

**Prosperity Dielectrics Co., Ltd.**

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

Tel : 886-3-4753355

Fax : 886-3-4854959

**Messrs. :** 一般共用

**Date :** 2020/01/31

# 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 |
|-------------|-------------|
|             |             |

信昌電子陶瓷股份有限公司

PROSPERITY DIELECTRICS CO., LTD.

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

**Tel : 03-4753355 ext :**

**Fax : 03-4854959**

**Contactor :** \_\_\_\_\_ **Mobile :** \_\_\_\_\_

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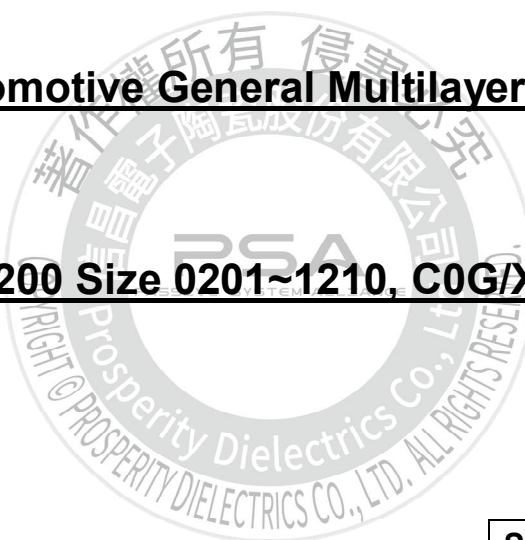
# SPECIFICATION

FOR

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

## 3. APPLICATIONS

- For Navigation & Information equipments.
- For entertainment equipments.
- For comfortable equipments.
- For Automotive electronic equipment.

## 4. HOW TO ORDER

| <b>MT</b>         | <b>31</b>   | <b>X</b>          | <b>471</b>         | <b>K</b>         | <b>251</b>           | <b>E</b>         | <b>C</b>         | <b>G</b>            |
|-------------------|-------------|-------------------|--------------------|------------------|----------------------|------------------|------------------|---------------------|
| <b>PDC Family</b> | <b>Size</b> | <b>Dielectric</b> | <b>Capacitance</b> | <b>Tolerance</b> | <b>Rated Voltage</b> | <b>Packaging</b> | <b>Thickness</b> | <b>Control Code</b> |
| 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       | C0G         | X                                   | X7R         |

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

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

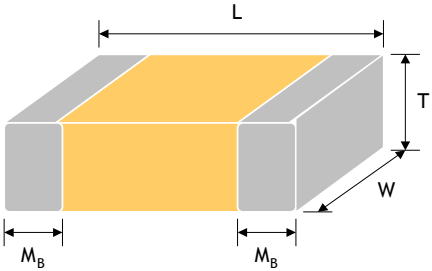
| Table 6 |             | Rated Voltage |             |      |             |
|---------|-------------|---------------|-------------|------|-------------|
| Code    | Description | Code          | Description | Code | Description |
| 6R3     | 6.3Vdc      | 500           | 50Vdc       | 401  | 400Vdc      |
| 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 <sub>B</sub> (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<br>3.30±0.30* | 1.60±0.20<br>1.60 +0.3/-0.1# |                            | 0.60±0.20           |                                                                                     |
| 1210(3225)     | 3.20±0.30<br>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.

Fig. 5.1 The outline of MLCC

### 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.&lt;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                                                                                                                                                                                                          |                              |         |           |           |           |        |                                                                 |
| Measured at the condition of 30~70% related humidity |                                                                                                                                                                                                                 |                              |         |           |           |           |        |                                                                 |
| Capacitance & Tan δ Test condition                   | 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                                                          |                              |         |           |           |           |        |                                                                 |
| Insulation resistance at Ur                          | ≥10GΩ or RxC≥500Ω-F, whichever is smaller                                                                                                                                                                       |                              |         |           |           |           |        |                                                                 |
|                                                      | Follow No.17 of 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS                                                                                                                                                 |                              |         |           |           |           |        |                                                                 |
|                                                      | -55°C to +125°C                                                                                                                                                                                                 |                              |         |           |           |           |        |                                                                 |
| Operating temperature                                |                                                                                                                                                                                                                 |                              |         |           |           |           |        |                                                                 |
| Capacitance characteristic                           | ±30ppm/°C                                                                                                                                                                                                       | ±15%                         |         |           |           |           |        |                                                                 |
| Termination                                          | Cu/Ni/Sn (lead-free termination)                                                                                                                                                                                |                              |         |           |           |           |        |                                                                 |

**7. CAPACITANCE RANGE**

**7-1. C0G**

| Cap(pF) | EIA Size | 0201 |     |     |     |     | 0402 |     |     |     |     | 0603 |     |     |     |     |      | 0805 |      |     |     |     |     |      |      |      |      |
|---------|----------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|------|------|-----|-----|-----|-----|------|------|------|------|
|         |          | Code | 10V | 16V | 25V | 50V | 100V | 10V | 16V | 25V | 50V | 100V | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V |
| 0.1     | 0R1      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.2     | 0R2      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.3     | 0R3      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.4     | 0R4      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 0.5     | 0R5      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 1.0     | 1R0      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 1.2     | 1R2      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 1.5     | 1R5      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 1.8     | 1R8      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 2.2     | 2R2      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 2.7     | 2R7      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 3.3     | 3R3      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 3.9     | 3R9      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 4.7     | 4R7      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 5.6     | 5R6      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 6.8     | 6R8      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 8.2     | 8R2      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 10      | 100      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 12      | 120      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 15      | 150      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 18      | 180      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 22      | 220      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 27      | 270      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 33      | 330      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 39      | 390      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 47      | 470      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 56      | 560      | L    | L   | L   | L   | L   | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 68      | 680      | L    | L   | L   | L   |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | A    | A    |
| 82      | 820      | L    | L   | L   | L   |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | A    | A    | X    | X    |
| 100     | 101      | L    | L   | L   | L   |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | X    | X    | X    | X    |
| 120     | 121      | L    | L   | L   | L   |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | X    | X    | C    | C    |
| 150     | 151      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | C    | C    | C    | C    |
| 180     | 181      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | C    | C    | C    | C    |
| 220     | 221      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | S    | S    | A    | A   | A   | A   | A   | C    | C    | C    | C    |
| 270     | 271      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | B    | B    | A    | A   | A   | A   | A   | C    | C    | C    | C    |
| 330     | 331      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | B    | B    | A    | A   | A   | A   | A   | C    | C    | C    | C    |
| 390     | 391      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | B    | B    | X    | X   | X   | X   | X   | C    | C    | C    | C    |
| 470     | 471      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   | B    | B    | X    | X   | X   | X   | X   | C    | C    | I    | I    |
| 560     | 561      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   |      |      | X    | X   | X   | X   | X   | C    | C    | I    | I    |
| 680     | 681      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   |      |      | X    | X   | X   | X   | X   | C    | C    | I    | I    |
| 820     | 821      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   |      |      | X    | X   | X   | X   | X   | C    | C    | I    | I    |
| 1000    | 102      |      |     |     |     |     | N    | N   | N   | N   | N   | S    | S   | S   | S   | S   |      |      | X    | X   | X   | X   | X   | C    | C    | I    | I    |
| 1200    | 122      |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     |      | X    | X    | X   | X   | X   | C   | C    |      |      |      |
| 1500    | 152      |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     |      | X    | X    | X   | X   | X   | C   | C    |      |      |      |
| 1800    | 182      |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     |      | X    | X    | X   | X   | X   | C   | C    |      |      |      |
| 2200    | 222      |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     |      | X    | X    | X   | X   | X   | C   | C    |      |      |      |
| 2700    | 272      |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 3300    | 332      |      |     |     |     |     |      |     |     |     |     | B    | B   | B   | B   |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 3900    | 392      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 4700    | 472      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 5600    | 562      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 6800    | 682      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 8200    | 822      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      | C    | C    | C   | C   | C   |     |      |      |      |      |
| 10000   | 103      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      | C    | C    | C   | C   |     |     |      |      |      |      |
| 12000   | 123      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 15000   | 153      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 18000   | 183      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 22000   | 223      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 27000   | 273      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 33000   | 333      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 39000   | 393      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 47000   | 473      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 56000   | 563      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 68000   | 683      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 82000   | 823      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |
| 100000  | 104      |      |     |     |     |     |      |     |     |     |     |      |     |     |     |     |      |      |      |     |     |     |     |      |      |      |      |

**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    | M     |
| 12      | 120           | X    | X   | X   | X   | X    | X    | X    | X    | X    | X     | M    | 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    | M     |
| 18      | 180           | X    | X   | X   | X   | X    | X    | X    | X    | X    | X     | M    | 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    | M     |
| 27      | 270           | X    | X   | X   | X   | X    | X    | X    | X    | X    | C     | M    | 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    | M     |
| 39      | 390           | X    | X   | X   | X   | X    | X    | X    | X    | X    | C     | M    | 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    | M     |
| 56      | 560           | X    | X   | X   | X   | X    | X    | X    | X    | X    | C     | M    | 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    | M     |
| 82      | 820           | X    | X   | X   | X   | X    | X    | X    | X    | X    | C     | M    | 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    | M    | C     |
| 120     | 121           | X    | X   | X   | X   | X    | X    | X    | X    | X    | C     | M    | 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    | M    | C     |
| 180     | 181           | X    | X   | X   | X   | X    | X    | X    | X    | X    | E     | M    | 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    | M    | E     |
| 270     | 271           | X    | X   | X   | X   | X    | X    | M    | M    | M    | E     | M    | 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    | M    | E     |
| 390     | 391           | X    | X   | X   | X   | X    | X    | M    | M    | M    | E     | M    | 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    | M    | E     |
| 560     | 561           | X    | X   | X   | X   | X    | M    | C    | C    | C    | E     | M    | 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    | M    | E     |
| 820     | 821           | X    | X   | X   | X   | X    | M    | E    | E    | E    | E     | M    | 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    | C    | E     |
| 1200    | 122           | X    | X   | X   | X   | X    | M    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | C    | C    | C    |       |
| 1500    | 152           | X    | X   | X   | X   | X    | C    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | C    | C    | C    |       |
| 1800    | 182           | X    | X   | X   | X   | X    | C    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | C    | C    | C    |       |
| 2200    | 222           | X    | X   | X   | X   | X    | C    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | C    | C    | C    |       |
| 2700    | 272           | X    | X   | X   | X   | X    | C    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | C    | C    | C    |       |
| 3300    | 332           | X    | X   | X   | X   | X    | C    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | C    | C    | C    |       |
| 3900    | 392           | X    | X   | X   | X   | X    | C    | E    | E    | E    | E     | M    | M   | M   | M   | M    | C    | 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<br>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)<br>MIL-STD-202 Method 108 | * Test temp. : 150±3°C.<br>* Unpowered.<br>* Test time : 1000 +24/-0 hrs.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                                                                                                                                                         | * No remarkable damage.<br>* Cap. change : COG within ±2.5% or ±0.25pF, whichever is larger.<br>X7R within ±12.5%.<br>* Q/D.F. value :<br>COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.<br>X7R : D.F.≤200% of initial requirement.<br>* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br>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&gt;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<br>EIA-469                      | Per EIA-469.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | * No defects or abnormalities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |            |                 |                                         |                                                               |                                         |                                                              |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |      |                 |                                         |                                                               |                                         |                                                              |                                                                           |                                                                                 |  |
| 4                                                                               | Temperature Cycling<br>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) :<br>Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>* 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.<br>* Cap. change : COG within ±2.5% or 0.25pF, whichever is larger.<br>X7R within ±10.0%.<br>* Q/D.F. value :<br>COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.<br>X7R : D.F.≤200% of initial requirement.<br>* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br>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&gt;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<br>MIL-STD-202<br>Method 106 | * Test temp. : 25~65°C.<br>* Humidity : 80~100% RH.<br>* Test time : 10 cycles, t=24hrs/cycle.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.                                                                                                                                                                                                                         | * No remarkable damage.<br>* Cap. change : C0G within ±3.0% or 0.30pF, whichever is larger.<br>X7R within ±12.5%.<br>* Q/D.F. value :<br>C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF,<br>Q≥200+10C for Cap.<10pF.<br>X7R : D.F.≤200% of initial requirement.<br>* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br>Class II (X7R)                                                                                                                                                                                                                                                                                                                                                  |               |      |                 |                                          |                                                               |                                         |                                                              |                                                                           |                                                                                 |  |
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| 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<br>MIL-STD-202<br>Method 103     | * Test temp. : 85±3°C.<br>* Humidity : 85±5%RH.<br>* Test time : 1000 +24/-0 hrs.<br>* To apply voltage : Rated voltage (max. 100Vdc) and 1.3~1.5Vdc (add 100k ohm resistor).<br>* Before initial measurement (Class II only) :<br>To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.<br>* Cap. change : C0G within ±3.0% or 0.30pF, whichever is larger.<br>X7R within ±12.5%.<br>* Q/D.F. value :<br>C0G : Q≥200 for Cap.≥30pF, Q≥100+10/3C for Cap.<30pF.<br>X7R : D.F.≤200% of initial requirement.<br>* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.<br>Class II (X7R) for rated voltage test                                                                                                                                                                                                                                                                                                                                                             |               |      |                 |                                          |                                                               |                                         |                                                              |                                                                           |                                                                                 |  |
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| 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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| 10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF |                                                  |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |                 |                                          |                                                               |                                         |                                                              |                                                                           |                                                                                 |  |
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| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |      |                 |                                           |                                                               |                                         |
|---------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|-----------------|-------------------------------------------|---------------------------------------------------------------|-----------------------------------------|
| 7                                                                               | Operational Life<br>MIL-STD-202<br>Method 108       | * Test temp. : 125±3°C.<br>* To apply voltage : Full rated voltage.<br>* Test time : 1000 +24/-0 hrs.<br>* Before initial measurement (X7R only) :<br>Apply rated voltage for 1 hr at 125°C.<br>Remove and let set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.<br>* Cap. change : COG within ±3.0% or ±0.3pF, whichever is larger.<br>X7R within ±12.5%.<br>* Q/D.F. value :<br>COG : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF,<br>Q≥200+10C for Cap.<10pF.<br>X7R : D.F.≤200% of initial requirement.<br>* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.<br>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&gt;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 |
| 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                                                                               | External Visual<br>MIL-STD-883<br>Method 2009       | * Visual inspection.                                                                                                                                                                                                                                                                                                | * No remarkable defect.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |                 |                                           |                                                               |                                         |
| 9                                                                               | Physical Dimension<br>JESD22<br>Method JB-100       | * Using by calipers.                                                                                                                                                                                                                                                                                                | * Within the specified dimensions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |                 |                                           |                                                               |                                         |
| 10                                                                              | Resistance to Solvents<br>MIL-STD-202<br>Method 215 | * Temperature : 25±5°C.<br>* Time : 3 +0.5/-0 min.<br>* Solvent : Iso-propyl alcohol.                                                                                                                                                                                                                               | * No remarkable damage.<br>* Cap. : Within the specified tolerance.<br>* Q/D.F. value :<br>COG : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.<br>X7R : D.F.≤100% of initial requirement.<br>* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br>Class II (X7R)                                                                                                                                                                                                                                                                                                                                                                                  |               |      |                 |                                           |                                                               |                                         |
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| 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 |                                                     |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |      |                 |                                           |                                                               |                                         |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No.                                                                                                                                                                                  | AEC-Q200 Test Item                                                                     | AEC-Q200 Test Condition                                                                                                                                                                                          | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |                              |                                                                                        |                                                                                                                                                |                                                                                           |                                                                                                                                                  |                                                                                                                                                                                |                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11                                                                                                                                                                                   | <p><b>Mechanical Shock</b><br/>MIL-STD-202 Method 213</p>                              | <p>* Peak value : 1500g's.<br/>* Wave : 1/2 sine.<br/>* Velocity : 15.4 ft/sec.<br/>* Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks).</p> | <p>* No remarkable damage.<br/>* Cap. : Within the specified tolerance.<br/>* Q/D.F. value :<br/>C0G : <math>Q \geq 1000</math> for Cap. <math>\geq 30\text{pF}</math>, <math>Q \geq 400+20C</math> for Cap. <math>&lt; 30\text{pF}</math>.<br/>X7R : D.F. <math>\leq 100\%</math> of initial requirement.<br/>* I.R. : <math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 500\Omega\text{-F}</math>, whichever is smaller.<br/>Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td><math>\geq 100\text{V}</math> : All X7R</td> <td rowspan="6"><math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 100\Omega\text{-F}</math>, whichever is smaller</td> </tr> <tr> <td>50V : 0402 <math>&gt; 0.01\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td>35V : 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>25V : 0402 <math>\geq 1\mu\text{F}</math>, 0603 <math>\geq 2.2\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>16V : 0201 <math>\geq 0.1\mu\text{F}</math>, 0402 <math>\geq 0.22\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V : 0201 <math>\geq 0.047\mu\text{F}</math>, 0402 <math>\geq 0.47\mu\text{F}</math>, 0603 <math>\geq 0.47\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></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 $\geq 47\mu\text{F}$ |
| 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 |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |                              |                                                                                        |                                                                                                                                                |                                                                                           |                                                                                                                                                  |                                                                                                                                                                                |                                                                                                                                                                                      |
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| 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 $\geq 47\mu\text{F}$ |                                                                                        |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |                              |                                                                                        |                                                                                                                                                |                                                                                           |                                                                                                                                                  |                                                                                                                                                                                |                                                                                                                                                                                      |
| 12                                                                                                                                                                                   | <p><b>Vibration</b><br/>MIL-STD-202 Method 204</p>                                     | <p>* Vibration frequency : 10~2000 Hz/min. (5g's for 20 min.).<br/>* Total amplitude : 1.5mm.<br/>* 12 cycles each of 3 orientations (36 times).</p>                                                             | <p>* No remarkable damage.<br/>* Cap. : Within the specified tolerance.<br/>* Q/D.F. value :<br/>C0G : <math>Q \geq 1000</math> for Cap. <math>\geq 30\text{pF}</math>, <math>Q \geq 400+20C</math> for Cap. <math>&lt; 30\text{pF}</math>.<br/>X7R : D.F. <math>\leq 100\%</math> of initial requirement.<br/>* I.R. : <math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 500\Omega\text{-F}</math>, whichever is smaller.<br/>Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td><math>\geq 100\text{V}</math> : All X7R</td> <td rowspan="6"><math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 100\Omega\text{-F}</math>, whichever is smaller</td> </tr> <tr> <td>50V : 0402 <math>&gt; 0.01\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td>35V : 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>25V : 0402 <math>\geq 1\mu\text{F}</math>, 0603 <math>\geq 2.2\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>16V : 0201 <math>\geq 0.1\mu\text{F}</math>, 0402 <math>\geq 0.22\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V : 0201 <math>\geq 0.047\mu\text{F}</math>, 0402 <math>\geq 0.47\mu\text{F}</math>, 0603 <math>\geq 0.47\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></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 $\geq 47\mu\text{F}$ |
| 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 |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |                              |                                                                                        |                                                                                                                                                |                                                                                           |                                                                                                                                                  |                                                                                                                                                                                |                                                                                                                                                                                      |
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| 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 $\geq 10\mu\text{F}$                                     |                                                                                        |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |                              |                                                                                        |                                                                                                                                                |                                                                                           |                                                                                                                                                  |                                                                                                                                                                                |                                                                                                                                                                                      |
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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<br>MIL-STD-202 Method 210 | <p>* Solder temperature : 260±5°C.<br/>                     * Dipping time : 10±1 sec.<br/>                     * Before initial measurement (X7R only) :<br/>                     Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br/>                     * Measurement to be made after keeping at room temp. for 24±2 hrs.</p>                                                                                                                                                                                                                                                                 | <p>* No remarkable damage.<br/>                     * Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger.<br/>                     X7R within ±7.5%.<br/>                     * Q/D.F. value :<br/>                     C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.&lt;30pF.<br/>                     X7R : D.F.≤100% of initial requirement.<br/>                     * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br/>                     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&gt;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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |                 |                                          |                                                               |                                         |                                                              |                                                                           |                                                                                 |  |
| 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       |                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |            |                 |                                           |                                                               |                                         |                                                              |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |                 |                                          |                                                               |                                         |                                                              |                                                                           |                                                                                 |  |
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| 14                                                                              | Thermal Shock<br>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.<br/>                     * Before initial measurement (X7R only) :<br/>                     Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br/>                     * 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.<br/>                     * Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger.<br/>                     X7R within ±10.0%.<br/>                     * Q/D.F. value :<br/>                     C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.&lt;30pF.<br/>                     X7R : D.F.≤200% of initial requirement.<br/>                     * I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.<br/>                     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&gt;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<br>AEC-Q200-002                                                                    | * Per AEC-Q200-002.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>* No remarkable damage.<br/>                     * Cap. : Within the specified tolerance.<br/>                     * Q/D.F. value :<br/>                     COG : <math>Q \geq 1000</math> for Cap. <math>\geq 30\text{pF}</math>, <math>Q \geq 400+20C</math> for Cap. <math>&lt; 30\text{pF}</math>.<br/>                     X7R : D.F. <math>\leq 100\%</math> of initial requirement.<br/>                     * I.R. : <math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 500\Omega\text{-F}</math>, whichever is smaller.<br/>                     Class II (X7R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td><math>\geq 100\text{V}</math> : All X7R</td> <td rowspan="6"><math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 100\Omega\text{-F}</math>, whichever is smaller</td> </tr> <tr> <td>50V : 0402 <math>&gt; 0.01\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 1\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td>35V : 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 2.2\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>25V : 0402 <math>\geq 1\mu\text{F}</math>, 0603 <math>\geq 2.2\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>16V : 0201 <math>\geq 0.1\mu\text{F}</math>, 0402 <math>\geq 0.22\mu\text{F}</math>, 0603 <math>\geq 1\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 10\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V : 0201 <math>\geq 0.047\mu\text{F}</math>, 0402 <math>\geq 0.47\mu\text{F}</math>, 0603 <math>\geq 0.47\mu\text{F}</math>, 0805 <math>\geq 2.2\mu\text{F}</math>, 1206 <math>\geq 4.7\mu\text{F}</math>, 1210 <math>\geq 47\mu\text{F}</math></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 $\geq 47\mu\text{F}$ |
| 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 $\geq 47\mu\text{F}$ |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |                              |                                                                                        |                                                                                                                                                |                                                                                           |                                                                                                                                                  |                                                                                                                                                                                |                                                                                                                                                                                      |
| 16                                                                                                                                                                                   | Solderability<br>J-STD-002<br>JESD22-B102E                                             | <p>* Condition A<br/>                     Un-mounted chips 4hrs / 155°C*dry then completely immersed for <math>5 \pm 0.5</math> sec in solder bath at <math>245 \pm 5^\circ\text{C}</math>.<br/>                     * Condition B<br/>                     Un-mounted chips steam 8 hrs then completely immersed for <math>10 \pm 1</math> sec in solder bath at <math>220 +5/-0^\circ\text{C}</math>.<br/>                     * Condition C<br/>                     Un-mounted chips steam 8 hrs then completely immersed for <math>10 \pm 1</math> sec. in solder bath at <math>260 +0/-5^\circ\text{C}</math>.</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>C0G :<br/>Cap.≤1000pF : 1.0±0.2Vrms, 1MHz±10%.<br/>Cap.&gt;1000pF : 1.0±0.2Vrms, 1KHz±10%.<br/>X7R :<br/>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 :<br/>C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.&lt;30pF.<br/>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&gt;0.1μF, 0603≥0.068μF, 1206&gt;1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤10%</td> <td>0805&gt;0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤2.5%</td> <td>≤3%</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&gt;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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                                                |                                                               |                                         |                                                              |                                                                           |                                                                                 |                                                           |     |                                                |      |                         |     |       |     |                                                   |     |                         |      |                                                           |     |       |      |                                             |     |                                  |     |                         |     |       |      |                                                                          |        |             |     |                                                                             |     |       |      |                                                                                           |      |                                                                                            |      |                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ≤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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                                                |                                                               |                                         |                                                              |                                                                           |                                                                                 |                                                           |     |                                                |      |                         |     |       |     |                                                   |     |                         |      |                                                           |     |       |      |                                             |     |                                  |     |                         |     |       |      |                                                                          |        |             |     |                                                                             |     |       |      |                                                                                           |      |                                                                                            |      |                      |
| <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&gt;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&lt;V≤250</td> <td>2.0 times of UR</td> </tr> <tr> <td>250&lt;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 : C0G within ±30ppm/°C.<br/>X7R within ±15%.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                                                |                                                               |                                         |                                                              |                                                                           |                                                                                 |                                                           |     |                                                |      |                         |     |       |     |                                                   |     |                         |      |                                                           |     |       |      |                                             |     |                                  |     |                         |     |       |      |                                                                          |        |             |     |                                                                             |     |       |      |                                                                                           |      |                                                                                            |      |                      |

**8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS**

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

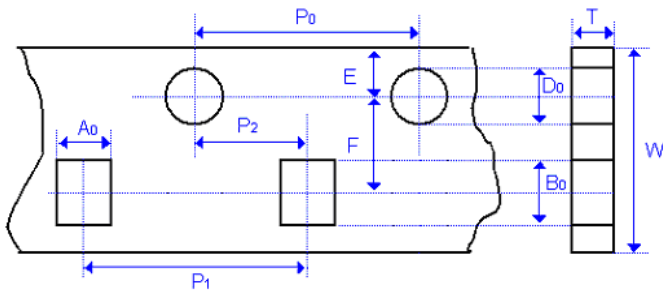


Fig. 9.1 The dimension of paper tape

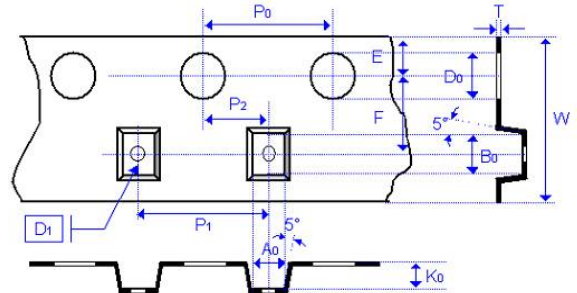


Fig. 9.2 The dimension of plastic tape

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

| Size              | 1206             |                                      |                                          | 1210                                                     |                  | 1812                                                     |                  |
|-------------------|------------------|--------------------------------------|------------------------------------------|----------------------------------------------------------|------------------|----------------------------------------------------------|------------------|
| Chip Thickness    | <b>0.80±0.10</b> | <b>0.95±0.10</b><br><b>1.25±0.10</b> | <b>1.60±0.20</b><br><b>1.60+0.3/-0.1</b> | <b>0.95±0.10</b><br><b>1.25±0.10</b><br><b>1.60±0.20</b> | <b>2.50±0.30</b> | <b>1.25±0.10</b><br><b>1.60±0.20</b><br><b>2.00±0.20</b> | <b>2.50±0.30</b> |
| A <sub>0</sub>    | 2.00±0.10        | <2.00                                | <2.00                                    | <3.05                                                    | <3.10            | <3.90                                                    | <3.90            |
| B <sub>0</sub>    | 3.50±0.10        | <3.60                                | <3.70                                    | <3.80                                                    | <4.00            | <5.30                                                    | <5.30            |
| T                 | 0.95±0.05        | 0.23±0.05                            | 0.23±0.05                                | 0.23±0.05                                                | 0.23±0.05        | 0.25±0.05                                                | 0.25±0.05        |
| K <sub>0</sub>    | -                | <2.50                                | <2.50                                    | <2.50                                                    | <3.50            | <2.50                                                    | <3.00            |
| W                 | 8.00±0.10        | 8.00±0.10                            | 8.00±0.10                                | 8.00±0.10                                                | 8.00±0.10        | 12.00±0.20                                               | 12.00±0.20       |
| P <sub>0</sub>    | 4.00±0.10        | 4.00±0.10                            | 4.00±0.10                                | 4.00±0.10                                                | 4.00±0.10        | 4.00±0.10                                                | 4.00±0.10        |
| 10xP <sub>0</sub> | 40.00±0.20       | 40.00±0.20                           | 40.00±0.20                               | 40.00±0.20                                               | 40.00±0.20       | 40.00±0.20                                               | 40.00±0.20       |
| P <sub>1</sub>    | 4.00±0.10        | 4.00±0.10                            | 4.00±0.10                                | 4.00±0.10                                                | 4.00±0.10        | 8.00±0.10                                                | 8.00±0.10        |
| P <sub>2</sub>    | 2.00±0.05        | 2.00±0.05                            | 2.00±0.05                                | 2.00±0.05                                                | 2.00±0.05        | 2.00±0.05                                                | 2.00±0.05        |
| D <sub>0</sub>    | 1.55±0.05        | 1.50 +0.10/-0                        | 1.50 +0.10/-0                            | 1.50 +0.10/-0                                            | 1.50 +0.10/-0    | 1.50 +0.10/-0                                            | 1.50 +0.10/-0    |
| D <sub>1</sub>    | -                | 1.00±0.10                            | 1.00±0.10                                | 1.00±0.10                                                | 1.00±0.10        | 1.50±0.10                                                | 1.50±0.10        |
| E                 | 1.75±0.10        | 1.75±0.10                            | 1.75±0.10                                | 1.75±0.10                                                | 1.75±0.10        | 1.75±0.10                                                | 1.75±0.10        |
| F                 | 3.50±0.05        | 3.50±0.05                            | 3.50±0.05                                | 3.50±0.05                                                | 3.50±0.05        | 5.50±0.05                                                | 5.50±0.05        |
| Unit :            | mm               | mm                                   | mm                                       | mm                                                       | mm               | mm                                                       | mm               |

**9. PACKAGE DIMENSION AND QUANTITY**

**9.2. REEL DIMENSIONS**

| Size           | 0201, 0402, 0603, 0805, 1206, 1210 |                   |                   |
|----------------|------------------------------------|-------------------|-------------------|
| Reel size      | 7"                                 | 7"                | 13"               |
| C              | 13.0<br>+0.5/-0.2                  | 13.0<br>+0.5/-0.2 | 13.0<br>+0.7/-0.3 |
| W <sub>1</sub> | 8.4<br>+1.5/-0                     | 12.4<br>+2.0/-0   | 8.4<br>+2.0/-0    |
| A              | 178.0<br>±0.10                     | 178.0<br>±0.10    | 330.0<br>±1.0     |
| N              | 60.0<br>+1.0/-0                    | 80.0<br>±1.0      | 100<br>±1.0       |

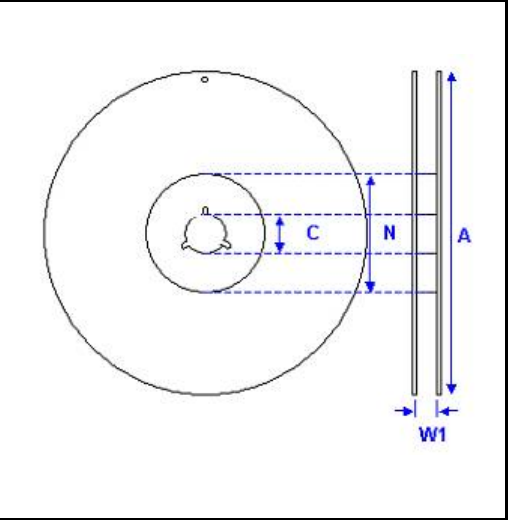
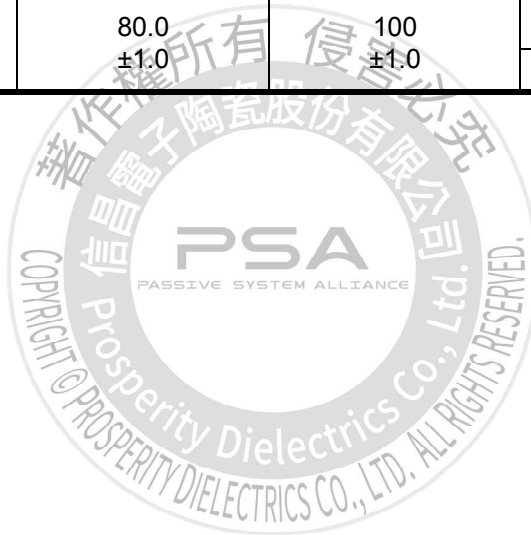


Fig. 9.3 The dimension of reel



**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.

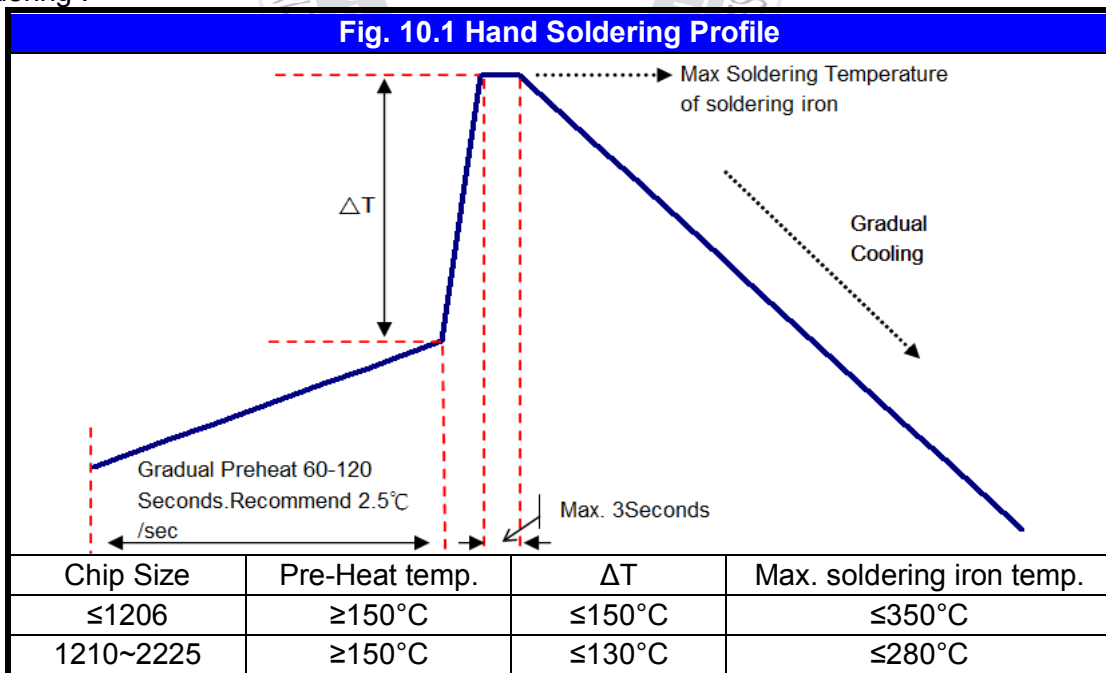
**PREHEAT**

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 :

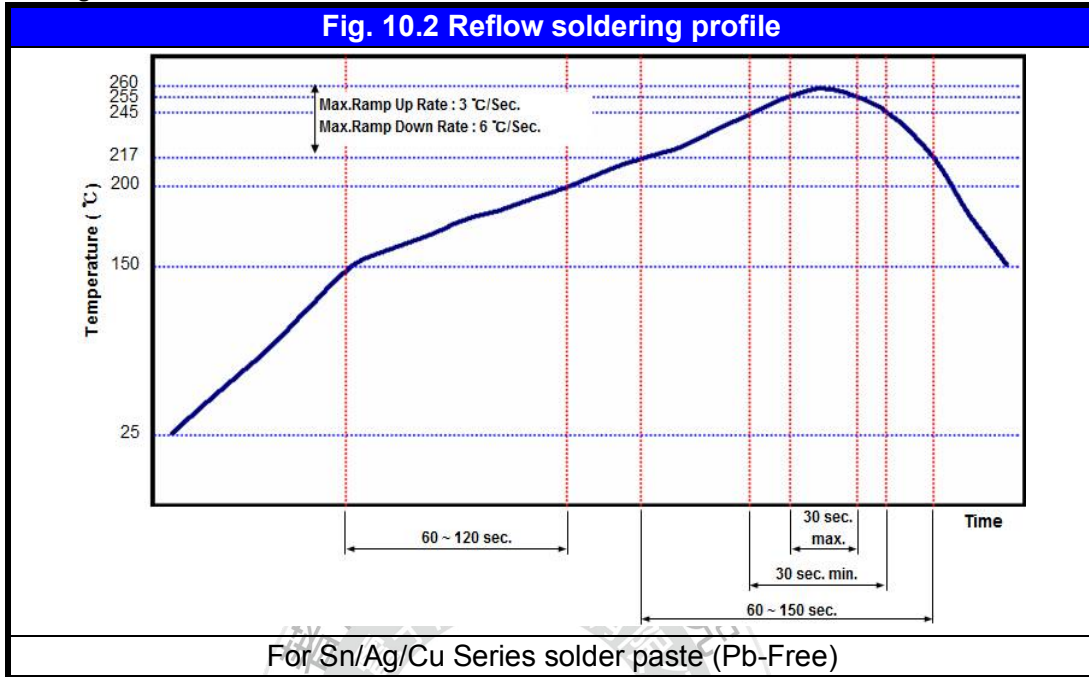


- \* Soldering iron tip diameter  $\leq 1.0$  mm and wattage max. 20W.
- \* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
- \* The required amount of solder shall be melted on the soldering tip.
- \* The tip of iron should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

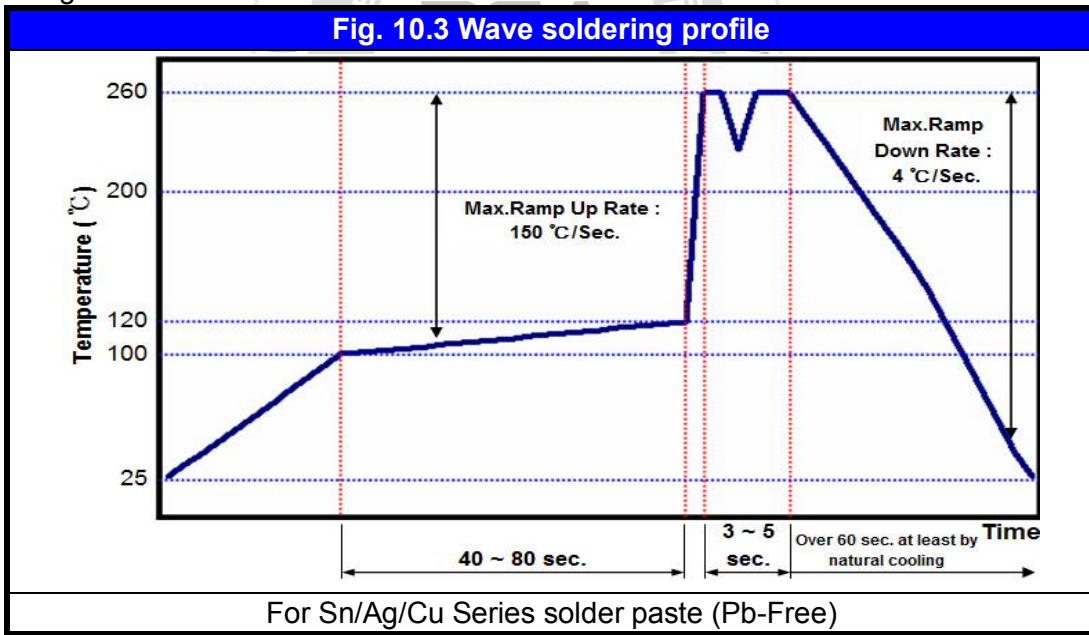


**10. APPLICATION NOTES**

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

| Size Inch (mm) | Temper. 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 indicates the 'Chip Thickness'. A horizontal double-headed arrow indicates the 'Soldering Height', which is the height of the solder bridge between the chip and the substrate.

**COOLING**

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

**CLEANING**

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

**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.