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**Messrs. :** 一般共用

**Date :** 2020/11/02

# APPROVAL SHEET

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

**Part No. :** FS Series

**Description :** Size≤2225, X7R/X7S/X6S/X5R/Y5V, Cap.≥1μF, U<sub>R</sub><1KV

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

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# SPECIFICATION

FOR

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SPEC. No. : FS-000-001-22

DATE : 2020/11/02

| DRAWN BY   | CHECEKED BY | APPROVED BY |
|------------|-------------|-------------|
| Jane Hsiao | Yvens Chou  | Joseph Ling |

## 1. INTRODUCTION

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

## 2. FEATURES

- Realize high capacitance in small sizes.
- Capacitor with lead-free termination (pure Tin).
- HALOGEN& RoHS compliant.
- Surface mount suited for wave and reflow soldering.
- High reliability and no polarity.

## 3. APPLICATIONS

- Digital circuit coupling or decoupling applications.
- For bypassing.
- Ideal for smoothing circuits.
- DC to DC converter.

## 4. HOW TO ORDER

| <u>FS</u>  | <u>55</u> | <u>X</u>   | <u>106</u>  | <u>K</u>  | <u>500</u>    | <u>E</u>  | <u>G</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  |
| FS                 | High Capacitance Capacitor $\geq 1\mu\text{F}$ (105) |

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

| Table 3 Dielectric Material Characteristics |             |      |             |
|---|-------------|------|-------------|
| Code  | Description | Code | Description |
| N   | C0G         | X    | X7R         |
| B   | X5R         | F    | Y5V         |
| S   | X6S         | A    | X7S         |

| Table 4 Capacitance Rule Code |                                  |      |                                    |
|-------------------------------|----------------------------------|------|------------------------------------|
| Code                          | Description                      | Code | Description                        |
| R47                           | 0.47pF                           | 102  | $102=10 \times 10^2=1000\text{pF}$ |
| 0R5                           | 0.5pF                            | 104  | $104=10 \times 10^4=100\text{nF}$  |
| 100                           | $100=10 \times 10^0=10\text{pF}$ | 106  | $106=10 \times 10^6=10\mu\text{F}$ |

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

| Table 6 Rated Voltage |             |      |             |      |             |
|-----------------------|-------------|------|-------------|------|-------------|
| Code                  | Description | Code | Description | Code | Description |
| 6R3                   | 6.3Vdc      | 201  | 200Vdc      | 202  | 2000Vdc     |
| 100                   | 10Vdc       | 251  | 250Vdc      | 302  | 3000Vdc     |
| 160                   | 16Vdc       | 401  | 400Vdc      | 402  | 4000Vdc     |
| 250                   | 25Vdc       | 501  | 500Vdc      | 502  | 5000Vdc     |
| 350                   | 35Vdc       | 631  | 630Vdc      | 602  | 6000Vdc     |
| 500                   | 50Vdc       | 102  | 1000Vdc     |      |             |
| 101                   | 100Vdc      | 152  | 1500Vdc     |      |             |

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

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

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5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm)   | W (mm)  | Code / T (mm)                    | M <sub>B</sub> (mm) |
|----------------|--|---|----------------------------------|---------------------|
| 0201(0603)     | 0.60±0.03<br>0.60±0.05 (Cap.≥0.68μF)<br>0.60±0.09 (Cap.≥1.0μF)         | 0.30±0.03<br>0.30±0.05 (Cap.≥0.68μF)<br>0.30±0.09 (Cap.≥1.0μF)                | See<br>No.4 Reference<br>Table 8 | 0.15±0.05           |
| 0402(1005)     | 1.00±0.10<br>1.00±0.20 <sup>#1</sup>                                   | 0.50±0.10<br>0.50±0.20 <sup>#1</sup>  |                                  | 0.25 +0.05/-0.10    |
| 0603(1608)     | 1.60±0.15<br>1.60±0.20 <sup>#2</sup>                                   | 0.80±0.15<br>0.80±0.20 <sup>#2</sup>  |                                  | 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>#3</sup><br>3.30±0.30 <sup>#4</sup> | 1.60±0.20<br>1.60 +0.30/-0.10 <sup>#3</sup><br>1.60 +0.30/-0.10 <sup>#4</sup> |                                  | 0.60±0.20           |
| 1210(3225)     | 3.20±0.30  | 2.50±0.30   |                                  | 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           |

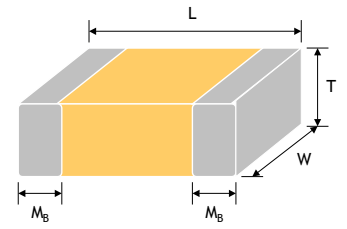


Fig. 5.1 The outline of MLCC

<sup>#1</sup> For 0402 size K thickness products. <sup>#2</sup> For 0603/Cap.≥10μF or 0603(≤6.3V)/Cap.≥4.7μF or 0603(>10V)/Cap.>1μF products or 0603/Cap.≥10μF SIZE S/B thickness ±0.2mm products. <sup>#3</sup> For 1206 size P thickness products. <sup>#4</sup> 1206/100V/Cap.≥1.2μF products

6. GENERAL ELECTRICAL DATA

| Dielectric                 | X7R  | X7S                            | X6S                                | X5R                                | Y5V                                 |
|----------------------------|--|--------------------------------|------------------------------------|------------------------------------|-------------------------------------|
| Size                       | 0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225 | 0402, 0603, 0805, 1206, 1210   | 0201, 0402, 0603, 0805, 1206, 1210 | 0201, 0402, 0603, 0805, 1206, 1210 | 0402, 0603, 0805, 1206, 1210, 1812  |
| Rated voltage (WVDC)       | 6.3V, 10V, 16V, 25V, 50V, 100V, 250V, 500V, 630V     | 6.3V, 10V, 16V, 25V, 50V, 100V | 6.3V, 10V, 16V, 25V, 35V, 50V      | 4V, 6.3V, 10V, 16V, 25V, 35V, 50V  | 6.3V, 10V, 16V, 25V, 35V, 50V, 100V |
| Capacitance range*         | 1μF to 47μF  | 1μF to 100μF                   | 1μF to 100μF                       | 1μF to 220μF                       | 1μF to 100μF                        |
| Capacitance tolerance**    | J(±5%)K(±10%), M(±20%)                               | K(±10%), M(±20%)               | K(±10%), M(±20%)                   | K(±10%), M(±20%)                   | Z(-20/+80%)                         |
| Tan δ*                     | Note 1   |                                |                                    |                                    |                                     |
| Operating temperature      | -55 to +125°C  | -55 to +125°C                  | -55 to +105°C                      | -55 to +85°C                       | -25 to +85°C                        |
| Capacitance characteristic | ±15%   | ±22%                           | ±22%                               | ±15%                               | +30/-80%                            |
| Termination                | Cu or Ag/Ni/Sn or Au (lead-free termination)         |                                |                                    |                                    |                                     |

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

X7R/X7S/X6S/X5R : Apply 1.0±0.2Vrms, 1.0KHz±10% for Cap.≤10μF; 0.5±0.2Vrms, 120Hz±20% for Cap.>10μF, at 25°C ambient temperature.

Y5V : Apply 1.0±0.2Vrms, 1.0KHz±10% for Cap.≤10μF; 0.5±0.2Vrms, 120Hz±20% for Cap.>10μF, at 20°C ambient temperature.

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

Note 1 : X7R/X7S/X6S/X5R

| Rated | D.F.≤ | Exception of D.F.≤  |
|-------|-------|---|
| ≥100V | ≤2.5% | ≤3.5% 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF   |
|       |       | ≤5% 0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF  |
|       |       | ≤10% 0805>0.22μF, 1210≥3.3μF  |
| 50V   | ≤2.5% | ≤3.5% 0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF |
|       |       | ≤5% 0201≥0.01μF, 1210≥4.7μF   |
|       |       | ≤10% 0402≥0.012μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF  |
| 35V   | ≤3.5% | ≤10% 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF  |
|       |       | ≤5% 0201≥0.01μF, 0805≥1μF, 1210≥10μF  |
|       |       | ≤7% 0603≥0.33μF   |
| 25V   | ≤3.5% | ≤10% 0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF                                       |
|       |       | ≤12.5% 0402≥0.47μF  |
|       |       | ≤5% 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF                                     |
| 16V   | ≤3.5% | ≤10% 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.15μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF                      |
|       |       | ≤15% 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF                     |
|       |       | ≤5% 0201≥0.1μF, 0402≥1μF, 0603≥10μF   |
| 10V   | ≤5%   | ≤10% 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF                     |
|       |       | ≤15% 0201≥0.1μF, 0402≥1μF, 0603≥10μF  |
|       |       | ≤5% 0201≥0.1μF, 0402≥1μF, 0603≥10μF   |
| 6.3V  | ≤10%  | ≤15% 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF   |
|       |       | ≤20% 0402≥2.2μF   |
|       |       | ---   |
| 4V    | ≤15%  | ---   |

Y5V

| Rated         | D.F.≤  | Exception of D.F.≤  |
|---------------|--------|---|
| ≥50V          | ≤5%    | ≤7% 0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF                         |
| 35V           | ≤7%    | ≤12.5% 1210≥6.8μF   |
|               |        | ---   |
| 25V           | ≤5%    | ≤7% 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, 1206≥1μF, 1210≥4.7μF |
|               |        | ≤9% 0402≥0.068μF, 0603≥0.47μF, 1206≥4.7μF, 1210≥22μF            |
|               |        | ≤9% 0402≥0.068μF, 0603≥0.68μF                                   |
| 16V (C<1.0μF) | ≤7%    | ≤12.5% 0402≥0.22μF  |
| 16V (C≥1.0μF) | ≤9%    | ≤12.5% 0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF  |
| 10V           | ≤12.5% | ≤20% 0402≥0.47μF  |
| 6.3V          | ≤20%   | ---   |

**7. CAPACITANCE RANGE**

**7-1. X7R**

| Dimension |      | 0402 |      |     | 0603 |     |     | 0805 |     |     |     | 1206 |      |     |     |     |     |     |      |
|-----------|------|------|------|-----|------|-----|-----|------|-----|-----|-----|------|------|-----|-----|-----|-----|-----|------|
| Cap(pF)   | code | 6.3V | 6.3V | 10V | 16V  | 25V | 50V | 6.3V | 10V | 16V | 25V | 50V  | 6.3V | 10V | 16V | 25V | 35V | 50V | 100V |
| 1000000   | 105  | N    | B    | B   | B    | B   | B   |      | C   | C   | C   | I    |      | J   | J   | J   | J   | P   | P    |
| 1200000   | 125  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     | P   |     | P    |
| 1500000   | 155  |      |      |     |      |     |     |      | I   | I   | I   |      | J    | J   | J   | P   |     | P   |      |
| 1800000   | 185  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     | P   |     | P    |
| 2200000   | 225  |      | B    | B   | B    |     |     | I    | I   | I   | I   |      | J    | J   | J   | P   |     | P   |      |
| 2700000   | 275  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 3300000   | 335  |      |      |     |      |     |     |      |     |     |     |      |      | P   | P   | P   |     |     |      |
| 3900000   | 395  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 4700000   | 475  |      | B    |     |      |     |     | I    | I   | I   | I   |      | P    | P   | P   | P   |     | P   |      |
| 5600000   | 565  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 6800000   | 685  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 8200000   | 825  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 10000000  | 106  |      |      |     |      |     |     | I    | I   |     |     |      | P    | P   | P   | P   | P   |     |      |
| 12000000  | 126  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 15000000  | 156  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 18000000  | 186  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |
| 22000000  | 226  |      |      |     |      |     |     |      |     |     |     |      | P    | P   | P*  |     |     |     |      |
| 47000000  | 476  |      |      |     |      |     |     |      |     |     |     |      |      |     |     |     |     |     |      |

| Dimension |      | 1210 |     |     |     |     |      | 1812 |     |     |     |      | 1825 |      |     |     |      |      |      |
|-----------|------|------|-----|-----|-----|-----|------|------|-----|-----|-----|------|------|------|-----|-----|------|------|------|
| Cap(pF)   | code | 6.3V | 10V | 16V | 25V | 50V | 100V | 10V  | 16V | 25V | 50V | 100V | 200V | 250V | 25V | 50V | 100V | 200V | 250V |
| 1000000   | 105  |      | C   | C   | C   | C   | F    | C    | C   | C   | F   | F    | G    | G    | F   | F   | F    | F    | F    |
| 1200000   | 125  |      |     |     |     | G   | G    |      |     | C   | F   | F    |      |      | F   | F   | F    |      |      |
| 1500000   | 155  |      |     | E   | E   | G   | G    |      |     | C   | F   | F    |      |      | F   | F   | F    |      |      |
| 1800000   | 185  |      |     |     |     | G   | G    |      |     | E   | F   | F    |      |      | F   | F   | F    |      |      |
| 2200000   | 225  |      |     | E   | E   | G   | G    |      |     | E   | F   | G    |      |      | F   | F   | F    |      |      |
| 2700000   | 275  |      |     |     |     | G   | G    |      |     | F   | F   | G    |      |      | F   | F   | F    |      |      |
| 3300000   | 335  |      |     | E   | E   | G   | G    |      |     | F   | F   | G    |      |      | F   | F   | F    |      |      |
| 3900000   | 395  |      |     |     |     | G   | G    |      |     | F   | F   | G    |      |      | F   | F   | F    |      |      |
| 4700000   | 475  |      | F   | F   | F   | G   | G    |      |     | G   | G   | G    |      |      | F   | F   | G    |      |      |
| 5600000   | 565  |      |     |     |     | G   | G    |      |     | G   | G   |      |      |      | G   | G   | G    |      |      |
| 6800000   | 685  |      |     |     |     | G   | G    |      |     | G   | G   |      |      |      | G   | G   | G    |      |      |
| 8200000   | 825  |      |     |     |     | G   | G    |      |     | G   | G   |      |      |      | G   | G   | G    |      |      |
| 10000000  | 106  |      | F   | F   | F/G | G   |      |      |     | G   | G   |      |      |      | G   | G   | G    |      |      |
| 12000000  | 126  |      |     |     |     |     |      |      |     |     |     |      |      |      |     |     |      |      |      |
| 15000000  | 156  |      |     |     |     |     |      |      |     |     |     |      |      |      |     |     |      |      |      |
| 18000000  | 186  |      |     |     |     |     |      |      |     |     |     |      |      |      |     |     |      |      |      |
| 22000000  | 226  |      | G   | G   | G   |     |      |      |     |     |     |      |      |      |     |     |      |      |      |
| 47000000  | 476  | G    | G   |     |     |     |      |      |     |     |     |      |      |      |     |     |      |      |      |

| Dimension |      | 2220 |     |      |      |      |      | 2225 |     |     |      |      |      |      |      |
|-----------|------|------|-----|------|------|------|------|------|-----|-----|------|------|------|------|------|
| Cap(pF)   | code | 25V  | 50V | 100V | 200V | 250V | 500V | 630V | 25V | 50V | 100V | 200V | 250V | 500V | 630V |
| 1000000   | 105  | F    | F   | F    | F    | F    |      |      | F   | F   | F    | F    | F    |      |      |
| 1200000   | 125  | F    | F   | F    | G    | G    |      |      | F   | F   | F    | G    | G    |      |      |
| 1500000   | 155  | F    | F   | F    | G    | G    |      |      | F   | F   | F    | G    | G    |      |      |
| 1800000   | 185  | F    | F   | F    | G    | G    |      |      | F   | F   | F    | G    | G    |      |      |
| 2200000   | 225  | F    | F   | F    | G    | G    |      |      | F   | F   | F    | G    | G    |      |      |
| 2700000   | 275  | F    | F   | F    |      |      |      |      | F   | F   | F    | G    | G    |      |      |
| 3300000   | 335  | F    | F   | F    |      |      |      |      | F   | F   | F    |      |      |      |      |
| 3900000   | 395  | F    | F   | F    |      |      |      |      | F   | F   | F    |      |      |      |      |
| 4700000   | 475  | F    | F   | F    |      |      |      |      | F   | F   | G    |      |      |      |      |
| 5600000   | 565  | F    | F   | F    |      |      |      |      | F   | F   | G    |      |      |      |      |
| 6800000   | 685  | F    | F   | F    |      |      |      |      | F   | F   | G    |      |      |      |      |
| 8200000   | 825  | G    | G   | G    |      |      |      |      | G   | G   | G    |      |      |      |      |
| 10000000  | 106  | G    | G   | G    |      |      |      |      | G   | G   | G    |      |      |      |      |
| 12000000  | 126  | H    | H   |      |      |      |      |      |     |     |      |      |      |      |      |
| 15000000  | 156  | H    | H   |      |      |      |      |      |     |     |      |      |      |      |      |
| 18000000  | 186  | H    | H   |      |      |      |      |      |     |     |      |      |      |      |      |
| 22000000  | 226  | H    | H   |      |      |      |      |      |     |     |      |      |      |      |      |
| 47000000  | 476  |      |     |      |      |      |      |      |     |     |      |      |      |      |      |

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

**7-2. X7S**

| Dimension |      | 0402 |     |     |     | 0603 |      |     |     | 0805 |    |      |     |     |     |     |      |
|-----------|------|------|-----|-----|-----|------|------|-----|-----|------|----|------|-----|-----|-----|-----|------|
| Cap(pF)   | code | 6.3V | 10V | 16V | 25V | 4V   | 6.3V | 10V | 16V | 25V  | 4V | 6.3V | 10V | 16V | 25V | 50V | 100V |
| 1000000   | 105  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 1500000   | 155  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 2200000   | 225  | K    |     |     |     |      |      |     | B   | B    |    |      |     |     |     |     |      |
| 3300000   | 335  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 4700000   | 475  |      |     |     |     |      |      |     |     |      |    |      |     |     | I   |     |      |
| 6800000   | 685  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 10000000  | 106  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 22000000  | 226  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 47000000  | 476  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 100000000 | 107  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |
| 220000000 | 227  |      |     |     |     |      |      |     |     |      |    |      |     |     |     |     |      |

| Dimension |      | 1206 |     |     |     | 1210 |     |     |     |
|-----------|------|------|-----|-----|-----|------|-----|-----|-----|
| Cap(pF)   | code | 6.3V | 10V | 16V | 25V | 6.3V | 10V | 16V | 25V |
| 1000000   | 105  |      |     |     |     |      |     |     |     |
| 1500000   | 155  |      |     |     |     |      |     |     |     |
| 2200000   | 225  |      |     |     |     |      |     |     |     |
| 3300000   | 335  |      |     |     |     |      |     |     |     |
| 4700000   | 475  |      |     |     |     |      |     |     |     |
| 6800000   | 685  |      |     |     |     |      |     |     |     |
| 10000000  | 106  |      |     |     |     |      |     |     |     |
| 22000000  | 226  |      |     | P*  |     |      |     |     |     |
| 47000000  | 476  | P*   |     |     |     |      |     |     |     |
| 100000000 | 107  |      |     |     |     | G*   |     |     |     |
| 220000000 | 227  |      |     |     |     |      |     |     |     |

\*\* Means M tolerance only.

**7-3. X6S**

| Dimension |      | 0201 |      | 0402 |     |     | 0603 |    |      |     |     | 0805 |    |      |     |     |     |     |
|-----------|------|------|------|------|-----|-----|------|----|------|-----|-----|------|----|------|-----|-----|-----|-----|
| Cap(pF)   | code | 4V   | 6.3V | 6.3V | 10V | 16V | 25V  | 4V | 6.3V | 10V | 16V | 25V  | 4V | 6.3V | 10V | 16V | 25V | 50V |
| 1000000   | 105  | L    | L*   | K/N  | K   | K   |      |    |      |     |     |      |    |      |     |     |     |     |
| 1500000   | 155  |      |      |      |     |     |      |    |      |     |     |      |    |      |     |     |     |     |
| 2200000   | 225  |      |      | K    | K   |     |      |    | B    | B   | B   |      |    |      |     | I   |     |     |
| 3300000   | 335  |      |      |      |     |     |      |    |      |     |     |      |    |      |     |     |     |     |
| 4700000   | 475  |      |      |      |     |     |      | B  | B    |     |     |      |    |      |     |     |     |     |
| 6800000   | 685  |      |      |      |     |     |      |    |      |     |     |      |    |      |     |     |     |     |
| 10000000  | 106  |      |      |      |     |     |      | B* | B*   |     |     |      | I  | I    | I   |     |     |     |
| 22000000  | 226  |      |      |      |     |     |      | B* | B*   |     |     |      | I  | I*   | I*  |     |     |     |
| 47000000  | 476  |      |      |      |     |     |      |    |      |     |     |      | I* | I*   |     |     |     |     |
| 100000000 | 107  |      |      |      |     |     |      |    |      |     |     |      |    |      |     |     |     |     |
| 220000000 | 227  |      |      |      |     |     |      |    |      |     |     |      |    |      |     |     |     |     |

| Dimension |      | 1206 |     |     |     | 1210 |     |     |     |      |
|-----------|------|------|-----|-----|-----|------|-----|-----|-----|------|
| Cap(pF)   | code | 6.3V | 10V | 16V | 25V | 6.3V | 10V | 16V | 25V | 100V |
| 1000000   | 105  |      |     |     |     |      |     |     |     |      |
| 1500000   | 155  |      |     |     |     |      |     |     |     |      |
| 2200000   | 225  |      |     |     |     |      |     |     |     |      |
| 3300000   | 335  |      |     |     |     |      |     |     |     |      |
| 4700000   | 475  |      |     |     |     |      |     |     |     |      |
| 6800000   | 685  |      |     |     |     |      |     |     |     |      |
| 10000000  | 106  |      |     |     | P   |      |     |     |     |      |
| 22000000  | 226  |      | P   | P*  |     |      |     |     | G   |      |
| 47000000  | 476  | P    |     |     |     | G    | G   |     |     |      |
| 100000000 | 107  |      |     |     |     | G*   | G*  |     |     |      |
| 220000000 | 227  |      |     |     |     |      |     |     |     |      |

\*\* Means M tolerance only.

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

**7-4. X5R**

| Dimension |      | 0201 |     |     | 0402 |      |     |     | 0603 |    |      |     |     |     |     |
|-----------|------|------|-----|-----|------|------|-----|-----|------|----|------|-----|-----|-----|-----|
| Cap(pF)   | code | 6.3V | 10V | 16V | 4V   | 6.3V | 10V | 16V | 25V  | 4V | 6.3V | 10V | 16V | 25V | 50V |
| 1000000   | 105  | L*   | L*  | L*  |      | K    | K   | N   | N    |    | B    | B   | B   | B   | B   |
| 1500000   | 155  |      |     |     |      |      |     |     |      |    | B    | B   |     |     |     |
| 2200000   | 225  | L*   |     |     |      | E/N  | N*  | K*  |      |    | B    | B   | B   | B   | B*  |
| 3300000   | 335  |      |     |     |      |      |     |     |      |    | B    | B   |     |     |     |
| 4700000   | 475  |      |     |     |      | K    | K*  |     |      |    | B    | B   | B*  | B*  |     |
| 6800000   | 685  |      |     |     |      |      |     |     |      |    |      |     |     |     |     |
| 10000000  | 106  |      |     |     | K*   | K*   | K*  |     |      | B  | B    | B*  | B*  | B*  |     |
| 22000000  | 226  |      |     |     |      | K*   |     |     |      | B* | B*   | B*  |     |     |     |
| 47000000  | 476  |      |     |     |      |      |     |     |      | B* | B*   |     |     |     |     |
| 100000000 | 107  |      |     |     |      |      |     |     |      |    |      |     |     |     |     |
| 220000000 | 227  |      |     |     |      |      |     |     |      |    |      |     |     |     |     |

| Dimension |      | 0805 |      |     |     |     |     | 1206 |      |     |     |     |     |
|-----------|------|------|------|-----|-----|-----|-----|------|------|-----|-----|-----|-----|
| Cap(pF)   | code | 4V   | 6.3V | 10V | 16V | 25V | 50V | 4V   | 6.3V | 10V | 16V | 25V | 50V |
| 1000000   | 105  |      |      | C   | C   | C   | I   |      |      |     |     |     | P   |
| 1500000   | 155  |      | I    | I   | I   | I   |     |      | J    | J   |     |     |     |
| 2200000   | 225  |      | I    | I   | I   | I   |     |      | J    | J   | P   | P   |     |
| 3300000   | 335  |      | I    | I   | I   | I   |     |      | P    | P   | P   |     |     |
| 4700000   | 475  |      | I    | I   | I   | I   |     |      | P    | P   | P   | P   | P   |
| 6800000   | 685  |      |      |     |     |     |     |      | P    | P   |     |     |     |
| 10000000  | 106  |      | I    | I   | I   | I   |     |      | P    | P   | P   | P   | P   |
| 22000000  | 226  |      | I    | I*  | I*  | I*  |     |      | P    | P   | P*  | P*  |     |
| 47000000  | 476  |      | I*   |     |     |     |     |      | P    |     | P*  |     |     |
| 100000000 | 107  |      |      |     |     |     |     |      | P*   |     |     |     |     |
| 220000000 | 227  |      |      |     |     |     |     | P*   |      |     |     |     |     |

| Dimension |      | 1210 |      |     |     |     |     |     |
|-----------|------|------|------|-----|-----|-----|-----|-----|
| Cap(pF)   | code | 4V   | 6.3V | 10V | 16V | 25V | 35V | 50V |
| 1000000   | 105  |      |      |     |     |     |     |     |
| 1500000   | 155  |      |      | F   | F   |     |     |     |
| 2200000   | 225  |      |      | F   | F   |     |     |     |
| 3300000   | 335  |      |      |     |     |     |     |     |
| 4700000   | 475  |      |      | F   | F   | F   |     |     |
| 6800000   | 685  |      |      |     |     |     |     |     |
| 10000000  | 106  |      | F    | F   | F   | F   | G*  | G*  |
| 22000000  | 226  |      | G    | G   | G   | G   | G*  |     |
| 47000000  | 476  |      | G    | G   | G   | G*  |     |     |
| 100000000 | 107  |      | G*   | G*  | G*  |     |     |     |
| 220000000 | 227  | G*   | G*   |     |     |     |     |     |

\*\*\* Means M tolerance only.

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

**7-5. Y5V**

| Dimension |      | 0603 |     |     |     | 0805 |     |     |     | 1206 |      |     |     |     |     |     |
|-----------|------|------|-----|-----|-----|------|-----|-----|-----|------|------|-----|-----|-----|-----|-----|
| Cap(pF)   | code | 6.3V | 10V | 16V | 25V | 6.3V | 10V | 16V | 25V | 50V  | 6.3V | 10V | 16V | 25V | 35V | 50V |
| 1000000   | 105  |      | S   | B   |     |      | X   | X   | C   | C    |      | M   | M   | M   |     | M   |
| 1500000   | 155  |      | S   |     |     |      | C   | C   |     |      |      | M   | M   | M   |     |     |
| 2200000   | 225  | S    | S   |     |     |      | C   | C   |     |      |      | M   | M   | M   |     |     |
| 3300000   | 335  |      |     |     |     |      | C   | C   |     |      |      | J   | J   | J   |     |     |
| 4700000   | 475  |      |     |     |     |      | C   | C   |     |      |      | J   | J   | J   | J   |     |
| 6800000   | 685  |      |     |     |     |      | I   |     |     |      |      | J   | J   |     |     |     |
| 10000000  | 106  |      |     |     |     | I    | I   |     |     |      |      | J   | J   |     |     |     |
| 22000000  | 226  |      |     |     |     |      |     |     |     |      |      | P   |     |     |     |     |
| 47000000  | 476  |      |     |     |     |      |     |     |     |      |      |     |     |     |     |     |
| 100000000 | 107  |      |     |     |     |      |     |     |     |      |      |     |     |     |     |     |
| 220000000 | 227  |      |     |     |     |      |     |     |     |      |      |     |     |     |     |     |

| Dimension |      | 1210 |     |     |     |     |     | 1812 |     |     |     |      |
|-----------|------|------|-----|-----|-----|-----|-----|------|-----|-----|-----|------|
| Cap(pF)   | code | 6.3V | 10V | 16V | 25V | 35V | 50V | 10V  | 16V | 25V | 50V | 100V |
| 1000000   | 105  |      | M   | M   | M   |     | M   | C    | C   | C   | C   | C    |
| 1500000   | 155  |      | M   | M   | M   |     |     | C    | C   | C   | C   |      |
| 2200000   | 225  |      | M   | M   | M   |     | E   | C    | C   | C   | C   |      |
| 3300000   | 335  |      | M   | M   | M   |     |     | C    | C   | C   | C   |      |
| 4700000   | 475  |      | M   | M   | C   |     | E   | C    | C   | C   | C   |      |
| 6800000   | 685  |      | M   | M   | C   |     |     | C    | C   | C   | C   |      |
| 10000000  | 106  |      | C   | C   | E   | F   |     | C    | C   | C   |     |      |
| 22000000  | 226  |      | F   | F   |     |     |     |      |     |     |     |      |
| 47000000  | 476  | F    | F   |     |     |     |     | G    |     |     |     |      |
| 100000000 | 107  | G    |     |     |     |     |     |      |     |     |     |      |
| 220000000 | 227  |      |     |     |     |     |     |      |     |     |     |      |



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   | <p>* Class II : (X7R, X7S, X6S, X5R, Y5V)<br/>Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**.<br/>Cap.&gt;10μF, 0.5±0.2Vrms, 120Hz±20%.</p> <p>** Test condition : 0.5±0.2Vrms, 1KHz±10%.<br/>X7R:<br/>0805=106(6.3V), 0603/475(6.3V)<br/>X5R:<br/>0201 ≥ 224 (6.3V,10V,16V)#1,<br/>0402 ≥ 475 (6.3V,16V), 0402 ≥ 225(10V),<br/>0603=106 (6.3V)<br/>TT18X ≥ 475(10V) , TT15X series<br/>X6S:<br/>0201/474(4V),0201 ≥ 104 (6.3V,10V#1),<br/>0402 ≥ 225 (6.3V),<br/>0402/475 (10V), 0603/106 (6.3V),<br/>X7S:<br/>0402/225(6.3V)</p> <p>#1 Excluding<br/>X5R/0201/105(6.3V);225(10V),<br/>X6S/0201/104(10V)<br/>(1.0±0.2Vrms · 1KHz±10%)</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>* Shall not exceed the limits given in the detailed spec.</p> <p>* X7R/X7S/X6S/X5R :</p> <table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td rowspan="3">≤2.5%</td> <td>≤3.5%</td> <td>1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2225≥4.7μF</td> </tr> <tr> <td>≤5%</td> <td>0603≥0.068μF, 0805&gt;0.1μF, 1206&gt;1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤10%</td> <td>0805&gt;0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤2.5%</td> <td>≤3.5%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.1μF, 0603&gt;0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>35V</td> <td>≤3.5%</td> <td>≤10%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</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, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤5%</td> <td>≤10%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> <tr> <td>6.3V</td> <td>≤10%</td> <td>≤15%</td> <td>0402≥2.2μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>* Y5V</p> <table border="1"> <thead> <tr> <th>Rated Vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥50V</td> <td rowspan="2">≤5%</td> <td>≤7%</td> <td>0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF</td> </tr> <tr> <td>≤12.5%</td> <td>1210≥6.8μF</td> </tr> <tr> <td>35V</td> <td>≤7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤7%</td> <td>0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, 1206≥1μF, 1210≥4.7μF</td> </tr> <tr> <td>≤9%</td> <td>0402≥0.068μF, 0603≥0.47μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.068μF, 0603≥0.68μF</td> </tr> <tr> <td>16V (C&lt;1.0μF)</td> <td>≤7%</td> <td>≤12.5%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>≤9%</td> <td>≤12.5%</td> <td>0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>≤12.5%</td> <td>≤20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated           | D.F.≤   | Exception of D.F.≤ |     | ≥100V             | ≤2.5% | ≤3.5%             | 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2225≥4.7μF | ≤5%               | 0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF | ≤10%       | 0805>0.22μF, 1210≥3.3μF | 50V  | ≤2.5%      | ≤3.5% | 0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF | ≤5%  | 0201≥0.01μF, 1210≥4.7μF | ≤10% | 0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF | 35V        | ≤3.5% | ≤10%     | 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V           | ≤3.5% | ≤5%  | 0201≥0.01μF, 0805≥1μF, 1210≥10μF | ≤7%  | 0603≥0.33μF | ≤10% | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF | 16V  | ≤3.5% | ≤5%        | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF | ≤10%      | 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF | ≤15%      | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF | 10V       | ≤5%       | ≤10% | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF | ≤15% | 0201≥0.1μF, 0402≥1μF | ≤20% | 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF | 6.3V       | ≤10% | ≤15%   | 0402≥2.2μF | 4V                 | ≤15% | ---         | --- | Rated Vol.  | D.F.≤ | Exception of D.F.≤ |     | ≥50V        | ≤5% | ≤7%              | 0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF | ≤12.5% | 1210≥6.8μF | 35V | ≤7% | --- | --- | 25V | ≤5% | ≤7% | 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, 1206≥1μF, 1210≥4.7μF | ≤9% | 0402≥0.068μF, 0603≥0.47μF, 1206≥4.7μF, 1210≥22μF | ≤12.5% | 0402≥0.068μF, 0603≥0.68μF | 16V (C<1.0μF) | ≤7% | ≤12.5% | 0402≥0.22μF | 16V (C≥1.0μF) | ≤9% | ≤12.5% | 0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF | 10V | ≤12.5% | ≤20% | 0402≥0.47μF | 6.3V | ≤20% | --- | --- |
| Rated         | D.F.≤   | Exception of D.F.≤  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| ≥100V         | ≤2.5%   | ≤3.5%   | 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2225≥4.7μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤5%   | 0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤10%  | 0805>0.22μF, 1210≥3.3μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 50V           | ≤2.5%   | ≤3.5%   | 0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤5%   | 0201≥0.01μF, 1210≥4.7μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤10%  | 0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 35V           | ≤3.5%   | ≤10%  | 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 25V           | ≤3.5%   | ≤5%   | 0201≥0.01μF, 0805≥1μF, 1210≥10μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤7%   | 0603≥0.33μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤10%  | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 16V           | ≤3.5%   | ≤5%   | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤10%  | 0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤15%  | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 10V           | ≤5%   | ≤10%  | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤15%  | 0201≥0.1μF, 0402≥1μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤20%  | 0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 6.3V          | ≤10%  | ≤15%  | 0402≥2.2μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 4V            | ≤15%  | ---   | ---  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| Rated Vol.    | D.F.≤   | Exception of D.F.≤  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| ≥50V          | ≤5%   | ≤7%   | 0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤12.5%  | 1210≥6.8μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 35V           | ≤7%   | ---   | ---  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 25V           | ≤5%   | ≤7%   | 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, 1206≥1μF, 1210≥4.7μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤9%   | 0402≥0.068μF, 0603≥0.47μF, 1206≥4.7μF, 1210≥22μF   |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               |   | ≤12.5%  | 0402≥0.068μF, 0603≥0.68μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 16V (C<1.0μF) | ≤7%   | ≤12.5%  | 0402≥0.22μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 16V (C≥1.0μF) | ≤9%   | ≤12.5%  | 0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 10V           | ≤12.5%  | ≤20%  | 0402≥0.47μF  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 6.3V          | ≤20%  | ---   | ---  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 3.            | Q/D.F. (Tangent loss angle) Of                                      |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 4.            | Temperature Coefficient (Temperature characteristic of capacitance) | <p>* With no electrical load.</p> <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp.</th> </tr> </thead> <tbody> <tr> <td>X7R/X7S</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>-55~ 85°C at 25°C</td> </tr> <tr> <td>Y5V</td> <td>-25~ 85°C at 20°C</td> </tr> </tbody> </table> <p>* Measurement voltage for X7R/X7S/X6S/X5R/Y5V :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Cap. Range</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td rowspan="3">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>Cap.≥1μF</td> <td>0.1V</td> </tr> <tr> <td rowspan="3">0402</td> <td>Cap.&lt;0.1μF</td> <td>1V</td> </tr> <tr> <td>Cap.=1μF</td> <td>0.5V</td> </tr> <tr> <td>1μF&lt;Cap.&lt;10μF</td> <td>0.2V</td> </tr> <tr> <td rowspan="3">0603</td> <td>Cap.≥10μF</td> <td>0.1V</td> </tr> <tr> <td>Cap.≤1μF</td> <td>1V</td> </tr> <tr> <td>1μF&lt;Cap.≤4.7μF</td> <td>0.5V</td> </tr> <tr> <td rowspan="3">0805</td> <td>Cap.&gt;4.7μF</td> <td>0.2V</td> </tr> <tr> <td>Cap.&lt;10μF</td> <td>1V</td> </tr> <tr> <td>Cap.=10μF</td> <td>0.5V</td> </tr> <tr> <td rowspan="3">1206/1210</td> <td>Cap.&gt;10μF</td> <td>0.2V</td> </tr> <tr> <td>Cap.≤10μF</td> <td>1V</td> </tr> <tr> <td>10μF&lt;Cap.≤100μF</td> <td>0.5V</td> </tr> <tr> <td></td> <td>Cap.&gt;100μF</td> <td>0.2V</td> </tr> </tbody> </table> | T.C.   | Operating Temp. | X7R/X7S | -55~125°C at 25°C  | X6S | -55~105°C at 25°C | X5R   | -55~ 85°C at 25°C | Y5V   | -25~ 85°C at 20°C | Size   | Cap. Range | Condition               | 0201 | Cap.<0.1μF | 1V    | 0.1μF≤Cap.<1μF  | 0.2V | Cap.≥1μF                | 0.1V | 0402  | Cap.<0.1μF | 1V    | Cap.=1μF | 0.5V  | 1μF<Cap.<10μF | 0.2V  | 0603 | Cap.≥10μF                        | 0.1V | Cap.≤1μF    | 1V   | 1μF<Cap.≤4.7μF  | 0.5V | 0805  | Cap.>4.7μF | 0.2V  | Cap.<10μF | 1V  | Cap.=10μF | 0.5V   | 1206/1210 | Cap.>10μF | 0.2V | Cap.≤10μF  | 1V   | 10μF<Cap.≤100μF      | 0.5V |  | Cap.>100μF | 0.2V | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X7S</td> <td>Within ±22%</td> </tr> <tr> <td>X6S</td> <td>Within ±22%</td> </tr> <tr> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table> | T.C.       | Capacitance Change | X7R  | Within ±15% | X7S | Within ±22% | X6S   | Within ±22%        | X5R | Within ±15% | Y5V | Within +30%/-80% |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| T.C.          | Operating Temp.   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X7R/X7S       | -55~125°C at 25°C   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X6S           | -55~105°C at 25°C   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X5R           | -55~ 85°C at 25°C   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| Y5V           | -25~ 85°C at 20°C   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| Size          | Cap. Range  | Condition   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 0201          | Cap.<0.1μF  | 1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | 0.1μF≤Cap.<1μF  | 0.2V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.≥1μF  | 0.1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 0402          | Cap.<0.1μF  | 1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.=1μF  | 0.5V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | 1μF<Cap.<10μF   | 0.2V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 0603          | Cap.≥10μF   | 0.1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.≤1μF  | 1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | 1μF<Cap.≤4.7μF  | 0.5V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 0805          | Cap.>4.7μF  | 0.2V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.<10μF   | 1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.=10μF   | 0.5V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| 1206/1210     | Cap.>10μF   | 0.2V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.≤10μF   | 1V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | 10μF<Cap.≤100μF   | 0.5V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
|               | Cap.>100μF  | 0.2V  |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| T.C.          | Capacitance Change  |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X7R           | Within ±15%   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X7S           | Within ±22%   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X6S           | Within ±22%   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| X5R           | Within ±15%   |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |
| Y5V           | Within +30%/-80%  |   |  |                 |         |                    |     |                   |       |                   |   |                   |  |            |                         |      |            |       |   |      |                         |      |   |            |       |          |   |               |       |      |                                  |      |             |      |   |      |       |            |   |           |   |           |  |           |           |      |  |      |                      |      |  |            |      |  |            |                    |      |             |     |             |       |                    |     |             |     |                  |                                     |        |            |     |     |     |     |     |     |     |   |     |  |        |                           |               |     |        |             |               |     |        |   |     |        |      |             |      |      |     |     |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.   | Item  | Test Condition  | Requirements  |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
|---|---|---|---|-----------------------------|------------|-----------------------|---|---|---|--|--|--|----------------------------|--|------|-----------------------------|-----------------------------|---|--------------------------|---|--|---|
| 5.  | Insulation Resistance   | * To apply rated voltage for Max. 120sec.   | * $\geq 10G\Omega$ or $RxC \geq 500\Omega \cdot F$ , whichever is smaller.<br>* Except :  |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
|   |   |   | <table border="1"> <tr> <th>Rated voltage (X7R/X5R/Y5V)</th> <th>I.R.</th> </tr> <tr> <td><math>\geq 100V</math> : All X7R</td> <td rowspan="10"><math>\geq 10G\Omega</math> or <math>RxC \geq 100\Omega \cdot F</math>, whichever is smaller</td> </tr> <tr> <td>50V : 0402<math>&gt;0.01\mu F</math>, 0603<math>\geq 1\mu F</math>, 0805<math>\geq 1\mu F</math>, 1206<math>\geq 4.7\mu F</math>, 1210<math>\geq 4.7\mu F</math>, 1812<math>\geq 10\mu F</math>, 2220<math>\geq 22\mu F</math></td> </tr> <tr> <td>35V : 0805<math>\geq 2.2\mu F</math>, 1206<math>\geq 2.2\mu F</math>, 1210<math>\geq 10\mu F</math></td> </tr> <tr> <td>25V : 0402<math>\geq 1\mu F</math>, 0603<math>\geq 2.2\mu F</math>, 0805<math>\geq 2.2\mu F</math>, 1206<math>\geq 10\mu F</math>, 1210<math>\geq 10\mu F</math></td> </tr> <tr> <td>16V : 0201<math>\geq 0.1\mu F</math>, 0402<math>\geq 0.22\mu F</math>, 0603<math>\geq 1\mu F</math>, 0805<math>\geq 2.2\mu F</math>, 1206<math>\geq 10\mu F</math>, 1210<math>\geq 47\mu F</math></td> </tr> <tr> <td>10V : 0201<math>\geq 47nF</math>, 0402<math>\geq 0.47\mu F</math>, 0603<math>\geq 0.47\mu F</math>, 0805<math>\geq 2.2\mu F</math>, 1206<math>\geq 4.7\mu F</math>, 1210<math>\geq 47\mu F</math></td> </tr> <tr> <td>6.3V; 4V</td> </tr> <tr> <th>Rated voltage (X7R/X7S/X6S/X5R/Y5V)</th> <th>I.R.</th> </tr> <tr> <td>100V : 1210<math>\geq 3.3\mu F</math></td> <td rowspan="10"><math>RxC \geq 50\Omega \cdot F</math></td> </tr> <tr> <td>50V : 0402<math>\geq 0.1\mu F</math>, 0603<math>\geq 2.2\mu F</math>, 0805<math>\geq 10\mu F</math>, 1206<math>\geq 10\mu F</math></td> </tr> <tr> <td>35V : 0603<math>\geq 1\mu F</math></td> </tr> <tr> <td>25V : 0201<math>\geq 0.1\mu F</math>, 0402<math>\geq 2.2\mu F</math>, 0603<math>\geq 10\mu F</math>, 0805<math>\geq 10\mu F</math>, 1206<math>\geq 22\mu F</math></td> </tr> <tr> <td>16V : 0603<math>\geq 10\mu F</math>, 0402<math>\geq 1\mu F</math>, 0201<math>\geq 0.22\mu F</math></td> </tr> <tr> <td>10V : 0201<math>&gt;0.1\mu F</math>, 0402<math>\geq 1\mu F</math>, 0603<math>\geq 10\mu F</math>, 0805<math>\geq 47\mu F</math></td> </tr> <tr> <td>6.3V : 0201<math>\geq 0.1\mu F</math>, 0603<math>\geq 4.7\mu F</math>, 0805<math>\geq 47\mu F</math>, 1206<math>\geq 10\mu F</math></td> </tr> <tr> <td>4V : 0603<math>\geq 22\mu F</math>, 0805<math>\geq 47\mu F</math>, 1206<math>\geq 100\mu F</math></td> </tr> <tr> <td>All X7S items; All X6S items</td> </tr> </table> | Rated voltage (X7R/X5R/Y5V) | I.R.       | $\geq 100V$ : All X7R | $\geq 10G\Omega$ or $RxC \geq 100\Omega \cdot F$ , whichever is smaller | 50V : 0402 $>0.01\mu F$ , 0603 $\geq 1\mu F$ , 0805 $\geq 1\mu F$ , 1206 $\geq 4.7\mu F$ , 1210 $\geq 4.7\mu F$ , 1812 $\geq 10\mu F$ , 2220 $\geq 22\mu F$ | 35V : 0805 $\geq 2.2\mu F$ , 1206 $\geq 2.2\mu F$ , 1210 $\geq 10\mu F$ | 25V : 0402 $\geq 1\mu F$ , 0603 $\geq 2.2\mu F$ , 0805 $\geq 2.2\mu F$ , 1206 $\geq 10\mu F$ , 1210 $\geq 10\mu F$ | 16V : 0201 $\geq 0.1\mu F$ , 0402 $\geq 0.22\mu F$ , 0603 $\geq 1\mu F$ , 0805 $\geq 2.2\mu F$ , 1206 $\geq 10\mu F$ , 1210 $\geq 47\mu F$ | 10V : 0201 $\geq 47nF$ , 0402 $\geq 0.47\mu F$ , 0603 $\geq 0.47\mu F$ , 0805 $\geq 2.2\mu F$ , 1206 $\geq 4.7\mu F$ , 1210 $\geq 47\mu F$ | 6.3V; 4V                   | Rated voltage (X7R/X7S/X6S/X5R/Y5V)                | I.R. | 100V : 1210 $\geq 3.3\mu F$ | $RxC \geq 50\Omega \cdot F$ | 50V : 0402 $\geq 0.1\mu F$ , 0603 $\geq 2.2\mu F$ , 0805 $\geq 10\mu F$ , 1206 $\geq 10\mu F$   | 35V : 0603 $\geq 1\mu F$ | 25V : 0201 $\geq 0.1\mu F$ , 0402 $\geq 2.2\mu F$ , 0603 $\geq 10\mu F$ , 0805 $\geq 10\mu F$ , 1206 $\geq 22\mu F$ | 16V : 0603 $\geq 10\mu F$ , 0402 $\geq 1\mu F$ , 0201 $\geq 0.22\mu F$ | 10V : 0201 $>0.1\mu F$ , 0402 $\geq 1\mu F$ , 0603 $\geq 10\mu F$ , 0805 $\geq 47\mu F$ |
| Rated voltage (X7R/X5R/Y5V)   | I.R.  |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| $\geq 100V$ : All X7R   | $\geq 10G\Omega$ or $RxC \geq 100\Omega \cdot F$ , whichever is smaller |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 50V : 0402 $>0.01\mu F$ , 0603 $\geq 1\mu F$ , 0805 $\geq 1\mu F$ , 1206 $\geq 4.7\mu F$ , 1210 $\geq 4.7\mu F$ , 1812 $\geq 10\mu F$ , 2220 $\geq 22\mu F$ |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 35V : 0805 $\geq 2.2\mu F$ , 1206 $\geq 2.2\mu F$ , 1210 $\geq 10\mu F$   |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 25V : 0402 $\geq 1\mu F$ , 0603 $\geq 2.2\mu F$ , 0805 $\geq 2.2\mu F$ , 1206 $\geq 10\mu F$ , 1210 $\geq 10\mu F$  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 16V : 0201 $\geq 0.1\mu F$ , 0402 $\geq 0.22\mu F$ , 0603 $\geq 1\mu F$ , 0805 $\geq 2.2\mu F$ , 1206 $\geq 10\mu F$ , 1210 $\geq 47\mu F$                  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 10V : 0201 $\geq 47nF$ , 0402 $\geq 0.47\mu F$ , 0603 $\geq 0.47\mu F$ , 0805 $\geq 2.2\mu F$ , 1206 $\geq 4.7\mu F$ , 1210 $\geq 47\mu F$                  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 6.3V; 4V  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| Rated voltage (X7R/X7S/X6S/X5R/Y5V)   |   | I.R.  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 100V : 1210 $\geq 3.3\mu F$   |   | $RxC \geq 50\Omega \cdot F$   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 50V : 0402 $\geq 0.1\mu F$ , 0603 $\geq 2.2\mu F$ , 0805 $\geq 10\mu F$ , 1206 $\geq 10\mu F$   |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 35V : 0603 $\geq 1\mu F$  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 25V : 0201 $\geq 0.1\mu F$ , 0402 $\geq 2.2\mu F$ , 0603 $\geq 10\mu F$ , 0805 $\geq 10\mu F$ , 1206 $\geq 22\mu F$   |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 16V : 0603 $\geq 10\mu F$ , 0402 $\geq 1\mu F$ , 0201 $\geq 0.22\mu F$  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 10V : 0201 $>0.1\mu F$ , 0402 $\geq 1\mu F$ , 0603 $\geq 10\mu F$ , 0805 $\geq 47\mu F$   |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 6.3V : 0201 $\geq 0.1\mu F$ , 0603 $\geq 4.7\mu F$ , 0805 $\geq 47\mu F$ , 1206 $\geq 10\mu F$  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 4V : 0603 $\geq 22\mu F$ , 0805 $\geq 47\mu F$ , 1206 $\geq 100\mu F$   |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| All X7S items; All X6S items  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 6.  | Dielectric Strength   |   | <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td><math>\leq 100</math></td> <td>2.5 times of <math>U_R</math></td> </tr> <tr> <td><math>100 &lt; V \leq 250</math></td> <td>2.0 times of <math>U_R</math></td> </tr> <tr> <td><math>250 &lt; V \leq 500</math></td> <td>1.5 times of <math>U_R</math></td> </tr> <tr> <td>630</td> <td>1.2 times of <math>U_R</math></td> </tr> </tbody> </table>  | Rated Voltage               | Condition  | $\leq 100$            | 2.5 times of $U_R$  | $100 < V \leq 250$  | 2.0 times of $U_R$  | $250 < V \leq 500$   | 1.5 times of $U_R$   | 630  | 1.2 times of $U_R$         | * No evidence of damage or flash over during test. |      |                             |                             |   |                          |   |  |   |
|   |   | Rated Voltage   | Condition   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| $\leq 100$  | 2.5 times of $U_R$  |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| $100 < V \leq 250$  | 2.0 times of $U_R$  |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| $250 < V \leq 500$  | 1.5 times of $U_R$  |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 630   | 1.2 times of $U_R$  |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| * Duration : 1 to 5 sec.<br>* Charge and discharge current less than 50mA.  |   |   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 7.  | Solderability   | * Solder temperature : $235 \pm 5^\circ C$ for (0201~1210).<br>* Solder temperature : $245 \pm 5^\circ C$ for (1808~2225).<br>* Dipping time : $2 \pm 0.5$ sec.   | * 75% min. coverage of all metalized area.  |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 8.  | Resistance to Soldering Heat  | * Solder temperature : $260 \pm 5^\circ C$ .<br>* Dipping time : $10 \pm 1$ sec.<br>* Preheating : 120 to $150^\circ C$ for 1 minute before immerse the capacitor in a eutectic solder.<br>* Before initial measurement (Class II only) : To apply de-aging at $150^\circ C$ for 1hr then set for $24 \pm 2$ hrs at room temp.<br>* Measurement to be made after keeping at room temp. for $48 \pm 4$ hrs (Class II).   | * No remarkable damage.<br>* Cap. change :<br>X7R/X7S/X6S/X5R : Within $\pm 7.5\%$ .<br>Y5V : Within $\pm 20\%$ .<br>* D.F., I.R. : To meet initial requirements.<br>* 25% max. leaching on each edge.  |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
|   |   | * Conduct the five cycles according to the temperatures and time. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(<math>^\circ C</math>)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30<math>\pm</math>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<math>\pm</math>3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> * Before initial measurement (Class II only) : To apply de-aging at $150^\circ C$ for 1hr then set for $24 \pm 2$ hrs at room temp.<br>* Measurement to be made after keeping at room temp. for $48 \pm 4$ hrs (Class II). | Step  | Temp.( $^\circ C$ )         | Time(min.) | 1                     | Min. operating temp. +0/-3  | 30 $\pm$ 3  | 2   | Room temp.   | 2~3  | 3  | Max. operating temp. +3/-0 | 30 $\pm$ 3   | 4    | Room temp.                  | 2~3                         | * No remarkable damage.<br>* Cap. change :<br>X7R/X7S/X6S/X5R : Within $\pm 7.5\%$ .<br>Y5V : Within $\pm 20\%$ .<br>* D.F. : $\leq 150\%$ of initial requirement.<br>* I.R. : $\geq 100\%$ of initial requirement. |                          |   |  |   |
| Step  | Temp.( $^\circ C$ )   | Time(min.)  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 1   | Min. operating temp. +0/-3  | 30 $\pm$ 3  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 2   | Room temp.  | 2~3   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 3   | Max. operating temp. +3/-0  | 30 $\pm$ 3  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 4   | Room temp.  | 2~3   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 9.  | Temperature Cycle (Rapid change of temperature)                         | * Conduct the five cycles according to the temperatures and time. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(<math>^\circ C</math>)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30<math>\pm</math>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<math>\pm</math>3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> * Before initial measurement (Class II only) : To apply de-aging at $150^\circ C$ for 1hr then set for $24 \pm 2$ hrs at room temp.<br>* Measurement to be made after keeping at room temp. for $48 \pm 4$ hrs (Class II). | Step  | Temp.( $^\circ C$ )         | Time(min.) | 1                     | Min. operating temp. +0/-3  | 30 $\pm$ 3  | 2   | Room temp.   | 2~3  | 3  | Max. operating temp. +3/-0 | 30 $\pm$ 3   | 4    | Room temp.                  | 2~3                         | * No remarkable damage.<br>* Cap. change :<br>X7R/X7S/X6S/X5R : Within $\pm 7.5\%$ .<br>Y5V : Within $\pm 20\%$ .<br>* D.F. : $\leq 150\%$ of initial requirement.<br>* I.R. : $\geq 100\%$ of initial requirement. |                          |   |  |   |
| Step  | Temp.( $^\circ C$ )   | Time(min.)  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 1   | Min. operating temp. +0/-3  | 30 $\pm$ 3  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 2   | Room temp.  | 2~3   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 3   | Max. operating temp. +3/-0  | 30 $\pm$ 3  |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |
| 4   | Room temp.  | 2~3   |   |                             |            |                       |   |   |   |  |  |  |                            |  |      |                             |                             |   |                          |   |  |   |

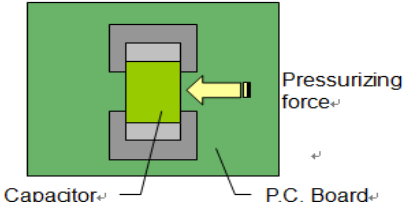
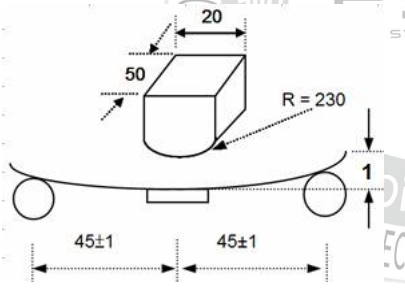
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.  | Item                                     | Test Condition  | Requirements   |               |      |                            |  |   |   |   |   |  |  |
|--|--|---|--|---------------|------|----------------------------|--|---|---|---|---|--|--|
| 10.  | Humidity (Damp Heat) Steady State        | * Test temp. : 40±2°C.<br>* Humidity : 90~95%RH.<br>* Test time : 500 +24/-0hrs.<br>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).  | * No remarkable damage.<br>* Cap. change :<br>X7R/X7S/X6S/X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V.<br>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.<br>Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V.<br>* D.F. : ≤200% of initial requirement.<br>* I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller.<br>Except : <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V : All X7R; 1210≥3.3μF</td> <td rowspan="7">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V : 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V; 4V; All X6S/X7S items; Size≥1812</td> </tr> </tbody> </table>    | Rated voltage | I.R. | 100V : All X7R; 1210≥3.3μF | ≥1GΩ or RxC≥10Ω-F, whichever is smaller  | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | 16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | 6.3V; 4V; All X6S/X7S items; Size≥1812 |
| Rated voltage  | I.R.                                     |   |  |               |      |                            |  |   |   |   |   |  |  |
| 100V : All X7R; 1210≥3.3μF   | ≥1GΩ or RxC≥10Ω-F, whichever is smaller  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF                |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF                            |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF  |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF    |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 6.3V; 4V; All X6S/X7S items; Size≥1812                                       |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 11.  | Humidity (Damp Heat) Load                | * Test temp. : 40±2°C.<br>* Humidity : 90~95%RH.<br>* Test time : 500 +24/-0hrs.<br>* To apply voltage : Rated voltage (500V max.).<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 48±4 hrs (Class II). | * No remarkable damage.<br>* Cap. change :<br>X7R/X7S/X6S/X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V.<br>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.<br>Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V.<br>* D.F. : ≤200% of initial requirement.<br>* I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller.<br>Except : <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V : All X7R; 1210≥3.3μF</td> <td rowspan="7">≥500MΩ or RxC≥5Ω-F, whichever is smaller</td> </tr> <tr> <td>50V : 0402&gt;0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V; 4V; All X6S/X7S items; Size≥1812</td> </tr> </tbody> </table> | Rated voltage | I.R. | 100V : All X7R; 1210≥3.3μF | ≥500MΩ or RxC≥5Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF | 16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF | 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | 6.3V; 4V; All X6S/X7S items; Size≥1812 |
| Rated voltage  | I.R.                                     |   |  |               |      |                            |  |   |   |   |   |  |  |
| 100V : All X7R; 1210≥3.3μF   | ≥500MΩ or RxC≥5Ω-F, whichever is smaller |   |  |               |      |                            |  |   |   |   |   |  |  |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF                |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF                            |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF  |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF    |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF |  |   |  |               |      |                            |  |   |   |   |   |  |  |
| 6.3V; 4V; All X6S/X7S items; Size≥1812                                       |  |   |  |               |      |                            |  |   |   |   |   |  |  |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.  | Item                              | Test Condition   | Requirements |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|------|-----------------------------------|--|--------------|------------|-------|-------------|------|-----------------|------|---------|------|---------|------|----------------------|---------------------|---------|----|--------|------|-----------------|-----------|---------|----------|---------|------|-----------------|----|--------|------|--------|------|-----------------|---------|--------|-------|--------|------|-----------------|-----|--------|-----|---------|------|------------|---------------|-------------|------|-----------------|---------|---------|-----|-----------|------|-----------------|-----|---------|--------|----------|------|-----------------|-----|----------|-----|----------|------|-----------------|--------|---------|-----|----------|------|-----------------|-------|----------|-----|---------|------|-----------------|------|---------|-----|---------|------|-----|------|---------|------|---------|------|-----|------|---------|------|---------|------|-----|------|---------|------|---------|------|-----|------|---------|------|---------|------|------------|---------------|-------------|------|-----|-------|--------|--|
| 12.  | High Temperature Load (Endurance) | <p>* Test temp. :<br/>X7R, X7S : 125±3°C.<br/>X6S : 105±3°C.<br/>X5R, Y5V : 85±3°C.</p> <p>* To apply voltage :<br/>(1) 10V≤Ur≤100V : 200% of rated voltage.<br/>or ≤6.3V or Cap.≥10μF : 150% of rated voltage.<br/>(2) 200V≤Ur≤500V : 150% of rated voltage.<br/>(3) =630V : 120% of rated voltage.<br/>(4) 100% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>≤10V</td> <td>C≥0.1μF</td> </tr> <tr> <td>≥16V</td> <td>C&gt;0.1μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X7S/X6S /Y5V</td> <td>6.3V, 10V, 16V, 25V</td> <td>C≥1.0μF</td> </tr> <tr> <td>4V</td> <td>C≥22μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>6.3V, 10V</td> <td>C≥4.7μF</td> </tr> <tr> <td>25V, 35V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>4V</td> <td>C≥47μF</td> </tr> <tr> <td>6.3V</td> <td>C≥22μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>10V~50V</td> <td>C≥10μF</td> </tr> <tr> <td>≤6.3V</td> <td>C≥47μF</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>16V</td> <td>C≥47μF</td> </tr> <tr> <td>X7R</td> <td>C≥3.3μF</td> </tr> </tbody> </table> <p>(5) 150% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>16V/25V</td> <td>C≥0.1μF</td> </tr> <tr> <td>X7R</td> <td>C≥0.022μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td>10~25V</td> <td>C≥0.22μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>16V</td> <td>C≥0.47μF</td> </tr> <tr> <td>Y5V</td> <td>C≥0.22μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>10~50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>50V</td> <td>C≥0.47μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>≥100V</td> <td>C≥0.12μF</td> </tr> <tr> <td>Y5V</td> <td>C≥4.7μF</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>≥50V</td> <td>C≥1.0μF</td> </tr> <tr> <td>X7R</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">1812</td> <td rowspan="2">X7R</td> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">1825</td> <td rowspan="2">X7R</td> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">2220</td> <td rowspan="2">X7R</td> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">2225</td> <td rowspan="2">X7R</td> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>100V</td> <td>C≥1.0μF</td> </tr> </tbody> </table> <p>(6) 120% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td>2220</td> <td>X7R</td> <td>≥100V</td> <td>C≥15μF</td> </tr> </tbody> </table> <p>* Test time : 1000 +24/-0 hrs.<br/>* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.<br/>* Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).<br/>** De-rating conditions :</p> | Size         | Dielectric | Rated | Capacitance | 0201 | X5R/X7R/X7S/X6S | ≤10V | C≥0.1μF | ≥16V | C>0.1μF | 0402 | X5R/X7R/X7S/X6S /Y5V | 6.3V, 10V, 16V, 25V | C≥1.0μF | 4V | C≥22μF | 0603 | X5R/X7R/X7S/X6S | 6.3V, 10V | C≥4.7μF | 25V, 35V | C≥1.0μF | 0805 | X5R/X7R/X7S/X6S | 4V | C≥47μF | 6.3V | C≥22μF | 1206 | X5R/X7R/X7S/X6S | 10V~50V | C≥10μF | ≤6.3V | C≥47μF | 1210 | X5R/X7R/X7S/X6S | 16V | C≥47μF | X7R | C≥3.3μF | Size | Dielectric | Rated Voltage | Capacitance | 0201 | X5R/X7R/X7S/X6S | 16V/25V | C≥0.1μF | X7R | C≥0.022μF | 0402 | X5R/X7R/X7S/X6S | 50V | C≥0.1μF | 10~25V | C≥0.22μF | 0603 | X5R/X7R/X7S/X6S | 16V | C≥0.47μF | Y5V | C≥0.22μF | 0805 | X5R/X7R/X7S/X6S | 10~50V | C≥4.7μF | 50V | C≥0.47μF | 1206 | X5R/X7R/X7S/X6S | ≥100V | C≥0.12μF | Y5V | C≥4.7μF | 1210 | X5R/X7R/X7S/X6S | ≥50V | C≥1.0μF | X7R | C≥1.0μF | 1812 | X7R | ≤50V | C≥4.7μF | 100V | C≥1.0μF | 1825 | X7R | ≤50V | C≥4.7μF | 100V | C≥1.0μF | 2220 | X7R | ≤50V | C≥4.7μF | 100V | C≥1.0μF | 2225 | X7R | ≤50V | C≥4.7μF | 100V | C≥1.0μF | Size | Dielectric | Rated Voltage | Capacitance | 2220 | X7R | ≥100V | C≥15μF | <p>* No remarkable damage.<br/>* Cap. change :<br/>X7R/X7S/X6S/X5R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V.<br/>**10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF.<br/>Y5V : Within ±30% for ≥10V, within +30/-40% for ≤6.3V.<br/>* D.F. : ≤200% of initial requirement.<br/>* I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller.<br/>Except :<br/>Rated voltage   I.R.<br/>100V : All X7R; 1210≥3.3μF<br/>50V : 0402≥0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF<br/>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF<br/>25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF<br/>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF<br/>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF<br/>6.3V; 4V; All X6S/X7S items; Size≥1812</p> |
| Size | Dielectric                        | Rated  | Capacitance  |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0201 | X5R/X7R/X7S/X6S                   | ≤10V   | C≥0.1μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | ≥16V   | C>0.1μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0402 | X5R/X7R/X7S/X6S /Y5V              | 6.3V, 10V, 16V, 25V  | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 4V   | C≥22μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0603 | X5R/X7R/X7S/X6S                   | 6.3V, 10V  | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 25V, 35V   | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0805 | X5R/X7R/X7S/X6S                   | 4V   | C≥47μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 6.3V   | C≥22μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 1206 | X5R/X7R/X7S/X6S                   | 10V~50V  | C≥10μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | ≤6.3V  | C≥47μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 1210 | X5R/X7R/X7S/X6S                   | 16V  | C≥47μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | X7R  | C≥3.3μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| Size | Dielectric                        | Rated Voltage  | Capacitance  |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0201 | X5R/X7R/X7S/X6S                   | 16V/25V  | C≥0.1μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | X7R  | C≥0.022μF    |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0402 | X5R/X7R/X7S/X6S                   | 50V  | C≥0.1μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 10~25V   | C≥0.22μF     |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0603 | X5R/X7R/X7S/X6S                   | 16V  | C≥0.47μF     |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | Y5V  | C≥0.22μF     |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 0805 | X5R/X7R/X7S/X6S                   | 10~50V   | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 50V  | C≥0.47μF     |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 1206 | X5R/X7R/X7S/X6S                   | ≥100V  | C≥0.12μF     |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | Y5V  | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 1210 | X5R/X7R/X7S/X6S                   | ≥50V   | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | X7R  | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 1812 | X7R                               | ≤50V   | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 100V   | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 1825 | X7R                               | ≤50V   | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 100V   | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 2220 | X7R                               | ≤50V   | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 100V   | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 2225 | X7R                               | ≤50V   | C≥4.7μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
|      |                                   | 100V   | C≥1.0μF      |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| Size | Dielectric                        | Rated Voltage  | Capacitance  |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |
| 2220 | X7R                               | ≥100V  | C≥15μF       |            |       |             |      |                 |      |         |      |         |      |                      |                     |         |    |        |      |                 |           |         |          |         |      |                 |    |        |      |        |      |                 |         |        |       |        |      |                 |     |        |     |         |      |            |               |             |      |                 |         |         |     |           |      |                 |     |         |        |          |      |                 |     |          |     |          |      |                 |        |         |     |          |      |                 |       |          |     |         |      |                 |      |         |     |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |     |      |         |      |         |      |            |               |             |      |     |       |        |  |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.             | Item   | Test Condition   | Requirements  |            |             |                 |                     |     |                   |
|-----------------|--|--|---|------------|-------------|-----------------|---------------------|-----|-------------------|
| 13.             | Adhesive Strength of Termination (Robustness of termination) | <p>* Capacitors mounted on a substrate. A force of 5N(<math>\leq 0603</math>) or 10N(<math>&gt;0603</math>) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for <math>10 \pm 1</math> second.</p>  <p>Capacitor, P.C. Board, Pressurizing force</p>  | <p>* No remarkable damage or removal of the terminations.</p>   |            |             |                 |                     |     |                   |
| 14.             | Resistance to Flexure of Substrate (Substrate bending test)  | <p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm.</p>  <p>Unit : mm</p>   | <p>* No remarkable damage.</p> <table border="1" data-bbox="798 1030 1492 1131"> <thead> <tr> <th>Dielectric</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>X7R/X7S/X6S/X5R</td> <td>Within <math>\pm 12.5\%</math></td> </tr> <tr> <td>Y5V</td> <td>Within <math>\pm 30\%</math></td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p> | Dielectric | Cap. Change | X7R/X7S/X6S/X5R | Within $\pm 12.5\%$ | Y5V | Within $\pm 30\%$ |
| Dielectric      | Cap. Change  |  |   |            |             |                 |                     |     |                   |
| X7R/X7S/X6S/X5R | Within $\pm 12.5\%$  |  |   |            |             |                 |                     |     |                   |
| Y5V             | Within $\pm 30\%$  |  |   |            |             |                 |                     |     |                   |
| 15.             | Vibration Resistance   | <p>* Vibration frequency : 10~55 Hz/min.<br/>                     * Total amplitude : 1.5mm.<br/>                     * Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions)<br/>                     * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for <math>24 \pm 2</math> hrs at room temp.<br/>                     * Measurement to be made after keeping at room temp. for <math>48 \pm 4</math> hrs (Class II).</p> | <p>* No remarkable damage.<br/>                     * Cap. change and D.F. : To meet initial spec.</p>  |            |             |                 |                     |     |                   |

**9. PACKAGE DIMENSION AND QUANTITY**

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

Unit : pcs

**9. PACKAGE DIMENSION AND QUANTITY**

**9.1. EMBOSSED TAPE DIMENSIONS**

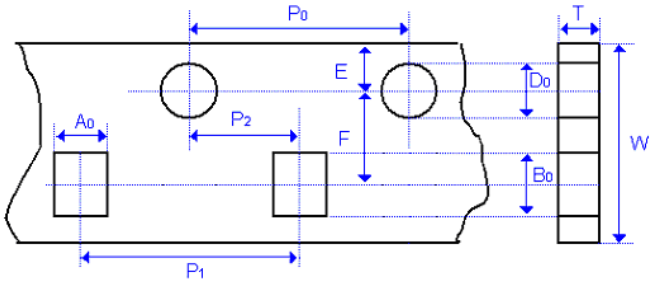


Fig. 9.1 The dimension of paper tape

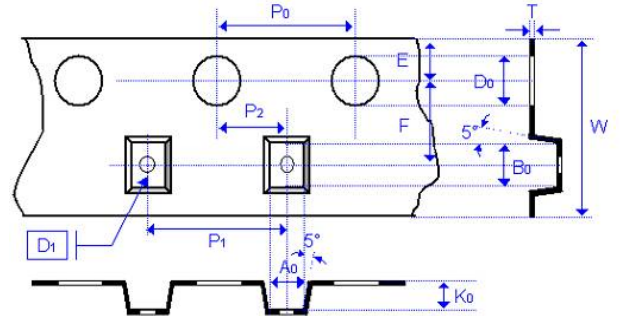


Fig. 9.2 The dimension of plastic tape

| Size              | 0201       | 0402                   | 0603            |                 | 0805       |                        |
|-------------------|------------|------------------------|-----------------|-----------------|------------|------------------------|
| Chip Thickness    | 0.30±0.03  | 0.50±0.05<br>0.50±0.10 | 0.80±0.07       | 0.80 +0.15/-0.1 | 0.80±0.10  | 1.25±0.10<br>1.25±0.20 |
| A <sub>0</sub>    | 0.39±0.07  | 0.70±0.20              | 1.00 +0.05/-0.1 | 1.02 +0.05/-0.1 | 1.50±0.10  | <1.65                  |
| B <sub>0</sub>    | 0.69±0.07  | 1.20±0.20              | 1.80±0.10       | 1.80±0.10       | 2.30±0.10  | <2.40                  |
| T                 | ≤0.50      | ≤0.80                  | 0.95±0.05       | 0.97±0.05       | 0.95±0.05  | 0.23±0.05              |
| K <sub>0</sub>    | -          | -                      | -               | -               | -          | <2.50                  |
| W                 | 8.00±0.10  | 8.00±0.10              | 8.00±0.10       | 8.00±0.10       | 8.00±0.10  | 8.00±0.10              |
| P <sub>0</sub>    | 4.00±0.10  | 4.00±0.10              | 4.00±0.10       | 4.00±0.10       | 4.00±0.10  | 4.00±0.10              |
| 10xP <sub>0</sub> | 40.00±0.10 | 40.00±0.10             | 40.00±0.20      | 40.00±0.20      | 40.00±0.20 | 40.00±0.20             |
| P <sub>1</sub>    | 2.00±0.05  | 2.00±0.05              | 4.00±0.10       | 4.00±0.10       | 4.00±0.10  | 4.00±0.10              |
| P <sub>2</sub>    | 2.00±0.05  | 2.00±0.05              | 2.00±0.05       | 2.00±0.05       | 2.00±0.05  | 2.00±0.05              |
| D <sub>0</sub>    | 1.55±0.05  | 1.55±0.05              | 1.55±0.05       | 1.55±0.05       | 1.55±0.05  | 1.50 +0.10/-0          |
| D <sub>1</sub>    | -          | -                      | -               | -               | -          | 1.00±0.10              |
| E                 | 1.75±0.05  | 1.75±0.05              | 1.75±0.05       | 1.75±0.05       | 1.75±0.05  | 1.75±0.10              |
| F                 | 3.50±0.05  | 3.50±0.05              | 3.50±0.05       | 3.50±0.05       | 3.50±0.05  | 3.50±0.05              |
| Unit :            | mm         | mm                     | mm              | mm              | mm         | mm                     |

| Size              | 1206       |                        |                            | 1210                                |               | 1812                                |               |
|-------------------|------------|------------------------|----------------------------|-------------------------------------|---------------|-------------------------------------|---------------|
| Chip Thickness    | 0.80±0.10  | 0.95±0.10<br>1.25±0.10 | 1.60±0.20<br>1.60+0.3/-0/1 | 0.95±0.10<br>1.25±0.10<br>1.60±0.20 | 2.50±0.30     | 1.25±0.10<br>1.60±0.20<br>2.00±0.20 | 2.50±0.30     |
| A <sub>0</sub>    | 2.00±0.10  | <2.00                  | <2.00                      | <3.05                               | <3.10         | <3.90                               | <3.90         |
| B <sub>0</sub>    | 3.50±0.10  | <3.60                  | <3.70                      | <3.80                               | <4.00         | <5.30                               | <5.30         |
| T                 | 0.95±0.05  | 0.23±0.05              | 0.23±0.05                  | 0.23±0.05                           | 0.23±0.05     | 0.25±0.05                           | 0.25±0.05     |
| K <sub>0</sub>    | -          | <2.50                  | <2.50                      | <2.50                               | <3.50         | <2.50                               | <3.00         |
| W                 | 8.00±0.10  | 8.00±0.10              | 8.00±0.10                  | 8.00±0.10                           | 8.00±0.10     | 12.00±0.20                          | 12.00±0.20    |
| P <sub>0</sub>    | 4.00±0.10  | 4.00±0.10              | 4.00±0.10                  | 4.00±0.10                           | 4.00±0.10     | 4.00±0.10                           | 4.00±0.10     |
| 10xP <sub>0</sub> | 40.00±0.20 | 40.00±0.20             | 40.00±0.20                 | 40.00±0.20                          | 40.00±0.20    | 40.00±0.20                          | 40.00±0.20    |
| P <sub>1</sub>    | 4.00±0.10  | 4.00±0.10              | 4.00±0.10                  | 4.00±0.10                           | 4.00±0.10     | 8.00±0.10                           | 8.00±0.10     |
| P <sub>2</sub>    | 2.00±0.05  | 2.00±0.05              | 2.00±0.05                  | 2.00±0.05                           | 2.00±0.05     | 2.00±0.05                           | 2.00±0.05     |
| D <sub>0</sub>    | 1.55±0.05  | 1.50 +0.10/-0          | 1.50 +0.10/-0              | 1.50 +0.10/-0                       | 1.50 +0.10/-0 | 1.50 +0.10/-0                       | 1.50 +0.10/-0 |
| D <sub>1</sub>    | -          | 1.00±0.10              | 1.00±0.10                  | 1.00±0.10                           | 1.00±0.10     | 1.50±0.10                           | 1.50±0.10     |
| E                 | 1.75±0.10  | 1.75±0.10              | 1.75±0.10                  | 1.75±0.10                           | 1.75±0.10     | 1.75±0.10                           | 1.75±0.10     |
| F                 | 3.50±0.05  | 3.50±0.05              | 3.50±0.05                  | 3.50±0.05                           | 3.50±0.05     | 5.50±0.05                           | 5.50±0.05     |
| Unit :            | mm         | mm                     | mm                         | mm                                  | mm            | mm                                  | mm            |

### 9. PACKAGE DIMENSION AND QUANTITY

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

### 9.2. REEL DIMENSIONS

| Size           | 0201, 0402, 0603,<br>0805, 1206, 1210 |                   | 1808, 1812, 1825,<br>2220, 2225 |
|----------------|---------------------------------------|-------------------|---------------------------------|
| Reel size      | 7"                                    | 13"               | 7"                              |
| C              | 13.0<br>+0.5/-0.2                     | 13.0<br>+0.7/-0.3 | 13.0<br>+0.5/-0.2               |
| W <sub>1</sub> | 8.4<br>+1.5/-0                        | 8.4<br>+2.0/-0    | 12.4<br>+2.0/-0                 |
| A              | 178.0<br>±0.10                        | 330.0<br>±1.0     | 178.0<br>±0.10                  |
| N              | 60.0<br>+1.0/-0                       | 100<br>±1.0       | 60.0<br>+1.0/-0                 |

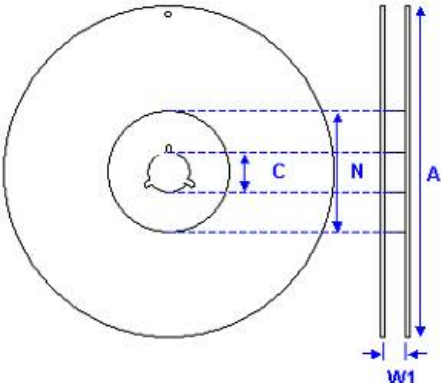


Fig. 9.3 The dimension of reel



**10. APPLICATION NOTES**

**STORAGE**

To prevent the damage of solderability of terminations, the following storage conditions are recommended :  
 Indoors under 5 ~ 40°C and 20% ~ 70% RH.

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

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

**HANDLING**

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

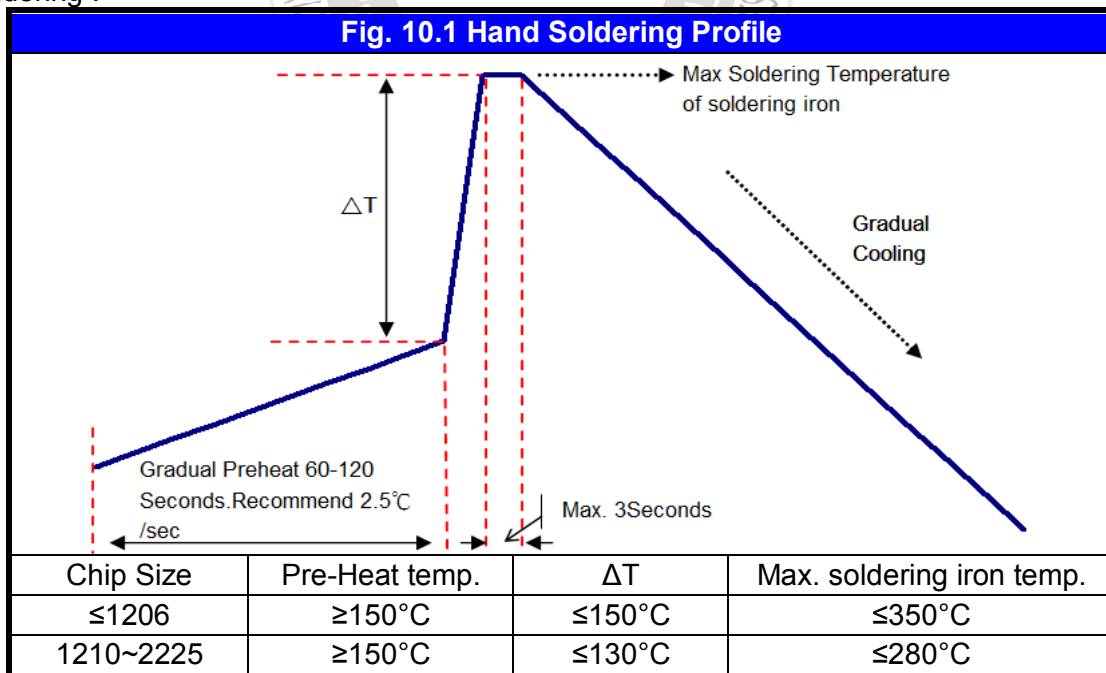
**PREHEAT**

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

**SOLDERING**

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

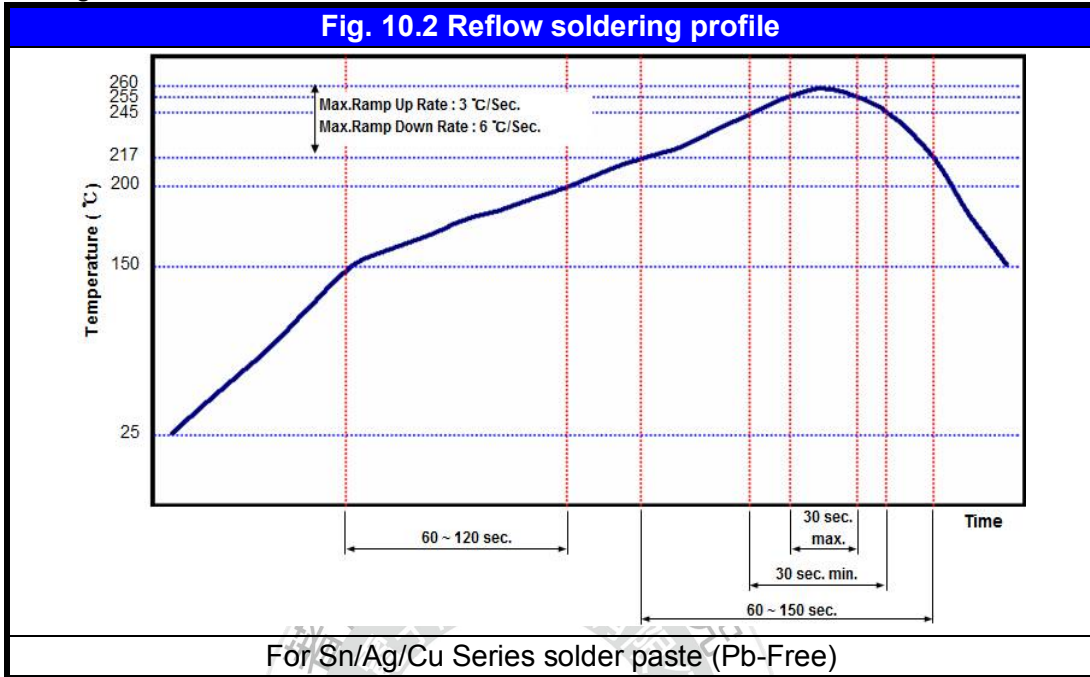
a.) Hand soldering :



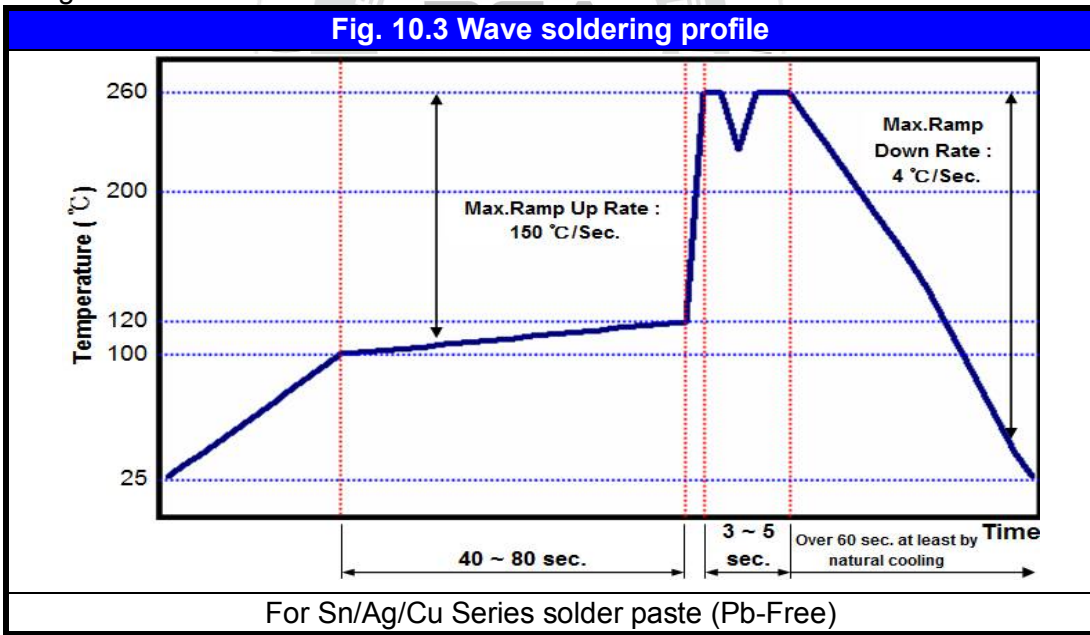
- \* Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- \* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- \* The required amount of solder shall be melted on the soldering tip.
- \* The tip of iron should not contact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

**10. APPLICATION NOTES**

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

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

**10. APPLICATION NOTES**

Soldering conditions :  
 Class II :

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

Soldering height :

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

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

**COOLING**

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

**CLEANING**

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

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[C2012C0G2A472J](#) [2220J2K00562KXT](#) [CCR06CG153FSV](#) [CDR33BX104AKUR](#) [CDR33BX683AKUS](#) [CGA3E1X7R1C684K](#)  
[CL10C0R8BB8ANNC](#) [M55342H06B20G0R-T/R](#) [C1005X5R0G225M](#) [C2012X7R2E223K](#) [C3216C0G2J272J](#) [D55342E07B35E7R-T/R](#)  
[CDR34BX563BKUS](#) [CDR34BX563BKWS](#) [NMC0402NPO220F50TRPF](#) [NMC0402X7R562J25TRPF](#) [NMC0603NPO102J25TRPF](#)  
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