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Date : 2020/01/31

APPROVAL SHEET

Product Name : Automotive General Multilayer Ceramic Capacitors

Part No. : MT Series

Description : AEC-Q200 Size 0201~1210, C0G/X7R, 10Vdc~1000Vdc

| PREPARED BY | APPROVED BY |
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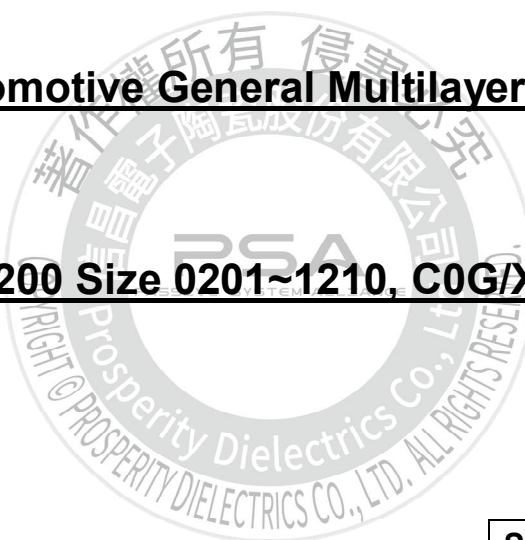
SPECIFICATION

FOR

Product Name : Automotive General Multilayer Ceramic Capacitors

Part No. : MT Series

Description : AEC-Q200 Size 0201~1210, C0G/X7R, 10Vdc~1000Vdc



SPEC. No. : MT-000-002-07

DATE : 2020/01/31

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

1. INTRODUCTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

PDC's MT series MLCC is made by X7R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MT series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications and qualified to AEC-Q200.

2. FEATURES

- a. A wide selection of sizes is available (0201 to 1210).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).
- d. The MT series meet AEC-Q200 requirement.

3. APPLICATIONS

- a. For Navigation & Information equipments.
- b. For entertainment equipments.
- c. For comfortable equipments.
- d. For Automotive electronic equipment.

4. HOW TO ORDER

| <u>MT</u> | <u>31</u> | <u>X</u> | <u>471</u> | <u>K</u> | <u>251</u> | <u>E</u> | <u>C</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 | | | | |
| MT | Automotive Capacitor Qualified to AEC-Q200 | | | | |

| Table 2 | | Size | | | |
|---------|-------------|------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| 03 | 0201(0603) | 18 | 0603(1608) | 31 | 1206(3216) |
| 15 | 0402(1005) | 21 | 0805(2012) | 32 | 1210(3225) |

| Table 3 | | Dielectric Material Characteristics | |
|---------|-------------|-------------------------------------|-------------|
| Code | Description | Code | Description |
| N | COG | X | X7R |

| 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 | | |

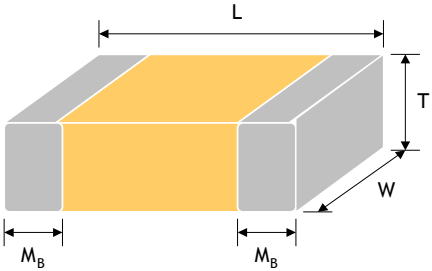
| Table 6 | | Rated Voltage | | | |
|---------|-------------|---------------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| 6R3 | 6.3Vdc | 500 | 50Vdc | 401 | 400Vdc |
| 100 | 10Vdc | 101 | 100Vdc | 501 | 500Vdc |
| 160 | 16Vdc | 201 | 200Vdc | 631 | 630Vdc |
| 250 | 25Vdc | 251 | 250Vdc | 102 | 1000Vdc |

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

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

| Table 9 | | Special Control Code | |
|---------|----------------------------------|----------------------|--|
| Code | Description | | |
| G | RoHS Compliant | | |
| Q | Surface Coating (size 1206-2225) | | |

5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm) | W (mm) | Code / T (mm) | M _B (mm) | |
|----------------|-------------------------|------------------------------|----------------------------|---------------------|---|
| 0201(0603) | 0.60±0.03 | 0.30±0.03 | See No.4 Reference Table 8 | 0.15±0.05 |  |
| 0402(1005) | 1.00±0.10 | 0.50±0.10 | | 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 3.30±0.30* | 1.60±0.20 1.60 +0.3/-0.1# | | 0.60±0.20 | |
| 1210(3225) | 3.20±0.30 3.30±0.40* | 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 | |
| | | | | | |

“*” for ≥ 1KV products. “#” for P thickness products.

6. GENERAL ELECTRICAL DATA

| Dielectric | C0G | X7R | | | | | | |
|---|---|---|-------------|-------------------------|-------------|-------------------------|--|---|
| Size | 0201, 0402, 0603, 0805, 1206, 1210 | 0402, 0603, 0805, 1206, 1210 | | | | | | |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V | | | | | | | |
| Capacitance range* | 0.1pF ~ 47nF | 100pF ~ 2.2μF | | | | | | |
| Capacitance tolerance | Reference to Table 5 | | | | | | | |
| Tan δ | <table border="1"> <thead> <tr> <th>Cap. Range</th> <th>Q Spec.</th> </tr> </thead> <tbody> <tr> <td>Cap.<30pF</td> <td>Q≥400+20C</td> </tr> <tr> <td>Cap.≥30pF</td> <td>Q≥1000</td> </tr> </tbody> </table> | Cap. Range | Q Spec. | Cap.<30pF | Q≥400+20C | Cap.≥30pF | Q≥1000 | Follow No.17 of 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS |
| | Cap. Range | Q Spec. | | | | | | |
| | Cap.<30pF | Q≥400+20C | | | | | | |
| Cap.≥30pF | Q≥1000 | | | | | | | |
| <p>Measured at the condition of 30~70% related humidity</p> <p>For 25°C at ambient temperature</p> | 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 | | | | | | | |
| <table border="1"> <thead> <tr> <th>Cap. Range</th> <th>Test Condition</th> </tr> </thead> <tbody> <tr> <td>Cap.≤1000pF</td> <td>1.0±0.2Vrms, 1.0MHz±10%</td> </tr> <tr> <td>Cap.>1000pF</td> <td>1.0±0.2Vrms, 1.0KHz±10%</td> </tr> </tbody> </table> | Cap. Range | Test Condition | Cap.≤1000pF | 1.0±0.2Vrms, 1.0MHz±10% | Cap.>1000pF | 1.0±0.2Vrms, 1.0KHz±10% | 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature | |
| Cap. Range | Test Condition | | | | | | | |
| Cap.≤1000pF | 1.0±0.2Vrms, 1.0MHz±10% | | | | | | | |
| Cap.>1000pF | 1.0±0.2Vrms, 1.0KHz±10% | | | | | | | |
| Insulation resistance at Ur | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | Follow No.17 of 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS | | | | | | |
| Operating temperature | -55°C to +125°C | | | | | | | |
| Capacitance characteristic | ±30ppm/°C | ±15% | | | | | | |
| Termination | Cu/Ni/Sn (lead-free termination) | | | | | | | |

7. CAPACITANCE RANGE

7-1. C0G

| Cap(pF) | EIA Size Code | 1206 | | | | | | | | | | 1210 | | | | | | | | | |
|---------|---------------|------|-----|-----|-----|------|------|------|------|------|-------|------|-----|-----|-----|------|------|------|------|------|-------|
| | | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V |
| 1.2 | 1R2 | X | X | X | X | X | X | X | X | X | | | | | | | | | | | |
| 1.5 | 1R5 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 1.8 | 1R8 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 2.2 | 2R2 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 2.7 | 2R7 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 3.3 | 3R3 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 3.9 | 3R9 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 4.7 | 4R7 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 5.6 | 5R6 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 6.8 | 6R8 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 8.2 | 8R2 | X | X | X | X | X | X | X | X | X | X | | | | | | | | | | |
| 10 | 100 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | |
| 12 | 120 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | |
| 15 | 150 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | |
| 18 | 180 | X | X | X | X | X | X | X | X | X | X | M | M | M | M | M | M | M | M | M | |
| 22 | 220 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 27 | 270 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 33 | 330 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 39 | 390 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 47 | 470 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 56 | 560 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 68 | 680 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 82 | 820 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | M | |
| 100 | 101 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | C | |
| 120 | 121 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | C | |
| 150 | 151 | X | X | X | X | X | X | X | X | X | C | M | M | M | M | M | M | M | M | C | |
| 180 | 181 | X | X | X | X | X | X | X | X | X | E | M | M | M | M | M | M | M | M | C | |
| 220 | 221 | X | X | X | X | X | X | X | X | X | E | M | M | M | M | M | M | M | M | E | |
| 270 | 271 | X | X | X | X | X | X | M | M | M | E | M | M | M | M | M | M | M | M | E | |
| 330 | 331 | X | X | X | X | X | X | M | M | M | E | M | M | M | M | M | M | M | M | E | |
| 390 | 391 | X | X | X | X | X | X | M | M | M | E | M | M | M | M | M | M | M | M | E | |
| 470 | 471 | X | X | X | X | X | M | M | M | M | E | M | M | M | M | M | M | M | M | E | |
| 560 | 561 | X | X | X | X | X | M | C | C | C | E | M | M | M | M | M | M | M | M | E | |
| 680 | 681 | X | X | X | X | X | M | C | C | C | E | M | M | M | M | M | M | M | M | E | |
| 820 | 821 | X | X | X | X | X | M | E | E | E | E | M | M | M | M | M | M | M | M | E | |
| 1000 | 102 | X | X | X | X | X | M | E | E | E | E | M | M | M | M | M | C | C | C | E | |
| 1200 | 122 | X | X | X | X | X | M | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 1500 | 152 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 1800 | 182 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 2200 | 222 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 2700 | 272 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 3300 | 332 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 3900 | 392 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | C | C | C | | |
| 4700 | 472 | X | X | X | X | X | C | E | E | E | E | M | M | M | M | M | E | E | | | |
| 5600 | 562 | X | X | X | X | X | | | | | | M | M | M | M | M | E | E | | | |
| 6800 | 682 | M | M | M | M | M | | | | | | M | M | M | M | M | E | E | | | |
| 8200 | 822 | C | C | C | C | C | | | | | | M | M | M | M | M | E | E | | | |
| 10000 | 103 | C | C | C | C | C | | | | | | M | M | M | M | M | E | E | | | |
| 12000 | 123 | | | | | | | | | | | C | C | C | C | C | | | | | |
| 15000 | 153 | | | | | | | | | | | C | C | C | C | C | | | | | |
| 18000 | 183 | | | | | | | | | | | F | F | F | F | F | | | | | |
| 22000 | 223 | | | | | | | | | | | F | F | F | F | F | | | | | |
| 27000 | 273 | | | | | | | | | | | F | F | F | F | F | | | | | |
| 33000 | 333 | | | | | | | | | | | F | F | F | F | F | | | | | |
| 39000 | 393 | | | | | | | | | | | F | F | F | F | F | | | | | |
| 47000 | 473 | | | | | | | | | | | F | F | F | F | F | | | | | |
| 56000 | 563 | | | | | | | | | | | | | | | | | | | | |
| 68000 | 683 | | | | | | | | | | | | | | | | | | | | |
| 82000 | 823 | | | | | | | | | | | | | | | | | | | | |
| 100000 | 104 | | | | | | | | | | | | | | | | | | | | |

7. CAPACITANCE RANGE

7-2. X7R

| Cap(pF) | EIA Size Code | 0201 | | | | 0402 | | | | 0603 | | | | | 0805 | | | | | | | | |
|---------|------------------|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|------|-----|-----|-----|------|------|------|------|------|
| | | 10V | 16V | 25V | 50V | 10V | 16V | 25V | 50V | 10V | 16V | 25V | 50V | 100V | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V | 630V |
| 100 | 101 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 120 | 121 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 150 | 151 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 180 | 181 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 220 | 221 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 270 | 271 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 330 | 331 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 390 | 391 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 470 | 471 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 560 | 561 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 680 | 681 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 820 | 821 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 1000 | 102 | L | L | L | L | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 1200 | 122 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 1500 | 152 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 1800 | 182 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 2200 | 222 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 2700 | 272 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 3300 | 332 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 3900 | 392 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | X | X |
| 4700 | 472 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | X | X | C | C |
| 5600 | 562 | L | L | L | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | C | C | C | C |
| 6800 | 682 | L | | | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | C | C | C | C |
| 8200 | 822 | L | | | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | C | C | C | C |
| 10000 | 103 | L | | | | N | N | N | N | S | S | S | S | S | X | X | X | X | X | C | C | C | C |
| 12000 | 123 | | | | | N | N | N | N | S | S | S | S | B | X | X | X | X | X | C | C | | |
| 15000 | 153 | | | | | N | N | N | N | S | S | S | S | B | X | X | X | X | X | C | C | | |
| 18000 | 183 | | | | | N | N | N | N | S | S | S | S | B | X | X | X | X | X | C | C | | |
| 22000 | 223 | | | | | N | N | N | N | S | S | S | S | B | X | X | X | X | X | C | C | | |
| 27000 | 273 | | | | | N | N | N | N | S | S | S | S | B | X | X | X | X | C | | | | |
| 33000 | 333 | | | | | N | N | N | N | S | S | S | B | B | X | X | X | X | C | | | | |
| 39000 | 393 | | | | | N | N | N | N | S | S | S | B | B | X | X | X | X | C | | | | |
| 47000 | 473 | | | | | N | N | N | N | S | S | S | B | B | X | X | X | X | C | | | | |
| 56000 | 563 | | | | | N | N | | | S | S | S | B | | X | X | X | X | C | | | | |
| 68000 | 683 | | | | | N | N | | | S | S | S | B | | X | X | X | X | C | | | | |
| 82000 | 823 | | | | | N | N | | | S | S | S | B | | X | X | X | C | C | | | | |
| 100000 | 104 | | | | | N | N | | | S | S | S | B | | X | X | X | C | C | | | | |
| 120000 | 124 | | | | | | | | | B | B | B | | | X | X | X | C | | | | | |
| 150000 | 154 | | | | | | | | | B | B | B | B | | C | C | C | C | | | | | |
| 180000 | 184 | | | | | | | | | B | B | B | | | C | C | C | C | | | | | |
| 220000 | 224 | | | | | | | | | B | B | B | B | | C | C | C | C/I | | | | | |
| 270000 | 274 | | | | | | | | | | | | | | C | C | C | | | | | | |
| 330000 | 334 | | | | | | | | | B | B | B | B | | C | C | C | | | | | | |
| 390000 | 394 | | | | | | | | | | | | | | C | C | C | | | | | | |
| 470000 | 474 | | | | | | | | | | | | | | C | C | C | | | | | | |
| 560000 | 564 | | | | | | | | | | | | | | C | C | C | | | | | | |
| 680000 | 684 | | | | | | | | | | | | | | C | C | C | | | | | | |
| 820000 | 824 | | | | | | | | | | | | | | C | C | C | | | | | | |
| 1000000 | 105 | | | | | | | | | | | | | | C | C | C | | | | | | |

7. CAPACITANCE RANGE

7-2. X7R

| Cap(pF) | EIA Size | 1206 | | | | | | | | | 1210 | | | | | | | |
|---------|----------|------|-----|-----|-----|-----|------|------|------|------|------|-----|-----|-----|-----|------|------|------|
| | | Code | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V | 630V | 10V | 16V | 25V | 50V | 100V | 250V | 500V |
| 100 | 101 | | | | | | C | C | C | C | | | | | | C | C | C |
| 120 | 121 | | | | | | C | C | C | C | | | | | | C | C | C |
| 150 | 151 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 180 | 181 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 220 | 221 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 270 | 271 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 330 | 331 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 390 | 391 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 470 | 471 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 560 | 561 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 680 | 681 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 820 | 821 | X | X | X | X | X | C | C | C | C | | | | | | C | C | C |
| 1000 | 102 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 1200 | 122 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 1500 | 152 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 1800 | 182 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 2200 | 222 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 2700 | 272 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 3300 | 332 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | C |
| 3900 | 392 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | E |
| 4700 | 472 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | E |
| 5600 | 562 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | E |
| 6800 | 682 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | E |
| 8200 | 822 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | E |
| 10000 | 103 | X | X | X | X | X | C | C | C | C | M | M | M | M | M | M | C | E |
| 12000 | 123 | X | X | X | X | X | C | C | | | M | M | M | M | M | M | C | |
| 15000 | 153 | X | X | X | X | X | C | C | | | M | M | M | M | M | M | C | |
| 18000 | 183 | X | X | X | X | X | C | C | | | M | M | M | M | M | M | C | |
| 22000 | 223 | X | X | X | X | X | C | C | | | M | M | M | M | M | M | C | |
| 27000 | 273 | X | X | X | X | X | | | | | M | M | M | M | M | M | | |
| 33000 | 333 | X | X | X | X | X | | | | | M | M | M | M | M | M | | |
| 39000 | 393 | X | X | X | X | X | | | | | M | M | M | M | M | M | | |
| 47000 | 473 | X | X | X | X | X | | | | | M | M | M | M | M | C | | |
| 56000 | 563 | X | X | X | X | X | | | | | M | M | M | M | M | | | |
| 68000 | 683 | X | X | X | X | X | | | | | M | M | M | M | M | | | |
| 82000 | 823 | X | X | X | X | C | | | | | M | M | M | M | M | | | |
| 100000 | 104 | X | X | X | X | C | | | | | M | M | M | M | M | | | |
| 120000 | 124 | X | X | X | X | C | | | | | M | M | M | M | | | | |
| 150000 | 154 | M | M | M | M | E | | | | | M | M | M | M | | | | |
| 180000 | 184 | M | M | M | M | E | | | | | M | M | M | M | | | | |
| 220000 | 224 | M | M | M | M | E | | | | | M | M | M | M | | | | |
| 270000 | 274 | M | M | M | C | | | | | | M | M | M | M | | | | |
| 330000 | 334 | M | M | M | C | | | | | | M | M | M | C | | | | |
| 390000 | 394 | M | M | J | P | | | | | | M | M | M | C | | | | |
| 470000 | 474 | J | J | J | P | | | | | | M | M | M | C | | | | |
| 560000 | 564 | J | J | J | P | | | | | | C | C | C | C | | | | |
| 680000 | 684 | J | J | J | P | | | | | | C | C | C | C | | | | |
| 820000 | 824 | J | J | J | P | | | | | | C | C | C | C | | | | |
| 1000000 | 105 | J | J | J | P | | | | | | C | C | C | C | | | | |
| 1500000 | 155 | | | | | | | | | | | F | | | | | | |
| 2200000 | 225 | | | | | | | | | | | F | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | | | | | | | | | | | |
|---|---|--|---|---------------|------------|-----------------|---|---|---|--|---|--|---------------|------|-----------------|---|---|---|--|---|---|--|
| 1 | Pre-and Post-Stress Electrical Test | --- | | | | | | | | | | | | | | | | | | | | |
| 2 | High Temperature Exposure (Storage) MIL-STD-202 Method 108 | * Test temp. : 150±3°C. * Unpowered. * Test time : 1000 +24/-0 hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage. * Cap. change : COG within ±2.5% or ±0.25pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value : COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | |
| Rated voltage | I.R. | | | | | | | | | | | | | | | | | | | | | |
| ≥100V : All X7R | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Destructive Physical Analysis EIA-469 | Per EIA-469. | * No defects or abnormalities. | | | | | | | | | | | | | | | | | | | |
| 4 | Temperature Cycling JESD22 Method JA-104 | * Conduct 1000 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>-55°C +0/-3</td> <td>30±1</td> </tr> <tr> <td>2</td> <td>+125°C +3/-0</td> <td>30±1</td> </tr> </tbody> </table> * Before initial measurement (X7R only) : Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. | Step | Temp.(°C) | Time(min.) | 1 | -55°C +0/-3 | 30±1 | 2 | +125°C +3/-0 | 30±1 | * No remarkable damage. * Cap. change : COG within ±2.5% or 0.25pF, whichever is larger. X7R within ±10.0%. * Q/D.F. value : COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | |
| Step | Temp.(°C) | Time(min.) | | | | | | | | | | | | | | | | | | | | |
| 1 | -55°C +0/-3 | 30±1 | | | | | | | | | | | | | | | | | | | | |
| 2 | +125°C +3/-0 | 30±1 | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | I.R. | | | | | | | | | | | | | | | | | | | | | |
| ≥100V : All X7R | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | | |
|---|--|--|---|---------------|------|-----------------|--|---|---|--|---|---|--|
| 5 | Moisture Resistance MIL-STD-202 Method 106 | * Test temp. : 25~65°C. * Humidity : 80~100% RH. * Test time : 10 cycles, t=24hrs/cycle. * Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage. * Cap. change : C0G within ±3.0% or 0.30pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | |
| Rated voltage | I.R. | | | | | | | | | | | | |
| ≥100V : All X7R | ≥1GΩ or RxC≥10Ω-F, whichever is smaller | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | |
| 6 | Biased Humidity MIL-STD-202 Method 103 | * Test temp. : 85±3°C. * Humidity : 85±5%RH. * Test time : 1000 +24/-0 hrs. * To apply voltage : Rated voltage (max. 100Vdc) and 1.3~1.5Vdc (add 100k ohm resistor). * Before initial measurement (Class II only) : To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage. * Cap. change : C0G within ±3.0% or 0.30pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value : C0G : Q≥200 for Cap.≥30pF, Q≥100+10/3C for Cap.<30pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R) for rated voltage test | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table> Class II (X7R) for 1.3~1.5Vdc test | Rated voltage | I.R. | ≥100V : All X7R | ≥500MΩ or RxC≥5Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | |
| Rated voltage | I.R. | | | | | | | | | | | | |
| ≥100V : All X7R | ≥500MΩ or RxC≥5Ω-F, whichever is smaller | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | |
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | |
|---|---|---|--|---------------|------|-----------------|---|---|---|--|---|---|
| 7 | Operational Life MIL-STD-202 Method 108 | * Test temp. : 125±3°C. * To apply voltage : Full rated voltage. * Test time : 1000 +24/-0 hrs. * Before initial measurement (X7R only) : Apply rated voltage for 1 hr at 125°C. Remove and let set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage. * Cap. change : COG within ±3.0% or ±0.3pF, whichever is larger. X7R within ±12.5%. * Q/D.F. value : COG : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="6">≥1GΩ or RxC≥100Ω-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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥1GΩ or RxC≥100Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF |
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| 8 | External Visual MIL-STD-883 Method 2009 | * Visual inspection. | * No remarkable defect. | | | | | | | | | |
| 9 | Physical Dimension JESD22 Method JB-100 | * Using by calipers. | * Within the specified dimensions. | | | | | | | | | |
| 10 | Resistance to Solvents MIL-STD-202 Method 215 | * Temperature : 25±5°C. * Time : 3 +0.5/-0 min. * Solvent : Iso-propyl alcohol. | * No remarkable damage. * Cap. : Within the specified tolerance. * Q/D.F. value : COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤100% of initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="6">≥10GΩ or RxC≥100Ω-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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF |
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | |
|--|--|--|--|---------------|------|------------------------------|--|--|---|--|--|--|
| 11 | <p>Mechanical Shock MIL-STD-202 Method 213</p> | <p>* Peak value : 1500g's. * Wave : 1/2 sine. * Velocity : 15.4 ft/sec. * Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks).</p> | <p>* No remarkable damage. * Cap. : Within the specified tolerance. * Q/D.F. value : C0G : $Q \geq 1000$ for Cap. $\geq 30\text{pF}$, $Q \geq 400+20C$ for Cap. $< 30\text{pF}$. X7R : D.F. $\leq 100\%$ of initial requirement. * I.R. : $\geq 10\text{G}\Omega$ or $\text{RxC} \geq 500\Omega\text{-F}$, whichever is smaller. Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>$\geq 100\text{V}$: All X7R</td> <td rowspan="6">$\geq 10\text{G}\Omega$ or $\text{RxC} \geq 100\Omega\text{-F}$, whichever is smaller</td> </tr> <tr> <td>50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$</td> </tr> <tr> <td>10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$</td> </tr> </tbody> </table> | Rated voltage | I.R. | $\geq 100\text{V}$: All X7R | $\geq 10\text{G}\Omega$ or $\text{RxC} \geq 100\Omega\text{-F}$, whichever is smaller | 50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$ | 35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | 25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | 16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ | 10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ |
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| 12 | <p>Vibration MIL-STD-202 Method 204</p> | <p>* Vibration frequency : 10~2000 Hz/min. (5g's for 20 min.). * Total amplitude : 1.5mm. * 12 cycles each of 3 orientations (36 times).</p> | <p>* No remarkable damage. * Cap. : Within the specified tolerance. * Q/D.F. value : C0G : $Q \geq 1000$ for Cap. $\geq 30\text{pF}$, $Q \geq 400+20C$ for Cap. $< 30\text{pF}$. X7R : D.F. $\leq 100\%$ of initial requirement. * I.R. : $\geq 10\text{G}\Omega$ or $\text{RxC} \geq 500\Omega\text{-F}$, whichever is smaller. Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>$\geq 100\text{V}$: All X7R</td> <td rowspan="6">$\geq 10\text{G}\Omega$ or $\text{RxC} \geq 100\Omega\text{-F}$, whichever is smaller</td> </tr> <tr> <td>50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$</td> </tr> <tr> <td>10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$</td> </tr> </tbody> </table> | Rated voltage | I.R. | $\geq 100\text{V}$: All X7R | $\geq 10\text{G}\Omega$ or $\text{RxC} \geq 100\Omega\text{-F}$, whichever is smaller | 50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$ | 35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | 25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | 16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ | 10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ |
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | | | | | | | | | | | |
|---|--|--|---|---------------|------------|-----------------|---|---|---|--|---|---|---------------|------|-----------------|--|---|---|--|---|---|--|
| 13 | Resistance to Soldering Heat MIL-STD-202 Method 210 | <p>* Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Before initial measurement (X7R only) : Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</p> | <p>* No remarkable damage. * Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger. X7R within ±7.5%. * Q/D.F. value : C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤100% of initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥10GΩ or RxC≥100Ω-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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | |
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| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | |
| 14 | Thermal Shock MIL-STD-202 Method 107 | <p>* Conduct 300 cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C +0/-3</td> <td>15±3</td> </tr> <tr> <td>2</td> <td>+125°C +3/-0</td> <td>15±3</td> </tr> </tbody> </table> <p>* Max. transfer time : 20 sec. * Before initial measurement (X7R only) : Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</p> | Step | Temp.(°C) | Time(min.) | 1 | -55°C +0/-3 | 15±3 | 2 | +125°C +3/-0 | 15±3 | <p>* No remarkable damage. * Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger. X7R within ±10.0%. * Q/D.F. value : C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller. Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥1GΩ or RxC≥100Ω-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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> <td></td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥1GΩ or RxC≥100Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | |
| Step | Temp.(°C) | Time(min.) | | | | | | | | | | | | | | | | | | | | |
| 1 | -55°C +0/-3 | 15±3 | | | | | | | | | | | | | | | | | | | | |
| 2 | +125°C +3/-0 | 15±3 | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | I.R. | | | | | | | | | | | | | | | | | | | | | |
| ≥100V : All X7R | ≥1GΩ or RxC≥100Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | |
|--|---|---|--|---------------|------|------------------------------|---|--|---|--|--|--|
| 15 | ESD AEC-Q200-002 | * Per AEC-Q200-002. | <p>* No remarkable damage. * Cap. : Within the specified tolerance. * Q/D.F. value : COG : $Q \geq 1000$ for Cap. $\geq 30\text{pF}$, $Q \geq 400+20C$ for Cap. $< 30\text{pF}$. X7R : D.F. $\leq 100\%$ of initial requirement. * I.R. : $\geq 10\text{G}\Omega$ or $RxC \geq 500\Omega\text{-F}$, whichever is smaller. Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>$\geq 100\text{V}$: All X7R</td> <td rowspan="6">$\geq 10\text{G}\Omega$ or $RxC \geq 100\Omega\text{-F}$, whichever is smaller</td> </tr> <tr> <td>50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$</td> </tr> <tr> <td>10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$</td> </tr> </tbody> </table> | Rated voltage | I.R. | $\geq 100\text{V}$: All X7R | $\geq 10\text{G}\Omega$ or $RxC \geq 100\Omega\text{-F}$, whichever is smaller | 50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$ | 35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | 25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | 16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ | 10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ |
| Rated voltage | I.R. | | | | | | | | | | | |
| $\geq 100\text{V}$: All X7R | $\geq 10\text{G}\Omega$ or $RxC \geq 100\Omega\text{-F}$, whichever is smaller | | | | | | | | | | | |
| 50V : 0402 $> 0.01\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$ | | | | | | | | | | | | |
| 35V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 2.2\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | | | | | | | | | | | | |
| 25V : 0402 $\geq 1\mu\text{F}$, 0603 $\geq 2.2\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$ | | | | | | | | | | | | |
| 16V : 0201 $\geq 0.1\mu\text{F}$, 0402 $\geq 0.22\mu\text{F}$, 0603 $\geq 1\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ | | | | | | | | | | | | |
| 10V : 0201 $\geq 0.047\mu\text{F}$, 0402 $\geq 0.47\mu\text{F}$, 0603 $\geq 0.47\mu\text{F}$, 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 47\mu\text{F}$ | | | | | | | | | | | | |
| 16 | Solderability J-STD-002 JESD22-B102E | <p>* Condition A Un-mounted chips 4hrs / 155°C dry then completely immersed for 5 ± 0.5 sec in solder bath at $245 \pm 5^\circ\text{C}$. * Condition B Un-mounted chips steam 8 hrs then completely immersed for 10 ± 1 sec in solder bath at $220 +5/-0^\circ\text{C}$. * Condition C Un-mounted chips steam 8 hrs then completely immersed for 10 ± 1 sec. in solder bath at $260 +0/-5^\circ\text{C}$.</p> | <p>* All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination.</p> | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|--------------------|--|---|---|--|---|---|---|-----|--|------|-------------------------|-----|-------|-----|---|-----|-------------------------|------|---|-----|-------|------|---|-----|----------------------------------|-----|-------------------------|-----|-------|------|--|--------|-------------|-----|---|-----|-------|------|---|------|--|------|----------------------|
| 17 | Electrical Characterization | <p>* Capacitance.</p> <p>* Q/D.F. (Dissipation Factor).</p> <p>COG : Cap.≤1000pF : 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF : 1.0±0.2Vrms, 1KHz±10%. X7R : Apply 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature.</p> | <p>* Capacitance within the specified tolerance.</p> <p>* Q/D.F. value : COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R :</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%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0805>0.1μF, 0603≥0.068μF, 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%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.012μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤3.5%</td> <td>≤10%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF, 1206≥4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤3.5%</td> <td>≤10%</td> <td>0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td> </tr> <tr> <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, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤3.5%</td> <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>≤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> </tbody> </table> | Rated | D.F.≤ | Exception of D.F.≤ | | ≥100V | ≤2.5% | ≤3% | 1206≥0.47μF | ≤5% | 0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF | ≤10% | 0805>0.22μF, 1210≥3.3μF | 50V | ≤2.5% | ≤3% | 0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF | ≤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, 1206≥4.7μF | 25V | ≤3.5% | ≤10% | 0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 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≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF | ≤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 |
| | | Rated | D.F.≤ | Exception of D.F.≤ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≥100V | ≤2.5% | ≤3% | 1206≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | ≤5% | 0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤10% | 0805>0.22μF, 1210≥3.3μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V | ≤2.5% | ≤3% | 0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ≤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, 1206≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V | ≤3.5% | ≤10% | 0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 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≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | ≤15% | 0201≥0.1μF, 0402≥1μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>* Insulation Resistance.</p> <p>To apply rated voltage for max. 120 sec.</p> | <p>* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.</p> <p>Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>≥100V : All X7R</td> <td rowspan="5">≥10GΩ or RxC≥100Ω-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 : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> </tbody> </table> | Rated voltage | I.R. | ≥100V : All X7R | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | I.R. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≥100V : All X7R | ≥10GΩ or RxC≥100Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25V : 0402≥1μF, 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≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>* Dielectric Strength.</p> <table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>≤100</td> <td>2.5 times of UR</td> </tr> <tr> <td>100<V≤250</td> <td>2.0 times of UR</td> </tr> <tr> <td>250<V≤500</td> <td>1.5 times of UR</td> </tr> <tr> <td>630≤V≤1000</td> <td>1.2 times of UR</td> </tr> </tbody> </table> <p>* Duration 1~5 sec, charge and discharge current less than 50mA.</p> | Rated Vol.(V) | Condition | ≤100 | 2.5 times of UR | 100<V≤250 | 2.0 times of UR | 250<V≤500 | 1.5 times of UR | 630≤V≤1000 | 1.2 times of UR | <p>* No evidence of damage or flash over during test.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated Vol.(V) | Condition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤100 | 2.5 times of UR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100<V≤250 | 2.0 times of UR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 250<V≤500 | 1.5 times of UR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 630≤V≤1000 | 1.2 times of UR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>* Temperature Coefficient (With no electrical load) Operation temperature : -55~125°C at 25°C.</p> | <p>* Capacitance Change : COG within ±30ppm/°C. X7R within ±15%.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | AEC-Q200 Test Item | AEC-Q200 Test Condition | Requirements |
|-----|--|---|--|
| 18 | Board Flex AEC-Q200-005 | * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 2mm and then the pressure shall be maintained for 5±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage. * Cap. change : C0G within ±5% or 0.5pF, whichever is larger. X7R within ±12.5%. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test) |
| 19 | Terminal Strength AEC-Q200-006 | * Pressurizing force : 2N (0402), 5N(0603), 10N(0805), 17.7N(≥1206). * Test time : 60±1 sec. | * No remarkable damage or removal of the terminations. * Capacitance within the specified tolerance. * Q/D.F. value : C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤100% of initial requirement. |
| 20 | Beam Load Test AEC-Q200-003 | * Break strength test. * Beam speed : 2.5±0.25 mm/sec. | * The chip endure following force : Chip length ≤2.5mm : Thickness >0.5mm (20N), ≤0.5mm (8N). Chip length ≥3.2mm : Thickness ≥1.25mm (54.5N), <1.25mm (15N). |

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 | - | - |
| 0603(1608) | 0.50±0.20 | 10k | - | - | - |
| | 0.50±0.10 | 4k | - | - | - |
| | 0.80±0.07 | 4k | 15k | - | - |
| 0805(2012) | 0.80 +0.15/-0.10 | 4k | 15k | - | - |
| | 0.50±0.10 | 4k | 15k | - | - |
| | 0.60±0.10 | 4k | 15k | - | - |
| 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 |
| 1210(3225) | 1.60 +0.30/-0.10 | - | - | 2k | 9k |
| | 0.85±0.10 | - | - | 3k | 10k |
| | 0.95±0.10 | - | - | 3k | 10k |
| | 1.25±0.10 | - | - | 3k | 10k |
| | 1.60±0.20 | - | - | 2k | - |
| | 2.00±0.20 | - | - | 1k | 6k |
| 1808(4520) | 2.50±0.30 | - | - | 1k | 6k |
| | 1.25±0.10 | - | - | 2k | 10k |
| | 1.60±0.20 | - | - | 2k | 8k |
| 1812(4532) | 2.00±0.20 | - | - | 1k | 6k |
| | 2.00±0.20 | - | - | 1k | - |
| | 2.50±0.30 | - | - | 0.5k | 3k |
| | 2.80±0.30 | - | - | 0.5k | - |
| 1825(4563) | 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

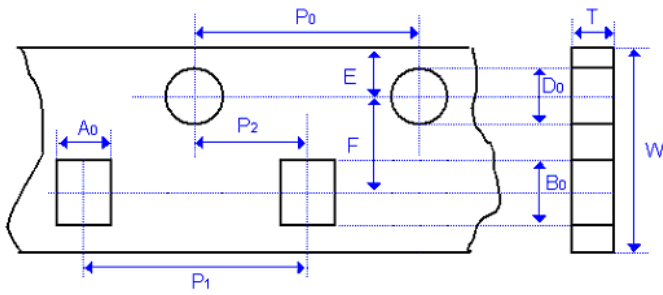


Fig. 9.1 The dimension of paper tape

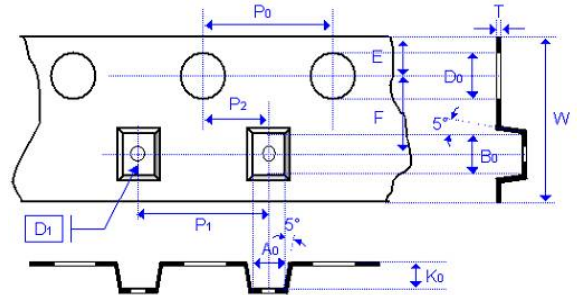


Fig. 9.2 The dimension of plastic tape

| Size | 0201 | 0402 | 0603 | | 0805 | |
|-------------------|------------|------------|-----------------|-----------------|------------|------------------------|
| Chip Thickness | 0.30±0.03 | 0.50±0.10 | 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

9.2. REEL DIMENSIONS

| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | |
|----------------|------------------------------------|-------------------|-------------------|
| Reel size | 7" | 7" | 13" |
| 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 | 12.4 +2.0/-0 | 8.4 +2.0/-0 |
| A | 178.0 ±0.10 | 178.0 ±0.10 | 330.0 ±1.0 |
| N | 60.0 +1.0/-0 | 80.0 ±1.0 | 100 ±1.0 |

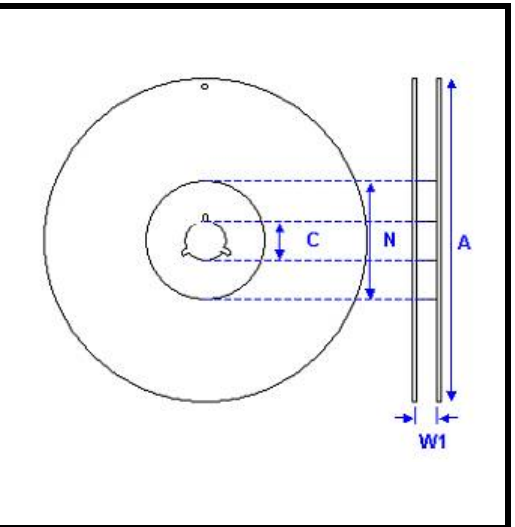
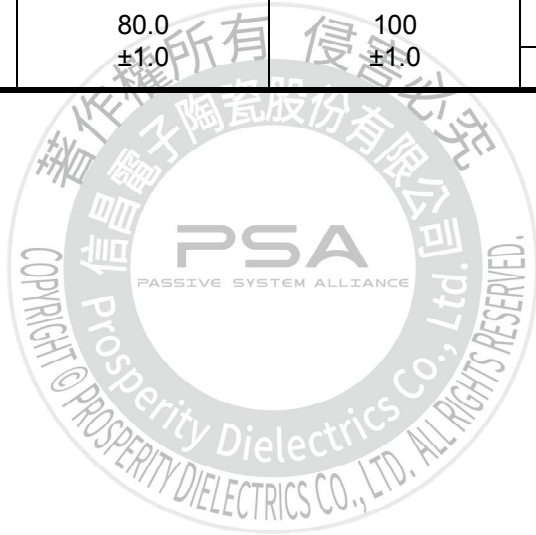


Fig. 9.3 The dimension of reel



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.

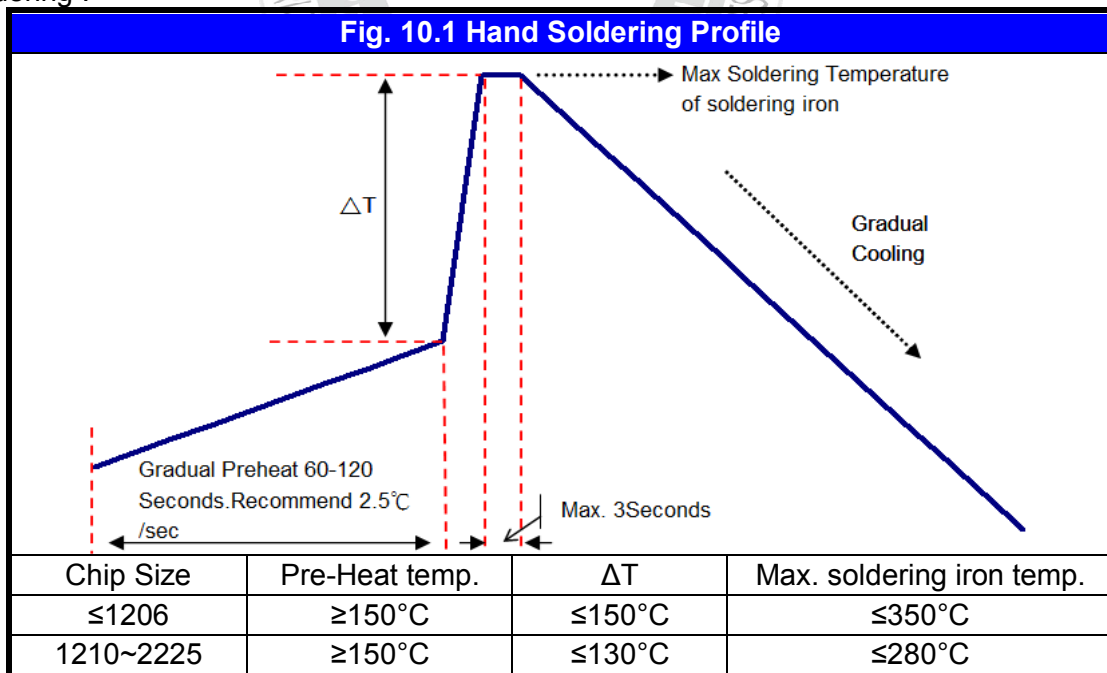
PREHEAT

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.

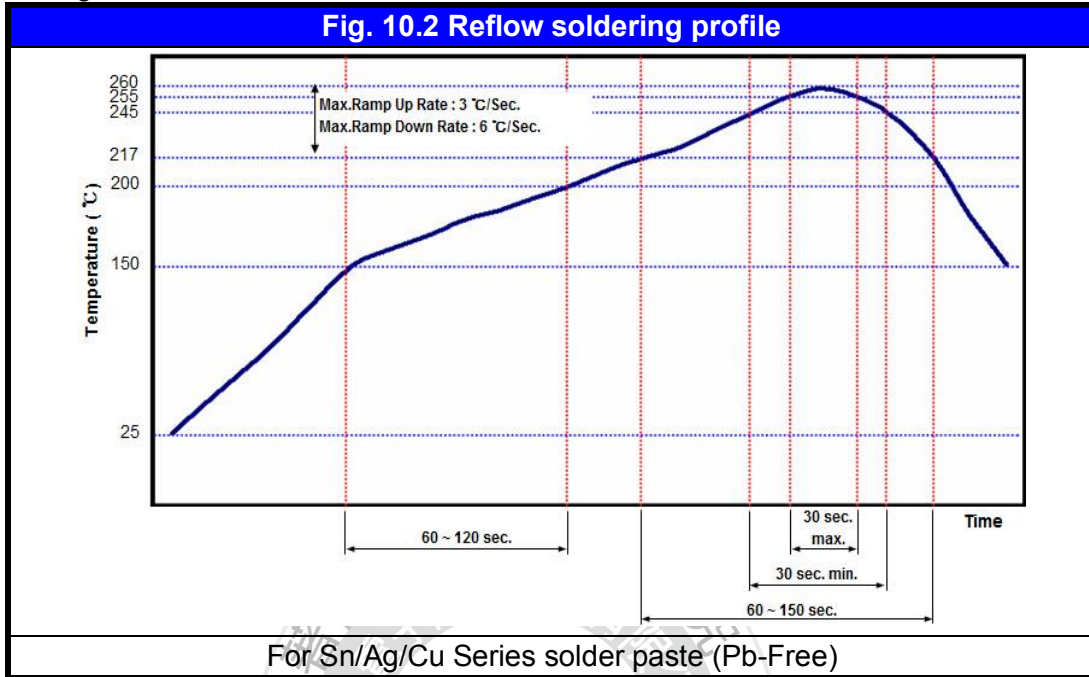
a.) Hand soldering :



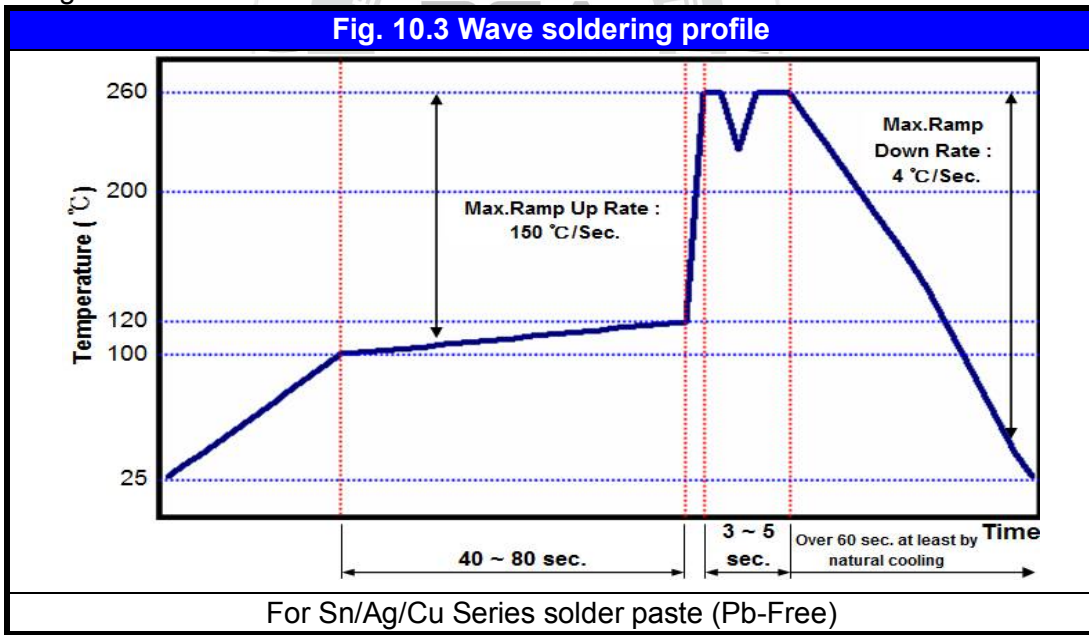
- * Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
- * The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- * The required amount of solder shall be melted on the soldering tip.
- * The tip of iron should not contact 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. Char. | 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 capacitor chip mounted on a substrate. The chip is shown in yellow and grey. A vertical double-headed arrow on the left indicates the 'Chip Thickness'. A vertical double-headed arrow on the right indicates the 'Soldering Height', which is the height of the solder bridge between the chip and the substrate. A dashed line shows the solder bridge height relative to the chip thickness.

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.

Notice of MT Series

The standard AEC-Q200 series capacitors are mainly used on general automotive equipment without safety considerations. Please select SAFETY concern type or contact our company in advanced if you intend to use capacitor for designing the equipment which may damage itself and the safety of third party. If necessary, please consider to add the protect circuit in devising process and obtaining fully safety evaluation. The contents of the acknowledgments only used for our parent company, marketing subsidiaries and official marketing agents who purchase our products. Not applicable for the other nonofficial channels.

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[NMC0805X7R224K16TRPLPF](#) [NMC1206X7R102K50TRPF](#) [NMC1206X7R106K10TRPLPF](#) [NMC1206X7R475K10TRPLPF](#)
[C1608C0G2A221J](#) [C1608X7R1E334K](#) [C2012C0G2A472J](#) [2220J2K00562KXT](#) [CDR33BX104AKUR](#) [CDR33BX683AKUS](#)
[CGA3E1X7R1C684K](#) [CL10C0R8BB8ANNC](#) [C1005X5R0G225M](#) [C2012X7R2E223K](#) [C3216C0G2J272J](#) [D55342E07B35E7R-T/R](#)
[NMC0402NPO150G50TRPF](#) [NMC0402NPO560F50TRPF](#) [NMC0402X7R562J25TRPF](#) [NMC0603NPO102J25TRPF](#)
[NMC1206X7R332K50TRPF](#) [726632-1](#) [CGA6M3X7R1H225K](#) [CGA5L2X7R2A105K](#) [CGA3E2X8R1H223K](#) [CDR33BX823AKUR\M500](#)
[CDR35BX474AKUR\M500](#) [CDR35BX104BKUR\M500](#) [69995D](#) [NMC0201X5R473K6.3TRPF](#) [NMC0201X7R221K25TRPF](#)
[NMC0402X5R105K10TRPF](#) [NMC0402X5R224K10TRPF](#) [NMC0603X7R104J25TRPF](#) [NMC0603X7R223K25TRPF](#)