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**Messrs. :** 一般共用

**Date :** 2018/08/17

# APPROVAL SHEET

**Product Name :** High Voltage Multilayer Ceramic Chip Capacitors

**Part No. :** FV Series

**Description :** Size 0805~2225, C0G/X7R, 1000V~4000V

| PREPARED BY | APPROVED BY |
|-------------|-------------|
|             |             |

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# SPECIFICATION

FOR

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**Part No. : FV Series**

**Description : Size 0805~2225, C0G/X7R, 1000V~4000V**

**SPEC. No. : FV-000-001-11**

**DATE : 2018/08/17**

| DRAWN BY        | CHECEKED BY       | APPROVED BY        |
|-----------------|-------------------|--------------------|
| <i>Tsu Chen</i> | <i>Yvens Chou</i> | <i>Joseph Ling</i> |

## 1. INTRODUCTION

PDC FV Series green type capacitors are manufactured by using environmental friendly material without lead or cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. This special design can distribute voltage gradients throughout the entire capacitor, so as to prevent short circuit failure. It is a safety design for LCD back-lighting inverter application.

## 2. FEATURES

- Special interior design offers high voltage rating in a given case size.
- High reliability and stability.
- RoHS & HALOGEM compliant.

## 3. APPLICATIONS

- DC to DC converter.
- High voltage coupling/DC blocking.
- Back-lighting inverters.
- LAN/WLAN interface.
- Modem.
- Power supplies.

## 4. HOW TO ORDER

| <u>FV</u>  | <u>31</u> | <u>X</u>   | <u>103</u>  | <u>K</u>  | <u>102</u>    | <u>E</u>  | <u>C</u>  | <u>G</u>     |
|------------|-----------|------------|-------------|-----------|---------------|-----------|-----------|--------------|
| PDC Family | Size      | Dielectric | Capacitance | Tolerance | Rated Voltage | Packaging | Thickness | Control Code |
| Table 1    | Table 2   | Table 3    | Table 4     | Table 5   | Table 6       | Table 7   | Table 8   | Table 9      |

| Table 1 |                                      | PDC Family |  |  |  |
|---------|--------------------------------------|------------|--|--|--|
| Code    | Description                          |            |  |  |  |
| FV      | High voltage application with ≥1KVdc |            |  |  |  |

| Table 2 |             | Size |             |      |             |
|---------|-------------|------|-------------|------|-------------|
| Code    | Description | Code | Description | Code | Description |
| 15      | 0402 (1005) | 32   | 1210 (3225) | 52   | 2211 (5728) |
| 18      | 0603 (1608) | 42   | 1808 (4520) | 55   | 2220 (5750) |
| 21      | 0805 (2012) | 43   | 1812 (4532) | 56   | 2225 (5763) |
| 31      | 1206 (3216) | 46   | 1825 (4563) |      |             |

| Table 3 |             | Dielectric Material Characteristics |             |
|---------|-------------|-------------------------------------|-------------|
| Code    | Description | Code                                | Description |
| N       | C0G         | X                                   | X7R         |

| Table 4 |                              | Capacitance Rule Code |                                |
|---------|------------------------------|-----------------------|--------------------------------|
| Code    | Description                  | Code                  | Description                    |
| R47     | 0.47pF                       | 102                   | 102=10x10 <sup>2</sup> =1000pF |
| 0R5     | 0.5pF                        | 104                   | 104=10x10 <sup>4</sup> =100nF  |
| 100     | 100=10x10 <sup>0</sup> =10pF | 106                   | 106=10x10 <sup>6</sup> =10μF   |

| Table 5 |             | Tolerance |             |      |             |
|---------|-------------|-----------|-------------|------|-------------|
| Code    | Description | Code      | Description | Code | Description |
| A       | ±0.05 pF    | J         | ±5 %        |      |             |
| B       | ±0.10 pF    | K         | ±10 %       |      |             |
| C       | ±0.25 pF    | L         | 0% ~ +10%   |      |             |
| D       | ±0.50 pF    | M         | ±20 %       |      |             |
| F       | ±1 %        | N         | -5% ~ +10%  |      |             |
| G       | ±2 %        | P         | ±0.02 pF    |      |             |
| H       | ±3 %        | Q         | ±0.03 pF    |      |             |
| I       | -10% ~ 0%   | Z         | -20% ~ +80% |      |             |

| Table 6 |             | Rated Voltage |             |      |             |
|---------|-------------|---------------|-------------|------|-------------|
| Code    | Description | Code          | Description | Code | Description |
| 102     | 1000Vdc     | 302           | 3000Vdc     | 502  | 5000Vdc     |
| 152     | 1500Vdc     | 402           | 4000Vdc     | 602  | 6000Vdc     |
| 202     | 2000Vdc     |               |             |      |             |

| Table 7 |                                  | Packaging Type |                               |
|---------|----------------------------------|----------------|-------------------------------|
| Code    | Description                      | Code           | Description                   |
| B       | Bulk                             | T              | Tray package                  |
| E       | Tape and 7" Reel, Embossed Tape  | P              | Tape and 7" Reel, Paper Tape  |
| K       | Tape and 10" Reel, Embossed Tape | D              | Tape and 10" Reel, Paper Tape |
| L       | Tape and 13" Reel, Embossed Tape | G              | Tape and 13" Reel, Paper Tape |

| Table 8 |                   | Thickness Description |                   |      |                     |
|---------|-------------------|-----------------------|-------------------|------|---------------------|
| Code    | Description       | Code                  | Description       | Code | Description         |
| A       | 0.60 ± 0.10 mm    | I                     | 1.25 ± 0.20 mm    | Q    | 0.50 +0.02/-0.05 mm |
| B       | 0.8+0.15/-0.10 mm | J                     | 1.15 ± 0.15 mm    | R    | 3.10 ± 0.30 mm      |
| C       | 1.25 ± 0.10 mm    | K                     | 0.50 ± 0.20 mm    | S    | 0.80 ± 0.07 mm      |
| D       | 1.40 ± 0.15 mm    | L                     | 0.30 ± 0.03 mm    | T    | 0.85 ± 0.10 mm      |
| E       | 1.60 ± 0.20 mm    | M                     | 0.95 ± 0.10 mm    | U    | 0.50 ± 0.10 mm      |
| F       | 2.00 ± 0.20 mm    | N                     | 0.50 ± 0.05 mm    | V    | 0.20 ± 0.02 mm      |
| G       | 2.50 ± 0.30 mm    | O                     | 3.50 ± 0.20 mm    | X    | 0.80 ± 0.10 mm      |
| H       | 2.80 ± 0.30 mm    | P                     | 1.60+0.3/-0.10 mm | Z    | 0.25 ± 0.03 mm      |

| Table 9 |                                  | Special Control Code |  |
|---------|----------------------------------|----------------------|--|
| Code    | Description                      |                      |  |
| G       | RoHS compliant                   |                      |  |
| Q       | Surface Coating (Size 1206~2225) |                      |  |
| O       | Gold plating (Size≥0603)         |                      |  |

### 5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm)           | W (mm)    | Code / T (mm)              | M <sub>B</sub> (mm) |                                                                                     |
|----------------|------------------|-----------|----------------------------|---------------------|-------------------------------------------------------------------------------------|
| 0805(2012)     | 2.10±0.20        | 1.25±0.20 | See No.4 Reference Table 8 | 0.50±0.20           |  |
| 1206(3216)     | 3.30±0.30        | 1.60±0.20 |                            | 0.60±0.20           |                                                                                     |
| 1210(3225)     | 3.30±0.40        | 2.50±0.30 |                            | 0.75±0.35           |                                                                                     |
| 1808(4520)     | 4.50 +0.50/-0.30 | 2.00±0.25 |                            | 0.75±0.35           |                                                                                     |
| 1812(4532)     | 4.50 +0.50/-0.30 | 3.20±0.40 |                            | 0.75±0.35           |                                                                                     |
| 1825(4563)     | 4.50 +0.50/-0.30 | 6.30±0.40 |                            | 0.75±0.35           |                                                                                     |
| 2211(5728)     | 5.70±0.40        | 2.80±0.30 |                            | 0.85±0.35           |                                                                                     |
| 2220(5750)     | 5.70±0.40        | 5.00±0.40 |                            | 0.85±0.35           |                                                                                     |
| 2225(5763)     | 5.70±0.40        | 6.30±0.40 |                            | 0.85±0.35           |                                                                                     |

Fig. 5.1 The outline of MLCC

### 6. GENERAL ELECTRICAL DATA

| Dielectric                              | C0G                                                                                                                                                                                                            | X7R                                                                                                                                                                                                            |         |           |           |           |        |       |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|-----------|-----------|--------|-------|
| Size                                    | 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225                                                                                                                                                                 | 0805, 1206, 1210, 1808, 1812, 1825, 2211, 2220, 2225                                                                                                                                                           |         |           |           |           |        |       |
| Rated voltage (WVDC)                    | 1000V, 1500V, 2000V, 3000V, 4000V                                                                                                                                                                              | 1000V, 1500V, 2000V, 3000V, 4000V                                                                                                                                                                              |         |           |           |           |        |       |
| Capacitance range                       | 1.5pF ~ 10nF                                                                                                                                                                                                   | 100pF ~ 220nF                                                                                                                                                                                                  |         |           |           |           |        |       |
| Capacitance tolerance                   | Reference to Table 5                                                                                                                                                                                           | Reference to Table 5                                                                                                                                                                                           |         |           |           |           |        |       |
| Tan δ                                   | <table border="1"> <thead> <tr> <th>Cap. Rang</th> <th>Q Spec.</th> </tr> </thead> <tbody> <tr> <td>Cap.&lt;30pF</td> <td>Q≥400+20C</td> </tr> <tr> <td>Cap.≥30pF</td> <td>Q≥1000</td> </tr> </tbody> </table> | Cap. Rang                                                                                                                                                                                                      | Q Spec. | Cap.<30pF | Q≥400+20C | Cap.≥30pF | Q≥1000 | ≤2.5% |
| Cap. Rang                               | Q Spec.                                                                                                                                                                                                        |                                                                                                                                                                                                                |         |           |           |           |        |       |
| Cap.<30pF                               | Q≥400+20C                                                                                                                                                                                                      |                                                                                                                                                                                                                |         |           |           |           |        |       |
| Cap.≥30pF                               | Q≥1000                                                                                                                                                                                                         |                                                                                                                                                                                                                |         |           |           |           |        |       |
| Capacitance & Tan δ Test condition      | Measured at the condition of 30~70% related humidity<br>For 25°C at 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<br>1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature |         |           |           |           |        |       |
| Insulation resistance at U <sub>r</sub> | ≥10GΩ or RxC≥500Ω-F, whichever is smaller                                                                                                                                                                      | ≥10GΩ or RxC≥100Ω-F, whichever is smaller                                                                                                                                                                      |         |           |           |           |        |       |
| Operating temperature                   | -55°C to +125°C                                                                                                                                                                                                |                                                                                                                                                                                                                |         |           |           |           |        |       |
| Capacitance characteristic              | ±30ppm/°C                                                                                                                                                                                                      | ±15%                                                                                                                                                                                                           |         |           |           |           |        |       |
| Termination                             | Cu or Ag/Ni/Sn or Au (lead-free termination)                                                                                                                                                                   |                                                                                                                                                                                                                |         |           |           |           |        |       |

**7. CAPACITANCE RANGE**

**7-1. C0G**

| Dimension |      | 0805  | 1206  |       |       | 1210  |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|-------|
| Cap.(pF)  | Code | 1000V | 1000V | 1500V | 2000V | 1000V | 1500V | 2000V |
| 1.5       | 1R5  | C     | X     | X     | X     |       |       |       |
| 1.8       | 1R8  | C     | X     | X     | X     |       |       |       |
| 2.2       | 2R2  | C     | X     | X     | X     |       |       |       |
| 2.7       | 2R7  | C     | X     | X     | X     |       |       |       |
| 3.3       | 3R3  | C     | X     | X     | X     |       |       |       |
| 3.9       | 3R9  | C     | X     | X     | X     |       |       |       |
| 4.7       | 4R7  | C     | X     | X     | X     |       |       |       |
| 5.0       | 5R0  | C     | X     | X     | X     |       |       |       |
| 5.6       | 5R6  | C     | X     | X     | X     |       |       |       |
| 6.8       | 6R8  | C     | X     | X     | X     |       |       |       |
| 8.2       | 8R2  | C     | X     | X     | X     |       |       |       |
| 10        | 100  | C     | X     | X     | X     | M     | M     | M     |
| 12        | 120  | C     | X     | X     | X     | M     | M     | M     |
| 15        | 150  | C     | X     | X     | X     | M     | M     | M     |
| 18        | 180  | C     | X     | X     | X     | M     | M     | M     |
| 22        | 220  | C     | X     | X     | X     | M     | M     | M     |
| 27        | 270  | C     | X     | X     | X     | M     | M     | M     |
| 33        | 330  | C     | X     | M     | M     | M     | M     | M     |
| 39        | 390  | C     | X     | M     | M     | M     | M     | M     |
| 47        | 470  | C     | X     | M     | M     | M     | M     | M     |
| 56        | 560  | C     | X     | C     | C     | M     | C     | C     |
| 68        | 680  | C     | X     | C     | C     | M     | C     | C     |
| 82        | 820  | C     | X     | C     | C     | M     | C     | C     |
| 100       | 101  | C     | X     | C     | C     | C     | C     | C     |
| 120       | 121  | C     | C     | E     | E     | C     | C     | C     |
| 150       | 151  | C     | C     | E     | E     | C     | E     | E     |
| 180       | 181  | C     | E     | E     | E     | C     | E     | E     |
| 220       | 221  | C     | E     | E     | E     | E     | E     | E     |
| 270       | 271  | C     | E     | P     | P     | E     | F     | F     |
| 330       | 331  | C     | E     | P     | P     | E     | F     | F     |
| 390       | 391  | C     | E     | P     | P     | E     | G     | G     |
| 470       | 471  |       | E     |       |       | E     | G     | G     |
| 560       | 561  |       | E     |       |       | E     | G     | G     |
| 680       | 681  |       | E     |       |       | E     | G     | G     |
| 820       | 821  |       | E     |       |       | E     | G     | G     |
| 1000      | 102  |       | E     |       |       | E     | G     | G     |
| 1200      | 122  |       |       |       |       | E     |       |       |
| 1500      | 152  |       |       |       |       | F     |       |       |
| 1800      | 182  |       |       |       |       | G     |       |       |
| 2200      | 222  |       |       |       |       | G     |       |       |
| 2700      | 272  |       |       |       |       | G     |       |       |
| 3300      | 332  |       |       |       |       | G     |       |       |
| 3900      | 392  |       |       |       |       | G     |       |       |

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**7. CAPACITANCE RANGE(Con.)**

**7-1. C0G**

| Dimension |      | 1808  |       |       |       | 1812  |       |       |       |       | 1825  |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cap.(pF)  | Code | 1000V | 1500V | 2000V | 3000V | 1000V | 1500V | 2000V | 3000V | 4000V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 1.5       | 1R5  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 1.8       | 1R8  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 2.2       | 2R2  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 2.7       | 2R7  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 3.3       | 3R3  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 3.9       | 3R9  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 4.7       | 4R7  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 5.0       | 5R0  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 5.6       | 5R6  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 6.8       | 6R8  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 8.2       | 8R2  | C     | C     | C     | C     |       |       |       |       |       |       |       |       |       |       |
| 10        | 100  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 12        | 120  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 15        | 150  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 18        | 180  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 22        | 220  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 27        | 270  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 33        | 330  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 39        | 390  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 47        | 470  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 56        | 560  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 68        | 680  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 82        | 820  | C     | C     | C     | C     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 100       | 101  | C     | C     | C     | F     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 120       | 121  | C     | C     | C     | F     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 150       | 151  | C     | F     | F     | F     | C     | C     | C     | C     | C     | F     | F     | F     | F     | F     |
| 180       | 181  | C     | F     | F     | F     | C     | C     | C     | F     |       | F     | F     | F     | F     | F     |
| 220       | 221  | C     | F     | F     | F     | C     | C     | C     | F     |       | F     | F     | F     | F     | F     |
| 270       | 271  | F     | F     | F     | F     | C     | F     | F     | F     |       | F     | F     | F     | F     | F     |
| 330       | 331  | F     | F     | F     | F     | C     | F     | F     | F     |       | F     | F     | F     | F     | F     |
| 390       | 391  | F     | F     | F     | F     | C     | F     | F     | F     |       | F     | F     | F     | F     | F     |
| 470       | 471  | F     | F     | F     |       | F     | F     | F     | F     |       | F     | F     | F     | F     | F     |
| 560       | 561  | F     | F     | F     |       | F     | F     | F     |       |       | F     | F     | F     | F     | F     |
| 680       | 681  | F     | F     | F     |       | F     | F     | F     |       |       | F     | F     | F     | F     | F     |
| 820       | 821  | F     | F     | F     |       | F     | F     | F     |       |       | F     | F     | F     | F     | F     |
| 1000      | 102  | F     | F     | F     |       | F     | F     | F     |       |       | F     | F     | F     | F     | F     |
| 1200      | 122  | F     |       |       |       | F     | E     | E     |       |       | F     | F     | F     |       |       |
| 1500      | 152  | F     |       |       |       | F     | E     | E     |       |       | F     | F     | F     |       |       |
| 1800      | 182  | F     |       |       |       | E     |       |       |       |       | F     | F     | F     |       |       |
| 2200      | 222  | F     |       |       |       | E     |       |       |       |       | F     | F     | F     |       |       |
| 2700      | 272  |       |       |       |       | F     |       |       |       |       | F     | F     | F     |       |       |
| 3300      | 332  |       |       |       |       | F     |       |       |       |       | F     | F     | F     |       |       |
| 3900      | 392  |       |       |       |       | G     |       |       |       |       | F     | F     | F     |       |       |
| 4700      | 472  |       |       |       |       |       |       |       |       |       | F     | F     | F     |       |       |
| 5600      | 562  |       |       |       |       |       |       |       |       |       | F     |       |       |       |       |
| 6800      | 682  |       |       |       |       |       |       |       |       |       | F     |       |       |       |       |
| 8200      | 822  |       |       |       |       |       |       |       |       |       | G     |       |       |       |       |
| 10000     | 103  |       |       |       |       |       |       |       |       |       | G     |       |       |       |       |
| 12000     | 123  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

**7. CAPACITANCE RANGE(Con.)**

**7-1. C0G**

| Dimension |      | 2220  |       |       |       |       | 2225  |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cap.(pF)  | Code | 1000V | 1500V | 2000V | 3000V | 4000V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 1.5       | 1R5  |       |       |       |       |       |       |       |       |       |       |
| 1.8       | 1R8  |       |       |       |       |       |       |       |       |       |       |
| 2.2       | 2R2  |       |       |       |       |       |       |       |       |       |       |
| 2.7       | 2R7  |       |       |       |       |       |       |       |       |       |       |
| 3.3       | 3R3  |       |       |       |       |       |       |       |       |       |       |
| 3.9       | 3R9  |       |       |       |       |       |       |       |       |       |       |
| 4.7       | 4R7  |       |       |       |       |       |       |       |       |       |       |
| 5.0       | 5R0  |       |       |       |       |       |       |       |       |       |       |
| 5.6       | 5R6  |       |       |       |       |       |       |       |       |       |       |
| 6.8       | 6R8  |       |       |       |       |       |       |       |       |       |       |
| 8.2       | 8R2  |       |       |       |       |       |       |       |       |       |       |
| 10        | 100  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 12        | 120  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 15        | 150  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 18        | 180  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 22        | 220  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 27        | 270  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 33        | 330  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 39        | 390  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 47        | 470  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 56        | 560  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 68        | 680  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 82        | 820  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 100       | 101  | F     | F     | F     | F     | F     | F     | F     | F     | F     | F     |
| 120       | 121  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 150       | 151  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 180       | 181  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 220       | 221  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 270       | 271  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 330       | 331  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 390       | 391  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 470       | 471  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 560       | 561  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 680       | 681  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 820       | 821  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 1000      | 102  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 1200      | 122  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 1500      | 152  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 1800      | 182  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 2200      | 222  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 2700      | 272  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 3300      | 332  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 3900      | 392  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 4700      | 472  | F     | F     | F     | F     | F     | F     | F     | F     | F     |       |
| 5600      | 562  | F     |       |       |       |       | F     | F     | F     | F     |       |
| 6800      | 682  | F     |       |       |       |       | F     | F     | F     | F     |       |
| 8200      | 822  | G     |       |       |       |       | F     | G     | G     | G     |       |
| 10000     | 103  | G     |       |       |       |       | G     | G     | G     | G     |       |
| 12000     | 123  |       |       |       |       |       |       |       |       |       |       |



**PSA** 信昌電子陶瓷股份有限公司  
**Prosperity Dielectrics Co., Ltd.**

**7. CAPACITANCE RANGE(Con.)**

**7-2. X7R**

| Dimension |      | 0805  | 1206  |       |       |       | 1210  |       |       | 1808  |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cap.(pF)  | Code | 1000V | 1000V | 1500V | 2000V | 2500V | 1000V | 1500V | 2000V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 100       | 101  | X     | C     | C     | C     | C     | C     | C     | C     |       |       |       |       |       |
| 120       | 121  | X     | C     | C     | C     | C     | C     | C     | C     |       |       |       |       |       |
| 150       | 151  | X     | C     | C     | C     | C     | C     | C     | C     | C     | C     | C     | C     | F*    |
| 180       | 181  | X     | C     | C     | C     | C     | C     | C     | C     | C     | C     | C     | C     | F*    |
| 220       | 221  | X     | C     | C     | C     | C     | C     | C     | E     | C     | C     | C     | C     | F*    |
| 270       | 271  | X     | C     | C     | C     | C     | C     | C     | E     | C     | C     | C     | C     | F*    |
| 330       | 331  | X     | C     | C     | C     | C     | C     | C     | E     | C     | C     | C     | F     | F*    |
| 390       | 391  | X     | C     | C     | C     | C     | C     | C     | E     | C     | C     | C     | F     | F*    |
| 470       | 471  | X     | C     | C     | C     | C     | C     | C     | E     | C     | C     | C     | F     | F*    |
| 560       | 561  | X     | C     | C     | C     | C     | C     | C     | E     | C     | C     | C     | F     | F*    |
| 680       | 681  | X     | C     | C     | C     | C*    | C     | C     | E     | C     | C     | C     | F     | F*    |
| 820       | 821  | X     | C     | C     | C     | C*    | C     | C     | E     | C     | C     | C     | F     | F*    |
| 1000      | 102  | X     | C     | C     | C     | C*    | C     | C     | E     | C     | C     | C     | F     | F*    |
| 1200      | 122  | X     | C     | E     | E     | E     | C     | G     | F     | C     | F     | F     | F     |       |
| 1500      | 152  | C     | C     | E     | E     | E     | C     | G     | F     | C     | F     | F     | F     |       |
| 1800      | 182  | C     | C     | E     | E     | E     | C     | G     | F     | C     | F     | F     | F     |       |
| 2200      | 222  | C     | C     | E     | E     | E     | C     | G     | F     | C     | F     | F     | F     |       |
| 2700      | 272  | C     | C     | E     | E     | E     | C     | G     | G     | C     | F     | F     |       |       |
| 3300      | 332  | C     | C     | E     | E     | E     | C     | G     | G     | C     | F     | F     |       |       |
| 3900      | 392  | C     | E     | E     | E     | E     | E     | G     | G     | C     | F     | F     |       |       |
| 4700      | 472  | C     | E     | E     | E     | E     | E     | G     | G     | C     | F     | F     |       |       |
| 5600      | 562  |       | E     | E     | E     | E     | E     | G     | G*    | F     | F     | F     |       |       |
| 6800      | 682  |       | E     | E     | E     | E     | E     | G     | G*    | F     | F     | F     |       |       |
| 8200      | 822  |       | E     | E     | E     | E     | E     | G     | G*    | F     |       |       |       |       |
| 10000     | 103  |       | E     | E     | E     | E     | E     |       |       | F     |       |       |       |       |
| 12000     | 123  |       | E     | E     | E     | E     | E     |       |       | F     |       |       |       |       |
| 15000     | 153  |       | E     | E     | E     | E     | E     |       |       | F     |       |       |       |       |
| 18000     | 183  |       | E     | E     | E     | E     | E     |       |       | F     |       |       |       |       |
| 22000     | 223  |       | E     | E     | E     | E     | E     |       |       | F     |       |       |       |       |
| 27000     | 273  |       |       |       |       |       | E     |       |       | F     |       |       |       |       |
| 33000     | 333  |       |       |       |       |       | E     |       |       | F     |       |       |       |       |
| 39000     | 393  |       |       |       |       |       | F     |       |       | F     |       |       |       |       |
| 47000     | 473  |       |       |       |       |       | G     |       |       | F     |       |       |       |       |
| 56000     | 563  |       |       |       |       |       |       |       |       | F     |       |       |       |       |
| 68000     | 683  |       |       |       |       |       |       |       |       |       |       |       |       |       |

\* Surface coating only.



**7. CAPACITANCE RANGE(Con.)**

**7-2. X7R**

| Dimension |      | 1812  |       |       |       |       | 1825  |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cap.(pF)  | Code | 1000V | 1500V | 2000V | 3000V | 4000V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 270       | 271  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 330       | 331  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 390       | 391  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 470       | 471  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 560       | 561  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 680       | 681  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 820       | 821  | C     | C     | C     | F     | F*    |       |       |       |       | F*    |
| 1000      | 102  | C     | C     | C     | F     | F*    | F     | F     | F     | F     | F*    |
| 1200      | 122  | C     | C     | C     | F     | G*    | F     | F     | F     | F     | G*    |
| 1500      | 152  | C     | C     | C     | F     | G*    | F     | F     | F     | F     | G*    |
| 1800      | 182  | C     | C     | C     | G     | G*    | F     | F     | F     | F     | G*    |
| 2200      | 222  | C     | C     | C     | G*    |       | F     | F     | F     | F*    |       |
| 2700      | 272  | C     | C     | C     | G*    |       | F     | F     | F     | F*    |       |
| 3300      | 332  | C     | F     | F     | G*    |       | F     | F     | F     | F*    |       |
| 3900      | 392  | C     | F     | F     |       |       | F     | F     | F     | F*    |       |
| 4700      | 472  | C     | F     | F     |       |       | F     | F     | F     | F*    |       |
| 5600      | 562  | C     | G     | G     |       |       | F     | F     | F     | G*    |       |
| 6800      | 682  | C     | G     | G     |       |       | F     | F     | F     | G*    |       |
| 8200      | 822  | C     | G     | G     |       |       | F     | F     | F     | G*    |       |
| 10000     | 103  | C     | G     | G     |       |       | F     | F     | F     | G*    |       |
| 12000     | 123  | F     |       |       |       |       | F     | G     | G     | H*    |       |
| 15000     | 153  | F     |       |       |       |       | F     | G     | G     | H*    |       |
| 18000     | 183  | G     |       |       |       |       | F     | G     | G     | H*    |       |
| 22000     | 223  | G     |       |       |       |       | F     | G     | G     |       |       |
| 27000     | 273  | G     |       |       |       |       | F     | H     | H     |       |       |
| 33000     | 333  | G     |       |       |       |       | F     | H     | H     |       |       |
| 39000     | 393  | G     |       |       |       |       | F     | H     | H     |       |       |
| 47000     | 473  | G     |       |       |       |       | F     | H     | H     |       |       |
| 56000     | 563  | G     |       |       |       |       | F     |       |       |       |       |
| 68000     | 683  | G     |       |       |       |       | F     |       |       |       |       |
| 82000     | 823  | G     |       |       |       |       | F     |       |       |       |       |
| 100000    | 104  | G     |       |       |       |       | G     |       |       |       |       |
| 120000    | 124  |       |       |       |       |       |       |       |       |       |       |
| 150000    | 154  |       |       |       |       |       |       |       |       |       |       |
| 180000    | 184  |       |       |       |       |       |       |       |       |       |       |
| 220000    | 224  |       |       |       |       |       |       |       |       |       |       |
| 270000    | 274  |       |       |       |       |       |       |       |       |       |       |
| 330000    | 334  |       |       |       |       |       |       |       |       |       |       |

\* Surface coating only.

**7. CAPACITANCE RANGE(Con.)**

**7-2. X7R**

| Dimension |      | 2211  |       | 2220  |       |       |       |       | 2225  |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cap.(pF)  | Code | 3000V | 4000V | 1000V | 1500V | 2000V | 3000V | 4000V | 1000V | 1500V | 2000V | 3000V | 4000V |
| 270       | 271  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 330       | 331  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 390       | 391  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 470       | 471  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 560       | 561  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 680       | 681  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 820       | 821  | F     | F*    |       |       |       |       | F*    |       |       |       |       | F*    |
| 1000      | 102  | F     | F*    | F     | F     | F     | F     | F*    | F     | F     | F     | F     | F*    |
| 1200      | 122  | G     | G*    | F     | F     | F     | F     | G*    | F     | F     | F     | F     | G*    |
| 1500      | 152  | G     | G*    | F     | F     | F     | F     | G*    | F     | F     | F     | F     | G*    |
| 1800      | 182  | G     | G*    | F     | F     | F     | F     | G*    | F     | F     | F     | F     | G*    |
| 2200      | 222  | G     |       | F     | F     | F     | F*    |       | F     | F     | F     | F*    |       |
| 2700      | 272  | G     |       | F     | F     | F     | F*    |       | F     | F     | F     | F*    |       |
| 3300      | 332  | G     |       | F     | F     | F     | F*    |       | F     | F     | F     | F*    |       |
| 3900      | 392  |       |       | F     | F     | F     | F*    |       | F     | F     | F     | F*    |       |
| 4700      | 472  |       |       | F     | F     | F     | F*    |       | F     | F     | F     | F*    |       |
| 5600      | 562  |       |       | F     | F     | F     | F*    |       | F     | F     | F     | G*    |       |
| 6800      | 682  |       |       | F     | F     | F     | G*    |       | F     | F     | F     | G*    |       |
| 8200      | 822  |       |       | F     | G     | G     | G*    |       | F     | F     | F     | G*    |       |
| 10000     | 103  |       |       | F     | G     | G     | G*    |       | F     | F     | F     | G*    |       |
| 12000     | 123  |       |       | F     | G     | G     | H*    |       | F     | G     | G     | G*    |       |
| 15000     | 153  |       |       | F     | G     | G     | H*    |       | F     | G     | G     | G*    |       |
| 18000     | 183  |       |       | F     | H     | H     | H*    |       | F     | G     | G     | H*    |       |
| 22000     | 223  |       |       | F     | H     | H     |       |       | F     | G     | G     |       |       |
| 27000     | 273  |       |       | F     | H     | H     |       |       | F     | G     | G     |       |       |
| 33000     | 333  |       |       | F     | H     | H     |       |       | F     | G     | G     |       |       |
| 39000     | 393  |       |       | F     | H     | H     |       |       | F     | G     | H     |       |       |
| 47000     | 473  |       |       | F     | H     | H     |       |       | F     | G     | H     |       |       |
| 56000     | 563  |       |       | F     | H     | H     |       |       | F     | G     | H     |       |       |
| 68000     | 683  |       |       | F     |       |       |       |       | F     | G     |       |       |       |
| 82000     | 823  |       |       | F     |       |       |       |       | F     | G     |       |       |       |
| 100000    | 104  |       |       | G     |       |       |       |       | G     | G     |       |       |       |
| 120000    | 124  |       |       | G     |       |       |       |       | H     |       |       |       |       |
| 150000    | 154  |       |       | H     |       |       |       |       | H     |       |       |       |       |
| 180000    | 184  |       |       | H     |       |       |       |       | H     |       |       |       |       |
| 220000    | 224  |       |       | H     |       |       |       |       | H     |       |       |       |       |
| 270000    | 274  |       |       |       |       |       |       |       |       |       |       |       |       |
| 330000    | 334  |       |       |       |       |       |       |       |       |       |       |       |       |
| 390000    | 394  |       |       |       |       |       |       |       |       |       |       |       |       |

\* Surface coating only.

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.            | Item                                      | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Requirements                                                                                                                                                                                                                                                                                                                                                                                   |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
|----------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|-------------------|----------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|-----------|-------------------------------------------|----------------|-------------------------------------------|------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.             | Visual and Dimensions                     | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | * No remarkable defect.<br>* Dimensions to confirm to individual specification sheet.                                                                                                                                                                                                                                                                                                          |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 2.             | Capacitance                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | * Shall not exceed the limits given in the detailed spec.                                                                                                                                                                                                                                                                                                                                      |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 3.             | Q/D.F. (Dissipation Factor)               | * Class I : C0G<br>Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%.<br>Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%.<br>* Class II : X7R<br>1.0±0.2Vrms, 1KHz±10%.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Rated Vol.(V)</th> <th>Q/D.F.</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Class I (C0G)</td> <td rowspan="2">All</td> <td>Q≥1000</td> <td>Cap.≥30pF</td> </tr> <tr> <td>Q≥400+20C</td> <td>Cap.&lt;30pF</td> </tr> <tr> <td>Class II (X7R)</td> <td>All</td> <td>D.F.≤2.5%</td> <td></td> </tr> </tbody> </table> | Dielectric      | Rated Vol.(V)  | Q/D.F.            | Remark                     | Class I (C0G)     | All                                                                                                                                                                                                                                                                               | Q≥1000     | Cap.≥30pF          | Q≥400+20C | Cap.<30pF                                 | Class II (X7R) | All                                       | D.F.≤2.5%  |     |                                                                                                                                                                                                                                                                          |
| Dielectric     | Rated Vol.(V)                             | Q/D.F.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Remark                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| Class I (C0G)  | All                                       | Q≥1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Cap.≥30pF                                                                                                                                                                                                                                                                                                                                                                                      |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
|                |                                           | Q≥400+20C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Cap.<30pF                                                                                                                                                                                                                                                                                                                                                                                      |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| Class II (X7R) | All                                       | D.F.≤2.5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 4.             | Temperature Coefficient                   | * With no electrical load.<br><table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp.</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | T.C.                                                                                                                                                                                                                                                                                                                                                                                           | Operating Temp. | C0G            | -55~125°C at 25°C | X7R                        | -55~125°C at 25°C | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> </tbody> </table>                                                                 | T.C.       | Capacitance Change | C0G       | Within ±30ppm/°C                          | X7R            | Within ±15%                               |            |     |                                                                                                                                                                                                                                                                          |
| T.C.           | Operating Temp.                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| C0G            | -55~125°C at 25°C                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| X7R            | -55~125°C at 25°C                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| T.C.           | Capacitance Change                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| C0G            | Within ±30ppm/°C                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| X7R            | Within ±15%                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 5.             | Insulation Resistance                     | <table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Apply Voltage</th> <th>Test Condition</th> </tr> </thead> <tbody> <tr> <td>&gt;500</td> <td>500Vdc</td> <td>60 sec.</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Rated Vol.(V)                                                                                                                                                                                                                                                                                                                                                                                  | Apply Voltage   | Test Condition | >500              | 500Vdc                     | 60 sec.           | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Requirements</th> </tr> </thead> <tbody> <tr> <td>Class I</td> <td>≥10GΩ or RxC≥500Ω-F, whichever is smaller</td> </tr> <tr> <td>Class II</td> <td>≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> </tbody> </table> | Dielectric | Requirements       | Class I   | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | Class II       | ≥10GΩ or RxC≥100Ω-F, whichever is smaller |            |     |                                                                                                                                                                                                                                                                          |
| Rated Vol.(V)  | Apply Voltage                             | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| >500           | 500Vdc                                    | 60 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| Dielectric     | Requirements                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| Class I        | ≥10GΩ or RxC≥500Ω-F, whichever is smaller |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| Class II       | ≥10GΩ or RxC≥100Ω-F, whichever is smaller |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 6.             | Solderability                             | * Solder temperature : 235±5°C for (0603~1210).<br>* Solder temperature : 245±5°C for (1808~2225).<br>* Dipping time : 2±0.5 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | * 75% min. coverage of all metalized area.                                                                                                                                                                                                                                                                                                                                                     |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 7.             | Dielectric Strength                       | <table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>630≤V≤3000V</td> <td>1.2 times of UR</td> </tr> <tr> <td>3000&lt;V≤5000V</td> <td>1.1 times of UR</td> </tr> </tbody> </table> <p>* Duration : 1 to 5 sec.<br/>* Voltage ramp up rate ≤500Vdc/sec.<br/>* Charge and discharge current less than 50mA.<br/>* Test in insulating fluid.</p>                                                                                                                                                                                                                                                                                                  | Rated Vol.(V)                                                                                                                                                                                                                                                                                                                                                                                  | Condition       | 630≤V≤3000V    | 1.2 times of UR   | 3000<V≤5000V               | 1.1 times of UR   | * No evidence of damage or flashover during test.                                                                                                                                                                                                                                 |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| Rated Vol.(V)  | Condition                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 630≤V≤3000V    | 1.2 times of UR                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 3000<V≤5000V   | 1.1 times of UR                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 8.             | Resistance to Soldering Heat              | * Solder temperature : 260±5°C.<br>* Dipping time : 10±1 sec.<br>* Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.<br>* Before initial measurement (Class II only) : Perform 150 +0/-10°C for 1 hr and then set for 48±4 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).                                                                                                                                                                                                                                                                                                          | * No remarkable damage.<br>* Cap. Change :<br>COG : Within ±2.5% or ±0.25pF, whichever is larger.<br>X7R : Within ±7.5%.<br>* Q/D.F. & I.R. : To meet the initial requirement.<br>* 25% max. leaching on each edge.                                                                                                                                                                            |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |
| 9.             | Temperature Cycle                         | * Conduct the five cycles according to the temperatures and time.<br><table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> <p>* Before initial measurement (Class II only) : Perform 150 +0/-10°C for 1 hr and then set for 48±4 hrs at room temp.<br/>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p> | Step                                                                                                                                                                                                                                                                                                                                                                                           | Temp.(°C)       | Time(min.)     | 1                 | Min. operating temp. +0/-3 | 30±3              | 2                                                                                                                                                                                                                                                                                 | Room temp. | 2~3                | 3         | Max. operating temp. +3/-0                | 30±3           | 4                                         | Room temp. | 2~3 | * No remarkable damage.<br>* Cap. change :<br>COG : Within ±2.5% or ±0.25pF, whichever is larger.<br>X7R : Within ±7.5%.<br>* Q/D.F. :<br>COG : To meet the initial requirement.<br>X7R : D.F.≤150% of initial requirement.<br>* I.R. : To meet the initial requirement. |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                   |                            |                   |                                                                                                                                                                                                                                                                                   |            |                    |           |                                           |                |                                           |            |     |                                                                                                                                                                                                                                                                          |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.            | Item                                        | Test Condition                                                                                                                                                                                                                                                                                                                   | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |             |               |                                             |                |               |
|----------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|---------------|---------------------------------------------|----------------|---------------|
| 10.            | Humidity (Damp Heat) Steady State           | <ul style="list-style-type: none"> <li>* Test temp. : 40±2°C.</li> <li>* Humidity : 90~95%RH.</li> <li>* Test time : 500 +24/-0 hrs.</li> <li>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</li> </ul>                                                                     | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap. change :<br/>C0G : Within ±5.0% or ±0.5pF, whichever is larger.<br/>X7R : Within ±12.5%.</li> <li>* Q/D.F. :<br/>C0G : Cap.&gt;30pF, Q≥350; 10pF≤Cap.≤30pF, Q≥275+2.5C; Cap.&lt;10pF, Q≥200+10C.<br/>X7R : D.F.≤200% of initial requirement.</li> <li>* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.</li> </ul>                                                                                                                                                                                        |            |             |               |                                             |                |               |
| 11.            | Humidity (Damp Heat) Load                   | <ul style="list-style-type: none"> <li>* Test temp. : 40±2°C.</li> <li>* Humidity : 90~95% RH.</li> <li>* Test time : 500 +24/-0hrs.</li> <li>* To apply voltage : 500Vdc.</li> <li>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</li> </ul>                               | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap. change :<br/>C0G : Within ±7.5% or ±0.75pF, whichever is larger.<br/>X7R : Within ±12.5%.</li> <li>* Q/D.F. :<br/>C0G : Cap.≥30pF, Q≥200; Cap.&lt;30pF, Q≥100+10/3C.<br/>X7R : D.F.≤200% of initial requirement.</li> <li>* I.R. : ≥500MΩ or RxC≥25Ω-F, whichever is smaller.</li> </ul>                                                                                                                                                                                                                  |            |             |               |                                             |                |               |
| 12.            | High Temperature Load (Endurance)           | <ul style="list-style-type: none"> <li>* Test temp. : 125±3°C.</li> <li>* Apply voltage : 110% of rated voltage.</li> <li>* Test time : 1000 +24/-0 hrs.</li> <li>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</li> </ul>                                                 | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap. change :<br/>C0G : Within ±3.0% or ±0.3pF, whichever is larger.<br/>X7R : Within ±12.5%.</li> <li>* Q/D.F. :<br/>C0G : Cap.&gt;30pF, Q≥350; 10pF≤Cap.≤30pF, Q≥275+2.5C; Cap.&lt;10pF, Q≥200+10C.<br/>X7R : D.F.≤200% of initial requirement.</li> <li>* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.</li> </ul>                                                                                                                                                                                        |            |             |               |                                             |                |               |
| 13             | Resistance to Flexure of Substrate          | <p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm.</p>  <p style="text-align: center;">Unit : mm</p>                                 | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> </ul> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Dielectric</th> <th style="width: 50%;">Cap. Change</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td>Within ±3.0% or ±2.0pF, whichever is larger</td> </tr> <tr> <td>Class II (X7R)</td> <td>Within ±12.5%</td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p> | Dielectric | Cap. Change | Class I (C0G) | Within ±3.0% or ±2.0pF, whichever is larger | Class II (X7R) | Within ±12.5% |
| Dielectric     | Cap. Change                                 |                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |             |               |                                             |                |               |
| Class I (C0G)  | Within ±3.0% or ±2.0pF, whichever is larger |                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |             |               |                                             |                |               |
| Class II (X7R) | Within ±12.5%                               |                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |             |               |                                             |                |               |
| 14.            | Adhesive Strength of Termination            | <p>* Capacitors mounted on a substrate. A force of 5N(≤0603) or 10N(&gt;0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 second.</p>                                   | <ul style="list-style-type: none"> <li>* No remarkable damage or removal of the terminations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |             |               |                                             |                |               |
| 15.            | Vibration Resistance                        | <ul style="list-style-type: none"> <li>* Vibration frequency : 10~55 Hz/min.</li> <li>* Total amplitude : 1.5mm.</li> <li>* Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions)</li> <li>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</li> </ul> | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap. change and Q/D.F. : To meet the initial spec.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |             |               |                                             |                |               |

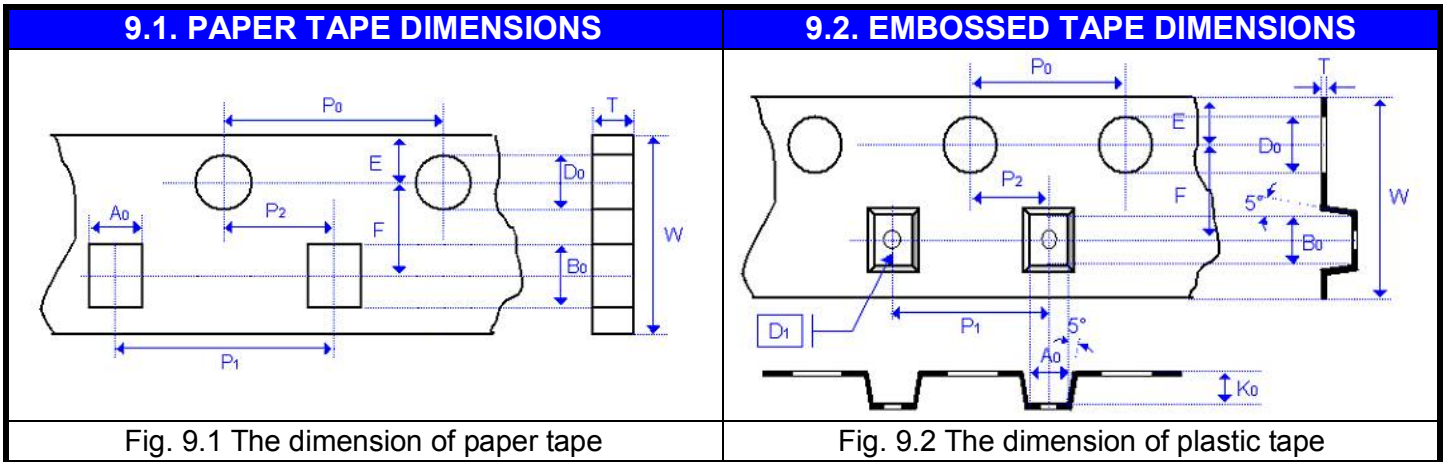
**9. PACKAGE DIMENSION AND QUANTITY**

| Size       | Thickness (mm)   | Paper tape |          | Plastic tape |          |
|------------|------------------|------------|----------|--------------|----------|
|            |                  | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0402(1005) | 0.50±0.05        | 10k        | 50K      | -            | -        |
| 0603(1608) | 0.80±0.07        | 4k         | 15k      | -            | -        |
|            | 0.80 +0.15/-0.10 | 4k         | 15k      | -            | -        |
| 0805(2012) | 0.60±0.10        | 4k         | 15k      | -            | -        |
|            | 0.80±0.10        | 4k         | 15k      | -            | -        |
|            | 1.25±0.10        | -          | -        | 3k           | 10k      |
|            | 1.25±0.20        | -          | -        | 3k           | -        |
| 1206(3216) | 0.80±0.10        | 4k         | 15k      | -            | -        |
|            | 0.95±0.10        | -          | -        | 3k           | 10k      |
|            | 1.25±0.10        | -          | -        | 3k           | 10k      |
|            | 1.60±0.20        | -          | -        | 2k           | -        |
| 1210(3225) | 0.95±0.10        | -          | -        | 3k           | 10k      |
|            | 1.25±0.10        | -          | -        | 3k           | 10k      |
|            | 1.60±0.20        | -          | -        | 2k           | -        |
|            | 2.50±0.30        | -          | -        | 1k           | -        |
| 1808(4520) | 1.25±0.10        | -          | -        | 2k           | -        |
|            | 1.60±0.20        | -          | -        | 2k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
| 1812(4532) | 1.25±0.10        | -          | -        | 1k           | -        |
|            | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
|            | 2.50±0.30        | -          | -        | 0.5k         | -        |
| 1825(4563) | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
|            | 2.50±0.30        | -          | -        | 0.5k         | -        |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |
| 2211(5728) | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
|            | 2.50±0.30        | -          | -        | 0.5k         | -        |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |
| 2220(5750) | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
|            | 2.50±0.30        | -          | -        | 0.5k         | -        |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |
| 2225(5763) | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
|            | 2.50±0.30        | -          | -        | 0.5k         | -        |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |

Unit : pcs



**9. PACKAGE DIMENSION AND QUANTITY**



| Size              | 0603                |                     | 0805       |                        | 1206       |                        |                            |
|-------------------|---------------------|---------------------|------------|------------------------|------------|------------------------|----------------------------|
| Chip Thickness    | 0.80±0.07           | 0.80<br>+0.15/-0.1  | 0.80±0.10  | 1.25±0.10<br>1.25±0.20 | 0.80±0.10  | 0.95±0.10<br>1.25±0.10 | 1.60±0.20<br>1.60+0.3/-0.1 |
| A <sub>0</sub>    | 1.00<br>+0.05/-0.10 | 1.02<br>+0.05/-0.10 | 1.50±0.10  | <1.65                  | 2.00±0.10  | <2.00                  | <2.00                      |
| B <sub>0</sub>    | 1.80±0.10           | 1.80±0.10           | 2.30±0.10  | <2.40                  | 3.50±0.10  | <3.60                  | <3.70                      |
| T                 | 0.95±0.05           | 0.97±0.05           | 0.95±0.05  | 0.23±0.05              | 0.95±0.05  | 0.23±0.05              | 0.23±0.05                  |
| K <sub>0</sub>    | -                   | -                   | -          | <2.50                  | -          | <2.50                  | <2.50                      |
| W                 | 8.00±0.10           | 8.00±0.10           | 8.00±0.10  | 8.00±0.10              | 8.00±0.10  | 8.00±0.10              | 8.00±0.10                  |
| P <sub>0</sub>    | 4.00±0.10           | 4.00±0.10           | 4.00±0.10  | 4.00±0.10              | 4.00±0.10  | 4.00±0.10              | 4.00±0.10                  |
| 10xP <sub>0</sub> | 40.00±0.20          | 40.00±0.20          | 40.00±0.20 | 40.00±0.20             | 40.00±0.20 | 40.00±0.20             | 40.00±0.20                 |
| P <sub>1</sub>    | 4.00±0.10           | 4.00±0.10           | 4.00±0.10  | 4.00±0.10              | 4.00±0.10  | 4.00±0.10              | 4.00±0.10                  |
| P <sub>2</sub>    | 2.00±0.05           | 2.00±0.05           | 2.00±0.05  | 2.00±0.05              | 2.00±0.05  | 2.00±0.05              | 2.00±0.05                  |
| D <sub>0</sub>    | 1.55±0.05           | 1.55±0.05           | 1.55±0.05  | 1.50 +0.10/-0          | 1.55±0.05  | 1.50 +0.10/-0          | 1.50 +0.10/-0              |
| D <sub>1</sub>    | -                   | -                   | -          | 1.00±0.10              | -          | 1.00±0.10              | 1.00±0.10                  |
| E                 | 1.75±0.05           | 1.75±0.05           | 1.75±0.05  | 1.75±0.10              | 1.75±0.10  | 1.75±0.10              | 1.75±0.10                  |
| F                 | 3.50±0.05           | 3.50±0.05           | 3.50±0.05  | 3.50±0.05              | 3.50±0.05  | 3.50±0.05              | 3.50±0.05                  |
| Unit :            | mm                  | mm                  | mm         | mm                     | mm         | mm                     | mm                         |

| Size              | 1210                                |               | 1808                   |               | 1812                                |               |
|-------------------|-------------------------------------|---------------|------------------------|---------------|-------------------------------------|---------------|
| Chip Thickness    | 0.95±0.10<br>1.25±0.10<br>1.60±0.20 | 2.50±0.30     | 1.25±0.10<br>1.60±0.20 | 2.00±0.20     | 1.25±0.10<br>1.60±0.20<br>2.00±0.20 | 2.50±0.30     |
| A <sub>0</sub>    | <3.05                               | <3.10         | <2.50                  | <2.50         | <3.90                               | <3.90         |
| B <sub>0</sub>    | <3.80                               | <4.00         | <5.30                  | <5.30         | <5.30                               | <5.30         |
| T                 | 0.23±0.05                           | 0.23±0.05     | 0.25±0.05              | 0.25±0.05     | 0.25±0.05                           | 0.25±0.05     |
| K <sub>0</sub>    | <2.50                               | <3.50         | <2.50                  | <2.50         | <2.50                               | <3.00         |
| W                 | 8.00±0.10                           | 8.00±0.10     | 12.00±0.20             | 12.00±0.20    | 12.00±0.20                          | 12.00±0.20    |
| P <sub>0</sub>    | 4.00±0.10                           | 4.00±0.10     | 4.00±0.10              | 4.00±0.10     | 4.00±0.10                           | 4.00±0.10     |
| 10xP <sub>0</sub> | 40.00±0.20                          | 40.00±0.20    | 40.00±0.20             | 40.00±0.20    | 40.00±0.20                          | 40.00±0.20    |
| P <sub>1</sub>    | 4.00±0.10                           | 4.00±0.10     | 4.00±0.10              | 4.00±0.10     | 8.00±0.10                           | 8.00±0.10     |
| P <sub>2</sub>    | 2.00±0.05                           | 2.00±0.05     | 2.00±0.05              | 2.00±0.05     | 2.00±0.05                           | 2.00±0.05     |
| D <sub>0</sub>    | 1.50 +0.10/-0                       | 1.50 +0.10/-0 | 1.50 +0.10/-0          | 1.50 +0.10/-0 | 1.50 +0.10/-0                       | 1.50 +0.10/-0 |
| D <sub>1</sub>    | 1.00±0.10                           | 1.00±0.10     | 1.50±0.10              | 1.50±0.10     | 1.50±0.10                           | 1.50±0.10     |
| E                 | 1.75±0.10                           | 1.75±0.10     | 1.75±0.10              | 1.75±0.10     | 1.75±0.10                           | 1.75±0.10     |
| F                 | 3.50±0.05                           | 3.50±0.05     | 5.50±0.05              | 5.50±0.05     | 5.50±0.05                           | 5.50±0.05     |
| Unit :            | mm                                  | mm            | mm                     | mm            | mm                                  | mm            |

### 9. PACKAGE DIMENSION AND QUANTITY

| Size              | 1825                   |                  | 2211                   |                  | 2220                                |                  | 2225                   |                  |
|-------------------|------------------------|------------------|------------------------|------------------|-------------------------------------|------------------|------------------------|------------------|
| Chip Thickness    | 1.60±0.20<br>2.00±0.20 | 2.50±0.30        | 1.60±0.20<br>2.00±0.20 | 2.50±0.30        | 1.40±0.15<br>1.60±0.20<br>2.00±0.20 | 2.50±0.30        | 1.60±0.20<br>2.00±0.20 | 2.50±0.30        |
| A <sub>0</sub>    | <6.80                  | <6.80            | <3.30                  | <3.30            | <5.80                               | <5.80            | <6.80                  | <6.80            |
| B <sub>0</sub>    | <5.30                  | <5.30            | <6.50                  | <6.50            | <6.50                               | <6.50            | <6.50                  | <6.50            |
| T                 | 0.30±0.10              | 0.30±0.10        | 0.30±0.10              | 0.30±0.10        | 0.30±0.10                           | 0.30±0.10        | 0.30±0.10              | 0.30±0.10        |
| K <sub>0</sub>    | <2.50                  | <3.10            | <2.50                  | <3.10            | <2.50                               | <3.10            | <2.50                  | <3.10            |
| W                 | 12.00±0.20             | 12.00±0.20       | 12.00±0.20             | 12.00±0.20       | 12.00±0.20                          | 12.00±0.20       | 12.00±0.20             | 12.00±0.20       |
| P <sub>0</sub>    | 4.00±0.10              | 4.00±0.10        | 4.00±0.10              | 4.00±0.10        | 4.00±0.10                           | 4.00±0.10        | 4.00±0.10              | 4.00±0.10        |
| 10xP <sub>0</sub> | 40.00±0.20             | 40.00±0.20       | 40.0±0.20              | 40.0±0.20        | 40.00±0.20                          | 40.00±0.20       | 40.00±0.20             | 40.00±0.20       |
| P <sub>1</sub>    | 8.00±0.10              | 8.00±0.10        | 8.00±0.10              | 8.00±0.10        | 8.00±0.10                           | 8.00±0.10        | 8.00±0.10              | 8.00±0.10        |
| P <sub>2</sub>    | 2.00±0.05              | 2.00±0.05        | 2.00±0.05              | 2.00±0.05        | 2.00±0.05                           | 2.00±0.05        | 2.00±0.05              | 2.00±0.05        |
| D <sub>0</sub>    | 1.50<br>+0.10/-0       | 1.50<br>+0.10/-0 | 1.50<br>+0.10/-0       | 1.50<br>+0.10/-0 | 1.50<br>+0.10/-0                    | 1.50<br>+0.10/-0 | 1.50<br>+0.10/-0       | 1.50<br>+0.10/-0 |
| D <sub>1</sub>    | 1.50±0.10              | 1.50±0.10        | 1.50±0.10              | 1.50±0.10        | 1.50±0.10                           | 1.50±0.10        | 1.50±0.10              | 1.50±0.10        |
| E                 | 1.75±0.10              | 1.75±0.10        | 1.75±0.10              | 1.75±0.10        | 1.75±0.10                           | 1.75±0.10        | 1.75±0.10              | 1.75±0.10        |
| F                 | 5.50±0.05              | 5.50±0.05        | 5.50±0.05              | 5.50±0.05        | 5.50±0.05                           | 5.50±0.05        | 5.50±0.05              | 5.50±0.05        |
| Unit :            | mm                     | mm               | mm                     | mm               | mm                                  | mm               | mm                     | mm               |

### 9.3. REEL DIMENSIONS

| Size           | 0603, 0805, 1206, 1210 |                   |                   | 1808, 1812, 1825,<br>2211, 2220, 2225 |
|----------------|------------------------|-------------------|-------------------|---------------------------------------|
| Reel size      | 7"                     | 7"                | 13"               | 7"                                    |
| C              | 13.0<br>+0.5/-0.2      | 13.0<br>+0.5/-0.2 | 13.0<br>+0.5/-0.2 | 13.0<br>+0.5/-0.2                     |
| W <sub>1</sub> | 8.4<br>+1.5/-0         | 12.4<br>+2.0/-0   | 8.4<br>+1.5/-0    | 8.4<br>+1.5/-0                        |
| A              | 178.0<br>±0.10         | 178.0<br>±0.10    | 330.0<br>±1.0     | 178.0<br>±0.10                        |
| N              | 60.0<br>+1.0/-0        | 80.0<br>±1.0      | 100<br>±1.0       | 60.0<br>+1.0/-0                       |

Fig. 9.3 The dimension of reel



**10. APPLICATION NOTES**

**STORAGE**

To prevent the damage of solderability of terminations, the following storage conditions are recommended :

Indoors under 5 ~ 40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The product is recommended to be used within 12 months after shipment and checked the solderability before use.

**HANDLING**

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

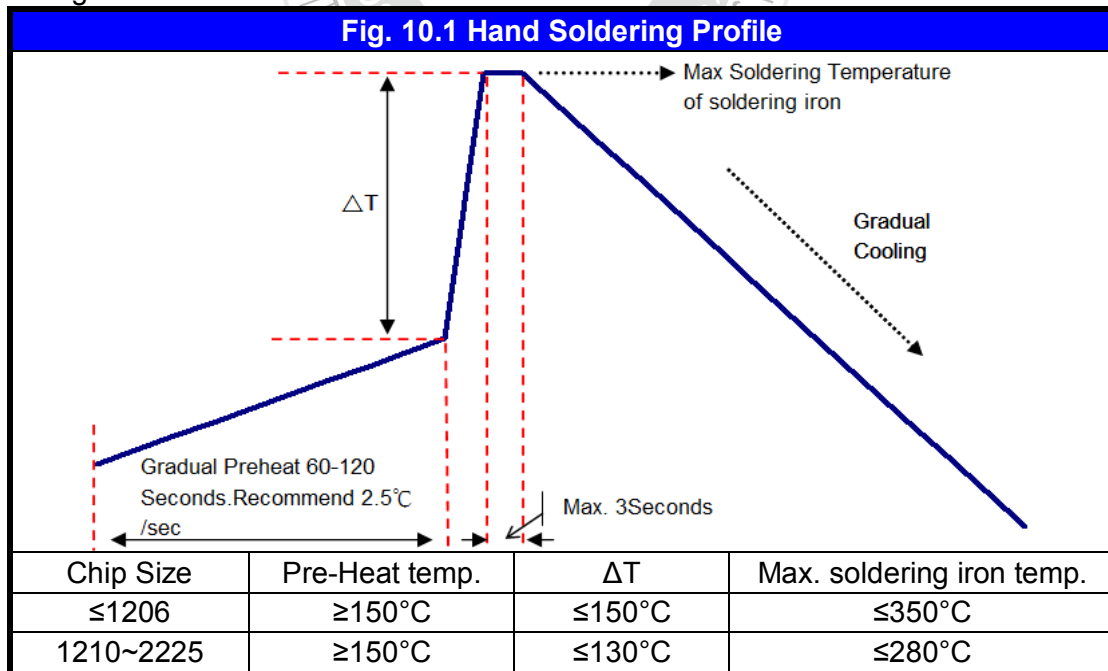
**PREHEAT**

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

**SOLDERING**

Use middy activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

a.) Hand soldering :



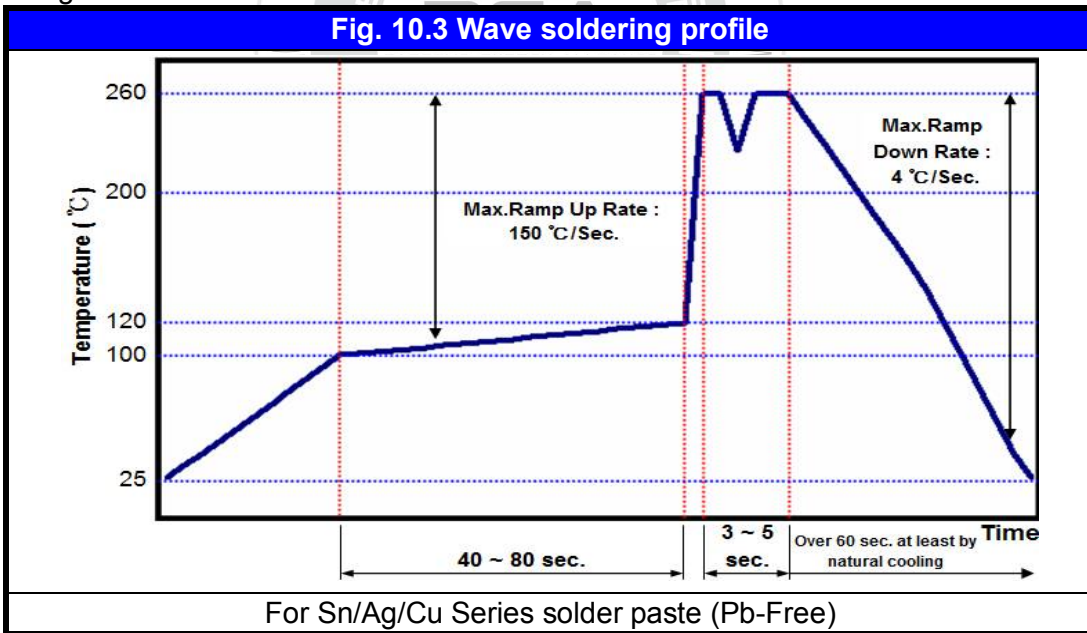
- \* Soldering iron tip diameter  $\leq 1.0$  mm and wattage max. 20W.
- \* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- \* The required amount of solder shall be melted on the soldering tip.
- \* The tip of iron should not contact the ceramic body directly.
- \* The Capacitors shall be cooled gradually at room temperature after soldering.
- \* Forced air cooling is not allowed.

**10. APPLICATION NOTES**

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

| Size Inch (mm) | Temper. Char. | Capacitance | Condition |        |
|----------------|---------------|-------------|-----------|--------|
|                |               |             | Wave      | Reflow |
| ≤0402 (1005)   | Class I - C0G | All         | X         | O      |
| 0603 (1608)    | Class I - C0G | All         | O         | O      |
| 0805 (2012)    | Class I - C0G | All         | O         | O      |
| 1206 (3216)    | Class I - C0G | All         | O         | O      |
| ≥1210 (3225)   | Class I - C0G | All         | X         | O      |

**10. APPLICATION NOTES**

Soldering conditions :  
 Class II :

| Size Inch (mm) | Temper. Cher.  | Capacitance | Condition |        |
|----------------|----------------|-------------|-----------|--------|
|                |                |             | Wave      | Reflow |
| ≤0402 (1005)   | Class II - X7R | All         | X         | O      |
| 0603 (1608)    | Class II - X7R | Cap. <2.2μF | O         | O      |
|                |                | Cap. ≥2.2μF | X         | O      |
| 0805 (2012)    | Class II - X7R | Cap. <4.7μF | O         | O      |
|                |                | Cap. ≥4.7μF | X         | O      |
| 1206 (3216)    | Class II - X7R | Cap. <4.7μF | O         | O      |
|                |                | Cap. ≥4.7μF | X         | O      |
| ≥1210 (3225)   | Class II - X7R | All         | X         | O      |

Soldering height :

The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less.  
 (Reference from IPC-610E)

The diagram illustrates a cross-section of a chip on a substrate. The chip is shown in yellow and grey. A vertical double-headed arrow on the left indicates the 'Chip Thickness'. A vertical double-headed arrow on the right indicates the 'Soldering Height', which is the height of the solder joint between the chip and the substrate.

**COOLING**

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint.

**CLEANING**

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

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