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**Date : 2023/04/07**

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

**Description : Size 01R5~2225, C0G/X7R/X7S/X6S/X5R,  $U_R \leq 50V$**

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# SPECIFICATION

## FOR

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

Description : Size 01R5~2225, C0G/X7R/X7S/X6S/X5R,  $U_R \leq 50V$

SPEC. No. : FN-000-001-21

DATE : 2023/04/07

| DRAWN BY   | CHECEKED BY | APPROVED BY |
|------------|-------------|-------------|
| Jane Hsiao | Yvens Chou  | Jason Lin   |

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

## 3. APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.
- 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                    |
| FN      | General purpose product ≤50Vdc |

| Table 2 |             | General Purpose |             |      |             |
|---------|-------------|-----------------|-------------|------|-------------|
| Code    | Description | Code            | Description | Code | Description |
| 02      | 01R5 (0402) | 31              | 1206 (3216) | 52   | 2211 (5728) |
| 03      | 0201 (0603) | 32              | 1210 (3225) | 55   | 2220 (5750) |
| 15      | 0402 (1005) | 42              | 1808 (4520) | 56   | 2225 (5763) |
| 18      | 0603 (1608) | 43              | 1812 (4532) |      |             |
| 21      | 0805 (2012) | 46              | 1825 (4563) |      |             |

| Table 3 |             | Dielectric Material Characteristics |             |      |             |
|---------|-------------|-------------------------------------|-------------|------|-------------|
| Code    | Description | Code                                | Description | Code | Description |
| N       | C0G         | X                                   | X7R         | S    | X6S         |
| B       | X5R         | A                                   | X7S         |      |             |

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

| Table 5 |             | Tolerance |             |      |             |
|---------|-------------|-----------|-------------|------|-------------|
| Code    | Description | Code      | Description | Code | Description |
| A       | ±0.05 pF    | 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 6 |             | Rated Voltage |             |      |             |
|---------|-------------|---------------|-------------|------|-------------|
| Code    | Description | Code          | Description | Code | Description |
| 4R0     | 4.0Vdc      | 100           | 10Vdc       | 250  | 25Vdc       |
| 6R3     | 6.3Vdc      | 160           | 16Vdc       | 500  | 50Vdc       |

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

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

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

## 5. EXTERNAL DIMENSIONS

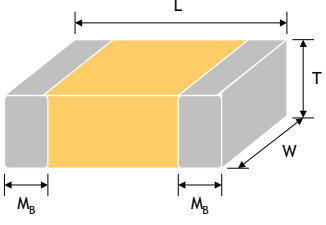
| Size Inch (mm) | L (mm)                                      | W (mm)                                      | Code / T (mm)                    | M <sub>B</sub> (mm) |                                                                                     |
|----------------|---------------------------------------------|---------------------------------------------|----------------------------------|---------------------|-------------------------------------------------------------------------------------|
| 01R5(0402)     | 0.40±0.02                                   | 0.20±0.02                                   | See<br>No.4 Reference<br>Table 8 | 0.10±0.03           |  |
| 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)        |                                  | 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           |                                                                                     |

Fig. 5.1 The outline of MLCC

<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                          | X6S                    | X7S           |
|----------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------|------------------------|---------------|
| Size                       | 01R5, 0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225  | 01R5, 0201, 0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225 | 01R5, 0201, 0402, 0603       | 0201, 0402             | 0201          |
| Rated voltage (WVDC)       | 10V, 16V, 25V, 50V                                                      | 6.3V, 10V, 16V, 25V, 50V                                         | 4V, 6.3V, 10V, 16V, 25V, 50V | 4V, 6.3V, 10V,16V, 25V | 10V           |
| Capacitance range*         | 0R1 to 100nF                                                            | 100pF to 820nF                                                   | 100pF to 820nF               | 100nF to 470nF         | 100nF         |
| Capacitance tolerance**    | B(±0.1pF),<br>C(±0.25pF),D(±0.5pF)<br>F(±1%),G(±2%)<br>J(±5% ), K(±10%) | J(±5% ), K(±10%), M(±20%)                                        |                              | K(±10%), M(±20%)       |               |
| Tan δ*                     | Cap.<30pF :<br>Q≥400+20C<br>Cap.≥30pF : Q≥1000                          | Note 1                                                           |                              |                        |               |
| Operating temperature      | -55 to +125°C                                                           |                                                                  | -55 to +85°C                 | -55 to +105°C          | -55 to +125°C |
| Capacitance characteristic | ±30ppm/°C                                                               | ±15%                                                             |                              | ±22%                   | ±22%          |
| Termination                | Cu/Ni/Sn (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/X7S/X6S : Apply 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature.

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

Note 1 : X7R/X5R/X6S/X7S

| 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                                 |
|          |       | ≤5% 0201≥0.01μF                                               |
| 25V      | ≤3.5% | ≤7% 0603≥0.33μF                                               |
|          |       | ≤10% 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF                     |
|          |       | ≤12.5% 0402≥0.47μF                                            |
|          |       | ≤5% 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF,      |
| 16V      | ≤3.5% | ≤10% 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF,  |
|          |       | ≤10% 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, |
| 10V      | ≤5%   | ≤15% 0201≥0.1μF                                               |
| 6.3V     | ≤10%  | ≤15% 0201≥0.1μF                                               |
| 4V       | ≤15%  | ---                                                           |
| 10V      | ≤5%   | ---                                                           |
| 6.3V,10V | ≤10%  | ---                                                           |

## 7. CAPACITANCE RANGE

## 7-1. C0G

| Cap(pF) | EIA Size<br>Code | 0201 |     |     |     | 0402 |     |     |     | 0603 |     |     |     | 0805 |     |     |     | 1206 |     |     |     |
|---------|------------------|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|
|         |                  | 10V  | 16V | 25V | 50V | 10V  | 16V | 25V | 50V | 10V  | 16V | 25V | 50V | 10V  | 16V | 25V | 50V | 10V  | 16V | 25V | 50V |
| 0.1     | 0R1              | L    | L   | L   | L   | N    | N   | N   | N   |      |     |     |     |      |     |     |     |      |     |     |     |
| 0.2     | 0R2              | L    | L   | L   | L   | N    | N   | N   | N   |      |     |     |     |      |     |     |     |      |     |     |     |
| 0.3     | 0R3              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   |      |     |     |     |      |     |     |     |
| 0.4     | 0R4              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   |      |     |     |     |      |     |     |     |
| 0.5     | 0R5              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     |     |
| 0.6     | 0R6              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     |     |
| 0.7     | 0R7              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     |     |
| 0.8     | 0R8              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     |     |
| 0.9     | 0R9              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     |     |
| 1.0     | 1R0              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     | X   |
| 1.0     | 1R0              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   |      |     |     | X   |
| 1.2     | 1R2              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 1.5     | 1R5              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 1.8     | 1R8              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 2.2     | 2R2              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 2.7     | 2R7              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 3.3     | 3R3              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 3.9     | 3R9              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 4.7     | 4R7              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 5.6     | 5R6              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 6.8     | 6R8              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 8.2     | 8R2              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 10      | 100              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 12      | 120              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 15      | 150              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 18      | 180              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 22      | 220              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 27      | 270              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 33      | 330              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 39      | 390              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 47      | 470              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 56      | 560              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 68      | 680              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 82      | 820              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 100     | 101              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 120     | 121              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 150     | 151              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 180     | 181              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 220     | 221              | L    | L   | L   | L   | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 270     | 271              |      |     | L   |     | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 330     | 331              |      |     |     |     | N    | N   | N   | N   | S    | S   | S   | S   | A    | A   | A   | A   | X    | X   | X   | X   |
| 390     | 391              |      |     | L   |     | N    | N   | N   | N   | S    | S   | S   | S   | X    | X   | X   | X   | X    | X   | X   | X   |
| 470     | 471              |      |     | L   |     | N    | N   | N   | N   | S    | S   | S   | S   | X    | X   | X   | X   | X    | X   | X   | X   |
| 560     | 561              |      |     |     |     | N    | N   | N   | N   | S    | S   | S   | S   | X    | X   | X   | X   | X    | X   | X   | X   |
| 680     | 681              |      |     |     |     | N    | N   | N   | N   | S    | S   | S   | S   | X    | X   | X   | X   | X    | X   | X   | X   |
| 820     | 821              |      |     |     |     | N    | N   | N   | N   | S    | S   | S   | S   | X    | X   | X   | X   | X    | X   | X   | X   |
| 1000    | 102              |      |     |     |     | N    | N   | N   | N   | S    | S   | S   | S   | X    | X   | X   | X   | X    | X   | X   | X   |
| 1200    | 122              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | X    | X   | X   | X   | X    | X   | X   | X   |
| 1500    | 152              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | X    | X   | X   | X   | X    | X   | X   | X   |
| 1800    | 182              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | X    | X   | X   | X   | X    | X   | X   | X   |
| 2200    | 222              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | X    | X   | X   | X   | X    | X   | X   | X   |
| 2700    | 272              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | X    | X   | X   | X   |
| 3300    | 332              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | X    | X   | X   | X   |
| 3900    | 392              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | X    | X   | X   | X   |
| 4700    | 472              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | X    | X   | X   | X   |
| 5600    | 562              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | X    | X   | X   | X   |
| 6800    | 682              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | C    | C   | C   | C   |
| 8200    | 822              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | C    | C   | C   | C   |
| 10000   | 103              |      |     |     |     |      |     |     |     | B    | B   | B   | B   | C    | C   | C   | C   | C    | C   | C   | C   |
| 12000   | 123              |      |     |     |     |      |     |     |     |      |     |     |     | T/C  | T/C | T/C | C   | P    | P   | P   | P   |
| 15000   | 153              |      |     |     |     |      |     |     |     |      |     |     |     | C    | C   | C   | C   | P    | P   | P   | P   |
| 18000   | 183              |      |     |     |     |      |     |     |     |      |     |     |     | C    | C   | C   | C   | P    | P   | P   | P   |
| 22000   | 223              |      |     |     |     |      |     |     |     |      |     |     |     | C    | C   | C   | C   | P    | P   | P   | P   |
| 27000   | 273              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 33000   | 333              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 39000   | 393              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 47000   | 473              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 56000   | 563              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 68000   | 683              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 82000   | 823              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | P    | P   | P   | P   |
| 100000  | 104              |      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     | E/P  | E/P | E/P | E/P |

**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  | 50V |
| 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   |

## 7. CAPACITANCE RANGE(Con.)

## 7-2. X7R

| Cap(pF) | EIA Size | 0201 |     |     |     |     | 0402 |     |     |     |     | 0603 |     |     |     |     | 0805 |     |     |     |     |
|---------|----------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|
|         | Code     | 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   | 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   |
| 1200    | 122      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 1800    | 182      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 2700    | 272      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 3900    | 392      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 5600    | 562      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 8200    | 822      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 12000   | 123      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 18000   | 183      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 27000   | 273      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 39000   | 393      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 56000   | 563      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 82000   | 823      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 120000  | 124      |      | X   | X   | X   | X   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 180000  | 184      |      | M   | M   | M   | M   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 270000  | 274      |      | M   | M   | M   | C   |      | M   | M   | M   | M   | C    | C   | C   | C   | 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   |
| 390000  | 394      |      | M   | M   | C   | P   |      | M   | M   | M   | C   | C    | C   | C   | C   | 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   |
| 560000  | 564      |      | J   | J   | C/J | P   |      | C   | C   | C   | C   | C    | C   | C   | C   | 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   |
| 820000  | 824      |      | J   | J   | C/J | P   |      | C   | C   | C   | C   | C    | C   | C   | F   | F    | F   | F    | F   | F    | F   |

**7. CAPACITANCE RANGE(Con.)****7-3. X5R**

| Cap(pF) | EIA Size | 0201 |      |     |     |     |     | 0402 |      |     |     |     |     | 0603 |      |     |     |     |     |
|---------|----------|------|------|-----|-----|-----|-----|------|------|-----|-----|-----|-----|------|------|-----|-----|-----|-----|
|         | Code     | 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   |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 2200    | 222      |      |      | L   | L   | L   |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 2700    | 272      |      |      |     |     |     |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 3300    | 332      |      |      | L   | L   |     |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 4700    | 472      |      |      | L   | L   | L   |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 6800    | 682      |      |      | L   | L   |     |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 10000   | 103      |      | L    | L   | L   | L   | L   |      |      |     |     |     |     |      |      |     |     |     |     |
| 15000   | 153      |      | L    | L   |     |     |     |      |      |     |     |     | N   |      |      |     |     |     |     |
| 22000   | 223      |      | L    | L   |     |     |     |      |      |     |     |     | N   | N    |      |     |     |     |     |
| 27000   | 273      |      |      |     |     |     |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 33000   | 333      |      | L    | L   |     |     |     |      |      |     | N   |     | N   |      |      |     |     |     |     |
| 39000   | 393      |      |      |     |     |     |     |      |      |     |     |     |     |      |      |     |     |     |     |
| 47000   | 473      |      | L    | L   |     |     |     |      | N    | N   | N   |     | N   |      |      |     |     |     |     |
| 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   | 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.)****7-5. X6S**

| Cap(pF) | EIA Size | 0201 |      |     |     |     | 0402 |     |     |     |     |
|---------|----------|------|------|-----|-----|-----|------|-----|-----|-----|-----|
|         | Code     | 4V   | 6.3V | 10V | 16V | 25V | 6.3V | 10V | 16V | 25V | 50V |
| 100000  | 104      | L    | L    | L   | L   | L   | N    |     |     |     |     |
| 150000  | 154      |      |      |     |     |     |      |     |     |     |     |
| 220000  | 224      |      | L    | L*  |     |     | N    |     |     |     |     |
| 330000  | 334      |      |      |     |     |     |      |     |     |     |     |
| 470000  | 474      | L    |      |     |     |     | K/N  |     |     |     |     |
| 680000  | 684      |      |      |     |     |     |      |     |     |     |     |

**7. CAPACITANCE RANGE(Con.)****7-6. X7S**

| Cap(pF) | EIA Size | 0201 |
|---------|----------|------|
|         | Code     | 10V  |
| 100000  | 104      | L    |
| 150000  | 154      |      |
| 220000  | 224      |      |
| 330000  | 334      |      |
| 470000  | 474      |      |
| 680000  | 684      |      |



**7. CAPACITANCE RANGE(Con.)****7-7. 01R5**

| SIZE                |             | 01R5 |    |    |
|---------------------|-------------|------|----|----|
| DIELECTRIC          |             | NP0  |    |    |
| RATED VOLTAGE (VDC) |             | 16   | 25 | 50 |
| Capacitance         | 0.2pF (0R2) | V    | V  | V  |
|                     | 0.3pF (0R3) | V    | V  | V  |
|                     | 0.4pF (0R4) | V    | V  | V  |
|                     | 0.5pF (0R5) | V    | V  | V  |
|                     | 1.0pF (1R0) | V    | V  | V  |
|                     | 1.5pF (1R5) | V    | V  | V  |
|                     | 2.0pF (2R0) | V    | V  | V  |
|                     | 3.0pF (3R0) | V    | V  | V  |
|                     | 4.0pF (4R0) | V    | V  | V  |
|                     | 5.0pF (5R0) | V    | V  | V  |
|                     | 6.0pF (6R0) | V    | V  | V  |
|                     | 7.0pF (7R0) | V    | V  | V  |
|                     | 8.0pF (8R0) | V    | V  | V  |
|                     | 9.0pF (9R0) | V    | V  | V  |
|                     | 10pF (100)  | V    | V  | V  |
|                     | 12pF (120)  | V    | V  | V  |
|                     | 15pF (150)  | V    | V  | V  |
|                     | 18pF (180)  | V    | V  | V  |
|                     | 22pF (220)  | V    | V  | V  |
|                     | 27pF (270)  | V    | V  | V  |
|                     | 33pF (330)  | V    | V  | V  |
|                     | 39pF (390)  | V    | V  | V  |
|                     | 47pF (470)  | V    | V  | V  |
|                     | 56pF (560)  | V    | V  | V  |
|                     | 68pF (680)  | V    | V  | V  |
|                     | 82pF (820)  | V    | V  | V  |
|                     | 100pF (101) | V    | V  | V  |
|                     | 120pF (121) | V    | V  | V  |
|                     | 150pF (151) | V    | V  | V  |
|                     | 180pF (181) | V    | V  | V  |
|                     | 220pF (221) | V    | V  | V  |

| SIZE                |               | 01R5 |
|---------------------|---------------|------|
| DIELECTRIC          |               | X7R  |
| RATED VOLTAGE (VDC) |               | 10   |
| Capacitance         | 100pF (101)   | V    |
|                     | 150pF (151)   | V    |
|                     | 220pF (221)   | V    |
|                     | 330pF (331)   | V    |
|                     | 470pF (471)   | V    |
|                     | 1,000pF (102) | V    |

| SIZE                |               | 01R5 |    |
|---------------------|---------------|------|----|
| DIELECTRIC          |               | X5R  |    |
| RATED VOLTAGE (VDC) |               | 6.3  | 10 |
| Capacitance         | 1,000pF (102) | V    | V  |
|                     | 1,500pF (152) |      | V  |
|                     | 2,200pF (222) |      | V  |
|                     | 3,300pF (332) |      | V  |
|                     | 4,700pF (472) |      | V  |
|                     | 6,800pF (682) |      | V  |
|                     | 0.010μF (103) | V    | V  |
|                     | 0.015μF (153) |      |    |
|                     | 0.022μF (223) | V    |    |
|                     | 0.033μF (333) | V    |    |
|                     | 0.047μF (473) | V    |    |
|                     | 0.068μF (683) |      |    |
|                     | 0.10μF (104)  | V    |    |

## 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.<br>(Tangent of loss angle) | * Class I : (C0G)<br>Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%.<br>Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%.<br>* Class II : (X7R, X5R, X7S,X6S)<br>Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**.<br>Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%.<br>** Test condition : 0.5±0.2Vrms, 1KHz±10%.<br>X5R : 0201≥224(6.3V,10V,16V) <sup>#1</sup> ,<br>X7R & X5R(≥10V) & 01R5X103≤6.3V & 01R5X104≤10V<br>* 0.5±0.2Vrms, 1kHz±10%:<br>X5R(≤6.3V);<br>Excluding 01R5X103≤6.3V & 01R5X104≤10V | * C0G : Cap.≥30pF, Q≥1000; Cap.<30pF, Q≥400+20C.<br>* 01R5 : X7R: ≤5.0 %<br>X5R: ≤10 %<br>*X7R/X5R/X7S/X6S :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                    |                                                  |  |     |       |       |                                                  |     |             |      |                          |     |       |     |             |     |             |      |                                       |        |             |     |       |     |                                                     |      |                                                        |     |     |      |                                                         |      |            |      |      |      |            |    |      |     |     |
|      |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <table><tr><th>Rated</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><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="4">25V</td><td rowspan="4">≤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>≤12.5%</td><td>0402≥0.47μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><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="2">10V</td><td rowspan="2">≤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>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></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, | ≤12.5% | 0402≥0.47μF | 16V | ≤3.5% | ≤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 | 6.3V | ≤10% | ≤15% | 0201≥0.1μF | 4V | ≤15% | --- | --- |
|      |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 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,            |  |     |       |       |                                                  |     |             |      |                          |     |       |     |             |     |             |      |                                       |        |             |     |       |     |                                                     |      |                                                        |     |     |      |                                                         |      |            |      |      |      |            |    |      |     |     |
|      |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       | ≤12.5%             | 0402≥0.47μF                                      |  |     |       |       |                                                  |     |             |      |                          |     |       |     |             |     |             |      |                                       |        |             |     |       |     |                                                     |      |                                                        |     |     |      |                                                         |      |            |      |      |      |            |    |      |     |     |
| 16V  | ≤3.5%                             | ≤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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |                    |                                                  |  |     |       |       |                                                  |     |             |      |                          |     |       |     |             |     |             |      |                                       |        |             |     |       |     |                                                     |      |                                                        |     |     |      |                                                         |      |            |      |      |      |            |    |      |     |     |
| 6.3V | ≤10%                              | ≤15%                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0201≥0.1μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |                    |                                                  |  |     |       |       |                                                  |     |             |      |                          |     |       |     |             |     |             |      |                                       |        |             |     |       |     |                                                     |      |                                                        |     |     |      |                                                         |      |            |      |      |      |            |    |      |     |     |
| 4V   | ≤15%                              | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |                    |                                                  |  |     |       |       |                                                  |     |             |      |                          |     |       |     |             |     |             |      |                                       |        |             |     |       |     |                                                     |      |                                                        |     |     |      |                                                         |      |            |      |      |      |            |    |      |     |     |

## 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.               | Item                                                                   | Test Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|-------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------|-------------------|-------------------------------------------|-------------------------------|-----------------------------------------------------|----------------------------------|------------------|---------------------|------------------|----------------------------------------|------------------|-------------------|-----------|------|------------|----|----------------|------|------|------------|----|------|------------|------|------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------|-----|------------------|-----|-------------|-----|-------------|-----|-------------|-----|-------------|
| 4.                | Temperature Coefficient<br>(Temperature characteristic of capacitance) | <div><p>* With no electrical load.</p><table><tr><th>T.C.</th><th>Operating Temp.</th></tr><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>X7S</td><td>-55 ~ 125°C at 25°C</td></tr><tr><td>X6S</td><td>-55~105°C at 25°C</td></tr></table><p>* Measurement voltage for Class II :</p><table><tr><th>Size</th><th>Cap. Range</th><th>Condition</th></tr><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><tr><td rowspan="2">01R5</td><td>Cap≤0.01μF</td><td>0.5V</td></tr><tr><td>Cap&gt;0.01μF</td><td>0.2V</td></tr></table></div> | 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                | X7S              | -55 ~ 125°C at 25°C | X6S              | -55~105°C at 25°C                      | Size             | Cap. Range        | Condition | 0201 | Cap.<0.1μF | 1V | 0.1μF≤Cap.<1μF | 0.2V | 0402 | Cap.<0.1μF | 1V | 01R5 | Cap≤0.01μF | 0.5V | Cap>0.01μF | 0.2V | <table><tr><th>T.C.</th><th>Capacitance Change</th></tr><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>X7S</td><td>Within ±22%</td></tr><tr><td>X6S</td><td>Within ±22%</td></tr></table> | T.C. | Capacitance Change | C0G | Within ±30ppm/°C | X7R | Within ±15% | X5R | Within ±15% | X7S | Within ±22% | X6S | Within ±22% |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 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                         |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | X7S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -55 ~ 125°C at 25°C                       |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | X6S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -55~105°C at 25°C                         |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Cap. Range                                | Condition |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Cap.<0.1μF                                | 1V        |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.1μF≤Cap.<1μF                            | 0.2V      |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| 0402              | Cap.<0.1μF                                                             | 1V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| 01R5              | Cap≤0.01μF                                                             | 0.5V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   | Cap>0.01μF                                                             | 0.2V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| T.C.              | Capacitance Change                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| C0G               | Within ±30ppm/°C                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| X7R               | Within ±15%                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| X5R               | Within ±15%                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| X7S               | Within ±22%                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| X6S               | Within ±22%                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| 5.                | Insulation Resistance                                                  | <div><p>* To apply rated voltage for Max. 120sec.</p></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <div><p>* ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br/>01R5: NP0, X7R: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br/>X5R: RxC≥50Ω-F</p><p>* Except :</p><table><tr><th>Rated voltage (X7R/X5R/ X7S/X6S)</th><th>I.R.</th></tr><tr><td>50V : 0402&gt;0.01μF</td><td rowspan="4">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td></tr><tr><td>16V : 0201≥0.1μF, 0402≥0.22μF</td></tr><tr><td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 6.3V; 4V</td></tr><tr><th>Rated voltage (X7R/X5R/ X7S/X6S)</th></tr><tr><td>50V : 0402≥0.1μF</td><td rowspan="5">RxC≥50Ω-F</td></tr><tr><td>25V : 0201≥0.1μF</td></tr><tr><td>16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF</td></tr><tr><td>10V : 0201&gt;0.1μF</td></tr><tr><td>6.3V : 0201≥0.1μF</td></tr></table></div> | Rated voltage (X7R/X5R/ X7S/X6S)          | I.R.      | 50V : 0402>0.01μF | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | 16V : 0201≥0.1μF, 0402≥0.22μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 6.3V; 4V | Rated voltage (X7R/X5R/ X7S/X6S) | 50V : 0402≥0.1μF | RxC≥50Ω-F           | 25V : 0201≥0.1μF | 16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF | 10V : 0201>0.1μF | 6.3V : 0201≥0.1μF |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Rated voltage (X7R/X5R/ X7S/X6S)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I.R.                                      |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 50V : 0402>0.01μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ≥10GΩ or RxC≥100Ω-F, whichever is smaller |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 16V : 0201≥0.1μF, 0402≥0.22μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 6.3V; 4V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Rated voltage (X7R/X5R/ X7S/X6S)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 50V : 0402≥0.1μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RxC≥50Ω-F                                 |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 25V : 0201≥0.1μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
|                   |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10V : 0201>0.1μF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |
| 6.3V : 0201≥0.1μF |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |           |                   |                                           |                               |                                                     |                                  |                  |                     |                  |                                        |                  |                   |           |      |            |    |                |      |      |            |    |      |            |      |            |      |                                                                                                                                                                                                                                                                                    |      |                    |     |                  |     |             |     |             |     |             |     |             |

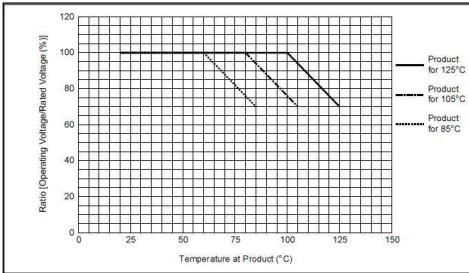
**8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS**

| 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 (01R5,0201~1210).</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><li>* 95% min. coverage of all metalized area.(for 01R5)</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,X6S,X7S : Within ±7.5%.</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><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 ,X7S, X6S : Within ±7.5%.<br/>01R5 X5R: Within ±15.0%</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><li>* 01R5 Q/D.F., I.R. and dielectric strength: 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                               |           |            |   |                            |      |   |            |     |   |                            |      |   |            |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

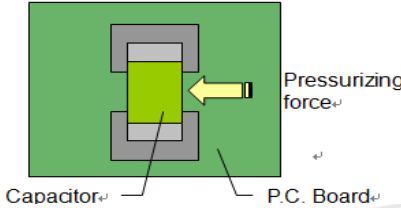
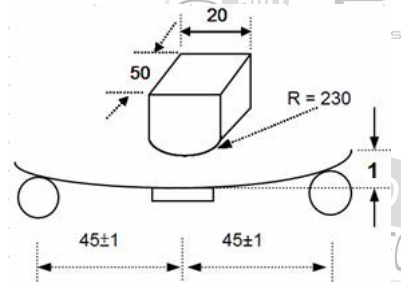
## 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.                                        | Item                                              | Test Condition                                                                                                                                                                                                                                                                                                                                                                     | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |                   |                                                   |                               |                               |                                            |                     |
|--------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|-------------------|---------------------------------------------------|-------------------------------|-------------------------------|--------------------------------------------|---------------------|
| 10.                                        | Humidity<br>(Damp Heat)<br>Steady<br>State        | <p>* Test temp. : 40±2°C.</p> <p>* Humidity : 90~95% RH.</p> <p>* Test time : 500 +24/-0hrs.</p> <p>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p> <p>* 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.</p> <p>* Cap. change :<br/>C0G : Within ±5.0% or ±0.5pF, whichever is larger.<br/>X7R, X5R, X6S, X7S : Within ±12.5% for ≥10V**, within ±25% for 6.3V.<br/>01R5 X5R: within ±25.0%<br/>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.</p> <p>* Q/DF for C0G :<br/>Cap.&gt;30pF, Q≥350.<br/>10pF≤Cap.≤30pF, Q≥275+2.5C.<br/>Cap.&lt;10pF, Q≥200+10C.<br/>01R5 X7R : ≤7.5%<br/>01R5 X5R: ≤20%</p> <p>* I.R 01R5.:<br/>NP0, X7R: ≥1GΩ or RxC≥50Ω-F whichever is smaller.<br/>X5R: RxC≥10Ω-F.</p> <p>* D.F.(Class II) : ≤200% of initial requirement.</p> <p>* I.R. : ≥10V, ≥1GΩ or R×C≥50Ω-F, whichever is smaller.<br/>Class II (X7R, X5R, X7S,X6S )</p> <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>50V : 0402&gt;0.01μF</td><td rowspan="5">≥1GΩ or<br/>RxC≥10Ω-F,<br/>whichever is<br/>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></table> | Rated voltage | I.R. | 50V : 0402>0.01μF | ≥1GΩ or<br>RxC≥10Ω-F,<br>whichever is<br>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<br>RxC≥10Ω-F,<br>whichever is<br>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<br>(Damp Heat)<br>Load                   | <p>* Test temp. : 40±2°C.</p> <p>* Humidity : 90~95%RH.</p> <p>* Test time : 500 +24/-0hrs.</p> <p>* To apply voltage : Rated voltage.</p> <p>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p> <p>* 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.</p> <p>* Cap. change :<br/>C0G : Within ±7.5% or ±0.75pF, whichever is larger.<br/>X7R, X5R,X7S, X6S : Within ±12.5% for ≥10V**, within ±25% for 6.3V.<br/>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.</p> <p>* Q for C0G : Cap.≥30pF, Q≥200; Cap.&lt;30pF, Q≥100+10/3C.</p> <p>* 01R5 Q/D.F. value: NP0: Cap≥30pF, Q≥200; Cap&lt;30pF; Q≥100+10/3C<br/>X7R: ≤7.5%<br/>X5R: ≤20%</p> <p>* I.R.:<br/>NP0, X7R: ≥500MΩ or RxC≥25Ω-F whichever is smaller.<br/>X5R: RxC≥5Ω-F.</p> <p>* D.F.(Class II) : ≤200% of initial requirement.</p> <p>* I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller.<br/>Class II (X7R, X5R, X7S, X6S)</p> <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>50V : 0402&gt;0.01μF</td><td rowspan="5">≥500MΩ or<br/>RxC≥5Ω-F,<br/>whichever<br/>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></table>          | Rated voltage | I.R. | 50V : 0402>0.01μF | ≥500MΩ or<br>RxC≥5Ω-F,<br>whichever<br>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<br>RxC≥5Ω-F,<br>whichever<br>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,X7S : 125±3°C.<br/>X5R : 85±3°C.<br/>X6S: 105±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><tr><th>Size</th><th>Dielectric</th><th>Rated</th><th>Capacitance range</th></tr><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><tr><td>01R5</td><td>X5R</td><td>6.3V</td><td>-</td></tr></table> <p>(4) 150% of rated voltage for below range :</p> <table><tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr><tr><td>01R5</td><td>X5R</td><td>10V</td><td>-</td></tr><tr><td rowspan="2">0201</td><td>X5R/X7R/X6S</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/X6S</td><td>50V</td><td>C≥0.1μF</td></tr><tr><td>10~25V</td><td>C≥0.22μF</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></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 : (For 100% of rated voltage items)</p> <div></div> | Size         | Dielectric    | Rated             | Capacitance range | 0201 | X5R/X7R | ≤10V | C≥0.1μF | ≥16V | C>0.1μF | 01R5 | X5R | 6.3V | - | Size | Dielectric | Rated Voltage | Capacitance | 01R5 | X5R | 10V | - | 0201 | X5R/X7R/X6S | 16V/25V | C≥0.1μF | X7R | 16V | C≥0.022μF | 0402 | X5R/X7R/X6S | 50V | C≥0.1μF | 10~25V | C≥0.22μF | 0603 | X7R | ≥50V | C≥0.082μF | 0805 | X5R/X7R | 50V | C≥0.47μF | <p>* No remarkable damage.</p> <p>* Cap. change :<br/>C0G : Within ±3.0% or ±0.3pF, whichever is larger.<br/>X7R, X5R,X7S, X6S : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V.<br/>01R5 :X7R Within ±12.5%,X5R Within ±25.0%<br/>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.</p> <p>* Q for C0G :<br/>Cap.&gt;30pF, Q≥350.<br/>10pF≤Cap.≤30pF, Q≥275+2.5C.<br/>01R5 : X7R ≤7.5%, X5R ≤20%<br/>Cap.&lt;10pF, Q≥200+10C.</p> <p>* D.F.(Class II) : ≤200% of initial requirement.</p> <p>* I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller.<br/>*01R5 I.R.: NP0, X7R: ≥1GΩ or RxC≥50Ω-F whichever is smaller.<br/>X5R: RxC≥10Ω-F.<br/>Class II (X7R, X5R, X7S, X6S )</p> <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>50V : 0402&gt;0.01μF</td><td>≥1GΩ or</td></tr><tr><td>25V : 0201≥0.1uF, 0402≥0.22μF</td><td>RxC≥10Ω-F,</td></tr><tr><td>16V : 0201≥0.1uF, 0402≥0.22μF</td><td>whichever</td></tr><tr><td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF,</td><td>is smaller</td></tr><tr><td>6.3V, 4V; Size≥1812</td><td></td></tr></table> | Rated voltage | I.R. | 50V : 0402>0.01μF | ≥1GΩ or | 25V : 0201≥0.1uF, 0402≥0.22μF | RxC≥10Ω-F, | 16V : 0201≥0.1uF, 0402≥0.22μF | whichever | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, | is smaller | 6.3V, 4V; Size≥1812 |  |
|                                            |                                   | Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Dielectric   | Rated         | Capacitance range |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   | 0201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R/X7R      | ≤10V          | C≥0.1μF           |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              | ≥16V          | C>0.1μF           |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   | 01R5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R          | 6.3V          | -                 |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   | Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Dielectric   | Rated Voltage | Capacitance       |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   | 01R5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R          | 10V           | -                 |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   | 0201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R/X7R/X6S  | 16V/25V       | C≥0.1μF           |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | X7R          | 16V           | C≥0.022μF         |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
|                                            |                                   | 0402                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | X5R/X7R/X6S  | 50V           | C≥0.1μF           |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 10~25V                                     | C≥0.22μF                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 0603                                       | X7R                               | ≥50V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | C≥0.082μF    |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 0805                                       | X5R/X7R                           | 50V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | C≥0.47μF     |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| Rated voltage                              | I.R.                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 50V : 0402>0.01μF                          | ≥1GΩ or                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 25V : 0201≥0.1uF, 0402≥0.22μF              | RxC≥10Ω-F,                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 16V : 0201≥0.1uF, 0402≥0.22μF              | whichever                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, | is smaller                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |
| 6.3V, 4V; Size≥1812                        |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |               |                   |                   |      |         |      |         |      |         |      |     |      |   |      |            |               |             |      |     |     |   |      |             |         |         |     |     |           |      |             |     |         |        |          |      |     |      |           |      |         |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                   |         |                               |            |                               |           |                                            |            |                     |  |

## 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.              | Item                                                            | Test Condition                                                                                                                                                                                                                                                                                                                                                                                               | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                        |            |             |     |                                             |                  |               |          |               |
|------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|-----|---------------------------------------------|------------------|---------------|----------|---------------|
| 13.              | Adhesive Strength of Termination<br>(Robustness of termination) | <p>* Capacitors mounted on a substrate. A force of 1N(01R5) or 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>* No remarkable damage or removal of the terminations.</p>                                                                                                                                                                                                                                                                                                                                                                       |            |             |     |                                             |                  |               |          |               |
| 14.              | Resistance to Flexure of Substrate<br>(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><tr><th>Dielectric</th><th>Cap. Change</th></tr><tr><td>C0G</td><td>Within ±5.0% or ±0.5pF, whichever is larger</td></tr><tr><td>X7R, X5R,X7S,X6S</td><td>Within ±12.5%</td></tr><tr><td>01R5 X5R</td><td>Within ±25.0%</td></tr></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 | C0G | Within ±5.0% or ±0.5pF, whichever is larger | X7R, X5R,X7S,X6S | Within ±12.5% | 01R5 X5R | Within ±25.0% |
| Dielectric       | Cap. Change                                                     |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |     |                                             |                  |               |          |               |
| C0G              | Within ±5.0% or ±0.5pF, whichever is larger                     |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |     |                                             |                  |               |          |               |
| X7R, X5R,X7S,X6S | Within ±12.5%                                                   |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |     |                                             |                  |               |          |               |
| 01R5 X5R         | Within ±25.0%                                                   |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |             |     |                                             |                  |               |          |               |
| 15.              | Vibration Resistance                                            | <p>* Vibration frequency : 10~55 Hz/min.</p> <p>* Total amplitude : 1.5mm.</p> <p>* Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions)</p> <p>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p> <p>* 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.</p> <p>* 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 |
| 01R5 (0402) | 0.20±0.02        | 20k        | -        | -            | -        |
| 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)  | 1.25±0.20        | -          | -        | 3k           | 10k      |
|             | 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      |
| 1210(3225)  | 1.60 +0.30/-0.10 | -          | -        | 2k           | 9k       |
|             | 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           | -        |
|             | 2.50±0.30        | -          | -        | 0.5k         | 3k       |
| 1825(4563)  | 2.80±0.30        | -          | -        | 0.5k         | -        |
|             | 1.60±0.20        | -          | -        | 1k           | -        |
|             | 2.00±0.20        | -          | -        | 1k           | -        |
|             | 2.50±0.30        | -          | -        | 0.5k         | -        |
| 2220(5750)  | 2.80±0.30        | -          | -        | 0.5k         | -        |
|             | 1.60±0.20        | -          | -        | 1k           | -        |
|             | 2.00±0.20        | -          | -        | 1k           | -        |
|             | 2.50±0.30        | -          | -        | 0.5k         | -        |
| 2225(5763)  | 2.80±0.30        | -          | -        | 0.5k         | -        |
|             | 1.60±0.20        | -          | -        | 1k           | -        |
|             | 2.00±0.20        | -          | -        | 1k           | -        |
|             | 2.50±0.30        | -          | -        | 0.5k         | -        |
|             | 2.80±0.30        | -          | -        | 0.5k         | -        |

Unit : pcs

## 9. PACKAGE DIMENSION AND QUANTITY

## 9.1. EMBOSSED TAPE DIMENSIONS

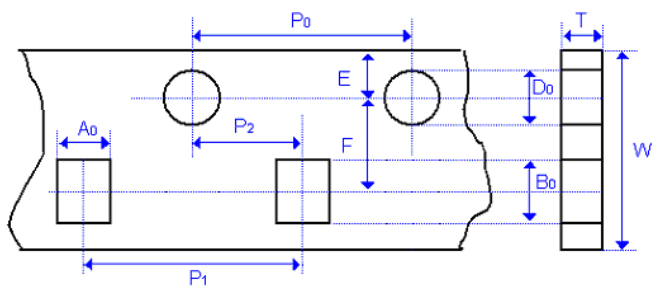


Fig. 9.1 The dimension of paper tape

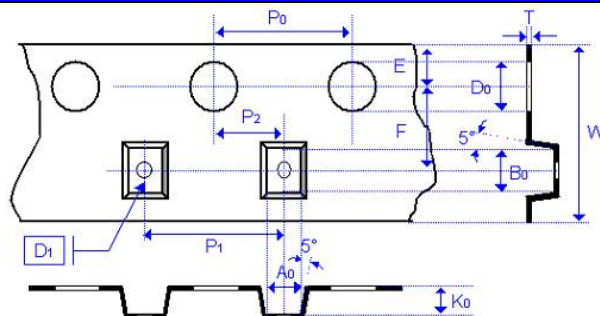


Fig. 9.2 The dimension of plastic tape

| Size              | 01R5        | 0201                   | 0402                   | 0603                          |
|-------------------|-------------|------------------------|------------------------|-------------------------------|
| Chip Thickness    | 0.20±0.02   | 0.50±0.05<br>0.50±0.10 | 0.50±0.05<br>0.50±0.10 | 0.80±0.07<br>0.80 + 0.15/-0.1 |
| A <sub>0</sub>    | 0.25±0.05   | 0.40±0.10              | 0.70±0.20              | 1.05 ±0.30                    |
| B <sub>0</sub>    | 0.45±0.07   | 0.70±0.10              | 1.20±0.20              | 1.80±0.30                     |
| T                 | ≤0.50       | ≤0.55                  | ≤0.80                  | ≤1.20                         |
| K <sub>0</sub>    | -           | -                      | -                      | -                             |
| W                 | 8.00±0.30   | 8.00±0.30              | 8.00±0.30              | 8.00±0.30                     |
| P <sub>0</sub>    | 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±0.10             | 40.00±0.20                    |
| P <sub>1</sub>    | 2.00±0.05   | 2.00±0.05              | 2.00±0.05              | 4.00±0.10                     |
| P <sub>2</sub>    | 2.00±0.05   | 2.00±0.05              | 2.00±0.05              | 2.00±0.05                     |
| D <sub>0</sub>    | 1.50+0.1/-0 | 1.50+0.1/-0            | 1.50+0.1/-0            | 1.50+0.1/-0                   |
| D <sub>1</sub>    | -           | -                      | -                      | -                             |
| E                 | 1.75±0.10   | 1.75±0.10              | 1.75±0.10              | 1.75±0.10                     |
| F                 | 3.50±0.05   | 3.50±0.05              | 3.50±0.05              | 3.50±0.05                     |
| Unit :            | mm          | mm                     | mm                     | mm                            |

| Size              | 0805             |                        | 1206             |                        |                                | 1210                   |                |
|-------------------|------------------|------------------------|------------------|------------------------|--------------------------------|------------------------|----------------|
| Chip Thickness    | 0.80±0.10        | 1.25±0.10<br>1.25±0.20 | 0.80±0.10        | 0.95±0.10<br>1.25±0.10 | 1.60±0.20<br>1.60 + 0.30/-0.10 | 1.25±0.10<br>1.60±0.20 | 2.50±0.30      |
| A <sub>0</sub>    | 1.50±0.20        | <1.80                  | 2.00±0.10        | <2.00                  | <2.50                          | <3.05                  | <3.20          |
| B <sub>0</sub>    | 2.30±0.20        | <2.70                  | 3.50±0.50        | <3.70                  | <4.00                          | <3.80                  | <4.00          |
| T                 | 0.95±0.05        | 0.23±0.05              | 0.95±0.05        | 0.23±0.05              | 0.23±0.05                      | 0.23±0.05              | 0.23±0.05      |
| K <sub>0</sub>    | -                | <2.50                  | -                | <2.50                  | <2.50                          | <2.50                  | <3.50          |
| W                 | 8.00±0.10        | 8.00±0.10              | 8.00±0.10        | 8.00±0.10              | 8.00±0.10                      | 8.00±0.10              | 8.00±0.10      |
| P <sub>0</sub>    | 4.00±0.10        | 4.00±0.10              | 4.00±0.10        | 4.00±0.10              | 4.00±0.10                      | 4.00±0.10              | 4.00±0.10      |
| 10xP <sub>0</sub> | 40.00±0.20       | 40.00±0.20             | 40.00±0.20       | 40.00±0.20             | 40.00±0.20                     | 40.00±0.20             | 40.00±0.20     |
| P <sub>1</sub>    | 4.00±0.10        | 4.00±0.10              | 4.00±0.10        | 4.00±0.10              | 4.00±0.10                      | 4.00±0.10              | 4.00±0.10      |
| P <sub>2</sub>    | 2.00±0.05        | 2.00±0.05              | 2.00±0.05        | 2.00±0.05              | 2.00±0.05                      | 2.00±0.05              | 2.00±0.05      |
| D <sub>0</sub>    | 1.50<br>+0.10/-0 | 1.50<br>+0.10/-0       | 1.50<br>+0.10/-0 | 1.50 + 0.10/-0         | 1.50 + 0.10/-0                 | 1.50 + 0.10/-0         | 1.50 + 0.10/-0 |
| D <sub>1</sub>    | -                | 1.00±0.10              | -                | 1.00±0.10              | 1.50±0.10                      | 1.50±0.10              | 1.00±0.10      |
| E                 | 1.75±0.05        | 1.75±0.10              | 1.75±0.10        | 1.75±0.10              | 1.75±0.10                      | 1.75±0.10              | 1.75±0.10      |
| F                 | 3.50±0.05        | 3.50±0.05              | 3.50±0.05        | 3.50±0.05              | 5.50±0.05                      | 5.50±0.05              | 3.50±0.05      |
| Unit :            | mm               | mm                     | mm               | mm                     | mm                             | mm                     | mm             |

**9. PACKAGE DIMENSION AND QUANTITY**

| Size              | 1808                   |               | 1812                                |                        | 1825                   |                        |
|-------------------|------------------------|---------------|-------------------------------------|------------------------|------------------------|------------------------|
| Chip Thickness    | 1.25±0.10<br>1.60±0.20 | 2.00±0.20     | 1.25±0.10<br>1.60±0.20<br>2.00±0.20 | 2.50±0.30<br>2.80±0.30 | 1.60±0.20<br>2.00±0.20 | 2.50±0.30<br>2.80±0.30 |
| A <sub>0</sub>    | <2.50                  | <2.50         | <3.90                               | <3.90                  | <6.80                  | <6.80                  |
| B <sub>0</sub>    | <5.30                  | <5.30         | <5.30                               | <5.30                  | <5.30                  | <5.30                  |
| T                 | 0.25±0.05              | 0.25±0.05     | 0.25±0.05                           | 0.25±0.05              | 0.30±0.10              | 0.30±0.10              |
| K <sub>0</sub>    | <2.50                  | <2.50         | <2.50                               | <3.00                  | <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>    | 4.00±0.10              | 4.00±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              | 2220                                |                        | 2225                   |                        |
|-------------------|-------------------------------------|------------------------|------------------------|------------------------|
| Chip Thickness    | 1.40±0.15<br>1.60±0.20<br>2.00±0.20 | 2.50±0.30<br>2.80±0.30 | 1.60±0.20<br>2.00±0.20 | 2.50±0.30<br>2.80±0.30 |
| A <sub>0</sub>    | <5.80                               | <6.80                  | <6.80                  | <6.80                  |
| B <sub>0</sub>    | <6.50                               | <6.50                  | <6.50                  | <6.50                  |
| T                 | 0.30±0.10                           | 0.30±0.10              | 0.30±0.10              | 0.30±0.10              |
| K <sub>0</sub>    | <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             |
| P <sub>0</sub>    | 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             |
| P <sub>1</sub>    | 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              |
| D <sub>0</sub>    | 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              |
| E                 | 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              |
| Unit :            | mm                                  | mm                     | mm                     | mm                     |

**9. PACKAGE DIMENSION AND QUANTITY****9.2. REEL DIMENSIONS**

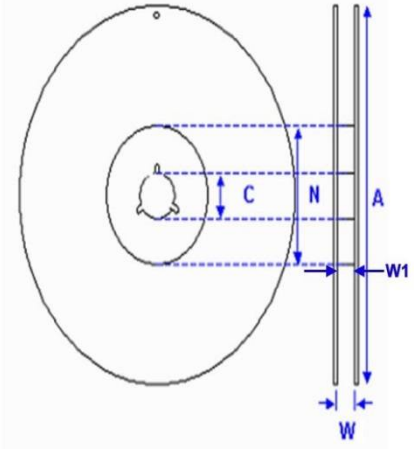
| Size           | 01R5            | 0201, 0402, 0603,<br>0805, 1206, 1210 |                   | 1808, 1812, 1825,<br>2220, 2225                         |  |
|----------------|-----------------|---------------------------------------|-------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------|
| Reel size      | 7"              | 7"                                    | 13"               | 7"                                                      |                                                                                     |
| C              | 13.0<br>±0.05   | 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     | 8.4<br>+1.5                           | 8.4<br>+1.5       | 12.4<br>+2.0/-0                                         |                                                                                     |
| W              | 14.4max         | 14.4max                               | 14.4max           | shall accommodate<br>tape width without<br>interference |                                                                                     |
| A              | 178.0<br>±0.20  | 178.0<br>±0.20                        | 330.0<br>±1.0     | 178.0<br>±0.20                                          |                                                                                     |
| N              | 60.0<br>+1.0/-0 | 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.

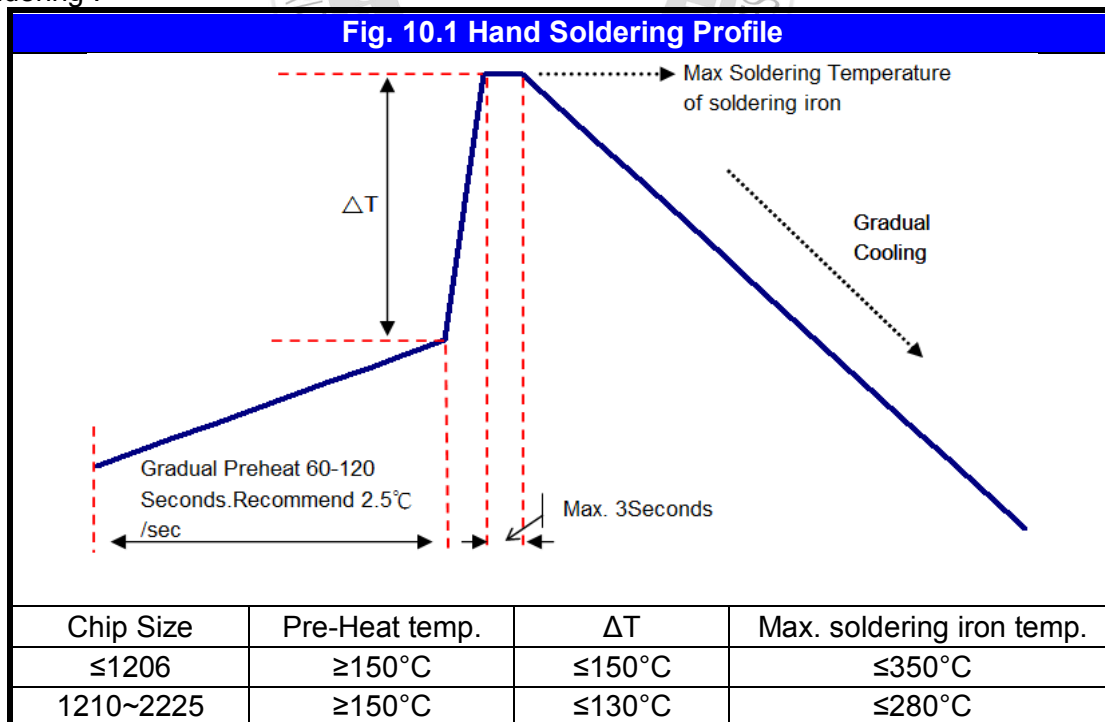
### PREHEAT

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

a.) Hand soldering :



\* Soldering iron tip diameter  $\leq 1.0$  mm and wattage max. 20W.

\* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.

\* The required amount of solder shall be melted on the soldering tip.

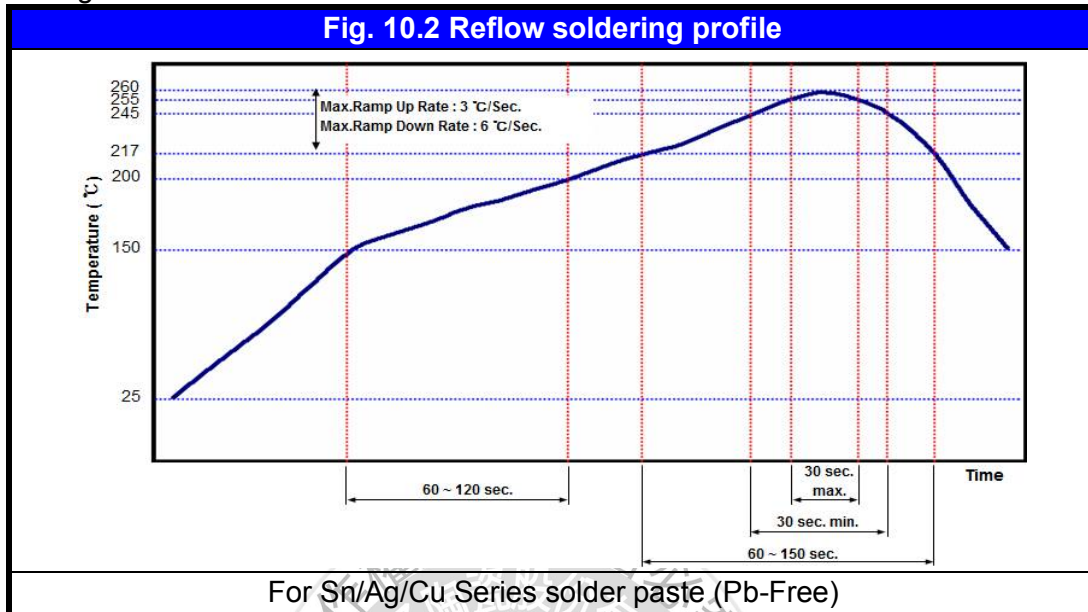
\* The tip of iron should not contact the ceramic body directly.

\* The Capacitors shall be cooled gradually at room temperature after soldering.

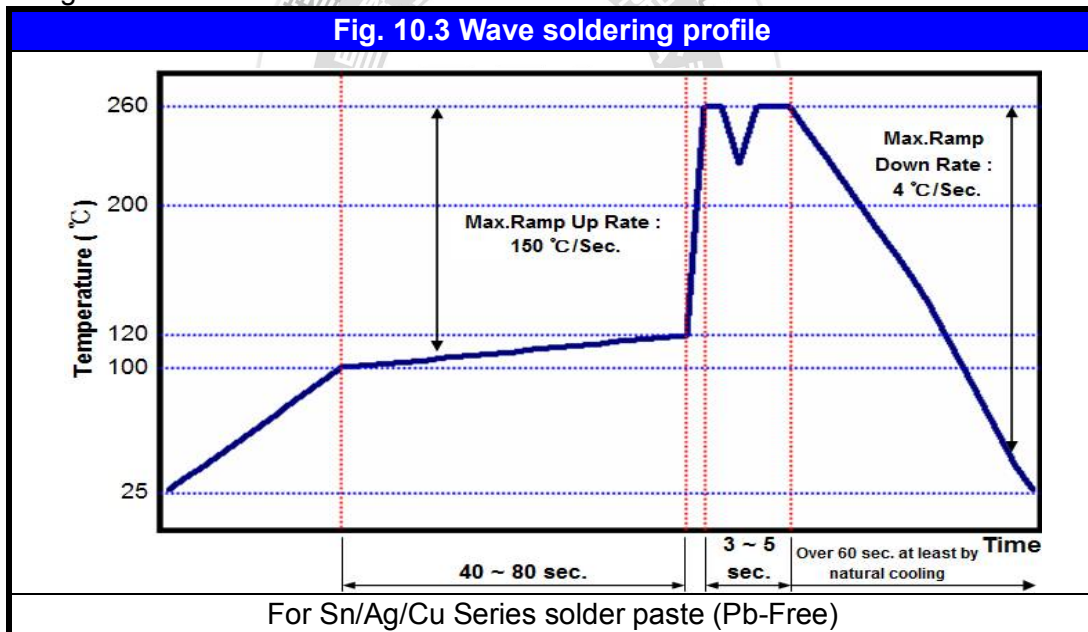
\* Forced air cooling is not allowed.

**10. APPLICATION NOTES**

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

| Size Inch (mm)   | Temper. Cher. | Capacitance       | Condition |        |
|------------------|---------------|-------------------|-----------|--------|
|                  |               |                   | Wave      | Reflow |
| ≤0402 (1005)     | Class I       | All               | X         | O      |
| 0603 (1608)      | Class I       | All               | O         | O      |
| 0805 (2012)      | Class I       | All               | O         | O      |
| 1206 (3216)      | Class I       | All               | O         | O      |
|                  |               | Thickness >0.95mm | X         | O      |
| ≥1210 (3225)     | Class I       | All               | X         | O      |
| Coating Products | All           | All               | X         | O      |

**10. APPLICATION NOTES**

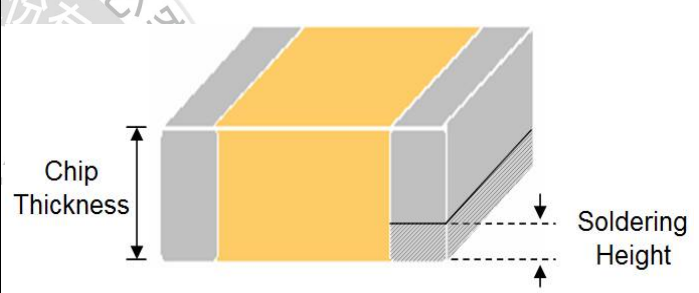
Soldering conditions :

Class II :

| Size Inch (mm)   | Temper. Cher. | Capacitance        | Condition |        |
|------------------|---------------|--------------------|-----------|--------|
|                  |               |                    | Wave      | Reflow |
| ≤0402 (1005)     | Class II      | All                | X         | O      |
| 0603 (1608)      | Class II      | Cap. <2.2μF        | O         | O      |
|                  |               | Cap. ≥2.2μF        | X         | O      |
| 0805 (2012)      | Class II      | Thickness ≤ 0.95mm | O         | O      |
|                  |               | Thickness > 0.95mm | X         | O      |
| 1206 (3216)      | Class II      | Thickness ≤ 0.95mm | O         | O      |
|                  |               | Thickness > 0.95mm | X         | O      |
| ≥1210 (3225)     | Class II      | All                | X         | O      |
| Coating Products | All           | 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)



**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.