT line.
- Available for any item in standard series range.

## 3. APPLICATIONS

- Power supply and related industries.
- Lighting industry.
- The other mechanical stress concerned products.

## 4. HOW TO ORDER

| <u>SH</u>           | <u>31</u>                                                                                                                                                                        | <u>B</u>                      | <u>104</u>                                                                                                                   | <u>K</u>                                                                         | <u>500</u>                                                                                                                                                                                                                                                                                                                                                               | <u>C</u>            | <u>I</u>                    |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------|
| <u>Series</u>       | <u>Size</u>                                                                                                                                                                      | <u>Dielectric</u>             | <u>Capacitance</u>                                                                                                           | <u>Tolerance</u>                                                                 | <u>Rated voltage</u>                                                                                                                                                                                                                                                                                                                                                     | <u>Termination</u>  | <u>Packaging</u>            |
| SH=Soft termination | 15=0402 (1005)<br>18=0603 (1608)<br>21=0805 (2012)<br>31=1206 (3216)<br>32=1210 (3225)<br>42=1808 (4520)<br>43=1812 (4532)<br>46=1825 (4563)<br>55=2220 (5750)<br>56=2225 (5763) | N=NP0 (C0G)<br>B=X7R<br>X=X5R | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br>Eg.<br>104=10x10 <sup>4</sup> =100nF | B=±0.1pF<br>C=±0.25pF<br>D=±0.5pF<br>F=±1%<br>G=±2%<br>J=±5%<br>K=±10%<br>M=±20% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>6R3=6.3 VDC<br>100=10 VDC<br>160=16 VDC<br>250=25 VDC<br>500=50 VDC<br>101=100 VDC<br>201=200 VDC<br>251=250 VDC<br>401=400 VDC<br>451=450 VDC<br>501=500 VDC<br>631=630 VDC<br>102=1000 VDC<br>152=1500 VDC<br>202=2000 VDC<br>252=2500 VDC<br>302=3000 VDC<br>402=4000 VDC | C=Ag Polymer /Ni/Sn | T=7" reeled<br>G=13" reeled |

## 5. EXTERNAL DIMENSIONS & CONSTRUCTIONS

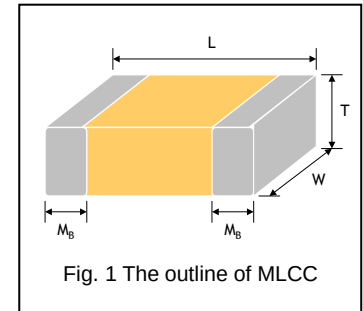
| Size<br>Inch (mm) | L (mm)                       | W (mm)    | T (mm)/Symbol | Remark | M <sub>B</sub> (mm)       |
|-------------------|------------------------------|-----------|---------------|--------|---------------------------|
| 0402 (1005)       | 1.00±0.20                    | 0.50±0.20 | 0.50±0.20     | E #    | 0.25<br>+0.05/-0.10       |
| 0603 (1608)       | 1.60±0.20                    | 0.80±0.10 | 0.80±0.07     | S      | 0.40±0.15                 |
|                   | 1.60±0.30                    | 0.80±0.30 | 0.80±0.30     | X      |                           |
| 0805 (2012)       | 2.00±0.20                    | 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±0.30                    | 1.25±0.30 | 1.25±0.30     | I #    |                           |
| 1206 (3216)       | 3.20+0.4/-0.1                | 1.60±0.15 | 0.80±0.10     | B      | 0.60±0.20<br>(0.50±0.25)* |
|                   |                              |           | 0.95±0.10     | C      |                           |
|                   |                              |           | 1.15±0.15     | J      |                           |
|                   |                              |           | 1.25±0.10     | D      |                           |
|                   | 3.20+0.4/-0.1<br>3.30±0.30#2 | 1.60±0.20 | 1.60±0.20     | G      |                           |
|                   |                              |           | 1.60±0.50     | P      |                           |
| 1210 (3225)       | 3.20±0.40                    | 2.50±0.20 | 0.95±0.10     | C      | 0.75±0.25                 |
|                   |                              |           | 1.25±0.10     | D      |                           |
|                   | 3.20±0.60                    | 2.50±0.50 | 1.60±0.20     | G      |                           |
|                   |                              |           | 2.00±0.20     | K      |                           |
|                   |                              |           | 2.50±0.50     | M      |                           |
|                   |                              |           | 2.50±0.30#1   | M      |                           |
| 1808 (4520)       | 4.50+0.6/-0.4                | 2.03±0.25 | 1.25±0.10     | D      | 0.50±0.25                 |
|                   |                              |           | 2.00±0.20     | K      |                           |
| 1812 (4532)       | 4.50+0.6/-0.4                | 3.20±0.30 | 0.95±0.10     | C      | 0.75±0.25<br>(0.50±0.25)* |
|                   |                              |           | 1.25±0.10     | D      |                           |
|                   |                              |           | 1.60±0.20     | G      |                           |
|                   |                              |           | 2.00±0.20     | K      |                           |
|                   |                              | 3.20±0.40 | 2.50±0.50     | M      |                           |
|                   |                              |           | 2.80±0.30     | U      |                           |
|                   |                              |           | 3.10±0.30     | R      |                           |
|                   |                              |           |               |        |                           |
| 1825 (4563)       | 4.50+0.6/-0.4                | 6.30±0.40 | 2.00±0.20 (K) | #      | 0.75±0.35                 |
| 2220 (5750)       | 5.70±0.50                    | 5.00±0.40 | 2.50±0.30 (M) | #      | 0.85±0.35                 |
| 2225 (5763)       | 5.70±0.50                    | 6.30±0.40 | 2.80±0.30 (U) | #      | 0.85±0.35                 |
|                   |                              |           | 3.10±0.30 (R) | #      |                           |

# Reflow soldering only is recommended.

\* For 1206 ≥ 1000V, 1808/1812 200V~4000V products. Excluding: 1206B183~223/1000V

#1 For 1210N563 to 1210N104/200V~250V

#2 For 1206B183~223/1000V



## 6. GENERAL ELECTRICAL DATA

|                            |                                                                                                                                                                                                 |                    |                 |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|
| Dielectric                 | NP0                                                                                                                                                                                             | X7R                | X5R             |
| Size                       | 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225                                                                                                                                      |                    |                 |
| Capacitance range*         | 0.1pF to 0.1μF                                                                                                                                                                                  | 100pF to 47μF      | 0.033μF to 10μF |
| Capacitance tolerance**    | Cap≤5pF <sup>#1</sup> :<br>B (±0.1pF), C (±0.25pF)<br>5pF<Cap<10pF <sup>#1</sup> :<br>A (±0.05pF),B (±0.1pF) ,<br>C (±0.25pF),D (±0.5pF)<br>Cap≥10pF:<br>F (±1%), G (±2%),<br>J (±5%), K (±10%) | K (±10%), M (±20%) |                 |
| Rated voltage (WVDC)       | 6.3V to 4000V                                                                                                                                                                                   |                    |                 |
| Operating temperature      | -55 to +125°C                                                                                                                                                                                   | -55 to +125°C      | -55 to +85°C    |
| Capacitance characteristic | ±30ppm                                                                                                                                                                                          | ±15%               | ±15%            |
| Termination                | Ni/Sn (lead-free termination)                                                                                                                                                                   |                    |                 |

#1: NP0, 0.1pF and 5pF < Cap < 10pF products need to check with sales if it can supply A (±0.05pF).

\* 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.

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

## 7. CAPACITANCE RANGE (NP0 Dielectric)

NP0 Dielectric 0402, 0603 Sizes

| DIELECTRIC          |             | NP0  |    |    |    |     |      |    |    |    |     |     |     |
|---------------------|-------------|------|----|----|----|-----|------|----|----|----|-----|-----|-----|
| SIZE                |             | 0402 |    |    |    |     | 0603 |    |    |    |     |     |     |
| RATED VOLTAGE (VDC) |             | 10   | 16 | 25 | 50 | 100 | 10   | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance         | 0.1pF (0R1) | E    | E  | E  | E  |     |      |    |    |    |     |     |     |
|                     | 0.2pF (0R2) | E    | E  | E  | E  |     |      |    |    |    |     |     |     |
|                     | 0.3pF (0R3) | E    | E  | E  | E  |     | S    | S  | S  | S  |     |     |     |
|                     | 0.4pF (0R4) | E    | E  | E  | E  |     | S    | S  | S  | S  |     |     |     |
|                     | 0.5pF (0R5) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 0.6pF (0R6) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 0.7pF (0R7) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 0.8pF (0R8) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 0.9pF (0R9) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 1.0pF (1R0) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 1.2pF (1R2) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 1.5pF (1R5) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 1.8pF (1R8) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 2.2pF (2R2) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 2.7pF (2R7) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 3.3pF (3R3) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 3.9pF (3R9) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 4.7pF (4R7) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 5.6pF (5R6) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 6.8pF (6R8) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 8.2pF (8R2) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 10pF (100)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 12pF (120)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 15pF (150)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 18pF (180)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 22pF (220)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 27pF (270)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 33pF (330)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 39pF (390)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 47pF (470)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 56pF (560)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 68pF (680)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 82pF (820)  | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 100pF (101) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 120pF (121) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 150pF (151) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 180pF (181) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 220pF (221) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | S   | S   |
|                     | 270pF (271) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | X   | X   |
|                     | 330pF (331) | E    | E  | E  | E  | E   | S    | S  | S  | S  | S   | X   | X   |
| 390pF (391)         | E           | E    | E  | E  | E  | S   | S    | S  | S  | S  | X   | X   |     |
| 470pF (471)         | E           | E    | E  | E  | E  | S   | S    | S  | S  | S  | X   | X   |     |
| 560pF (561)         | E           | E    | E  | E  | E  | S   | S    | S  | S  | S  |     |     |     |
| 680pF (681)         | E           | E    | E  | E  | E  | S   | S    | S  | S  | S  |     |     |     |
| 820pF (821)         | E           | E    | E  | E  | E  | S   | S    | S  | S  | S  |     |     |     |
| 1,000pF (102)       | E           | E    | E  | E  | E  | S   | S    | S  | S  | S  |     |     |     |
| 1,200pF (122)       |             |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 1,500pF (152)       |             |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 1,800pF (182)       |             |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 2,200pF (222)       |             |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 2,700pF (272)       |             |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 3,300pF (332)       |             |      |    |    |    | X   | X    | X  | X  |    |     |     |     |
| 3,900pF (392)       |             |      |    |    |    |     |      |    |    |    |     |     |     |
| 4,700pF (472)       |             |      |    |    |    |     |      |    |    |    |     |     |     |
| 5,600pF (562)       |             |      |    |    |    |     |      |    |    |    |     |     |     |
| 6,800pF (682)       |             |      |    |    |    |     |      |    |    |    |     |     |     |
| 8,200pF (822)       |             |      |    |    |    |     |      |    |    |    |     |     |     |
| 0.010uF (103)       |             |      |    |    |    |     |      |    |    |    |     |     |     |
| 0.012uF (123)       |             |      |    |    |    |     |      |    |    |    |     |     |     |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 0805 Size

| DIELECTRIC          |               | NP0  |    |    |    |     |     |     |     |     |      |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|-----|------|
| SIZE                |               | 0805 |    |    |    |     |     |     |     |     |      |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance         | 0.5pF (0R5)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 0.6pF (0R6)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 0.7pF (0R7)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 0.8pF (0R8)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 0.9pF (0R9)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 1.0pF (1R0)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 1.2pF (1R2)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 1.5pF (1R5)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 1.8pF (1R8)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 2.2pF (2R2)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 2.7pF (2R7)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 3.3pF (3R3)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 3.9pF (3R9)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 4.7pF (4R7)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 5.6pF (5R6)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 6.8pF (6R8)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 8.2pF (8R2)   | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 10pF (100)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 12pF (120)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 15pF (150)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 18pF (180)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 22pF (220)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 27pF (270)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 33pF (330)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 39pF (390)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 47pF (470)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 56pF (560)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 68pF (680)    | A    | A  | A  | A  | A   | A   | A   | A   | A   | D    |
|                     | 82pF (820)    | A    | A  | A  | A  | A   | A   | A   | B   | B   | D    |
|                     | 100pF (101)   | A    | A  | A  | A  | A   | A   | B   | B   | B   | D    |
|                     | 120pF (121)   | A    | A  | A  | A  | A   | A   | B   | D   | D   | D    |
|                     | 150pF (151)   | A    | A  | A  | A  | A   | B   | D   | D   | D   | D    |
|                     | 180pF (181)   | A    | A  | A  | A  | A   | B   | D   | D   | D   | D    |
|                     | 220pF (221)   | A    | A  | A  | A  | A   | D   | D   | D   | D   | D    |
|                     | 270pF (271)   | A    | A  | A  | A  | A   | D   | D   | D   | D   | D    |
|                     | 330pF (331)   | A    | A  | A  | A  | A   | D   | D   | D   | D   | D    |
|                     | 390pF (391)   | B    | B  | B  | B  | B   | D   | D   | D   | D   | D    |
|                     | 470pF (471)   | B    | B  | B  | B  | B   | D   | D   | I   | I   |      |
|                     | 560pF (561)   | B    | B  | B  | B  | B   | D   | D   | I   | I   |      |
|                     | 680pF (681)   | B    | B  | B  | B  | B   | D   | D   | I   | I   |      |
|                     | 820pF (821)   | B    | B  | B  | B  | B   | D   | D   | I   | I   |      |
|                     | 1,000pF (102) | B    | B  | B  | B  | B   | D   | D   | I   | I   |      |
|                     | 1,200pF (122) | B    | B  | B  | B  | B   | D   | D   |     |     |      |
|                     | 1,500pF (152) | B    | B  | B  | B  | B   | D   | D   |     |     |      |
|                     | 1,800pF (182) | B    | B  | B  | B  | B   | D   | D   |     |     |      |
|                     | 2,200pF (222) | B    | B  | B  | B  | B   | D   | D   |     |     |      |
|                     | 2,700pF (272) | D    | D  | D  | D  | D   |     |     |     |     |      |
|                     | 3,300pF (332) | D    | D  | D  | D  | D   |     |     |     |     |      |
|                     | 3,900pF (392) | D    | D  | D  | D  | D   |     |     |     |     |      |
|                     | 4,700pF (472) | D    | D  | D  | D  | D   |     |     |     |     |      |
|                     | 5,600pF (562) | D    | D  | D  | D  | D   |     |     |     |     |      |
|                     | 6,800pF (682) | D    | D  | D  | D  | D   |     |     |     |     |      |
|                     | 8,200pF (822) | D    | D  | D  | D  |     |     |     |     |     |      |
|                     | 0.010μF (103) | D    | D  | D  | D  |     |     |     |     |     |      |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1206 Size

| DIELECTRIC          |               | NP0  |    |    |    |     |     |     |     |     |      |      |      |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|-----|------|------|------|
| SIZE                |               | 1206 |    |    |    |     |     |     |     |     |      |      |      |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 | 1500 | 2000 |
| Capacitance         | 1.0pF (1R0)   |      |    |    |    |     |     |     |     |     |      |      |      |
|                     | 1.2pF (1R2)   | B    | B  | B  | B  | B   |     |     |     |     |      |      |      |
|                     | 1.5pF (1R5)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 1.8pF (1R8)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 2.2pF (2R2)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 2.7pF (2R7)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 3.3pF (3R3)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 3.9pF (3R9)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 4.7pF (4R7)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 5.6pF (5R6)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 6.8pF (6R8)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 8.2pF (8R2)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 10pF (100)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 12pF (120)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 15pF (150)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 18pF (180)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 22pF (220)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 27pF (270)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | B    | B    |
|                     | 33pF (330)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | C    | C    |
|                     | 39pF (390)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | B    | C    | C    |
|                     | 47pF (470)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | C    | C    | C    |
|                     | 56pF (560)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | C    | D    | D    |
|                     | 68pF (680)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | C    | D    | D    |
|                     | 82pF (820)    | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    | D    | D    |
|                     | 100pF (101)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    | D    | D    |
|                     | 120pF (121)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    | G    | G    |
|                     | 150pF (151)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    | G    | G    |
|                     | 180pF (181)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | D    | G    | G    |
|                     | 220pF (221)   | B    | B  | B  | B  | B   | B   | B   | B   | B   | G    | G    | G    |
|                     | 270pF (271)   | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    | P    | P    |
|                     | 330pF (331)   | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    | P    | P    |
|                     | 390pF (391)   | B    | B  | B  | B  | B   | B   | C   | C   | C   | G    | P    | P    |
|                     | 470pF (471)   | B    | B  | B  | B  | B   | C   | C   | C   | C   | G    |      |      |
|                     | 560pF (561)   | B    | B  | B  | B  | B   | C   | D   | D   | D   | G    |      |      |
|                     | 680pF (681)   | B    | B  | B  | B  | B   | C   | D   | D   | D   | G    |      |      |
|                     | 820pF (821)   | B    | B  | B  | B  | B   | C   | G   | G   | G   | G    |      |      |
|                     | 1,000pF (102) | B    | B  | B  | B  | B   | C   | G   | G   | G   | G    |      |      |
|                     | 1,200pF (122) | B    | B  | B  | B  | B   | C   | G   | G   | G   | G    |      |      |
|                     | 1,500pF (152) | B    | B  | B  | B  | B   | D   | G   | G   | G   | G    |      |      |
|                     | 1,800pF (182) | B    | B  | B  | B  | B   | D   | G   | G   | G   | G    |      |      |
|                     | 2,200pF (222) | B    | B  | B  | B  | B   | D   | G   | G   | G   | G    |      |      |
|                     | 2,700pF (272) | B    | B  | B  | B  | B   | D   | G   | G   | G   | G    |      |      |
|                     | 3,300pF (332) | B    | B  | B  | B  | B   | D   | G   | G   | G   | G    |      |      |
|                     | 3,900pF (392) | B    | B  | B  | B  | B   | D   | G   | G   | G   | G    |      |      |
|                     | 4,700pF (472) | B    | B  | B  | B  | B   | D   | G   | P   | P   |      |      |      |
|                     | 5,600pF (562) | B    | B  | B  | B  | B   |     |     | P   | P   |      |      |      |
|                     | 6,800pF (682) | C    | C  | C  | C  | C   |     |     | P   | P   |      |      |      |
|                     | 8,200pF (822) | D    | D  | D  | D  | D   |     |     | P   | P   |      |      |      |
|                     | 0.010μF (103) | D    | D  | D  | D  | D   |     |     | P   | P   |      |      |      |
|                     | 0.012μF (123) | P    | P  | P  | P  | P   |     |     |     |     |      |      |      |
|                     | 0.015μF (153) | P    | P  | P  | P  | P   |     |     |     |     |      |      |      |
|                     | 0.018μF (183) | P    | P  | P  | P  | P   |     |     |     |     |      |      |      |
|                     | 0.022μF (223) | P    | P  | P  | P  | P   |     |     |     |     |      |      |      |
|                     | 0.027μF (273) | P    | P  | P  | P  |     |     |     |     |     |      |      |      |
|                     | 0.033μF (333) | P    | P  | P  | P  |     |     |     |     |     |      |      |      |
|                     | 0.039μF (393) | P    | P  | P  | P  |     |     |     |     |     |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1210 Size

| DIELECTRIC          |               | NP0  |    |    |    |     |     |     |     |     |      |      |      |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|-----|------|------|------|
| SIZE                |               | 1210 |    |    |    |     |     |     |     |     |      |      |      |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 | 1500 | 2000 |
| Capacitance         | 10pF (100)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 12pF (120)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 15pF (150)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 18pF (180)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 22pF (220)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 27pF (270)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 33pF (330)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 39pF (390)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 47pF (470)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | C    | C    |
|                     | 56pF (560)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | D    | D    |
|                     | 68pF (680)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | D    | D    |
|                     | 82pF (820)    | C    | C  | C  | C  | C   | C   | C   | C   | C   | C    | D    | D    |
|                     | 100pF (101)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    | D    | D    |
|                     | 120pF (121)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    | D    | D    |
|                     | 150pF (151)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    | G    | G    |
|                     | 180pF (181)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | D    | G    | G    |
|                     | 220pF (221)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    | G    | G    |
|                     | 270pF (271)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    | K    | K    |
|                     | 330pF (331)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    | K    | K    |
|                     | 390pF (391)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    | M    | M    |
|                     | 470pF (471)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    | M    | M    |
|                     | 560pF (561)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |      |      |
|                     | 680pF (681)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |      |      |
|                     | 820pF (821)   | C    | C  | C  | C  | C   | C   | C   | C   | C   | G    |      |      |
|                     | 1,000pF (102) | C    | C  | C  | C  | C   | D   | D   | D   | D   | G    |      |      |
|                     | 1,200pF (122) | C    | C  | C  | C  | C   | D   | D   | D   | D   | G    |      |      |
|                     | 1,500pF (152) | C    | C  | C  | C  | C   | D   | D   | D   | D   | K    |      |      |
|                     | 1,800pF (182) | C    | C  | C  | C  | C   | D   | D   | D   | D   | M    |      |      |
|                     | 2,200pF (222) | C    | C  | C  | C  | C   | D   | D   | D   | D   | M    |      |      |
|                     | 2,700pF (272) | C    | C  | C  | C  | C   | D   | D   | D   | D   | M    |      |      |
|                     | 3,300pF (332) | C    | C  | C  | C  | C   | D   | D   | D   | D   | M    |      |      |
|                     | 3,900pF (392) | C    | C  | C  | C  | C   | D   | D   | D   | D   | M    |      |      |
|                     | 4,700pF (472) | C    | C  | C  | C  | C   | G   | G   | G   | G   | M    |      |      |
|                     | 5,600pF (562) | C    | C  | C  | C  | C   | G   | G   | G   | G   | M    |      |      |
|                     | 6,800pF (682) | C    | C  | C  | C  | C   | G   | G   | G   | G   | M    |      |      |
|                     | 8,200pF (822) | C    | C  | C  | C  | C   | G   | G   | G   | G   | M    |      |      |
|                     | 0.010μF (103) | C    | C  | C  | C  | C   | G   | G   | K   | K   | M    |      |      |
|                     | 0.012μF (123) | D    | D  | D  | D  | D   | K   | K   | M   | M   | M    |      |      |
|                     | 0.015μF (153) | D    | D  | D  | D  | D   | K   | K   | M   | M   | M    |      |      |
|                     | 0.018μF (183) | K    | K  | K  | K  | K   | K   | K   | M   | M   | M    |      |      |
|                     | 0.022μF (223) | K    | K  | K  | K  | K   | K   | K   | M   | M   | M    |      |      |
|                     | 0.027μF (273) | K    | K  | K  | K  | K   | K   | K   | M   | M   |      |      |      |
|                     | 0.033μF (333) | K    | K  | K  | K  | K   | K   | K   | M   | M   |      |      |      |
|                     | 0.039μF (393) | K    | K  | K  | K  | K   | K   | K   |     |     |      |      |      |
|                     | 0.047μF (473) | K    | K  | K  | K  | K   | K   | K   |     |     |      |      |      |
|                     | 0.056μF (563) |      |    |    |    |     | M   | M   |     |     |      |      |      |
|                     | 0.068μF (683) |      |    |    |    |     | M   | M   |     |     |      |      |      |
|                     | 0.082μF (823) |      |    |    |    |     | M   | M   |     |     |      |      |      |
|                     | 0.1μF (104)   |      |    |    |    |     | M   | M   |     |     |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.



Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1808 Size

| DIELECTRIC          |               | NP0  |     |      |      |      |      |
|---------------------|---------------|------|-----|------|------|------|------|
| SIZE                |               | 1808 |     |      |      |      |      |
| RATED VOLTAGE (VDC) |               | 500  | 630 | 1000 | 1500 | 2000 | 3000 |
| Capacitance         | 2.0pF (2R0)   |      |     |      |      |      |      |
|                     | 2.2pF (2R2)   | D    | D   | D    | D    | D    | D    |
|                     | 2.7pF (2R7)   | D    | D   | D    | D    | D    | D    |
|                     | 3.3pF (3R3)   | D    | D   | D    | D    | D    | D    |
|                     | 3.9pF (3R9)   | D    | D   | D    | D    | D    | D    |
|                     | 4.7pF (4R7)   | D    | D   | D    | D    | D    | D    |
|                     | 5.6pF (5R6)   | D    | D   | D    | D    | D    | D    |
|                     | 6.8pF (6R8)   | D    | D   | D    | D    | D    | D    |
|                     | 8.2pF (8R2)   | D    | D   | D    | D    | D    | D    |
|                     | 10pF (100)    | D    | D   | D    | D    | D    | D    |
|                     | 12pF (120)    | D    | D   | D    | D    | D    | D    |
|                     | 15pF (150)    | D    | D   | D    | D    | D    | D    |
|                     | 18pF (180)    | D    | D   | D    | D    | D    | D    |
|                     | 22pF (220)    | D    | D   | D    | D    | D    | D    |
|                     | 27pF (270)    | D    | D   | D    | D    | D    | D    |
|                     | 33pF (330)    | D    | D   | D    | D    | D    | D    |
|                     | 39pF (390)    | D    | D   | D    | D    | D    | D    |
|                     | 47pF (470)    | D    | D   | D    | D    | D    | D    |
|                     | 56pF (560)    | D    | D   | D    | D    | D    | D    |
|                     | 68pF (680)    | D    | D   | D    | D    | D    | D    |
|                     | 82pF (820)    | D    | D   | D    | D    | D    | D    |
|                     | 100pF (101)   | D    | D   | D    | D    | D    | K    |
|                     | 120pF (121)   | D    | D   | D    | D    | D    | K    |
|                     | 150pF (151)   | D    | D   | D    | K    | K    | K    |
|                     | 180pF (181)   | D    | D   | D    | K    | K    | K    |
|                     | 220pF (221)   | D    | D   | D    | K    | K    | K    |
|                     | 270pF (271)   | K    | K   | K    | K    | K    | K    |
|                     | 330pF (331)   | K    | K   | K    | K    | K    | K    |
|                     | 390pF (391)   | K    | K   | K    | K    | K    | K    |
|                     | 470pF (471)   | K    | K   | K    | K    | K    | K    |
|                     | 560pF (561)   | K    | K   | K    | K    | K    |      |
|                     | 680pF (681)   | K    | K   | K    | K    | K    |      |
|                     | 820pF (821)   | K    | K   | K    | D    | D    |      |
|                     | 1,000pF (102) | K    | K   | K    | G    | G    |      |
|                     | 1,200pF (122) | K    | K   | G    |      |      |      |
|                     | 1,500pF (152) | K    | K   | G    |      |      |      |
|                     | 1,800pF (182) | K    | K   | K    |      |      |      |
|                     | 2,200pF (222) | K    | K   | K    |      |      |      |
|                     | 2,700pF (272) | K    | K   |      |      |      |      |
|                     | 3,300pF (332) | K    | K   |      |      |      |      |
|                     | 3,900pF (392) |      |     |      |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.



Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1812 Size

| DIELECTRIC          |               | NP0  |    |    |    |     |     |     |     |     |      |      |      |      |                |
|---------------------|---------------|------|----|----|----|-----|-----|-----|-----|-----|------|------|------|------|----------------|
| SIZE                |               | 1812 |    |    |    |     |     |     |     |     |      |      |      |      |                |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 | 1500 | 2000 | 3000 | 4000           |
| Capacitance         | 10pF (100)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 12pF (120)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 15pF (150)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 18pF (180)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 22pF (220)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 27pF (270)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 33pF (330)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | D <sup>+</sup> |
|                     | 39pF (390)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | D <sup>+</sup> |
|                     | 47pF (470)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | G <sup>+</sup> |
|                     | 56pF (560)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | G <sup>+</sup> |
|                     | 68pF (680)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | K <sup>+</sup> |
|                     | 82pF (820)    | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | K <sup>+</sup> |
|                     | 100pF (101)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | K <sup>+</sup> |
|                     | 120pF (121)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | M <sup>+</sup> |
|                     | 150pF (151)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    |                |
|                     | 180pF (181)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | K              |
|                     | 220pF (221)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | D    | K              |
|                     | 270pF (271)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | K    | K    | K    |                |
|                     | 330pF (331)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | K    | K    | K    |                |
|                     | 390pF (391)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | K    | K    | K    |                |
|                     | 470pF (471)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    | K    | K    | K    |                |
|                     | 560pF (561)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    | K    | K    | G    |                |
|                     | 680pF (681)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    | K    | K    | K    |                |
|                     | 820pF (821)   | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    | K    | K    | M    |                |
|                     | 1,000pF (102) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    | K    | K    | M    |                |
|                     | 1,200pF (122) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    |      | K    | U    |                |
|                     | 1,500pF (152) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    |      | K    |      |                |
|                     | 1,800pF (182) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    |      | K    |      |                |
|                     | 2,200pF (222) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    |      | K    |      |                |
|                     | 2,700pF (272) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    |      | M    |      |                |
|                     | 3,300pF (332) | D    | D  | D  | D  | D   | D   | D   | D   | D   | K    |      | M    |      |                |
|                     | 3,900pF (392) | D    | D  | D  | D  | D   | D   | D   | D   | D   | M    |      |      |      |                |
|                     | 4,700pF (472) | D    | D  | D  | D  | D   | D   | D   | D   | D   | M    |      |      |      |                |
|                     | 5,600pF (562) | D    | D  | D  | D  | D   | D   | D   | D   | D   | M    |      |      |      |                |
|                     | 6,800pF (682) | D    | D  | D  | D  | D   | D   | D   | D   | D   |      |      |      |      |                |
|                     | 8,200pF (822) | D    | D  | D  | D  | D   | C   | C   | D   | D   |      |      |      |      |                |
|                     | 0.010μF (103) | D    | D  | D  | D  | D   | C   | C   | D   | D   |      |      |      |      |                |
|                     | 0.012μF (123) | D    | D  | D  | D  | D   | G   | G   | G   | G   |      |      |      |      |                |
|                     | 0.015μF (153) | D    | D  | D  | D  | D   | G   | G   | G   | G   |      |      |      |      |                |
|                     | 0.018μF (183) | D    | D  | D  | D  | D   | K   | K   | K   | K   |      |      |      |      |                |
|                     | 0.022μF (223) | D    | D  | D  | D  | D   | K   | K   | K   | K   |      |      |      |      |                |
|                     | 0.027μF (273) | D    | D  | D  | D  | D   | M   | M   | K   | K   |      |      |      |      |                |
|                     | 0.033μF (333) | D    | D  | D  | D  | D   | M   | M   | M   | M   |      |      |      |      |                |
|                     | 0.039μF (393) |      |    |    |    |     | M   | M   | M   | M   |      |      |      |      |                |
|                     | 0.047μF (473) |      |    |    |    |     | M   | M   | U   | U   |      |      |      |      |                |
|                     | 0.056μF (563) |      |    |    |    |     | M   | M   |     |     |      |      |      |      |                |
|                     | 0.068μF (683) |      |    |    |    |     | M   | M   |     |     |      |      |      |      |                |
|                     | 0.082μF (823) |      |    |    |    |     | U   | U   |     |     |      |      |      |      |                |
|                     | 0.1μF (104)   |      |    |    |    |     | R   | R   |     |     |      |      |      |      |                |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.
3. "+" mark only supply "surface coating" products

Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1825 to 2225 Sizes

| DIELECTRIC          |               | NP0  |     |     |      |      |      |      |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
|---------------------|---------------|------|-----|-----|------|------|------|------|-----|-----|-----|------|------|------|-----|-----|-----|-----|------|------|------|------|
| SIZE                |               | 1825 |     |     |      |      |      | 2220 |     |     |     |      |      | 2225 |     |     |     |     |      |      |      |      |
| RATED VOLTAGE (VDC) |               | 100  | 200 | 500 | 1000 | 2000 | 3000 | 100  | 200 | 500 | 630 | 1000 | 2000 | 3000 | 100 | 200 | 500 | 630 | 1000 | 2000 | 3000 | 4000 |
| Capacitance         | 10pF (100)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 12pF (120)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 15pF (150)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 18pF (180)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 22pF (220)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 27pF (270)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 33pF (330)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 39pF (390)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 47pF (470)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 56pF (560)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 68pF (680)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 82pF (820)    | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 100pF (101)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    | K    |
|                     | 120pF (121)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    |      |
|                     | 150pF (151)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    |      |
|                     | 180pF (181)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    |      |
|                     | 220pF (221)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    |      |
|                     | 270pF (271)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | K   | K   | K   | K   | K    | K    | K    |      |
|                     | 330pF (331)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | K    |      |
|                     | 390pF (391)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | K    |      |
|                     | 470pF (471)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | K    |      |
|                     | 560pF (561)   | K    | K   | K   | K    | K    | K    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | K    |      |
|                     | 680pF (681)   | K    | K   | K   | K    | K    | M    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | K    |      |
|                     | 820pF (821)   | K    | K   | K   | K    | K    | M    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | M    |      |
|                     | 1,000pF (102) | K    | K   | K   | K    | K    | M    | K    | K   | K   | K   | K    | K    | K    | M   | K   | K   | K   | K    | K    | M    |      |
|                     | 1,200pF (122) | K    | K   | K   | K    | K    |      | K    | K   | K   | K   | M    | M    | M    | M   | K   | K   | K   | K    | K    | M    |      |
|                     | 1,500pF (152) | K    | K   | K   | K    | M    |      | K    | K   | K   | K   | M    | M    | M    | M   | K   | K   | K   | K    | K    | M    |      |
|                     | 1,800pF (182) | K    | K   | K   | K    | M    |      | K    | K   | K   | K   | M    | M    | M    |     | K   | K   | K   | K    | K    | M    |      |
|                     | 2,200pF (222) | K    | K   | K   | K    | M    |      | K    | K   | K   | K   | M    | M    | M    |     | K   | K   | K   | K    | K    | M    |      |
|                     | 2,700pF (272) | K    | K   | K   | K    | M    |      | K    | K   | K   | K   | M    | M    | M    |     | K   | K   | K   | K    | K    | M    |      |
|                     | 3,300pF (332) | K    | K   | K   | K    | M    |      | K    | K   | K   | K   | M    | M    | M    |     | K   | K   | K   | K    | K    | M    |      |
|                     | 3,900pF (392) | K    | K   | K   | M    | M    |      | K    | K   | K   | K   | M    | M    | M    |     | K   | K   | K   | K    | K    | M    |      |
|                     | 4,700pF (472) | K    | K   | K   | M    | M    |      | K    | K   | K   | K   | M    | M    | M    |     | K   | K   | K   | K    | K    | M    |      |
|                     | 5,600pF (562) | K    | K   | K   | M    |      |      | K    | K   | K   | K   | M    | M    |      |     | K   | K   | K   | K    | M    | M    |      |
|                     | 6,800pF (682) | K    | K   | K   | M    |      |      | K    | K   | K   | K   | M    | M    |      |     | K   | K   | K   | K    | M    | M    |      |
|                     | 8,200pF (822) | K    | K   | K   | M    |      |      | K    | K   | K   | K   | M    | M    |      |     | K   | K   | K   | K    | M    | M    |      |
| 0.010uF (103)       | K             | K    | K   | M   |      |      | K    | K    | K   | K   | M   | M    |      |      | K   | K   | K   | K   | M    | M    |      |      |
| 0.012uF (123)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.015uF (153)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.018uF (183)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.022uF (223)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.027uF (273)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.033uF (333)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.039uF (393)       | K             | K    | K   |     |      |      | K    | K    | K   | K   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.047uF (473)       | K             | K    | K   |     |      |      | K    | M    | M   | M   |     |      |      |      | K   | K   | K   | K   |      |      |      |      |
| 0.056uF (563)       | K             | M    | K   |     |      |      | K    | M    | M   | M   |     |      |      |      | K   | M   | M   | M   |      |      |      |      |
| 0.068uF (683)       | K             | M    | K   |     |      |      | K    | M    | U   | U   |     |      |      |      | K   | M   | M   | M   |      |      |      |      |
| 0.082uF (823)       | M             |      |     |     |      |      | M    |      | U   | U   |     |      |      |      | K   | M   | M   |     |      |      |      |      |
| 0.1uF (104)         | M             |      |     |     |      |      | M    |      | U   | U   |     |      |      |      | M   | M   |     |     |      |      |      |      |
| 0.12uF (124)        |               |      |     |     |      |      |      |      |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.15uF (154)        |               |      |     |     |      |      |      |      |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.18uF (184)        |               |      |     |     |      |      |      |      |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.22uF (224)        |               |      |     |     |      |      |      |      |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.27uF (274)        |               |      |     |     |      |      |      |      |     |     |     |      |      |      |     |     |     |     |      |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 7-1. CAPACITANCE RANGE (X7R Dielectric)

0402, 0603 Sizes

| DIELECTRIC          |               | X7R  |    |    |    |     |      |    |    |    |    |     |     |     |
|---------------------|---------------|------|----|----|----|-----|------|----|----|----|----|-----|-----|-----|
| SIZE                |               | 0402 |    |    |    |     | 0603 |    |    |    |    |     |     |     |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 50 | 100 | 6.3  | 10 | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance         | 100pF (101)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 120pF (121)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 150pF (151)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 180pF (181)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 220pF (221)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 270pF (271)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 330pF (331)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 390pF (391)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 470pF (471)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 560pF (561)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 680pF (681)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 820pF (821)   | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 1,000pF (102) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 1,200pF (122) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 1,500pF (152) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 1,800pF (182) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 2,200pF (222) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 2,700pF (272) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 3,300pF (332) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 3,900pF (392) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 4,700pF (472) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 5,600pF (562) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 6,800pF (682) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 8,200pF (822) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 0.010μF (103) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | S   | X   | X   |
|                     | 0.012μF (123) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | X   |     |     |
|                     | 0.015μF (153) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | X   |     |     |
|                     | 0.018μF (183) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | X   |     |     |
|                     | 0.022μF (223) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | X   |     |     |
|                     | 0.027μF (273) | E    | E  | E  | E  | E   |      | S  | S  | S  | S  | X   |     |     |
|                     | 0.033μF (333) | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.039μF (393) | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.047μF (473) | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.056μF (563) | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.068μF (683) | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.082μF (823) | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.10μF (104)  | E    | E  | E  | E  | E   |      | S  | S  | S  | X  | X   |     |     |
|                     | 0.12μF (124)  |      |    |    |    |     |      | S  | S  | X  |    |     |     |     |
|                     | 0.15μF (154)  |      |    |    |    |     |      | S  | S  | X  |    |     |     |     |
|                     | 0.18μF (184)  |      |    |    |    |     |      | S  | S  | X  |    |     |     |     |
|                     | 0.22μF (224)  |      |    |    |    |     |      | S  | S  | X  | X  |     |     |     |
|                     | 0.27μF (274)  |      |    |    |    |     | X    | X  | X  | X  |    |     |     |     |
|                     | 0.33μF (334)  |      |    |    |    |     |      | X  | X  | X  | X  |     |     |     |
|                     | 0.39μF (394)  |      |    |    |    |     |      | X  | X  | X  |    |     |     |     |
|                     | 0.47μF (474)  |      |    |    |    |     | X    | X  | X  | X  | X  |     |     |     |
|                     | 0.56μF (564)  |      |    |    |    |     |      | X  | X  |    |    |     |     |     |
|                     | 0.68μF (684)  |      |    |    |    |     | X    | X  | X  |    |    |     |     |     |
|                     | 0.82μF (824)  |      |    |    |    |     |      | X  | X  |    |    |     |     |     |
|                     | 1.0μF (105)   |      |    |    |    |     | X    | X  | X  | X  | X  |     |     |     |
|                     | 1.5μF (155)   |      |    |    |    |     |      |    |    |    |    |     |     |     |
|                     | 2.2μF (225)   |      |    |    |    |     | X    | X  | X  |    |    |     |     |     |
|                     | 4.7μF (475)   |      |    |    |    |     |      |    |    |    |    |     |     |     |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 0805 Size

| DIELECTRIC<br>SIZE     |               | X7R<br>0805 |    |    |    |     |     |     |     |     |      |
|------------------------|---------------|-------------|----|----|----|-----|-----|-----|-----|-----|------|
| RATED VOLTAGE<br>(VDC) |               | 10          | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance            | 100pF (101)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 120pF (121)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 150pF (151)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 180pF (181)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 220pF (221)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 270pF (271)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 330pF (331)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 390pF (391)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 470pF (471)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 560pF (561)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 680pF (681)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 820pF (821)   | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 1,000pF (102) | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 1,200pF (122) | D           | D  | D  | D  | D   | D   | D   | B   | B   | B    |
|                        | 1,500pF (152) | D           | D  | D  | D  | D   | D   | D   | B   | B   | D    |
|                        | 1,800pF (182) | D           | D  | D  | D  | D   | D   | D   | B   | B   | D    |
|                        | 2,200pF (222) | D           | D  | D  | D  | D   | D   | D   | B   | B   | D    |
|                        | 2,700pF (272) | D           | D  | D  | D  | D   | D   | D   | B   | B   |      |
|                        | 3,300pF (332) | D           | D  | D  | D  | D   | D   | D   | B   | B   |      |
|                        | 3,900pF (392) | D           | D  | D  | D  | D   | D   | D   | B   | B   |      |
|                        | 4,700pF (472) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 5,600pF (562) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 6,800pF (682) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 8,200pF (822) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.010μF (103) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.012μF (123) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.015μF (153) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.018μF (183) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.022μF (223) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.027μF (273) | D           | D  | D  | D  | D   | D   | D   | D   | D   |      |
|                        | 0.033μF (333) | D           | D  | D  | D  | D   | D   | D   | D   |     |      |
|                        | 0.039μF (393) | D           | D  | D  | D  | D   | D   | D   |     |     |      |
|                        | 0.047μF (473) | D           | D  | D  | D  | D   | D   | D   |     |     |      |
|                        | 0.056μF (563) | D           | D  | D  | D  | D   | D   | D   |     |     |      |
|                        | 0.068μF (683) | D           | D  | D  | D  | D   | D   | D   |     |     |      |
|                        | 0.082μF (823) | D           | D  | D  | D  | D   | D   |     |     |     |      |
|                        | 0.10μF (104)  | D           | D  | D  | D  | D   | D   |     |     |     |      |
|                        | 0.12μF (124)  | D           | D  | D  | D  | I   |     |     |     |     |      |
|                        | 0.15μF (154)  | D           | D  | D  | D  | I   |     |     |     |     |      |
|                        | 0.18μF (184)  | D           | D  | D  | D  | I   |     |     |     |     |      |
|                        | 0.22μF (224)  | D           | D  | D  | D  | I   |     |     |     |     |      |
|                        | 0.27μF (274)  | I           | I  | I  | I  | I   |     |     |     |     |      |
|                        | 0.33μF (334)  | I           | I  | I  | I  | I   |     |     |     |     |      |
|                        | 0.39μF (394)  | I           | I  | I  | I  | I   |     |     |     |     |      |
|                        | 0.47μF (474)  | I           | I  | I  | I  | I   |     |     |     |     |      |
|                        | 0.56μF (564)  | I           | I  | I  |    |     |     |     |     |     |      |
|                        | 0.68μF (684)  | I           | I  | I  |    |     |     |     |     |     |      |
|                        | 0.82μF (824)  | I           | I  | I  |    |     |     |     |     |     |      |
|                        | 1.0μF (105)   | I           | I  | I  | I  |     |     |     |     |     |      |
|                        | 1.5μF (155)   | I           | I  | I  |    |     |     |     |     |     |      |
|                        | 2.2μF (225)   | I           | I  | I  |    |     |     |     |     |     |      |
|                        | 4.7μF (475)   | I           | I  | I  |    |     |     |     |     |     |      |
|                        | 10μF (106)    | I           |    |    |    |     |     |     |     |     |      |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1206 Size

| DIELECTRIC          |               | X7R  |    |    |    |    |     |     |     |     |     |     |     |      |      |      |
|---------------------|---------------|------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| SIZE                |               | 1206 |    |    |    |    |     |     |     |     |     |     |     |      |      |      |
| RATED VOLTAGE (VDC) |               | 10   | 16 | 25 | 35 | 50 | 100 | 200 | 250 | 400 | 450 | 500 | 630 | 1000 | 1500 | 2000 |
| Capacitance         | 100pF (101)   |      |    |    |    |    |     | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 120pF (121)   |      |    |    |    |    |     | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 150pF (151)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 180pF (181)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 220pF (221)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 270pF (271)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 330pF (331)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 390pF (391)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 470pF (471)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 560pF (561)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 680pF (681)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 820pF (821)   | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 1,000pF (102) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | D    | D    |
|                     | 1,200pF (122) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    | G    |
|                     | 1,500pF (152) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    | G    |
|                     | 1,800pF (182) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    | G    |
|                     | 2,200pF (222) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    | G    |
|                     | 2,700pF (272) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    | G    |
|                     | 3,300pF (332) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    | G    |
|                     | 3,900pF (392) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    |      |
|                     | 4,700pF (472) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    |      |
|                     | 5,600pF (562) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    |      |
|                     | 6,800pF (682) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    |      |
|                     | 8,200pF (822) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    |      |
|                     | 0.010μF (103) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | D    | G    |      |
|                     | 0.012μF (123) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | G    |      |      |
|                     | 0.015μF (153) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | G    |      |      |
|                     | 0.018μF (183) | D    | D  | D  |    | D  | D   | D   | D   |     |     | D   | D   | G    |      |      |
|                     | 0.022μF (223) | D    | D  | D  |    | D  | D   | D   | D   |     |     | G   | G   | G    |      |      |
|                     | 0.027μF (273) | D    | D  | D  |    | D  | D   | D   | D   |     |     | G   | G   |      |      |      |
|                     | 0.033μF (333) | D    | D  | D  |    | D  | D   | G   | G   |     |     | G   | G   |      |      |      |
|                     | 0.039μF (393) | D    | D  | D  |    | D  | D   | G   | G   |     |     | G   | G   |      |      |      |
|                     | 0.047μF (473) | D    | D  | D  |    | D  | D   | G   | G   |     |     | G   | G   |      |      |      |
|                     | 0.056μF (563) | D    | D  | D  |    | D  | D   | G   | G   |     |     | G   | G   |      |      |      |
|                     | 0.068μF (683) | D    | D  | D  |    | D  | D   | G   | G   | G   | G   |     |     |      |      |      |
|                     | 0.082μF (823) | D    | D  | D  |    | D  | D   | G   | G   | G   | G   |     |     |      |      |      |
|                     | 0.10μF (104)  | D    | D  | D  |    | D  | D   | G   | G   | G   | G   |     |     |      |      |      |
|                     | 0.12μF (124)  | D    | D  | D  |    | D  | D   |     |     |     |     |     |     |      |      |      |
|                     | 0.15μF (154)  | C    | C  | C  |    | C  | G   |     |     |     |     |     |     |      |      |      |
|                     | 0.18μF (184)  | C    | C  | C  |    | C  | G   |     |     |     |     |     |     |      |      |      |
|                     | 0.22μF (224)  | C    | C  | C  |    | C  | G   | G   | G   |     |     |     |     |      |      |      |
|                     | 0.27μF (274)  | C    | C  | C  |    | D  | G   |     |     |     |     |     |     |      |      |      |
|                     | 0.33μF (334)  | C    | C  | C  |    | D  | G   |     |     |     |     |     |     |      |      |      |
|                     | 0.39μF (394)  | C    | C  | J  |    | P  | G   |     |     |     |     |     |     |      |      |      |
|                     | 0.47μF (474)  | J    | J  | J  |    | P  | G   |     |     |     |     |     |     |      |      |      |
|                     | 0.56μF (564)  | J    | J  | J  |    | P  | P   |     |     |     |     |     |     |      |      |      |
|                     | 0.68μF (684)  | J    | J  | J  |    | P  | P   |     |     |     |     |     |     |      |      |      |
| 0.82μF (824)        | J             | J    | J  |    | P  | P  |     |     |     |     |     |     |     |      |      |      |
| 1.0μF (105)         | J             | J    | J  |    | P  | P  |     |     |     |     |     |     |     |      |      |      |
| 1.5μF (155)         | J             | J    | P  |    | P  | P  |     |     |     |     |     |     |     |      |      |      |
| 2.2μF (225)         | J             | J    | P  |    | P  | P  |     |     |     |     |     |     |     |      |      |      |
| 3.3μF (335)         | P             | P    | P  |    | P  |    |     |     |     |     |     |     |     |      |      |      |
| 4.7μF (475)         | P             | P    | P  |    | P  |    |     |     |     |     |     |     |     |      |      |      |
| 10μF (106)          | P             | P    | P  | P  |    |    |     |     |     |     |     |     |     |      |      |      |
| 22μF (226)          | P             |      |    |    |    |    |     |     |     |     |     |     |     |      |      |      |
| 47μF (476)          |               |      |    |    |    |    |     |     |     |     |     |     |     |      |      |      |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1210 Size

| DIELECTRIC          |               | X7R  |    |    |    |    |     |     |     |     |     |     |     |      |      |      |   |
|---------------------|---------------|------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|---|
| SIZE                |               | 1210 |    |    |    |    |     |     |     |     |     |     |     |      |      |      |   |
| RATED VOLTAGE (VDC) |               | 6.3  | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 400 | 450 | 500 | 630 | 1000 | 1500 | 2000 |   |
| Capacitance         | 100pF (101)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 120pF (121)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 150pF (151)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 180pF (181)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 220pF (221)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 270pF (271)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 330pF (331)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 390pF (391)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 470pF (471)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 560pF (561)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 680pF (681)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 820pF (821)   |      |    |    |    |    |     |     |     |     |     | D   | D   | D    | D    | D    |   |
|                     | 1,000pF (102) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | D    | D |
|                     | 1,200pF (122) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | M    | M |
|                     | 1,500pF (152) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | M    | M |
|                     | 1,800pF (182) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | M    | M |
|                     | 2,200pF (222) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | M    | M |
|                     | 2,700pF (272) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | M    | M |
|                     | 3,300pF (332) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | D    | M    | M |
|                     | 3,900pF (392) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    | M    | M |
|                     | 4,700pF (472) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    | M    | M |
|                     | 5,600pF (562) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    | M    | M |
|                     | 6,800pF (682) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    | M    | M |
|                     | 8,200pF (822) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    | M    | M |
|                     | 0.010μF (103) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    | M    | M |
|                     | 0.012μF (123) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    |      |   |
|                     | 0.015μF (153) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    |      |   |
|                     | 0.018μF (183) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    |      |   |
|                     | 0.022μF (223) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | D   | D    | G    |      |   |
|                     | 0.027μF (273) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | G   | G    | G    |      |   |
|                     | 0.033μF (333) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | G   | G    | G    |      |   |
|                     | 0.039μF (393) |      | C  | C  | C  | C  | C   | C   | C   | C   |     |     | G   | G    | K    |      |   |
|                     | 0.047μF (473) |      | C  | C  | C  | C  | C   | C   | D   | D   |     |     | G   | G    | M    |      |   |
|                     | 0.056μF (563) |      | C  | C  | C  | C  | C   | C   | D   | D   |     |     | G   | G    |      |      |   |
|                     | 0.068μF (683) |      | C  | C  | C  | C  | C   | C   | G   | G   |     |     | K   | K    |      |      |   |
|                     | 0.082μF (823) |      | C  | C  | C  | C  | C   | C   | G   | G   |     |     | K   | K    |      |      |   |
|                     | 0.10μF (104)  |      | C  | C  | C  | C  | C   | C   | G   | G   |     |     | K   | K    |      |      |   |
|                     | 0.12μF (124)  |      | C  | C  | C  | C  | C   | C   | G   | G   | M   | M   | M   | M    |      |      |   |
|                     | 0.15μF (154)  |      | C  | C  | C  | C  | C   | D   | M   | M   | M   | M   | M   | M    |      |      |   |
|                     | 0.18μF (184)  |      | C  | C  | C  | C  | C   | D   | M   | M   | M   | M   |     |      |      |      |   |
|                     | 0.22μF (224)  |      | C  | C  | C  | C  | C   | D   | M   | M   | M   | M   |     |      |      |      |   |
|                     | 0.27μF (274)  |      | C  | C  | C  | C  | C   | G   | M   | M   | M   | M   |     |      |      |      |   |
|                     | 0.33μF (334)  |      | C  | C  | C  | C  | D   | G   | M   | M   | M   | M   |     |      |      |      |   |
|                     | 0.39μF (394)  |      | C  | C  | C  | C  | D   | M   | M   | M   |     |     |     |      |      |      |   |
|                     | 0.47μF (474)  |      | C  | C  | C  | C  | D   | M   | M   | M   |     |     |     |      |      |      |   |
|                     | 0.56μF (564)  |      | D  | D  | D  | D  | D   | M   | M   | M   |     |     |     |      |      |      |   |
| 0.68μF (684)        |               | D    | D  | D  | D  | D  | K   | M   | M   |     |     |     |     |      |      |      |   |
| 0.82μF (824)        |               | D    | D  | D  | D  | D  | K   |     |     |     |     |     |     |      |      |      |   |
| 1.0μF (105)         |               | D    | D  | D  | D  | D  | K   |     |     |     |     |     |     |      |      |      |   |
| 1.5μF (155)         |               |      |    | K  | G  | M  | M   |     |     |     |     |     |     |      |      |      |   |
| 2.2μF (225)         |               |      |    | K  | G  | M  | M   |     |     |     |     |     |     |      |      |      |   |
| 3.3μF (335)         |               |      |    | K  | G  | M  |     |     |     |     |     |     |     |      |      |      |   |
| 4.7μF (475)         |               | K    | K  | K  | K  | M  | M   |     |     |     |     |     |     |      |      |      |   |
| 10μF (106)          |               | K    | K  | K  | M  | M  |     |     |     |     |     |     |     |      |      |      |   |
| 22μF (226)          |               | M    | M  | M  |    |    |     |     |     |     |     |     |     |      |      |      |   |
| 47μF (476)          | M             |      |    |    |    |    |     |     |     |     |     |     |     |      |      |      |   |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.



X7R Dielectric 1808, 1812 Sizes

| DIELECTRIC          |               | X7R  |     |      |      |      |              |      |    |    |    |     |     |     |     |     |      |      |      |      |  |
|---------------------|---------------|------|-----|------|------|------|--------------|------|----|----|----|-----|-----|-----|-----|-----|------|------|------|------|--|
| SIZE                |               | 1808 |     |      |      |      |              | 1812 |    |    |    |     |     |     |     |     |      |      |      |      |  |
| RATED VOLTAGE (VDC) |               | 500  | 630 | 1000 | 1500 | 2000 | 2500<br>3000 | 10   | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 | 1500 | 2000 | 3000 |  |
| Capacitance         | 100pF (101)   |      |     |      |      |      |              |      |    |    |    |     |     |     |     |     |      |      |      |      |  |
|                     | 150pF (151)   | D    | D   | D    | D    | D    | D            |      |    |    |    |     |     |     |     |     |      |      |      |      |  |
|                     | 180pF (181)   | D    | D   | D    | D    | D    | D            |      |    |    |    |     |     |     |     |     |      |      |      |      |  |
|                     | 220pF (221)   | D    | D   | D    | D    | D    | D            |      |    |    |    |     |     |     |     |     |      |      |      |      |  |
|                     | 270pF (271)   | D    | D   | D    | D    | D    | D            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 330pF (331)   | D    | D   | D    | D    | D    | K            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 390pF (391)   | D    | D   | D    | D    | D    | K            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 470pF (471)   | D    | D   | D    | D    | D    | K            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 560pF (561)   | D    | D   | D    | D    | D    | K            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 680pF (681)   | D    | D   | D    | D    | D    | K            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 820pF (821)   | D    | D   | D    | D    | D    | K            |      |    |    |    |     | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 1,000pF (102) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 1,200pF (122) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 1,500pF (152) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | D    | K    |  |
|                     | 1,800pF (182) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | G    | M    |  |
|                     | 2,200pF (222) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | G    | M    |  |
|                     | 2,700pF (272) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | G    | M    |  |
|                     | 3,300pF (332) | D    | D   | D    | K    | K    | K            | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | K    | M    |  |
|                     | 3,900pF (392) | D    | D   | D    | K    | K    |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | K    | M    |  |
|                     | 4,700pF (472) | D    | D   | D    | K    | K    |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | K    | M    |  |
|                     | 5,600pF (562) | K    | K   | K    | K    | K    |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | M    | M    |  |
|                     | 6,800pF (682) | K    | K   | K    | K    | K    |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | M    | M    |  |
|                     | 8,200pF (822) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | M    | M    |  |
|                     | 0.010μF (103) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | D    | M    | M    |  |
|                     | 0.012μF (123) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | K    |      |      |  |
|                     | 0.015μF (153) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | K    |      |      |  |
|                     | 0.018μF (183) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | M    |      |      |  |
|                     | 0.022μF (223) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | M    |      |      |  |
|                     | 0.027μF (273) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | M    |      |      |  |
|                     | 0.033μF (333) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | M    |      |      |  |
|                     | 0.039μF (393) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | M    |      |      |  |
|                     | 0.047μF (473) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | D   | D    | M    |      |      |  |
|                     | 0.056μF (563) | K    | K   | K    |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | K   | K    | M    |      |      |  |
|                     | 0.068μF (683) | K    | K   |      |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | K   | K    | M    |      |      |  |
|                     | 0.082μF (823) | K    | K   |      |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | K   | K    | M    |      |      |  |
|                     | 0.10μF (104)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | K   | K    | M    |      |      |  |
|                     | 0.12μF (124)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | D   | D   | D   | M   | M    |      |      |      |  |
|                     | 0.15μF (154)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | K   | K   | M   | M   |      |      |      |      |  |
|                     | 0.18μF (184)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | K   | K   | M   | M   |      |      |      |      |  |
|                     | 0.22μF (224)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | K   | K   | M   | M   |      |      |      |      |  |
|                     | 0.27μF (274)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | K   | K   | M   |     |      |      |      |      |  |
|                     | 0.33μF (334)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | K   | K   | M   |     |      |      |      |      |  |
|                     | 0.39μF (394)  |      |     |      |      |      |              | D    | D  | D  | D  | D   | K   | K   | M   |     |      |      |      |      |  |
|                     | 0.47μF (474)  |      |     |      |      |      |              | D    | D  | D  | D  | K   | K   | K   | M   |     |      |      |      |      |  |
|                     | 0.56μF (564)  |      |     |      |      |      |              | D    | D  | D  | D  | K   | M   | M   |     |     |      |      |      |      |  |
|                     | 0.68μF (684)  |      |     |      |      |      |              | D    | D  | D  | K  | K   | M   | M   |     |     |      |      |      |      |  |
|                     | 0.82μF (824)  |      |     |      |      |      |              | D    | D  | D  | K  | K   | M   | M   |     |     |      |      |      |      |  |
| 1.0μF (105)         |               |      |     |      |      |      | D            | D    | D  | K  | K  | M   | M   |     |     |     |      |      |      |      |  |
| 1.5μF (155)         |               |      |     |      |      |      | D            | D    | D  | K  | K  |     |     |     |     |     |      |      |      |      |  |
| 2.2μF (225)         |               |      |     |      |      |      | G            | G    | G  | M  | M  |     |     |     |     |     |      |      |      |      |  |
| 3.3μF (335)         |               |      |     |      |      |      | K            | K    | K  | K  |    |     |     |     |     |     |      |      |      |      |  |
| 4.7μF (475)         |               |      |     |      |      |      | M            | M    | M  | M  |    |     |     |     |     |     |      |      |      |      |  |
| 6.8μF (685)         |               |      |     |      |      |      | M            | M    | M  | M  |    |     |     |     |     |     |      |      |      |      |  |
| 10μF (106)          |               |      |     |      |      |      | M            | M    | M  | M  |    |     |     |     |     |     |      |      |      |      |  |
| 15μF (156)          |               |      |     |      |      |      | M            | M    | M  |    |    |     |     |     |     |     |      |      |      |      |  |
| 22μF (226)          |               |      |     |      |      |      | M            | M    | M  |    |    |     |     |     |     |     |      |      |      |      |  |
| 47μF (476)          |               |      |     |      |      |      |              |      |    |    |    |     |     |     |     |     |      |      |      |      |  |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.



Multilayer Ceramic Capacitors

Approval Sheet

**X7R Dielectric 1825 to 2225 Sizes**

| DIELECTRIC          |               | X7R  |     |     |      |      |      |      |    |     |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|---------------------|---------------|------|-----|-----|------|------|------|------|----|-----|-----|-----|-----|------|------|------|------|------|-----|------|------|------|------|--|--|
| SIZE                |               | 1825 |     |     |      |      |      | 2220 |    |     |     |     |     |      |      |      |      | 2225 |     |      |      |      |      |  |  |
| RATED VOLTAGE (VDC) |               | 250  | 500 | 630 | 1000 | 2000 | 3000 | 25   | 50 | 100 | 250 | 500 | 630 | 1000 | 1500 | 2000 | 3000 | 500  | 630 | 1000 | 1500 | 2000 | 3000 |  |  |
| Capacitance         | 1,000pF (102) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 1,200pF (122) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 1,500pF (152) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 1,800pF (182) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 2,200pF (222) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 2,700pF (272) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 3,300pF (332) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 3,900pF (392) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 4,700pF (472) | K    | K   | K   | K    | K    | K    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | K    |  |  |
|                     | 5,600pF (562) | K    | K   | K   | K    | K    | M    | K    | K  | K   | K   | K   | K   | K    | K    | K    | K    | K    | K   | K    | K    | K    | M    |  |  |
|                     | 6,800pF (682) | K    | K   | K   | K    | K    | M    | K    | K  | K   | K   | K   | K   | K    | K    | K    | M    | K    | K   | K    | K    | K    | M    |  |  |
|                     | 8,200pF (822) | K    | K   | K   | K    | K    | M    | K    | K  | K   | K   | K   | K   | K    | M    | M    | M    | K    | K   | K    | K    | K    | M    |  |  |
|                     | 0.010μF (103) | K    | K   | K   | K    | K    | M    | K    | K  | K   | K   | K   | K   | K    | M    | M    | M    | K    | K   | K    | K    | K    | M    |  |  |
|                     | 0.012μF (123) | K    | K   | K   | K    | M    | U    | K    | K  | K   | K   | K   | K   | K    | M    | M    | U    | K    | K   | K    | M    | M    | M    |  |  |
|                     | 0.015μF (153) | K    | K   | K   | K    | M    | U    | K    | K  | K   | K   | K   | K   | K    | M    | M    | U    | K    | K   | K    | M    | M    | M    |  |  |
|                     | 0.018μF (183) | K    | K   | K   | K    | M    | U    | K    | K  | K   | K   | K   | K   | K    | U    | U    | U    | K    | K   | K    | M    | M    | U    |  |  |
|                     | 0.022μF (223) | K    | K   | K   | K    | M    |      | K    | K  | K   | K   | K   | K   | K    | U    | U    |      | K    | K   | K    | M    | M    |      |  |  |
|                     | 0.027μF (273) | K    | K   | K   | K    | U    |      | K    | K  | K   | K   | K   | K   | K    | U    | U    |      | K    | K   | K    | M    | M    |      |  |  |
|                     | 0.033μF (333) | K    | K   | K   | K    | U    |      | K    | K  | K   | K   | K   | K   | K    | U    | U    |      | K    | K   | K    | M    | M    |      |  |  |
|                     | 0.039μF (393) | K    | K   | K   | K    | U    |      | K    | K  | K   | K   | K   | K   | K    | U    | U    |      | K    | K   | K    | M    | U    |      |  |  |
|                     | 0.047μF (473) | K    | K   | K   | K    | U    |      | K    | K  | K   | K   | K   | K   | K    | U    | U    |      | K    | K   | K    | M    | U    |      |  |  |
|                     | 0.056μF (563) | K    | K   | K   | K    |      |      | K    | K  | K   | K   | K   | K   | K    | U    | U    |      | K    | K   | K    | M    | U    |      |  |  |
|                     | 0.068μF (683) | K    | K   | K   | K    |      |      | K    | K  | K   | K   | K   | K   | K    |      |      |      | K    | K   | K    | M    |      |      |  |  |
|                     | 0.082μF (823) | K    | K   | K   | M    |      |      | K    | K  | K   | K   | K   | K   | K    |      |      |      | K    | K   | K    | M    |      |      |  |  |
|                     | 0.10μF (104)  | K    | K   | K   | M    |      |      | K    | K  | K   | K   | K   | K   | K    |      |      |      | K    | K   | K    | M    |      |      |  |  |
|                     | 0.12μF (124)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   | M    |      |      |      | K    | K   | U    |      |      |      |  |  |
|                     | 0.15μF (154)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   | U    |      |      |      | K    | K   | U    |      |      |      |  |  |
|                     | 0.18μF (184)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   | U    |      |      |      | K    | K   | U    |      |      |      |  |  |
|                     | 0.22μF (224)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   | U    |      |      |      | K    | K   | U    |      |      |      |  |  |
|                     | 0.27μF (274)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   |      |      |      |      | K    | K   |      |      |      |      |  |  |
|                     | 0.33μF (334)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   |      |      |      |      | K    | K   |      |      |      |      |  |  |
|                     | 0.39μF (394)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   |      |      |      |      | K    | K   |      |      |      |      |  |  |
|                     | 0.47μF (474)  | K    | K   | K   |      |      |      | K    | K  | K   | K   | K   | K   |      |      |      |      | K    | K   |      |      |      |      |  |  |
|                     | 0.56μF (564)  | K    | M   | M   |      |      |      | K    | K  | K   | K   | M   | M   |      |      |      |      | K    | K   |      |      |      |      |  |  |
|                     | 0.68μF (684)  | K    |     |     |      |      |      | K    | K  | K   | K   | M   | M   |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 0.82μF (824)  | K    |     |     |      |      |      | K    | K  | K   | K   | U   | U   |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 1.0μF (105)   | K    |     |     |      |      |      | K    | K  | K   | K   | U   | U   |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 1.5μF (155)   |      |     |     |      |      |      | K    | K  | K   | M   |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 2.2μF (225)   |      |     |     |      |      |      | K    | K  | K   | M   |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 3.3μF (335)   |      |     |     |      |      |      | K    | K  | K   |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 4.7μF (475)   |      |     |     |      |      |      | K    | K  | M   |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 6.8μF (685)   |      |     |     |      |      |      | M    | M  | M   |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 10μF (106)    |      |     |     |      |      |      | M    | M  | M   |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 15μF (156)    |      |     |     |      |      |      | U    | U  | U   |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 22μF (226)    |      |     |     |      |      |      | U    | U  | R   |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |
|                     | 47μF (476)    |      |     |     |      |      |      | R    |    |     |     |     |     |      |      |      |      |      |     |      |      |      |      |  |  |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 7-2. CAPACITANCE RANGE (X5R Dielectric)

| Dielectric    |               | X5R  |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|---------------|---------------|------|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|
| Size          |               | 0402 |    |    |    | 0603 |    |    |    |    | 0805 |    |    |    |    | 1206 |    |    |    |    | 1210 |    |    |    |    |
| Rated Voltage |               | 6.3  | 10 | 16 | 25 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 |
| Capacitance   | 0.033μF (333) |      |    | E  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.047μF (473) |      |    | E  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.068μF (683) |      | E  | E  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.10μF (104)  | E    | E  | E  | E  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.15μF (154)  | E    | E  | E  | E  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.22μF (224)  | E    | E  | E  | E  |      |    | X  | X  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.33μF (334)  | E    | E  |    |    | X    | X  | X  | X  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.47μF (474)  | E    | E  |    |    |      | X  | X  | X  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 0.68μF (684)  | E    | E  |    |    | X    | X  | X  | X  |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |
|               | 1.0μF (105)   | E    | E  |    |    | X    | X  | X  | X  |    |      | I  | I  | I  |    |      |    |    |    |    |      |    |    |    |    |
|               | 1.5μF (155)   |      |    |    |    | X    |    |    |    |    | I    | I  | I  | I  |    |      | J  | J  |    |    |      | K  | K  |    |    |
|               | 2.2μF (225)   |      |    |    |    | X    | X  | X  |    |    | I    | I  | I  | I  |    |      | J  | J  | P  |    |      | K  | K  |    |    |
|               | 3.3μF (335)   |      |    |    |    | X    |    |    |    |    | I    | I  | I  | I  |    |      | P  | P  | P  | P  |      |    |    |    |    |
|               | 4.7μF (475)   |      |    |    |    | X    | X  |    |    |    |      |    |    |    |    | P    | P  | P  | P  |    |      | K  | K  | K  |    |
|               | 6.8uF (685)   |      |    |    |    |      |    |    |    |    |      |    |    |    |    | P    | P  |    |    |    |      |    |    |    |    |
| 10μF (106)    |               |      |    |    |    |      |    |    |    | I  | I    | I  | I  |    | P  | P    | P  | P  |    | K  | K    | K  |    |    |    |
| 22μF (226)    |               |      |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.



## 8. PACKAGING STYLE AND QUANTITY

| Size        | Thickness (mm)/Symbol |   | Paper tape |          | Plastic tape |          |
|-------------|-----------------------|---|------------|----------|--------------|----------|
|             |                       |   | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0402 (1005) | 0.50±0.20             | E | 10k        | -        | -            | -        |
| 0603 (1608) | 0.80±0.07             | S | 4k         | 15k      | -            | -        |
|             | 0.80±0.30             | X | 4k         | 15k      | -            | -        |
| 0805 (2012) | 0.60±0.10             | A | 4k         | 15k      | -            | -        |
|             | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|             | 1.25±0.30             | I | -          | -        | 3k           | 10k      |
| 1206 (3216) | 0.80±0.10             | B | 4k         | 15k      | -            | -        |
|             | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|             | 1.15±0.15             | J | -          | -        | 3k           | 10k      |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|             | 1.60±0.20             | G | -          | -        | 2k           | 10k      |
|             | 1.60±0.50             | P | -          | -        | 2k           | 9k       |
| 1210 (3225) | 0.95±0.10             | C | -          | -        | 3k           | 10k      |
|             | 1.25±0.10             | D | -          | -        | 3k           | 10k      |
|             | 1.60±0.20             | G | -          | -        | 2k           | 8k       |
|             | 2.00±0.20             | K | -          | -        | 1k           | 6k       |
|             | 2.50±0.50             | M | -          | -        | 1k           | 6k       |
| 1808 (4520) | 1.25±0.10             | D | -          | -        | 2k           | 10k      |
|             | 1.60±0.20             | G | -          | -        | 2k           | 8k       |
|             | 2.00±0.20             | K | -          | -        | 1k           | 6k       |
| 1812 (4532) | 1.25±0.10             | D | -          | -        | 1k           | 5k       |
|             | 1.60±0.20             | G | -          | -        | 1k           | 4k       |
|             | 2.00±0.20             | K | -          | -        | 1k           | 3k       |
|             | 2.50±0.50             | M | -          | -        | 0.5k         | 3k       |
|             | 2.80±0.30             | U | -          | -        | 0.5k         | 1.5k     |
|             | 3.10±0.30             | R | -          | -        | 0.5k         | -        |
| 1825 (4563) | 2.00±0.20             | K | -          | -        | 1k           | -        |
| 2220 (5750) | 2.50±0.30             | M | -          | -        | 0.5k         | -        |
| 2225 (5763) | 2.80±0.30             | U | -          | -        | 0.5k         | -        |
|             | 3.10±0.30             | R | -          | -        | -            | 1k       |

Unit: pieces

## 9. 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                     | *Test temp.: Room Temperature.                                                                                                                                                                                                                                                                                                  | * Shall not exceed the limits given in the detailed spec.                                                                                             |                     |                                                                                               |
| 3.   | Q/ D.F.<br>(Dissipation Factor) | *Class I: (NP0)<br>≤1000pF, 1.0±0.2Vrms · 1MHz±10%<br>> 1000pF, 1.0±0.2Vrms · 1KHz±10%<br>Class II: (X7R, X7E, X6S, X5R,X7S)<br>C≤10μF, 1.0±0.2Vrms · 1KHz±10% **<br>C> 10μF, 0.5±0.2Vrms · 120Hz±20%                                                                                                                           | NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C<br>X7R, X5R, X6S, X7S:                                                                                      |                     |                                                                                               |
|      |                                 | Rated vol.                                                                                                                                                                                                                                                                                                                      | D.F.≤                                                                                                                                                 | Exception of D.F. ≤ |                                                                                               |
|      |                                 | ≥ 100V                                                                                                                                                                                                                                                                                                                          | ≤ 2.5%                                                                                                                                                | ≤3%                 | 1206 ≥ 0.47μF                                                                                 |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 3.5%              | 1812 ≥ 4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF                                              |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 5%                | 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series                             |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 10%               | 0805 > 0.22μF; 1210 ≥ 3.3μF                                                                   |
|      |                                 | 50V                                                                                                                                                                                                                                                                                                                             | ≤ 2.5%                                                                                                                                                | ≤3%                 | 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF                                       |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 3.5%              | 1812 ≥ 4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF                                              |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 5%                | 0201 ≥ 0.01μF; 0402≥0.012μF; 1210 ≥ 3.3μF                                                     |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 10%               | 0402 ≥ 0.047μF; 0603>0.1μF; 0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series |
|      |                                 | 35V                                                                                                                                                                                                                                                                                                                             | ≤ 3.5%                                                                                                                                                | ≤ 12.5%             | 1206/X5R=10μF                                                                                 |
|      |                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                       | ≤ 10%               | 0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF                                             |
| 25V  | ≤ 3.5%                          | ≤ 5%                                                                                                                                                                                                                                                                                                                            | 0201 ≥ 0.01μF(0201/X5R=0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*                                                                                              |                     |                                                                                               |
|      |                                 | ≤ 7%                                                                                                                                                                                                                                                                                                                            | 0603 ≥ 0.33μF                                                                                                                                         |                     |                                                                                               |
|      |                                 | ≤ 10%                                                                                                                                                                                                                                                                                                                           | 0201 ≥ 0.1μF(0201/X5R>0.01μF); 0603 ≥ 0.47μF; TT series; 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF(1210/X5R ≥ 10μF)* |                     |                                                                                               |
|      |                                 | ≤ 12.5%                                                                                                                                                                                                                                                                                                                         | 0402 ≥ 0.33μF; 0805/X5R/X6S=10μF                                                                                                                      |                     |                                                                                               |
| 16V  | ≤ 3.5%                          | ≤ 5%                                                                                                                                                                                                                                                                                                                            | 0201 ≥ 0.01μF(0201/X5R=0.01μF); 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF                                              |                     |                                                                                               |
|      |                                 | ≤ 10%                                                                                                                                                                                                                                                                                                                           | 0201 ≥ 0.1μF(0201/X5R>0.01μF; 0201/X7R ≥ 0.022μF); 0402 ≥ 0.22uF(0402/X7R ≥ 0.15μF); 0603>0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series  |                     |                                                                                               |
|      |                                 | ≤ 12.5%                                                                                                                                                                                                                                                                                                                         | 0402/X5R ≥ 1μF; 0402/X6S=1μF; 0805/X5R/X6S=10μF                                                                                                       |                     |                                                                                               |
|      |                                 | ≤ 10%                                                                                                                                                                                                                                                                                                                           | 0201 ≥ 0.012μF; 0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R; TT series                         |                     |                                                                                               |
| 10V  | ≤ 5%                            | ≤ 12.5%                                                                                                                                                                                                                                                                                                                         | 0805/X5R/X6S=10μF                                                                                                                                     |                     |                                                                                               |
|      |                                 | ≤ 15%                                                                                                                                                                                                                                                                                                                           | 0201 ≥ 0.1μF(0201/X5R>0.1μF); 0402 ≥ 1μF; 0603/X5R ≥ 10μF                                                                                             |                     |                                                                                               |
| 6.3V | ≤ 10%                           | ≤ 15%                                                                                                                                                                                                                                                                                                                           | 0201 ≥ 0.1μF(0201/X5R>0.1μF); 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series                          |                     |                                                                                               |
|      |                                 | ≤ 20%                                                                                                                                                                                                                                                                                                                           | 0402 ≥ 2.2μF                                                                                                                                          |                     |                                                                                               |
| 4V   | ≤ 15%                           | ---                                                                                                                                                                                                                                                                                                                             | ---                                                                                                                                                   |                     |                                                                                               |
| 4.   | Dielectric Strength             | *To apply voltage:<br>≤100V: 250% of rated voltage.<br>200V ~ 300V: 200% of rated voltage.<br>400V ~ 450V: 120% of rated voltage.<br>500V ~ 999V: 150% of rated voltage.<br>1000V ~ 3000V: 120% of rated voltage.<br>4000V: 110% of rated voltage.<br><br>*Duration: 1 to 5 sec.<br>*Charge & discharge current less than 50mA. | * No evidence of damage or flash over during test.                                                                                                    |                     |                                                                                               |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

Approval Sheet

| No.                                                                                           | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Test Condition                           | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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| 5.                                                                                            | Insulation Resistance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | *Test temp.: Room Temperature.           | 10GΩ or $RxC \geq 500\Omega \cdot F$ whichever is smaller.                                                                                                                                                                                         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|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | *To apply rated voltage for MAX. 120sec. | Class II (X7R, X7E, X5R,X6S,X7S)                                                                                                                                                                                                                   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|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          | <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R</td><td rowspan="6">10GΩ or <math>RxC \geq 100 \Omega \cdot F</math> whichever is 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TT21&gt;4.7μF</td></tr><tr><td>6.3V: 0201≥0.1μF; 0402≥1μF;0603&gt;4.7μF;0805≥47μF;1206≥10μF;4V:0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr></table> | Rated voltage | Insulation Resistance | All X6S items, All X7S items | RxC≥50 Ω·F. | 100V: 1210≥3.3μF | 50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF | 35V: 0603≥1μF; | 25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF | 16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF | 10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF | 6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;4V:0603≥22μF; 0805≥47μF; 1206≥100μF |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  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| 100V: All X7R                                                                                 | 10GΩ or $RxC \geq 100 \Omega \cdot F$ whichever is smaller.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                          |                                                                                                                                                                                                                                                    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| 50V:0402≥0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 35V:0805≥2.2μF;1206≥2.2μF;1210≥10μF                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 16V: 0201≥0.1μF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥47μF                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 6.3V ; 4V ; TT series; Size≥1812                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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|                                                                                               | <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>All X6S items, All X7S items</td><td rowspan="8">RxC≥50 Ω·F.</td></tr><tr><td>100V: 1210≥3.3μF</td></tr><tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF</td></tr><tr><td>35V: 0603≥1μF;</td></tr><tr><td>25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF</td></tr><tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr><tr><td>10V: 0201&gt;0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21&gt;4.7μF</td></tr><tr><td>6.3V: 0201≥0.1μF; 0402≥1μF;0603&gt;4.7μF;0805≥47μF;1206≥10μF;4V:0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr></table> | Rated voltage                            | Insulation Resistance                                                                                                                                                                                                                              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0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF         | 6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;4V:0603≥22μF; 0805≥47μF; 1206≥100μF |                                  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                       |                              |             |                  |                                                  |                |           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| Rated voltage                                                                                 | Insulation Resistance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          |                                                                                                                                                                                                                                                    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| All X6S items, All X7S items                                                                  | RxC≥50 Ω·F.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                          |                                                                                                                                                                                                                                                    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| 100V: 1210≥3.3μF                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 35V: 0603≥1μF;                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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| 6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;4V:0603≥22μF; 0805≥47μF; 1206≥100μF |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                    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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

Approval Sheet

| No.  | Item                             | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Requirements                                                                                                                                                                                                                                                                    |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
|------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.   | Adhesive Strength of Termination | * Pressurizing force :<br>2N (0201) and 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):<br>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 5 mm and then the pressure shall be maintained for 5±1 sec.<br>*Before initial measurement (Class II only):<br>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% or 0.5pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±12.5%<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, X5R, X6S, X7S: within ±7.5%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.<br>* 25% max. leaching on each edge.                                   |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |
| 12.  | Temperature Cycle                | * Conduct the five cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table> *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. | Step                                                                                                                                                                                                                                                                            | Temp. (°C) | Time (min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | * No remarkable damage.<br>* Cap change :<br>NP0: within ±2.5% or 0.25pF whichever is larger<br>X7R, X5R, X6S, X7S: within ±7.5%<br>* Q/D.F., I.R. and dielectric strength: To meet initial requirements. |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                 |            |             |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                           |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



Multilayer Ceramic Capacitors

Approval Sheet

| No. | Item                              | Test Condition                                                                                                      | Requirements                                                                                     |
|-----|-----------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 13. | Humidity (Damp Heat) Steady State | *Test temp.: 40±2°C                                                                                                 | * No remarkable damage.                                                                          |
|     |                                   | *Humidity: 90~95%RH                                                                                                 | * Cap change:                                                                                    |
|     |                                   | *Test time: 500+24/-0hrs.                                                                                           | NP0: within ±5% or 0.5pF whichever is larger                                                     |
|     |                                   | *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. | X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br>TT series & C≥ 1uF, within ±25% |
|     |                                   | * 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.    | **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%;                                            |
|     |                                   |                                                                                                                     | * Q/D.F. value:                                                                                  |
|     |                                   |                                                                                                                     | NP0: More than 30pF Q≥350, 10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF Q≥200+10C                   |
|     |                                   |                                                                                                                     | X7R, X5R, X6S, X7S:                                                                              |
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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



Multilayer Ceramic Capacitors

Approval Sheet

| No                                                                        | Item                                       | Test Condition                                                                                                                                                                                                                                                                                                                                                                                         | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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--------------------------------------------------------------------------------------------------|----|-------|-----|-----|---------------|-----------------------|--------------------------|--------------------------------------------|----------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------|
| 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 :<br/>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:<br/>NP0: ±7.5% or 0.75pF whichever is larger.<br/>X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤6.3V within ±25%;<br/>TT series &amp; C≥ 1uF,within ±25%</p> <p>**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;</p> <p>Q/D.F. value:<br/>NP0: C≥30pF,Q≥200;C&lt;30pF, Q≥100+10/3C<br/>X7R, X5R, X6S, X7S:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤ 3%</td><td>≤ 6%</td><td>1206 ≥ 0.47μF</td></tr><tr><td>≤ 7%</td><td>1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤ 7.5%</td><td>0603 ≥ 0.068μF;0805 &gt; 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series</td></tr><tr><td>≤ 20%</td><td>0805 &gt; 0.22μF;1210 ≥ 3.3μF</td></tr><tr><td rowspan="4">50V</td><td rowspan="4">≤ 3%</td><td>≤ 6%</td><td>0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF</td></tr><tr><td>≤ 7%</td><td>1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤ 10%</td><td>0201 ≥ 0.01uF;0402 ≥ 0.012μF;1210 ≥ 3.3μF</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 0.047μF;0603&gt;0.1μF;0805 ≥ 1μF(0805/X7R&gt;0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series</td></tr><tr><td>35V</td><td>≤ 5%</td><td>≤ 20%</td><td>0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.01μF(0201/X5R=0.01μF);0805 ≥ 1μF;1210 ≥ 10μF*</td></tr><tr><td>≤ 14%</td><td>0603 ≥ 0.33μF</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.1μF(0201/X5R&gt;0.01μF); 0603 ≥ 0.47μF;TTseries</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)*</td></tr><tr><td>16V</td><td>≤ 5%</td><td>≤ 10%</td><td>0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤ 7.5%</td><td>≤ 15%</td><td>0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF);0402 ≥ 0.033μF; 0603&gt;0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.012μF;0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</td></tr><tr><td>≤ 20%</td><td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603/X5R ≥ 10μF;TT series;01R5/X5R</td></tr><tr><td>6.3V</td><td>≤ 15%</td><td>≤ 30%</td><td>0201 ≥ 0.1μF;0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF;0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td><td>---</td></tr></table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.<br/>Class II (X7R, X5R, X6S, X7S)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">500MΩ or RxC ≥ 5 Ω-F whichever is smaller.</td></tr><tr><td>50V: 0402&gt;0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0603≥1μF;0805≥2.2μF; 1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td>25V:0201 ≥ 0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201 ≥ 0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr><tr><td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td></tr></table> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ |  | ≥ 100V | ≤ 3% | ≤ 6% | 1206 ≥ 0.47μF | ≤ 7% | 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF | ≤ 7.5% | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series | ≤ 20% | 0805 > 0.22μF;1210 ≥ 3.3μF | 50V | ≤ 3% | ≤ 6% | 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF | ≤ 7% | 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF | ≤ 10% | 0201 ≥ 0.01uF;0402 ≥ 0.012μF;1210 ≥ 3.3μF | ≤ 20% | 0402 ≥ 0.047μF;0603>0.1μF;0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series | 35V | ≤ 5% | ≤ 20% | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF | 25V | ≤ 5% | ≤ 10% | 0201 ≥ 0.01μF(0201/X5R=0.01μF);0805 ≥ 1μF;1210 ≥ 10μF* | ≤ 14% | 0603 ≥ 0.33μF | ≤ 15% | 0201 ≥ 0.1μF(0201/X5R>0.01μF); 0603 ≥ 0.47μF;TTseries | ≤ 20% | 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)* | 16V | ≤ 5% | ≤ 10% | 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF | 10V | ≤ 7.5% | ≤ 15% | 0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF);0402 ≥ 0.033μF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series | ≤ 15% | 0201 ≥ 0.012μF;0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF | ≤ 20% | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603/X5R ≥ 10μF;TT series;01R5/X5R | 6.3V | ≤ 15% | ≤ 30% | 0201 ≥ 0.1μF;0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF;0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series | 4V | ≤ 20% | --- | --- | Rated voltage | Insulation Resistance | 100V: All X7R;1210≥3.3μF | 500MΩ or RxC ≥ 5 Ω-F whichever is smaller. | 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF | 35V:0603≥1μF;0805≥2.2μF; 1206 ≥ 2.2μF;1210 ≥ 10μF | 25V:0201 ≥ 0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF | 16V: 0201 ≥ 0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF | 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF | 6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812 |
| Rated vol.                                                                | D.F. ≤                                     | Exception of D.F. ≤                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| ≥ 100V                                                                    | ≤ 3%                                       | ≤ 6%                                                                                                                                                                                                                                                                                                                                                                                                   | 1206 ≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 7%                                                                                                                                                                                                                                                                                                                                                                                                   | 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 7.5%                                                                                                                                                                                                                                                                                                                                                                                                 | 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 20%                                                                                                                                                                                                                                                                                                                                                                                                  | 0805 > 0.22μF;1210 ≥ 3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 50V                                                                       | ≤ 3%                                       | ≤ 6%                                                                                                                                                                                                                                                                                                                                                                                                   | 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF                                                                                                                                                                                                                                                                                                                                                                                                                                                 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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 7%                                                                                                                                                                                                                                                                                                                                                                                                   | 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                      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|                                                                           |                                            | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.01uF;0402 ≥ 0.012μF;1210 ≥ 3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                            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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 20%                                                                                                                                                                                                                                                                                                                                                                                                  | 0402 ≥ 0.047μF;0603>0.1μF;0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series                                                                                                                                                                                                                                                                                                                                                                                                           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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 35V                                                                       | ≤ 5%                                       | ≤ 20%                                                                                                                                                                                                                                                                                                                                                                                                  | 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF                                                                                                                                                                                                                                                                                                                                                                                                                                                       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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 25V                                                                       | ≤ 5%                                       | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.01μF(0201/X5R=0.01μF);0805 ≥ 1μF;1210 ≥ 10μF*                                                                                                                                                                                                                                                                                                                                                                                                                                               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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 14%                                                                                                                                                                                                                                                                                                                                                                                                  | 0603 ≥ 0.33μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 15%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.1μF(0201/X5R>0.01μF); 0603 ≥ 0.47μF;TTseries                                                                                                                                                                                                                                                                                                                                                                                                                                                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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 20%                                                                                                                                                                                                                                                                                                                                                                                                  | 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)*                                                                                                                                                                                                                                                                                                                                                                                                           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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 16V                                                                       | ≤ 5%                                       | ≤ 10%                                                                                                                                                                                                                                                                                                                                                                                                  | 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF                                                                                                                                                                                                                                                                                                                                                                                                                                                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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 10V                                                                       | ≤ 7.5%                                     | ≤ 15%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF);0402 ≥ 0.033μF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 15%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.012μF;0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF                                                                                                                                                                                                                                                                                                                                                                                                 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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
|                                                                           |                                            | ≤ 20%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.1μF;0402 ≥ 1μF;0603/X5R ≥ 10μF;TT series;01R5/X5R                                                                                                                                                                                                                                                                                                                                                                                                                                           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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 6.3V                                                                      | ≤ 15%                                      | ≤ 30%                                                                                                                                                                                                                                                                                                                                                                                                  | 0201 ≥ 0.1μF;0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF;0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series                                                                                                                                                                                                                                                                                                                                                                                              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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 4V                                                                        | ≤ 20%                                      | ---                                                                                                                                                                                                                                                                                                                                                                                                    | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| Rated voltage                                                             | Insulation Resistance                      |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 100V: All X7R;1210≥3.3μF                                                  | 500MΩ or RxC ≥ 5 Ω-F whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF                  |                                            |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 35V:0603≥1μF;0805≥2.2μF; 1206 ≥ 2.2μF;1210 ≥ 10μF                         |                                            |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 25V:0201 ≥ 0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF |                                            |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 16V: 0201 ≥ 0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF    |                                            |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF    |                                            |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                                                                                             |    |       |     |     |               |                       |                          |                                            |                                                          |                                                   |                                                                           |                                                                        |                                                                        |                                                      |
| 6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812                      |                                            |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

## Multilayer Ceramic Capacitors

## Approval Sheet

| No                                                                          | Item                                      | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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-|------------------|--|---------|----------|--------|--|-----|----------|--------|------|-------------|-------|--------|------|-------------|-----|--------|--|-----|------|---------|------|-----|------|---------|------|-------------|------|--------|------|------------|---------------|-------------|------|---------|----------|---------|--|-----|-----|-----------|------|-----------------|---------------|----------------------|------|-----|----------|----------|--|-----|-----|---------|--|--|-----|---------|--|-----|-----|---------|--|---------------------|----------|---------|------|---------------------|--------------------|---------------------------------|--|--|--------|---------|------|-----|------|---------|--|-----------------|-----|---------|--|--|------|---------|--|--|-----|---------|------|---------------------|----------|---------|------|-----|--------------|--------------------|----------------------|-----|-----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|---------------------|------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-------------------------------------------------------------------------------------------------------------|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------------------------------------------------------------------------------------------------|----|------|-----|---------------|-----------------------|---------------------------|-------------------------------------------|--------------------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------|
| 15.                                                                         | High Temperature Load (Endurance)         | <p>* Test temp. :<br/>NP0, X7R/X7S: 125±3°C<br/>X6S: 105±3°C<br/>X5R: 85±3°C</p> <p>* Test time: 1000+24/-0 hrs.</p> <p>* To apply voltage:<br/>(1) 100% of rated voltage for below range.</p> <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td>01R5</td><td>X5R</td><td>≤10V</td><td>C≥0.1μF</td></tr><tr><td>0201</td><td>X5R/X7R/<br/>X6S/X7S</td><td>≤10V<br/>≤16V</td><td>C≥0.1μF<br/>C&gt;0.1μF</td></tr><tr><td>0402</td><td>X5R</td><td>≤16V<br/>25V, 50V<br/>6.3V, 10V</td><td>C&gt;1.0μF<br/>C≥1.0μF<br/>C&gt;1.0μF</td></tr><tr><td></td><td>X6S</td><td>16V, 25V<br/>6.3V, 10V</td><td>C≥1.0μF<br/>C≥1.0μF</td></tr><tr><td></td><td>X7R/X7S</td><td>6.3V, 10V</td><td>C≥1.0μF</td></tr><tr><td>0603</td><td>X5R/X7R/<br/>X6S/X7S</td><td>4V<br/>6.3V, 10V</td><td>C≥22μF<br/>C≥4.7μF<sup>#1</sup></td></tr><tr><td></td><td>X5R/X6S/X7S</td><td>25V</td><td>C≥1.0μF</td></tr><tr><td></td><td>X7R</td><td>35V</td><td>C≥1.0μF</td></tr><tr><td>0805</td><td>X5R/X7R/<br/>X6S/X7S</td><td>4V<br/>6.3V<br/>10V, 50V</td><td>C≥47μF<br/>C≥22μF<br/>C≥10μF</td></tr><tr><td></td><td>X6S</td><td>16V<br/>25V</td><td>C&gt;10μF<br/>C≥10μF</td></tr><tr><td></td><td>X7R/X7S</td><td>16V, 25V</td><td>C≥10μF</td></tr><tr><td></td><td>X5R</td><td>16V, 25V</td><td>C≥22μF</td></tr><tr><td>1206</td><td>X5R/X7R/X6S</td><td>≤6.3V</td><td>C≥47μF</td></tr><tr><td>1210</td><td>X5R/X7R/X6S</td><td>16V</td><td>C≥47μF</td></tr><tr><td></td><td>X7R</td><td>100V</td><td>C≥3.3μF</td></tr><tr><td>TT15</td><td>X5R</td><td>6.3V</td><td>C&gt;1.0μF</td></tr><tr><td>TT21</td><td>X5R/X7R/X6S</td><td>≤10V</td><td>C≥10μF</td></tr></table> <p>**1WV items must follow de-rating conditions.<br/>#1. 0603X106/475(10V)&amp;0603S106(4V&amp;6.3V): 150% of rated voltage<br/>(2) 150% of rated voltage for below range.</p> <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td>0201</td><td>X5R/X6S</td><td>16V, 25V</td><td>C=0.1μF</td></tr><tr><td></td><td>X7R</td><td>16V</td><td>C≥0.022μF</td></tr><tr><td>0402</td><td>X7R/X5R/<br/>X6S</td><td>50V<br/>10~25V</td><td>C&gt;0.01μF<br/>C≥0.22μF</td></tr><tr><td>0603</td><td>X7S</td><td>50V~100V</td><td>C&gt;0.22μF</td></tr><tr><td></td><td>X7R</td><td>50V</td><td>C&gt;0.1μF</td></tr><tr><td></td><td></td><td>25V</td><td>C=1.0μF</td></tr><tr><td></td><td>X5R</td><td>50V</td><td>C≥1.0μF</td></tr><tr><td></td><td>X5R/X7R/<br/>X6S/X7S</td><td>10V, 16V</td><td>C≥1.0μF</td></tr><tr><td>0805</td><td>X5R/X7R/<br/>X6S/X7S</td><td>100V<br/>50V<br/>35V</td><td>C≥0.47μF<br/>C≥0.68μF<br/>C≥2.2μF</td></tr><tr><td></td><td></td><td>10~25V</td><td>C≥4.7μF</td></tr><tr><td>1206</td><td>X7R</td><td>100V</td><td>C≥1.0μF</td></tr><tr><td></td><td>X5R/X6S/<br/>X7S</td><td>50V</td><td>C≥2.2μF</td></tr><tr><td></td><td></td><td>100V</td><td>C&gt;1.0μF</td></tr><tr><td></td><td></td><td>50V</td><td>C=4.7μF</td></tr><tr><td>1210</td><td>X5R/X7R/<br/>X6S/X7S</td><td>50V~100V</td><td>C≥2.2μF</td></tr><tr><td>1812</td><td>X7R</td><td>≤50V<br/>100V</td><td>C≥4.7μF<br/>C≥1.0μF</td></tr><tr><td>1825<br/>2220<br/>2225</td><td>X7R</td><td>100V~250V</td><td>C≥1.0μF<sup>#2</sup></td></tr></table> <p>#2. 2220/X7R/126~226(100V): 120% of rated voltage.<br/>(3) ≤6.3V or C≥10μF: 150% of rated voltage.<br/>(4) 10V~250V: 200% of rated voltage. Excluding 1210/NP0(200V&amp;250V)/104: 100% of rated voltage.<br/>1210/NP0(200V&amp;250V)/563~823: 150% of rated voltage.<br/>1812/NP0(200V&amp;250V)/822~104: 150% of rated voltage.<br/>(5) 400V~450V: 120% of rated voltage.<br/>(6) 500V: 150% of rated voltage.<br/>(7) 630V~3kV: 120% of rated voltage. Excluding 1206/NP0(1kV)/122~332/183~223: 110% of rated voltage.<br/>1210/X7R(2kV)/103: 110% of rated voltage.<br/>1808/X7R(3kV)/102(T:1.25mm):: 110% of rated voltage.<br/>1210/NP0(1kV)/333: 100% of rated voltage.<br/>1812/NP0(1kV)/472~562: 100% of rated voltage.<br/>1812/NP0(2kV)/122~332: 100% of rated voltage.<br/>1812/NP0(4kV)/330~121: 100% of rated voltage.<br/>(8) Ur=3.5kV &amp; 4kV: 110% of rated voltage.<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.<br/>** De-rating conditions:</p> | Size                            | Dielectric | Rated voltage | Capacitance | 01R5 | X5R | ≤10V | C≥0.1μF | 0201 | X5R/X7R/<br>X6S/X7S | ≤10V<br>≤16V | C≥0.1μF<br>C>0.1μF | 0402 | X5R | ≤16V<br>25V, 50V<br>6.3V, 10V | C>1.0μF<br>C≥1.0μF<br>C>1.0μF |  | X6S | 16V, 25V<br>6.3V, 10V | C≥1.0μF<br>C≥1.0μF |  | X7R/X7S | 6.3V, 10V | C≥1.0μF | 0603 | X5R/X7R/<br>X6S/X7S | 4V<br>6.3V, 10V | C≥22μF<br>C≥4.7μF <sup>#1</sup> |  | X5R/X6S/X7S | 25V | C≥1.0μF |  | X7R | 35V | C≥1.0μF | 0805 | X5R/X7R/<br>X6S/X7S | 4V<br>6.3V<br>10V, 50V | C≥47μF<br>C≥22μF<br>C≥10μF |  | X6S | 16V<br>25V | C>10μF<br>C≥10μF |  | X7R/X7S | 16V, 25V | C≥10μF |  | X5R | 16V, 25V | C≥22μF | 1206 | X5R/X7R/X6S | ≤6.3V | C≥47μF | 1210 | X5R/X7R/X6S | 16V | C≥47μF |  | X7R | 100V | C≥3.3μF | TT15 | X5R | 6.3V | C>1.0μF | TT21 | X5R/X7R/X6S | ≤10V | C≥10μF | Size | Dielectric | Rated voltage | Capacitance | 0201 | X5R/X6S | 16V, 25V | C=0.1μF |  | X7R | 16V | C≥0.022μF | 0402 | X7R/X5R/<br>X6S | 50V<br>10~25V | C>0.01μF<br>C≥0.22μF | 0603 | X7S | 50V~100V | C>0.22μF |  | X7R | 50V | C>0.1μF |  |  | 25V | C=1.0μF |  | X5R | 50V | C≥1.0μF |  | X5R/X7R/<br>X6S/X7S | 10V, 16V | C≥1.0μF | 0805 | X5R/X7R/<br>X6S/X7S | 100V<br>50V<br>35V | C≥0.47μF<br>C≥0.68μF<br>C≥2.2μF |  |  | 10~25V | C≥4.7μF | 1206 | X7R | 100V | C≥1.0μF |  | X5R/X6S/<br>X7S | 50V | C≥2.2μF |  |  | 100V | C>1.0μF |  |  | 50V | C=4.7μF | 1210 | X5R/X7R/<br>X6S/X7S | 50V~100V | C≥2.2μF | 1812 | X7R | ≤50V<br>100V | C≥4.7μF<br>C≥1.0μF | 1825<br>2220<br>2225 | X7R | 100V~250V | C≥1.0μF <sup>#2</sup> | <p>* No remarkable damage.</p> <p>Cap change:<br/>NP0: ±3.0% or ±0.3pF whichever is larger<br/>X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;<br/>TT series &amp; C≥1μF, within ±25%<br/>**10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%;</p> <p>Q/D.F. value:<br/>NP0: More than 30pF, Q≥350<br/>10pF≤C&lt;30pF, Q≥275+2.5C<br/>Less than 10pF, Q≥200+10C</p> <p>X7R, X5R, X6S, X7S:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td>100V</td><td>≤3%</td><td>≤6% 1206≥0.47μF<br/>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF<br/>≤7.5% 0603≥0.068μF; 0805&gt;0.1μF; 1206≥1μF; 1210≥2.2μF; TT series<br/>≤20% 0805&gt;0.22μF; 1210≥3.3μF</td></tr><tr><td>50V</td><td>≤3%</td><td>≤6% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF<br/>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF<br/>≤10% 0201≥0.01μF; 0402≥0.012μF; 1210≥3.3μF<br/>≤20% 0402≥0.047μF; 0603&gt;0.1μF; 0805≥1μF(0805/X7R&gt;0.47μF); 1206≥2.2μF; 1210≥10μF; TT series</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20% 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF<br/>≤10% 0201≥0.01μF(0201/X5R=0.01μF); 0805≥1μF; 1210≥10μF*</td></tr><tr><td>25V</td><td>≤5%</td><td>≤14% 0603≥0.33μF<br/>≤15% 0201≥0.1μF(0201/X5R&gt;0.01μF); 0603≥0.47μF; TT series<br/>0402≥0.10μF(0402/X7R≥0.056μF); 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)*</td></tr><tr><td>16V</td><td>≤5%</td><td>≤20% 0402≥0.33μF<br/>≤10% 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF<br/>≤15% 0201≥0.01μF(0201/X7R≥0.022μF); 0402≥0.033μF; 0603&gt;0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series</td></tr><tr><td>10V</td><td>≤7.5%</td><td>≤15% 0201≥0.012μF; 0402≥0.22μF(0402/X7R≥0.15μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF<br/>≤20% 0201≥0.1μF; 0402≥1μF; 0603/X5R≥10μF; TT series; 01R5/X5R</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td></tr></table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.</p> <p>Class II (X7R, X5R, X6S, X7S)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R; 1210≥3.3μF</td><td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td></tr><tr><td>50V: 0402&gt;0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF</td></tr><tr><td>35V: 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF</td></tr><tr><td>25V: 0201≥0.1μF; 0402≥0.22μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF</td></tr><tr><td>16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF</td></tr><tr><td>10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF</td></tr><tr><td>6.3V; 4V; TT series; All X6S/X7S items; Size≥1812</td></tr></table> <p>**De-rating conditions:</p> | Rated vol. | D.F. ≤ | Exception of D.F. ≤ | 100V | ≤3% | ≤6% 1206≥0.47μF<br>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF<br>≤7.5% 0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF; TT series<br>≤20% 0805>0.22μF; 1210≥3.3μF | 50V | ≤3% | ≤6% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF<br>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF<br>≤10% 0201≥0.01μF; 0402≥0.012μF; 1210≥3.3μF<br>≤20% 0402≥0.047μF; 0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF; 1210≥10μF; TT series | 35V | ≤5% | ≤20% 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF<br>≤10% 0201≥0.01μF(0201/X5R=0.01μF); 0805≥1μF; 1210≥10μF* | 25V | ≤5% | ≤14% 0603≥0.33μF<br>≤15% 0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF; TT series<br>0402≥0.10μF(0402/X7R≥0.056μF); 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)* | 16V | ≤5% | ≤20% 0402≥0.33μF<br>≤10% 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF<br>≤15% 0201≥0.01μF(0201/X7R≥0.022μF); 0402≥0.033μF; 0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series | 10V | ≤7.5% | ≤15% 0201≥0.012μF; 0402≥0.22μF(0402/X7R≥0.15μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF<br>≤20% 0201≥0.1μF; 0402≥1μF; 0603/X5R≥10μF; TT series; 01R5/X5R | 6.3V | ≤15% | ≤30% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series | 4V | ≤20% | --- | Rated voltage | Insulation Resistance | 100V: All X7R; 1210≥3.3μF | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. | 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF | 35V: 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF | 25V: 0201≥0.1μF; 0402≥0.22μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF | 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF | 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF | 6.3V; 4V; TT series; All X6S/X7S items; Size≥1812 |
| Size                                                                        | Dielectric                                | Rated voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Capacitance                     |            |               |             |      |     |      |         |      |                     |              |                    |      |     |                               |                               |  |     |                       |                    |  |         |           |         |      |                     |                 |                                 |  |             |     |         |  |     |     |         |      |                     |                        |                            |  |     |            |                  |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 01R5                                                                        | X5R                                       | ≤10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | C≥0.1μF                         |            |               |             |      |     |      |         |      |                     |              |                    |      |     |                               |                               |  |     |                       |                    |  |         |           |         |      |                     |                 |                                 |  |             |     |         |  |     |     |         |      |                     |                        |                            |  |     |            |                  |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 0201                                                                        | X5R/X7R/<br>X6S/X7S                       | ≤10V<br>≤16V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| 0402                                                                        | X5R                                       | ≤16V<br>25V, 50V<br>6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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|                                                                             | X6S                                       | 16V, 25V<br>6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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|                                                                             | X7R/X7S                                   | 6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| 0603                                                                        | X5R/X7R/<br>X6S/X7S                       | 4V<br>6.3V, 10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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|                                                                             | X5R/X6S/X7S                               | 25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 0805                                                                        | X5R/X7R/<br>X6S/X7S                       | 4V<br>6.3V<br>10V, 50V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       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|                                                                             | X6S                                       | 16V<br>25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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|                                                                             | X7R/X7S                                   | 16V, 25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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|                                                                             | X5R                                       | 16V, 25V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| TT21                                                                        | X5R/X7R/X6S                               | ≤10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| 1812                                                                        | X7R                                       | ≤50V<br>100V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | C≥4.7μF<br>C≥1.0μF              |            |               |             |      |     |      |         |      |                     |              |                    |      |     |                               |                               |  |     |                       |                    |  |         |           |         |      |                     |                 |                                 |  |             |     |         |  |     |     |         |      |                     |                        |                            |  |     |            |   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| 1825<br>2220<br>2225                                                        | X7R                                       | 100V~250V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| Rated vol.                                                                  | D.F. ≤                                    | Exception of D.F. ≤                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| 100V                                                                        | ≤3%                                       | ≤6% 1206≥0.47μF<br>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF<br>≤7.5% 0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF; TT series<br>≤20% 0805>0.22μF; 1210≥3.3μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 50V                                                                         | ≤3%                                       | ≤6% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF<br>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF<br>≤10% 0201≥0.01μF; 0402≥0.012μF; 1210≥3.3μF<br>≤20% 0402≥0.047μF; 0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF; 1210≥10μF; TT series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 35V                                                                         | ≤5%                                       | ≤20% 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF<br>≤10% 0201≥0.01μF(0201/X5R=0.01μF); 0805≥1μF; 1210≥10μF*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 25V                                                                         | ≤5%                                       | ≤14% 0603≥0.33μF<br>≤15% 0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF; TT series<br>0402≥0.10μF(0402/X7R≥0.056μF); 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 16V                                                                         | ≤5%                                       | ≤20% 0402≥0.33μF<br>≤10% 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF<br>≤15% 0201≥0.01μF(0201/X7R≥0.022μF); 0402≥0.033μF; 0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| 10V                                                                         | ≤7.5%                                     | ≤15% 0201≥0.012μF; 0402≥0.22μF(0402/X7R≥0.15μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF<br>≤20% 0201≥0.1μF; 0402≥1μF; 0603/X5R≥10μF; TT series; 01R5/X5R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 6.3V                                                                        | ≤15%                                      | ≤30% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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| 4V                                                                          | ≤20%                                      | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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| Rated voltage                                                               | Insulation Resistance                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 100V: All X7R; 1210≥3.3μF                                                   | 1GΩ or RxC ≥ 10 Ω-F whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF                |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 35V: 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF                            |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 25V: 0201≥0.1μF; 0402≥0.22μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF  |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF    |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |
| 6.3V; 4V; TT series; All X6S/X7S items; Size≥1812                           |                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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               |  |         |          |        |  |     |          |        |      |             |       |        |      |             |     |        |  |     |      |         |      |     |      |         |      |             |      |        |      |            |               |             |      |         |          |         |  |     |     |           |      |                 |               |                      |      |     |          |          |  |     |     |         |  |  |     |         |  |     |     |         |  |                     |          |         |      |                     |                    |                                 |  |  |        |         |      |     |      |         |  |                 |     |         |  |  |      |         |  |  |     |         |      |                     |          |         |      |     |              |                    |                      |     |           |                       |                                       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                |    |      |     |               |                       |                           |                                           |                                                              |                                                  |                                                                            |                                                                          |                                                                             |                                                   |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

## APPENDIXES

### ■ Tape & reel dimensions

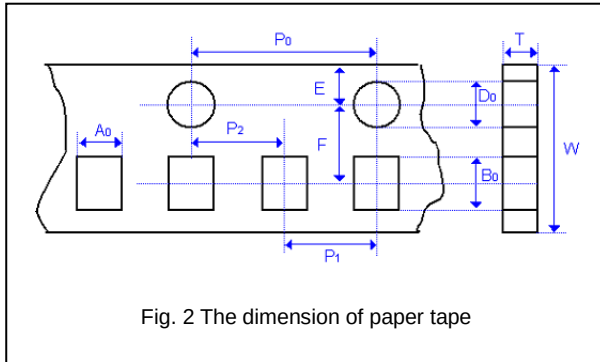


Fig. 2 The dimension of paper tape

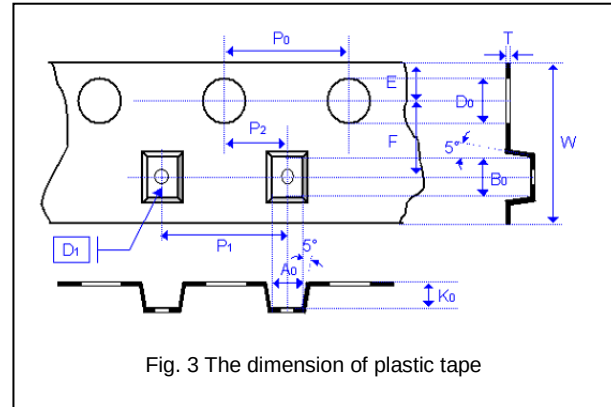


Fig. 3 The dimension of plastic tape

| Size              | 0402             | 0603             | 0805             |                  |                  | 1206             |                  |                  | 1210             |                  | 1808             | 1812             |                  | 1825             |                  | 2220             |                  |                  | 2225             |                  |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Thickness         | N,E              | S,X              | A,H              | B,T              | D,I              | B,T              | C,J,<br>D        | G,P              | C,D,<br>G,K      | M                | D,F,<br>G,K      | D,F,<br>G,K      | M,U              | K                | M,U              | K                | M,U              | R                | K                | M,U              |
| A <sub>0</sub>    | 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           | < 3.20           | < 2.50           | < 3.90           | < 3.90           | < 6.80           | < 6.80           | < 5.80           | < 5.80           | < 5.80           | < 6.80           | < 6.80           |
| B <sub>0</sub>    | 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           | < 4.00           | < 5.30           | < 5.30           | < 5.30           | < 5.30           | < 5.30           | < 6.50           | < 6.50           | < 6.50           | < 6.50           | < 6.50           |
| T                 | ≤ 0.80           | ≤ 1.20           | ≤ 1.15           | ≤ 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   | 0.23<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.25<br>+/-0.1   | 0.30<br>+/-0.1   | 0.30<br>+/-0.1   | 0.30<br>+/-0.1   | 0.30<br>+/-0.1   | 0.30<br>+/-0.1   | 0.30<br>+/-0.1   | 0.30<br>+/-0.1   |
| K <sub>0</sub>    | -                | -                | -                | -                | < 2.50           | -                | < 2.50           | < 2.50           | < 2.50           | < 3.20           | < 2.50           | < 2.50           | < 3.50           | < 2.50           | < 3.50           | < 2.50           | < 3.50           | < 4.20           | < 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  | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<br>+/-0.30 | 12.00<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  | 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>+/-0.20 | 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 | 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  | 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  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<br>+/-0.10  | 8.00<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>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 2.00<br>+/-0.10  | 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  | 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  | 1.00<br>+/-0.10  | 1.00<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<br>+/-0.10  | 1.50<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  | 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  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  | 5.50<br>+/-0.10  |

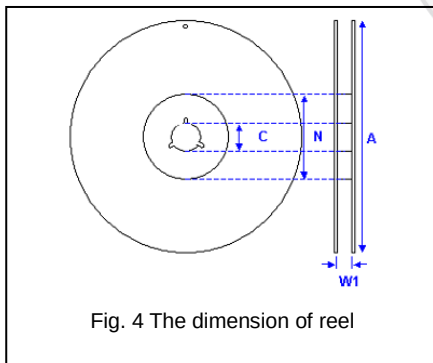
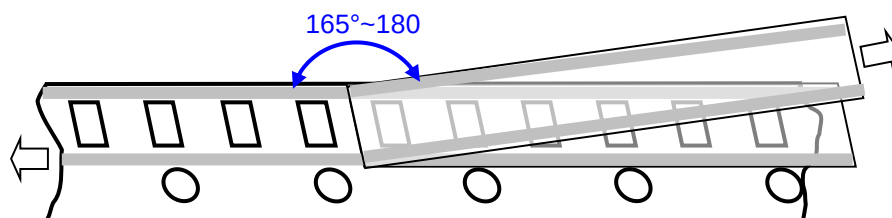


Fig. 4 The dimension of reel

| Size           | 0402, 0603, 0805, 1206, 1210 |           |           | 1808 to 2225 |             |
|----------------|------------------------------|-----------|-----------|--------------|-------------|
| Reel size      | 7"                           | 10"       | 13"       | 7"           | 13"         |
| C              | 13.0±0.5                     | 13.0±0.5  | 13.0±0.5  | 13.0±0.5     | 13.0±0.5    |
| W <sub>1</sub> | 10.0±1.5                     | 10.0±1.5  | 10.0±1.5  | 12.4+2.0/-0  | 12.4+2.0/-0 |
| A              | 178.0±2.0                    | 250.0±2.0 | 330.0±2.0 | 178.0±2.0    | 330.0±2.0   |
| N              | 60.0+1.0/-0                  | 50 min    | 50 min    | 60.0+1.0/-0  | 100.0±2.0   |

### ■ Peeling force (EIA-481)

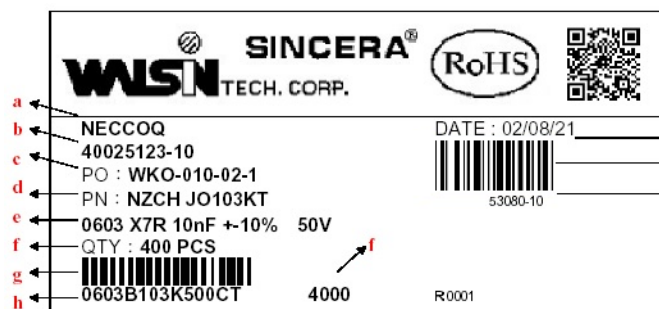
Peel-off force should be in the range of 10 grams to 100 grams at a peel-off speed of 300±10 mm/min.



## Multilayer Ceramic Capacitors

## Approval Sheet

### Example of customer label



\*Customized label is available upon request

- 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, X5R                 |
|-----|------------------|--------------------------|--------------------------|
| ①   | Ceramic material | CaZrO <sub>3</sub> based | BaTiO <sub>3</sub> based |
| ②   | Inner electrode  | Ni                       |                          |
| ③   | Termination      | Inner layer              | Cu + Ag Polymer          |
| ④   |                  | Middle layer             | Ni                       |
| ⑤   |                  | Outer layer              | Sn                       |

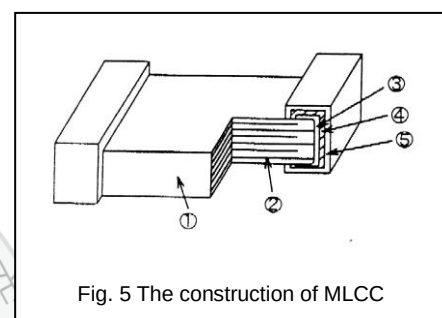


Fig. 5 The construction of MLCC

### Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions; MSL Level 1.
- (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.

### Caution for SOFT TERMINATION Products

Since the middle layer of the terminal electrode contains Ag (silver), when chip capacitors on printed circuit board (PCB), it should be protected by moisture proof-sealing to prevent electromigration of Ag under high temperature, high humidity and failure due to corrosive gas.

### Recommended soldering conditions

## Multilayer Ceramic Capacitors

## Approval Sheet

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  $N_2$  within oven are recommended.

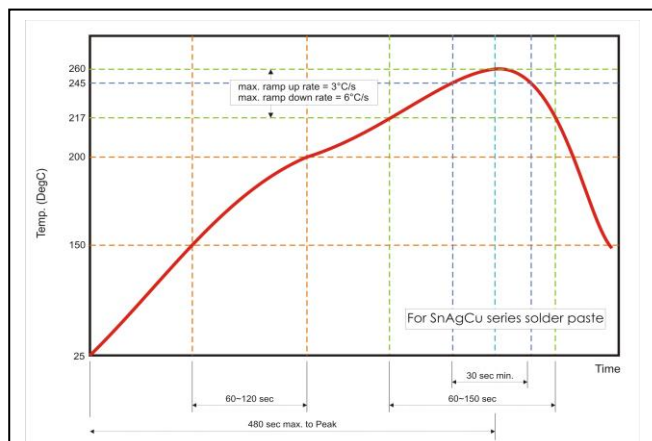


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

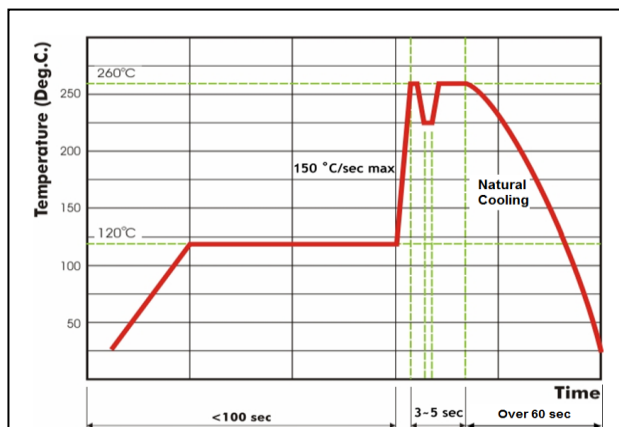


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

