



信昌電子陶瓷股份有限公司

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Date : 2020/11/02

## APPROVAL SHEET

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

Description : Size 0201~2225, C0G/X7R/X5R/Y5V, U<sub>R</sub>≤50V

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

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# SPECIFICATION

## FOR

**Product Name : General Purpose Multilayer Ceramic Chip Capacitors**

**Part No. : FN Series**

**Description : Size 0201~2225, C0G/X7R/X5R/Y5V, U<sub>R</sub>≤50V**



**SPEC. No. : FN-000-001-17**

**DATE : 2020/11/02**

| DRAWN BY          | CHECEKED BY       | APPROVED BY        |
|-------------------|-------------------|--------------------|
| <i>Jane Hsiao</i> | <i>Yvens Chou</i> | <i>Joseph Ling</i> |

## 1. INTRODUCTION

POSPERITY Multilayer Ceramic Chip Capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

## 2. FEATURES

- a. A wide selection of sizes is available (0201 to 2225).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).
- d. RoHS & HALOGEN compliant.

## 3. APPLICATIONS

- a. For general digital circuit.
- b. For power supply bypass capacitors.
- c. For consumer electronics.
- d. For telecommunication.
- e. DC to DC converter.

## 4. HOW TO ORDER

| <u>FN</u>  | <u>21</u> | <u>X</u>   | <u>471</u>  | <u>K</u>  | <u>500</u>    | <u>P</u>  | <u>X</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                    | Code       | Description |
| FN      | General purpose product ≤50Vdc |            |             |

| Table 6 |             | Rated Voltage |             |      |             |
|---------|-------------|---------------|-------------|------|-------------|
| Code    | Description | Code          | Description | Code | Description |
| 4R0     | 4.0Vdc      | 100           | 10Vdc       | 250  | 25Vdc       |
| 6R3     | 6.3Vdc      | 160           | 16Vdc       | 500  | 50Vdc       |

| Table 2 |             | General Purpose |             |      |             |
|---------|-------------|-----------------|-------------|------|-------------|
| Code    | Description | Code            | Description | Code | Description |
| 03      | 0201 (0603) | 31              | 1206 (3216) | 46   | 1825 (4563) |
| 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) |

| Table 7 |                                  | Packaging Type |                               |      |             |
|---------|----------------------------------|----------------|-------------------------------|------|-------------|
| Code    | Description                      | 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 3 |             | Dielectric Material Characteristics |             |      |             |
|---------|-------------|-------------------------------------|-------------|------|-------------|
| Code    | Description | Code                                | Description | Code | Description |
| N       | C0G         | X                                   | X7R         |      |             |
| B       | X5R         | F                                   | Y5V         |      |             |

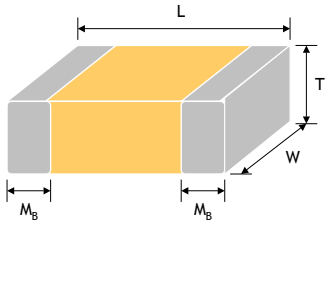
| Table 8 |                     | Thickness Description |                     |      |                     |
|---------|---------------------|-----------------------|---------------------|------|---------------------|
| Code    | Description         | Code                  | Description         | Code | 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 4 |                              | Capacitance Rule Code |                                |      |             |
|---------|------------------------------|-----------------------|--------------------------------|------|-------------|
| Code    | Description                  | 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    | I         | -10% ~ 0%   | Q    | ±0.03 pF    |
| B       | ±0.10 pF    | J         | ±5 %        | Z    | -20% ~ +80% |
| C       | ±0.25 pF    | K         | ±10 %       | X    | +10% ~ +20% |
| D       | ±0.50 pF    | L         | 0% ~ +10%   |      |             |
| F       | ±1 %        | M         | ±20 %       |      |             |
| G       | ±2 %        | N         | -5% ~ +10%  |      |             |
| H       | ±3 %        | P         | ±0.02 pF    |      |             |

| Table 9 |                | Special Control Code |             |
|---------|----------------|----------------------|-------------|
| Code    | Description    | Code                 | Description |
| G       | RoHS Compliant |                      |             |

### 5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm)                                      | W (mm)                                      | Code / T (mm)              | M <sub>B</sub> (mm) |  <p>Fig. 5.1 The outline of MLCC</p> |
|----------------|---|---|----------------------------|---------------------|---|
| 0201(0603)     | 0.60±0.03<br>0.60±0.05 (Cap.≥0.68μF)        | 0.30±0.03<br>0.30±0.05 (Cap.≥0.68μF)        | See No.4 Reference Table 8 | 0.15±0.05           |   |
| 0402(1005)     | 1.00±0.10<br>1.00±0.20 <sup>#1</sup>        | 0.50±0.10<br>0.50±0.20 <sup>#1</sup>        |                            | 0.25 +0.05/-0.10    |   |
| 0603(1608)     | 1.60±0.15                                   | 0.80±0.15                                   |                            | 0.40±0.15           |   |
| 0805(2012)     | 2.00±0.20                                   | 1.25±0.20                                   |                            | 0.50±0.20           |   |
| 1206(3216)     | 3.20±0.20<br>3.20 +0.30/-0.10 <sup>#2</sup> | 1.60±0.20<br>1.60 +0.30/-0.10 <sup>#2</sup> |                            | 0.60±0.20           |   |
| 1210(3225)     | 3.20±0.30                                   | 2.50±0.30                                   |                            | 0.75±0.35           |   |
| 1808(4520)     | 4.50±0.40                                   | 2.00±0.25                                   |                            | 0.75±0.35           |   |
| 1812(4532)     | 4.50±0.40                                   | 3.20±0.30                                   |                            | 0.75±0.35           |   |
| 1825(4563)     | 4.50±0.40                                   | 6.30±0.40                                   |                            | 0.75±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           |   |

<sup>#1</sup> For 0402 size K thickness products. <sup>#2</sup> For 1206 size P thickness products.

### 6. GENERAL ELECTRICAL DATA

| Dielectric                 | C0G   | X7R  | X5R                          | Y5V                                      |
|----------------------------|---|--|------------------------------|--|
| Size                       | 0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225  | 0201, 0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225 | 0201, 0402, 0603             | 0201, 0402, 0603, 0805, 1206, 1210, 1812 |
| Rated voltage (WVDC)       | 10V, 16V, 25V, 50V  | 6.3V, 10V, 16V, 25V, 50V                                   | 4V, 6.3V, 10V, 16V, 25V, 50V | 6.3V, 10V, 16V, 25V, 50V                 |
| Capacitance range*         | 0R1 to 100nF  | 100pF to 820nF   | 100pF to 820nF               | 10nF to 680nF                            |
| Capacitance tolerance**    | B(±0.1pF), C(±0.25pF), D(±0.5pF), F(±1%), G(±2%), J(±5%), K(±10%) | J(±5%), K(±10%), M(±20%)                                   |                              | Z(-20/+80%)                              |
| Tan δ*                     | Cap. <30pF : Q≥400+20C<br>Cap. ≥30pF : Q≥1000                     | Note 1   |                              |  |
| Operating temperature      | -55 to +125°C   |  | -55 to +85°C                 | -25 to +85°C                             |
| Capacitance characteristic | ±30ppm/°C   | ±15%   |                              | +30/-80%                                 |
| Termination                | Cu or Ag/Ni/Sn or Au (lead-free termination)                      |  |                              |  |

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

C0G : Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap.≤1000pF and 1.0±0.2Vrms, 1.0KHz±10% for Cap.>1000pF, 25°C at ambient temperature.

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

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

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

Note 1 : X7R/X5R

| Rated | D.F.≤ | Exception of D.F.≤  |
|-------|-------|---|
| 50V   | ≤2.5% | ≤3.5% 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF        |
|       |       | ≤5% 0201≥0.01μF,  |
|       |       | ≤10% 0402≥0.012μF, 0603>0.1μF                                 |
| 25V   | ≤3.5% | ≤5% 0201≥0.01μF   |
|       |       | ≤7% 0603≥0.33μF   |
|       |       | ≤10% 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF                     |
|       |       | ≤12.5% 0402≥0.47μF  |
| 16V   | ≤3.5% | ≤5% 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF,      |
|       |       | ≤10% 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF,  |
|       |       | ≤15% 0201≥0.1μF   |
| 10V   | ≤5%   | ≤10% 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, |
|       |       | ≤15% 0201≥0.1μF   |
| 6.3V  | ≤10%  | 0201≥0.1μF  |
| 4V    | ≤15%  | ---   |

Y5V

| Rated         | D.F.≤  | Exception of D.F.≤                         |
|---------------|--------|--|
| 50V           | ≤5%    | ≤7% 0603≥0.1μF, 0805≥0.47μF                |
| 35V           | ≤7%    | ---  |
| 25V           | ≤5%    | ≤7% 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, |
|               |        | ≤9% 0402≥0.068μF, 0603≥0.47μF              |
| 16V (C<1.0μF) | ≤7%    | ≤9% 0402≥0.068μF, 0603≥0.68μF              |
|               |        | ≤12.5% 0402≥0.22μF                         |
| 10V           | ≤12.5% | ≤20% 0402≥0.47μF                           |
| 6.3V          | ≤20%   | ---  |



## 7. CAPACITANCE RANGE(Con.)

### 7-1. C0G

| Cap(pF) | EIA Size | 1210 |     |     |     | 1808 |     | 1812 |     |     |     | 1825 |     | 2220 |     | 2225 |     |
|---------|----------|------|-----|-----|-----|------|-----|------|-----|-----|-----|------|-----|------|-----|------|-----|
|         |          | Code | 10V | 16V | 25V | 50V  | 25V | 50V  | 10V | 16V | 25V | 50V  | 25V | 50V  | 25V | 50V  | 25V |
| 2.2     | 2R2      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 2.7     | 2R7      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 3.3     | 3R3      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 3.9     | 3R9      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 4.7     | 4R7      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 5.6     | 5R6      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 6.8     | 6R8      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 8.2     | 8R2      |      |     |     |     | C    | C   |      |     |     |     |      |     |      |     |      |     |
| 10      | 100      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 12      | 120      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 15      | 150      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 18      | 180      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 22      | 220      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 27      | 270      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 33      | 330      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 39      | 390      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 47      | 470      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 56      | 560      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 68      | 680      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 82      | 820      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 100     | 101      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 120     | 121      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 150     | 151      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 180     | 181      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 220     | 221      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 270     | 271      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 330     | 331      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 390     | 391      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 470     | 471      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 560     | 561      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 680     | 681      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 820     | 821      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 1000    | 102      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 1200    | 122      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 1500    | 152      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 1800    | 182      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 2200    | 222      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 2700    | 272      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 3300    | 332      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 3900    | 392      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 4700    | 472      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 5600    | 562      | M    | M   | M   | M   | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 6800    | 682      | M    | M   | M/C | M/C | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 8200    | 822      | M    | M   | M/C | M/C | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 10000   | 103      | M    | M   | M/C | M/C | C    | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 12000   | 123      | C    | C   | C/E | C/E | E    | E   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 15000   | 153      | C    | C   | C/E | C/E | E    | E   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 18000   | 183      | F    | F   | F   | F   | F    | F   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 22000   | 223      | F    | F   | F   | F   | F    | F   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   |
| 27000   | 273      | F    | F   | F/G | F/G |      |     | C    | C   | E   | E   | F    | F   | F    | F   | F    | F   |
| 33000   | 333      | F    | F   | F/G | F/G |      |     | C    | C   | E   | E   | F    | F   | F    | F   | F    | F   |
| 39000   | 393      | F    | F   | F/G | F/G |      |     | G    | G   | G   | G   | F    | F   | F    | F   | F    | F   |
| 47000   | 473      | F    | F   | F/G | F/G |      |     | G    | G   | G   | G   | F    | F   | F    | F   | F    | F   |
| 56000   | 563      |      |     |     |     |      |     | G    | G   | G   | G   | F    | F   | F    | F   | F    | F   |
| 68000   | 683      |      |     |     |     |      |     | G    | G   | G   | G   | F    | F   | F    | F   | F    | F   |
| 82000   | 823      |      |     |     |     |      |     | G    | G   | G   | G   | F    | F   | F    | F   | F    | F   |
| 100000  | 104      |      |     |     |     |      |     | G    | G   | G   | G   | G    | G   | G    | G   | F    | F   |

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**Prosperity Dielectrics Co., Ltd.**

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

**7-2. X7R**

| Cap(pF) | EIA Size<br>Code | 0201 |     |     |     |     | 0402 |     |     |     |     | 0603 |     |     |     |     | 0805 |     |     |     |     |
|---------|------------------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|
|         |                  | 6.3V | 10V | 16V | 25V | 50V | 6.3V | 10V | 16V | 25V | 50V | 6.3V | 10V | 16V | 25V | 50V | 6.3V | 10V | 16V | 25V | 50V |
| 100     | 101              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 120     | 121              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 150     | 151              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 180     | 181              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 220     | 221              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 270     | 271              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 330     | 331              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 390     | 391              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 470     | 471              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 560     | 561              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 680     | 681              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 820     | 821              |      |     | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 1000    | 102              | L    | L   | L   | L   | L   |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 1200    | 122              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 1500    | 152              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 1800    | 182              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 2200    | 222              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 2700    | 272              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 3300    | 332              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 3900    | 392              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 4700    | 472              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 5600    | 562              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 6800    | 682              | L    | L   | L   |     |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 8200    | 822              | L    | L   | L   |     |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 10000   | 103              | L    | L   | L   | L   |     |      | N   | N   | N   | N   |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 12000   | 123              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 15000   | 153              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 18000   | 183              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 22000   | 223              |      | L   | L   |     |     | N    | N   | N   | N   | N/K |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 27000   | 273              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | S   | S   |      | X   | X   | X   | X   |
| 33000   | 333              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | B   | B   |      | X   | X   | X   | X   |
| 39000   | 393              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | B   | B   |      | X   | X   | X   | X   |
| 47000   | 473              |      |     |     |     |     |      | N   | N   | N   | N/K |      | S   | S   | B   | B   |      | X   | X   | X   | X   |
| 56000   | 563              |      |     |     |     |     |      | N   | N   | N   | K   |      | S   | S   | B   | B   |      | X   | X   | X   | X   |
| 68000   | 683              |      |     |     |     |     |      | N   | N   | N   | K   |      | S   | S   | B   | B   |      | X   | X   | X   | X   |
| 82000   | 823              |      |     |     |     |     |      | N   | N   | N   | K   |      | S   | S   | B   | B   |      | X   | X   | X   | X/C |
| 100000  | 104              |      |     |     |     |     | N    | N   | N   | N   | K   |      | S   | S   | B   | B   |      | X   | X   | X   | X/C |
| 120000  | 124              |      |     |     |     |     |      |     |     |     |     |      | S   | S   | B   |     |      | X   | X   | X   | C   |
| 150000  | 154              |      |     |     |     |     |      |     |     |     |     |      | S   | S   | B   | B   |      | C   | C   | C   | C   |
| 180000  | 184              |      |     |     |     |     |      |     |     |     |     |      | S   | S   | B   |     |      | C   | C   | C   | C   |
| 220000  | 224              |      |     |     |     |     | N    | N   | N   | N   |     |      | S   | S   | B   | B   |      | C   | C   | C   | C/I |
| 270000  | 274              |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     | C    | C   | C   | C   | I   |
| 330000  | 334              |      |     |     |     |     |      |     |     |     |     |      | B   | B   | B   | B   |      | C   | C   | C   | I   |
| 390000  | 394              |      |     |     |     |     |      |     |     |     |     |      | B   | B   | B   |     |      | C   | C   | C   | I   |
| 470000  | 474              |      |     |     |     |     | N    | N   |     |     |     | B    | B   | B   | B   | B   |      | C   | C   | C   | I   |
| 560000  | 564              |      |     |     |     |     |      |     |     |     |     |      | B   | B   |     |     |      | C   | C   | C   | I   |
| 680000  | 684              |      |     |     |     |     |      |     |     |     |     | B    | B   | B   |     |     |      | C   | C   | C   | I   |
| 820000  | 824              |      |     |     |     |     |      |     |     |     |     |      | B   | B   |     |     |      | C   | C   | C   | I   |

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

**7-2. X7R**

| Cap(pF) | EIA Size | 1206 |      |     |     |     | 1210 |      |     |     |     | 1812 |     |     |     | 1825 |     | 2220 |     | 2225 |     |     |
|---------|----------|------|------|-----|-----|-----|------|------|-----|-----|-----|------|-----|-----|-----|------|-----|------|-----|------|-----|-----|
|         |          | Code | 6.3V | 10V | 16V | 25V | 50V  | 6.3V | 10V | 16V | 25V | 50V  | 10V | 16V | 25V | 50V  | 25V | 50V  | 25V | 50V  | 25V | 50V |
| 100     | 101      |      |      |     | X   | X   |      |      |     |     |     |      |     |     |     |      |     |      |     |      |     |     |
| 120     | 121      |      |      |     | X   | X   |      |      |     |     |     |      |     |     |     |      |     |      |     |      |     |     |
| 150     | 151      |      | X    | X   | X   | X   |      |      |     |     |     |      |     |     |     |      |     |      |     |      |     |     |
| 180     | 181      |      | X    | X   | X   | X   |      |      |     |     |     |      |     |     |     |      |     |      |     |      |     |     |
| 220     | 221      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     |     |     |      |     |      |     |      |     |     |
| 270     | 271      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 330     | 331      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 390     | 391      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 470     | 471      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 560     | 561      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 680     | 681      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 820     | 821      |      | X    | X   | X   | X   |      |      |     | M   | M   |      |     | C   | C   |      |     |      |     |      |     |     |
| 1000    | 102      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 1200    | 122      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 1500    | 152      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 1800    | 182      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 2200    | 222      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 2700    | 272      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 3300    | 332      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 3900    | 392      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 4700    | 472      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 5600    | 562      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 6800    | 682      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 8200    | 822      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 10000   | 103      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 12000   | 123      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 15000   | 153      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 18000   | 183      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 22000   | 223      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 27000   | 273      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 33000   | 333      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 39000   | 393      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 47000   | 473      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 56000   | 563      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 68000   | 683      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 82000   | 823      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 100000  | 104      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 120000  | 124      |      | X    | X   | X   | X   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 150000  | 154      |      | M    | M   | M   | M   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 180000  | 184      |      | M    | M   | M   | M   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 220000  | 224      |      | M    | M   | M   | M   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 270000  | 274      |      | M    | M   | M   | C   |      | M    | M   | M   | M   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 330000  | 334      |      | M    | M   | M   | C   |      | M    | M   | M   | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 390000  | 394      |      | M    | M   | C   | P   |      | M    | M   | M   | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 470000  | 474      |      | J    | J   | C/J | P   |      | M    | M   | M   | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 560000  | 564      |      | J    | J   | C/J | P   |      | C    | C   | C   | C   | C    | C   | C   | C   | F    | F   | F    | F   | F    | F   | F   |
| 680000  | 684      |      | J    | J   | C/J | P   |      | C    | C   | C   | C   | C    | C   | C   | F   | F    | F   | F    | F   | F    | F   | F   |
| 820000  | 824      |      | J    | J   | E/J | P   |      | C    | C   | C   | C   | C    | C   | C   | F   | F    | F   | F    | F   | F    | F   | F   |



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

**7-3. X5R**

| Cap(pF) | EIA Size<br>Code | 0201 |      |     |     |     | 0402 |    |      |     |     | 0603 |     |     |      |     |     |     |     |
|---------|------------------|------|------|-----|-----|-----|------|----|------|-----|-----|------|-----|-----|------|-----|-----|-----|-----|
|         |                  | 4V   | 6.3V | 10V | 16V | 25V | 50V  | 4V | 6.3V | 10V | 16V | 25V  | 50V | 4V  | 6.3V | 10V | 16V | 25V | 50V |
| 100     | 101              |      |      |     | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 120     | 121              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 150     | 151              |      |      |     | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 180     | 181              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 220     | 221              |      |      |     | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 270     | 271              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 330     | 331              |      |      |     | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 390     | 391              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 470     | 471              |      |      |     | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 560     | 561              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 680     | 681              |      |      |     | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 820     | 821              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 1000    | 102              |      |      | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 1500    | 152              |      |      | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 2200    | 222              |      |      | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 2700    | 272              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 3300    | 332              |      |      | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 4700    | 472              |      |      | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 6800    | 682              |      |      | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 10000   | 103              |      | L    | L   | L   | L   | L    |    |      |     |     |      |     |     |      |     |     |     |     |
| 15000   | 153              |      | L    | L   |     |     |      |    |      |     |     |      |     |     |      |     |     |     | K   |
| 22000   | 223              |      | L    | L   |     |     |      |    |      |     |     |      | N   | N/K |      |     |     |     |     |
| 27000   | 273              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 33000   | 333              |      | L    | L   |     |     |      |    |      | N   |     |      |     | N/K | K    |     |     |     |     |
| 39000   | 393              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 47000   | 473              |      | L    | L   |     |     |      |    | N    | N   | N   |      |     | N/K |      |     |     |     |     |
| 56000   | 563              |      | L    | L   |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 68000   | 683              |      | L    | L   |     |     |      |    | N    | N   | N   |      |     | K   |      |     |     |     |     |
| 82000   | 823              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 100000  | 104              |      | L    | L   | L   | L   |      |    | N    | N   | N   | N    | K   |     |      |     |     |     | S   |
| 150000  | 154              |      |      |     |     |     |      |    | N    | N   | N   | N    |     |     |      |     |     |     |     |
| 220000  | 224              |      |      |     |     |     |      |    | N    | N   | N   | N    | N   |     | B    | B   | B   | B   | B   |
| 270000  | 274              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 330000  | 334              |      | L    |     |     |     |      |    | N    | N   |     |      |     |     | B    | B   | B   | B   |     |
| 390000  | 394              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |
| 470000  | 474              | L    | L    |     |     |     |      |    | N    | N   | N/K | K    | K   |     | B    | B   | B   | B   | B   |
| 680000  | 684              |      |      |     |     |     |      |    | N    | N   |     |      |     |     | B    | B   | B   | B   |     |
| 820000  | 824              |      |      |     |     |     |      |    |      |     |     |      |     |     |      |     |     |     |     |

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

**7-4. Y5V**

| Cap(pF) | EIA Size | 0201 |      |     |     |     |     | 0402 |     |     |     |     |      | 0603 |     |     |     |     | 0805 |     |     |  |
|---------|----------|------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|------|-----|-----|-----|-----|------|-----|-----|--|
|         | Code     | 6.3V | 6.3V | 10V | 16V | 25V | 50V | 6.3V | 10V | 16V | 25V | 50V | 6.3V | 10V  | 16V | 25V | 50V | 10V | 16V  | 25V | 50V |  |
| 10000   | 103      |      |      | N   | N   | N   | N   |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 15000   | 153      |      |      | N   | N   | N   | N   |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 22000   | 223      |      |      | N   | N   | N   | N   |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 33000   | 333      |      |      | N   | N   | N   | N   |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 47000   | 473      |      |      | N   | N   | N   |     |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 68000   | 683      |      |      | N   | N   | N   |     |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 100000  | 104      |      |      | N   | N   | N   |     |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 150000  | 154      |      | N    | N   |     |     |     |      | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 220000  | 224      |      | N    | N   |     |     |     | S    | S   | S   | S   | S   | A    | A    | A   | A   |     |     |      |     |     |  |
| 330000  | 334      |      | N    | N   |     |     |     |      | S   | S   |     |     | X    | X    | X   | X   |     |     |      |     |     |  |
| 470000  | 474      |      | N    | N   |     |     |     |      | S   | S   |     |     | X    | X    | X   | B/C |     |     |      |     |     |  |
| 680000  | 684      |      |      |     |     |     |     |      | S   | B   |     |     | X    | X    | C   | C   |     |     |      |     |     |  |

| Cap(pF) | EIA Size | 1206 |     |     |     |     |     | 1210 |     |     |     |     |     | 1812 |     |     |     |
|---------|----------|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|-----|-----|
|         | Code     | 6.3V | 10V | 16V | 25V | 35V | 50V | 6.3V | 10V | 16V | 25V | 35V | 50V | 10V  | 16V | 25V | 50V |
| 10000   | 103      |      | X   | X   | X   |     | X   |      |     |     |     |     |     |      |     |     |     |
| 15000   | 153      |      | X   | X   | X   |     | X   |      |     |     |     |     |     |      |     |     |     |
| 22000   | 223      |      | X   | X   | X   |     | X   |      |     |     |     |     |     |      |     |     |     |
| 33000   | 333      |      | X   | X   | X   |     | X   |      |     |     |     |     |     |      |     |     |     |
| 47000   | 473      |      | X   | X   | X   |     | X   |      |     |     |     |     |     |      |     |     |     |
| 68000   | 683      |      | X   | X   | X   |     | X   |      |     |     |     |     |     |      |     |     |     |
| 100000  | 104      |      | X   | X   | X   |     | X   | M    | M   | M   |     | M   | C   | C    | C   | C   |     |
| 150000  | 154      |      | X   | X   | X   |     | X   | M    | M   | M   |     | M   | C   | C    | C   | C   |     |
| 220000  | 224      |      | X   | X   | X   |     | X   | M    | M   | M   |     | M   | C   | C    | C   | C   |     |
| 330000  | 334      |      | X   | X   | X   |     | X   | M    | M   | M   |     | M   | C   | C    | C   | C   |     |
| 470000  | 474      |      | X   | X   | X   |     | X   | M    | M   | M   |     | M   | C   | C    | C   | C   |     |
| 680000  | 684      |      | X   | X   | X   |     | X   | M    | M   | M   |     | M   | C   | C    | C   | C   |     |

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. (Tangent of loss angle) | <p>* Class I : (C0G)<br/>Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%.<br/>Cap.&gt;1000pF, 1.0±0.2Vrms, 1KHz±10%.</p> <p>* Class II : (X7R, X5R, Y5V)<br/>Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**.<br/>Cap.&gt;10μF, 0.5±0.2Vrms, 120Hz±20%.</p> <p>** Test condition : 0.5±0.2Vrms, 1KHz±10%.<br/>X5R :<br/>01R5≥103, 0201≥224(6.3V,10V,16V)*1.</p> | <p>* C0G : Cap.≥30pF, Q≥1000; Cap.&lt;30pF, Q≥400+20C.<br/>*X7R/X5R :</p> <table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤2.5%</td> <td>≤3.5%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01uF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.012μF, 0603&gt;0.1μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF,</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤3.5%</td> <td>≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤5%</td> <td>≤10%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF</td> </tr> <tr> <td>6.3V</td> <td>≤10%</td> <td>≤15%</td> <td>0201≥0.1μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>* Y5V</p> <table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>50V</td> <td>≤5%</td> <td>≤7%</td> <td>0603≥0.1μF, 0805≥0.47μF</td> </tr> <tr> <td>35V</td> <td>≤7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤5%</td> <td>≤7%</td> <td>0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF</td> </tr> <tr> <td>≤9%</td> <td>0402≥0.068μF, 0603≥0.47μF,</td> </tr> <tr> <td rowspan="2">16V (C&lt;1.0μF)</td> <td rowspan="2">≤7%</td> <td>≤9%</td> <td>0402≥0.068μF, 0603≥0.68μF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>10V</td> <td>≤12.5%</td> <td>≤20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated | D.F.≤ | Exception of D.F.≤ |  | 50V | ≤2.5% | ≤3.5% | 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF | ≤5% | 0201≥0.01uF | ≤10% | 0402≥0.012μF, 0603>0.1μF | 25V | ≤3.5% | ≤5% | 0201≥0.01μF | ≤7% | 0603≥0.33μF | ≤10% | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, | 16V | ≤3.5% | ≤12.5% | 0402≥0.47μF | ≤5% | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF | ≤10% | 0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF | 10V | ≤5% | ≤10% | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF | ≤15% | 0201≥0.1μF | ≤10% | 0201≥0.1μF | 6.3V | ≤10% | ≤15% | 0201≥0.1μF | 4V | ≤15% | --- | --- | Rated | D.F.≤ | Exception of D.F.≤ |  | 50V | ≤5% | ≤7% | 0603≥0.1μF, 0805≥0.47μF | 35V | ≤7% | --- | --- | 25V | ≤5% | ≤7% | 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF | ≤9% | 0402≥0.068μF, 0603≥0.47μF, | 16V (C<1.0μF) | ≤7% | ≤9% | 0402≥0.068μF, 0603≥0.68μF | ≤12.5% | 0402≥0.22μF | 10V | ≤12.5% | ≤20% | 0402≥0.47μF | 6.3V | ≤20% | --- | --- |
| Rated         | D.F.≤                          | Exception of D.F.≤  |  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 50V           | ≤2.5%                          | ≤3.5%   | 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤5%   | 0201≥0.01uF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤10%  | 0402≥0.012μF, 0603>0.1μF   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 25V           | ≤3.5%                          | ≤5%   | 0201≥0.01μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤7%   | 0603≥0.33μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤10%  | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF,  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 16V           | ≤3.5%                          | ≤12.5%  | 0402≥0.47μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤5%   | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤10%  | 0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 10V           | ≤5%                            | ≤10%  | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤15%  | 0201≥0.1μF   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤10%  | 0201≥0.1μF   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 6.3V          | ≤10%                           | ≤15%  | 0201≥0.1μF   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 4V            | ≤15%                           | ---   | ---  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| Rated         | D.F.≤                          | Exception of D.F.≤  |  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 50V           | ≤5%                            | ≤7%   | 0603≥0.1μF, 0805≥0.47μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 35V           | ≤7%                            | ---   | ---  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 25V           | ≤5%                            | ≤7%   | 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤9%   | 0402≥0.068μF, 0603≥0.47μF,   |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 16V (C<1.0μF) | ≤7%                            | ≤9%   | 0402≥0.068μF, 0603≥0.68μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
|               |                                | ≤12.5%  | 0402≥0.22μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 10V           | ≤12.5%                         | ≤20%  | 0402≥0.47μF  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |
| 6.3V          | ≤20%                           | ---   | ---  |       |       |                    |  |     |       |       |  |     |             |      |                          |     |       |     |             |     |             |      |                                       |     |       |        |             |     |   |      |  |     |     |      |   |      |            |      |            |      |      |      |            |    |      |     |     |       |       |                    |  |     |     |     |                         |     |     |     |     |     |     |     |                                       |     |                            |               |     |     |                           |        |             |     |        |      |             |      |      |     |     |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.   | Item  | Test Condition  | Requirements  |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|---|---|---|---|-----------------|------------|-------------------|----------------|-------------------|------|-------------------|-----|-------------------|--|------|--------------------|-----|------------------|-----|-------------|-----|-------------|-----|------------------|
| 4.  | Temperature Coefficient (Temperature characteristic of capacitance) | * With no electrical load.  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | <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> <tr> <td>X5R</td> <td>-55~ 85°C at 25°C</td> </tr> <tr> <td>Y5V</td> <td>-25~ 85°C at 20°C</td> </tr> </tbody> </table> | T.C.  | Operating Temp. | C0G        | -55~125°C at 25°C | X7R            | -55~125°C at 25°C | X5R  | -55~ 85°C at 25°C | Y5V | -25~ 85°C at 20°C | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table> | T.C. | Capacitance Change | C0G | Within ±30ppm/°C | X7R | Within ±15% | X5R | Within ±15% | Y5V | Within +30%/-80% |
|   |   | T.C.  | Operating Temp.   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | C0G   | -55~125°C at 25°C   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| X7R   | -55~125°C at 25°C   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| X5R   | -55~ 85°C at 25°C   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| Y5V   | -25~ 85°C at 20°C   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| T.C.  | Capacitance Change  |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| C0G   | Within ±30ppm/°C  |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| X7R   | Within ±15%   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| X5R   | Within ±15%   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| Y5V   | Within +30%/-80%  |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| * Measurement voltage for Class II :  |   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| <table border="1"> <thead> <tr> <th>Size</th> <th>Cap. Range</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td>Cap.&lt;0.1µF</td> <td>1V</td> </tr> <tr> <td>0.1µF≤Cap.&lt;1µF</td> <td>0.2V</td> </tr> <tr> <td>0402</td> <td>Cap.&lt;0.1µF</td> <td>1V</td> </tr> </tbody> </table> | Size  | Cap. Range  | Condition   | 0201            | Cap.<0.1µF | 1V                | 0.1µF≤Cap.<1µF | 0.2V              | 0402 | Cap.<0.1µF        | 1V  |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| Size  | Cap. Range  | Condition   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| 0201  | Cap.<0.1µF  | 1V  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   | 0.1µF≤Cap.<1µF  | 0.2V  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| 0402  | Cap.<0.1µF  | 1V  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| 5.  | Insulation Resistance   | * To apply rated voltage for Max. 120sec.   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | * $\geq 10G\Omega$ or $RxC \geq 500\Omega \cdot F$ , whichever is smaller.  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | * Except :  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | Rated voltage (X7R/X5R/Y5V)   | I.R.  |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | 50V : 0402>0.01µF   | $\geq 10G\Omega$ or $RxC \geq 100\Omega \cdot F$ , whichever is smaller |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | 16V : 0201 $\geq 0.1\mu F$ , 0402 $\geq 0.22\mu F$  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | 10V : 0201 $\geq 47nF$ , 0402 $\geq 0.47\mu F$ , 0603 $\geq 0.47\mu F$ , 6.3V; 4V   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | Rated voltage (X7R/X5R/Y5V)   | I.R.  |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | 50V : 0402 $\geq 0.1\mu F$  | $RxC \geq 50\Omega \cdot F$   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
|   |   | 25V : 0201 $\geq 0.1\mu F$  |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| 16V : 0603 $\geq 10\mu F$ , 0402 $\geq 1\mu F$ , 0201 $\geq 0.22\mu F$  |   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| 10V : 0201>0.1µF  |   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |
| 6.3V : 0201 $\geq 0.1\mu F$   |   |   |   |                 |            |                   |                |                   |      |                   |     |                   |  |      |                    |     |                  |     |             |     |             |     |                  |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.  | Item  | Test Condition   | Requirements  |           |            |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
|------|---|--|---|-----------|------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|---|
| 6.   | Dielectric Strength                             | <ul style="list-style-type: none"> <li>* To apply 250% of rated voltage.</li> <li>* Duration : 1 to 5 sec.</li> <li>* Charge and discharge current less than 50mA.</li> </ul>  | <ul style="list-style-type: none"> <li>* No evidence of damage or flash over during test.</li> </ul>  |           |            |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 7.   | Solderability                                   | <ul style="list-style-type: none"> <li>* Solder temperature : 235±5°C for (0201~1210).</li> <li>* Solder temperature : 245±5°C for (1808~2225).</li> <li>* Dipping time : 2±0.5 sec.</li> </ul>  | <ul style="list-style-type: none"> <li>* 75% min. coverage of all metalized area.</li> </ul>  |           |            |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 8.   | Resistance to Soldering Heat                    | <ul style="list-style-type: none"> <li>* Solder temperature : 260±5°C.</li> <li>* Dipping time : 10±1 sec.</li> <li>* Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.</li> <li>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</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 ±2.5% or ±0.25pF, whichever is larger.<br/>X7R, X5R : Within ±7.5%.<br/>Y5V : Within ±20%.</li> <li>* D.F.(Q)/I.R. : To meet initial requirements.</li> <li>* 25% max. leaching on each edge.</li> </ul> |           |            |   |                            |      |   |            |     |   |                            |      |   |            |     |   |
| 9.   | Temperature Cycle (Rapid change of temperature) | <ul style="list-style-type: none"> <li>* Conduct the five cycles according to the temperatures and time.</li> </ul> <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> <ul style="list-style-type: none"> <li>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</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> | 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 | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap. change :<br/>C0G : Within ±2.5% or ±0.25pF, whichever is larger.<br/>X7R, X5R : Within ±7.5%.<br/>Y5V : Within ±20%.</li> <li>* Q for C0G : To meet initial requirements.</li> <li>* D.F.(Class II) : ≤150% of initial requirement.</li> <li>* I.R. : To meet initial requirements.</li> </ul> |
| 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  |   |           |            |   |                            |      |   |            |     |   |                            |      |   |            |     |   |

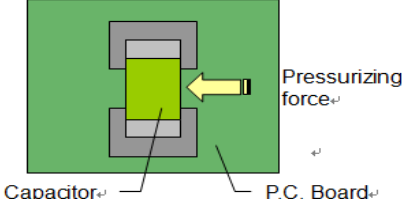
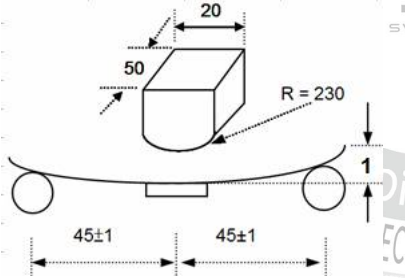
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.  | Item                                     | Test Condition  | Requirements   |               |      |                   |  |                               |                               |  |                     |
|--|--|---|--|---------------|------|-------------------|--|-------------------------------|-------------------------------|--|---------------------|
| 10.  | Humidity (Damp Heat) Steady State        | * Test temp. : 40±2°C.<br>* Humidity : 90~95% RH.<br>* Test time : 500 +24/-0hrs.<br>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).                                       | * No remarkable damage.<br>* Cap. change :<br>C0G : Within ±5.0% or ±0.5pF, whichever is larger.<br>X7R, X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V.<br>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.<br>Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V.<br>* Q for C0G :<br>Cap.>30pF, Q≥350.<br>10pF≤Cap.≤30pF, Q≥275+2.5C.<br>Cap.<10pF, Q≥200+10C.<br>* D.F.(Class II) : ≤200% of initial requirement.<br>* I.R. : ≥10V, ≥1GΩ or R×C≥50Ω-F, whichever is smaller.<br>Class II (X7R, X5R, Y5V) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402&gt;0.01μF</td> <td rowspan="5">≥1GΩ or R×C≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>25V : 0201≥0.1uF, 0402≥0.22μF</td> </tr> <tr> <td>16V : 0201≥0.1uF, 0402≥0.22μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF,</td> </tr> <tr> <td>6.3V; 4V; Size≥1812</td> </tr> </tbody> </table> | Rated voltage | I.R. | 50V : 0402>0.01μF | ≥1GΩ or R×C≥10Ω-F, whichever is smaller  | 25V : 0201≥0.1uF, 0402≥0.22μF | 16V : 0201≥0.1uF, 0402≥0.22μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, | 6.3V; 4V; Size≥1812 |
| Rated voltage                              | I.R.                                     |   |  |               |      |                   |  |                               |                               |  |                     |
| 50V : 0402>0.01μF                          | ≥1GΩ or R×C≥10Ω-F, whichever is smaller  |   |  |               |      |                   |  |                               |                               |  |                     |
| 25V : 0201≥0.1uF, 0402≥0.22μF              |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 16V : 0201≥0.1uF, 0402≥0.22μF              |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 6.3V; 4V; Size≥1812                        |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 11.  | Humidity (Damp Heat) Load                | * Test temp. : 40±2°C.<br>* Humidity : 90~95%RH.<br>* Test time : 500 +24/-0hrs.<br>* To apply voltage : Rated voltage.<br>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>* 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>C0G : Within ±7.5% or ±0.75pF, whichever is larger.<br>X7R, X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V.<br>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.<br>Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V.<br>* Q for C0G : Cap.≥30pF, Q≥200; Cap.<30pF, Q≥100+10/3C.<br>* D.F.(Class II) : ≤200% of initial requirement.<br>* I.R. : ≥10V, ≥500MΩ or R×C≥25Ω-F, whichever is smaller.<br>Class II (X7R, X5R, Y5V) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402&gt;0.01μF</td> <td rowspan="5">≥500MΩ or R×C≥5Ω-F, whichever is smaller</td> </tr> <tr> <td>25V : 0201≥0.1uF, 0402≥0.22μF</td> </tr> <tr> <td>16V : 0201≥0.1uF, 0402≥0.22μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF,</td> </tr> <tr> <td>6.3V; 4V; Size≥1812</td> </tr> </tbody> </table>                                | Rated voltage | I.R. | 50V : 0402>0.01μF | ≥500MΩ or R×C≥5Ω-F, whichever is smaller | 25V : 0201≥0.1uF, 0402≥0.22μF | 16V : 0201≥0.1uF, 0402≥0.22μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, | 6.3V; 4V; Size≥1812 |
| Rated voltage                              | I.R.                                     |   |  |               |      |                   |  |                               |                               |  |                     |
| 50V : 0402>0.01μF                          | ≥500MΩ or R×C≥5Ω-F, whichever is smaller |   |  |               |      |                   |  |                               |                               |  |                     |
| 25V : 0201≥0.1uF, 0402≥0.22μF              |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 16V : 0201≥0.1uF, 0402≥0.22μF              |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, |  |   |  |               |      |                   |  |                               |                               |  |                     |
| 6.3V; 4V; Size≥1812                        |  |   |  |               |      |                   |  |                               |                               |  |                     |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.  | Item                                    | Test Condition   | Requirements      |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
|--|---|--|-------------------|------------|-------|-------------------|------|---------|------|---------|------|---------|------|------------|---------------|-------------|------|---------|---------|---------|-----|-----|-----------|------|---------|-----|---------|--------|----------|--|-----|-----|----------|------|-----|------|-----------|------|---------|-----|----------|---|---------------|------|-------------------|---|-------------------------------|-------------------------------|--|---------------------|
| 12.  | High Temperature Load (Endurance)       | <p>* Test temp. :<br/>C0G, X7R : 125±3°C.<br/>X5R, Y5V : 85±3°C.</p> <p>* To apply voltage :<br/>(1) ≤6.3V : 150% of rated voltage.<br/>(2) 10V≤Ur≤50V : 200% of rated voltage.<br/>(3) 100% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R</td> <td>≤10V</td> <td>C≥0.1μF</td> </tr> <tr> <td>≥16V</td> <td>C&gt;0.1μF</td> </tr> </tbody> </table> <p>(4) 150% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td>X5R/X7R</td> <td>16V/25V</td> <td>C≥0.1μF</td> </tr> <tr> <td>X7R</td> <td>16V</td> <td>C≥0.022μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R</td> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td>10~25V</td> <td>C≥0.22μF</td> </tr> <tr> <td></td> <td>Y5V</td> <td>16V</td> <td>C≥0.47μF</td> </tr> <tr> <td>0603</td> <td>X7R</td> <td>≥50V</td> <td>C≥0.082μF</td> </tr> <tr> <td>0805</td> <td>X5R/X7R</td> <td>50V</td> <td>C≥0.47μF</td> </tr> </tbody> </table> <p>* Test time : 1000 +24/-0 hrs.<br/>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br/>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).<br/>** De-rating conditions :</p> | Size              | Dielectric | Rated | Capacitance range | 0201 | X5R/X7R | ≤10V | C≥0.1μF | ≥16V | C>0.1μF | Size | Dielectric | Rated Voltage | Capacitance | 0201 | X5R/X7R | 16V/25V | C≥0.1μF | X7R | 16V | C≥0.022μF | 0402 | X5R/X7R | 50V | C≥0.1μF | 10~25V | C≥0.22μF |  | Y5V | 16V | C≥0.47μF | 0603 | X7R | ≥50V | C≥0.082μF | 0805 | X5R/X7R | 50V | C≥0.47μF | <p>* No remarkable damage.<br/>* Cap. change :<br/>C0G : Within ±3.0% or ±0.3pF, whichever is larger.<br/>X7R, X5R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V.<br/>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.<br/>Y5V : Within ±30% for ≥10V, within +30/-40% for ≤6.3V.<br/>* Q for C0G :<br/>Cap.&gt;30pF, Q≥350.<br/>10pF≤Cap.≤30pF, Q≥275+2.5C.<br/>Cap.&lt;10pF, Q≥200+10C.<br/>* D.F.(Class II) : ≤200% of initial requirement.<br/>* I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller.<br/>Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402&gt;0.01μF</td> <td rowspan="5">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>25V : 0201≥0.1uF, 0402≥0.22μF</td> </tr> <tr> <td>16V : 0201≥0.1uF, 0402≥0.22μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF,</td> </tr> <tr> <td>6.3V; 4V; Size≥1812</td> </tr> </tbody> </table> | Rated voltage | I.R. | 50V : 0402>0.01μF | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | 25V : 0201≥0.1uF, 0402≥0.22μF | 16V : 0201≥0.1uF, 0402≥0.22μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, | 6.3V; 4V; Size≥1812 |
| Size                                       | Dielectric                              | Rated  | Capacitance range |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 0201                                       | X5R/X7R                                 | ≤10V   | C≥0.1μF           |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
|  |   | ≥16V   | C>0.1μF           |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| Size                                       | Dielectric                              | Rated Voltage  | Capacitance       |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 0201                                       | X5R/X7R                                 | 16V/25V  | C≥0.1μF           |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
|  | X7R                                     | 16V  | C≥0.022μF         |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 0402                                       | X5R/X7R                                 | 50V  | C≥0.1μF           |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
|  |   | 10~25V   | C≥0.22μF          |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
|  | Y5V                                     | 16V  | C≥0.47μF          |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 0603                                       | X7R                                     | ≥50V   | C≥0.082μF         |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 0805                                       | X5R/X7R                                 | 50V  | C≥0.47μF          |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| Rated voltage                              | I.R.                                    |  |                   |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 50V : 0402>0.01μF                          | ≥1GΩ or RxC≥10Ω-F, whichever is smaller |  |                   |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 25V : 0201≥0.1uF, 0402≥0.22μF              |   |  |                   |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 16V : 0201≥0.1uF, 0402≥0.22μF              |   |  |                   |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, |   |  |                   |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |
| 6.3V; 4V; Size≥1812                        |   |  |                   |            |       |                   |      |         |      |         |      |         |      |            |               |             |      |         |         |         |     |     |           |      |         |     |         |        |          |  |     |     |          |      |     |      |           |      |         |     |          |   |               |      |                   |   |                               |                               |  |                     |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.        | Item   | Test Condition   | Requirements   |            |             |     |   |          |               |     |             |
|------------|--|--|--|------------|-------------|-----|---|----------|---------------|-----|-------------|
| 13.        | Adhesive Strength of Termination (Robustness of termination) | <p>* Capacitors mounted on a substrate. A force of 2N(0201) or 5N(0402~0603) 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>  <p>Capacitor, P.C. Board, Pressurizing force</p>   | <p>* No remarkable damage or removal of the terminations.</p>  |            |             |     |   |          |               |     |             |
| 14.        | Resistance to Flexure of Substrate (Substrate bending test)  | <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>Unit : mm</p>   | <p>* No remarkable damage.</p> <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>COG</td> <td>Within ±5.0% or ±0.5pF, whichever is larger</td> </tr> <tr> <td>X7R, X5R</td> <td>Within ±12.5%</td> </tr> <tr> <td>Y5V</td> <td>Within ±30%</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 | COG | Within ±5.0% or ±0.5pF, whichever is larger | X7R, X5R | Within ±12.5% | Y5V | Within ±30% |
| Dielectric | Cap. Change  |  |  |            |             |     |   |          |               |     |             |
| COG        | Within ±5.0% or ±0.5pF, whichever is larger                  |  |  |            |             |     |   |          |               |     |             |
| X7R, X5R   | Within ±12.5%  |  |  |            |             |     |   |          |               |     |             |
| Y5V        | Within ±30%  |  |  |            |             |     |   |          |               |     |             |
| 15.        | Vibration Resistance   | <p>* Vibration frequency : 10~55 Hz/min.<br/>                     * Total amplitude : 1.5mm.<br/>                     * Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions)<br/>                     * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br/>                     * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p> | <p>* No remarkable damage.<br/>                     * Cap. change and D.F. : To meet initial spec.</p>   |            |             |     |   |          |               |     |             |



**9. PACKAGE DIMENSION AND QUANTITY**

| Size       | Thickness (mm)   | Paper tape |          | Plastic tape |          |
|------------|------------------|------------|----------|--------------|----------|
|            |                  | 7" reel    | 13" reel | 7" reel      | 13" reel |
| 0201(0603) | 0.30±0.03        | 15k        | 70k      | -            | -        |
|            | 0.30±0.05        | 15k        | -        | -            | -        |
|            | 0.30±0.09        | 15k        | -        | -            | -        |
| 0402(1005) | 0.50±0.05        | 10k        | 50k      | -            | -        |
|            | 0.50 +0.02/-0.05 | 10k        | 50k      | -            | -        |
|            | 0.50±0.20        | 10k        | -        | -            | -        |
| 0603(1608) | 0.50±0.10        | 4k         | -        | -            | -        |
|            | 0.80±0.07        | 4k         | 15k      | -            | -        |
|            | 0.80 +0.15/-0.10 | 4k         | 15k      | -            | -        |
| 0805(2012) | 0.50±0.10        | 4k         | 15k      | -            | -        |
|            | 0.60±0.10        | 4k         | 15k      | -            | -        |
|            | 0.80±0.10        | 4k         | 15k      | -            | -        |
|            | 0.85±0.10        | 4k         | 15k      | -            | -        |
|            | 1.25±0.10        | -          | -        | 3k           | 10k      |
| 1206(3216) | 0.80±0.10        | 4k         | 15k      | -            | -        |
|            | 0.85±0.10        | 4k         | 15k      | -            | -        |
|            | 0.95±0.10        | -          | -        | 3k           | 10k      |
|            | 1.15±0.15        | -          | -        | 3k           | 10k      |
|            | 1.25±0.10        | -          | -        | 3k           | 10k      |
|            | 1.60±0.20        | -          | -        | 2k           | 10k      |
|            | 1.60 +0.30/-0.10 | -          | -        | 2k           | 9k       |
| 1210(3225) | 0.85±0.10        | -          | -        | 3k           | 10k      |
|            | 0.95±0.10        | -          | -        | 3k           | 10k      |
|            | 1.25±0.10        | -          | -        | 3k           | 10k      |
|            | 1.60±0.20        | -          | -        | 2k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | 6k       |
| 1808(4520) | 2.50±0.30        | -          | -        | 1k           | 6k       |
|            | 1.25±0.10        | -          | -        | 2k           | 10k      |
|            | 1.60±0.20        | -          | -        | 2k           | 8k       |
| 1812(4532) | 2.00±0.20        | -          | -        | 1k           | 6k       |
|            | 1.25±0.10        | -          | -        | 1k           | 5k       |
|            | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
| 1825(4563) | 2.50±0.30        | -          | -        | 0.5k         | 3k       |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |
|            | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
| 2220(5750) | 2.50±0.30        | -          | -        | 0.5k         | -        |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |
|            | 1.60±0.20        | -          | -        | 1k           | -        |
|            | 2.00±0.20        | -          | -        | 1k           | -        |
| 2225(5763) | 2.50±0.30        | -          | -        | 0.5k         | -        |
|            | 2.80±0.30        | -          | -        | 0.5k         | -        |
|            | 1.60±0.20        | -          | -        | 1k           | -        |

Unit : pcs

**9. PACKAGE DIMENSION AND QUANTITY**

**9.1. EMBOSSED TAPE DIMENSIONS**

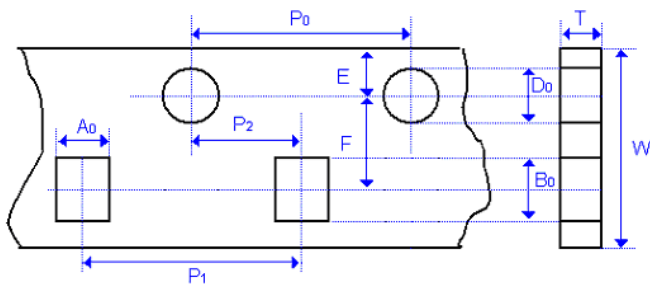


Fig. 9.1 The dimension of paper tape

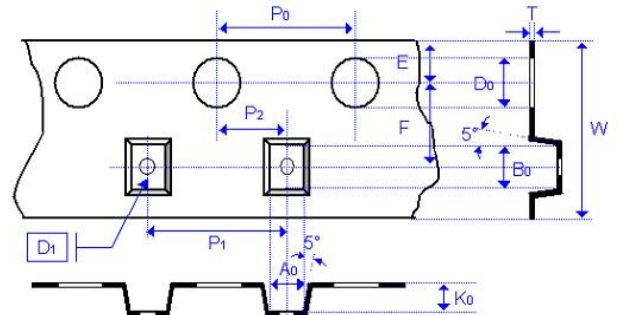


Fig. 9.2 The dimension of plastic tape

| Size              | 0201       | 0402                   | 0603            |                 | 0805       |                        |
|-------------------|------------|------------------------|-----------------|-----------------|------------|------------------------|
| Chip Thickness    | 0.30±0.03  | 0.50±0.05<br>0.50±0.10 | 0.80±0.07       | 0.80 +0.15/-0.1 | 0.80±0.10  | 1.25±0.10<br>1.25±0.20 |
| A <sub>0</sub>    | 0.39±0.07  | 0.70±0.20              | 1.00 +0.05/-0.1 | 1.02 +0.05/-0.1 | 1.50±0.10  | <1.65                  |
| B <sub>0</sub>    | 0.69±0.07  | 1.20±0.20              | 1.80±0.10       | 1.80±0.10       | 2.30±0.10  | <2.40                  |
| T                 | ≤0.50      | ≤0.80                  | 0.95±0.05       | 0.97±0.05       | 0.95±0.05  | 0.23±0.05              |
| K <sub>0</sub>    | -          | -                      | -               | -               | -          | <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              |
| 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±0.10 | 40.00±0.10             | 40.00±0.20      | 40.00±0.20      | 40.00±0.20 | 40.00±0.20             |
| P <sub>1</sub>    | 2.00±0.05  | 2.00±0.05              | 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              |
| D <sub>0</sub>    | 1.55±0.05  | 1.55±0.05              | 1.55±0.05       | 1.55±0.05       | 1.55±0.05  | 1.50 +0.10/-0          |
| D <sub>1</sub>    | -          | -                      | -               | -               | -          | 1.00±0.10              |
| E                 | 1.75±0.05  | 1.75±0.05              | 1.75±0.05       | 1.75±0.05       | 1.75±0.05  | 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              |
| Unit :            | mm         | mm                     | mm              | mm              | mm         | mm                     |

| Size              | 1206       |                        |                        | 1210                   |               | 1808                   |               |
|-------------------|------------|------------------------|------------------------|------------------------|---------------|------------------------|---------------|
| Chip Thickness    | 0.80±0.10  | 0.95±0.10<br>1.25±0.10 | 1.25±0.10<br>1.60±0.20 | 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     |
| A <sub>0</sub>    | 2.00±0.10  | <2.00                  | <2.50                  | <2.50                  | <3.10         | <2.50                  | <2.50         |
| B <sub>0</sub>    | 3.50±0.10  | <3.60                  | <5.30                  | <5.30                  | <4.00         | <5.30                  | <5.30         |
| T                 | 0.95±0.05  | 0.23±0.05              | 0.25±0.05              | 0.25±0.05              | 0.23±0.05     | 0.25±0.05              | 0.25±0.05     |
| K <sub>0</sub>    | -          | <2.50                  | <2.50                  | <2.50                  | <3.50         | <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     | 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     |
| 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  | 1.50 +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              | 1.50±0.10              | 1.50±0.10              | 1.00±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     |
| F                 | 3.50±0.05  | 3.50±0.05              | 5.50±0.05              | 5.50±0.05              | 3.50±0.05     | 5.50±0.05              | 5.50±0.05     |
| Unit :            | mm         | mm                     | mm                     | mm                     | mm            | mm                     | mm            |

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9. PACKAGE DIMENSION AND QUANTITY

| Size              | 1812                                |               | 1825                   |               | 2220                                |               |
|-------------------|-------------------------------------|---------------|------------------------|---------------|-------------------------------------|---------------|
| Chip Thickness    | 1.25±0.10<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     | 1.40±0.15<br>1.60±0.20<br>2.00±0.20 | 2.50±0.30     |
| A <sub>0</sub>    | <3.90                               | <3.90         | <6.80                  | <6.80         | <5.80                               | <6.80         |
| B <sub>0</sub>    | <5.30                               | <5.30         | <5.30                  | <5.30         | <6.50                               | <6.50         |
| T                 | 0.25±0.05                           | 0.25±0.05     | 0.30±0.10              | 0.30±0.10     | 0.30±0.10                           | 0.30±0.10     |
| K <sub>0</sub>    | <2.50                               | <3.00         | <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    |
| 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>    | 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     |
| 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>    | 1.50±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     |
| 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     |
| Unit :            | mm                                  | mm            | mm                     | mm            | mm                                  | mm            |

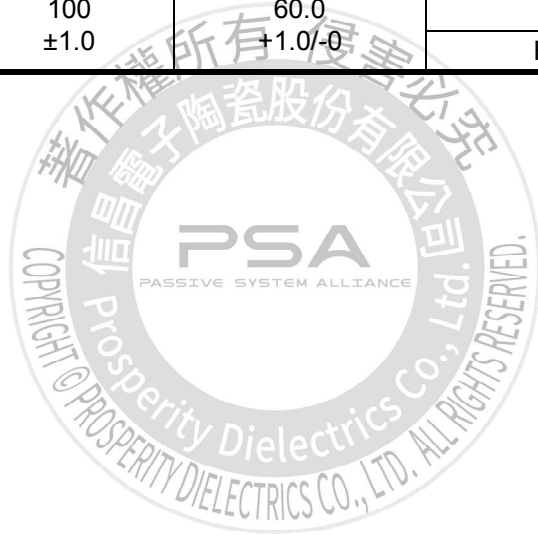
| Size              | 2225                   |               |
|-------------------|------------------------|---------------|
| Chip Thickness    | 1.60±0.20<br>2.00±0.20 | 2.50±0.30     |
| A <sub>0</sub>    | <6.80                  | <6.80         |
| B <sub>0</sub>    | <6.50                  | <6.50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

**9. PACKAGE DIMENSION AND QUANTITY**

**9.2. REEL DIMENSIONS**

| Size           | 0201, 0402, 0603,<br>0805, 1206, 1210 |                   | 1808, 1812, 1825,<br>2220, 2225 |
|----------------|---------------------------------------|-------------------|---------------------------------|
| Reel size      | 7"                                    | 13"               | 7"                              |
| C              | 13.0<br>+0.5/-0.2                     | 13.0<br>+0.5/-0.2 | 13.0<br>+0.7/-0.3               |
| W <sub>1</sub> | 8.4<br>+1.5/-0                        | 8.4<br>+1.5/-0    | 12.4<br>+2.0/-0                 |
| A              | 178.0<br>±0.10                        | 330.0<br>±1.0     | 178.0<br>±0.10                  |
| N              | 60.0<br>+1.0/-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.

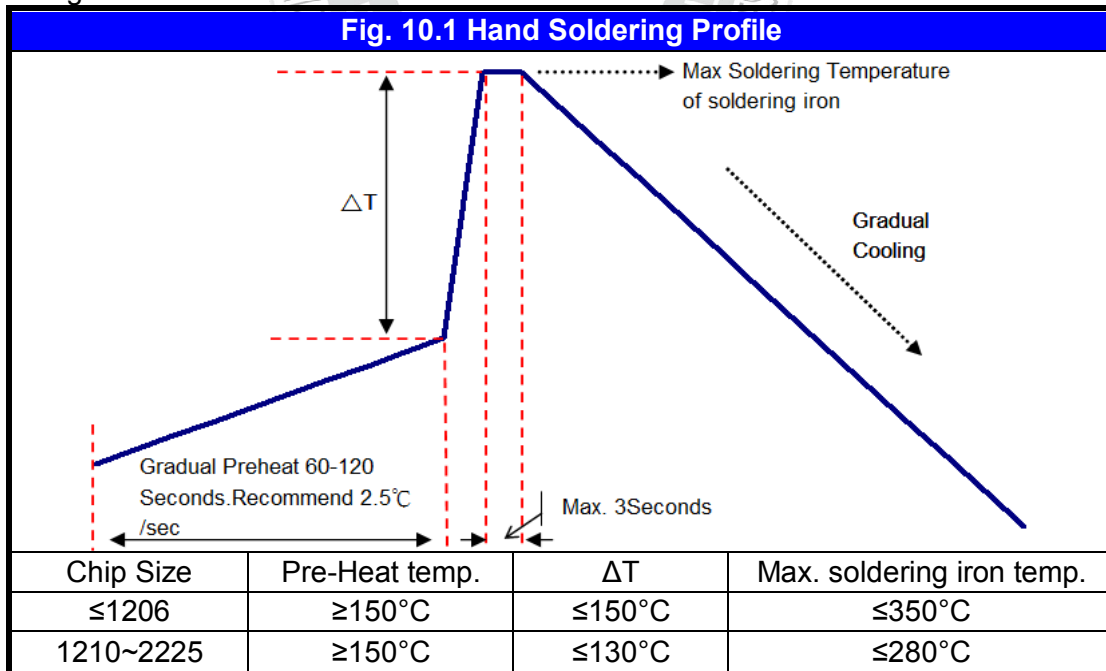
**PREHEAT**

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.

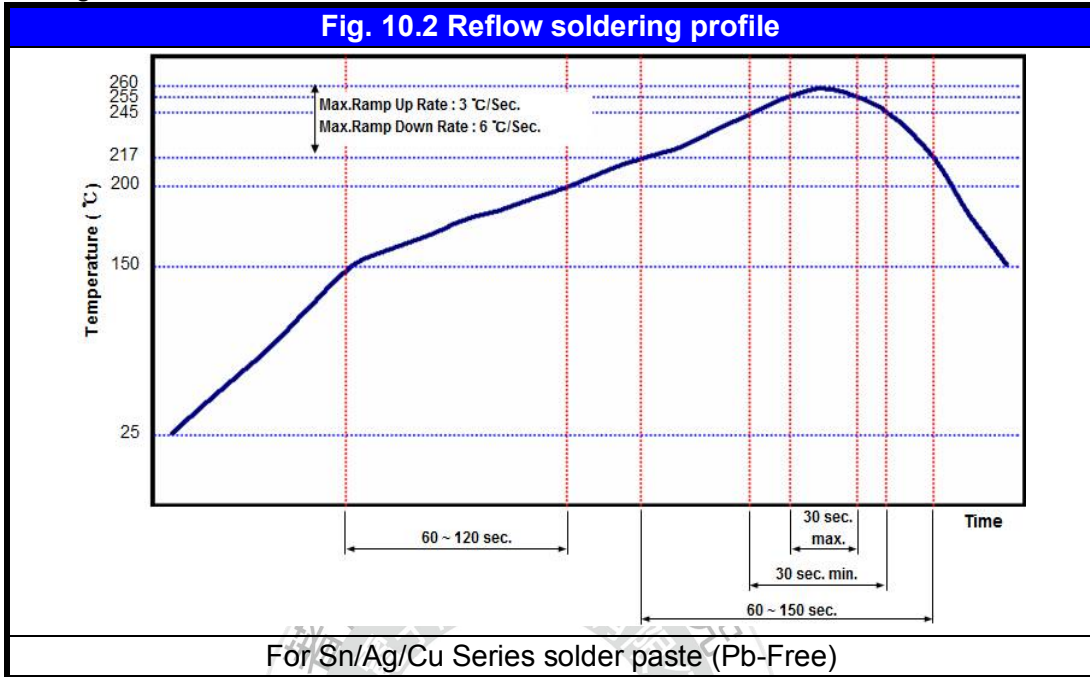
a.) Hand soldering :



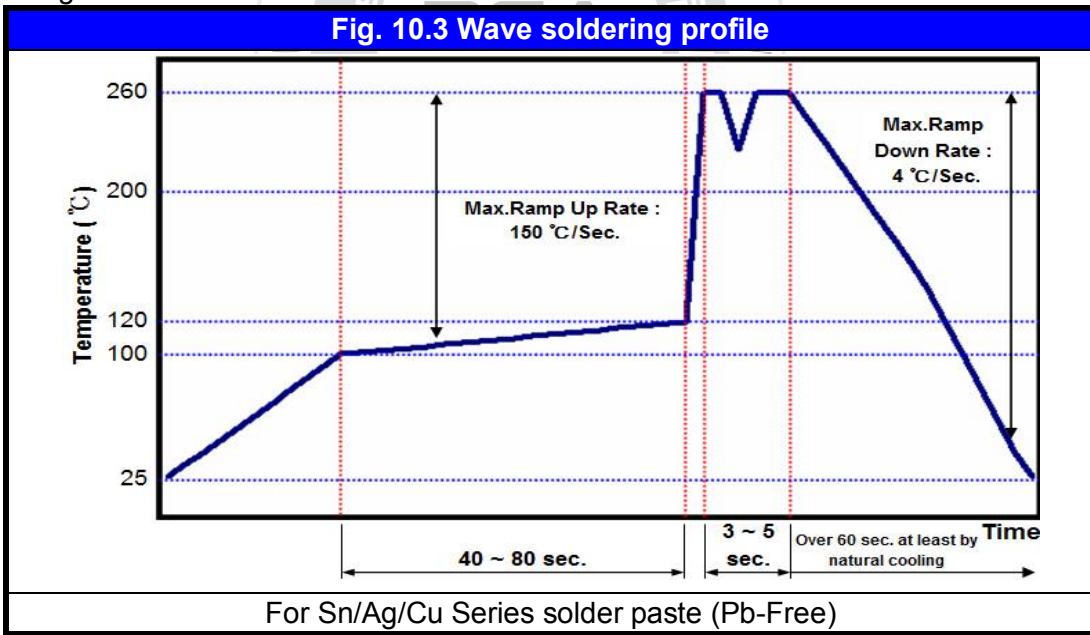
- \* Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- \* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- \* The required amount of solder shall be melted on the soldering tip.
- \* The tip of iron should not contact 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. Cher. | Capacitance | Condition |        |
|----------------|---------------|-------------|-----------|--------|
|                |               |             | Wave      | Reflow |
| ≤0402 (1005)   | All Class I   | All         | X         | O      |
| 0603 (1608)    | All Class I   | All         | O         | O      |
| 0805 (2012)    | All Class I   | All         | O         | O      |
| 1206 (3216)    | All Class I   | All         | O         | O      |
| ≥1210 (3225)   | All Class I   | All         | X         | O      |

**10. APPLICATION NOTES**

Soldering conditions :  
 Class II :

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