

**EYANG TECHNOLOGY DEVELOPMENT CO.,LTD**

**C0402X7R104K500NTC**

**High Capacitance Multi-layer Ceramic Chip Capacitor**

**SPECIFICATION**

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## 1. Scope:

This specifications are applicable to the high capacitance multi-layer ceramic chip capacitor (MLCC) .

Type of Dielectrics: X5R;

Chip Size: 0402;

Capacitance range: 0.1 $\mu$ F;

## 2. Part Number System:

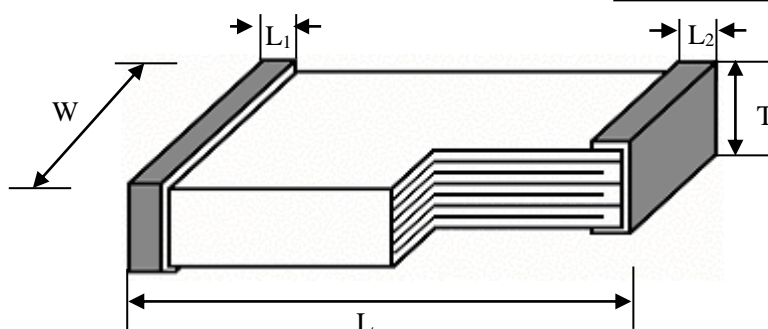
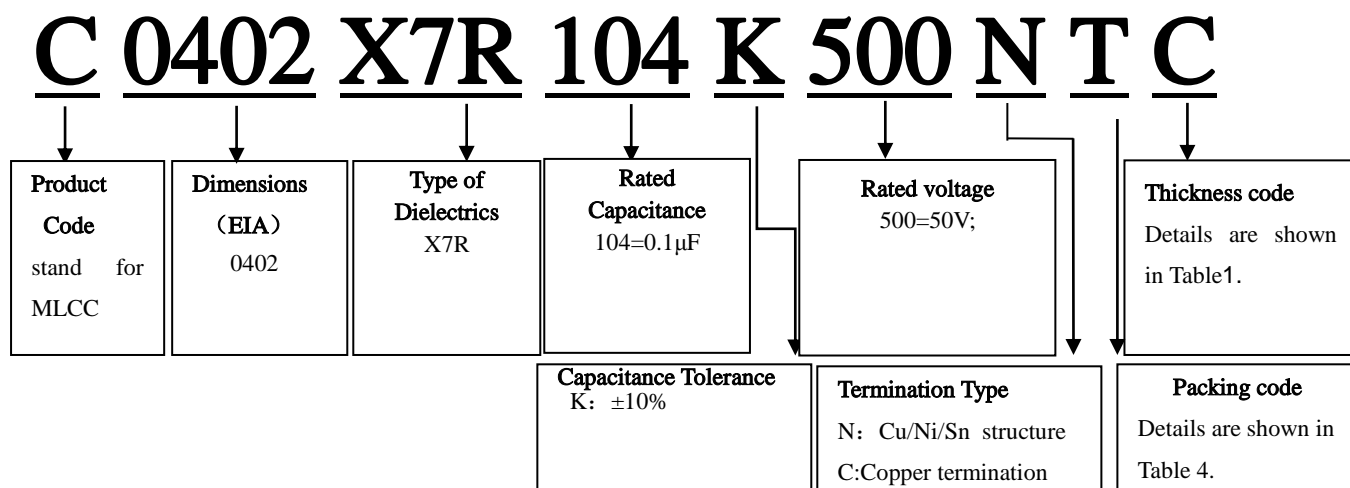


Fig.1 Configuration and Dimension of MLCC

Table 1 Dimension of MLCC (Unite: mm)

Size	Length (L)	Width (W)	Width of Termination (L <sub>1</sub> 、L <sub>2</sub> )	Thickness (T)	Thickness code
0402	1.00 <sup>+0.30</sup> <sub>-0.05</sub>	0.50 <sup>+0.30</sup> <sub>-0.05</sub>	0.10~0.35	0.50 <sup>+0.30</sup> <sub>-0.05</sub>	C

Table 2 Type of dielectrics

Type of Dielectrics	Operating Temperature Range	Temperature Coefficient or Characteristic
X7R	-55℃ ~ +125℃	$\pm 15\%$

Table 3 Rated Voltage and Rated Capacitance

Size	Rate voltage /U <sub>R</sub>	Capacitance	Thickness code
		X5R	
0402	50V	0.1 $\mu$ F	C

## Type of Packing:

Reel Packaging (standard carrier tape disc packaging), every disc smallest package shown in Table 4.

Table 4 Packing type

Chip Size	0402	
Packing code	T	J
Disc size	7"	13"
QTY (Kpcs)	10	50
Carrier Tape type	Paper	Paper
Thickness code	B/N	B/N

Firstly, 5 reels in 1 box; Secondly, 12 boxes maximum in 1 carton. Each carton mostly outfit 12 boxes, the remaining gap fill with lightweight complementary material. The packaging can meet customers' special demands.

### 3. Technical specifications and test methods:

#### 3.1 Visual Inspection:

**3.1.1 Requirement:** no obvious defects on ceramic body and termination.

**3.1.2 Test Method:** Microscope 10×

#### 3.2 Size:

**3.2.1 Requirement:** Configuration and dimension of MLCC are shown in Figure 1 and Table 1.

**3.2.2 Test Method:** Measuring by gages which precision is not less than 0.01 mm .

#### 3.3 Operating Environment:

X7R	Temperature: -55℃~+125℃; Relative humidity: ≤95% (25℃)	Atmosphere: 86 KPa ~106KPa
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#### 3.4 Electrical Parameters and Test Methods:

Table 5 Specifications and Test Methods of MLCC Electrical Parameter

No.	Item	Specification	Test Method
1	Capacitance (C)	Within the specified tolerance	<b>Temperature:</b> 18~28℃; <b>Humidity:</b> ≤RH 80%; <b>Test requery:</b> <b>X7R, X5R, Y5V:</b> 100pF<C≤10μF, f=1KHz±10%; C>10μF, f=100 or 120Hz;
2	Tangent of Loss Angle/ (tgδ)	<b>X7R, X5R, X5S, X5T:</b> U <sub>R</sub> ≥25V tgδ≤1000×10 <sup>-4</sup> U <sub>R</sub> =16V tgδ≤1250×10 <sup>-4</sup> U <sub>R</sub> ≤10V tgδ≤1500×10 <sup>-4</sup>  <b>Y5V:</b> U <sub>R</sub> ≥25V tgδ≤1000×10 <sup>-4</sup> U <sub>R</sub> =16V tgδ≤1500×10 <sup>-4</sup> U <sub>R</sub> ≤10V tgδ≤1800×10 <sup>-4</sup>	<b>Test Voltage:</b> 100pF<C≤10μF: U <sub>R</sub> >6.3V 1.0±0.2Vrms U <sub>R</sub> ≤6.3V 0.5±0.2Vrms; C>10μF: 0.5±0.2Vrms
3	Insulation Resistances/ (Ri)	Ri×C≥100s	<b>Temperature:</b> 18~28℃; <b>Humidity:</b> ≤RH 80%; Rated voltage 60 ± 5S
4	Withstanding voltage (WV)	No breakdown or flashover during test	2.5×U <sub>R</sub> t=1 minute Charge/discharge current not exceeds 50mA.

Note: Capacitance test instructions of Class 2 ceramic capacitors

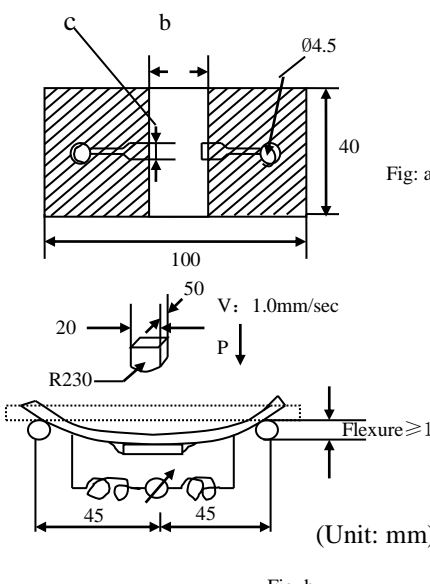
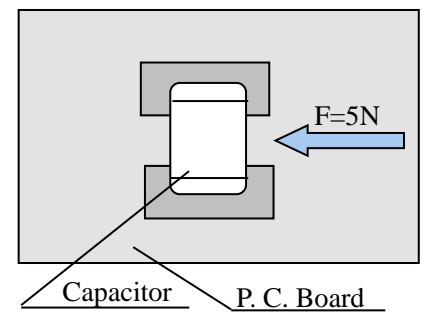
When the capacitor initial capacitance is lower than its tolerance value, the test sample need to be heated for 60 ± 5 minutes at 150 °C ± 10 °C. Recover it, let sit at room temperature for 24±2 hrs, and then test the capacitance.

## 3.5 Environment Test Specifications and Methods:

Without specific note, the “test method” in Table 6 is based on GB/T 21041/21042 IDT IEC60384-21/22 .

Table 6 Environment Test Specifications and Methods

No.	Item	Specification		Test Method																						
1	Temperature Coefficient of Capacitance ( $\alpha_c$ ) or Temperature Characteristics	<b>X7R, X5R:</b> $\Delta C/C \leq \pm 15\%$ <b>X5S:</b> $\Delta C/C \leq \pm 22\%$ <b>X5T:</b> $-33\% \leq \Delta C/C \leq +22\%$ <b>Y5V:</b> $-82\% \leq \Delta C/C \leq +22\%$	Special preconditioning for 1hr at 150°C followed by 24hrs, The ranges of capacitance change compared with the temperature ranges ( $\theta_1$ , 25°C, $\theta_2$ ) shall be within the specified ranges. <b>X5R, X5S, X5T, Y5V:</b> $\theta_1 = -55^\circ\text{C}$ , $\theta_2 = 85^\circ\text{C}$ <b>X7R:</b> $\theta_1 = -55^\circ\text{C}$ , $\theta_2 = 125^\circ\text{C}$ <b>Test Voltage:</b> <table><tr><th>Size</th><th>Type of Dielectrics</th><th>Capacitance</th><th>Rate voltage</th><th>Test Voltage</th></tr><tr><td rowspan="3">0402/0603/0805/1206/1210</td><td rowspan="3">X7R/X5R/X5S/X5T/Y5V</td><td><math>100\text{pF} &lt; C \leq 10\mu\text{F}</math></td><td>UR &gt; 6.3V</td><td>1.0±0.2Vrms</td></tr><tr><td></td><td>UR ≤ 6.3V</td><td>0.5±0.2Vrms</td></tr><tr><td><math>C &gt; 10\mu\text{F}</math></td><td>—</td><td>0.5±0.2Vrms</td></tr><tr><td>0805</td><td>X5R</td><td>100μF</td><td>—</td><td>0.2±0.05Vrms</td></tr></table>			Size	Type of Dielectrics	Capacitance	Rate voltage	Test Voltage	0402/0603/0805/1206/1210	X7R/X5R/X5S/X5T/Y5V	$100\text{pF} < C \leq 10\mu\text{F}$	UR > 6.3V	1.0±0.2Vrms		UR ≤ 6.3V	0.5±0.2Vrms	$C > 10\mu\text{F}$	—	0.5±0.2Vrms	0805	X5R	100μF	—	0.2±0.05Vrms
Size	Type of Dielectrics	Capacitance	Rate voltage	Test Voltage																						
0402/0603/0805/1206/1210	X7R/X5R/X5S/X5T/Y5V	$100\text{pF} < C \leq 10\mu\text{F}$	UR > 6.3V	1.0±0.2Vrms																						
			UR ≤ 6.3V	0.5±0.2Vrms																						
		$C > 10\mu\text{F}$	—	0.5±0.2Vrms																						
0805	X5R	100μF	—	0.2±0.05Vrms																						
2	Resistance to Soldering Heat	<b>Visual:</b> No visible damage and terminations uncovered shall be less than 25%.  <b>Capacitance Change:</b> <b>X7R, X5R, X5S :</b> $\Delta C/C \leq \pm 15\%$ ; <b>X5T, Y5V:</b> $\Delta C/C \leq \pm 30\%$  <b>tgδ and Ri:</b> meet the initial specification in Table 5.		Special preconditioning for 1hr at 150°C followed by 24hrs; Preheat the capacitor at 110 to 140°C for 30-60s. Immerse the capacitor in an eutectic solder solution at 260±5°C for 10±1 seconds. The depth of immersion is 10mm.Recover it, let sit at room temperature for 6 24±2hrs,then observe appearance and measure electrical characteristics.																						
3	Solderability	75% min. coverage of both terminal electrodes is soldered evenly and continuously.		Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it at 80 to 140°C for 30s to 60s and immerse it into molten solder of 235±5°C for 2±0.2 seconds. The depth of immersion is 10mm.																						

4	Bond Strength of Termination	<b>Visual:</b> No visible damage.	<p>Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a. Apply a force in the direction shown in Fig. b. Bending 2mm at a speed of 1mm/sec and hold for <math>5\pm 1</math>secs, then measure the capacitance.</p>  <p>Fig. a</p> <p>Fig. b</p>
		<b>Capacitance Change:</b> <b>X7R, X5R:</b> $\Delta C/C \leq \pm 10\%$ ; <b>Y5V:</b> $\Delta C/C \leq \pm 30\%$	
5	Adhesion	<b>Visual:</b> No visible damage.	<p>When Soldering the capacitor on a P. C. board, apply a pushing force of 5N for <math>10\pm 1</math>secs.</p>  <p>Capacitor P. C. Board</p>
6	Vibration	<b>Visual:</b> No visible damage.	<p>Sample shall be mounted on a suitable substrate.</p> <p><b>Amplitude:</b> 1.5mm</p> <p><b>Frequencies:</b> 10 Hz~100 Hz ~200Hz, and Harmonic vibration of uniform changes, 5 minutes sweep cycle.</p> <p>Repeat this for 2hrs each in 3 perpendicular directions X, Y, Z, total 6hrs.</p> <p>(Related STD: IEC 68-2-6 test Fc)</p>
		<b>Capacitance Change:</b> <b>X7R, X5R:</b> $\Delta C/C \leq \pm 15\%$ ; <b>X5T, Y5V:</b> $\Delta C/C \leq \pm 20\%$	
		<b>tgδ and Ri:</b> meet the initial specification in Table 5.	

7	Rapid change of temperature	<b>Visual:</b> No visible damage.	<p>Special preconditioning for 1hr at 150℃ followed by 24hrs. Fix the capacitor to the supporting jig. Expose the capacitors in the condition step 1 through 4 and perform 5 cycles. Step      temperature (℃)      time 1                    θ<sub>A</sub>                    30 min 2                    25                    2~5 min 3                    θ<sub>B</sub>                    30 min 4                    25                    2~5 min <b>X7R:</b> θ<sub>A</sub> =-55℃ , θ<sub>B</sub> =125℃ ; <b>X5R, X5S, X5T, Y5V:</b> θ<sub>A</sub>=-55℃ , θ<sub>B</sub>=85℃ Recover it, let sit at room temperature for 24±2hrs, then observe appearance and measure electrical characteristics.</p>
		<b>Capacitance Change:</b> <b>X7R, X5R, X5S:</b> ΔC/C≤±15%; <b>X5T, Y5V:</b> ΔC/C≤±20%	
		<b>tgδ and Ri:</b> meet the initial specification in Table 5.	
8	Damp Heat (Steady State)	<b>Visual:</b> No visible damage.	<p>Special preconditioning for 1hr at 150℃ followed by 24hr <b>Test Temperature:</b> 60℃±2℃ <b>Humidity:</b> RH 90~95% <b>Duration:</b>500hrs Recover it, let sit at room temperature for 24±2hrs, then observe appearance and measure electrical characteristics.</p>
		<b>Capacitance change:</b> <b>X7R, X5R, X5S:</b> ΔC/C≤±12.5%; <b>X5T, Y5V:</b> ΔC/C≤±30%	
		<b>Tgδ:</b> tgδ≤2×The initial index in Table 5	
		<b>Insulation Resistances (Ri):</b> <b>X7R, X5R, X5S, X5T, Y5V:</b> Ri≥1000MΩ or Ri×C≥50s (U <sub>R</sub> ≥25V) , whichever is smaller; Ri≥1000MΩ or Ri×C≥10s (U <sub>R</sub> ≤16V) , whichever is smaller	
9	Damp heat with load	<b>Visual:</b> No visible damage.	<p>Apply 100% of the rated DC voltage at 60℃ for 1hr. Remove and set for 24hours at room temperature. Perform initial measurement. <b>Test Temperature:</b> 60±2℃; <b>Humidity:</b> RH 90~95%; <b>Test Voltage:</b> U<sub>R</sub>; <b>Duration:</b> 500hrs; Charge/discharge current not exceeds 50mA. Recover it, let sit at room temperature for 24±2hrs, then observe appearance and measure electrical characteristics.</p>
		<b>Capacitance change:</b> <b>X7R:</b> ΔC/C≤±12.5%; <b>X5R, X5S:</b> ΔC/C≤±15%; <b>Y5V:</b> ΔC/C≤±30%	
		<b>Tgδ:</b> tgδ≤2×The initial index in Table 5	
		<b>Insulation Resistances (Ri):</b> Ri≥500MΩ or Ri×C≥25s,whichever is smaller;	

10	Endurance	<b>Visual:</b> No visible damage.	Special preconditioning for 1hr at 150°C followed by 24hrs <b>Test Temperature:</b> <b>X7R:</b> 125°C; <b>X5R, X5S, X5R, Y5V:</b> 85°C; <b>Duration:</b> 1000hrs; <b>Test Voltage:</b> $1.5 \times U_R$ * Recover it, let sit at room temperature for $24 \pm 2$ hrs, then observe appearance and measure electrical characteristics.  *Note: 0402 X5R 105, 0603 X5R 475, 0805 X5R 106, 1206 X5R 106 and above capacity test voltage is $1.0 \times U_R$
		<b>Capacitance Change:</b> <b>X7R, X5R, X5S:</b> $\Delta C/C \leq \pm 15\%$ ; <b>X5T, Y5V:</b> $\Delta C/C \leq \pm 30\%$	
		<b>Tgδ:</b> $\text{tg}\delta \leq 2 \times \text{The initial index in Table 5}$	
		<b>Insulation Resistances (Ri):</b>  $R_i \geq 1000\text{M}\Omega$ or $R_i \times C \geq 50\text{s}$ ( $U_R \geq 25\text{V}$ ) whichever is smaller; $R_i \geq 1000\text{M}\Omega$ or $R_i \times C \geq 10\text{s}$ ( $U_R \leq 16\text{V}$ ) , whichever is smaller;	

## 4. Packaging, transportation and storage:

### 4.1 Packing:

#### 4.1.1 Type of packing:

Reel Packaging (standard carrier tape disc packaging), single disc smallest package are shown in Table 4.

#### 4.1.2 Carrier Tape Dimensions:

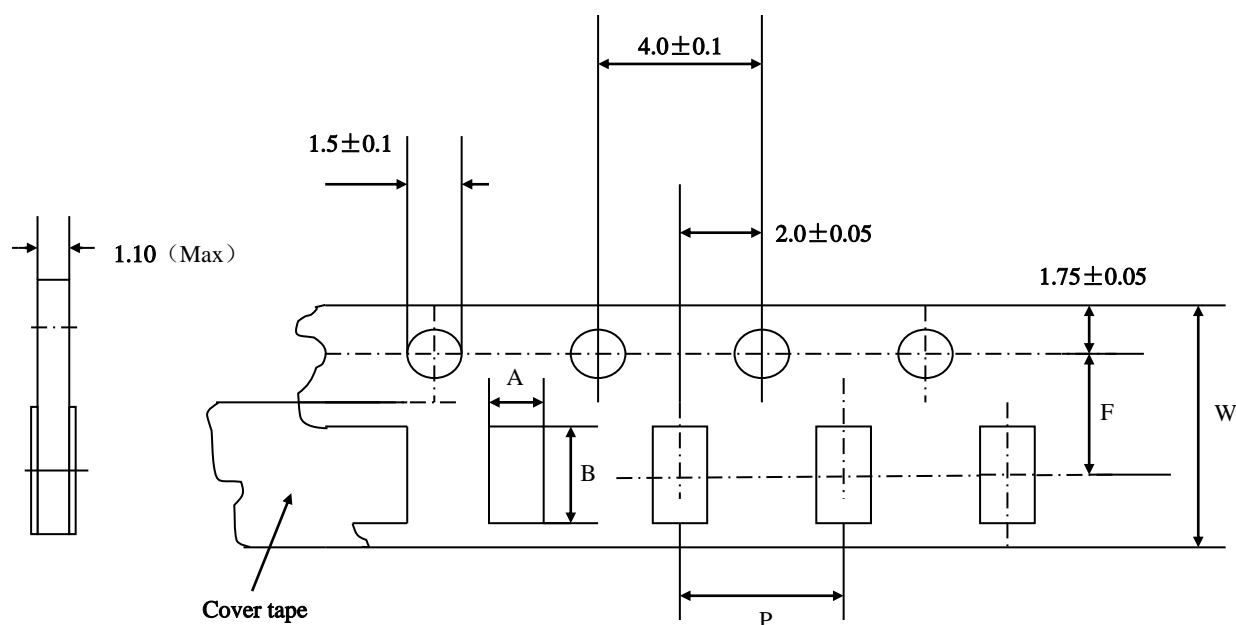


Figure 2 Carrier

Table 7 Carrier size

Mark	Size of product
	0402
	Size (Unit: mm)
A ( Width of the square hole )	$0.70\pm0.10$
B ( Length of the square hole )	$1.20\pm0.10$
F ( Center distance between positioning hole and square hole )	$3.50\pm0.05$
P ( Square hole spacing )	$2.00\pm0.10$
W (Width of carrier)	$8.00\pm0.20$

## 4.1.3 Disc Size:

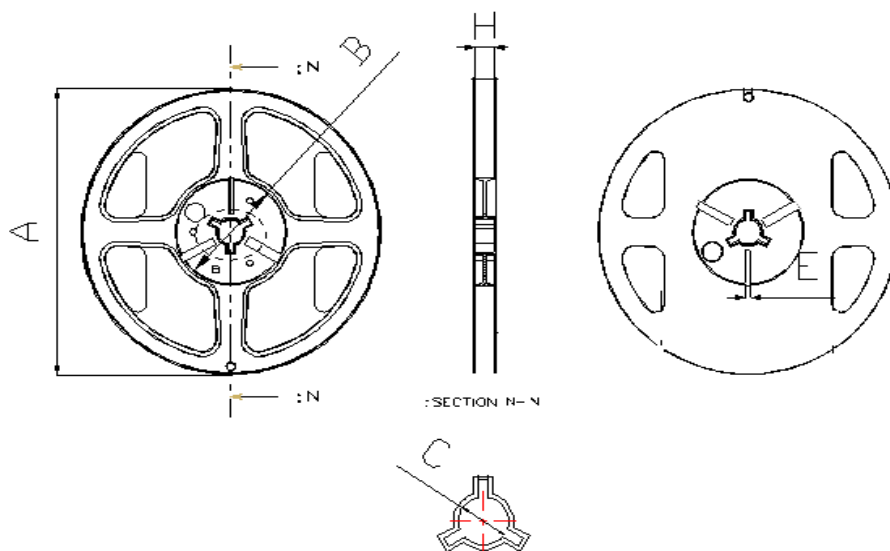
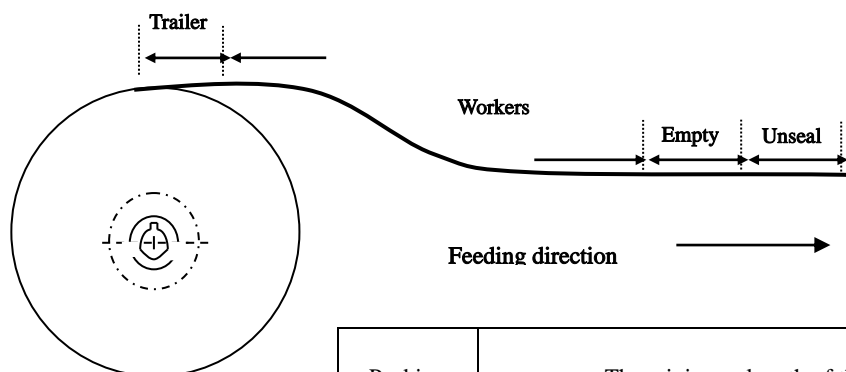


Figure 3 disc

Table 8 Disc Size

圆盘尺寸	A/mm	B/mm	C/mm	E/mm	H/mm
7"	$\Phi 178\pm 2.0$	$\Phi 60\pm 2.0$	$\Phi 13\pm 1.0$	$4\pm 1.0$	$9.5\pm 1.0$
13"	$\Phi 330\pm 2.0$	$\Phi 100\pm 2.0$	$\Phi 13\pm 1.0$	$3\pm 1.0$	$10\pm 1.0$

#### 4.1.4 Carrier Tape Specifications:



Packing	The minimum length of the reserved spaces		
Carrier tape	Trailer	Empty	Unseal
	60 mm	200mm	160 mm

#### 4.1.5 Performance of Carrier Taping::

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

###### a. Carrier Tape

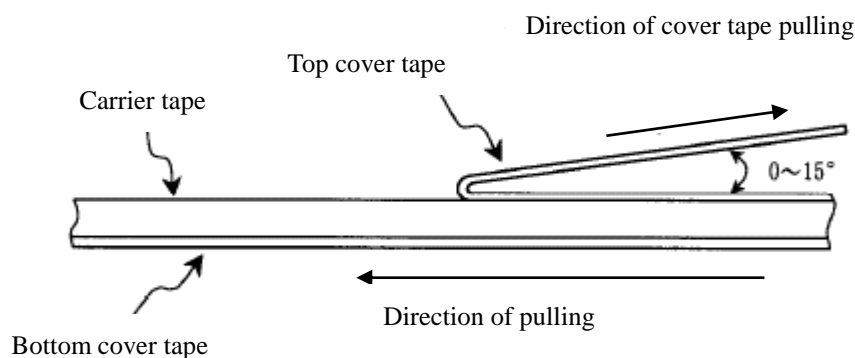
When a tensile force 1.02kgf is applied in the direction to unreel the tape, the tape shall withstand this force.

###### b. Top cover Tape

When a tensile force 1.02kgf 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 to 71.4 gf when the top cover tape is pulled at a speed of 300mm/min with the angle of 0 to 15° (see the following figure).



#### 4.2 Shipment:

It must not be got rain, snow, and must avoid erosion of acid and alkali during the course of shipment.

#### 4.3 Storage:

##### Period of Store:

12 months, otherwise, its solderability must be inspected again.

##### Condition of Store:

Temperature: Below 35°C

Humidity: Below RH70%.