1、Purpose versus Application characteristics：

The specifications are applicable to Multi-layer Ceramic Chip Capacitor (MLCC)：

■ Universal； □ Automotive Grade；

2、The term / Definition：:

2.1 Structural design classification：■General； □ Ultra Micro； □ High Capacitance； □ High-Q；

□ High-voltage

2.2 Chip Size：□01005、□0201、■0402、□0603、___(Others)；

2.3 Capacitance range：0.1pF~4.7μF；

2.4 Voltage range：4.0V~ 50V；

2.5 Type of Dielectrics：■C0G、■X7R、■X5R、■Y5V、■X6S、■X6T、■X7T、■X7S、____(Others)；

ADD： Viiyong Hi-Tech Park,No.1 Chuangye 2nd Road, Shuangdong Sub-district, 527200,Luoding City, Guangdong Province, P. R. China

Postcode：527200 TEL：0766-3810639 FAX：0766-3810639

Mark：The product specification is only for reference of design selection, not used as the basis for delivery

3、Part Number System：

V 104 K 0402 X5R 160 N B *

- **V** — General-purpose MLCC
- **104** — Rated Capacitance For example：0R5=0.5pF；101=100pF
- **K** — Capacitance Tolerance
  A：±0.05pF　B：±0.1pF　C：±0.25 pF　D：±0.5pF
  F：±1%　G：±2%　J：±5%　K：±10%
  L：±15%　M：±20%　N：±30%　X：±40%
  Z：+80/-20%
  Y：+150/-20%
- **0402** — Size Code（EIA size）0402；
- **X5R** — Type of Dielectrics C0G、X5R、X7R、Y5V、X6S、X7T、X7S、X6T
- **160** — Rated Voltage 6R3=6.3V；100=10V　160=16V ；250=25V　500=50V
- **N** — Termination Type N：Cu /Ni/Sn structure；
- **B** — Thickness Code Details are shown in Table1.
- ***** — Control code

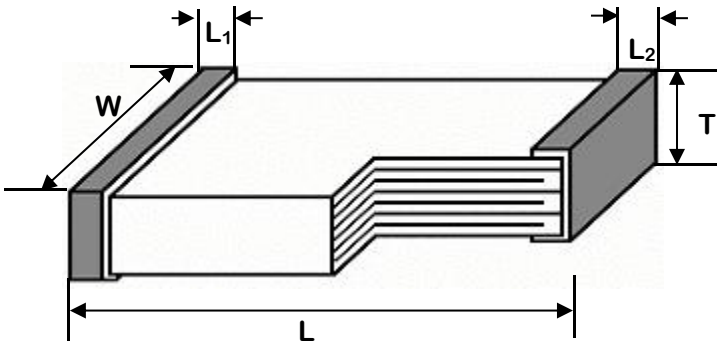


Figure 1 Configuration and Dimension of MLCC

Table 1　Dimension of　MLCC (Unite：　mm)

Size	Length（L）	Width（W）	Width of Termination（L1、L2）	Thickness（T）	Thickness code
0402	1.00±0.05	0.50±0.05	0.10～0.35	0.50±0.05	B
	$1.00^{+0.15}_{-0.05}$	$0.50^{+0.13}_{-0.05}$	0.10～0.35	$0.50^{+0.13}_{-0.05}$	N
	$1.00^{+0.15}_{-0.05}$	$0.50^{+0.15}_{-0.05}$	0.10～0.35	$0.50^{+0.15}_{-0.05}$	6
	$1.00^{+0.20}_{-0.05}$	$0.50^{+0.20}_{-0.05}$	0.10～0.35	$0.50^{+0.20}_{-0.05}$	C

Table 2 Type of dielectrics

Type of Dielectrics	Operating Temperature Range	Temperature Coefficient or Characteristic
NP0	-55℃～+125℃	C0G：0±30ppm/℃
		C0H：0±60ppm/℃
X7R	-55℃～+125℃	±15%
X5R	-55℃～+85℃	±15%
Y5V	-30℃～+85℃	+22/-82%
X6S	-55℃～+105℃	±22%
X6T	-55℃～+105℃	+22%～-33%
X7T	-55℃～+125℃	+22%～-33%
X7S	-55℃～+125℃	±22%

Table 3 Rated Voltage and Rated Capacitance

Size	Rate voltage /U_R	Capacitance								Thickness code
		C0G	X7R	X5R	Y5V	X6S	X6T	X7T	X7S	
0402	50V	0.1pF～1.0nF	100pF～68nF	100pF～100nF	100pF～68nF	—	—	—	—	B
		360pF～1.0nF	22nF～68nF	22nF～100nF	22nF～68nF	—	—	—	—	N
		—	100nF	—	—	100 nF	—	—	100 nF	C
	35V	—	100nF	100nF	—	—	—	—	—	B
		—	100 nF	—	—	100 nF	—	—	100 nF	C
	25V	0.1pF～1.0nF	22nF～100nF	10nF～1.0uF	10nF～68nF	—	—	—	100 nF	B
		470pF～1.0nF	100nF	82nF～1.0uF	100nF	—	—	—	—	N
		—	—	1.0uF	—	120nF~470nF	—	—	220nF	C
	16V	—	56nF～100nF	100nF～1.0uF	47nF～150nF	120nF~220nF	—	—	—	B
		—	—	100nF～1.0uF	150nF～220nF	120nF~220nF	—	—	120nF~220nF	N
		—	—	1.0uF～2.2uF	—	220nF~470nF	—	—	120nF~220nF	C
	10V	—	—	100nF～1.0uF	100nF	120nF~470nF	—	—	120nF～470nF	B
		—	—	100nF～470nF	150nF～220nF	120nF~1.0uF	—	—	120nF～470nF	N
		—	—	1.0uF~2.2uF	—	1.0uF	—	—	470nF	C
	6.3V	—	—	100nF～2.2uF	—	120nF~1.0uF	—	—	120nF～470nF	B
		—	—	100nF～470nF, 2.2uF	220nF	120nF~470nF	—	470nF	220nF~470nF	N
		—	—	4.7uF	—	—	—	—	—	6
		—	—	2.2uF~4.7uF	—	1.0uF ~4.7uF	4.7uF	1.0uF	—	C
	4.0V	—	—	2.2uF	—	1.0uF ~2.2uF	—	1.0uF ~2.2uF	—	C

Note: 1) E12 series for X7R, X5R, X6S、X6T、X7T and X7S groups, E6 series for Y5V group, E24 series for C0G group, integer nominal values such as 1.0, 2.0, 3.0pF, etc. are allowed for the specifications below 10pF.

2) For products of the same size, material and capacity, the rated voltage can be covered from high to low.

Type of Packing：

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

Table 4 Packing type

Chip Size	0402	
Thickness code	B/N/C/6	B/N/C/6
Disc size	7”	13”
Carrier Tape type	Paper	Paper
QTY (Kpcs)	10	50

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. Specifications and Test Methods：

4.1 Visual Inspection：

4.1.1 Requirement: no obvious defects on ceramic body and termination.

4.1.2 Test Method: Microscope 10×.

4.2 Size:

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

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

4.3 Operating Environment:

C0G/C0H(NP0), X7R	Temperature：-55℃～+125℃;Relative humidity： ≤95%（25℃）	Atmosphere：86kPa ～106KPa
X5R	Temperature：-55℃～+85℃;Relative humidity： ≤95%（25℃）	Atmosphere：86kPa ～106KPa
Y5V	Temperature：-30℃～+85℃;Relative humidity： ≤95%（25℃）	Atmosphere：86kPa ～106KPa
X6T、X6S	Temperature：-30℃～+105℃;Relative humidity：≤95%（25℃）	Atmosphere：86kPa ～106KPa
X7T,X7S	Temperature：-30℃～+125℃;Relative humidity：≤95%（25℃）	Atmosphere：86kPa ～106KPa

4.4 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		Temperature： 18～28℃; Humidity： ≤RH 80%; Test frequency： C0G/C0H(NP0)： C≤1000pF, f=1MHz±10%; C>1000pF, f=1KHz±10% X7R、 X5R、 Y5V、X6S、X6T、X7T、X7S： C≤100pF, f=1MHz±10%; C>100pF, f=1KHz±10% Test Voltage： C≤4. 7μF 1.0±0.2 Vrms
2	Tangent of Loss Angle/ (tgδ)	C0G/C0H(NP0)： C≥30pF，tgδ≤10×10^{-4}; C<30pF， tgδ≤$1.0\times(90/C+7)\times10^{-4}$		
		X7R： U_R=50V ,tgδ≤350×10^{-4} U_R=25V ,tgδ≤480×10^{-4} U_R≤16V ,tgδ≤500×10^{-4}	X5R： U_R =50V/25V,tgδ≤750×10^{-4} U_R =16V,tgδ≤800×10^{-4} U_R =10V,tgδ≤900×10^{-4} U_R=6.3V,tgδ≤1000×10^{-4}	
		Y5V: U_R ≥25V tgδ≤950×10^{-4} U_R =16V tgδ≤1300×10^{-4} U_R≤10V tgδ≤1600×10^{-4}		
		X6S,X6T,X7T,X7S: UR ≥25V tgδ≤1000×10^{-4}; UR =16V tgδ≤1250×10^{-4}; UR =10V tgδ≤1250×10^{-4}; UR≤6.3V tgδ≤1500×10^{-4}.		
3	Insulation Resistances/ (Ri)	C0G/C0H(NP0): C≤10nF，Ri≥10000MΩ C>10nF，Ri×C≥500s		Temperature: 18～28℃; Humidity:≤RH 80%; Apply rated voltage within 60 ± 5S
		X7R,X5R: C≤25 nF,Ri≥4000MΩ C>25nF,Ri×C≥100s X6S,X6T,X7T,X7S: Ri×C≥100s	Y5V： C≤25nF, Ri≥4000MΩ C>25nF, Ri×C≥100s	
4	Withstanding voltage （WV）	No breakdown or flashover during test		C0G/C0H(NP0)： $3\times U_R$ X7R,X5R,Y5V,X6S,X6T,X7T,X7S: $2.5\times U_R$ t=1minute Charge/discharge current not exceeds 50mA

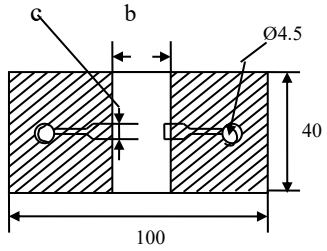
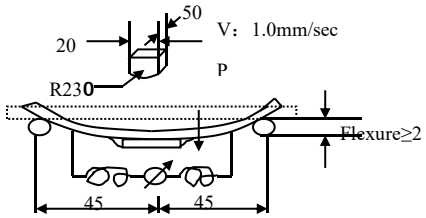
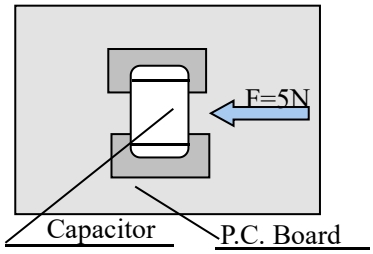
Note: Capacitance test instructions of Class 2 ceramic capacitors（X7R、X5R、Y5V、X6S、X6T、X7T、X7S） When the capacitor initial capacitance is lower than its tolerance value, the test sample need to be heated for 60 ± 5 minutes at 150℃± 10℃. Recover it, let sit at room temperature for 24±2 hrs, and then test the capacitance.

4.5 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 (α_c) or Temperature Characteristics	NP0(C0G/C0H): $\alpha_c \leq \pm 30$ppm/℃ (125℃); $-72 \leq \alpha_c \leq +30$ppm/℃ (-55℃); （ The accident below 10pF shall be guaranteed by the characteristics of medium materials.）	Preliminary Drying for 16~24hrs C0G/C0H(NP0),Special preconditioning for 1hr at 150℃ followed by 24hrs(X7R,X5R,Y5V,X6S,X7S,X7T),The ranges of capacitance change compared with the temperature ranges (θ1,25℃,θ2) shall be within the specified ranges. X5R:θ1=-55℃,θ2=85℃ X6S、X6T:θ_1=-55℃,θ_2=105℃; X7R,X7S,X7T:θ1=-55℃,θ2=125℃; Y5V:θ1=-30℃,θ2=85℃ Test voltage： See attached table 6-1 for test voltage of special specifications; 0402 X7R 27nF≤C≤100nF：0.5±0.1Vrms 0402 100nF <C≤2.2uF：0.5±0.1Vrms； Others： 1.0±0.2Vrms
		X7R,X5R:ΔC/C ≤ ±15%	
		X6S,X7S:-22%≤ΔC/C≤22%； X6T、X7T:-33%≤ΔC/C≤22%	
		Y5V:-82%≤ΔC/C≤+22%	
2	Resistance to Soldering Heat	Visual:No visible damage and terminations uncovered shall be less than 25%.	Special preconditioning for 1hr at 150℃ followed by 24±1hrs（X7R、X5R、Y5V、X6S、X6T、X7T、X7S）;Preheat the capacitor at 110 to 150℃ for 30-60s. Immerse the capacitor in an eutectic solder solution at 260±5℃ for 10±1 seconds. The depth of immersion is 10mm.Recover it, let sit at room temperature for 6-24hrs [C0G/C0H(NP0)] or 24±2hrs(X7R,X5R,Y5V,X6S,X6T,X7T,X7S),then observe appearance and measure electrical characteristics.
		Capacitance Change: NP0(C0G/C0H): ΔC/C ≤ ±2.5% or ±0.25pF, whichever is larger; X7R,X5R:ΔC/C≤±7.5%; X6S,X6T,X7T,X7S:ΔC/C≤±15% Y5V: ΔC/C ≤ ±20%	
		tgδ and Ri: meet the initial specification in Table 5.	
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 180℃ for 30s to 60s and immerse it into molten solder of 235±5℃ for 2±0.2 seconds. The depth of immersion is 10mm.

4	Bond Strength of Termination	Visual: No visible damage.	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 5±1secs, then measure the capacitance.  Fig. a  Capacitance Fig. **b** (Unit：mm)
		Capacitance Change: NP0(C0G/C0H): ΔC/C ≤ ±5% or ±0.5pF, whichever is larger; X7R,X5R,X6S,X6T,X7T,X7S: ΔC/C≤±12.5%; Y5V: ΔC/C ≤ ±30%	
5	Adhesion	Visual: No visible damage.	When Soldering the capacitor on a P. C. board, apply a pushing force of 5N for 10±1secs. 
6	Vibration	Visual: No visible damage.	Sample shall be mounted on a suitable substrate. Amplitude: 1.5mm Frequencies: 10 Hz~55 Hz and Harmonic vibration of uniform changes, 1 minutes sweep cycle. Repeat this for 2hrs each in 3 perpendicular directions X, Y, Z, total 6hrs. (Related STD: IEC 68-2-6 test Fc)
		Capacitance Change: NP0(C0G/C0H): ΔC/C ≤ ±2.5% or ±0.25pF, whichever is larger; X7R, X5R: ΔC/C≤±7.5%; X6S,X6T,X7T,X7S: ΔC/C≤±15%; Y5V: ΔC/C ≤ ±20%	
		tgδ and Ri: meet the initial specification in Table 5.	

7	Rapid change of temperature	Visual: No visible damage. Capacitance Change: NP0(C0G/C0H): ΔC/C ≤ ±2.5% or ±0.25pF, whichever is larger; X7R, X5R: ΔC/C≤±15%; X6S,X6T,X7T,X7S: ΔC/C≤±20%; Y5V: ΔC/C ≤ ±20% tgδ and Ri: meet the initial specification in Table 5.	Special preconditioning for 1hr at 150℃ followed by 24hrs（X7R、X5R、Y5V、X6S、X6T、X7T、X7S）.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_A 30 min 2 25 2~5 min 3 θ_B 30 min 4 25 2~5 min NP0(C0G/C0H), X7R,X7S,X7T: θ_A =-55℃,θ_B =125℃; X6S,X6T:θ_A=-55℃,θ_B=105℃; X5R: θA=-55℃,θB=85℃ Y5V: θA=-30℃,θB=85℃ Recover it, let sit at room temperature for 6~24hrs [C0G/C0H(NP0)] or 24±2hrs (X7R, X5R,Y5V, X6S,X6T,X7T,X7S), then observe appearance and measure electrical characteristics.
8	Damp Heat (Steady State)	Visual: No visible damage. Capacitance Change: NP0(C0G/C0H): ΔC/C ≤ ±5% or ±0.5pF, whichever is larger; X7R, X5R: ΔC/C≤±12.5%; X6S,X6T,X7T,X7S: ΔC/C≤±30%; Y5V: ΔC/C ≤ ±30% tgδ: NP0(C0G/C0H): tgδ≤20×10^{-4} (C≥30pF) or tgδ≤ $2\times(90/C+7)\times10^{-4}$(C<30pF); X7R: tgδ≤$700\times10^{-4}$; X6S,X6T,X7T,X7S:tgδ≤2×the initial specification in Table5; X5R: tgδ≤1200×10^{-4} Y5V:U_R≥25V tgδ≤950×10^{-4} U_R =16V tgδ≤1300×10^{-4} U_R＜16V tgδ≤1600×10^{-4}. Ri: NP0(C0G/C0H): Ri≥2500MΩ or Ri×C≥50s, which is smaller; X7R,X5R,Y5V,X6S,X6T,X7T,X7S: Ri≥1000MΩ or Ri×C≥50s (U_R≥25V), which is smaller; Ri≥1000MΩ or Ri×C≥10s (U_R≤16V), which is smaller.	Special preconditioning for 1hr at 150℃ followed by 24hr（X7R、X5R 、Y5V、X6S、X6T、X7T、X7S）. Test Temperature: 40℃±2℃ Humidity: RH 90~95% Duration:500hrs Recover it, let sit at room temperature for 6~24hrs [C0G/C0H(NP0)] or 24±2hrs(X7R,X5R,Y5V, X6S,X6T,X7T,X7S), then observe appearance and measure electrical characteristics.

9	Damp heat with load	Visual: No visible damage.	Special preconditioning for 1hr at 150℃（X7R、X5R、X5S、Y5V、X6S、X6T、X7T、X7S）; Remove and set for 24hours at room temperature. Perform initial measurement. According to article 9.9 of jis-c-5102. X5R, X7R, Y5V, X6S, X6T, X7T and X7S products are pretreated at 60 2℃ and rated voltage for 1 hour, and then they are left at room temperature for 24 ±2 hours before appearance inspection and electrical performance test. Test Temperature: 40±2℃; Humidity: RH 90～95%; Test Voltage: 1.0×U_R; Duration: 500hrs; Charge/discharge current not exceeds 50mA. Recover it, let sit at room temperature for 6~24hrs [C0G/C0H(NP0)] or 24±2hrs （ X7R,X5R,Y5V, X6S,X6T,X7T,X7S ）, then observe appearance and measure electrical characteristics. （ C≥100nF Special preconditioning for 1hr at 150℃ followed by 24±4hrs）。
		Capacitance Change: NP0(C0G/C0H): ΔC/C≤±7.5% or ±0.75pF, which is larger; X7R: ΔC/C≤±12.5%; X6S,X6T,X7T,X7S: ΔC/C≤±30% X5R: ΔC/C≤±15%; Y5V: ΔC/C≤±30%.	
		Tgδ: NP0(C0G/C0H): tgδ≤50×10^{-4} (C≥30pF) or tgδ≤ $5\times(90/C+7)\times10^{-4}$(C<30pF); X7R:tgδ≤$700\times10^{-4}$; X6S,X6T,X7T,X7S:tgδ≤2×the initial specification in Table5; X5R: tgδ≤1200×10^{-4}; Y5V:U_R≥25V tgδ≤950×10^{-4}; U_R =16V tgδ≤1300×10^{-4}; U_R ＜16V tgδ≤1600×10^{-4}.	
		Ri: Ri≥500MΩ or Ri×C≥25s, which is smaller	

10	Endurance	Visual: No visible damage.	Special preconditioning for 1hr at 150℃ followed by 24hrs（X7R、X5R、Y5V、X6S、X6T、X7S、X7T） Test Temperature: NP0(C0G/C0H)/X7R/X7S/X7T: 125℃; X6S/X6T:105℃; X5R/ Y5V: 85℃; Duration: 1000hrs; Test Voltage: 1.5×U_R Recover it, let sit at room temperature for 6~24hrs [C0G/C0H(NP0)] or 24±2hrs(X7R,X5R,Y5V, X6S,X6T,X7T,X7S), then observe appearance and measure electrical characteristics. (C≥100nF Special preconditioning for 1hr at 150℃ followed by 24±4hrs）.
		Capacitance Change: NP0(C0G/C0H): ΔC/C≤±3% or ±0.3pF, which is larger; X7R, X5R: ΔC/C≤±15%; X6S,X6T,X7T,X7S: ΔC/C≤±30%; Y5V: ΔC/C≤±30%.	
		Tgδ: NP0(C0G/C0H): tgδ≤20×10^{-4} (C≥30pF) or tgδ≤$2\times(90/C+7)\times10^{-4}$(C<30pF); X7R:tgδ≤$700\times10^{-4}$; X6S,X6T,X7T,X7S:tgδ≤2×the initial specification in Table5; X5R: tgδ≤1200×10^{-4}; Y5V:U_R≥25V tgδ≤950×10^{-4} U_R =16V tgδ≤1300×10^{-4} U_R ＜16V tgδ≤1600×10^{-4}.	
		Ri: NP0(C0G/C0H): Ri≥1000MΩ or Ri×C≥50s,which is smaller; X7R,X5R,Y5V, X6S,X6T,X7T,X7S: Ri≥1000MΩ or Ri×C≥50s (U_R≥25V), which is smaller; Ri≥1000MΩ or Ri×C≥10s (U_R≤16V), which is smaller.	

Table 6-1 Test Voltage for Temperature Characteristics of Special Specifications Products.

Size	Rate voltage/U_R	Capacitance				Test Voltage/Vrms
		X5R	X6S	X6T	X7T	
0402	10V	——	1.0uF	——	——	0.2±0.01
	6.3V	2.2uF（B thickness code）/4.7uF	1.0uF/2.2μF/4.7uF	4.7uF	1.0μF	0.2±0.01
	4V	——	2.2μF	——	2.2μF	0.2±0.01

5. Packaging, Shipment and storage:

5.1 Packing：

5.1.1 Packing type：

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

5.1.2 Carrier Tape size：

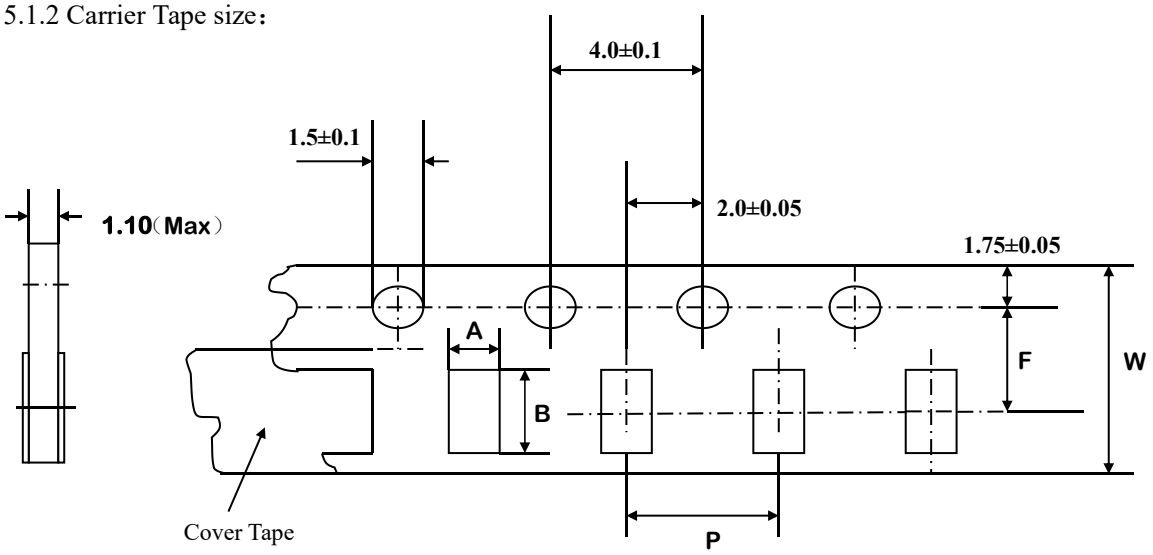


Figure 2 Carrier

Table 7 Carrier size

Mark	Size of product
	0402
	Size（Unit： mm）
A （ Width of the square hole ）	0.70±0.10
B （ Length of the square hole ）	1.20±0.10
F （Center distance between positioning hole and square hole ）	3.50±0.05
P （ Square hole spacing ）	2.00±0.10
W （Width of carrier）	8.00±0.20

5.1.3 Disc size：

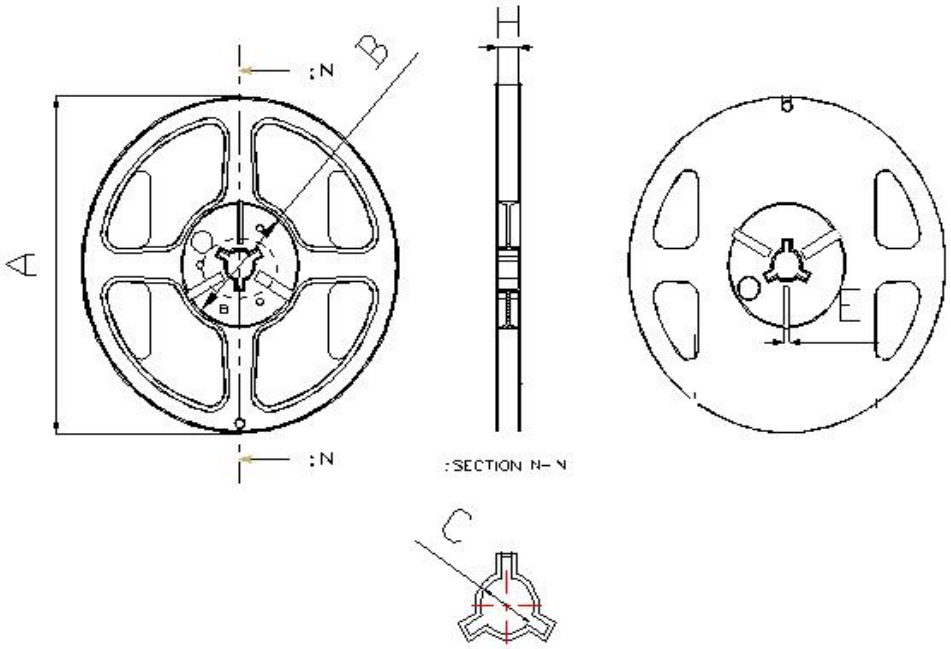
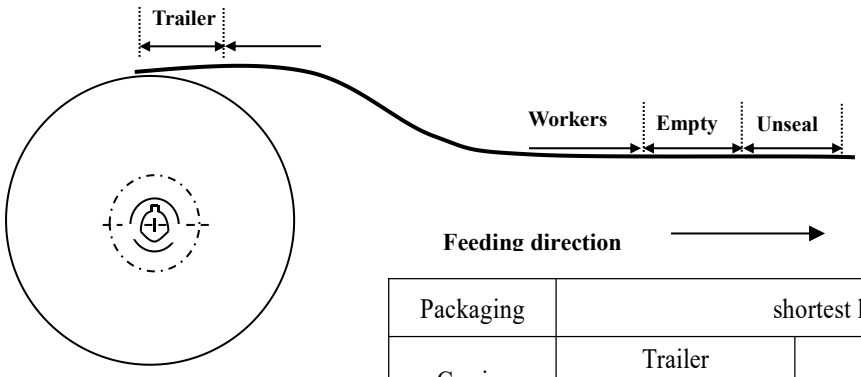


Figure 3 Disc

Table 8 Disc size

Disc Size	A/mm	B/mm	C/mm	E/mm	H/mm
7″	Φ178±2.0	Φ60±2.0	Φ13±1.0	4±1.0	9.5±1.0
13″	Φ330±2.0	Φ100±2.0	Φ13±1.0	3±1.0	10±1.0

5.1.4 Carrier specifications:



Packaging	shortest length of the reserved space		
Carrier	Trailer	Empty	Unseal
	60 mm	200mm	160 mm

5.1.5 Performance of Carrier Taping:

5.1.5.1 Strength of Carrier Tape and Top Cover Tape:

a. Carrier Tape

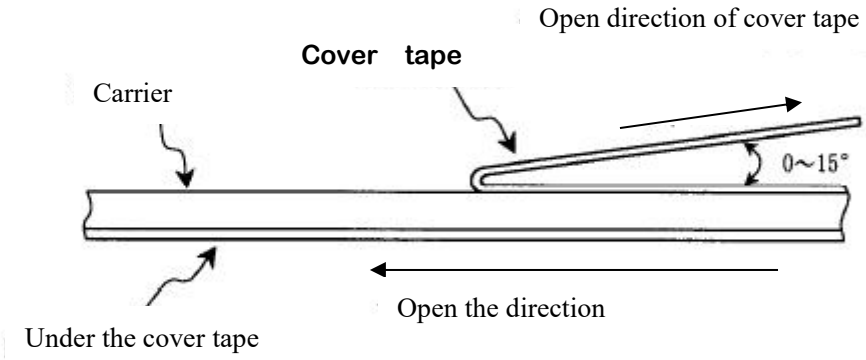
When a tensile force 1.02kgf is applied in the direction to unreel the tape, the tape shall withstand this force.

b. Top cover Tape

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

5.1.5.2 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).



5.2 Shipment:

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

5.3 Storage:

Period of Store:

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

Condition of Store:

Temperature: Below 35℃

Humidity: Below RH70％.