

## Data Sheet

**Customer:**

**Product:** Open-Mode Design MLCC – OP Series

**Size.:** 0603/0805/1206/1210/1812

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## Open-Mode Design MLCC

### Feature

- There is high reliability on monolithic structure of laminated layers.
- And its character of excellent soldering ability and soldering resistance ability is suitable for reflow soldering and peak soldering.
- It includes high and stable capacitance.
- Open circuit during capacitor cracking can protect the circuit.
- This type of capacitor adopts special inner electrode designs as fig.2 and fig.3 below
- Executive Standard: GH/T 21041-2007, GH/T 21042-2007

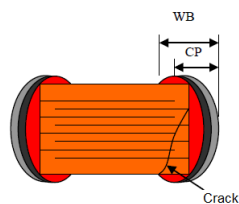


Fig.1 Normal design (CP<WB) circuit leakage during cracking.

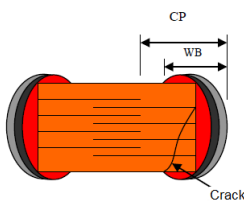


Fig.2 Open-mode design (CP>WB) circuit open during cracking.

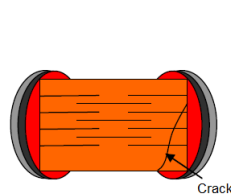
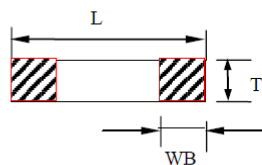
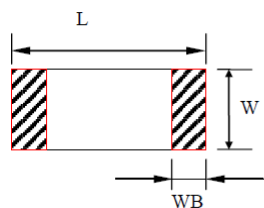


Fig.3 Floating design circuit open during cracking.

### Dimensions



| Type | Size (Inch) | L (mm)    | W (mm)    | T/Symbol (mm) |   | WB (mm)   |
|------|-------------|-----------|-----------|---------------|---|-----------|
| 03   | 0603        | 1.60±0.10 | 0.80±0.10 | 0.80±0.10     | H | 0.35±0.20 |
| 05   | 0805        | 2.00±0.20 | 1.25±0.25 | 0.80±0.20     | B | 0.50±0.20 |
|      |             |           |           | 1.25±0.25     | J |           |
| 06   | 1206        | 3.20±0.30 | 1.60±0.30 | 0.80±0.20     | B | 0.60±0.30 |
|      |             |           |           | 1.25±0.25     | J |           |
|      |             |           |           | 1.60±0.30     | L |           |
| 10   | 1210        | 3.20±0.30 | 2.50±0.30 | 1.25±0.25     | J | 0.60±0.30 |
|      |             |           |           | 1.60±0.30     | L |           |
|      |             |           |           | 2.00±0.30     | S |           |
| 12   | 1812        | 4.50±0.40 | 3.20±0.30 | 1.25±0.25     | J | 0.60±0.30 |
|      |             |           |           | 1.60±0.30     | L |           |
|      |             |           |           | 2.00±0.30     | S |           |
|      |             |           |           | 2.50±0.30     | O |           |

### Temperature Coefficient /Characteristics

| Dielectric | Reference Temperature Point | Temperature Coefficient | Operation Temperature Range |
|------------|-----------------------------|-------------------------|-----------------------------|
| NPO        | 25°C                        | 0±30 ppm/°C             | -55°C ~125°C                |
| X7R        | 25°C                        | ±15%                    | -55°C ~125°C                |

## Part Numbering

| OP           | 05                                                       | K                                                                                                                                                  | T              | B                     | 201                                              | 331                                      |
|--------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------|--------------------------------------------------|------------------------------------------|
| Product Type | Dimensions (L×W)                                         | Capacitance Tolerance                                                                                                                              | Packaging      | Dielectric            | Voltage                                          | Capacitance                              |
|              | 03: 0603<br>05: 0805<br>06: 1206<br>10: 1210<br>12: 1812 | A: ±0.05pF (Cap≤10pF)<br>B: ±0.1pF (Cap≤10pF)<br>C: ±0.25pF (Cap≤10pF)<br>D: ±0.5pF (Cap≤10pF)<br>F: ±1%<br>G: ±2%<br>J: ±5%<br>K: ±10%<br>M: ±20% | T: Taping Reel | N: NPO(COG)<br>B: X7R | 6V3: 6.3V<br>100: 10V<br>101: 100V<br>102: 1000V | 331: 330pF<br>102: 1000pF<br>222: 2200pF |

## General Capacitance & Voltage

Capacitance & Voltage (NPO 50V~2000V)

| Dielectric |       | NPO  |      |      |      |      |      |      |      |      |       |      |      |      |      |      |      |       |       |
|------------|-------|------|------|------|------|------|------|------|------|------|-------|------|------|------|------|------|------|-------|-------|
| EIA        | Size  | 0603 |      |      |      | 0805 |      |      |      |      |       | 1206 |      |      |      |      |      |       |       |
| Code       | VDCW  | 50V  | 100V | 200V | 250V | 50V  | 100V | 200V | 250V | 500V | 1000V | 50V  | 100V | 200V | 250V | 500V | 630V | 1000V | 2000V |
| 0R1        | 0.1pF | H    |      |      |      |      |      |      |      |      |       |      |      |      |      |      |      |       |       |
| 0R3        | 0.3   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     |       |
| R47        | 0.47  | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     |       |
| 1R0        | 1.0   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     |       |
| 1R2        | 1.2   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     |       |
| 1R5        | 1.5   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     |       |
| 1R8        | 1.8   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     |       |
| 2R0        | 2.0   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 2R2        | 2.2   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 2R7        | 2.7   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 3R0        | 3.0   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 3R3        | 3.3   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 3R6        | 3.6   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 3R9        | 3.9   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 4R7        | 4.7   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 5R0        | 5.0   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 5R6        | 5.6   | H    |      |      |      | B    |      |      |      |      |       | B    |      |      |      | B    | J    | J     | J     |
| 6R8        | 6.8   | H    |      |      |      | B    |      |      |      | B    |       | B    |      |      |      | J    | J    | J     | J     |
| 8R0        | 8.0   | H    |      |      |      | B    |      |      |      | B    |       | B    |      |      |      | J    | J    | J     | J     |
| 8R2        | 8.2   | H    |      |      |      | B    |      |      |      | B    |       | B    |      |      |      | J    | J    | J     | J     |
| 100        | 10pF  | H    |      |      |      | B    | B    |      |      | J    | B     | B    |      |      |      | B    | J    | J     | J     |
| 120        | 12    | H    |      |      |      | B    | B    |      |      | B    | J     | B    |      |      |      | B/J* | J    | J     | J     |
| 150        | 15    | H    |      |      |      | B    | B    |      |      | B    | J     | B    |      |      |      | J    | J    | J     | J     |
| 180        | 18    | H    |      |      |      | B    | B    |      |      | B    | J     | B    |      |      |      | J    | J    | J     | J     |
| 220        | 22    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      |      |      | J    | J    | J     | J     |
| 270        | 27    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      | B    |      | J    | J    | J     | J     |
| 330        | 33    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      | B    |      | J    | J    | J     | J     |
| 390        | 39    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      | B    |      | B    | J    | J     | J     |
| 470        | 47    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      | B    |      | B/J* | J    | J     | J     |
| 560        | 56    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      | B    |      | J    | J    | J     | J     |
| 680        | 68    | H    | H    |      |      | B    | B    |      |      | B    | J     | B    |      | B    | B    | J    | J    | J     | L     |
| 820        | 82    |      |      |      |      |      |      |      |      |      |       | B    |      | B    | B    | J    | J    | J     | L     |
| 101        | 100pF | H    | H    | H    |      | B    | B    | B    | B    | B    | J     | B    |      | B    | B    | B    | J    | J     | L     |
| 121        | 120   | H    | H    | H    |      | B    | B    | B    | B    | B    | J     | B    |      | B    | B    | B    | J    | J     | L     |
| 151        | 150   | H    | H    | H    |      | B    | B    | B    | B    | B    | J     | B    |      | B    | B    | B/J* | J    | J     | L     |
| 181        | 180   | H    | H    | H    | H    | B    | B    | B    | B    | J    | J     | B    |      | B    | B    | B/J* | J    | J     | L     |
| 221        | 220   | H    | H    | H    | H    | B    | B    | B    | B    | J    |       | B    |      | B    | B    | B/J* | J    | J     | L     |
| 271        | 270   | H    | H    | H    | H    | B    | B    | B    | B    | J    |       | B    |      | B    | B    | J    | J    | J     |       |
| 331        | 330   | H    | H    | H    | H    | B    | B    | B    | B    | J    |       | B    | B    | B    | B    | J    | J    | J     |       |
| 391        | 390   | H    | H    | H    |      | B    | B    | B    | B    | J    |       | B    | B    | B    | B    | J    | J    | J     |       |
| 471        | 470   | H    | H    | H    |      | B    | B    | B    | B    | J    |       | B    | B    | B    | B    | J    | J    | J     |       |
| 561        | 560   | H    | H    |      |      | B    | B    | B    | B    |      |       | B    | B    | B    | B    | J    | J    | L     |       |
| 681        | 680   | H    | H    |      |      | B    | B    | B    | B    |      |       | B    | B    | B    | B    | J/L* | J    | L     |       |
| 821        | 820   |      |      |      |      |      |      |      |      |      |       | B    | B    | B    | B    | L    | J    |       |       |
| 102        | 1nF   | H    | H    |      |      | B    | B    | B    | B    |      |       | B    | B    | B    | B    | L    | L    |       |       |
| 122        | 1.2   |      |      |      |      |      |      |      |      |      |       | B    | B    |      |      | L    |      |       |       |

| Dielectric |      | NPO  |      |      |      |      |      |      |      |      |       |     |      |      |      |      |      |       |       |
|------------|------|------|------|------|------|------|------|------|------|------|-------|-----|------|------|------|------|------|-------|-------|
| EIA        | Size | 0603 |      |      |      | 0805 |      |      |      | 1206 |       |     |      |      |      |      |      |       |       |
| Code       | VDCW | 50V  | 100V | 200V | 250V | 50V  | 100V | 200V | 250V | 500V | 1000V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 2000V |
| 152        | 1.5  |      |      |      |      | B    | B    |      |      |      |       | B   | B    |      |      | L    |      |       |       |
| 182        | 1.8  |      |      |      |      | B    | B    |      |      |      |       | B   | B    |      |      |      |      |       |       |
| 222        | 2.2  |      |      |      |      | B    | B    |      |      |      |       | B   | B    |      |      |      |      |       |       |
| 272        | 2.7  |      |      |      |      |      |      |      |      |      |       | B   |      |      |      |      |      |       |       |
| 332        | 3.3  |      |      |      |      |      |      |      |      |      |       | B   |      |      |      |      |      |       |       |

■The letter in cell is expressed the symbol of product thickness

■Add "\*" as special product.

## ■General Capacitance & Voltage

Capacitance & Voltage (NPO 50V~2000V)

| Dielectric |       | NPO  |      |      |      |      |      |       |       |      |      |      |      |
|------------|-------|------|------|------|------|------|------|-------|-------|------|------|------|------|
| EIA        | Size  | 1210 |      |      |      |      |      |       |       | 1812 |      |      |      |
| Code       | VDCW  | 50V  | 100V | 200V | 250V | 500V | 630V | 1000V | 2000V | 50V  | 100V | 200V | 250V |
| 100        | 10pF  | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 120        | 12    | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 150        | 15    | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 180        | 18    | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 220        | 22    | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 270        | 27    | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 330        | 33    | J    |      | J    | J    | J    |      |       |       | J    |      |      |      |
| 390        | 39    | J    |      | J    | J    | J    |      |       | J     | J    |      |      |      |
| 470        | 47    | J    |      | J    | J    | J    |      |       | J*/L  | J    |      |      |      |
| 560        | 56    | J    |      | J    | J    | J    |      |       | J*/L  | J    | J    |      |      |
| 680        | 68    | J    |      | J    | J    | J    |      |       | J*/L  | J    | J    |      |      |
| 820        | 82    | J    |      | J    | J    | J    |      |       | J*/L  | J    | J    |      |      |
| 101        | 100pF | J    | J    | J    | J    | J    | J    | J*/L  | L     | J    | J    |      |      |
| 121        | 120   | J    | J    | J    | J    | J    | L    | S     | L     | J    | J    |      |      |
| 151        | 150   | J    | J    | J    | J    | J    | L    | S     | L     | J    | J    |      |      |
| 181        | 180   | J    | J    | J    | J    | J    | L    | S     | L     | J    | J    |      |      |
| 221        | 220   | J    | J    | J    | J    | J    | L    | S     | L     | J    | J    |      | J    |
| 271        | 270   | J    | J    | J    | J    | J    | L    | S     | L     | J    | J    |      | J    |
| 331        | 330   | J    | J    | J    | J    | J    | L    | S     | S     | J    | J    |      | J    |
| 391        | 390   | J    | J    | J    | J    | J    | L    | S     |       | J    | J    |      | J    |
| 471        | 470   | J    | J    | J    | J    | J    | L    | L*/S  |       | J    | J    |      | J    |
| 561        | 560   | J    | J    | J    | J    | J    | L    | L     |       | J    | J    |      | J    |
| 681        | 680   | J    | J    | J    | J    | J    | L    | L     |       | J    | J    |      | J    |
| 821        | 820   | J    | J    | J    | J    | J    | L    | L*/S  |       | J    | J    |      | J    |
| 102        | 1nF   | J    | J    | J    | J    | L    | S    | L*/S  |       | J    | J    |      | J    |
| 152        | 1.5   | J    | J    | J    | J    | L    |      |       |       | J    | J*/L |      | L    |
| 182        | 1.8   | J    | J    | J    | J    | L    |      |       |       | J    | J*/L |      | L    |
| 222        | 2.2   | J    | J    |      |      |      |      |       |       | J    | J*/L |      | L    |
| 272        | 2.7   | J    | J    |      |      |      |      |       |       | J    | J*/L |      | L    |
| 332        | 3.3   | J    | J    |      |      |      |      |       |       | J    | J*/L |      | L    |
| 392        | 3.9   | J    | J    |      |      |      |      |       |       | J    | J*/L | L    | L    |
| 472        | 4.7   |      |      |      |      |      |      |       |       | J    | J*/L | L    | L    |
| 562        | 5.6   |      |      |      |      |      |      |       |       | J    |      |      |      |
| 682        | 6.8   |      |      |      |      |      |      |       |       | J    |      |      |      |
| 822        | 8.2   |      |      |      |      |      |      |       |       | J    |      |      |      |
| 103        | 10nF  |      |      |      |      |      |      |       |       | J    |      |      |      |

■The letter in cell is expressed the symbol of product thickness

■Add "\*" as special product.

## ■ General Capacitance & Voltage

Capacitance & Voltage (X7R 6.3V~500V)

| Dielectric |       | X7R   |     |     |     |     |      |      |      |       |     |     |     |     |      |      |      |      |   |
|------------|-------|-------|-----|-----|-----|-----|------|------|------|-------|-----|-----|-----|-----|------|------|------|------|---|
| EIA        | Size  | 0603  |     |     |     |     |      |      |      | 0805  |     |     |     |     |      |      |      |      |   |
| Code       | VDCW  | ≤6.3V | 10V | 16V | 25V | 50V | 100V | 200V | 250V | ≤6.3V | 10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V |   |
| 101        | 100pF | H     | H   | H   | H   | H   | H    | H    |      |       |     |     |     |     |      |      |      |      |   |
| 121        | 120   | H     | H   | H   | H   | H   | H    | H    |      |       |     |     |     |     |      |      |      |      |   |
| 151        | 150   | H     | H   | H   | H   | H   | H    | H    |      |       |     |     |     |     |      |      |      |      |   |
| 181        | 180   | H     | H   | H   | H   | H   | H    | H    |      |       |     |     |     |     |      |      |      |      |   |
| 201        | 200   |       |     |     |     |     |      |      |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 221        | 220   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 271        | 270   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 331        | 330   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 391        | 390   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 471        | 470   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 561        | 560   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 681        | 680   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 821        | 820   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | B    |   |
| 102        | 1nF   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 122        | 1.2   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 152        | 1.5   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 182        | 1.8   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 222        | 2.2   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 272        | 2.7   | H     | H   | H   | H   | H   | H    | H    |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 332        | 3.3   | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 392        | 3.9   | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 472        | 4.7   | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 562        | 5.6   | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 682        | 6.8   | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 822        | 8.2   | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 103        | 10nF  | H     | H   | H   | H   | H   | H    | H    | H    | B     | B   | B   | B   | B   | B    | B    | J    | J    | J |
| 123        | 12    | H     | H   | H   | H   | H   | H    |      |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 153        | 15    | H     | H   | H   | H   | H   | H    |      |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 183        | 18    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 223        | 22    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 273        | 27    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | B    | J    | J    |   |
| 333        | 33    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    | J    | J    |   |
| 393        | 39    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    |      |      |   |
| 473        | 47    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    |      |      |   |
| 563        | 56    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    |      |      |   |
| 683        | 68    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    |      |      |   |
| 823        | 82    | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    |      |      |   |
| 104        | 100nF | H     | H   | H   | H   | H   |      |      |      | B     | B   | B   | B   | B   | B    | J    |      |      |   |
| 124        | 120   | H     |     |     |     |     |      |      |      |       |     |     |     |     |      |      |      |      |   |
| 154        | 150   | H     |     |     |     |     |      |      |      |       |     |     |     |     |      |      |      |      |   |
| 184        | 180   | H     |     |     |     |     |      |      |      |       |     |     |     |     |      |      |      |      |   |
| 224        | 220   | H     |     |     |     |     |      |      |      | B     | B   | B   |     |     |      |      |      |      |   |
| 274        | 270   | H     |     |     |     |     |      |      |      | B     | B   |     |     |     |      |      |      |      |   |
| 334        | 330   | H     |     |     |     |     |      |      |      | B     | B   |     |     |     |      |      |      |      |   |
| 394        | 390   | H     |     |     |     |     |      |      |      | B     | B   |     |     |     |      |      |      |      |   |
| 474        | 470   | H     |     |     |     |     |      |      |      | J     | J   |     |     |     |      |      |      |      |   |
| 564        | 560   |       |     |     |     |     |      |      |      | J     |     |     |     |     |      |      |      |      |   |
| 684        | 680   |       |     |     |     |     |      |      |      | J     |     |     |     |     |      |      |      |      |   |
| 824        | 820   |       |     |     |     |     |      |      |      | J     |     |     |     |     |      |      |      |      |   |
| 105        | 1uF   |       |     |     |     |     |      |      |      | J     |     |     |     |     |      |      |      |      |   |

■ The letter in cell is expressed the symbol of product thickness

## General Capacitance & Voltage

Capacitance & Voltage (X7R 10V~2000V)

| Dielectric |       | X7R  |     |     |     |      |      |      |      |      |       |       |
|------------|-------|------|-----|-----|-----|------|------|------|------|------|-------|-------|
| EIA        | Size  | 1206 |     |     |     |      |      |      |      |      |       |       |
| Code       | VDCW  | ≤10V | 16V | 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 2000V |
| 201        | 200pF | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 221        | 220   | B    | B   | B   | B   | B    | B    | B    | B    | B    | B*/J  | J     |
| 271        | 270   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 331        | 330   | B    | B   | B   | B   | B    | B    | B    | B    | B    | B*/J  | J     |
| 391        | 390   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 471        | 470   | B    | B   | B   | B   | B    | B    | B    | B    | B    | B*/J  | J     |
| 561        | 560   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 681        | 680   | B    | B   | B   | B   | B    | B    | B    | B    | B    | B*/J  | J     |
| 821        | 820   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 102        | 1nF   | B    | B   | B   | B   | B    | B    | B    | B    | B    | B*/J  | J     |
| 122        | 1.2   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 152        | 1.5   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 182        | 1.8   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 222        | 2.2   | B    | B   | B   | B   | B    | B    | B    | B    | B    | J     | J     |
| 272        | 2.7   | B    | B   | B   | B   | B    | B    | B    | B*/J | B*/J | J     | J     |
| 332        | 3.3   | B    | B   | B   | B   | B    | B    | B    | B*/J | B*/J | J     | J     |
| 472        | 4.7   | B    | B   | B   | B   | B    | B    | B    | J    | J    | J     |       |
| 562        | 5.6   | B    | B   | B   | B   | B    | B    | B    | J    | J    | J     |       |
| 682        | 6.8   | B    | B   | B   | B   | B    | B    | B    | J    | J    | J*/L  |       |
| 822        | 8.2   | B    | B   | B   | B   | B    | B    | B    | J    | J    | J     |       |
| 103        | 10nF  | B    | B   | B   | B   | B    | B    | B    | J    | J    | J     |       |
| 123        | 12    | B    | B   | B   | B   | B    | B    | B    | J    | J    |       |       |
| 153        | 15    | B    | B   | B   | B   | B    | B    | B    | J    | J    |       |       |
| 183        | 18    | B    | B   | B   | B   | B    | B    | B    | J    | J    |       |       |
| 223        | 22    | B    | B   | B   | B   | B    | B/J* | B/J* | J    | J    |       |       |
| 333        | 33    | B    | B   | B   | B   | B/J* | J    | J    | J    | J    |       |       |
| 473        | 47    | B    | B   | B   | B   | B/J* | J    | J    | J    | J    |       |       |
| 563        | 56    | B    | B   | B   | B   |      |      |      |      |      |       |       |
| 683        | 68    | B    | B   | B   | B   |      |      |      |      |      |       |       |
| 823        | 82    | B    | B   | B   | B   |      |      |      |      |      |       |       |
| 104        | 100nF | B    | B   | B   | B   |      |      |      |      |      |       |       |
| 224        | 220   | B    | B   | B   | B   |      |      |      |      |      |       |       |
| 334        | 330   | J    | J   | J   | J   |      |      |      |      |      |       |       |
| 474        | 470   | J    | J   | J   | J   |      |      |      |      |      |       |       |
| 684        | 680   | J    | J   | J   | J   |      |      |      |      |      |       |       |
| 824        | 820   | J    | J   | J   | J   |      |      |      |      |      |       |       |
| 105        | 1uF   | L    | L   | L   | L   |      |      |      |      |      |       |       |
| 125        | 1.2   | L    |     |     |     |      |      |      |      |      |       |       |
| 155        | 1.5   | L    |     |     |     |      |      |      |      |      |       |       |
| 185        | 1.8   | L    |     |     |     |      |      |      |      |      |       |       |
| 225        | 2.2   | L    |     |     |     |      |      |      |      |      |       |       |
| 335        | 3.3   | L    |     |     |     |      |      |      |      |      |       |       |
| 475        | 4.7   | L    |     |     |     |      |      |      |      |      |       |       |
| 565        | 5.6   | L    |     |     |     |      |      |      |      |      |       |       |
| 685        | 6.8   | L    |     |     |     |      |      |      |      |      |       |       |
| 825        | 8.2   | L    |     |     |     |      |      |      |      |      |       |       |
| 106        | 10uF  | L    |     |     |     |      |      |      |      |      |       |       |
| 126        | 12    | L    |     |     |     |      |      |      |      |      |       |       |
| 156        | 15    | L    |     |     |     |      |      |      |      |      |       |       |
| 186        | 18    | L    |     |     |     |      |      |      |      |      |       |       |
| 226        | 22    | L    |     |     |     |      |      |      |      |      |       |       |

■The letter in cell is expressed the symbol of product thickness

■Add "\*" as special product.

## General Capacitance & Voltage

Capacitance & Voltage (X7R 16V~2000V)

| Dielectric |       | X7R  |     |     |      |      |      |      |      |       |       |
|------------|-------|------|-----|-----|------|------|------|------|------|-------|-------|
| EIA        | Size  | 1210 |     |     |      |      |      |      |      |       |       |
| Code       | VDCW  | ≤16V | 25V | 50V | 100V | 200V | 250V | 500V | 630V | 1000V | 2000V |
| 221        | 220pF | J    | J   | J   |      |      |      |      |      | J     | J     |
| 271        | 270   | J    | J   | J   |      |      |      |      |      | J     | L     |
| 331        | 330   | J    | J   | J   |      |      |      |      |      | J     | L     |
| 391        | 390   | J    | J   | J   |      |      |      |      |      | J     | L     |
| 471        | 470   | J    | J   | J   |      |      |      |      |      | J     | L     |
| 561        | 560   | J    | J   | J   |      |      |      |      |      | J     | L     |
| 681        | 680   | J    | J   | J   |      |      |      |      | J    | J     | L     |
| 821        | 820   | J    | J   | J   |      |      |      |      | J    | J     | L     |
| 102        | 1nF   | J    | J   | J   |      |      | J    |      | J    | J     | L     |
| 122        | 1.2   | J    | J   | J   |      |      | J    |      | J    | J     | L     |
| 152        | 1.5   | J    | J   | J   |      |      | J    |      | J    | J     | L     |
| 182        | 1.8   | J    | J   | J   |      |      | J    |      | J    | J     | L     |
| 222        | 2.2   | J    | J   | J   |      |      | J    |      | J    | J     | L     |
| 272        | 2.7   | J    | J   | J   |      |      | J    |      | J    | J     | L     |
| 332        | 3.3   | J    | J   | J   |      |      | J    | J    | J    | J     | J     |
| 392        | 3.9   | J    | J   | J   |      |      | J    | J    | J    | J     | J     |
| 472        | 4.7   | J    | J   | J   | J    |      | J    | J    | J    | J/L*  | L     |
| 562        | 5.6   | J    | J   | J   | J    |      | J    | J    | J    | J/L*  | L     |
| 682        | 6.8   | J    | J   | J   | J    |      | J    | J    | J    | J*/L  | L     |
| 822        | 8.2   | J    | J   | J   | J    |      | J    | J    | J    | J*/L  | L     |
| 103        | 10nF  | J    | J   | J   | J    |      | J    | J    | J    | J*/L  | L     |
| 123        | 12    | J    | J   | J   | J    |      | J    | J    | J    | L     |       |
| 153        | 15    | J    | J   | J   | J    |      | J    | J    | J    | L     |       |
| 183        | 18    | J    | J   | J   | J    |      | J    | J    | J    | L     |       |
| 223        | 22    | J    | J   | J   | J    |      | J    | J    | J    | L     |       |
| 273        | 27    | J    | J   | J   | J    |      | J    | J    | J    |       |       |
| 333        | 33    | J    | J   | J   | J    |      | J    | J/L* | J/L  |       |       |
| 393        | 39    | J    | J   | J   | J    |      | J    | J/L* | J/L* |       |       |
| 473        | 47    | J    | J   | J   | J    | J    | J    |      |      |       |       |
| 563        | 56    | J    | J   | J   | J    |      |      |      |      |       |       |
| 683        | 68    | J    | J   | J   | J    |      |      |      |      |       |       |
| 823        | 82    | J    | J   | J   | J    |      |      |      |      |       |       |
| 104        | 100nF | J    | J   | J   | J    |      |      |      |      |       |       |
| 124        | 120   | J    | J   | J   | J    |      |      |      |      |       |       |
| 154        | 150   | J    | J   | J   | J    |      |      |      |      |       |       |
| 184        | 180   | J    | J   | J   | J    |      |      |      |      |       |       |
| 224        | 220   | L    | L   | L   | L    |      |      |      |      |       |       |
| 274        | 270   | S    | S   | S   |      |      |      |      |      |       |       |
| 334        | 330   | S    | S   | S   |      |      |      |      |      |       |       |
| 394        | 390   | S    | S   | S   |      |      |      |      |      |       |       |
| 474        | 470   | S    | S   | S   |      |      |      |      |      |       |       |
| 564        | 560   | S    | S   | S   |      |      |      |      |      |       |       |
| 684        | 680   | S    | S   | S   |      |      |      |      |      |       |       |
| 824        | 820   | S    | S   | S   |      |      |      |      |      |       |       |
| 105        | 1uF   | S    | S   | S   |      |      |      |      |      |       |       |
| 125        | 1.2   | S    | S   | S   |      |      |      |      |      |       |       |
| 155        | 1.5   | S    | S   | S   |      |      |      |      |      |       |       |
| 185        | 1.8   | S    | S   | S   |      |      |      |      |      |       |       |
| 225        | 2.2   | S    | S   | S   |      |      |      |      |      |       |       |
| 335        | 3.3   | S    | S   | S   |      |      |      |      |      |       |       |
| 475        | 4.7   | S    | S   | S   |      |      |      |      |      |       |       |

■ The letter in cell is expressed the symbol of product thickness

■ Add "\*" as special product.

## ■General Capacitance & Voltage

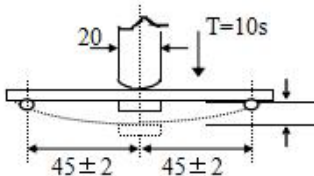
Capacitance & Voltage (X7R 100V~5000V)

| Dielectric |       | X7R  |      |      |      |      |       |       |       |       |       |
|------------|-------|------|------|------|------|------|-------|-------|-------|-------|-------|
| EIA        | Size  | 1812 |      |      |      |      |       |       |       |       |       |
| Cod e      | VDCW  | 100V | 200V | 250V | 500V | 630V | 1000V | 2000V | 3000V | 4000V | 5000V |
| 471        | 470pF |      |      |      |      |      | L     | L     | L     | L     |       |
| 561        | 560   |      |      |      |      |      | L     | L     | L     | L     |       |
| 681        | 680   |      |      | L    |      |      | L     | L     | L     | L     |       |
| 821        | 820   |      |      | L    |      |      | L     | L     | L     | L     |       |
| 102        | 1nF   |      | L    | L    |      |      | L     | L     | L     | L     |       |
| 122        | 1.2   |      | L    | L    |      |      | L     | L     | L     | L     |       |
| 152        | 1.5   |      | L    | L    |      |      | L     | L     | L     | L     |       |
| 182        | 1.8   |      | L    | L    | L    |      | L     | L     | L     | L     |       |
| 222        | 2.2   |      | L    | L    | L    |      | L     | L     | L/S*  | L     | L/S*  |
| 272        | 2.7   |      | L    | L    | L    |      | L     | L     | L     | L     |       |
| 332        | 3.3   |      | L    | L    | L    |      | L     | L     | L     | L     |       |
| 472        | 4.7   |      | L    | L    | L    |      | L     | L     | L     |       |       |
| 562        | 5.6   |      | L    | L    | L    |      | L     | L     | L/O*  |       |       |
| 682        | 6.8   |      | L    | L    | L    |      | L     | L     | L/O*  |       |       |
| 822        | 8.2   |      | L    | L    | L    |      | L     | L     | L/O*  |       |       |
| 103        | 10nF  | J    | L    | L    | L    |      | L     | L     | O     |       |       |
| 123        | 12    | J    | L    | L    | L    |      | L     | L     |       |       |       |
| 153        | 15    | J    | L    | L    | L    |      | L     | L     |       |       |       |
| 183        | 18    | J    | L    | L    | L    |      | L     | O     |       |       |       |
| 223        | 22    | J    | L    | L    | L    | L    | L     |       |       |       |       |
| 273        | 27    | J    | L    | L    | J    | L    | L     |       |       |       |       |
| 333        | 33    | J    | L    | L    | J    | L    | L     |       |       |       |       |
| 473        | 47    | J    | L    | L    | L    | L    | L     |       |       |       |       |
| 563        | 56    | J    | L    | L    | L    | L    | O     |       |       |       |       |
| 683        | 68    | J    | L    | L    | L    | L    |       |       |       |       |       |
| 823        | 82    | J    | L    | L    | L    | L    |       |       |       |       |       |
| 104        | 100nF | J    | L    | L    | L    | L    |       |       |       |       |       |
| 124        | 120   | J    | L    | L    | L    | S    |       |       |       |       |       |
| 154        | 150   | J    | L    | L    | S    | S    |       |       |       |       |       |
| 184        | 180   | J    | L    | L    | S    | S    |       |       |       |       |       |
| 224        | 220   | J    | L/S* | L/S* |      |      |       |       |       |       |       |
| 274        | 270   | J    | L/S* | L/S* |      |      |       |       |       |       |       |
| 334        | 330   | J    | S    | S    |      |      |       |       |       |       |       |
| 394        | 390   | J    | S    | O    |      |      |       |       |       |       |       |
| 474        | 470   | J    | S*/O | S*/O |      |      |       |       |       |       |       |
| 564        | 560   | J    |      |      |      |      |       |       |       |       |       |
| 684        | 680   | S    |      |      |      |      |       |       |       |       |       |
| 824        | 820   | S    |      |      |      |      |       |       |       |       |       |
| 105        | 1uF   | S    |      |      |      |      |       |       |       |       |       |

■The letter in cell is expressed the symbol of product thickness

■Add "\*" as special product

## Environmental Characteristics

| Item                                                  | Requirement                                                                                                                |                                                                                   |                                                                                                                                            | Test Method                                                                                                                                                                                                                                   |                                                                                                                      |             |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------|
| Capacitance                                           | NPO                                                                                                                        | Should be within the specified tolerance                                          | Capacitance                                                                                                                                | Measuring Frequency                                                                                                                                                                                                                           | Measuring Voltage                                                                                                    |             |
|                                                       |                                                                                                                            |                                                                                   | ≤1000pF                                                                                                                                    | 1MHZ±10%                                                                                                                                                                                                                                      | 1.0±0.2Vrms                                                                                                          |             |
|                                                       |                                                                                                                            |                                                                                   | > 1000pF                                                                                                                                   |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       | X7R                                                                                                                        | Test Temperature: 25℃±3℃<br>Test Frequency: 1KHZ±10%<br>Test Voltage: 1.0±0.2Vrms |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
| (DF, tanδ)<br>Dissipation Factor                      | NPO                                                                                                                        | DF                                                                                | Capacitance                                                                                                                                | Measuring Frequency                                                                                                                                                                                                                           | Measuring Voltage                                                                                                    |             |
|                                                       |                                                                                                                            | ≤1/ ( 400+20C )                                                                   | C < 30 pF                                                                                                                                  | 1MHZ±10%                                                                                                                                                                                                                                      | 1.0±0.2Vrms                                                                                                          |             |
|                                                       |                                                                                                                            | ≤0.1%                                                                             | C≥30pF                                                                                                                                     |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       | X7R                                                                                                                        | <50V: ≤5%<br>≥50V: ≤2.5%                                                          | Test Frequency: 1KHZ±10%Test ≥50V Voltage: 1.0±0.2Vrms                                                                                     |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
| Insulation Resistance(IR)                             | NPO                                                                                                                        | C≤10 nF, Ri≥50000MΩ<br>C > 10 nF, Ri·CR≥500S                                      | Measuring Voltage: Rated Voltage ( Max 500V )<br>Duration: 60±5s<br>Test Humidity: ≤75%<br>Test Temperature: 25℃±3℃<br>Test Current: ≤50mA |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       | X7R                                                                                                                        | C≤25 nF, Ri≥ 10000MΩ<br>C > 25 nF, Ri · CR > 100S                                 |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
| Dielectric Withstanding Voltage(DWV)                  | No breakdown or damage.                                                                                                    |                                                                                   |                                                                                                                                            | Ur < 100V                                                                                                                                                                                                                                     | Measuring Voltage:<br>I class:300% Ur<br>II class :250% Ur<br>Duration: 1~5s<br>Charge/ Discharge Current: 50mA max. |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 100V≤Ur < 500V                                                                                                                                                                                                                                | Force 200%Rated Voltage for 5 second.<br>Max..current should not exceed 50 mA.                                       |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 500V≤Ur≤1000V                                                                                                                                                                                                                                 | Force 150%Rated Voltage for 5 second.<br>Max..current should not exceed 50 mA.                                       |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 1000V < Ur≤2000V                                                                                                                                                                                                                              | Force 120%Rated Voltage for 5 seconds.<br>Max..current should not exceed 50 mA.                                      |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 2000V < Ur≤5000V                                                                                                                                                                                                                              | Force 120%Rated Voltage for 5 seconds.<br>Max..current should not exceed 10 mA.                                      |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
| Solderability                                         | At least 95% of the terminal electrode is covered by new solder.<br>Visual Appearance: No visible damage.                  |                                                                                   |                                                                                                                                            | Preheating conditions:80 to 120℃; 10~30s.<br>Lead-free soldering<br>Solder Temperature: 245±5℃<br>Duration: 2±0.5s                                                                                                                            |                                                                                                                      |             |
| Resistance to Soldering Heat                          | Item                                                                                                                       | NPO                                                                               | X7R                                                                                                                                        | Preheating conditions: 100 to 200℃; 60-120S.<br>Solder Temperature: 265±5℃<br>Duration: 10±1s<br>Clean the capacitor with solvent and examine it with a 10X(min.) microscope.<br>Recovery Time: 24±2h<br>Recovery condition: Room temperature |                                                                                                                      |             |
|                                                       | ΔC/C                                                                                                                       | ≤±2.5% or ±0.25PF ,<br>whichever is larger                                        | ± 15%                                                                                                                                      |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       | DF                                                                                                                         | Same to initial value                                                             |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       | IR                                                                                                                         | Same to initial value                                                             |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
|                                                       | Appearance : No visible damage. At least 95% of the terminal electrode is covered by new solder.                           |                                                                                   |                                                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |
| Resistance to Flexure of Substrate (Bending Strength) | Appearance: No visible damage.<br>ΔC/C:<br>Class I (NPO): ≤±5% or ±0.5pF,whichever is larger.<br>Class II (X7R): ≤±10%     |                                                                                   |                                                                                                                                            | Test Board: PCB Warp: 1mm<br>Speed: 1mm/sec. Unit: mm<br>The measurement should be made with the board in the bending position.                                                                                                               |                                                                                                                      |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            |                                                                                                                                                           |                                                                                                                      |             |
| Termination Adhesion                                  | No visible damage                                                                                                          |                                                                                   |                                                                                                                                            | Applied Force: 5N<br>Duration: 10±1S                                                                                                                                                                                                          |                                                                                                                      |             |
| Temperature Cycle                                     | ΔC/C:<br>Class I (NPO): ≤±1% or ±1pF, whichever is larger.<br>Class II (X7R): -15% ~+15%<br>Appearance : No visible damage |                                                                                   |                                                                                                                                            | Initial Measurement<br>Cycling Times: 5 times, 1 cycle, 4 steps:                                                                                                                                                                              |                                                                                                                      |             |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | Step                                                                                                                                                                                                                                          | Temperature (℃)                                                                                                      | Time (min.) |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 1                                                                                                                                                                                                                                             | Low- category temp.: -55                                                                                             | 30          |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 2                                                                                                                                                                                                                                             | Normal temp.: +20                                                                                                    | 2~3         |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 3                                                                                                                                                                                                                                             | Up- category temp.: +125                                                                                             | 30          |
|                                                       |                                                                                                                            |                                                                                   |                                                                                                                                            | 4                                                                                                                                                                                                                                             | Normal temp.: +20                                                                                                    | 2~3         |
|                                                       |                                                                                                                            |                                                                                   | Recovery time after test: 24±2h                                                                                                            |                                                                                                                                                                                                                                               |                                                                                                                      |             |

| Item          | Requirement                          |                                                                                                                                                                                                     | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Humidity load | $\Delta C/C$                         | NPO: $\pm 7.5\%$ or $\pm 0.75\text{pF}$ , whichever is larger.<br>X7R: $\leq \pm 12.5\%$                                                                                                            | Tretreatment (Class II) : After preheating at $140^{\circ}\text{C} \sim 150^{\circ}\text{C}$ for $1\text{h} \pm 10\text{min}$ , place at room temperature for $24 \pm 2\text{h}$ .<br>Temperature: $40 \pm 2^{\circ}\text{C}$<br>Humidity: 90–95%RH<br>Voltage: Rated Voltage<br>Duration: 500hs<br>Recovery conditions: Room temperature<br>Recovery Time : $:24\text{h} \pm 2\text{h}$                                                                                                                                                       |
|               | DF                                   | Not more than twice of initial value.                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|               | IR                                   | Class I : $R_i \geq 2500\text{M}\Omega$ or $R_i \cdot CR \geq 25\text{S}$ whichever is smaller<br>Class II : $R_i \geq 1000\text{M}\Omega$ or $R_i \cdot CR \geq 10\text{S}$ whichever is smaller   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|               | Appearance: No visible damage        |                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Life Test     | $\Delta C/C$                         | Class I : $\leq \pm 3\%$ or $\pm 0.3\text{pF}$ , whichever is larger.<br>X7R: $\leq \pm 20\%$                                                                                                       | Temperature: $125^{\circ}\text{C}$ (NPO、X7R)、Time: 1000h<br>Charge/Discharge: Current: 50mA max.<br>Applied Voltage: 1. Low Voltage products ( $< 100\text{V}$ )<br>2 times rated operating Voltage<br>2. Medium and high pressure products:<br>$100\text{V} \leq \text{Rated Voltage} \leq 200\text{V}$ : 1.5 Multiple<br>$200\text{V} < \text{Rated Voltage} \leq 500\text{V}$ : 1.3 Multiple<br>$500\text{V} < \text{Rated Voltage}$ : 1.2 Multiple<br>Recovery Conditions: Room Temperature<br>Recovery Time : $:24\text{h} \pm 2\text{h}$ |
|               | DF                                   | Not more than twice of initial value                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|               | IR                                   | Class I : $R_i \geq 4000\text{M}\Omega$ or $R_i \cdot CR \geq 40\text{S}$ whichever is smaller.<br>Class II : $R_i \geq 2000\text{M}\Omega$ or $R_i \cdot CR \geq 50\text{S}$ whichever is smaller. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|               | Visual Appearance: No visible damage |                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

■ Storage Temperature:  $5 \sim 40^{\circ}\text{C}$ ; Humidity: 20~70%RH

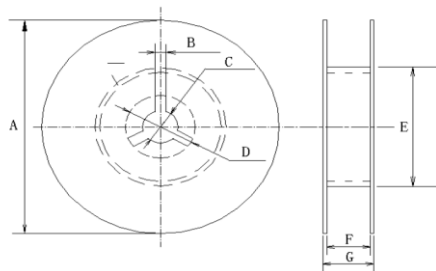
■ If it has been over six months since delivery, check the packaging and appearance before use. If it has been over a year, check the solderability before use.

## ■ Packaging

### Packaging Quantity

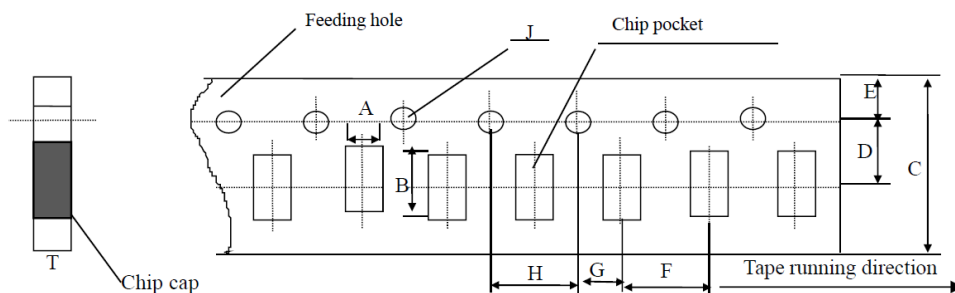
| Type | Thickness       | Packaging (7" Reel) |                                                     |
|------|-----------------|---------------------|-----------------------------------------------------|
|      |                 | Paper tape          | Plastic tape                                        |
| 0603 | $0.80 \pm 0.10$ | 4K                  | -                                                   |
| 0805 | $0.80 \pm 0.20$ | 4K                  | -                                                   |
|      | $1.25 \pm 0.25$ | -                   | $T \leq 1.35\text{mm}$ 3K<br>$T > 1.35\text{mm}$ 2K |
| 1206 | $0.80 \pm 0.20$ | 4K                  | -                                                   |
|      | $1.25 \pm 0.25$ | -                   | $T \leq 1.35\text{mm}$ 3K<br>$T > 1.35\text{mm}$ 2K |
|      | $1.60 \pm 0.30$ | -                   | 2K                                                  |
| 1210 | $1.25 \pm 0.25$ | -                   | 2K                                                  |
|      | $1.60 \pm 0.30$ | -                   | 1K                                                  |
|      | $2.00 \pm 0.30$ | -                   | 1K                                                  |
| 1812 | $1.25 \pm 0.25$ | -                   | 1K                                                  |
|      | $1.60 \pm 0.30$ | -                   | 0.5K                                                |
|      | $2.00 \pm 0.30$ | -                   | 0.5K                                                |
|      | $2.50 \pm 0.30$ | -                   | 0.5K                                                |

Tape and Reel



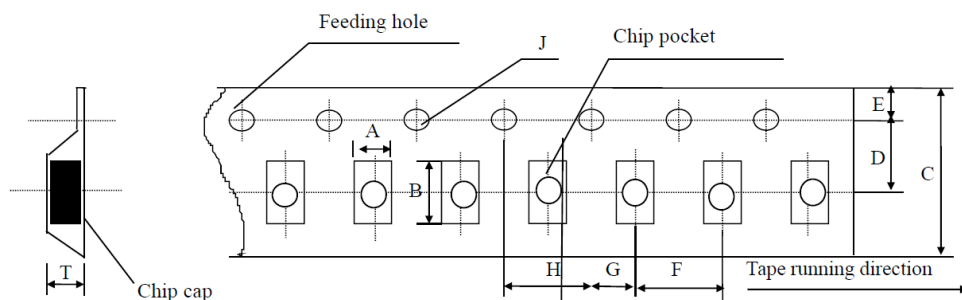
| Type | A (mm)      | B (mm) | C (mm)   | D (mm)   | E (mm)     | F (mm)   | G (mm) |
|------|-------------|--------|----------|----------|------------|----------|--------|
| 0603 | 178±2.0(7") | 3.0    | 13.0±0.5 | 21.0±0.8 | 50 or more | 10.0±1.5 | 12 max |
| 0805 | 178±2.0(7") | 3.0    | 13.0±0.5 | 21.0±0.8 | 50 or more | 10.0±1.5 | 12 max |
| 1206 | 178±2.0(7") | 3.0    | 13.0±0.5 | 21.0±0.8 | 50 or more | 10.0±1.5 | 12 max |
| 1210 | 178±2.0(7") | 3.0    | 13.0±0.5 | 21.0±0.8 | 50 or more | 10.0±1.5 | 12 max |
| 1812 | 178±2.0(7") | 3.0    | 13.0±0.5 | 21.0±0.8 | 50 or more | 10.0±1.5 | 12 max |

Paper Tape Size Specification



| Type | A (mm)    | B (mm)    | C (mm)    | D (mm)    | E (mm)    | F (mm)    | G (mm)    | H (mm)    | J (mm)       | T (mm)   |
|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------|----------|
| 0603 | 1.10±0.10 | 1.90±0.10 | 8.00±0.10 | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 2.00±0.10 | 4.00±0.10 | 1.55-0/+0.05 | 1.10 max |
| 0805 | 1.45±0.15 | 2.30±0.15 | 8.00±0.15 | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 2.00±0.10 | 4.00±0.10 | 1.55-0/+0.05 | 1.10 max |
| 1206 | 1.80±0.20 | 3.40±0.20 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 2.00±0.10 | 4.00±0.10 | 1.55-0/+0.05 | 1.10 max |

Plastic Tape Size Specification



| Type | A (mm)    | B (mm)    | C (mm)     | D (mm)    | E (mm)    | F (mm)    | G (mm)    | H (mm)    | J (mm)       | T (mm)   |
|------|-----------|-----------|------------|-----------|-----------|-----------|-----------|-----------|--------------|----------|
| 0805 | 1.55±0.20 | 2.35±0.20 | 8.00±0.20  | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 2.00±0.10 | 4.00±0.10 | 1.55-0/+0.05 | 1.50 Max |
| 1206 | 1.95±0.20 | 3.60±0.20 | 8.00±0.20  | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 2.00±0.10 | 4.00±0.10 | 1.55-0/+0.05 | 1.85 Max |
| 1210 | 2.70±0.10 | 3.42±0.10 | 8.00±0.10  | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 2.00±0.05 | 4.00±0.10 | 1.55-0/+0.05 | 3.20 Max |
| 1812 | 3.66±0.10 | 4.95±0.10 | 12.00±0.10 | 5.50±0.05 | 1.75±0.10 | 8.00±0.10 | 2.00±0.05 | 4.00±0.10 | 1.55-0/+0.05 | 4.00 Max |

## Open-Mode Design MLCC

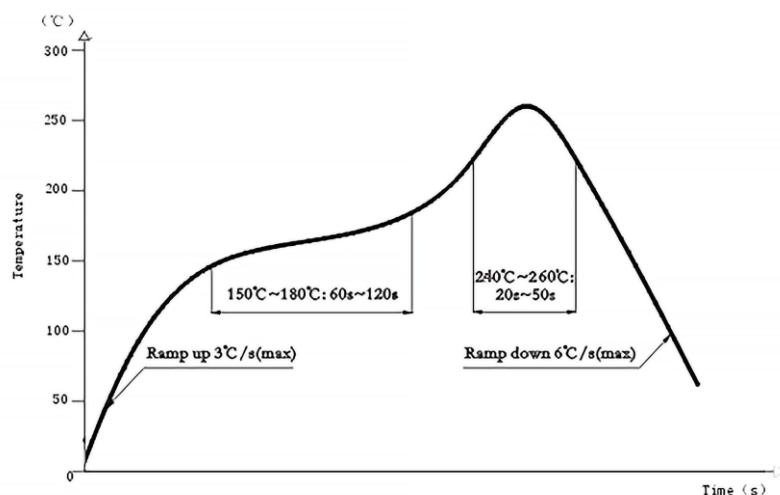
### Recommended Soldering Method

| Type        | Dielectric | Capacitance             | Soldering Method |
|-------------|------------|-------------------------|------------------|
| 0603        | NPO        | ---                     | R / W            |
|             | X7R        | $C \geq 1\mu\text{F}$   | R                |
|             |            | $C < 1\mu\text{F}$      | R / W            |
| 0805        | NPO        | ---                     | R / W            |
|             | X7R        | $C \geq 4.7\mu\text{F}$ | R                |
|             |            | $C < 4.7\mu\text{F}$    | R / W            |
| 1206        | NPO        | ---                     | R / W            |
|             | X7R        | $C \geq 10\mu\text{F}$  | R                |
|             |            | $C < 10\mu\text{F}$     | R / W            |
| $\geq 1210$ | NPO        | ---                     | R                |
|             | X7R        | ---                     | R                |

Soldering method : R – Reflow Soldering ; W – Wave Soldering

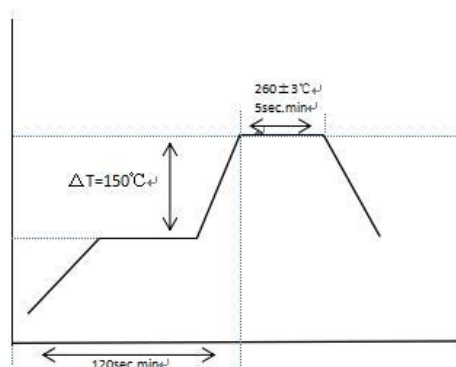
### The Temperature Profile for Soldering

#### Re-flow Soldering



While in preheating, please keep the temperature difference between soldering temperature and surface temperature of chips as:  $T \leq 150^\circ\text{C}$ .

#### Wave Soldering



While in preheating, please keep the temperature difference between soldering temperature and surface temperature of chips as:  $T \leq 150^\circ\text{C}$ .

**REVISION HISTORY**

| REVISION   | DATE        | CHANGE NOTIFICATION | DESCRIPTION                                                                        |
|------------|-------------|---------------------|------------------------------------------------------------------------------------|
| Version A  | Jul 22,2022 |                     | -Release                                                                           |
|            |             |                     | -Modify the description of the Features                                            |
|            |             |                     | -Modify the size specifications for 0603/0805/1206/1210/1812                       |
|            |             |                     | -Remove the specifications for Dielectric X5R/Y5V                                  |
|            |             |                     | -Modify the capacitance specifications for NPO and X7R in 0603/0805/1206/1210/1812 |
| Version A1 | Jul 22,2025 |                     | -Modify the Environmental Characteristics contents                                 |
|            |             |                     | -Modify the packaging specifications for 0603/0805/1206/1210/1812                  |
|            |             |                     | -Modify the Recommended Soldering Method                                           |
|            |             |                     | -Modify the Recommended soldering temperature profile chart                        |
|            |             |                     | -Add Temperature Coefficient / Characteristics                                     |