

Prosperity Dielectrics Co., Ltd.

No.566-1, Kaoshi Rd., Yangmei, Taoyuan 32668, Taiwan (R.O.C.)

Tel : 886-3-4753355

Fax : 886-3-4854959

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_R<1KV

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

信昌電子陶瓷股份有限公司

PROSPERITY DIELECTRICS CO., LTD.

桃園市楊梅區高獅路 566-1 號 <http://www.pdc.com.tw>

Tel : 03-4753355 ext :

Fax : 03-4854959

Contactor : _____ **Mobile :** _____

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SPECIFICATION

FOR

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Part No. : FS Series

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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 |

Prosperity Dielectrics Co., Ltd.

5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm) | W (mm) | Code / T (mm) | M _B (mm) |
|----------------|--|---|----------------------------------|---------------------|
| 0201(0603) | 0.60±0.03 0.60±0.05 (Cap.≥0.68μF) 0.60±0.09 (Cap.≥1.0μF) | 0.30±0.03 0.30±0.05 (Cap.≥0.68μF) 0.30±0.09 (Cap.≥1.0μF) | See No.4 Reference Table 8 | 0.15±0.05 |
| 0402(1005) | 1.00±0.10 1.00±0.20 ^{#1} | 0.50±0.10 0.50±0.20 ^{#1} | | 0.25 +0.05/-0.10 |
| 0603(1608) | 1.60±0.15 1.60±0.20 ^{#2} | 0.80±0.15 0.80±0.20 ^{#2} | | 0.40±0.15 |
| 0805(2012) | 2.00±0.20 | 1.25±0.20 | | 0.50±0.20 |
| 1206(3216) | 3.20±0.20 3.20 +0.30/-0.10 ^{#3} 3.30±0.30 ^{#4} | 1.60±0.20 1.60 +0.30/-0.10 ^{#3} 1.60 +0.30/-0.10 ^{#4} | | 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 |

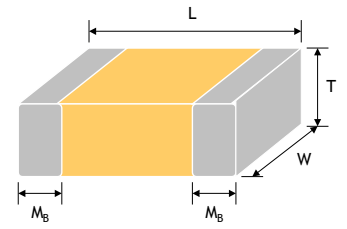


Fig. 5.1 The outline of MLCC

^{#1} For 0402 size K thickness products. ^{#2} 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. ^{#3} For 1206 size P thickness products. ^{#4} 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≥0.1μF, 0402≥1μF, 0603≥10μF |
| | | ≤15% 0201≥0.1μF, 0402≥1μF, 0603≥10μF |
| | | ≤20% 0402≥2.2μF |
| 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 |
| 16V (C<1.0μF) | ≤7% | ≤9% 0402≥0.068μF, 0603≥0.68μF |
| | | ≤12.5% 0402≥0.22μF |
| 16V (C≥1.0μF) | ≤9% | ≤12.5% 0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF |
| | | ≤20% 0402≥0.47μF |
| 10V | ≤12.5% | --- |
| 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. * Dimensions to confirm to individual specification sheet. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | Capacitance | <p>* Class II : (X7R, X7S, X6S, X5R, Y5V) Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**. Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%.</p> <p>** Test condition : 0.5±0.2Vrms, 1KHz±10%. X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V,10V,16V)#1, 0402 ≥ 475 (6.3V,16V), 0402 ≥ 225(10V), 0603=106 (6.3V) TT18X ≥ 475(10V) , TT15X series X6S: 0201/474(4V),0201 ≥ 104 (6.3V,10V#1), 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V)</p> <p>#1 Excluding X5R/0201/105(6.3V);225(10V), X6S/0201/104(10V) (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>0.1μF, 1206>1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤10%</td> <td>0805>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>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<1.0μF)</td> <td>≤7%</td> <td>≤12.5%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">16V (C≥1.0μF)</td> <td rowspan="2">≤9%</td> <td>≤12.5%</td> <td>0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>10V</td> <td>≤12.5%</td> <td>≤20%</td> <td>---</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 | ≤20% | 0402≥0.47μF | 10V | ≤12.5% | ≤20% | --- | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤20% | 0402≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤12.5% | ≤20% | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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.<0.1μF</td> <td>1V</td> </tr> <tr> <td>0.1μF≤Cap.<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.<0.1μF</td> <td>1V</td> </tr> <tr> <td>Cap.=1μF</td> <td>0.5V</td> </tr> <tr> <td>1μF<Cap.<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<Cap.≤4.7μF</td> <td>0.5V</td> </tr> <tr> <td rowspan="3">0805</td> <td>Cap.>4.7μF</td> <td>0.2V</td> </tr> <tr> <td>Cap.<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.>10μF</td> <td>0.2V</td> </tr> <tr> <td>Cap.≤10μF</td> <td>1V</td> </tr> <tr> <td>10μF<Cap.≤100μF</td> <td>0.5V</td> </tr> <tr> <td></td> <td>Cap.>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. * Except : | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <tr> <th>Rated voltage (X7R/X5R/Y5V)</th> <th>I.R.</th> </tr> <tr> <td>$\geq 100V$: All X7R</td> <td rowspan="10">$\geq 10G\Omega$ or $RxC \geq 100\Omega \cdot F$, whichever is smaller</td> </tr> <tr> <td>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$\geq 22\mu F$</td> </tr> <tr> <td>35V : 0805$\geq 2.2\mu F$, 1206$\geq 2.2\mu F$, 1210$\geq 10\mu F$</td> </tr> <tr> <td>25V : 0402$\geq 1\mu F$, 0603$\geq 2.2\mu F$, 0805$\geq 2.2\mu F$, 1206$\geq 10\mu F$, 1210$\geq 10\mu F$</td> </tr> <tr> <td>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$\geq 47\mu F$</td> </tr> <tr> <td>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$\geq 47\mu F$</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$\geq 3.3\mu F$</td> <td rowspan="10">$RxC \geq 50\Omega \cdot F$</td> </tr> <tr> <td>50V : 0402$\geq 0.1\mu F$, 0603$\geq 2.2\mu F$, 0805$\geq 10\mu F$, 1206$\geq 10\mu F$</td> </tr> <tr> <td>35V : 0603$\geq 1\mu F$</td> </tr> <tr> <td>25V : 0201$\geq 0.1\mu F$, 0402$\geq 2.2\mu F$, 0603$\geq 10\mu F$, 0805$\geq 10\mu F$, 1206$\geq 22\mu F$</td> </tr> <tr> <td>16V : 0603$\geq 10\mu F$, 0402$\geq 1\mu F$, 0201$\geq 0.22\mu F$</td> </tr> <tr> <td>10V : 0201$>0.1\mu F$, 0402$\geq 1\mu F$, 0603$\geq 10\mu F$, 0805$\geq 47\mu F$</td> </tr> <tr> <td>6.3V : 0201$\geq 0.1\mu F$, 0603$\geq 4.7\mu F$, 0805$\geq 47\mu F$, 1206$\geq 10\mu F$</td> </tr> <tr> <td>4V : 0603$\geq 22\mu F$, 0805$\geq 47\mu F$, 1206$\geq 100\mu F$</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>≤ 100</td> <td>2.5 times of U_R</td> </tr> <tr> <td>$100 < V \leq 250$</td> <td>2.0 times of U_R</td> </tr> <tr> <td>$250 < V \leq 500$</td> <td>1.5 times of U_R</td> </tr> <tr> <td>630</td> <td>1.2 times of U_R</td> </tr> </tbody> </table> | Rated Voltage | Condition | ≤ 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 | | | | | | | | | | | | | | | | | | | |
| ≤ 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. * Charge and discharge current less than 50mA. | | | | | | | | | | | | | | | | | | | | | | |
| 7. | Solderability | * Solder temperature : $235 \pm 5^\circ C$ for (0201~1210). * Solder temperature : $245 \pm 5^\circ C$ for (1808~2225). * Dipping time : 2 ± 0.5 sec. | * 75% min. coverage of all metalized area. | | | | | | | | | | | | | | | | | | | |
| 8. | Resistance to Soldering Heat | * Solder temperature : $260 \pm 5^\circ C$. * Dipping time : 10 ± 1 sec. * Preheating : 120 to $150^\circ C$ for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only) : To apply de-aging at $150^\circ C$ for 1hr then set for 24 ± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48 ± 4 hrs (Class II). | * No remarkable damage. * Cap. change : X7R/X7S/X6S/X5R : Within $\pm 7.5\%$. Y5V : Within $\pm 20\%$. * D.F., I.R. : To meet initial requirements. * 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.($^\circ C$)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30\pm3</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\pm3</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 ± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48 ± 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. * Cap. change : X7R/X7S/X6S/X5R : Within $\pm 7.5\%$. Y5V : Within $\pm 20\%$. * D.F. : $\leq 150\%$ of initial requirement. * 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.($^\circ C$)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30\pm3</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\pm3</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 ± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48 ± 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. * Cap. change : X7R/X7S/X6S/X5R : Within $\pm 7.5\%$. Y5V : Within $\pm 20\%$. * D.F. : $\leq 150\%$ of initial requirement. * 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 | | | | | | | | | | | | | | | | | | | | |

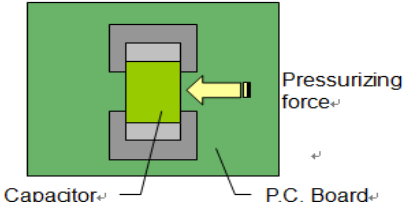
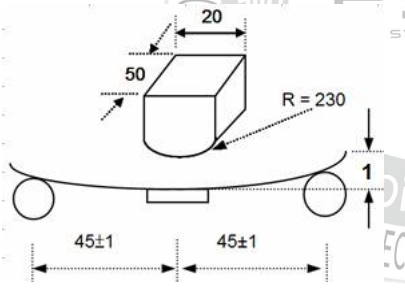
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | |
|--|--|---|---|---------------|------|----------------------------|--|---|---|---|
| 10. | Humidity (Damp Heat) Steady State | * Test temp. : 40±2°C. * Humidity : 90~95%RH. * Test time : 500 +24/-0hrs. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II). | * No remarkable damage. * Cap. change : X7R/X7S/X6S/X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF. Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V. * D.F. : ≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. 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>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 |
| 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. * Humidity : 90~95%RH. * Test time : 500 +24/-0hrs. * To apply voltage : Rated voltage (500V max.). * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II). | * No remarkable damage. * Cap. change : X7R/X7S/X6S/X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF. Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V. * D.F. : ≤200% of initial requirement. * I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller. 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>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 |
| 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. : X7R, X7S : 125±3°C. X6S : 105±3°C. X5R, Y5V : 85±3°C.</p> <p>* To apply voltage : (1) 10V≤Ur≤100V : 200% of rated voltage. or ≤6.3V or Cap.≥10μF : 150% of rated voltage. (2) 200V≤Ur≤500V : 150% of rated voltage. (3) =630V : 120% of rated voltage. (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>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≥0.082μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X7S/X6S</td> <td>10V, 16V, 50V</td> <td>C≥1.0μF</td> </tr> <tr> <td>Y5V</td> <td>C≥2.2μF</td> </tr> <tr> <td rowspan="2">1206</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">1210</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">1812</td> <td rowspan="2">X7R</td> <td>16V</td> <td>C≥1.0μF</td> </tr> <tr> <td>≥50V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">1825</td> <td rowspan="2">X7R</td> <td>100V</td> <td>C≥0.22μF</td> </tr> <tr> <td>≥100V</td> <td>C≥0.22μF</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≥1.0μF</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. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II). ** 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≥0.082μF | 0805 | X5R/X7R/X7S/X6S | 10V, 16V, 50V | C≥1.0μF | Y5V | C≥2.2μF | 1206 | X5R/X7R/X7S/X6S | 10~50V | C≥4.7μF | 50V | C≥0.47μF | 1210 | X5R/X7R/X7S/X6S | ≥100V | C≥0.12μF | Y5V | C≥4.7μF | 1812 | X7R | 16V | C≥1.0μF | ≥50V | C≥1.0μF | 1825 | X7R | 100V | C≥0.22μF | ≥100V | C≥0.22μF | 2220 | X7R | ≤50V | C≥4.7μF | 100V | C≥1.0μF | 2225 | X7R | ≤50V | C≥1.0μF | 100V | C≥1.0μF | Size | Dielectric | Rated Voltage | Capacitance | 2220 | X7R | ≥100V | C≥15μF | <p>* No remarkable damage. * Cap. change : X7R/X7S/X6S/X5R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF. Y5V : Within ±30% for ≥10V, within +30/-40% for ≤6.3V. * D.F. : ≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Except : Rated voltage I.R. 100V : All X7R; 1210≥3.3μF 50V : 0402≥0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF 35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF 25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF 16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF 10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF 6.3V; 4V; 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≥0.082μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0805 | X5R/X7R/X7S/X6S | 10V, 16V, 50V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Y5V | C≥2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1206 | X5R/X7R/X7S/X6S | 10~50V | C≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50V | C≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1210 | X5R/X7R/X7S/X6S | ≥100V | C≥0.12μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Y5V | C≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1812 | X7R | 16V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥50V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1825 | X7R | 100V | C≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥100V | C≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2220 | X7R | ≤50V | C≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 100V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2225 | X7R | ≤50V | C≥1.0μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 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(≤ 0603) or 10N(>0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 second.</p>  <p>Capacitor, P.C. Board, Pressurizing force</p> | <p>* No remarkable damage or removal of the terminations.</p> | | | | | | |
| 14. | Resistance to Flexure of Substrate (Substrate bending test) | <p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm.</p>  <p>Unit : mm</p> | <p>* No remarkable damage.</p> <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>X7R/X7S/X6S/X5R</td> <td>Within $\pm 12.5\%$</td> </tr> <tr> <td>Y5V</td> <td>Within $\pm 30\%$</td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p> | Dielectric | Cap. Change | 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. * Total amplitude : 1.5mm. * Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions) * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48 ± 4 hrs (Class II).</p> | <p>* No remarkable damage. * 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

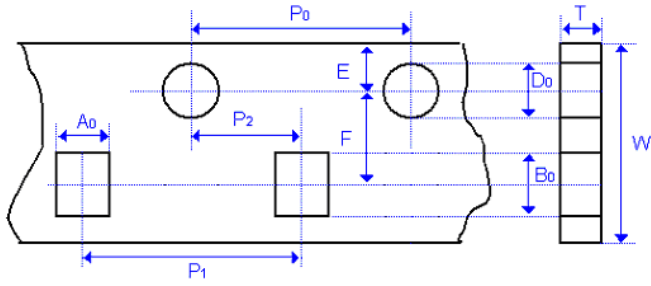


Fig. 9.1 The dimension of paper tape

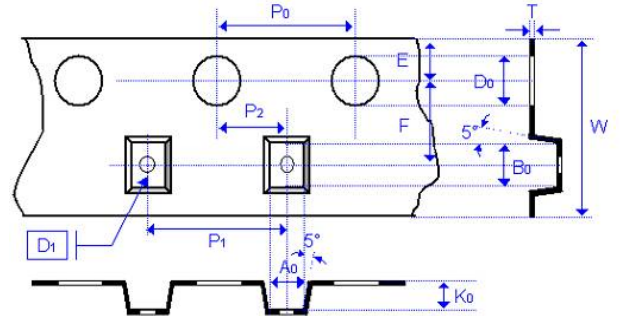


Fig. 9.2 The dimension of plastic tape

| Size | 0201 | 0402 | 0603 | | 0805 | |
|-------------------|------------|------------------------|-----------------|-----------------|------------|------------------------|
| Chip Thickness | 0.30±0.03 | 0.50±0.05 0.50±0.10 | 0.80±0.07 | 0.80 +0.15/-0.1 | 0.80±0.10 | 1.25±0.10 1.25±0.20 |
| A ₀ | 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 ₀ | 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 ₀ | - | - | - | - | - | <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 ₀ | 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 ₀ | 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 ₁ | 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 ₂ | 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 ₀ | 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 ₁ | - | - | - | - | - | 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 1.25±0.10 | 1.60±0.20 1.60+0.3/-0/1 | 0.95±0.10 1.25±0.10 1.60±0.20 | 2.50±0.30 | 1.25±0.10 1.60±0.20 2.00±0.20 | 2.50±0.30 |
| A ₀ | 2.00±0.10 | <2.00 | <2.00 | <3.05 | <3.10 | <3.90 | <3.90 |
| B ₀ | 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 ₀ | - | <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 ₀ | 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 ₀ | 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 ₁ | 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 ₂ | 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 ₀ | 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 ₁ | - | 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 2.00±0.20 | 2.50±0.30 | 1.40±0.15 1.60±0.20 2.00±0.20 | 2.50±0.30 | 1.60±0.20 2.00±0.20 | 2.50±0.30 |
| A ₀ | <6.80 | <6.80 | <5.80 | <5.80 | <6.80 | <6.80 |
| B ₀ | <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 ₀ | <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 ₀ | 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 ₀ | 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 ₁ | 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 ₂ | 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 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 | 1.50 +0.10/-0 |
| D ₁ | 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, 0805, 1206, 1210 | | 1808, 1812, 1825, 2220, 2225 |
|----------------|---------------------------------------|-------------------|---------------------------------|
| Reel size | 7" | 13" | 7" |
| C | 13.0 +0.5/-0.2 | 13.0 +0.7/-0.3 | 13.0 +0.5/-0.2 |
| W ₁ | 8.4 +1.5/-0 | 8.4 +2.0/-0 | 12.4 +2.0/-0 |
| A | 178.0 ±0.10 | 330.0 ±1.0 | 178.0 ±0.10 |
| N | 60.0 +1.0/-0 | 100 ±1.0 | 60.0 +1.0/-0 |

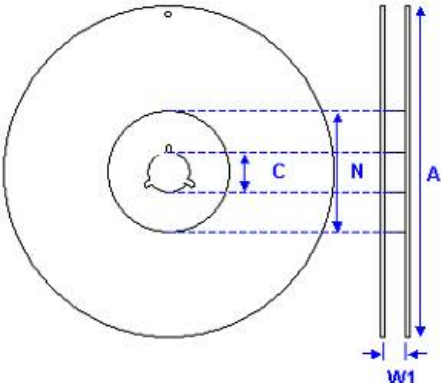


Fig. 9.3 The dimension of reel

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.

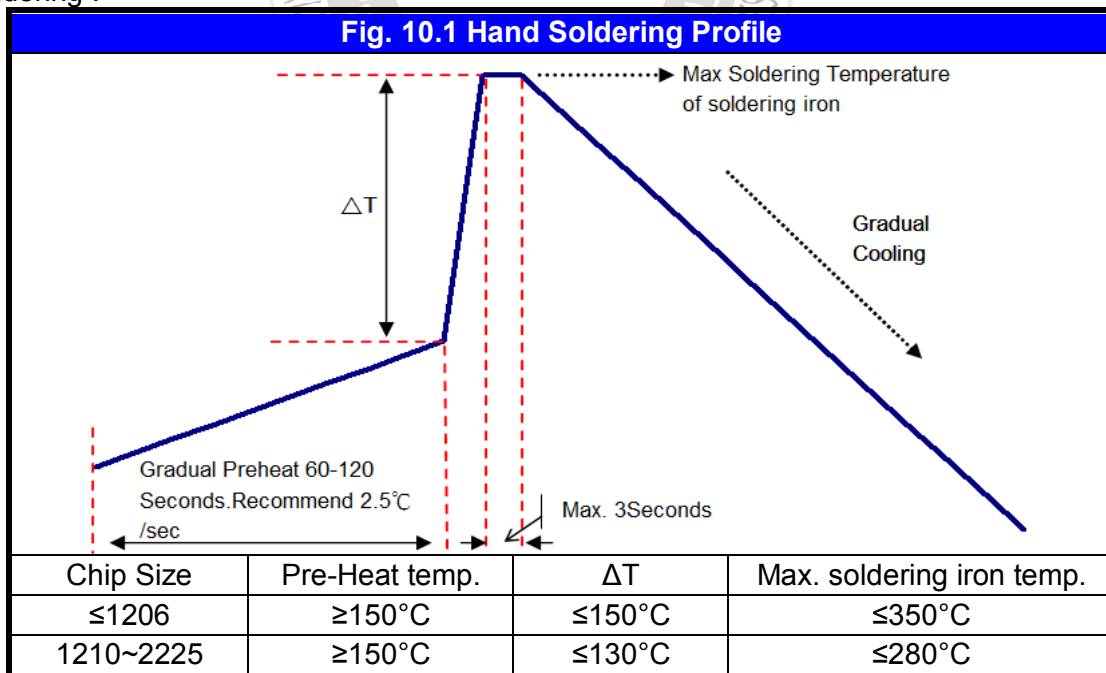
PREHEAT

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.

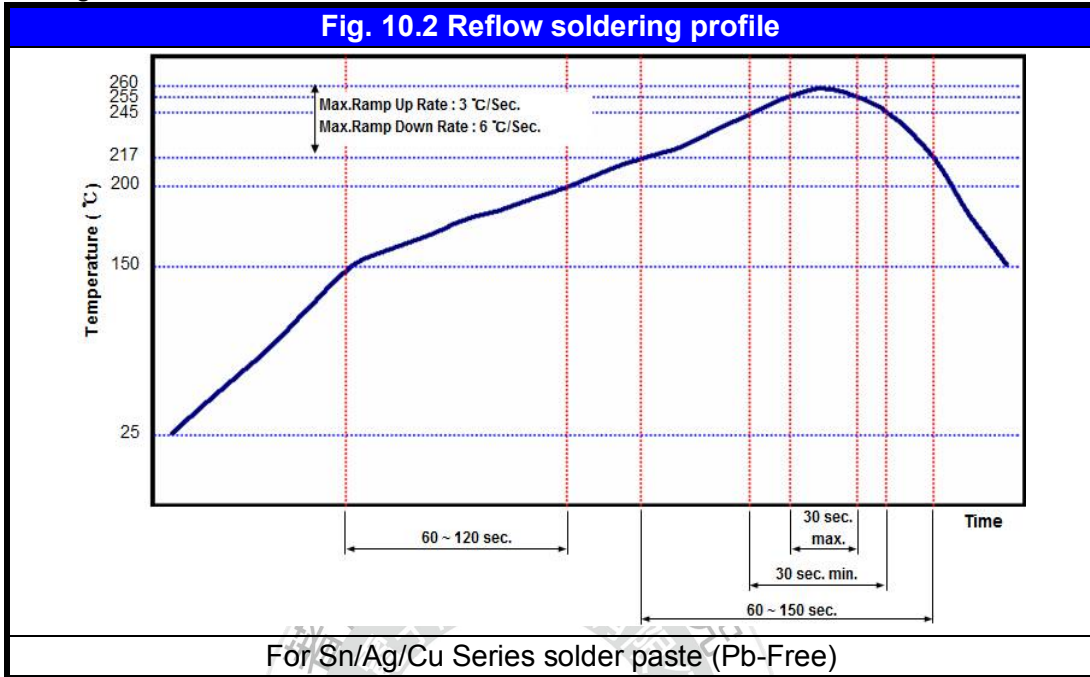
a.) Hand soldering :



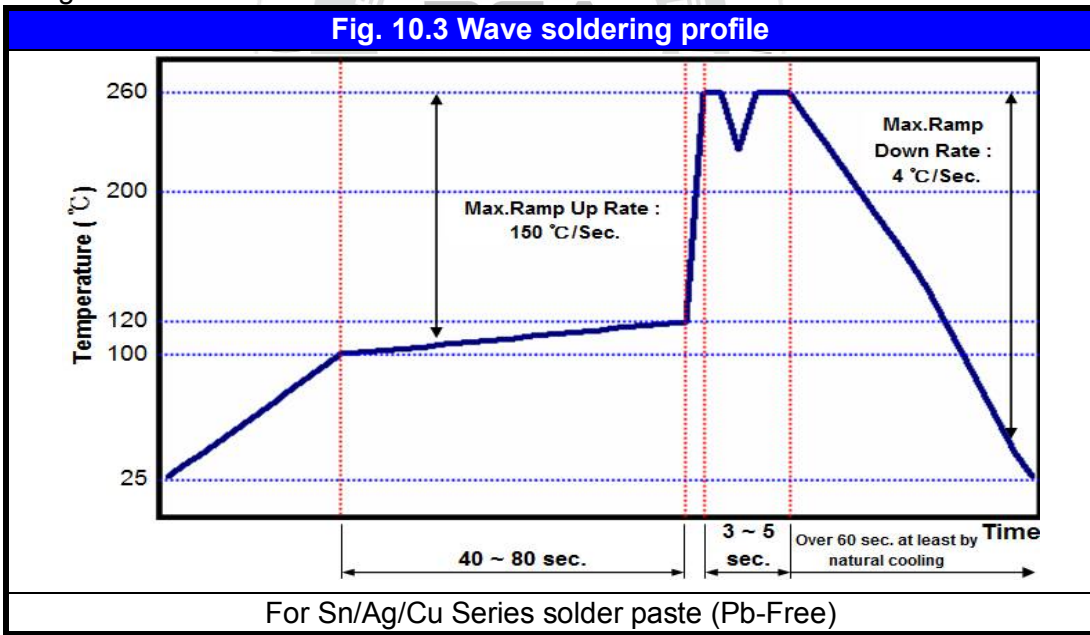
- * Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- * The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- * The required amount of solder shall be melted on the soldering tip.
- * The tip of iron should not contact 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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[NMC0805X7R224K16TRPLPF](#) [NMC1206X7R102K50TRPF](#) [NMC1206X7R106K10TRPLPF](#) [NMC1206X7R475K10TRPLPF](#) [NMC-](#)
[Q0402NPO8R2D200TRPF](#) [C1608C0G2A221J](#) [C1608X7R1E334K](#) [C2012C0G2A472J](#) [2220J2K00562KXT](#) [CDR33BX104AKUR](#)
[CDR33BX683AKUS](#) [CGA3E1X7R1C684K](#) [CL10C0R8BB8ANNC](#) [C1005X5R0G225M](#) [C2012X7R2E223K](#) [C3216C0G2J272J](#)
[D55342E07B35E7R-T/R](#) [NMC0402X7R562J25TRPF](#) [NMC0603NPO102J25TRPF](#) [NMC1206X7R332K50TRPF](#) [726632-1](#)
[CGA6M3X7R1H225K](#) [CGA5L2X7R2A105K](#) [CGA3E2X8R1H223K](#) [CDR33BX823AKUR\M500](#) [CDR35BX474AKUR\M500](#)
[CDR35BX104BKUR\M500](#) [69995D](#) [NMC0201X5R473K6.3TRPF](#) [NMC0201X7R221K25TRPF](#) [NMC0402X5R105K10TRPF](#)
[NMC0402X5R224K10TRPF](#) [NMC0603X7R104J25TRPF](#) [NMC0603X7R223K25TRPF](#) [NMC0805NPO100J50TRPF](#)
[NMC0805X7R104M50TRPF](#)