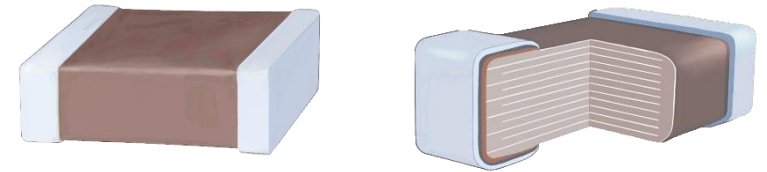


## Multilayer Ceramic Chip Capacitors

江苏芯声微电子科技有限公司

Jiangsu Holy Ram Electronics

Technology Limited



## CAI Series (Automotive Grade)

| Material      | X7R          | C0G          |
|---------------|--------------|--------------|
| Temp. Range   | -55°C--125°C | -55°C--125°C |
| Cap.Tolerance | ±15%         | ±30ppm/°C    |



## PRECAUTIONS FOR USE

Please attach the purchase specification before using this product.

## SAFETY INFORMATION

Please pay attention to safety precautions when using this product.

### Limitation of Applications

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

- ①Aircraft equipment
- ②Aerospace equipment
- ③Undersea equipment
- ④Power plant control equipment
- ⑤Medical equipment
- ⑥Transportation equipment(vehicles,trains,ships,etc.)
- ⑦Traffic signal equipment
- ⑧Disaster prevention / crime prevention equipment
- ⑨Data-processing equipment
- ⑩Application of similar complexity and/or

### Methods of transportation and storage

#### 1.Transportation:

Packaged products suitable for modern transportation, in the process of transportation to prevent rain and acid and alkali corrosion, gravity throwing and force extrusion.

#### 2.Storage:

The storage period to ensure good weldability of the product is one year from the date of production. Do not open the braid before use of the product (in the case of packaging and delivery). After the braid is opened, the product should be used within three months.

storage temperature: 0°C~35°C

Storage relative humidity:<70%

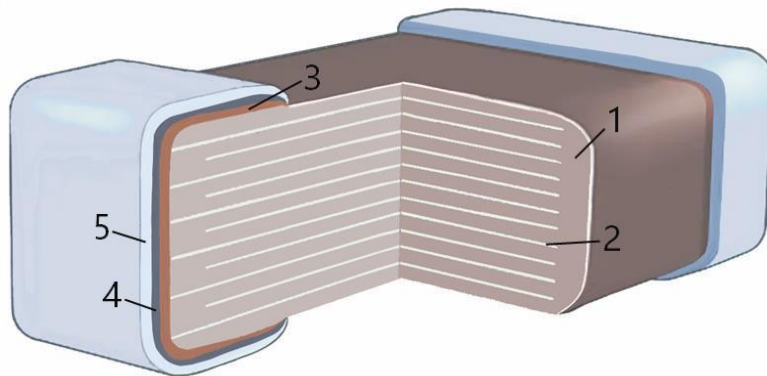
## Characteristic

- complies with AEC-Q200 standard
- conforms to the MSL class :MSL 1
- complies with vehicle regulation J-STD-020D
- High reliability and equipment reliability
- Pass 100% six-sided photosynthesis test

## Application

- car audio and video
- Body electronics
- High reliability
- Industrial applications

## Product Structure Diagram



| Serial number | Designation              |
|---------------|--------------------------|
| 1             | Dielectric ceramics      |
| 2             | Inner electrode (nickel) |
| 3             | Outer electrode (copper) |
| 4             | Nickel layer             |
| 5             | Tin layer                |

## Product model naming rules

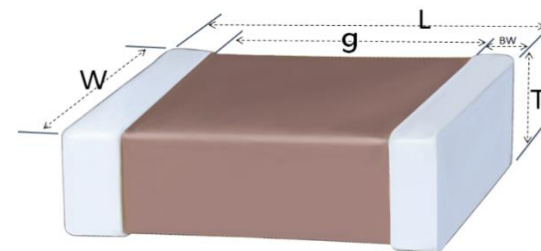
**EX: C AI 0402 X7R 104 K 500 G T**  
 (1) (2) (3) (4) (5) (6) (7) (8) (9)

|                                   |               |        |          |                          |  |            |          |           |          |            |          |           |         |            |          |  |        |  |
|-----------------------------------|---------------|--------|----------|--------------------------|--|------------|----------|-----------|----------|------------|----------|-----------|---------|------------|----------|--|--------|--|
| (1)                               | C:MLCC        |        |          | (5)<br>Capacitance Value | Cap. > =10pF:<br>First Two×10 <sup>third</sup><br>104=10×10 <sup>4</sup> =100nF<br>123=12×10 <sup>3</sup> =12nF<br>Cap. < 10pF: R30=0.3pF, 1R0=1pF |            |          |           |          |            |          |           |         |            |          |  |        |  |
| (2)<br>Application                | Al:Automotive |        |          |                          | (6)<br>Capacitance Tolerance   | A: ±0.05pF |          | B: ±0.1pF |          | C: ±0.25pF |          | D: ±0.5pF |         | F: ±1.0%   |          |  |        |  |
| (3)<br>Size (L*W)                 | Coding        | inch   | Size(mm) | (7)<br>Rate voltage Vdc  |  | G: ±2%     |          | J: ±5%    |          | K: ±10%    |          | M: ±20%   |         | Z: 80/-20% |          |  |        |  |
|                                   | 00R4          | 008004 | 0201     |                          | 2R5:2.5  |            | 4R0:4.0  |           | 6R3:6.3  |            | 100:10   |           | 160:16  |            | 250:25   |  |        |  |
|                                   | 01R5          | 01005  | 0402     |                          | 350:35   |            | 500:50   |           | 630:63   |            | 800:80   |           | 101:100 |            | 201:200  |  |        |  |
|                                   | 0201          | 0201   | 0603     |                          | 251:250  |            | 401:400  |           | 451:450  |            | 501:500  |           | 631:630 |            | 102:1000 |  |        |  |
|                                   | 0402          | 0402   | 1005     |                          | 202:2000   |            | 252:2500 |           | 302:3000 |            | 402:4000 |           |         |            |          |  |        |  |
|                                   | 0603          | 0603   | 1608     |                          | (8)<br>Thickness (mm)  |            | A:0.10   |           | B:0.13   |            | C:0.18   |           | D:0.20  |            | E:0.30   |  | F:0.45 |  |
|                                   | 0805          | 0805   | 2012     |                          |  |            | G:0.50   |           | H:0.60   |            | J:0.80   |           | K:0.85  |            | L:1.15   |  | M:1.25 |  |
|                                   | 1206          | 1206   | 3216     |                          |  |            | N:1.60   |           | P:1.90   |            | Q:2.00   |           | R:2.50  |            |          |  |        |  |
| (4)<br>Temperature Characteristic | COG X7R       |        |          | (9)<br>Packing           | T: Finished product packaging (7" Reel)  |            |          |           |          |            |          |           |         |            |          |  |        |  |

## Size & Packing Specifications

Generally, a  $\Phi 180\text{mm}$  (7") tray is used for packing.

Each 5 disks is packed into a box, and each 12 boxes is a whole box.



| 规格   | Size (mm) |           |           |      | Packing ( 7" ) |              |
|------|-----------|-----------|-----------|------|----------------|--------------|
|      | Length    | Width     | Thickness | g    | Number (star)  | Method       |
| 0201 | 0.60±0.03 | 0.30±0.03 | 0.30±0.03 | 0.20 | 15,000         | Paper tape   |
| 0402 | 1.00±0.05 | 0.50±0.05 | 0.50±0.05 | 0.30 | 10,000         | Paper tape   |
| 0603 | 1.60±0.10 | 0.80±0.10 | 0.80±0.10 | 0.30 | 4,000          | Paper tape   |
| 0805 | 2.00±0.20 | 1.25±0.20 | 0.85±0.20 | 0.50 | 4,000          | Paper tape   |
|      |           |           | 1.25±0.20 |      | 3,000/2,000    | Plastic tape |
| 1206 | 3.20±0.20 | 1.60±0.20 | 0.85±0.20 | 1.00 | 4,000          | Paper tape   |
|      |           |           | 1.25±0.20 |      | 3,000/2,000    | Plastic tape |
|      |           |           | 1.60±0.20 |      | 2,000          | Plastic tape |
| 1210 | 3.20±0.40 | 2.50±0.30 | 1.25±0.30 | 1.00 | 3,000          | Plastic tape |
|      |           |           | 1.60±0.30 |      | 2,000          |              |
|      |           |           | 2.50±0.30 |      | 1,000          |              |

**\* Plz refer to the single specification for details**

## Capacitance Range 【COG】 0402~0805

| Size<br>(inch) | Thick<br>(Code) | RV<br>(Vdc) | 1pF |     |     | 10pF |     |     |     |     |     | 100pF |     |     |     |     |     | 1nF |     |     |     |     |     | 10nF |  |  |
|----------------|-----------------|-------------|-----|-----|-----|------|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|--|
|                |                 |             | 1R0 | 2R2 | 4R7 | 100  | 150 | 220 | 330 | 470 | 680 | 101   | 151 | 221 | 331 | 471 | 681 | 102 | 152 | 222 | 332 | 472 | 682 | 103  |  |  |
| 0402           | 0.50<br>(G)     | 25          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                |                 | 50          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
| 0603           | 0.80<br>(J)     | 25          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                |                 | 50          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                |                 | 100         |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
| 0805           | 0.60<br>(H)     | 25          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                |                 | 50          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                | 0.85<br>(K)     | 25          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                |                 | 50          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                | 1.25<br>(M)     | 25          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |
|                |                 | 50          |     |     |     |      |     |     |     |     |     |       |     |     |     |     |     |     |     |     |     |     |     |      |  |  |

## 【X7R】 0201~1210

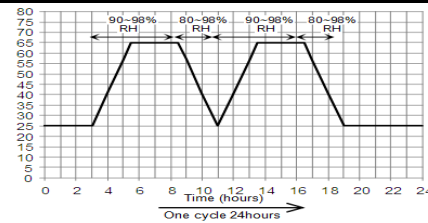
| Size<br>(inch) | Thick<br>(Code) | RV<br>(Vdc) | 150pF |     |     |     | 1nF |     |     |     | 15nF |     |     | 100nF |     |     | 1uF |     |     | 10uF |
|----------------|-----------------|-------------|-------|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-------|-----|-----|-----|-----|-----|------|
|                |                 |             | 151   | 221 | 331 | 681 | 102 | 152 | 332 | 682 | 153  | 333 | 473 | 104   | 224 | 474 | 105 | 225 | 475 | 106  |
| 0201           | 0.30<br>(E)     | 16<br>25    |       |     |     |     | ■   | ■   |     |     |      |     |     |       |     |     |     |     |     |      |
| 0402           | 0.50<br>(G)     | 6.3         |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 16          | ■     | ■   | ■   | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                |                 | 25          | ■     | ■   | ■   | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                |                 | 50          | ■     | ■   | ■   | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
| 100            | ■               | ■           | ■     | ■   | ■   | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   |      |
| 0603           | 0.80<br>(J)     | 10          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 16          |       |     |     |     | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                |                 | 25          |       |     |     |     | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                |                 | 50          | ■     | ■   | ■   | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
| 100            | ■               | ■           | ■     | ■   | ■   | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   |      |
| 0805           | 0.85<br>(K)     | 16          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 25          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 50          |       |     |     |     | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                | 100             |             |       |     |     | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                | 250             |             |       |     |     | ■   | ■   | ■   | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
|                | 1.25<br>(M)     | 6.3         |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
| 10             |                 |             |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
| 16             |                 |             |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
| 25             |                 |             |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
| 50             |                 |             |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
| 100            |                 |             |       |     |     |     |     |     |     | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   | ■    |
| 250            |                 |             |       |     |     |     |     |     | ■   | ■   | ■    | ■   | ■   | ■     | ■   | ■   | ■   | ■   | ■   |      |
| 1206           | 1.60<br>(N)     | 25          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 50          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 100         |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
| 1210           | 2.00<br>(Q)     | 50          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 100         |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                | 2.50<br>(R)     | 25          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |
|                |                 | 50          |       |     |     |     |     |     |     |     |      |     |     |       |     |     |     |     |     |      |

## Specifications and Test Methods

| No             | Item  | Specification | Test Method(Ref. Standard:AEC—Q200)   |                      |   |            |
|----------------|---|---------------|---------------------------------------|----------------------|---|------------|
| 1              | Pre-and-Post-Stress Electrical Test                       | --            | --                                    |                      |   |            |
| 2              | High Temperature Exposure (Storage)                       | Appearance    | No defects or abnormalities.          | Mounting method      | Solder the capacitor on the test substrate  |            |
|                |   | Cap. Change   | Plz refer to the single specification | Test Temperature     | 150+/-3°C   |            |
|                |   | Q or D.F.     | Within the specified initial value    | Test Time            | 1000+/-12h  |            |
|                |   | I.R.          | Within the specified initial value    | Post-treatment       | Let sit for 24+/-2hours at room temperature, then measure.  |            |
| 3              | Temperature Cycling                                       | Appearance    | No defects or abnormalities.          | Mounting method      | Solder the capacitor on the test substrate  |            |
|                |   |               |                                       | Pre-treatment        | Perform a heat treatment at 150+0/-10°C for 1hour and then let sit for 24+/-2hours at room temperature, then measure. |            |
|                |   | Cap. Change   | Plz refer to the single specification | Cycles               | 1000 cycles   |            |
|                |   |               |                                       | Temperature Cycling: |   |            |
|                |   | Q or D.F.     | Within the specified initial value    | Step                 | Temperature (°C)  | Time (min) |
|                |   |               |                                       | 1                    | Min. Operating Temp.+0/-3   | 30+/-3     |
|                |   |               |                                       | 2                    | Room Temperature  | 1          |
|                |   | I.R.          | Within the specified initial value    | 3                    | Max. Operating Temp.+3/-0   | 30+/-3     |
| 4              | Room Temperature  |               |                                       | 1                    |   |            |
| Post-treatment | Let sit for 24+/-2hours at room temperature, then measure |               |                                       |                      |   |            |



### Specifications and Test Methods

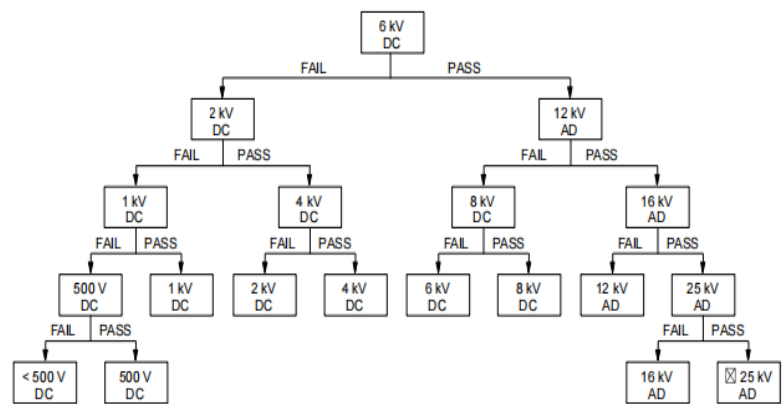
| No             | Item  | Specification   | Test Method(Ref. Standard:AEC—Q200)   |
|----------------|---|---|---|
| 4              | DPA   | Appearance<br>No defects or abnormalities.                | Per EIA-469   |
| 5              | Moisture Resistance                                       | Appearance<br>No defects or abnormalities.                | Mounting method<br>Solder the capacitor on the test substrate   |
|                |   | Cap. Change<br>Plz refer to the single specification      | Test Temperature<br>+25°C to +65°C  |
|                |   | Q or D.F.<br>Within the specified initial value           | Test Humidity<br>80% to 98% R.H.  |
|                |   | I.R.<br>Within the specified initial value                | Test Time<br>Apply the 24h treatment shown below,<br>10 consecutive times.  |
|                |   |   | Temperature and Humidity cycle:<br>  |
| Post-treatment | Let sit for 24+/-2hours at room temperature, then measure |   |   |
| 6              | Biased Humidity   | Appearance<br>No defects or abnormalities.                | Mounting method<br>Solder the capacitor on the test substrate   |
|                |   | Cap. Change<br>Plz refer to the single specification      | Test Temperature<br>85+/-3°C  |
|                |   | Q or D.F.<br>Within the specified initial value           | Test Humidity<br>80% to 85% R.H.  |
|                |   | I.R.<br>Within the specified initial value                | Test Time<br>1000+/-12h   |
|                |   |   | Test Voltage<br>1. Rated voltage (not exceeding 630V)<br>2. Apply 1.5V (silver electrode)<br>Connect the 100KΩ resistor |
|                | Charge/discharge current<br>50mA max                      |   |   |
|                | Post-treatment  | Let sit for 24+/-2hours at room temperature, then measure |   |

## Specifications and Test Methods

| No | Item                   | Specification                |                                       | Test Method(Ref. Standard:AEC—Q200)                   |  |
|----|------------------------|------------------------------|---------------------------------------|---|--|
| 7  | Operational Life       | Appearance                   | No defects or abnormalities.          | Mounting method                                       | Solder the capacitor on the test substrate   |
|    |                        | Cap. Change                  | Plz refer to the single specification | Test Temperature                                      | Maximum Operating Temperature +/-3℃  |
|    |                        | Q or D.F.                    | Within the specified initial value    | Test Time   | 1000+/-12h   |
|    |                        |                              |                                       | Test Voltage (R.V.)                                   | Plz refer to the single specification  |
|    |                        | I.R.                         | Within the specified initial value    | Charge/discharge current                              | 50mA max   |
|    |                        |                              |                                       | Post-treatment  | Let sit for 24+/-2hours at room temperature, then measure  |
| 8  | Appearance             | No defects or abnormalities. |                                       | Visual inspection                                     |  |
| 9  | Dimension              | Shown in Dimension.          |                                       | Using Measuring instrument of dimension               |  |
| 10 | Resistance to Solvents | Appearance                   | No defects or abnormalities.          | Per MIL-STD-202 Method 215 (Only for the Mark points) |  |
|    |                        | Cap. Change                  | Within the specified initial value    |   |  |
|    |                        | Q or D.F.                    | Within the specified initial value    |   |  |
|    |                        | I.R.                         | Within the specified initial value    |   |  |
| 11 | Mechanical Shock       | Appearance                   | No defects or abnormalities.          | Mounting method                                       | Solder the capacitor on the test substrate   |
|    |                        |                              |                                       | Waveform  | Half-sine  |
|    |                        | Cap. Change                  | Within the specified initial value    | Peak value  | 1500g  |
|    |                        | Q or D.F.                    | Within the specified initial value    | Holding Time  | 0.5ms  |
|    |                        |                              |                                       | Velocity change                                       | 4.7m/s   |
|    |                        | I.R.                         | Within the specified initial value    | Shocks directions and times                           | Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). |

## Specifications and Test Methods

| No | Item                            | Specification                 | Test Method(Ref. Standard:AEC—Q200)   |
|----|---------------------------------|-------------------------------|---|
| 12 | Mechanical<br>Vibration         | Appearance                    | No defects or abnormalities.  |
|    |                                 | Cap. Change                   | Within the specified initial value  |
|    |                                 | Q or D.F.                     | Within the specified initial value  |
|    |                                 | I.R.                          | Within the specified initial value  |
|    |                                 | Mounting method               | Solder the capacitor on the test substrate  |
|    |                                 | Kind of Vibration             | A 10Hz ~ 2000Hz ~ 10Hz  |
|    |                                 | Vibration Time                | 20min   |
|    |                                 | Total amplitude               | 1.5mm   |
|    |                                 | Vibration directions and time | This motion should be applied for 12 items in each 3 mutually perpendicular directions (total of 36 times). |
| 13 | Resistance<br>to Soldering Heat | Appearance                    | No defects or abnormalities.  |
|    |                                 | Cap. Change                   | Within the specified initial value  |
|    |                                 | Q or D.F.                     | Within the specified initial value  |
|    |                                 | I.R.                          | Within the specified initial value  |
|    |                                 | Test Method                   | Solder bath method  |
|    |                                 | Kind of Solder                | Sn-3.0Ag-0.5Cu(Lead Free Solder)  |
|    |                                 | Test Temperature              | 260+/-5°C   |
|    |                                 | Test Time                     | 10+/-1s   |
|    |                                 | Post-treatment                | Let sit for 24+/-2hours at room temperature, then measure.  |
| 14 | ESD                             | Appearance                    | No defects or abnormalities.  |
|    |                                 | Cap. Change                   | Within the specified initial value  |
|    |                                 | Q or D.F.                     | Within the specified initial value  |
|    |                                 | I.R.                          | Within the specified initial value  |
|    |                                 | Per AEC-Q200-002              |   |

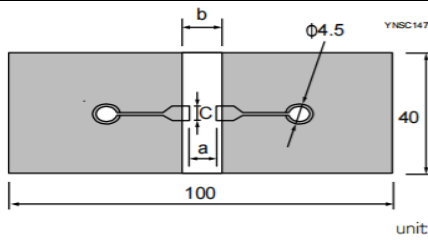
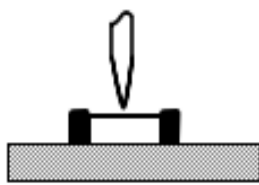
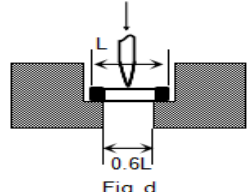


Note: It is classified according to the highest level of electrostatic voltage under static test. Flow chart of passive component HBM anti-static test (DC = direct contact discharge, AD = air discharge)

## Specifications and Test Methods

| No            | Item                                  | Specification   | Test Method(Ref. Standard:AEC—Q200) |  |                          |                                       |              |  |  |
|---------------|---------------------------------------|---|-------------------------------------|--|--------------------------|---------------------------------------|--------------|--|--|
| 15            | Solderability (a)                     | 95% of the terminations is to be soldered evenly and continuously | Pre-treatment                       | Perform a heat treatment at 155°C            |                          |                                       |              |  |  |
|               |                                       |   | Flux                                | Solution of rosin ethanol 25(mass)%          |                          |                                       |              |  |  |
|               |                                       |   | Kind of Solder                      | Sn-3.0Ag-0.5Cu(Lead Free Solder)             |                          |                                       |              |  |  |
|               |                                       |   | Solder Temperature                  | Sn-3.0Ag-0.5Cu solder solution at 245+/-5 °C |                          |                                       |              |  |  |
|               |                                       |   | Immersion time                      | 5+0/-0.5s                                    |                          |                                       |              |  |  |
|               |                                       |   | Immersion and emersion rate         | 25+/-5mm/s                                   |                          |                                       |              |  |  |
|               |                                       |   | 16                                  | Electrical Characterization                  | Capacitance              | Shown in Rated value                  |              |  |  |
| Q or D.F.     | Plz refer to the single specification |   |                                     |  | Test Temperature         | 25°C                                  |              |  |  |
|               |                                       |   |                                     |  | Test Frequency           | 1.0+/-0.1MHz                          |              |  |  |
|               |                                       |   |                                     |  | Test Voltage             | 1.0±0.2Vrms                           |              |  |  |
| I.R.          | Within the specified initial value    |   |                                     |  | Test Temperature         | 25°C                                  |              |  |  |
|               |                                       |   |                                     |  | Test Voltage             | Plz refer to the single specification |              |  |  |
|               |                                       |   |                                     |  | Charging Time            | 1min                                  |              |  |  |
|               |                                       |   |                                     |  | Charge/discharge current | 50mA max                              |              |  |  |
| Voltage proof | No defects or abnormalities.          |   |                                     |  | Material                 | Rate Voltage                          | Test Voltage |  |  |
|               |                                       |   |                                     |  | C0G                      | RV≤50V                                | 300% RV      |  |  |
|               |                                       |   |                                     |  |                          | 50V < RV≤100V                         | 250% RV      |  |  |
|               |                                       |   |                                     |  |                          | 100V < RV≤250V                        | 200% RV      |  |  |
|               |                                       |   |                                     |  |                          | 250V < RV≤500V                        | 150% RV      |  |  |
|               |                                       |   |                                     |  |                          | 500V < RV≤1000V                       | 130% RV      |  |  |
|               |                                       |   |                                     | X7R  | RV≤100V                  | 250% RV                               |              |  |  |
|               |                                       |   |                                     |  | 100V < RV≤250V           | 200%RV                                |              |  |  |
|               |                                       |   |                                     |  | 250V < RV≤630V           | 150% RV                               |              |  |  |
|               |                                       |   |                                     |  | 630V < RV≤1000V          | 120% RV                               |              |  |  |

## Specifications and Test Methods

| No                                | Item                                | Specification   | Test Method(Ref. Standard:AEC—Q200)    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|-----------------------------------|-------------------------------------|---|--|---|---------------------------------|-------------------------------------|-----------------------------------|----------------------------------|--|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|---|-----|------|---|-----|-----|------|---|
| 17                                | Board Flex                          | Appearance  | No defects or abnormalities.           |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | Cap. Change   | Plz refer to the single specification  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | Q or D.F.   | Within the specified initial value     |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | I.R.  | Within the specified initial value     |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     |   |  | <div style="display: flex; align-items: center;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>尺寸</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>0402</td> <td>0.5</td> <td>1.5</td> <td>0.6</td> </tr> <tr> <td>0603</td> <td>0.6</td> <td>2.2</td> <td>0.9</td> </tr> <tr> <td>0805</td> <td>0.8</td> <td>3</td> <td>1.3</td> </tr> <tr> <td>1206</td> <td>2</td> <td>4.4</td> <td>1.7</td> </tr> <tr> <td>1210</td> <td>2</td> <td>4.4</td> <td>2.6</td> </tr> </tbody> </table> </div> | 尺寸                              | a                                   | b                                 | c                                | 0201   | 0.3 | 0.9 | 0.3 | 0402 | 0.5 | 1.5 | 0.6 | 0603 | 0.6 | 2.2 | 0.9 | 0805 | 0.8 | 3 | 1.3 | 1206 | 2 | 4.4 | 1.7 | 1210 | 2 |
| 尺寸                                | a                                   | b   | c                                      |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 0201                              | 0.3                                 | 0.9   | 0.3                                    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 0402                              | 0.5                                 | 1.5   | 0.6                                    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 0603                              | 0.6                                 | 2.2   | 0.9                                    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 0805                              | 0.8                                 | 3   | 1.3                                    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 1206                              | 2                                   | 4.4   | 1.7                                    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 1210                              | 2                                   | 4.4   | 2.6                                    |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 18                                | Terminal Strength                   | Appearance  | No defects or abnormalities.           |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | Cap. Change   | Within the specified initial value     |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | Q or D.F.   | Within the specified initial value     |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | I.R.  | Within the specified initial value     |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     |   |  | <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>Mounting method</p> <p>Solder the capacitor on the test substrate</p> </div> <div> <p>Applied Force</p> <p>keep applying 17.7N (1.8Kg)</p> <p>*0402 Apply 2N</p> <p>*0201 Apply 1N</p> <p>Note: Apply the force gradually so as not to impact the parts under test</p> </div> </div>   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>Mounting method</p> <p>Solder the capacitor on the test substrate</p> </div> <div> <p>Applied Force</p> <p>keep applying 17.7N (1.8Kg)</p> <p>*0402 Apply 2N</p> <p>*0201 Apply 1N</p> <p>Note: Apply the force gradually so as not to impact the parts under test</p> </div> </div>     |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>Mounting method</p> <p>Solder the capacitor on the test substrate</p> </div> <div> <p>Applied Force</p> <p>keep applying 17.7N (1.8Kg)</p> <p>*0402 Apply 2N</p> <p>*0201 Apply 1N</p> <p>Note: Apply the force gradually so as not to impact the parts under test</p> </div> </div>     |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>Mounting method</p> <p>Solder the capacitor on the test substrate</p> </div> <div> <p>Applied Force</p> <p>keep applying 17.7N (1.8Kg)</p> <p>*0402 Apply 2N</p> <p>*0201 Apply 1N</p> <p>Note: Apply the force gradually so as not to impact the parts under test</p> </div> </div>     |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>Mounting method</p> <p>Solder the capacitor on the test substrate</p> </div> <div> <p>Applied Force</p> <p>keep applying 17.7N (1.8Kg)</p> <p>*0402 Apply 2N</p> <p>*0201 Apply 1N</p> <p>Note: Apply the force gradually so as not to impact the parts under test</p> </div> </div>     |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| 19                                | Beam Load Test                      | The tolerance should exceed the following values:   | Speed supplied the Stress Load 0.1mm/s |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | <table border="0"> <tr> <td>Size <math>L \leq 2.5\text{mm}</math></td> <td>Size <math>L \geq 3.2\text{mm}</math></td> </tr> <tr> <td>Thickness <math>&gt; 0.5\text{mm}</math>:20N</td> <td>Thickness <math>\geq 1.25\text{mm}</math>:54N</td> </tr> <tr> <td>Thickness <math>\leq 0.5\text{mm}</math>:8N</td> <td>Thickness <math>&lt; 1.25\text{mm}</math>:15N</td> </tr> </table> | Size $L \leq 2.5\text{mm}$             | Size $L \geq 3.2\text{mm}$  | Thickness $> 0.5\text{mm}$ :20N | Thickness $\geq 1.25\text{mm}$ :54N | Thickness $\leq 0.5\text{mm}$ :8N | Thickness $< 1.25\text{mm}$ :15N | <p>Placement diagram:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>[Size <math>L \leq 2.5\text{mm}</math>]</p>  </div> <div style="text-align: center;"> <p>[Size <math>L \geq 3.2\text{mm}</math>]</p>  <p>Fig. d</p> </div> </div> |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     | Size $L \leq 2.5\text{mm}$  | Size $L \geq 3.2\text{mm}$             |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| Thickness $> 0.5\text{mm}$ :20N   | Thickness $\geq 1.25\text{mm}$ :54N |   |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
| Thickness $\leq 0.5\text{mm}$ :8N | Thickness $< 1.25\text{mm}$ :15N    |   |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |
|                                   |                                     |   |  |   |                                 |                                     |                                   |                                  |  |     |     |     |      |     |     |     |      |     |     |     |      |     |   |     |      |   |     |     |      |   |

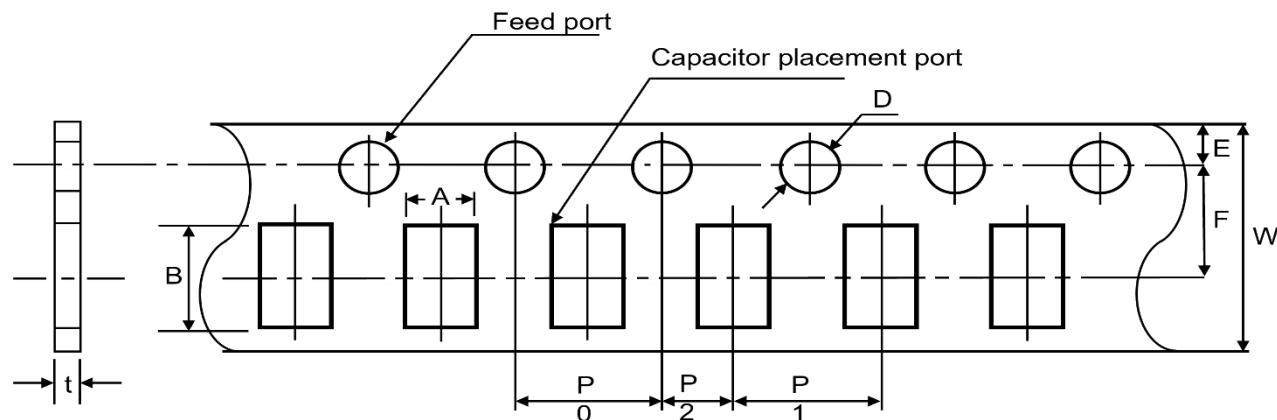
## Specifications and Test Methods

| No | Item                                       | Specification   | Test Method(Ref. Standard:AEC—Q200)   |                               |
|----|--|---|---|-------------------------------|
| 20 | Temperature Characteristics of Capacitance | Cap. Change<br><br>The nominal value of the temperature coefficient is shown in the rating. The change of capacitance at reference temperature is shown in Table A. | The capacitance change should be measured after 5 min at each specified temp. stage.                                  |                               |
|    |  |   | Capacitance value as a reference is the value in "*" marked step.   |                               |
|    |  |   | Cap. Change<br><br>Tolerance changes are calculated by dividing the difference between the maximum and minimum values |                               |
|    |  |   | Test Voltage<br><br>Less than 1.0Vrms (Refer to the individual data sheet)  |                               |
|    |  | C0G: $\pm 30\text{ppm}/^\circ\text{C}$<br><br>X7R: $\pm 15\%$   | Temperature Step: (A)   |                               |
|    |  |   | Step  | Temperature                   |
|    |  |   | 1   | Ref. Temperature: $\pm 2$     |
|    |  |   | 2   | Min. Operating Temp.: $\pm 3$ |
|    |  |   | 3*  | Ref. Temperature: $\pm 2$     |
|    |  |   | 4   | Max. Operating Temp.: $\pm 3$ |
| 5  | Ref. Temperature: $\pm 2$                  |   |   |                               |

## Product Packaging

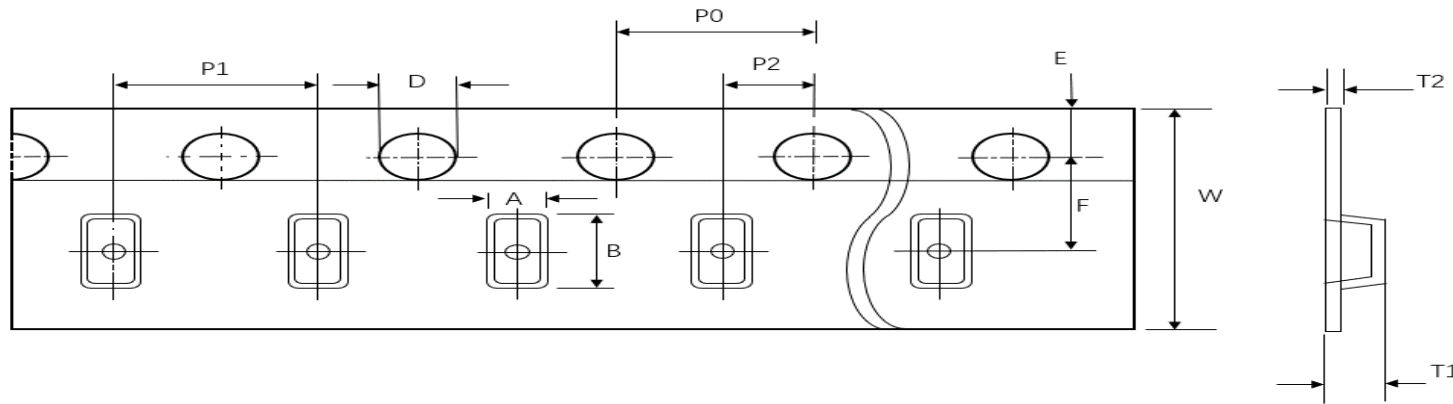
At present, the most common way of packaging is to carry coil packaging. A coil with a diameter of 180mm (7") can contain 1000~20000 capacitors, or coil packaging can be carried out according to customer requirements.

### 1. Tape Size



|    | <b>01005<br/>(0402)</b> | <b>0201<br/>(0603)</b> | <b>0402<br/>(1005)</b> | <b>0603<br/>(1608)</b> | <b>0805<br/>(2012)</b> | <b>1206<br/>(3216)</b> |
|----|-------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| P1 | 2.00±0.05(1.0 ±0.05)    |                        |                        | 4.00±0.10              |                        |                        |
| P0 | 4.00±0.10               |                        |                        | 4.00±0.10              |                        |                        |
| P2 | 2.00±0.05               |                        |                        | 2.00±0.05              |                        |                        |
| A  | 0.25±0.02               | 0.38±0.03              | 0.62±0.05              | 1.00±0.01              | 1.55±0.10              | 2.05±0.10              |
| B  | 0.46±0.02               | 0.68±0.03              | 1.12±0.05              | 1.90±0.10              | 2.30±0.10              | 3.60±0.10              |
| W  | 8.00±0.30               |                        |                        | 8.00±0.30              |                        |                        |
| E  | 1.75±0.10               |                        |                        | 1.75±0.10              |                        |                        |
| F  | 3.50±0.05               |                        |                        | 3.50±0.05              |                        |                        |
| D  | φ1.50+0.10/-0.03        |                        |                        | φ1.50+0.10/-0          |                        |                        |
| t  | 0.25±0.02               | 0.35±0.03              | 0.60±0.05              | 1.1Below               |                        |                        |

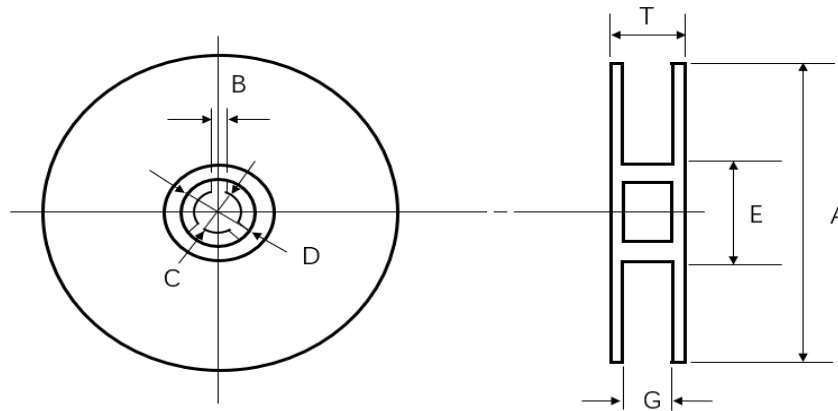
## 2. Plastic Size



|    | <b>0603<br/>(1608)</b> | <b>0805<br/>(2012)</b> | <b>1206<br/>(3216)</b> | <b>1210<br/>(3225)</b> |
|----|------------------------|------------------------|------------------------|------------------------|
| P1 | 4±0.1                  | 4±0.1                  | 4±0.1                  | 4±0.1                  |
| P0 | 4±0.1                  | 4±0.1                  | 4±0.1                  | 4±0.1                  |
| P2 | 2±0.05                 | 2±0.05                 | 2±0.05                 | 2±0.05                 |
| A  | 1.2±0.2                | 1.45±0.2               | 1.9±0.2                | 2.8±0.2                |
| B  | 2.0±0.2                | 2.3±0.2                | 3.5±0.2                | 3.6±0.2                |
| W  | 8±0.3                  | 8±0.2                  | 8±0.2                  | 8±0.2                  |
| E  | 1.75±0.1               | 1.75±0.1               | 1.75±0.1               | 1.75±0.1               |
| F  | 3.5±0.05               | 3.5±0.05               | 3.5±0.05               | 3.5±0.05               |
| D  | 1.5 (+0.1/-0.0)        | 1.5 (+0.1/-0.0)        | 1.5 (+0.1/-0.0)        | 1.5 (+0.1/-0.0)        |
| T1 | 1.4 max                | 2.5 max.               | 2.5 max.               | 2.5 max.               |
| T2 | 0.25±0.1               | 0.305±0.1              | 0.30±0.1               | 0.30±0.1               |



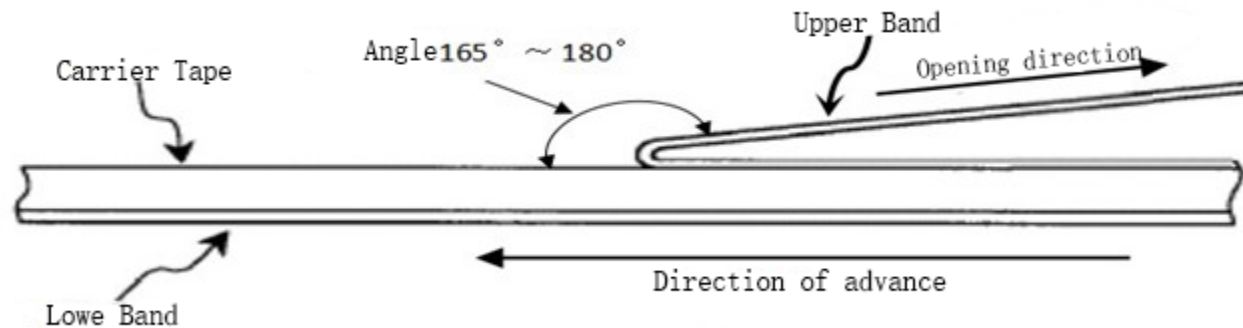
## 3. Disk Size



| Disk Size | A (mm)             | B (mm)        | C (mm)            | D (mm)            | E (mm)        | G (mm)       | T (mm)       |
|-----------|--------------------|---------------|-------------------|-------------------|---------------|--------------|--------------|
| 7"Reel    | $\Phi 178 \pm 2.0$ | $2.0 \pm 0.5$ | $\Phi 13 \pm 1.0$ | $\Phi 21 \pm 0.8$ | $\Phi 50$ 或更大 | $10 \pm 1.0$ | $13 \pm 1.0$ |

## 4. Instructions for use of reel tape

When the finished product is in use, the upper band (film) is at a speed of  $300 \pm 10 \text{ mm/min}$ , an Angle of  $165^\circ \sim 180^\circ$  (as shown below), and the peeling strength is  $0.1 \text{ N} \sim 0.7 \text{ N}$  ( $10 \text{ g.f.} \leq \text{peeling force} \leq 70 \text{ g.f.}$ ).



## Precautions for use

Multi-layer Ceramic Chip Capacitors (MLCC) may have short circuit or open circuit under the harsh working environment beyond the use frequency described in this letter of admission or related instructions, or under the action of external mechanical force overpressure. Or it may smoke, burn or even explode, so when using, we should first consider to follow the relevant instructions in this acknowledgement, if there is anything unclear, please contact our technical department, Quality Control Department or production Department.

### 1. The amount of solder used in welding

A. Too much solder will cause capacitor damage due to excessive pressure at the capacitor end.

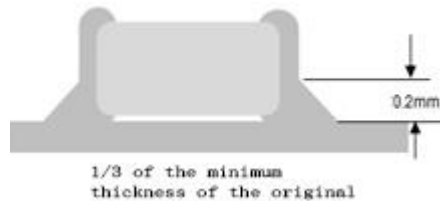


B. Too little solder fixed force is insufficient, may cause capacitor chip and line contact is poor.

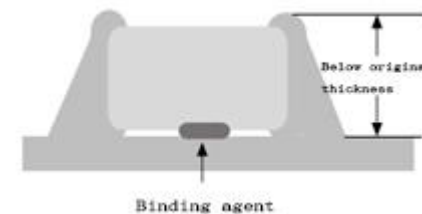


### 2. Recommended amount of solder:

A. Optimal amount of solder for reflow welding



B. Optimum amount of solder for wave soldering

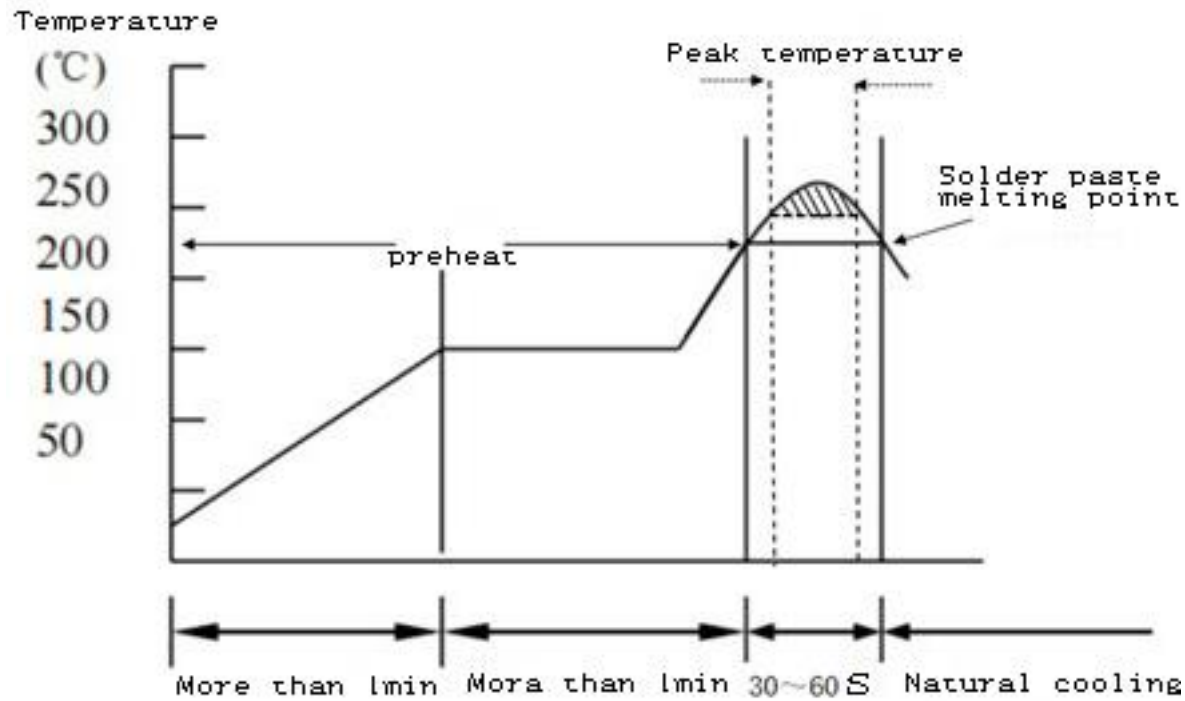


C. The optimal amount of solder used for repair with soldering iron



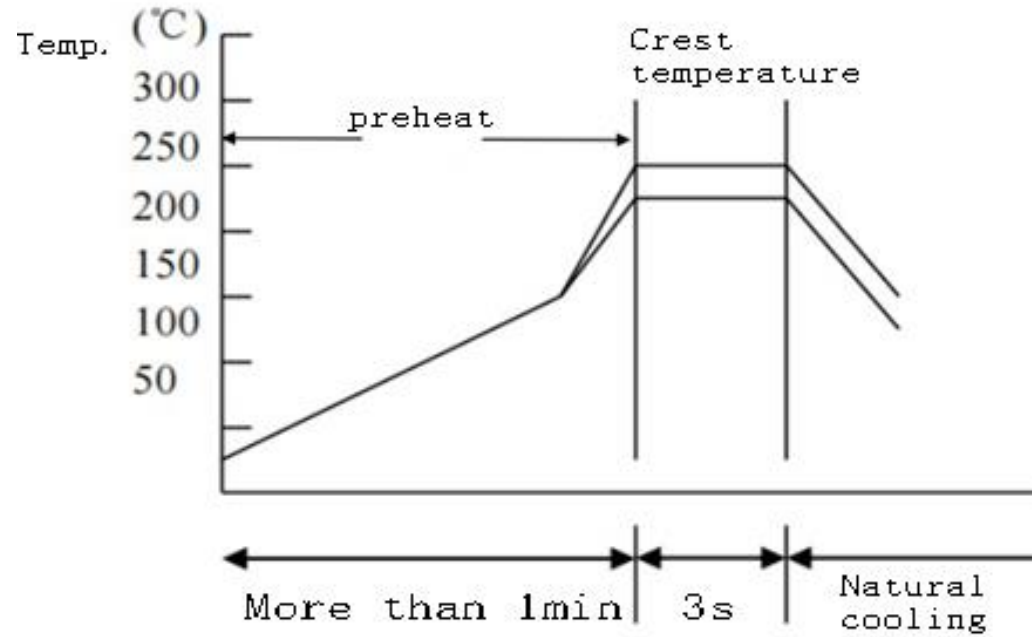
### 3. Recommended welding temperature curve:

Reflow welding



| Solder type      | Pb-Sn welding | Lead-free welding |
|------------------|---------------|-------------------|
| Peak temperature | 230°C ~ 250°C | 240°C ~ 260°C     |
| Peak time        | 3s ~ 10s      | 3s ~ 10s          |

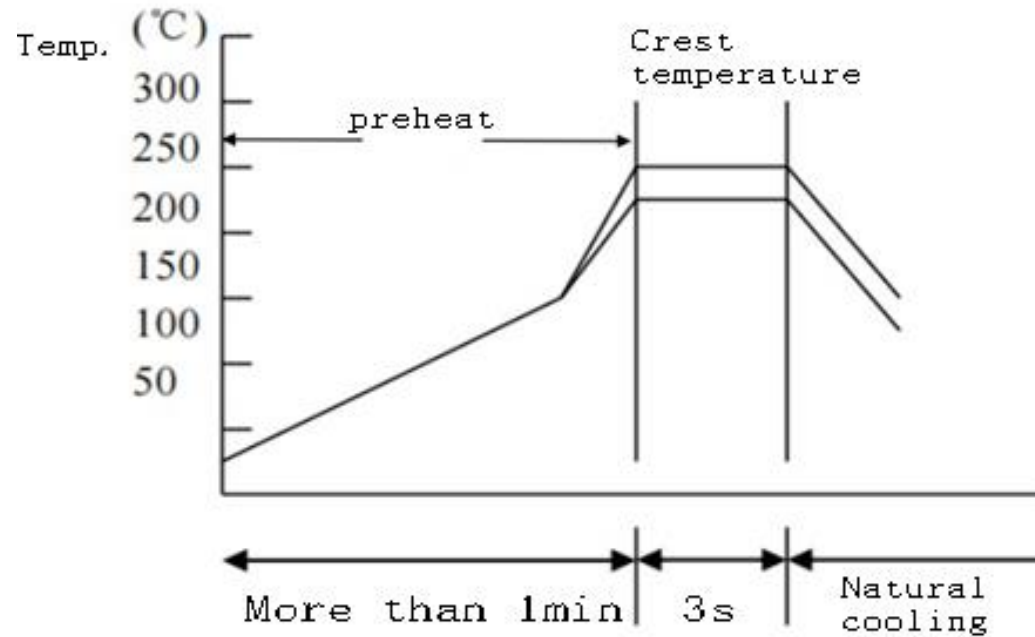
## Wave soldering



| Solder type      | Pb-Sn welding | Lead-free welding |
|------------------|---------------|-------------------|
| Peak temperature | 230°C ~ 260°C | 240°C ~ 270°C     |
| Peak time        | Within 3s     | Within 3s         |

## Hand welding

Manual welding is easy to cause micro-cracking or partial cracking of porcelain because of uneven local heating of capacitor. Therefore, the use of electric iron manual welding should be carefully operated, and the choice of the tip of the electric branding iron and tip temperature control should be more careful.



| Preheat                           | Temperature                | Power             | Diameter           | Time             | Tin paste                        | Notice   |
|-----------------------------------|----------------------------|-------------------|--------------------|------------------|----------------------------------|--|
| $\Delta \leq 130^{\circ}\text{C}$ | $\leq 350^{\circ}\text{C}$ | $\leq 20\text{W}$ | Recommended<br>1mm | $\leq 3\text{s}$ | $\leq 1/2$ Capacitance<br>height | Do not contact the iron head<br>directly with the ceramic body |

| 版本            | 修订日期      | 修订内容叙述  |
|---------------|-----------|---|
| CAI-A-2023-01 | 2023/2/25 | Initial issue   |
| CAI-A-2023-02 | 2023/6/25 | <ol style="list-style-type: none"><li>1. Update the tolerance range legend</li><li>2. Update the packaging quantity</li><li>3. Update the Feature content</li></ol> |

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[NMC0402NPO220J50TRPF](#) [NMC0402X5R105K6.3TRPF](#) [NMC0402X5R224K6.3TRPF](#) [NMC0402X7R103J25TRPF](#)  
[NMC0402X7R392K50TRPF](#) [NMC0603NPO201J50TRPF](#) [NMC0603X7R333K16TRPF](#) [NMC0805NPO820J50TRPF](#)  
[NMC0805X7R224K16TRPLPF](#) [NMC1206X7R102K50TRPF](#) [NMC1206X7R106K10TRPLPF](#) [NMC1206X7R475K10TRPLPF](#) [NMC-](#)  
[Q0402NPO8R2D200TRPF](#) [C1608C0G2A221J](#) [C1608X7R1E334K](#) [C2012C0G2A472J](#) [2220J2K00562KXT](#) [CDR33BX104AKUR](#)  
[CDR33BX683AKUS](#) [CGA3E1X7R1C684K](#) [CL10C0R8BB8ANNC](#) [C1005X5R0G225M](#) [C2012X7R2E223K](#) [C3216C0G2J272J](#)  
[D55342E07B35E7R-T/R](#) [NMC0402X7R562J25TRPF](#) [NMC0603NPO102J25TRPF](#) [NMC1206X7R332K50TRPF](#) [726632-1](#)  
[CGA6M3X7R1H225K](#) [CGA5L2X7R2A105K](#) [CGA3E2X8R1H223K](#) [CDR33BX823AKUR\M500](#) [CDR35BX474AKUR\M500](#)  
[CDR35BX104BKUR\M500](#) [69995D](#) [NMC0201X5R473K6.3TRPF](#) [NMC0201X7R221K25TRPF](#) [NMC0402X5R105K10TRPF](#)  
[NMC0402X5R224K10TRPF](#) [NMC0603X7R104J25TRPF](#) [NMC0603X7R223K25TRPF](#) [NMC0805NPO100J50TRPF](#)  
[NMC0805X7R104M50TRPF](#)