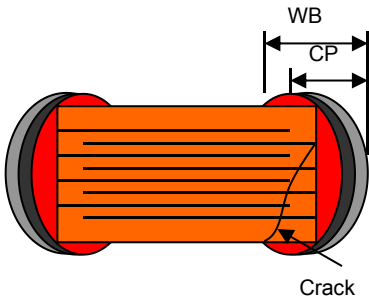
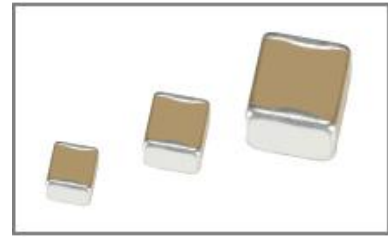


■ Open-Mode Design MLCC

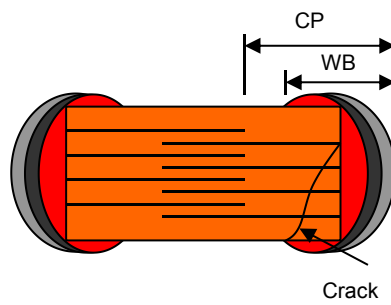
◆ Feature

- \* There is high reliability on monolithic structure of laminated layers.
- \* And its character of excellent soldering ability and soldering resistance ability is suitable for reflow soldering and peak soldering.
- \* It includes high and stable capacitance.
- \* Open circuit during capacitor cracking can protect the circuit.
- \* This type of capacitor adopts special inner electrode designs as picture2 and picture3 below
- \* Executive Standard: GB/T 21041-2007 GB/T 21042-2007



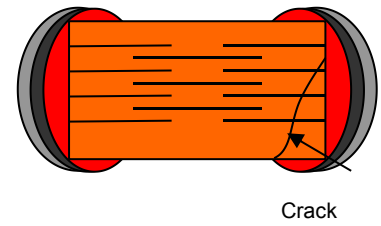
Normal design ( $CP < WB$ ), Circuit leakage current during cracking

图 1



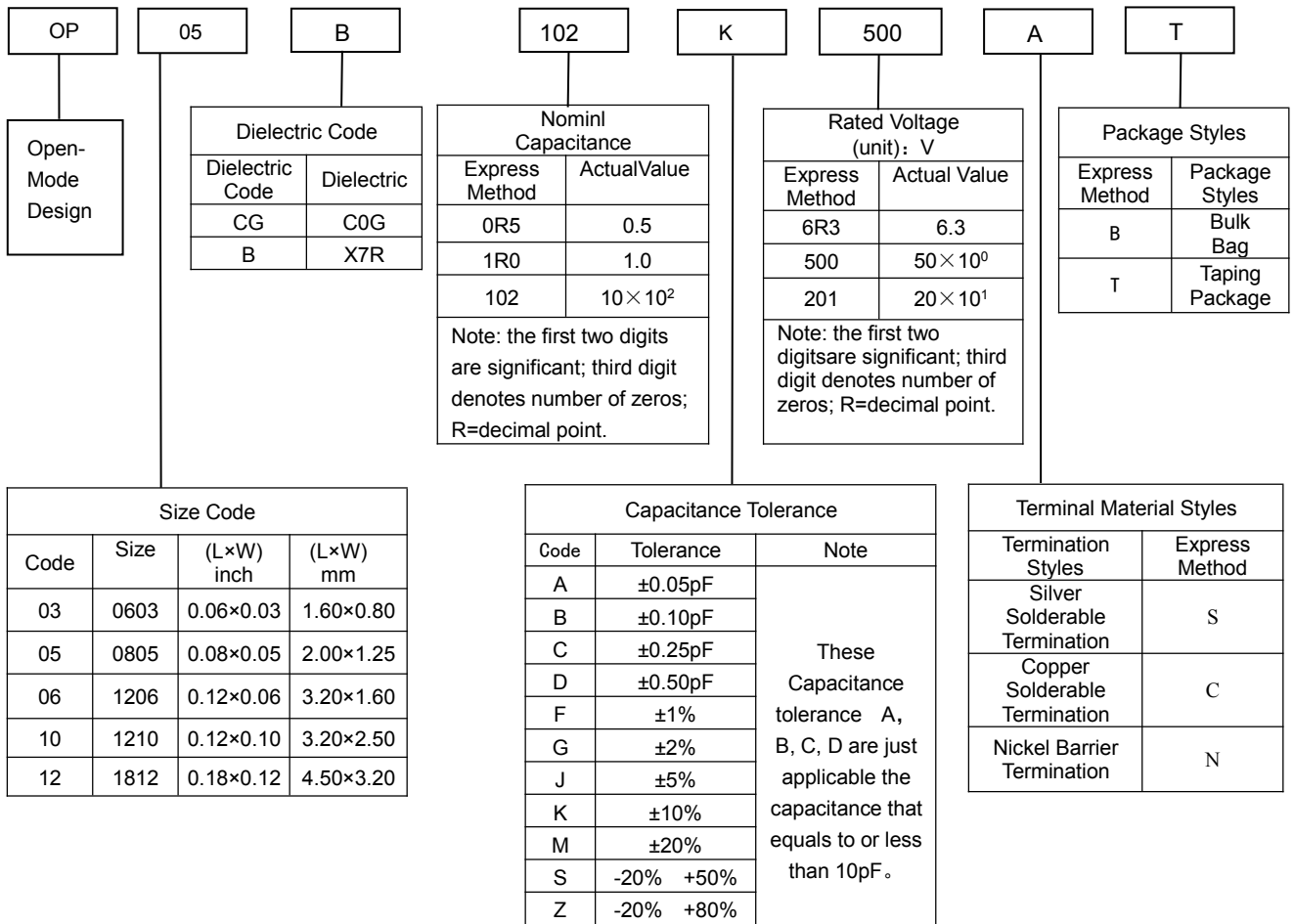
Open-mode design ( $CP > WB$ ), the circuit is open when cracked

图 2



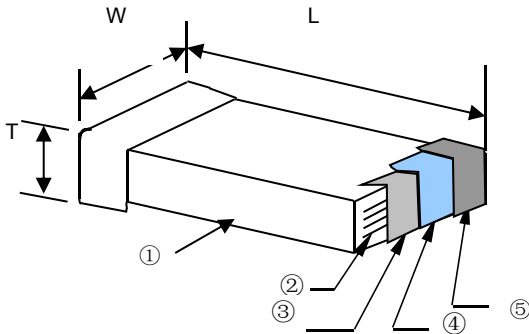
Suspension design, the circuit is open when cracked

图 3

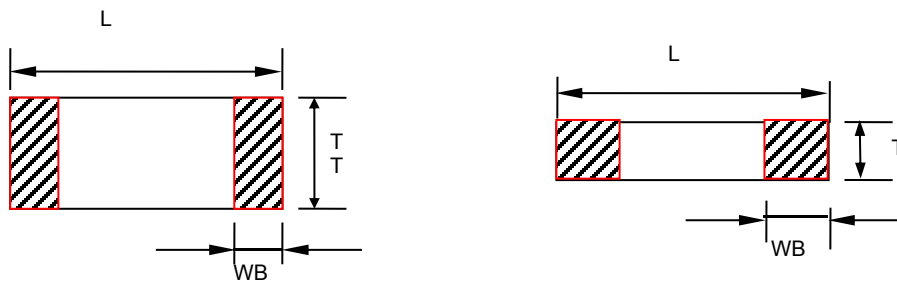
**◆ How To Order**

**◆ Temperature Coefficient /Characteristics**

Dielectric	Reference Temperature Point	Temperature Coefficient	Operation Temperature Range
COG	20°C	0±30 ppm/°C	-55°C ~ 125°C
X7R	20°C	±15%	-55°C ~ 125°C

Note: Nominal temperature coefficient and allowed tolerance of class I are decided by the changing of the capacitance between 20°C and 85°C. Nominal temperature coefficient of class II are decided by the temperature of 20°C.

**◆ Product Structure**


NO.	Name
①	Ceramic dielectric
②	Inner electrode
③	Substrate electrode
④	Nickel Layer
⑤	Tin Layer

**◆ Product Dimensions**


Type			Dimensions (mm)			
Code	British expression	Metric expression	L	W	T	WB
03	0603	1608	1.60±0.10	0.80±0.10	0.80±0.10	0.35±0.20
05	0805	2012	2.00±0.20	1.25±0.20	≤0.55 0.80±0.20 1.25±0.20	0.50±0.20
06	1206	3216	3.20±0.30	1.60±0.30	0.80±0.20 1.25±0.20 1.60±0.30	0.60±0.30
10	1210	3225	3.20±0.30	2.50±0.30	≤2.80	0.60±0.30
12	1812	4532	4.50±0.40	3.20±0.30	≤3.50	0.60±0.30

Note: We can design according to customer special requirements

**◆ Capacitance Range and Operating Voltage**

Code	Size	Rated Voltage	C0G(pF)	X7R(pF)
03	0603	4V	---	150~470,000
		6.3V	---	150~470,000
		10V	---	150~100,000
		16V	---	150~100,000
		25V	---	150~100,000
		50V	0.1~1,000	150~100,000
		100V	0.1~1,000	150~15,000
		200V	0.1~220	150~4,700
		250V	0.1~220	150~4,700

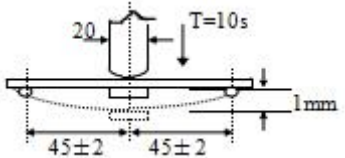
**◆ Capacitance Range and Operating Voltage**

Code	Size	Rated Voltage	C0G(pF)	X7R(pF)
05	0805	4V	---	150~1,000,000
		6.3V	---	150~1,000,000
		10V	---	150~470,000
		16V	---	150~220,000
		25V	---	150~100,000
		50V	0.3~2,200	150~100,000
		100V	0.3~2,200	150~47,000
		200V	0.3~1,000	150~22,000
		250V	0.3~1,000	150~22,000
		500V	0.3~470	150~10,000
		1000V	0.3~100	---
06	1206	4V	---	200~22,00,000
		6.3V	---	200~2,200,000
		10V	---	200~2,200,000
		16V	---	200~1,000,000
		25V	---	200~1,000,000
		50V	0.3~3,300	200~1,000,000
		100V	0.3~3,300	200~10,000
		200V	0.3~2,200	200~47,000
		250V	0.3~2,200	200~47,000
		500V	0.3~1,000	200~22,000
		630V	0.3~1,000	200~22,000
		1000V	0.3~680	200~10,000
		2000V	0.3~220	200~3,300
10	1210	4V	---	220~4,700,000
		6.3V	---	220~4,700,000
		10V	---	220~4,700,000
		16V	---	220~4,700,000
		25V	---	220~2,200,000
		50V	10~3,900	220~2,200,000
		100V	10~3,900	220~1,000,000
		200V	10~3,300	220~47,000
		250V	10~3,300	220~47,000
		500V	10~1,800	220~27,000
		630V	10~1,800	220~27,000
		1000V	10~1,000	220~22,000
		2000V	10~330	220~10,000
12	1812	50V	10~10,000	---
		100V	10~10,000	470~1,000,000
		200V	10~5,600	470~470,000
		250V	10~5,600	470~470,000
		500V	---	470~100,000
		630V	---	470~100,000
		1000V	---	470~56,000
		2000V	---	470~12,000
		3000V	---	470~10,000
		4000V	---	470~3,300
		5000V	---	470~1,000

Note: We can design according to the customer requirements

**◆ Reliability Test**

Item	Technical Specification		Test Method and Remarks		
Capacitance	C0G	Should be within the specified tolerance.	Capacitance	Measuring Frequency	Measuring Voltage
			≤1000pF	1MHZ±10%	1.0±0.2Vrms
	> 1000 pF	Test Temperature: 25°C±3°C Test Frequency: 1KHZ±10% Test Voltage: 1.0±0.2Vrms			
X7R	Should be within the specified tolerance.				
Insulation Resistance	C0G	C≤10 nF, Ri≥50000MΩ C> 10 nF, Ri•Cr≥500S	Measuring Voltage: Rated Voltage (Max 500V) Duration: 60±5s Test Humidity: ≤75% Test Temperature: 25°C±3°C Test Current: ≤50mA		
	X7R	C≤25 nF, Ri≥10000MΩ C> 25 nF, Ri•Cr> 100S			
(DF, tanδ) Dissipation Factor	C0G	DF	Capacitance	Measuring Frequency	Measuring Voltage
		≤1/ (400+20C)	C<30 pF	1MHZ±10%	1.0±0.2Vrms
		≤0.1%	C≥30pF		
	X7R	<50V	≤5%	Test Frequency: 1KHZ±10% Test Voltage: 1.0±0.2Vrms	
≥50V	≤2.5%				
Dielectric Withstanding Voltage	No breakdown or damage.	Ur< 100V	Measuring Voltage: I class:300% Ur      II class :250% Ur Duration: 1~5s      Charge/ Discharge Current: 50mA max.		
		100V≤Ur <500V	Force 200%Rated voltage for 5 second. Max..current should not exceed 50 mA.		
		500V≤Ur ≤1000V	Force 150%Rated voltage for 5 second. Max..current should not exceed 50 mA.		
		1000V<Ur ≤2000V	Force 120%Rated voltage for 5 seconds. Max..current should not exceed 50 mA.		
		2000V<Ur ≤5000V	Force 120%Rated voltage for 5 seconds. Max..current should not exceed 10 mA.		

Item	Technical Specification	Test Method and Remarks																				
Solderability	At least 95% of the terminal electrode is covered by new solder. Visual Appearance: No visible damage.	Preheating conditions: 80 to 120°C; 10~30s. Pb-Sn soldering Solder Temperature: 235±5°C Duration: 2±0.5s Lead-free soldering Solder Temperature: 245±5°C Duration: 2±0.5s																				
Resistance to Soldering Heat	<table border="1"> <tr> <td rowspan="2">ΔC/C</td> <td>COG</td> <td>≤ ± 2.5% or ± 0.25PF, whichever is larger</td> </tr> <tr> <td>X7R</td> <td>±15%</td> </tr> <tr> <td>DF</td> <td colspan="2">Same to initial value.</td> </tr> <tr> <td>IR</td> <td colspan="2">Same to initial value.</td> </tr> </table> <p>Appearance: No visible damage. At least 95% of the terminal electrode is covered by new solder.</p>	ΔC/C	COG	≤ ± 2.5% or ± 0.25PF, whichever is larger	X7R	±15%	DF	Same to initial value.		IR	Same to initial value.		<p>Preheating conditions: 100 to 200°C; 60~120s. Solder Temperature: 265±5°C Duration: 10±1s Clean the capacitor with solvent and examine it with a 10X(min.) microscope. Recovery Time: 24±2h Recovery condition: Room temperature</p>									
ΔC/C	COG		≤ ± 2.5% or ± 0.25PF, whichever is larger																			
	X7R	±15%																				
DF	Same to initial value.																					
IR	Same to initial value.																					
Resistance to Flexure of Substrate (Bending Strength)	<p>Appearance: No visible damage.</p> <p>Class I : ≤ ±5% 或 ±0.5pF, whichever is larger. Class II : ≤ ±10%</p>	<p>Test Board: PCB Warp: 1mm Speed: 1mm/sec. Unit: mm The measurement should be made with the board in the bending position.</p> 																				
Termination Adhesion	No visible damage.	Applied Force: 5N Duration: 10±1S																				
Temperature Cycle	<table border="1"> <tr> <td rowspan="2">ΔC/C</td> <td>COG</td> <td>≤ ±1% or ±1pF, whichever is larger</td> </tr> <tr> <td>X7R</td> <td>-15% ~ +15%</td> </tr> </table> <p>Appearance: No visible damage</p>	ΔC/C	COG	≤ ±1% or ±1pF, whichever is larger	X7R	-15% ~ +15%	<p>Preheating conditions: up-category temperature, 1h Recovery time: 24±1h Cycling Times: 5 times, 1 cycle, 4 steps:</p> <table border="1"> <thead> <tr> <th>Step</th> <th>(Temperature) (°C)</th> <th>(Time)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>(Low- category temp.): -55</td> <td>30min</td> </tr> <tr> <td>2</td> <td>(Normal temp.): +20°C</td> <td>2~3min</td> </tr> <tr> <td>3</td> <td>(Up- category temp.): +125</td> <td>30min</td> </tr> <tr> <td>4</td> <td>(Normal temp.): +20°C</td> <td>2~3min</td> </tr> </tbody> </table> <p>Recovery time after test: 24±2h</p>	Step	(Temperature) (°C)	(Time)	1	(Low- category temp.): -55	30min	2	(Normal temp.): +20°C	2~3min	3	(Up- category temp.): +125	30min	4	(Normal temp.): +20°C	2~3min
ΔC/C	COG		≤ ±1% or ±1pF, whichever is larger																			
	X7R	-15% ~ +15%																				
Step	(Temperature) (°C)	(Time)																				
1	(Low- category temp.): -55	30min																				
2	(Normal temp.): +20°C	2~3min																				
3	(Up- category temp.): +125	30min																				
4	(Normal temp.): +20°C	2~3min																				

Item	Technical Specification			Test Method and Remarks
Humidity load	ΔC/C	C0G	±7.5% or ±0.75pF, whichever is larger.	※ Pretreatment (Class II) : After preheating at 140°C~150°C for 1h±10min, place at room temperature for 24±2h. Temperature: 40±2°C Humidity: 90~95%RH Voltage: Rated Voltage Duration: 500h Recovery conditions: Room temperature Recovery Time: :24h±2h
		X7R	≤±12.5%	
	DF	Not more than twice of initial value.		
	IR	C0G	.Ri≥2500MΩ or Ri•CR≥25S whichever is smaller.	
		X7R	Ri≥1000MΩ or Ri•CR≥10S whichever is smaller.	
Appearance: No visible damage.				
Life Test	ΔC/C	C0G	≤±3%或±0.3pF, whichever is larger.	※ Pretreatment (ClassII) :After preheating at 140°C~150°C for 1h±10min, place at room temperature for 24±2h. Temperature:125°C (C0G、X7R) 、 Time:1000h Charge/Discharge:Current:50mA max. Applied Voltage:1.Low voltage products (< 100V) 2 times rated operating voltage 2. Medium and high pressure products: 100V≤Rated Voltage≤200V: 1.5 Multiple 200V<Rated Voltage≤500V: 1.3 Multiple 500V<Rated Voltage: 1.2 Multiple Recovery Conditions: Room Temperature Recovery Time: :24h±2h
		X7R	-20% ~ +20%	
	DF	Not more than twice of initial value.		
	IR	C0G	Ri≥4000MΩ or Ri•CR≥40S whichever is smaller.	
		X7R	Ri≥2000MΩ or Ri•CR≥50S whichever is smaller.	
Appearance: No visible damage.				

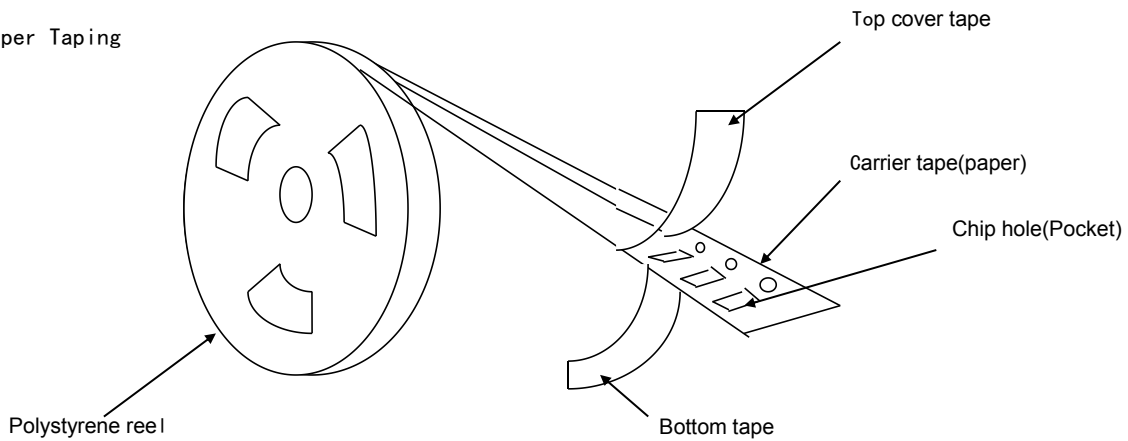
Note:

Pretreatment (only for class2 capacitor)

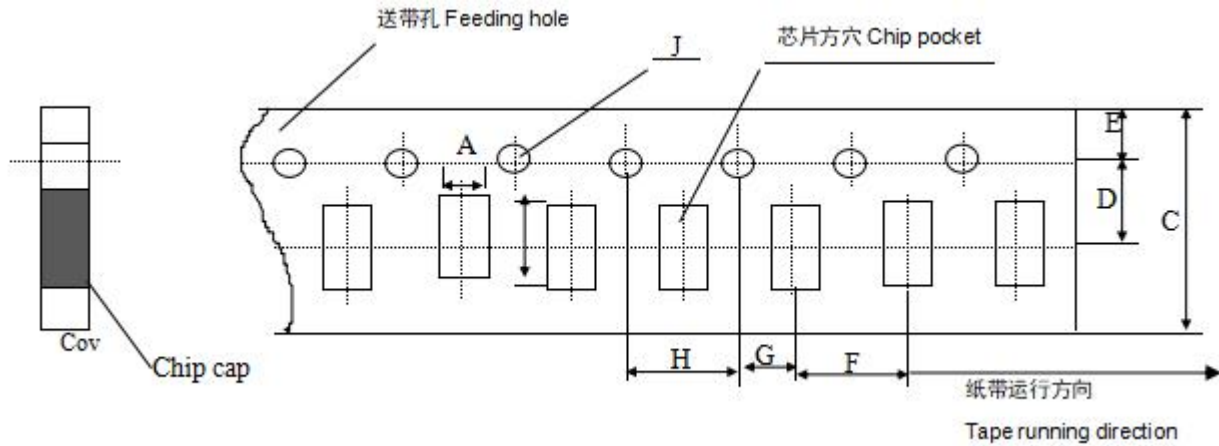
Pretreatment (only for class2 capacitor) is a method to treat the capacitor before measurement. First, place the capacitor in the up-category temperature or other specified higher temperature environment for 1hour. Then recovery the capacitor at standard pressure conditions for 24±1hours.

◆ **Package**

\* Paper Taping



\*Dimensions of paper taping for OP03, OP05, OP06 types.



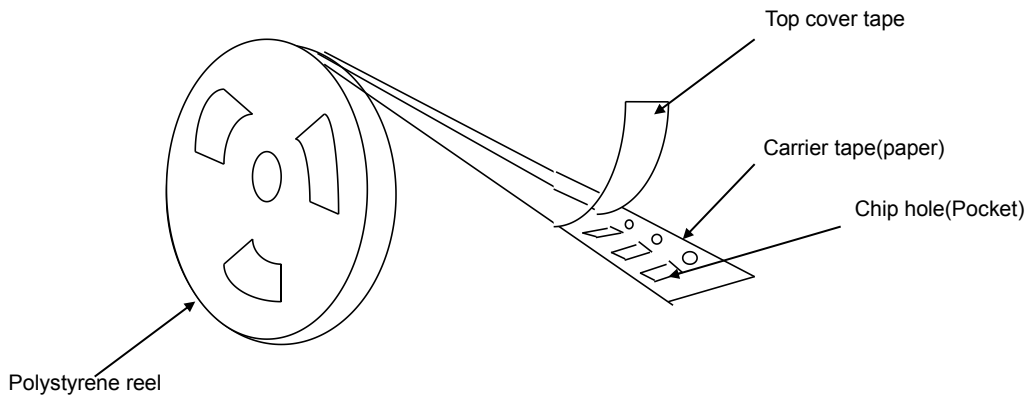
Unit: mm

Code paper size	A	B	C	D*	E	F	G*	H	J	T
OP03	1.10 ±0.10	1.90 ±0.10	8.00 ±0.10	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.10 Max
OP05	1.45 ±0.15	2.30 ±0.15	8.00 ±0.15	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.10 Max
OP06	1.80 ±0.20	3.40 ±0.20	8.00 ±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.10 Max

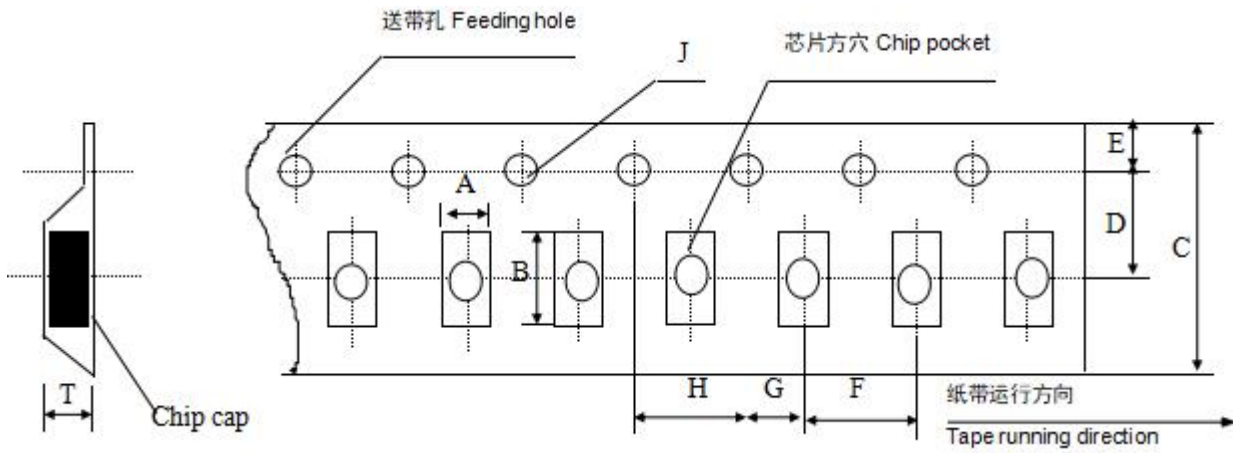
Note: The place with "\*" means where needs exactly dimensions.



\*  
Embossed taping



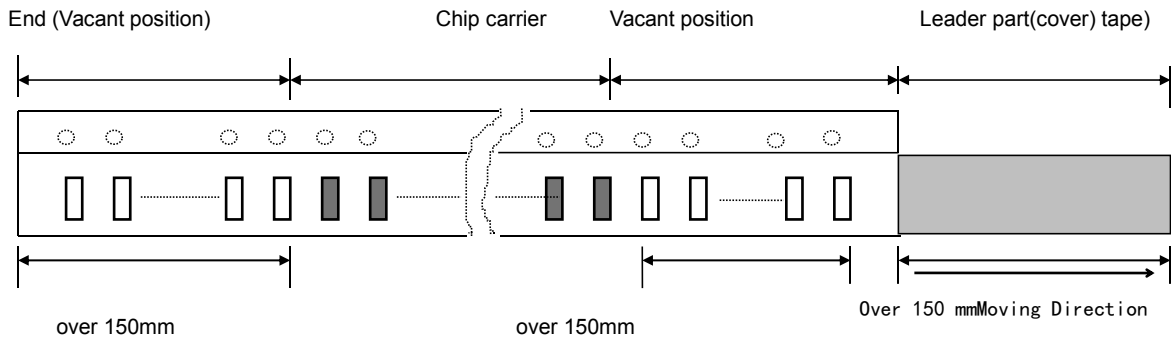
\* Dimensions of embossed taping for 0805~1812 type



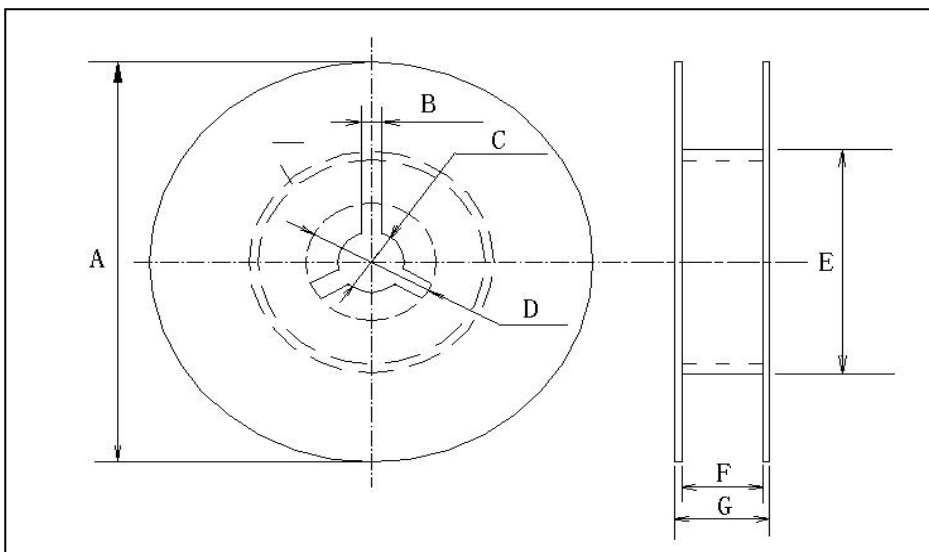
Code Tape size	A	B	C	D*	E	F	G*	H	J	T
OP05	1.55 ±0.20	2.35 ±0.20	8.00 ±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.50 Max
OP06	1.95 ±0.20	3.60 ±0.20	8.00 ±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.1	1.50 -0/+0.10	1.85 Max
OP10	2.70 ±0.10	3.42 ±0.10	8.00 ±0.10	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.55 -0/+0.10	3.2 Max
OP12	3.66 ±0.10	4.95 ±0.10	12.00 ±0.10	5.50 ±0.05	1.75 ±0.10	8.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.55 -0/+0.10	4.0 Max

Note: The place with "\*" means where needs exactly dimensions.

\* Structure of leader part and end part of the carrier paper



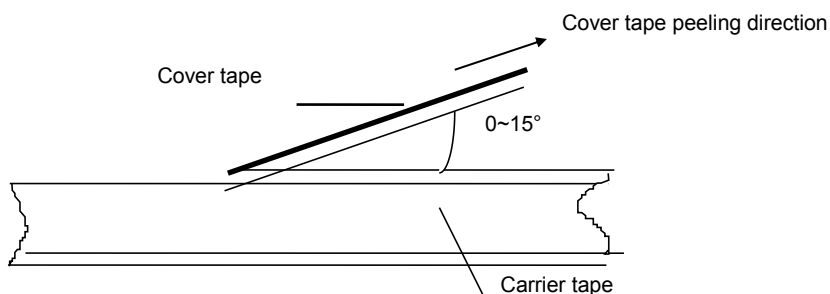
\* Reel dimensions (unit: mm)



	A	B	C	D	E	F	G
7'REEL	$\phi 178 \pm 2.0$	3.0	$\phi 13 \pm 0.5$	$\phi 21 \pm 0.8$	$\phi 50$ or more	$10.0 \pm 1.5$	12max

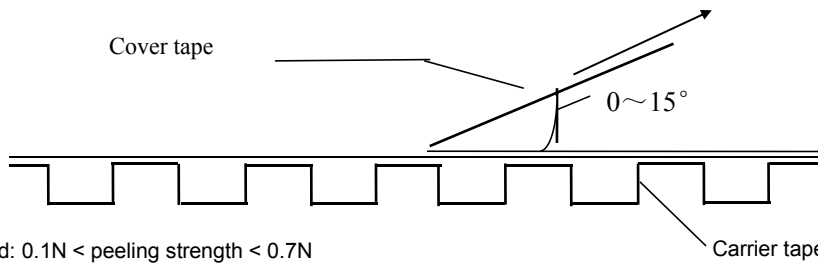
\* Taping specification: top tape peeling strength

\* Paper Tapin



\* Embossed Taping

Cover tape peeling direction



Standard: 0.1N < peeling strength < 0.7N

No paper dirty remains on the scotch when peeling, and sticks to top and bottom tape.

\* Bulk Case Package

(unit) :mm

Symbol	A	B	T	C	D	E
Dimension	6.80±0.10	8.80±1.00	12.00±0.10	15.00+0.10/-0	2.00+0/-0.10	4.70±0.10
Symbol	F	W	G	H	L	I
Dimension	31.50+0.20/-0	36.00+0/-0.20	19.00±0.35	7.00±0.35	110.00±0.70	5.00±0.35

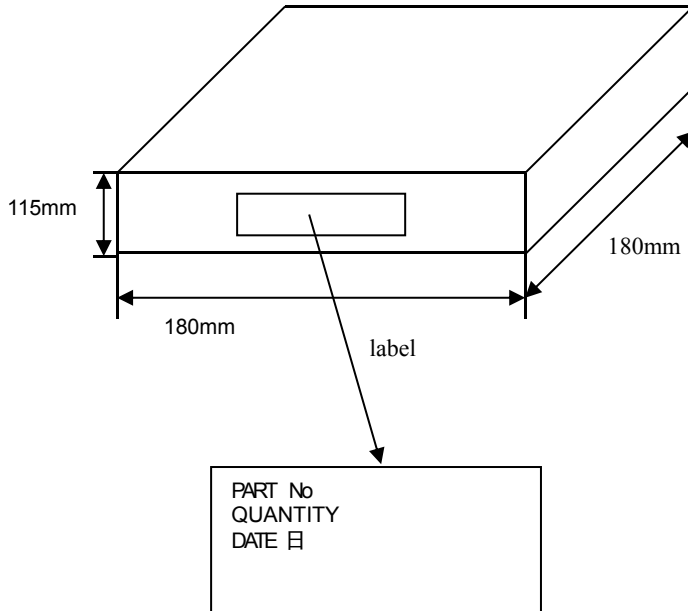
\* Packing Quantity

Type	( Package Style & Quantity) unit: pcs				
	(EPT)	(PT)	(ET)	(BC)	(BP)
OP03	-----	4000	-----	15000	5000
OP05	-----	4000	3000	10000	5000
OP06	-----	4000	T≤1.35mm 3000 T>1.35mm 2000	5000	5000
OP10	-----	-----	T≤1.80mm 2000 T>1.80mm 1000	-----	2000
OP12	-----	-----	T≤1.85mm 1000 T>1.85mm 500	-----	2000

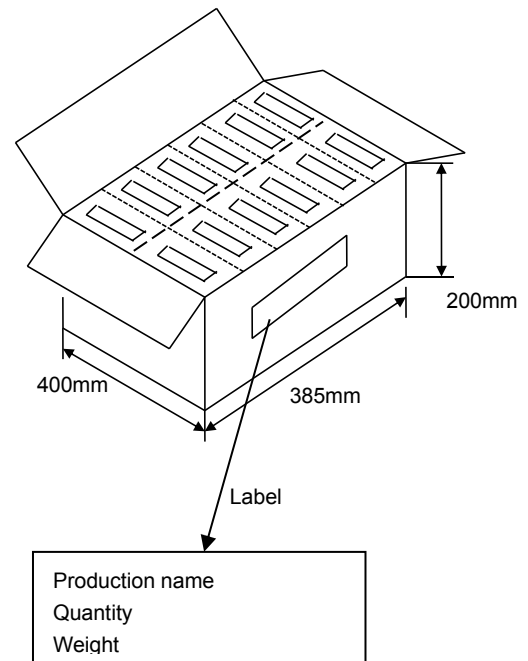
Note: We can choose packing style and quantity can be according to the customer's requirement.

**\* Outer packing**

The first package  
 Quantity: 10 reels



The second package  
 Quantity: 6 cases



**◆ Storage Methods**

- \* The guaranteed period for solderability is 12 months (Under deliver package condition).
- \* Storage conditions:  
 Temperature 5~40℃                      Relative Humidity 20~70%

**◆ Precautions For Use**

The Multi-layer Ceramic Capacitors (MLCC) may fail in a short circuit modern in an open circuit mode when subjected to severe conditions of electrical environment and / or mechanical stress beyond the specified "rating" and specified "conditions" in the specification, which will result in burn out, flaming or glowing in the worst case. Following "precautions for "safety" and Application Notes shall be taken in your major consideration. If you have a question about the precautions for handling, please contact our engineering section or factory.

**\* Soldering Profile**

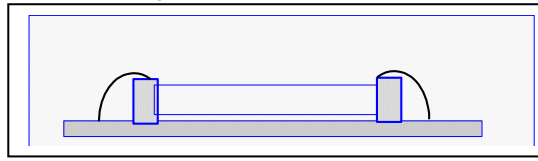
To avoid the crack problem by sudden temperature change, follow the temperature profile in the adjacent graph (refer to the graph in the enclosure page).

\*

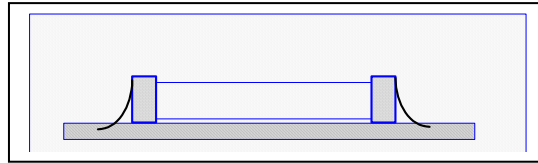
**Manual Soldering**

Manual soldering can pose a great risk of creating thermal cracks in capacitors. The hot soldering iron tip comes into direct contact with the end terminations, and operator's careless may cause the tip of the soldering iron to come into direct contact with the ceramic body of the capacitor. Therefore the soldering iron must be handled carefully, and pay much attention to the selection of the soldering iron tip and temperature contact of the tip.

\*Optimum Solder Amount for Reflow Soldering



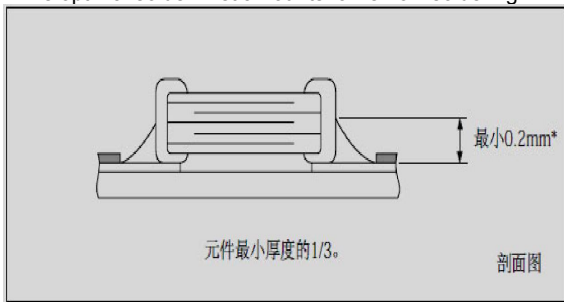
Cracks tend to occur due to large stress.



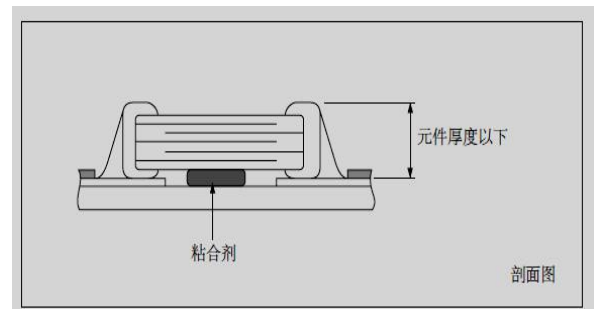
Weak holding force may cause badconnection between the capacitor and PCB.

\* Recommended Soldering amounts

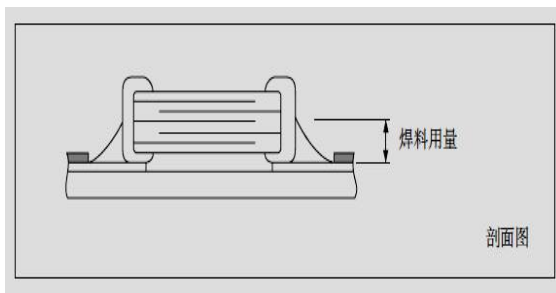
The optimal solder fillet amounts for re-flow soldering



The optimal solder fillet amounts for wave soldering



The optimal solder fillet amounts for reworking by using soldering iron



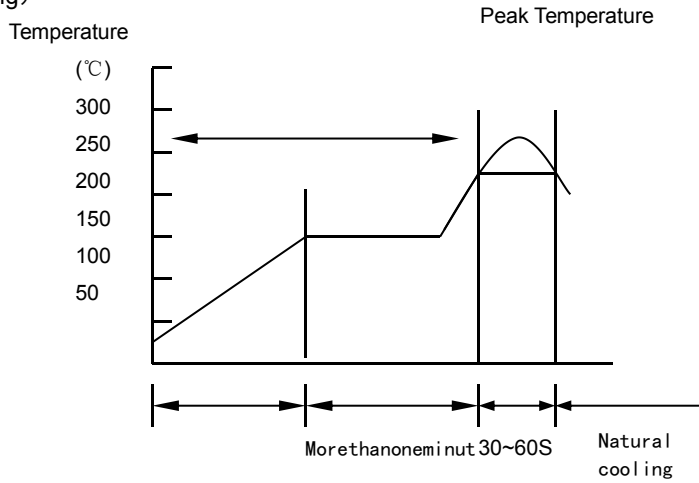
\* Recommended Soldering Method

Size	Temperature Characteristics	RatedVoltage	Capacitance	Soldering Method
OP03	C0G/X7R	/	$C \geq 1\mu f$	R
		/	$C < 1\mu f$	R/W
OP05	C0G/X7R	/	$C \geq 4.7\mu f$	R
		/	$C < 4.7\mu f$	R/W
OP06	C0G/X7R	/	$C \geq 10\mu f$	R
		/	$C < 10\mu f$	R/W
$\geq OP10$	C0G/X7R	/	/	R

Soldering method: R— Reflow Solering W— Wave Soldering

◆ The temperature profile for soldering

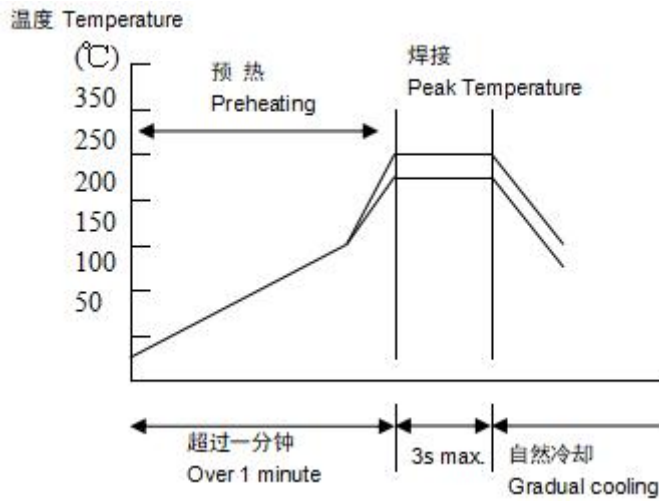
\* (Re-flow soldering)



	Pb-Sn soldering	Lead-free soldering
Peak temperature	230°C~250°C	240°C~260°C

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

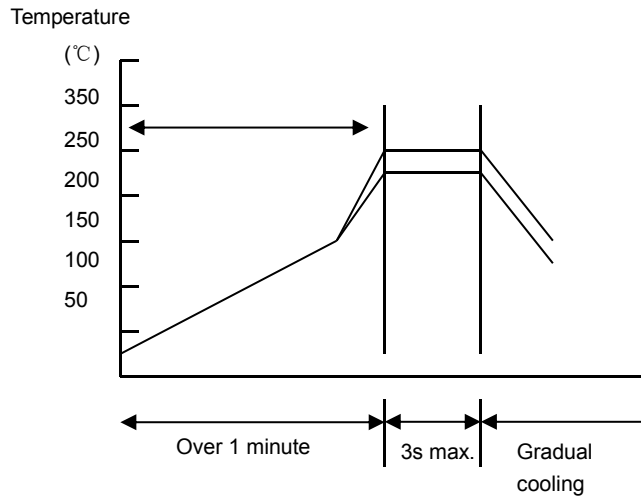
\* (Wave soldering)



	Pb-Sn soldering	Lead-free soldering
Peak temperature	230°C~260°C	240°C~270°C

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

\* Hand soldering



Conditions:

Preheating	Temperature of soldering iron head	Power of soldering iron	Diameter of soldering iron head	Soldering time	Solder paste amount	Restricted conditions
$\Delta \leq 130^{\circ}\text{C}$	Highest temperature: $350^{\circ}\text{C}$	20W at the highest	1mm recommended	3s at the longest	$\leq 1/2$ chip thickness	Please avoid the direct contact between soldering iron head and ceramic components

\*The latest version of the content shall prevail