

Multilayer Ceramic Chip Capacitors for Automotive

A0402X6S224K250NTN (0402,X6S,220 nF,DC 25 V)

1. Scope

This specification applies to Automotive-grade Multilayer Ceramic Chip Capacitors (MLCCs). Specifically intended for: automotive infotainment applications and non-safety-critical automotive smart systems.

Application Scope: In-Vehicle Infotainment (IVI) systems; Smart cockpits; Intelligent Parking Assist (IPA); Electronic Toll Collection (ETC); In-vehicle wireless charging, etc.

2. Part Number System

|             |           |                             |                     |                       |               |                  |                |                |
|-------------|-----------|-----------------------------|---------------------|-----------------------|---------------|------------------|----------------|----------------|
| A           | 0402      | X6S                         | 224                 | K                     | 250           | N                | T              | N              |
| ①           | ②         | ③                           | ④                   | ⑤                     | ⑥             | ⑦                | ⑧              | ⑨              |
| Series Code | Size Code | Temperature Characteristics | Nominal Capacitance | Capacitance Tolerance | Rated Voltage | Termination Type | Packaging Code | Thickness Code |

- ① Series Code A-Multilayer Ceramic Chip Capacitors for Automotive
- ② Size Code (Unit: mm)

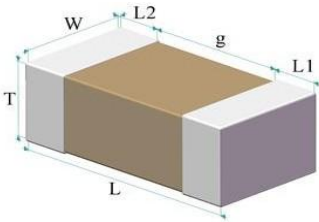


Fig.1 Structure & Dimension

| Size Code | L                 | W                 | L1,L2     | g        | T                 | ⑨ Thickness Code |
|-----------|-------------------|-------------------|-----------|----------|-------------------|------------------|
| 0402      | 1.00 + 0.15/-0.05 | 0.50 + 0.15/-0.05 | 0.15-0.35 | 0.30 min | 0.50 + 0.15/-0.05 | N                |

③ Temperature Characteristics

| Temperature Characteristics | Operating Temp. Range | Temperature Characteristics |               |            |
|-----------------------------|-----------------------|-----------------------------|---------------|------------|
|                             |                       | Temp. coeff. or Cap. Change | Temp. Range   | Ref. Temp. |
| X6S                         | -55 °C-105 °C         | ±22%                        | -55 °C-105 °C | 25 °C      |

④ Nominal Capacitance

| Code | Nominal Capacitance |
|------|---------------------|
| 224  | 220 nF              |

⑤ Capacitance Tolerance

| Code | Capacitance Tolerance |
|------|-----------------------|
| K    | ±10%                  |

⑥ Rated Voltage

| Code | Voltage Values |
|------|----------------|
| 250  | DC 25 V        |

⑦ Termination Type

| Code | Terminal Electrodes | Plating Material |
|------|---------------------|------------------|
| N    | Cu                  | Ni/Sn            |

⑧ Packaging Code

| Code | Square Hole Spacing | Disc Size | Carrier Tape | QTY (Kpcs) |
|------|---------------------|-----------|--------------|------------|
| T    | 2 mm                | 7 "       | Paper        | 10         |

## 3. Technical Specifications and Test Methods

## 1. Operating Environment

| Temp. Characteristics | Temp. Range   | Relative Humidity | Atmospheric Pressure |
|-----------------------|---------------|-------------------|----------------------|
| X6S                   | -55 °C-105 °C | ≤95% (25 °C)      | 86 kPa-106 kPa       |

## 3.2 Reliability Test Specifications and Methods

Table 1: Specifications and Test Methods

| No.  | Item<br>AEC-Q200 Test Item                |                                                    | Specification<br>Class 2 ( High dielectric constant type)                                                                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
|------|-------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|---|-----|--------|---|----|---|---|-----|--------|---|----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Pre-and Post-Stress<br>Electrical Test    |                                                    |                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 2    | High Temperature<br>Exposure<br>(Storage) | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>$\Delta C/C \leq \pm 12.5\%$<br>$\geq 500$ Mfi or 25 fi•F, (Whichever is smaller)<br>0.2 max | Pre-treatment<br>Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.<br>Test temperature<br>Test time<br>Post-treatment                                                                                                                                                                                                                                                                                         | Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure.<br><br>105 °C ± 3 °C<br>(1000 ± 12) h<br>Let sit for (24 ± 2) h at room temperature, then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 3    | Temperature<br>Cycling                    | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>$\Delta C/C \leq \pm 10\%$<br>$\geq 1000$ Mfi or 50 fi•F, (Whichever is smaller)<br>0.2 max  | Pre-treatment<br>Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.<br>Mounting method<br>The number of cycles<br>Temperature Step<br><table><tr><td>Step</td><td>Temp.(°C)</td><td>Time (min)</td></tr><tr><td>1</td><td>-55</td><td>30 ± 3</td></tr><tr><td>2</td><td>25</td><td>1</td></tr><tr><td>3</td><td>105</td><td>30 ± 3</td></tr><tr><td>4</td><td>25</td><td>1</td></tr></table><br>Post-treatment | Step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Temp.(°C) | Time (min) | 1 | -55 | 30 ± 3 | 2 | 25 | 1 | 3 | 105 | 30 ± 3 | 4 | 25 | 1 | Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure.<br><br>Solder the capacitor to the test substrate<br>1000 cycles<br><br>Let sit for (24 ± 2) h at room temperature, then measure. |
| Step | Temp.(°C)                                 | Time (min)                                         |                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 1    | -55                                       | 30 ± 3                                             |                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 2    | 25                                        | 1                                                  |                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 3    | 105                                       | 30 ± 3                                             |                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 4    | 25                                        | 1                                                  |                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 4    | Destructive Physical Analysis<br>(DPA)    |                                                    | No defects or abnormalities.                                                                                                 | EIA-469                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |
| 5    | Biased Humidity<br>(8585)                 | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>$\Delta C/C \leq \pm 12.5\%$<br>$\geq 100$ Mfi or 5 fi•F, (Whichever is smaller)<br>0.2 max  | Pre-treatment<br>Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.<br>Mounting method<br>Test temperature<br>Test humidity<br>Test time<br>Test voltage<br><br>The charge/discharge current<br>Post-treatment                                                                                                                                                                                                 | Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure.<br><br>Solder the capacitor to the test substrate<br>(85 ± 3) °C<br>(85 ± 3)% RH<br>(1000 ± 12) h<br>Rated voltage (U <sub>R</sub> ≤ 1000 V) and 1.3 V-1.5 Vdc (Add 100 kfi resister)<br>1000 ± 50 V (U <sub>R</sub> > 1000 V) and 1.3 V-1.5 Vdc (Add 100 kfi resister)<br>Note: For silver-containing ceramics (e.g., palladium-silver electrodes), low-voltage partial testing must be carried out simultaneously.<br><br>≤ 50 mA<br>Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure. |           |            |   |     |        |   |    |   |   |     |        |   |    |   |                                                                                                                                                                                                                                                  |

Table 1: Specifications and Test Methods

| No. | Item<br>AEC-Q200 Test Item   |                                                    | Specification<br>Class 2 ( High dielectric constant type)                                                                                                                                   | Test Method                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                              |
|-----|------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6   | Operational Life             | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>$\Delta C/C \leq \pm 12.5\%$<br>$\geq 100 \text{ Mfi or } 5 \text{ fi}\cdot\text{F}$ , (Whichever is smaller)<br>0.2 max                                    | Pre-treatment<br>Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.<br>Mounting method<br>Test temperature<br>Test time<br>Test voltage<br>The charge/discharge current<br>Post-treatment                                                        | Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure.<br>Solder the capacitor to the test substrate<br>105 °C ± 3 °C<br>(1000 ± 12) h<br>$1.0 \times U_R$<br>$\leq 50 \text{ mA}$<br>Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure. |
| 7   | Appearance                   |                                                    | No defects or abnormalities.                                                                                                                                                                | Visual inspection under 10x microscope                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                              |
| 8   | Physical Dimension           |                                                    | See Fig.1                                                                                                                                                                                   | Measuring by gages which precision is not less than 0.01 mm.                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                              |
| 9   | Mechanical Shock             | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>Within the specified initial value<br>$\geq 1000 \text{ Mfi or } 50 \text{ fi}\cdot\text{F}$ , (Whichever is smaller)<br>Within the specified initial value | Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.<br>Mounting method<br>Holding Time<br>Peak value<br>Velocity change<br>Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). | Solder the capacitor to the test substrate<br>0.5 ms<br>1500 g<br>4.7 m/s                                                                                                                                                                                                                                                                                    |
| 10  | Vibration                    | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>Within the specified initial value<br>$\geq 1000 \text{ Mfi or } 50 \text{ fi}\cdot\text{F}$ , (Whichever is smaller)<br>Within the specified initial value | Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.<br>Mounting method<br>Frequency<br>Amplitude<br>Vibration Time<br>This motion should be applied for 12 cycles in each 3 mutually perpendicular directions (total of 36 times).                | Solder the capacitor to the test substrate<br>10 Hz to 2000 Hz and return to 10 Hz<br>1.5 mm<br>20 min                                                                                                                                                                                                                                                       |
| 11  | Resistance to Soldering Heat | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>$\Delta C/C \leq \pm 15\%$<br>$\geq 1000 \text{ Mfi or } 50 \text{ fi}\cdot\text{F}$ , (Whichever is smaller)<br>Within the specified initial value         | Pre-treatment<br>Pre-heating<br>Test Method<br>Solder alloy<br>Solder temp.<br>Duration of immersion<br>Depth of immersion<br>Post-treatment                                                                                                                                                                                     | Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure.<br>120 °C-150 °C, Time: 60 s<br>Solder bath<br>Sn-Ag-Cu (Lead Free Solder)<br>(260 ± 5) °C<br>(10 ± 1) s<br>(10 ± 1) mm<br>Let sit for (24 ± 2) h at room temperature, then measure.                                                          |
| 12  | ESD                          | Appearance<br>Cap. Change<br>IR (Room Temp.)<br>DF | No defects or abnormalities.<br>Within the specified initial value<br>$\geq 1000 \text{ Mfi or } 50 \text{ fi}\cdot\text{F}$ , (Whichever is smaller)<br>Within the specified initial value | Per AEC-Q200-002<br>Pre-treatment                                                                                                                                                                                                                                                                                                | Perform heat treatment at (150 +0/−10) °C for 1 h, then soak at room temperature for (24 ± 2) h, then measure.                                                                                                                                                                                                                                               |

Table 1: Specifications and Test Methods

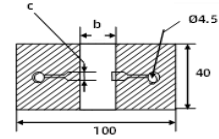
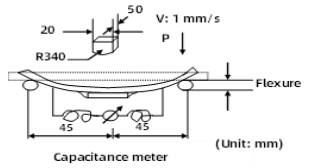
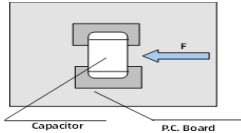
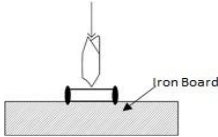
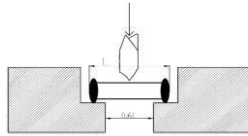
| No. | Item<br>AEC-Q200 Test Item     | Specification<br>Class 2 ( High dielectric constant type)                       | Test Method                                                                                                      |                                                                                                                                                                                                                                                                                                 |
|-----|--------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13  | Solderability                  | Appearance<br>95% of the terminations is to be soldered evenly and continuously | Pre-heating<br>Test Method<br>Flux<br>Solder alloy<br>Temperature<br>Duration of immersion<br>Depth of immersion | Temp.: 155 °C/Time: 4 h<br>Solder bath<br>Solution of rosin ethanol<br>Sn-Ag-Cu (Lead Free Solder)<br>(245 ± 5) °C<br>(5.0 ± 0.5) s<br>(10 ± 1) mm                                                                                                                                              |
| 14  | Electrical<br>Characterization | Capacitance                                                                     | Within the specified tolerance                                                                                   | Measurement Temperature<br>18 °C-28 °C                                                                                                                                                                                                                                                          |
| 15  |                                | DF                                                                              | 0.125 max                                                                                                        | Relative Humidity<br>≤ 80% RH<br>Measurement Frequency<br>$C \leq 10 \mu\text{F}, f = 1.0 \pm 0.1 \text{ KHz}; C > 10 \mu\text{F}, f = 120 \pm 24 \text{ Hz}$<br>Measurement Voltage<br>$C \leq 10 \mu\text{F}, U = 1.0 \pm 0.2 \text{ Vrms}; C > 10 \mu\text{F}, U = 0.5 \pm 0.1 \text{ Vrms}$ |
| 16  |                                | IR (Room Temp.)                                                                 | ≥ 1000 Mfi or 50 fi•F, (Whichever is smaller)                                                                    | Measurement Temperature<br>25 °C<br>Measurement Voltage<br>$U_R < 500 \text{ V}: U_R$<br>$U_R \geq 500 \text{ V}: 500 \text{ V} \pm 50 \text{ V}$<br>Charging Time<br>1 min<br>The charge/discharge current<br>≤ 50 mA                                                                          |
| 17  |                                | IR (High Temp.)                                                                 | ≥ 100 Mfi or 5 fi•F, (Whichever is smaller)                                                                      | Measurement Temperature<br>105 °C<br>Measurement Voltage<br>$U_R < 500 \text{ V}: U_R$<br>$U_R \geq 500 \text{ V}: 500 \text{ V} \pm 50 \text{ V}$<br>Charging Time<br>1 min<br>The charge/discharge current<br>≤ 50 mA                                                                         |
| 18  |                                | Voltage proof                                                                   | No defects or abnormalities.                                                                                     | Test Voltage<br>$\geq 2.5 \times U_R$<br>Applied Time<br>$t = 1-5 \text{ s}$<br>The charge/discharge current<br>≤ 50 mA                                                                                                                                                                         |
| 19  | Board Flex                     | Appearance                                                                      | No defects or abnormalities.                                                                                     | Mounting method<br>Solder the capacitor to the test substrate as shown in Fig 2                                                                                                                                                                                                                 |
|     |                                | Cap. Change                                                                     | $\Delta C/C \leq \pm 10\%$                                                                                       | Pressurization Method<br>Shown in Fig 3                                                                                                                                                                                                                                                         |
|     |                                | IR (Room Temp.)                                                                 | ≥ 1000 Mfi or 50 fi•F, (Whichever is smaller)                                                                    | Speed<br>1 mm/s                                                                                                                                                                                                                                                                                 |
|     |                                | DF                                                                              | Within the specified initial value                                                                               | Flexure<br>2 mm<br>Holding Time<br>$t = (60 \pm 1) \text{ s}$<br>then measure the capacitance                                                                                                                                                                                                   |
|     |                                |                                                                                 |                                                                                                                  |                                                                                                                       |

Table 1: Specifications and Test Methods

| No. | Item<br>AEC-Q200 Test Item                 |                   | Specification<br>Class 2 ( High dielectric constant type)                        | Test Method                                                                                                                                                                 |                                                                                                                                           |
|-----|--------------------------------------------|-------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 20  | Terminal Strength                          | Appearance        | No defects or abnormalities.                                                     | Subjected to 3 cycles of lead-free reflow at 260 °C (standard profile) for thermal shock testing, with ~30 minutes between cycles.                                          |                                                                                                                                           |
|     |                                            | Cap. Change       | Within the specified initial value                                               | Mounting method                                                                                                                                                             | Solder the capacitor to the test substrate as shown in Fig 4                                                                              |
|     |                                            | IR (Room Temp.)   | $\geq 1000 \text{ M}\Omega$ or $50 \text{ }\mu\text{F}$ , (Whichever is smaller) | Holding Time                                                                                                                                                                | $t = (60 \pm 1) \text{ s}$                                                                                                                |
|     |                                            | DF                | Within the specified initial value                                               | Pushing force                                                                                                                                                               | 0402: $F = 2 \text{ N}$                                                                                                                   |
|     |                                            |                   |                                                                                  |                                                                                                                                                                             |  <p>Fig. 4</p>                                         |
| 21  | Beam Load Test                             | Destruction value | Should be exceed following one                                                   | Mounting method                                                                                                                                                             | Place the capacitor in the beam load fixture as Fig 5/6                                                                                   |
|     |                                            |                   | Size Code      Destruction value                                                 | Speed supplied the Stress Load                                                                                                                                              | 0402 min: 0.5 mm/s, 0201: 0.1 mm/s                                                                                                        |
|     |                                            |                   | 0402 $\geq 8 \text{ N}$                                                          | <Size Code: 0805 max >                                                                                                                                                      | <Size Code: 1206 min>                                                                                                                     |
|     |                                            |                   |                                                                                  |  <p>Fig. 5</p>                                                                            |  <p>Fig. 6</p>                                         |
| 22  | Temperature Characteristics of Capacitance |                   | $X6S: \Delta C/C \leq \pm 22\%$                                                  | Pre-treatment                                                                                                                                                               | Perform heat treatment at $(150 \pm 10) ^\circ\text{C}$ for 1 h, then soak at room temperature for $(24 \pm 2) \text{ h}$ , then measure. |
|     |                                            |                   |                                                                                  | Measure the capacitance separately in 25 °C, $\theta_1, 25 ^\circ\text{C}, \theta_2, 25 ^\circ\text{C}$ , should satisfied related Temperature Coefficient of Capacitance . |                                                                                                                                           |
|     |                                            |                   |                                                                                  | X6S                                                                                                                                                                         | $\theta_1 = -55 ^\circ\text{C}, \theta_2 = 105 ^\circ\text{C}$                                                                            |
|     |                                            |                   |                                                                                  | T.C. Measurement Voltage                                                                                                                                                    | $\leq 1.0 \pm 0.2 \text{ Vrms}$ ※      [※ Please contact our technical support staff for more information.]                               |

## 4. Packaging, Shipment and storage

### 4.1 Packaging

#### 4.1.1 packaging type

Reel Packaging (standard carrier tape disc packaging), single disc smallest package see ⑧ Packaging Code

First packaging: Each multi-disc material is packed into a box.

The second packaging: the first packaged packaging box is loaded into the paper packaging box, and the remaining space in the box is filled with light auxiliary materials.

The above packaging forms can also be packaged according to user needs.

#### 4.1.2 Carrier Tape size

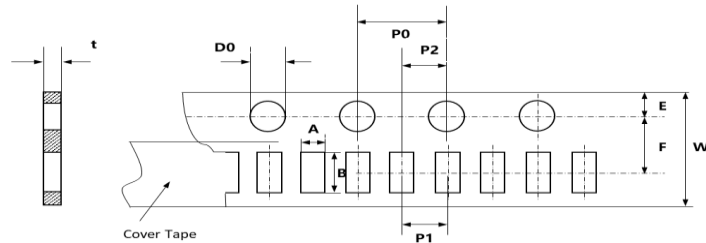


Fig. 7-1 0402 (Paper tape/ 2 mm pitch)

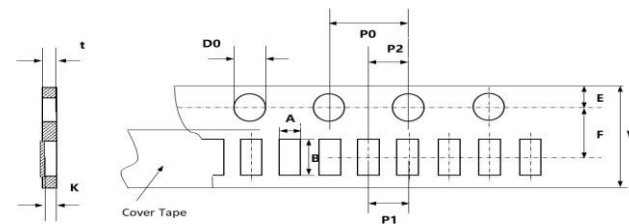


Fig. 7-2 0201 (Paper tape/ 2 mm pitch)

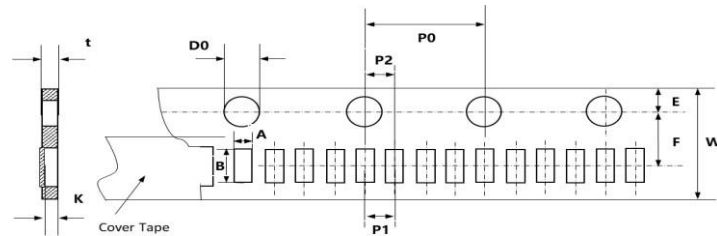


Fig. 7-3 0201 (Paper tape/ 1 mm pitch)

Table 2-1: Carrier size (Size Code: 0201,0402)

(Unit:mm)

| Size Code | Thickness code | Carrier Tape Type | Packaging Code | A           | B           | F           | P1          | E           | D0          | P2          | K           | W           | P0          | t       |
|-----------|----------------|-------------------|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------|
| 0201      | A              | Paper             | T              | 0.38 ± 0.03 | 0.68 ± 0.03 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.36 ± 0.02 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | A              | Paper             | J              | 0.38 ± 0.03 | 0.68 ± 0.03 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.36 ± 0.02 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | A              | Paper             | D              | 0.38 ± 0.03 | 0.68 ± 0.03 | 3.50 ± 0.05 | 1.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 1.00 ± 0.05 | 0.36 ± 0.02 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | A              | Paper             | L              | 0.38 ± 0.03 | 0.68 ± 0.03 | 3.50 ± 0.05 | 1.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 1.00 ± 0.05 | 0.36 ± 0.02 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | J              | Paper             | T              | 0.40 ± 0.04 | 0.70 ± 0.04 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.38 ± 0.04 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | J              | Paper             | J              | 0.40 ± 0.04 | 0.70 ± 0.04 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.38 ± 0.04 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | J              | Paper             | D              | 0.40 ± 0.04 | 0.70 ± 0.04 | 3.50 ± 0.05 | 1.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 1.00 ± 0.05 | 0.38 ± 0.04 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | J              | Paper             | L              | 0.40 ± 0.04 | 0.70 ± 0.04 | 3.50 ± 0.05 | 1.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 1.00 ± 0.05 | 0.38 ± 0.04 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.5 max |
| 0201      | X              | Paper             | T              | 0.44 ± 0.06 | 0.74 ± 0.06 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.40 ± 0.05 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.6 max |
| 0201      | X              | Paper             | J              | 0.44 ± 0.06 | 0.74 ± 0.06 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.40 ± 0.05 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.6 max |
| 0201      | F              | Paper             | T              | 0.44 ± 0.06 | 0.74 ± 0.06 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | 0.40 ± 0.05 | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.6 max |
| 0402      | B              | Paper             | T              | 0.63 ± 0.05 | 1.13 ± 0.05 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | /           | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.8 max |
| 0402      | B              | Paper             | J              | 0.63 ± 0.05 | 1.13 ± 0.05 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | /           | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.8 max |
| 0402      | N              | Paper             | T              | 0.70 ± 0.10 | 1.20 ± 0.10 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | /           | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.8 max |
| 0402      | N              | Paper             | J              | 0.70 ± 0.10 | 1.20 ± 0.10 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | /           | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.8 max |
| 0402      | C              | Paper             | T              | 0.75 ± 0.10 | 1.30 ± 0.10 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | /           | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.8 max |
| 0402      | C              | Paper             | J              | 0.75 ± 0.10 | 1.30 ± 0.10 | 3.50 ± 0.05 | 2.00 ± 0.05 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | /           | 8.00 ± 0.10 | 4.00 ± 0.10 | 0.8 max |

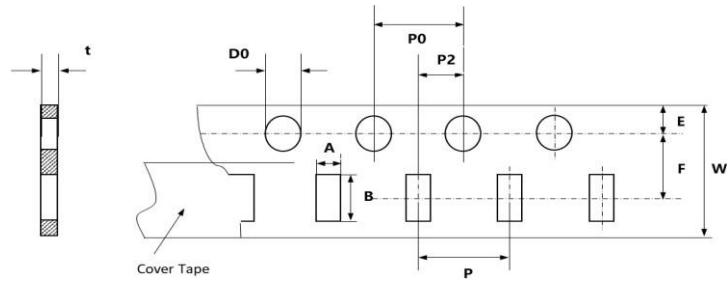


Fig. 7-4 0603, 0805, 1206, 1210 (Paper tape)

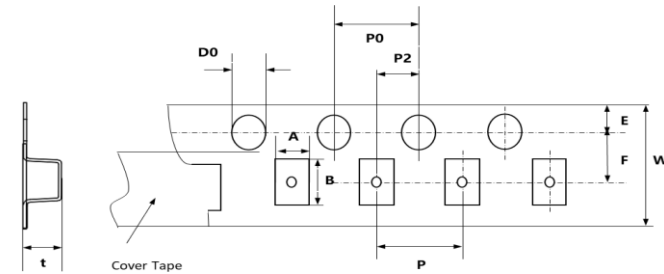


Fig. 7-5 0603,0805,1206,1210 (Plastic tape)

Table 2-2: Carrier size (Size Code:0603, 0805, 1206, 1210)

(Unit:mm)

| Size Code | Thickness code | Carrier Tape Type | Packaging Code | A           | B           | F           | P           | E           | D0          | P2          | K | W           | P0          | t        |
|-----------|----------------|-------------------|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---|-------------|-------------|----------|
| 0603      | D              | Paper             | T              | 1.00 ± 0.10 | 1.80 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | D              | Paper             | A              | 1.00 ± 0.10 | 1.80 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | D              | Plastic           | O              | 1.00 ± 0.10 | 1.80 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | D              | Paper             | W              | 1.00 ± 0.10 | 1.80 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | K              | Paper             | T              | 1.10 ± 0.10 | 1.90 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | K              | Paper             | A              | 1.10 ± 0.10 | 1.90 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | K              | Plastic           | O              | 1.10 ± 0.10 | 1.90 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | K              | Paper             | W              | 1.10 ± 0.10 | 1.90 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | K              | Plastic           | Q              | 1.10 ± 0.10 | 1.90 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0603      | K              | Plastic           | R              | 1.10 ± 0.10 | 1.90 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | C              | Paper             | T              | 1.45 ± 0.10 | 2.20 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 0.9 max  |
| 0805      | C              | Plastic           | R              | 1.45 ± 0.10 | 2.20 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 0.9 max  |
| 0805      | K              | Paper             | T              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | K              | Plastic           | R              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | K              | Plastic           | E              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | Y              | Paper             | T              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | Y              | Plastic           | E              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | Y              | Plastic           | P              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | Y              | Plastic           | R              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 0805      | G              | Plastic           | R              | 1.45 ± 0.10 | 2.20 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.75 max |
| 0805      | G              | Plastic           | P              | 1.45 ± 0.10 | 2.20 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.75 max |
| 0805      | G              | Plastic           | O              | 1.45 ± 0.10 | 2.20 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.75 max |
| 0805      | H              | Plastic           | R              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.00 max |
| 0805      | H              | Plastic           | P              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.00 max |
| 0805      | H              | Plastic           | O              | 1.45 ± 0.20 | 2.20 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.00 max |
| 1206      | E              | Plastic           | R              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 1206      | E              | Plastic           | P              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.15 max |
| 1206      | O              | Plastic           | R              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.45 max |
| 1206      | O              | Plastic           | P              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 1.45 max |

Table 2-2: Carrier size (Size Code:0603, 0805, 1206, 1210)

(Unit:mm)

| Size Code | Thickness code | Carrier Tape Type | Packaging Code | A           | B           | F           | P           | E           | D0          | P2          | K | W           | P0          | t        |
|-----------|----------------|-------------------|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---|-------------|-------------|----------|
| 1206      | L              | Plastic           | P              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1206      | L              | Plastic           | R              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1206      | L              | Plastic           | E              | 1.80 ± 0.20 | 3.40 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1206      | P              | Plastic           | P              | 1.90 ± 0.20 | 3.50 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1210      | Q              | Plastic           | F              | 2.70 ± 0.20 | 3.50 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1210      | Q              | Plastic           | S              | 2.70 ± 0.20 | 3.50 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1210      | Q              | Plastic           | Z              | 2.70 ± 0.20 | 3.50 ± 0.20 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 2.50 max |
| 1210      | R              | Plastic           | Z              | 2.70 ± 0.20 | 3.50 ± 0.30 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 3.00 max |
| 1210      | R              | Plastic           | S              | 2.70 ± 0.20 | 3.50 ± 0.30 | 3.50 ± 0.05 | 4.00 ± 0.10 | 1.75 ± 0.10 | 1.55 ± 0.05 | 2.00 ± 0.05 | / | 8.00 ± 0.20 | 4.00 ± 0.10 | 3.00 max |

## 4.1.3 Disc size

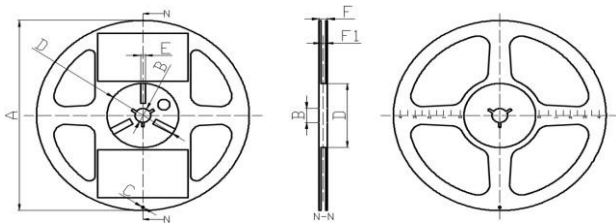


Fig. 8 Disc (Width of carrier-8 mm)

Table 3: Disc size

(Unit:mm)

| Disc size | Width of carrier | A          | B         | C          | D          | E         | F          | F1         | Size Code |
|-----------|------------------|------------|-----------|------------|------------|-----------|------------|------------|-----------|
| 7"        | 8.00 ± 0.10      | Φ178 ± 2.0 | Φ13 ± 1.0 | Φ4.0 ± 0.5 | Φ60 ± 2.0  | 4.0 ± 1.0 | 11.5 ± 1.0 | 10.0 ± 2.0 | All       |
| 13"       | 8.00 ± 0.10      | Φ330 ± 2.0 | Φ13 ± 1.0 | Φ4.0 ± 0.5 | Φ108 ± 2.0 | 4.0 ± 1.0 | 13.5 ± 2.0 | 10.0 ± 2.0 | All       |

## 4.1.4 Carrier Tape specifications

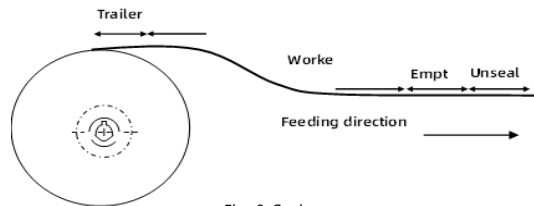


Fig. 9 Carrier

| Packaging | The minimum length of the reserved spaces |        |        |
|-----------|-------------------------------------------|--------|--------|
| Carrier   | Trailer                                   | Empty  | Unseal |
|           | 60 mm                                     | 200 mm | 160 mm |



#### 4.1.5 Performance of Carrier Taping

##### 4.1.5.1 Strength of Carrier Tape and Top Cover Tape

###### a. Carrier Tape

When a tensile force 1.02 kgf is applied in the direction to unreel the tape, the tape shall withstand this force.

###### b. Top cover Tape

When a tensile force 1.02 kgf is applied to the tape, the tape shall withstand this force.

##### 4.1.5.2 Peeling Strength of Top Cover Tape

Unless otherwise specified, the peeling strength of top cover tape shall be within 10.2 gf to 71.4 gf when the top cover tape is pulled at a speed of 300 mm/min with the angle of 0° to 15° (see Fig. 10).

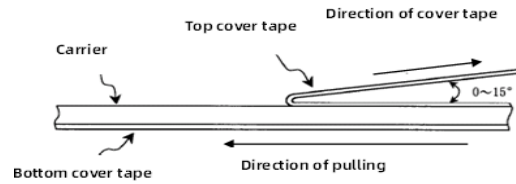


Fig. 10 Cover tape peel-off force

## 2. Shipment

Transport packaging products to adapt to the modern means of transport, but the product in the process of transport to prevent rain and acid and alkali corrosion, shall not be whipped extrusion casting and gravity.

## 3. Storage

### 1. Storage conditions:

The recommended temperature is less than 30 °C.

A temperature is 5 °C to 40 °C and a relative humidity is 20% to 70% as a standard condition.(MSL Level 1)

MLCC may be affected by the storage conditions. Please use them promptly after delivery.

High temperature and humidity conditions and/or prolonged storage may cause deterioration of the packaging materials.

If more than one year has elapsed since delivery, also check the solderability before use.

### 2. Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor solderability.

Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g.,hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)

## 5. MLCC Application of Technical Requirements

### 5.1 Circuit Design

#### 5.1.1 Operating Temperature

- Do not use capacitor above the maximum allowable operating temperature.
- Surface temperature including self-heating should be below maximum operating temperature.

#### 5.1.2 Operating Voltage

The operating voltage for capacitors must always be lower than their rated voltage.

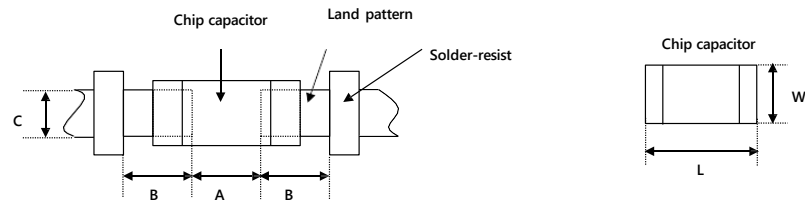
### 5.2 PCB Design

#### 5.2.1 Design of Land-patterns

When the capacitors are mounted on a PCB, the amount of solder at the terminations has a direct effect on the performance of the capacitors.

The greater the amount of solder, the higher the stress on the capacitor. Therefore, when designing land-patterns, it is necessary to consider the appropriate size and configuration of the solder pads.

Size and recommended land dimensions are shown in the following figure and table.



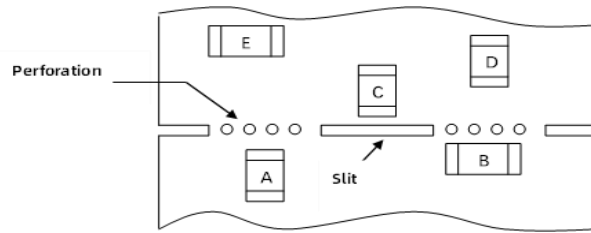
Recommended land dimensions for reflow-soldering

(unit: mm)

| Size Code | Length | Width | Tolerance                      | A           | B           | C           |
|-----------|--------|-------|--------------------------------|-------------|-------------|-------------|
| 0201      | 0.6    | 0.3   | $\pm 0.03$                     | 0.20 - 0.25 | 0.20 - 0.30 | 0.20 - 0.35 |
| 0201      | 0.6    | 0.3   | $\pm 0.05$                     | 0.20 - 0.25 | 0.25 - 0.35 | 0.30 - 0.40 |
| 0201      | 0.6    | 0.3   | $\pm 0.09, \pm 0.1$            | 0.23 - 0.30 | 0.25 - 0.35 | 0.30 - 0.40 |
| 0402      | 1.0    | 0.5   | $\pm 0.05$                     | 0.30 - 0.50 | 0.35 - 0.45 | 0.40 - 0.60 |
| 0402      | 1.0    | 0.5   | $\pm 0.15, \pm 0.20$           | 0.40 - 0.60 | 0.40 - 0.50 | 0.50 - 0.70 |
| 0402      | 1.0    | 0.5   | $\pm 0.30$                     | 0.40 - 0.60 | 0.40 - 0.50 | 0.50 - 0.80 |
| 0603      | 1.6    | 0.8   | $\pm 0.10$                     | 0.60 - 0.80 | 0.60 - 0.70 | 0.60 - 0.80 |
| 0603      | 1.6    | 0.8   | $\pm 0.20$                     | 0.70 - 0.90 | 0.70 - 0.80 | 0.80 - 1.00 |
| 0603      | 1.6    | 0.8   | $\pm 0.25, \pm 0.30$           | 0.70 - 0.90 | 0.70 - 0.90 | 0.80 - 1.10 |
| 0805      | 2.0    | 1.25  | $\pm 0.10, \pm 0.15, \pm 0.20$ | 1.00 - 1.40 | 0.60 - 0.80 | 1.20 - 1.40 |
| 0805      | 2.0    | 1.25  | $\pm 0.25$                     | 1.00 - 1.40 | 0.70 - 0.90 | 1.35 - 1.55 |
| 1206      | 3.2    | 1.6   | $\pm 0.15, \pm 0.20$           | 1.80 - 2.00 | 0.90 - 1.20 | 1.50 - 1.70 |
| 1206      | 3.2    | 1.6   | $\pm 0.30$                     | 1.90 - 2.10 | 1.00 - 1.30 | 1.60 - 1.90 |
| 1210      | 3.2    | 2.5   | $\pm 0.20$                     | 2.00 - 2.40 | 1.00 - 1.20 | 2.50 - 2.70 |
| 1210      | 3.2    | 2.5   | $\pm 0.30$                     | 2.00 - 2.40 | 1.10 - 1.30 | 2.50 - 2.80 |

### 5.2.2 Capacitor Layout on PC Board

Mechanical stress varies according to the location of capacitors on PC board. The recommendation for better design is as follows

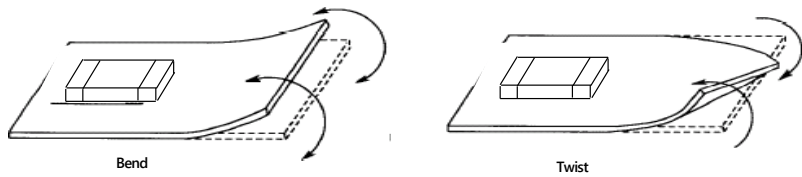


The stress in capacitors is in the following order:  $A > B = C > D > E$

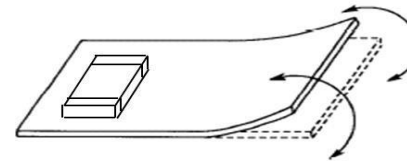
Pay attention not to bend or distort the PC board otherwise the capacitor may crack.

Please refer to the following examples of good and bad capacitors layout.

a. Not recommended

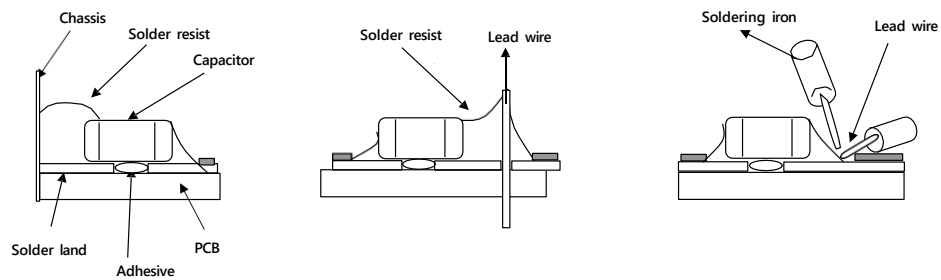


b. Recommended

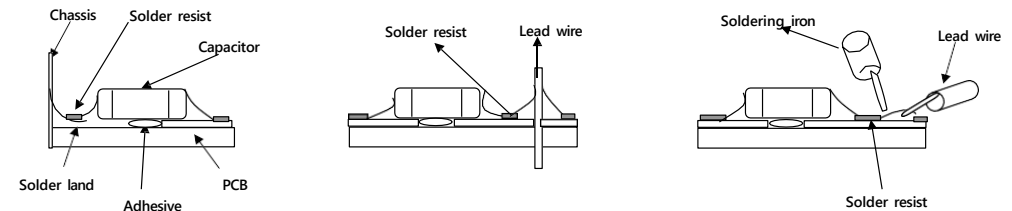


### 5.2.3 Solder Buildup and Soldering

a. Examples of soldering method not recommended



b. Examples of soldering method recommended

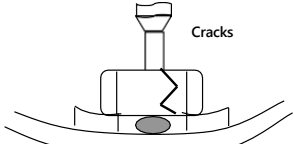
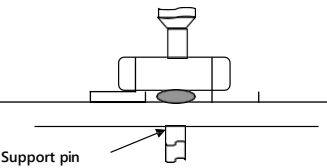
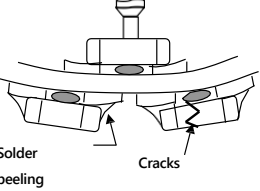
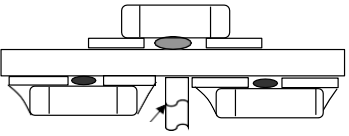


### 5.3 Consideration for Automatic Placement

If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitor to result in cracking. Please take following precautions

- Adjust the bottom dead center of the mounting head to reach on the PC board surface and not press it ;
- Adjust the mounting head pressure to be 1N to 3N of static weight ;
- To minimize the impact energy from mounting head, it is important to provide support from the bottom side of the PC board.

Please refer to the following samples

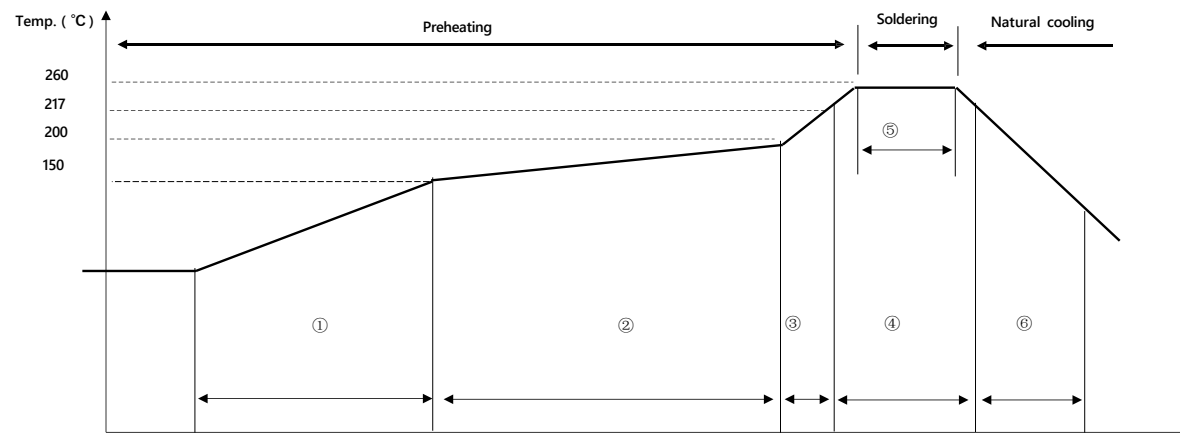
| Mounting              | Not recommended                                                                   | Recommended                                                                        |
|-----------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Singel-sided Mounting |  |  |
| Double-sided Mounting |  |  |

## 4. Soldering

### 1. Flux Selection

- It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.
- Please provide proper amount of flux. Excessive flux must be avoided.
- When water-soluble flux is used, enough washing is necessary.

### 5.4.2 Recommended Soldering Profile

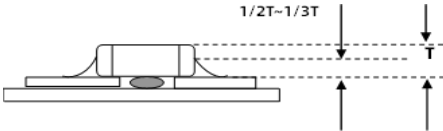


5.4.2.1 Reflow Soldering Condition

| NO. | Reflow Soldering zone | Reflow Soldering Condition                                                                            |
|-----|-----------------------|-------------------------------------------------------------------------------------------------------|
| ①   | Preheating 1          | $\leq 3\text{ }^{\circ}\text{C/s}, \geq 60\text{ s}$                                                  |
| ②   | Constant temperature  | $150^{\circ}\text{C}-200^{\circ}\text{C}, 60\text{ s}-120\text{ s}, \leq 1\text{ }^{\circ}\text{C/s}$ |
| ③   | Preheating 1          | $1-5\text{ }^{\circ}\text{C/s}$                                                                       |
| ④   | Soldering 1           | Above $217\text{ }^{\circ}\text{C}$ , 60-150 s                                                        |
| ⑤   | Soldering 1           | Above $260\text{ }^{\circ}\text{C}$ , over 10 s                                                       |
| ⑥   | Natural cooling       | $\leq 6\text{ }^{\circ}\text{C/s}$                                                                    |

Caution

a.Excessive solder will induce higher tensile force in chip capacitor when temperature changes and result in cracking. Insufficient solder may detach the capacitor from the PC board.  
The ideal condition is to have solder mass controlled to 1/2 to 1/3 of the thickness of the capacitors.



b.Soldering duration should be kept as close to recommended times as possible, because excessive duration can detrimentally affect solderability.  
c.The peak temperature of reflow soldering is  $245\text{ }^{\circ}\text{C} \pm 15\text{ }^{\circ}\text{C}$ .

6. All products in this specification comply with the EU RoHS directive

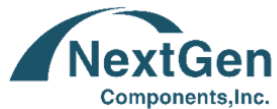
The EU RoHS Directive refers to the "Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment" stipulated by the European Union.

ORIGINAL MFG PART No.: **A0402X6S224K250NTN**

|                           |                                                          |
|---------------------------|----------------------------------------------------------|
| PRODUCT NAME:             | MLCC For Automotive A Series SMD 0402 X6S 220nF ±10% 25V |
| REVISION:                 | A3                                                       |
| NEXTGEN ORDER PART CODE*: | A0402S224K250N                                           |
| CROSS REF. PART NO.:      |                                                          |
| ORIGINAL MFG PART NO.:    | A0402X6S224K250NTN                                       |
| ORIGINAL MANUFACTURER:    | EYang Technology/Eyang MLCC                              |

*Image shown is a representation only.  
Exact specifications should be obtained  
from the product dimension*

\*: Please Indicate this Part Code For RFQ/Order Support



#### AUTHORIZED DISTRIBUTOR

NextGen Components, Inc.

US Warehouse Location: 9 Orchard Road, Suit 106, Lake Forest, CA 92630, USA

RFQ/Order Support: [sales@NextGenComponent.com](mailto:sales@NextGenComponent.com)

Note: This page was created by NextGen Components, Inc. ("NextGen"). The attached last document was created by the part manufacturer, not NextGen, and is provided strictly 'as is.' NextGen, its subsidiaries, affiliates, employees, and agents make no representations or warranties regarding the attached last document and disclaim any liability for the consequences of relying on the information therein. All referenced brands, product names, service names, and trademarks are the property of their respective owners.

## HOW TO ORDER

Please Follow Up Part Code Guide And Indicate NextGen Part Code A0402S224K250N For RFQ and new Order.**RFQ**[Request For Quotation](#)

| CODE | NAME                        | KEY SPECIFICATION OPTION                                                                                                                                                                                |
|------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A    | Series Code                 | A: Multilayer Ceramic Chip Capacitors For Automotive                                                                                                                                                    |
| 0402 | Case Size                   | 0105 : L0.40*W0.20mm; 0201 : L0.60*W0.30mm; 0402 : L1.00*W0.50mm; 0603 : L1.60*W0.80mm<br>0805 : L2.00*W1.25mm; 1206 : L3.20*W1.60mm; 1210 : L3.20*W2.50mm                                              |
| S    | Temperature Characteristics | N: NP0 (COG); B: X7R; W: X5R; S: X6S; Y: Y5V; T: X7S; R: X7T                                                                                                                                            |
| 224  | Capacitance                 | Two significant digits followed by number of Zero, The 3rd digit signifies the multiplying factor, and letter R is decimal point.<br>0R3: 0.3pF; 820: 82pF; 224: 220nF; 680: 68pF; 471: 470pF; 105: 1μF |
| K    | Capacitance Tolerance       | A: ±0.05pF; B: ±0.1pF; C: ±0.25pF; D: ±0.5pF; F: ±1%; G: ±2%; J: ±5%; K: ±10%<br>L: ±15%; M: ±20%; N: ±30%; P: ±0.02pF; X: ±40%; S: 50%/-20%; Y: 150%/-20% Z: 80%/-20%                                  |
| 250  | Rated Voltage               | Two significant digits followed by No. of zeros. "R" is in place of decimal point.<br>6R3: 6.3 VDC; 160: 16 VDC; 250: 25 VDC; 100: 10 VDC; 500: 50 VDC; 101: 100 VDC                                    |
| N    | Case Thickness              | N: 0.8mm Max, See Page 6 (T's Symbol) for Different part code                                                                                                                                           |
| XX   | Internal Control Code       | Blank: N/A; XX: Letter A~Z, a~z or digits (0~9) for Special/Custom Parameters                                                                                                                           |

## IMPORTANT NOTES AND DISCLAIMER

1. ROHS COMPLIANCE: The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU RoHS Directive (EU) 2015/863 EC (RoHS3). RoHS Test Report for this product can be obtained can be obtained at Download Center.
2. REACH COMPLIANCE: REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, REACH Test Report for this product can be obtained can be obtained at Download Center.
3. All Product parametric performance is indicated in the Electrical Characteristics for the listed herein test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
4. NextGen Component, Inc (*NextGen*) reserves the right to make changes to this document and its products and specifications at any time without notice. Customers should obtain and confirm the latest product information and specifications before final design, purchase or use.
5. *NextGen* makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, not does *NextGen* assume any liability for application assistance or customer product design.
6. *NextGen* does not warrant or accept any liability with products which are purchased or used for any unintended or unauthorized application. No license is granted by implication or otherwise under any intellectual property rights of NextGen.
7. *NextGen* products are not authorized for use as critical components in life support devices or systems without express written approval by *NextGen*.
8. *NextGen* requires that customers first obtain an RMA (Returned Merchandise Authorization) number prior to returning any products. Returns must be made within 30 days of the date of invoice, be in the original packaging, unused and like-new condition. At the time of quoting or purchasing, a product may say that it is Non-Cancelable/ Non-Returnable (NCNR). These products are not returnable and not refundable.