Multilayer Ceramic Capacitors
Middle & High Voltage Series

RoHS Compliant

Description:

WTC middle and high voltage series MLCC is designed by a special internal electrode pattern, which can reduce voltage concentrations by distributing voltage gradients throughout the entire capacitor. This special design also affords increased capacitance values in a given case size and voltage rating. Chips size 1206 and larger to use on reflow soldering process only. Capacitors with X7R dielectrics are not intended for AC line filtering applications. Capacitors may require protective surface coating to prevent external arcing.

Features:

- High voltage in a given case size
- High stability and reliability

Applications:

- Snubbers in high frequency power converters
- High voltage coupling/DC blocking
- DC-DC converters.
- Back-lighting inverters

General Electrical Data:

Dielectric	NP0	X7R
Size	0603, 0805, 1206, 1210	
Capacitance*	0.5pF to 6,800pF	100pF to 1μF
Capacitance tolerance***	Cap≤5pF: C (±0.25pF) 5pF<Cap<10pF: D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%),K (±10%)	K (±10%), M (±20%)
Rated voltage (WVDC)	200V to 3kV	
Q*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	≤2.5%
Insulation resistance at Ur**	Ur=200~630V: ≥10GΩ or RxC≥100Ω-F whichever is smaller Ur=1000~3000V: ≥10GΩ	
Dielectric strength	200~300V: ≥2 × WV DC 500~999V: ≥1.5 × WV DC 1,000~3,000V: ≥1.2 × WV DC	
Operating temperature	-55 to +125°C	
Capacitance characteristic	±30ppm	±15%
Termination	Ni/Sn (lead-free termination)	

* Measured at the condition of 30~70% related humidity.

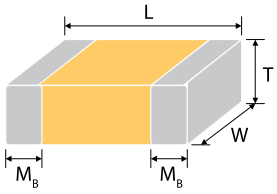
NP0: Apply 1 ±0.2Vrms, 1MHz ±10% for Cap ≤1,000pF and 1 ±0.2Vrms, 1kHz ±10% for Cap>1,000pF, 25°C at ambient temperature

X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C am bient temperature.

** Measured at 500V DC for 60 sec. for Ur>500V DC.

*** Preconditioning for Class II MLCC: Perform a heat treatment at 150 ±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

External Dimensions:



The outline of MLCC

Size Inch (mm)	L (mm)	W (mm)	T (mm) / Symbol		MB (mm)
0603 (1608)	1.6 ±0.1	0.8 ±0.1	0.8 ±0.07	S	0.4 ±0.15
	1.6 +0.15/-0.1	0.8 +0.15/-0.1	0.8 +0.15/-0.1	X	
0805 (2012)	2 ±0.15	1.25 ±0.1	0.6 ±0.1	A	0.5 ±0.2
			0.8 ±0.1	B	
			1.25 ±0.1	D	
1206 (3216)	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1	B	0.6 ±0.2 (0.5 ±0.25)*
			0.95 ±0.1	C	
			1.25 ±0.1	D	
	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2	G	
1210 (3225)	3.2 ±0.3	2.5 ±0.2	0.95 ±0.1	C	0.75 ±0.25
			1.25 ±0.1	D	
	3.2 ±0.4	2.5 ±0.3	1.6 ±0.2	G	
			2.5 ±0.3	M	

* For 1206_1,000V ~ 3,000V products.

Capacitance Range (Middle Voltage - 200V to 630V)

NP0 Dielectric

Dielectric		NP0													
Size		0603		0805				1206				1210			
Rated Voltage (V DC)		200	250	200	250	500	630	200	250	500	630	200	250	500	630
Capacitance	0.5pF (0R5)	S	S	A	A	A	A								
	1.0pF (1R0)	S	S	A	A	A	A								
	1.2pF (1R2)	S	S	A	A	A	A								
	1.5pF (1R5)	S	S	A	A	A	A	B	B	B	B				
	1.8pF (1R8)	S	S	A	A	A	A	B	B	B	B				
	2.2pF (2R2)	S	S	A	A	A	A	B	B	B	B				
	2.7pF (2R7)	S	S	A	A	A	A	B	B	B	B				
	3.3pF (3R3)	S	S	A	A	A	A	B	B	B	B				
	3.9pF (3R9)	S	S	A	A	A	A	B	B	B	B				
	4.7pF (4R7)	S	S	A	A	A	A	B	B	B	B				
	5.6pF (5R6)	S	S	A	A	A	A	B	B	B	B				
	6.8pF (6R8)	S	S	A	A	A	A	B	B	B	B				
	8.2pF (8R2)	S	S	A	A	A	A	B	B	B	B				

Capacitance Range (Middle Voltage - 200V to 630V)

Dielectric		NP0													
Size		0603		0805				1206				1210			
Rated Voltage (V DC)		200	250	200	250	500	630	200	250	500	630	200	250	500	630
Capacitance	10pF (100)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	12pF (120)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	15pF (150)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	18pF (180)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	22pF (220)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	27pF (270)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	33pF (330)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	39pF (390)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	47pF (470)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	56pF (560)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	68pF (680)	S	S	A	A	A	A	B	B	B	B	C	C	C	C
	82pF (820)	S	S	A	A	B	B	B	B	B	B	C	C	C	C
	100pF (101)	S	S	A	B	B	B	B	B	B	B	C	C	C	C
	120pF (121)	S	S	A	B	D	D	B	B	B	B	C	C	C	C
	150pF (151)	S	S	B	D	D	D	B	B	B	B	C	C	C	C
	180pF (181)	S	S	B	D	D	D	B	B	B	B	C	C	C	C
	220pF (221)	S	S	D	D	D	D	B	B	B	B	C	C	C	C
	270pF (271)	X	X	D	D	D	D	B	C	C	C	C	C	C	C
	330pF (331)	X	X	D	D	D	D	B	C	C	C	C	C	C	C
	390pF (391)	X	X	D	D	D	D	B	C	C	C	C	C	C	C
	470pF (471)	X	X	D	D			C	C	C	C	C	C	C	C
	560pF (561)			D	D			C	D	D	D	C	C	C	C
	680pF (681)			D	D			C	D	D	D	C	C	C	C
	820pF (821)			D	D			C	G	G	G	C	C	C	C
	1,000pF (102)			D				C	G	G	G	D	D	D	D
	1,200pF (122)							C	G	G	G	D	D	D	D
	1,500pF (152)							D	G	G	G	D	D	D	D
	1,800pF (182)							D	G	G	G	D	D	D	D
	2,200pF (222)							D	G	G	G	D	D		
	2,700pF (272)											D	D		
	3,300pF (332)											D	D		
	3,900pF (392)											D	D		
	4,700pF (472)														
	5,600pF (562)														
	6,800pF (682)														

1. The letter in cell is expressed the symbol of product thickness

Multilayer Ceramic Capacitors
Middle & High Voltage Series

X7R Dielectric

Dielectric		X7R													
Size		0603		0805				1206				1210			
Rated Voltage (V DC)		200	250	200	250	500	630	200	250	500	630	200	250	500	630
Capacitance	100pF (101)			B	B	B	B								
	120pF (121)			B	B	B	B								
	150pF (151)	X	X	B	B	B	B	D	D	D	D				
	180pF (181)	X	X	B	B	B	B	D	D	D	D				
	220pF (221)	X	X	B	B	B	B	D	D	D	D				
	270pF (271)	X	X	B	B	B	B	D	D	D	D				
	330pF (331)	X	X	B	B	B	B	D	D	D	D				
	390pF (391)	X	X	B	B	B	B	D	D	D	D				
	470pF (471)	X	X	B	B	B	B	D	D	D	D				
	560pF (561)	X	X	B	B	B	B	D	D	D	D				
	680pF (681)	X	X	B	B	B	B	D	D	D	D				
	820pF (821)	X	X	B	B	B	B	D	D	D	D				
	1,000pF (102)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	1,200pF (122)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	1,500pF (152)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	1,800pF (182)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	2,200pF (222)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	2,700pF (272)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	3,300pF (332)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	3,900pF (392)	X	X	B	B	B	B	D	D	D	D	C	C	D	D
	4,700pF (472)	X	X	B	B	D	D	D	D	D	D	C	C	D	D
	5,600pF (562)	X	X	D	D	D	D	D	D	D	D	C	C	D	D
	6,800pF (682)	X	X	D	D	D	D	D	D	D	D	C	C	D	D
	8,200pF (822)			D	D	D	D	D	D	D	D	C	C	D	D
	0.010µF (103)			D	D	D	D	D	D	D	D	C	C	D	D
	0.012µF (123)			D	D			D	D	D	D	C	C	D	D
	0.015µF (153)			D	D			D	D	D	D	C	C	D	D
	0.018µF (183)			D	D			D	D	D	D	C	C	D	D
	0.022µF (223)			D	D			D	D	G	G	C	C	D	D
	0.027µF (273)							D	D	G	G	C	C	G	G
	0.033µF (333)							G	G	G	G	C	C	G	G
	0.039µF (393)							G	G			C	C	G	G
	0.047µF (473)							G	G			D	D	G	G
	0.056µF (563)							G	G			D	D	G	G
	0.068µF (683)							G	G			G	G		
	0.082µF (823)							G	G			G	G		
	0.10µF (104)							G	G			G	G		
	0.12µF (124)											G	G		

X7R Dielectric

Dielectric		X7R												
Size		0603		0805				1206				1210			
Rated Voltage (V DC)		200	250	200	250	500	630	200	250	500	630	200	250	500	630
Capacitance	0.15µF (154)											M	M		
	0.18µF (184)											M	M		
	0.22µF (224)											M	M		
	0.27µF (274)											M	M		
	0.33µF (334)											M	M		
	0.39µF (394)											M	M		
	0.47µF (474)											M	M		
	0.56µF (564)														
	0.68µF (684)														
	0.84µF (844)														
	1.0µF (105)														

1. The letter in cell is expressed the symbol of product thickness.

Capacitance Range (High Voltage - 1kV to 3kV)

Dielectric		NP0			
Size		1206		1210	
Rated Voltage (V DC)		1,000	2,000	1,000	2,000
Capacitance	1.5pF (1R5)	B	B		
	1.8pF (1R8)	B	B		
	2.0pF (2R0)	B	B		
	2.2pF (2R2)	B	B		
	2.7pF (2R7)	B	B		
	3.3pF (3R3)	B	B		
	3.9pF (3R9)	B	B		
	4.7pF (4R7)	B	B		
	5.6pF (5R6)	B	B		
	6.8pF (6R8)	B	B		
	8.2pF (8R2)	B	B		
	10pF (100)	B	B	C	C
	12pF (120)	B	B	C	C
	15pF (150)	B	B	C	C
	18pF (180)	B	B	C	C
	22pF (220)	B	B	C	C
	27pF (270)	B	B	C	C
	33pF (330)	B	C	C	C
	39pF (390)	B	C	C	C

Dielectric		NP0			
Size		1206		1210	
Rated Voltage (V DC)		1,000	2,000	1,000	2,000
Capacitance	47pF (470)	C	C	C	C
	56pF (560)	C	D	C	D
	68pF (680)	C	D	C	D
	82pF (820)	D	D	C	D
	100pF (101)	D	D	D	D
	120pF (121)	D	G	D	D
	150pF (151)	D	G	D	G
	180pF (181)	G	G	D	G
	220pF (221)	G	G	G	G
	270pF (271)	G		G	
	330pF (331)	G		G	
	390pF (391)	G		G	
	470pF (471)	G		G	
	560pF (561)				
	680pF (681)				
	820pF (821)				
	1,000pF (102)				
	1,200pF (122)				
	1,500pF (152)				

1. The letter in cell is expressed the symbol of product thickness.

X7R Dielectric

Dielectric		X7R		
Size		1206		1210
Rated Voltage		1,000	2,000	1,000
Capacitance	100pF (101)	D	D	
	120pF (121)	D	D	
	150pF (151)	D	D	
	180pF (181)	D	D	
	220pF (221)	D	D	
	270pF (271)	D	D	
	330pF (331)	D	D	
	390pF (391)	D	D	
	470pF (471)	D	D	
	560pF (561)	D	D	
	680pF (681)	D	D	
	820pF (821)	D	G	
	1,000pF (102)	D	G	D

Dielectric		X7R		
Size		1206		1210
Rated Voltage		1,000	2,000	1,000
Capacitance	1,200pF (122)	D	G	D
	1,500pF (152)	D	G	D
	1,800pF (182)	D	G	D
	2,200pF (222)	D		D
	2,700pF (272)	D		D
	3,300pF (332)	D		D
	3,900pF (392)	D		G
	4,700pF (472)	D		G
	5,600pF (562)	D		G
	6,800pF (682)	D		G
	8,200pF (822)	D		G
	0.010µF (103)	D		G
	0.012µF (123)			
	0.015µF (153)			

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with “^” mark is expressed product with Ag/Ni/Sn terminations.

Packaging Dimension and Quantity

Size	Thickness/Symbol (mm)		Paper Tape		Plastic Tape	
			7” reel	13” reel	7” reel	13” reel
0603	0.8 ±0.07	S	4k	15k	-	-
0805	0.6 ±0.1	A	4k	15k	-	-
	0.8 ±0.1	B	4k	15k	-	-
	1.25 ±0.1	D	-	-	3k	10k
1206	0.8 ±0.1	B	4k	15k	-	-
	0.95 ±0.1	C	-	-	3k	10k
	1.25 ±0.1	D	-	-	3k	10k
	1.6 ±0.2	G	-	-	2k	10k
1210	0.95 ±0.1	C	-	-	3k	10k
	1.25 ±0.1	D	-	-	3k	10k
	1.6 ±0.2	G	-	-	2k	-
	2.5 ±0.3	M	-	-	1k	6k

Reliability Test Conditions and Requirements

<table>
<tr><th>No</th><th>Item</th><th colspan="2">Test Condition</th><th>Requirements</th></tr>
<tr><td>1</td><td>Visual and Mechanical</td><td colspan="2">-</td><td>No remarkable defect.
Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2</td><td>Capacitance</td><td colspan="2" rowspan="2">Class I: (NP0)
Cap ≤1,000pF, 1 ±0.2Vrms, 1MHz±10%
Cap >1,000pF, 1±0.2Vrms, 1kHz±10%
Class II: (X7R)
1 ±0.2Vrms, 1kHz ±10%</td><td>Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3</td><td>Q/ D.F. (Dissipation Factor)</td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C
X7R: ≤2.5%</td></tr>
<tr><td>4</td><td>Dielectric Strength</td><td colspan="2">To apply voltage:
200V ~ 300V ≥2 times V DC
500V ~ 999V ≥1.5 times V DC
1,000V ~ 3,000V ≥1.2 times V DC
Cut-off, set at 10mA
Test= 15 sec.
Ramp=0</td><td>No evidence of damage or flash over during test.</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Insulation Resistance</td><td>Rated voltage:
200V ~ 630V</td><td>To apply rated voltage (500V max.) for 60 sec.</td><td>≥10GΩor RxC≥100Ω-F whichever is smaller</td></tr>
<tr><td>Rated voltage:
≥ 630V</td><td>To apply 500V for 60 sec.</td><td>≥10G</td></tr>
<tr><td>6</td><td>Temperature Coefficient</td><td colspan="2">With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temperature</th></tr>
<tr><td>NP0</td><td>55~125°C at 25°C</td></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X5R</td><td>-55~85°C at 25°C</td></tr>
</table></td><td>
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NP0 (C0G)</td><td>Within ±30ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
</table></td></tr>
<tr><td>7</td><td>Adhesive Strength of Termination</td><td colspan="2">Pressurizing force:
5N (≤0603) and 10N (>0603)
Test time: 10 ±1 sec.</td><td>* No remarkable damage or removal of the terminations.</td></tr>
<tr><td>8</td><td>Vibration Resistance</td><td colspan="2">Vibration frequency: 10 ~ 55Hz/min.
Total amplitude: 1.5mm
Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)
Measurement to be made after keeping at room temp. for 24 ±2 hrs.</td><td>No remarkable damage.
Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9</td><td>Solderability</td><td colspan="2">Solder temperature: 235 ±5°C
Dipping time: 2 ±0.5 sec.</td><td>95% min. coverage of all metalized area.</td></tr>
</table>

Reliability Test Conditions and Requirements

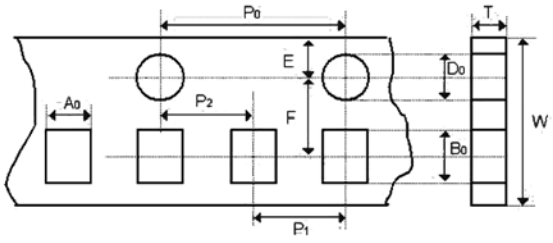
<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>10</td><td>Bending Test</td><td>The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>No remarkable damage.
Cap change:
NP0: within ±5.0% or ±0.5pF whichever is larger.
X7R: within ±12.5%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>11</td><td>Resistance to Soldering Heat</td><td>Solder temperature: 260±5°C
Dipping time: 10±1 sec
Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.
Before initial measurement (Class II only):
Perform 150+0/-10°C for 1 hour and then set for 24±2 hrs at room temp.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>No remarkable damage.
Cap change:
NP0: within ±2.5% or ±0.25pF whichever is larger.
X7R: within ±7.5%
Q/D.F., I.R. and dielectric strength: To meet initial requirements.
25% max. leaching on each edge.</td></tr>
<tr><td>12</td><td>Temperature Cycle</td><td>Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
Before initial measurement (Class II only):
Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at r oom temp.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>No remarkable damage.
Cap change:
NP0: within ±2.5% or ±0.25pF whichever is larger.
X7R: within ±7.5%
Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>13</td><td>Humidity (Damp Heat) Steady State</td><td>Test temp.: 40±2°C
Humidity: 90 ~ 95% RH
Test time: 500+24/-0hrs.
Before initial measurement (Class II only):
Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>No remarkable damage.
Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger.
X7R: within ±12.5%
Q/D.F. value:
NP0: Cap≥30pF, Q≥350; 10pF≤Cap<30pF, Q≥275+2.5C
Cap<10pF; Q≥200+10C
X7R: ≤3%
I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</td></tr>
</table>

Reliability Test Conditions and Requirements

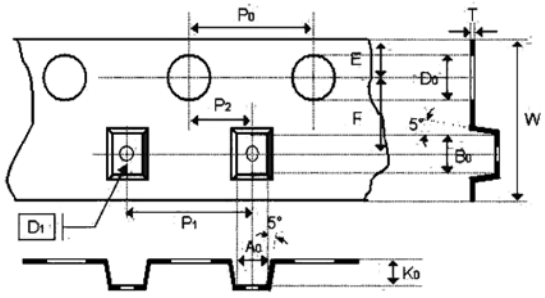
No	Item	Test Condition	Requirements
14	Humidity (Damp Heat) Load	Test temp.: 40±2°C Humidity: 90~95%RH Test time: 500+24/-0 hrs. To apply voltage: rated voltage (Max. 500V) Before initial measurement (Class II only): To apply test voltage for 1hour at 40°C and then set for 24±2 hrs a t room temp. Measurement to be made after keeping at room temp. for 24±2 hrs.	No remarkable damage. Cap change: NP0: within ±7.5% or ±0.75pF whichever is larger. X7R: within ±12.5% Q/D.F. value: NP0: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C X7R: ≤3% I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.
15	High Temperature Load (Endurance)	Test temp.: NP0, X7R: 125±3°C To apply voltage: (1) <500V: 200% of rated voltage. (2) 500V: 150% of rated voltage. (3) ≥630V: 120% of rated voltage. (4) 1206,NP0 ≥1.5pF: 100% of rated voltage. Test time: 1000+24/-0 hrs. Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. Measurement to be made after keeping at room temp. for 24±2 hrs	No remarkable damage. Cap change: NP0: within ±3.0% or ±0.3pF whichever is larger. X7R: within ±12.5% Q/D.F. value: NP0: Cap≥30pF, Q≥350 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF, Q≥200+10C X7R: ≤3% I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.

Appendixes:

Tape & Reel Dimensions:



The dimension of paper tape

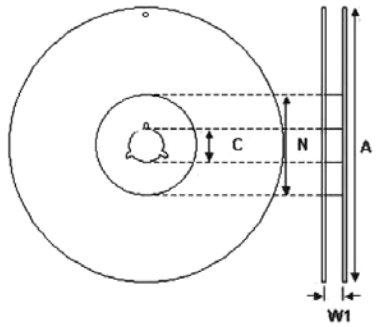


The dimension of plastic tape

Size	0603	0805		1206			1210	
Thickness	S. X	B	C. D. I	B	C. D	G	C. D. G	M
A_0	1.02 ±0.05	1.5 ±0.1	<1.57	2 ±0.1	<1.85	<1.95	<2.97	<2.97
B_0	1.8 ±0.05	2.3 ±0.1	<2.4	3.5 ±0.1	<3.46	<3.67	<3.73	<3.73
T	0.95 ±0.05	0.95 ±0.05	0.23 ±0.05	0.95 ±0.05	0.23 ±0.05	0.23 ±0.05	0.23 ±0.05	0.23 ±0.05

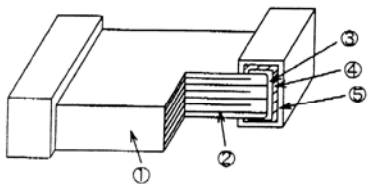
Size	0603	0805		1206			1210	
Thickness	S. X	B	C. D. I	B	C. D	G	C. D. G	M
K_0	-	-	<2.5	-	<2.5	<2.5	<2.5	<3
W	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1
P_0	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1
10xP_0	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1
P_1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1
P_2	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05
D_0	1.55 ±0.05	1.55 ±0.05	1.5 ±0.05	1.5 ±0.05	1.5 ±0.05	1.5 ±0.05	1.5 ±0.05	1.5 ±0.05
D_1	-	-	1 ±0.1	-	1 ±0.1	1 ±0.1	1 ±0.1	1 ±0.1
E	1.75 ±0.05	1.75 ±0.05	1.75 ±0.1	1.75 ±0.1	1.75 ±0.1	1.75 ±0.1	1.75 ±0.1	1.75 ±0.1
F	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05

Reel Dimensions:



Size	0603, 0805, 1206, 1210		
Reel size	7”	10”	13”
C	13 +0.5/-0.2	13 +0.5/-0.2	13 +0.5/-0.2
W_1	8.4 +1.5/-0	8.4 +1.5/-0	8.4+1.5/-0
A	178 ±0.1	250 ±1	330 ±1
N	60 +1/-0	100 ±1	100 ±1

Constructions:



No.	Name		NP0	NPO, X7R
1	Ceramic material		$BaTiO_3$ based	
2	Inner electrode		AgPd alloy	Ni
3	Termination	Inner layer	Ag	Cu
4		Middle layer	Ni	
5		Outer layer	Sn	

* Partial NP0 items are with Ag/Ni/Sn terminations, please ref to product range of NP0 dielectric for detail.

Storage and Handling Conditions:

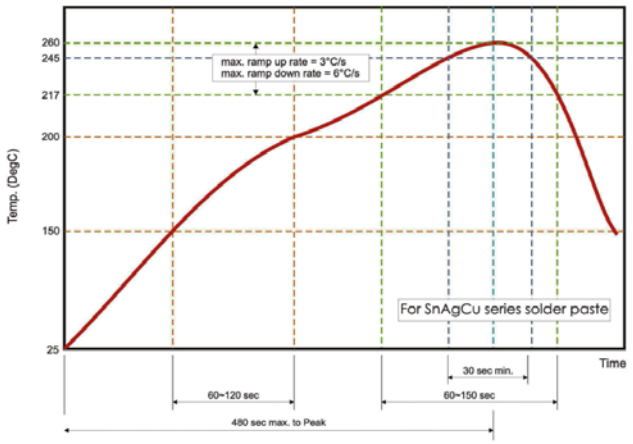
(1) To store products at 5°C to 40°C ambient temperature and 20 to 70%. related humidity conditions.
(2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

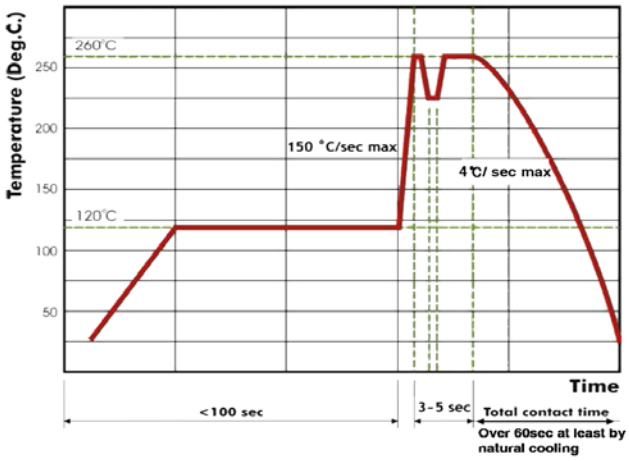
a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight,the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

Recommended soldering conditions:

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N_2 within oven are recommended.



Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.



Recommended wave soldering profile for SMT process with SnAgCu series solder.

Part Number Table

Description	Part Number
Capacitor, MLCC, 1NF, 200V, X7R, 0603, Reel	MC000436
Capacitor, MLCC, 100PF, 200V, NP0, 0805, Reel	MC000542
Capacitor, MLCC, 1NF, 200V, X7R, 0805, Reel	MC000543
Capacitor, MLCC, 10NF, 200V, X7R, 0805, Reel	MC000544
Capacitor, MLCC, 22NF, 200V, X7R, 0805, Reel	MC000545
Capacitor, MLCC, 3.3NF, 200V, X7R, 0805, Reel	MC000546
Capacitor, MLCC, 1NF, 200V, X7R, 1206, Reel	MC000649
Capacitor, MLCC, 10NF, 200V, X7R, 1206, Reel	MC000650
Capacitor, MLCC, 100NF, 200V, X7R, 1206, Reel	MC000651
Capacitor, MLCC, 2.2NF, 200V, X7R, 1206, Reel	MC000652
Capacitor, MLCC, 22NF, 200V, X7R, 1206, Reel	MC000653
Capacitor, MLCC, 47NF, 200V, X7R, 1206, Reel	MC000654
Capacitor, MLCC, 100PF, 500V, NP0, 1206, Reel	MC000698
Capacitor, MLCC, 220PF, 500V, NP0, 1206, Reel	MC000699
Capacitor, MLCC, 330PF, 500V, NP0, 1206, Reel	MC000700
Capacitor, MLCC, 470PF, 500V, NP0, 1206, Reel	MC000701
Capacitor, MLCC, 1NF, 500V, X7R, 1206, Reel	MC000702
Capacitor, MLCC, 10NF, 500V, X7R, 1206, Reel	MC000703
Capacitor, MLCC, 4.7NF, 500V, X7R, 1206, Reel	MC000704
Capacitor, MLCC, 47PF, 1KV, NP0, 1206, Reel	MC000705
Capacitor, MLCC, 1NF, 1KV, X7R, 1206, Reel	MC000706
Capacitor, MLCC, 1NF, 2KV, X7R, 1206, Reel	MC000707
Capacitor, MLCC, 100NF, 200V, X7R, 1210, Reel	MC000721
Capacitor, MLCC, 10NF, 500V, X7R, 1210, Reel	MC000737
Capacitor, MLCC, 33NF, 500V, X7R, 1210, Reel	MC000738