



信昌電子陶瓷股份有限公司

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Messrs. : 一般共用

Date : 2020/11/02

APPROVAL SHEET

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

Description : Size 0201~2225, C0G/X7R/X5R/Y5V, U_R≤50V

| PREPARED BY | APPROVED BY |
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| | |

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SPECIFICATION

FOR

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

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

DATE : 2020/11/02

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

1. INTRODUCTION

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

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

2. FEATURES

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

3. APPLICATIONS

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

4. HOW TO ORDER

| <u>FN</u> | <u>21</u> | <u>X</u> | <u>471</u> | <u>K</u> | <u>500</u> | <u>P</u> | <u>X</u> | <u>G</u> |
|------------|-----------|------------|-------------|-----------|---------------|-----------|-----------|--------------|
| PDC Family | Size | Dielectric | Capacitance | Tolerance | Rated Voltage | Packaging | Thickness | Control Code |
| Table 1 | Table 2 | Table 3 | Table 4 | Table 5 | Table 6 | Table 7 | Table 8 | Table 9 |

| Table 1 | | PDC Family | |
|---------|--------------------------------|------------|-------------|
| Code | Description | Code | Description |
| FN | General purpose product ≤50Vdc | | |

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

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

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

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

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

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

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

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

5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm) | W (mm) | Code / T (mm) | M _B (mm) |  |
|----------------|---|---|----------------------------|---------------------|---|
| 0201(0603) | 0.60±0.03 0.60±0.05 (Cap.≥0.68μF) | 0.30±0.03 0.30±0.05 (Cap.≥0.68μF) | 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 | 0.80±0.15 | | 0.40±0.15 | |
| 0805(2012) | 2.00±0.20 | 1.25±0.20 | | 0.50±0.20 | |
| 1206(3216) | 3.20±0.20 3.20 +0.30/-0.10 ^{#2} | 1.60±0.20 1.60 +0.30/-0.10 ^{#2} | | 0.60±0.20 | |
| 1210(3225) | 3.20±0.30 | 2.50±0.30 | | 0.75±0.35 | |
| 1808(4520) | 4.50±0.40 | 2.00±0.25 | | 0.75±0.35 | |
| 1812(4532) | 4.50±0.40 | 3.20±0.30 | | 0.75±0.35 | |
| 1825(4563) | 4.50±0.40 | 6.30±0.40 | | 0.75±0.35 | |
| 2220(5750) | 5.70±0.40 | 5.00±0.40 | | 0.85±0.35 | |
| 2225(5763) | 5.70±0.40 | 6.30±0.40 | | 0.85±0.35 | |

Fig. 5.1 The outline of MLCC

^{#1} For 0402 size K thickness products. ^{#2} For 1206 size P thickness products.

6. GENERAL ELECTRICAL DATA

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

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

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

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

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

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

Note 1 : X7R/X5R

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

Y5V

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

7. CAPACITANCE RANGE(Con.)

7-1. C0G

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

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7. CAPACITANCE RANGE(Con.)

7-2. X7R

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

7. CAPACITANCE RANGE(Con.)

7-2. X7R

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

7. CAPACITANCE RANGE(Con.)

7-3. X5R

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

7. CAPACITANCE RANGE(Con.)

7-4. Y5V

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

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

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|--------------------------------|---|--|-------|-------|--------------------|--|-----|-------|-------|--|-----|-------------|------|--------------------------|-----|-------|-----|-------------|-----|-------------|------|---------------------------------------|-----|-------|--------|-------------|-----|---|------|--|-----|-----|------|---|------|------------|------|------------|------|------|------|------------|----|------|-----|-----|-------|-------|--------------------|--|-----|-----|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|-----|----------------------------|---------------|-----|-----|---------------------------|--------|-------------|-----|--------|------|-------------|------|------|-----|-----|
| 1. | Visual and Dimensions | --- | * No remarkable defect. * Dimensions to confirm to individual specification sheet. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | Capacitance | | * Shall not exceed the limits given in the detailed spec. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | Q/D.F. (Tangent of loss angle) | <p>* Class I : (C0G) Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%.</p> <p>* Class II : (X7R, 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%. X5R : 01R5≥103, 0201≥224(6.3V,10V,16V)*1.</p> | <p>* C0G : Cap.≥30pF, Q≥1000; Cap.<30pF, Q≥400+20C. *X7R/X5R :</p> <table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤2.5%</td> <td>≤3.5%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01uF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.012μF, 0603>0.1μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF,</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤3.5%</td> <td>≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤5%</td> <td>≤10%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF</td> </tr> <tr> <td>6.3V</td> <td>≤10%</td> <td>≤15%</td> <td>0201≥0.1μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>* Y5V</p> <table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>50V</td> <td>≤5%</td> <td>≤7%</td> <td>0603≥0.1μF, 0805≥0.47μF</td> </tr> <tr> <td>35V</td> <td>≤7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤5%</td> <td>≤7%</td> <td>0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF</td> </tr> <tr> <td>≤9%</td> <td>0402≥0.068μF, 0603≥0.47μF,</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">≤7%</td> <td>≤9%</td> <td>0402≥0.068μF, 0603≥0.68μF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>10V</td> <td>≤12.5%</td> <td>≤20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> | Rated | D.F.≤ | Exception of D.F.≤ | | 50V | ≤2.5% | ≤3.5% | 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF | ≤5% | 0201≥0.01uF | ≤10% | 0402≥0.012μF, 0603>0.1μF | 25V | ≤3.5% | ≤5% | 0201≥0.01μF | ≤7% | 0603≥0.33μF | ≤10% | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, | 16V | ≤3.5% | ≤12.5% | 0402≥0.47μF | ≤5% | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF | ≤10% | 0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF | 10V | ≤5% | ≤10% | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF | ≤15% | 0201≥0.1μF | ≤10% | 0201≥0.1μF | 6.3V | ≤10% | ≤15% | 0201≥0.1μF | 4V | ≤15% | --- | --- | Rated | D.F.≤ | Exception of D.F.≤ | | 50V | ≤5% | ≤7% | 0603≥0.1μF, 0805≥0.47μF | 35V | ≤7% | --- | --- | 25V | ≤5% | ≤7% | 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF | ≤9% | 0402≥0.068μF, 0603≥0.47μF, | 16V (C<1.0μF) | ≤7% | ≤9% | 0402≥0.068μF, 0603≥0.68μF | ≤12.5% | 0402≥0.22μF | 10V | ≤12.5% | ≤20% | 0402≥0.47μF | 6.3V | ≤20% | --- | --- |
| Rated | D.F.≤ | Exception of D.F.≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V | ≤2.5% | ≤3.5% | 0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤5% | 0201≥0.01uF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0402≥0.012μF, 0603>0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤3.5% | ≤5% | 0201≥0.01μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤7% | 0603≥0.33μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V | ≤3.5% | ≤12.5% | 0402≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤5% | 0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤5% | ≤10% | 0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤15% | 0201≥0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤10% | 0201≥0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤10% | ≤15% | 0201≥0.1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4V | ≤15% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated | D.F.≤ | Exception of D.F.≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V | ≤5% | ≤7% | 0603≥0.1μF, 0805≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V | ≤7% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤5% | ≤7% | 0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤9% | 0402≥0.068μF, 0603≥0.47μF, | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16V (C<1.0μF) | ≤7% | ≤9% | 0402≥0.068μF, 0603≥0.68μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤12.5% | 0402≥0.22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10V | ≤12.5% | ≤20% | 0402≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.3V | ≤20% | --- | --- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

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

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | | | | | | | | |
|------|---|--|---|-----------|------------|---|----------------------------|------|---|------------|-----|---|----------------------------|------|---|------------|-----|---|
| 6. | Dielectric Strength | <ul style="list-style-type: none"> * To apply 250% of rated voltage. * Duration : 1 to 5 sec. * Charge and discharge current less than 50mA. | <ul style="list-style-type: none"> * No evidence of damage or flash over during test. | | | | | | | | | | | | | | | |
| 7. | Solderability | <ul style="list-style-type: none"> * Solder temperature : 235±5°C for (0201~1210). * Solder temperature : 245±5°C for (1808~2225). * Dipping time : 2±0.5 sec. | <ul style="list-style-type: none"> * 75% min. coverage of all metalized area. | | | | | | | | | | | | | | | |
| 8. | Resistance to Soldering Heat | <ul style="list-style-type: none"> * Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * 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 24±2 hrs (Class I) or 48±4 hrs (Class II). | <ul style="list-style-type: none"> * No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R, X5R : Within ±7.5%. Y5V : Within ±20%. * D.F.(Q)/I.R. : To meet initial requirements. * 25% max. leaching on each edge. | | | | | | | | | | | | | | | |
| 9. | Temperature Cycle (Rapid change of temperature) | <ul style="list-style-type: none"> * Conduct the five cycles according to the temperatures and time. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * 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 24±2 hrs (Class I) or 48±4 hrs (Class II). | Step | Temp.(°C) | Time(min.) | 1 | Min. operating temp. +0/-3 | 30±3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30±3 | 4 | Room temp. | 2~3 | <ul style="list-style-type: none"> * No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R, X5R : Within ±7.5%. Y5V : Within ±20%. * Q for C0G : To meet initial requirements. * D.F.(Class II) : ≤150% of initial requirement. * I.R. : To meet initial requirements. |
| Step | Temp.(°C) | Time(min.) | | | | | | | | | | | | | | | | |
| 1 | Min. operating temp. +0/-3 | 30±3 | | | | | | | | | | | | | | | | |
| 2 | Room temp. | 2~3 | | | | | | | | | | | | | | | | |
| 3 | Max. operating temp. +3/-0 | 30±3 | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 2~3 | | | | | | | | | | | | | | | | |

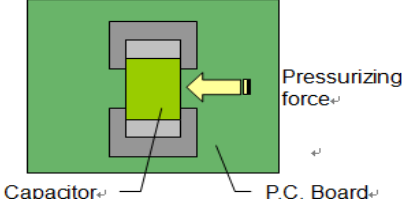
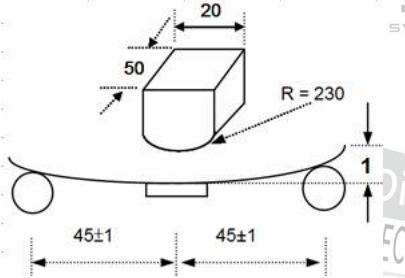
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

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

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

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

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Test Condition | Requirements | | | | | | | | |
|------------|--|--|--|------------|-------------|-----|---|----------|---------------|-----|-------------|
| 13. | Adhesive Strength of Termination (Robustness of termination) | <p>* Capacitors mounted on a substrate. A force of 2N(0201) or 5N(0402~0603) or 10N(>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>C0G</td> <td>Within ±5.0% or ±0.5pF, whichever is larger</td> </tr> <tr> <td>X7R, X5R</td> <td>Within ±12.5%</td> </tr> <tr> <td>Y5V</td> <td>Within ±30%</td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p> | Dielectric | Cap. Change | C0G | Within ±5.0% or ±0.5pF, whichever is larger | X7R, X5R | Within ±12.5% | Y5V | Within ±30% |
| Dielectric | Cap. Change | | | | | | | | | | |
| C0G | Within ±5.0% or ±0.5pF, whichever is larger | | | | | | | | | | |
| X7R, X5R | Within ±12.5% | | | | | | | | | | |
| Y5V | Within ±30% | | | | | | | | | | |
| 15. | Vibration Resistance | <p>* Vibration frequency : 10~55 Hz/min. * 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 24±2 hrs (Class I) or 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 | - |
| 1825(4563) | 2.50±0.30 | - | - | 0.5k | 3k |
| | 2.80±0.30 | - | - | 0.5k | - |
| | 1.60±0.20 | - | - | 1k | - |
| | 2.00±0.20 | - | - | 1k | - |
| 2220(5750) | 2.50±0.30 | - | - | 0.5k | - |
| | 2.80±0.30 | - | - | 0.5k | - |
| | 1.60±0.20 | - | - | 1k | - |
| | 2.00±0.20 | - | - | 1k | - |
| 2225(5763) | 2.50±0.30 | - | - | 0.5k | - |
| | 2.80±0.30 | - | - | 0.5k | - |
| | 1.60±0.20 | - | - | 1k | - |

Unit : pcs

9. PACKAGE DIMENSION AND QUANTITY

9.1. EMBOSSED TAPE DIMENSIONS



Fig. 9.1 The dimension of paper tape



Fig. 9.2 The dimension of plastic tape

| Size | 0201 | 0402 | 0603 | | 0805 | |
|-------------------|------------|------------------------|-----------------|-----------------|------------|------------------------|
| Chip Thickness | 0.30±0.03 | 0.50±0.05 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 | | 1808 | |
|-------------------|------------|------------------------|------------------------|------------------------|---------------|------------------------|---------------|
| Chip Thickness | 0.80±0.10 | 0.95±0.10 1.25±0.10 | 1.25±0.10 1.60±0.20 | 1.25±0.10 1.60±0.20 | 2.50±0.30 | 1.25±0.10 1.60±0.20 | 2.00±0.20 |
| A ₀ | 2.00±0.10 | <2.00 | <2.50 | <2.50 | <3.10 | <2.50 | <2.50 |
| B ₀ | 3.50±0.10 | <3.60 | <5.30 | <5.30 | <4.00 | <5.30 | <5.30 |
| T | 0.95±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 |
| K ₀ | - | <2.50 | <2.50 | <2.50 | <3.50 | <2.50 | <2.50 |
| W | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 12.00±0.20 | 12.00±0.20 |
| P 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 | 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 | 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 | 1.50±0.10 | 1.50±0.10 | 1.00±0.10 | 1.50±0.10 | 1.50±0.10 |
| E | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 |
| F | 3.50±0.05 | 3.50±0.05 | 5.50±0.05 | 5.50±0.05 | 3.50±0.05 | 5.50±0.05 | 5.50±0.05 |
| Unit : | mm | mm | mm | mm | mm | mm | mm |

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9. PACKAGE DIMENSION AND QUANTITY

| Size | 1812 | | 1825 | | 2220 | |
|-------------------|-------------------------------------|---------------|------------------------|---------------|-------------------------------------|---------------|
| Chip Thickness | 1.25±0.10 1.60±0.20 2.00±0.20 | 2.50±0.30 | 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 |
| A ₀ | <3.90 | <3.90 | <6.80 | <6.80 | <5.80 | <6.80 |
| B ₀ | <5.30 | <5.30 | <5.30 | <5.30 | <6.50 | <6.50 |
| T | 0.25±0.05 | 0.25±0.05 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 |
| K ₀ | <2.50 | <3.00 | <2.50 | <3.10 | <2.50 | <3.10 |
| W | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 | 12.00±0.20 |
| P 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 |

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

9. PACKAGE DIMENSION AND QUANTITY

9.2. REEL DIMENSIONS

| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | 1808, 1812, 1825, 2220, 2225 |
|----------------|---------------------------------------|-------------------|---------------------------------|
| Reel size | 7" | 13" | 7" |
| C | 13.0 +0.5/-0.2 | 13.0 +0.5/-0.2 | 13.0 +0.7/-0.3 |
| W ₁ | 8.4 +1.5/-0 | 8.4 +1.5/-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)

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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