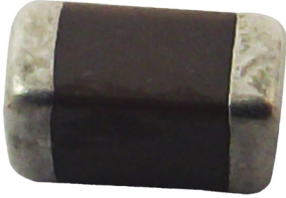


**RoHS  
Compliant**



**Description:**

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used. WTC's MLCC is made by NP0, X7R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

**Features:**

- A wide selection of sizes is available (0402 to 1812)
- High capacitance in given case size
- Capacitor with lead-free termination (pure Tin)

**Applications:**

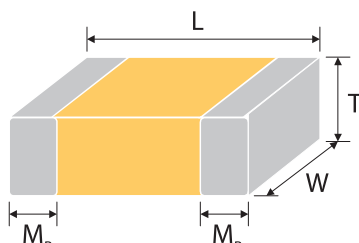
- For general digital circuit
- For power supply bypass capacitors
- For consumer electronics
- For telecommunication

**How To Order:**

MC	1206	F	104	Z	500	C	T
Multi-comp	<b>Size</b>	<b>Dielectric</b>	<b>Capacitance</b>	<b>Tolerance</b>	<b>Rated Voltage</b>	<b>Termination</b>	<b>Packaging style</b>
	Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1812 (4532)	N = NP0 (C0G) B = X7R F = Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point.  eg.: 0R5 = 0.5pF 1R0 = 1.0pF 104 = 10x10 <sup>4</sup> = 100nF	B = ±0.1pF C = ±0.25pF D = ±0.5pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20% Z = -20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point.  100 = 10V DC 160 = 16V DC 250 = 25V DC 500 = 50V DC 101 = 100V DC	C = Cu/Ni/Sn (for NP0, X7R, Y5V dielectric) L = Ag/Ni/Sn (for partial NPO items)	T=7" reeled R=7" reeled (2mm pitch for 0603 size; paper tape) G=13" reeled

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

**External Dimensions:**



The outline of MLCC

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M <sub>B</sub> (mm)
0402 (1005)	1 ±0.05	0.5 ±0.05	0.5 ±0.05	N #	0.25 +0.05/-0.1
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 #	
	2 ±0.2	1.25 ±0.2	1.25 ±0.2	I #	

**General Purpose Multilayer SMD Ceramic Capacitor  
0402 to 1812 Sizes, NPO, X7R & Y5V Dielectrics (10V to 100V)**



Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M <sub>B</sub> (mm)
1206 (3216)	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1	B	-	0.6 ±0.2
			0.95 ±0.1	C	-	
			1.15 ±0.15	J	#	
			1.25 ±0.1	D	#	
			1.6 ±0.2	G	#	
	3.2 +0.3/-0.1	1.6 +0.3/0.1	1.6 +0.3/-0.1	P	#	
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 ±0.2	K	#	
			2.5 ±0.3	M	#	
1812 (4532)	4.5 ±0.4	3.2 ±0.3	1.25 ±0.1	D	#	0.75 ±0.25
			2 ±0.2	K	#	

# Reflow soldering only is recommended.

**General Electrical Data:**

Dielectric	NPO	X7R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance*	0.5pF to 0.1µF	100pF to 0.82µF	10nF to 0.68µF
Capacitance tolerance**	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)	M (±20%), Z (-20/+80%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V	
DF (Tan δ)*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1,000	Note 1	
Operating temperature	-55°C to +125°C		-25 to +85°C
Capacitance change	±30ppm	±15%	+30/-80%
Termination	Ni/Sn (lead-free termination)		

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

NPO: 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 25°C ambient temperature.

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

\*\* 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.

**Note 1:**

Rated vol.	D.F. ≤	Exception of D.F. ≤	
≥100V	≤2.5%	≤3%	1206 ≥ 0.47μF
		≤5%	0805 > 0.1μF; 0603 ≥ 0.068μF
≥50V	≤2.5%	≤3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
		≤5%	1210 ≥ 4.7μF
		≤10%	0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF TT series
35V	≤3.5%	≤10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF
25V	≤3.5%	≤5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF
		≤7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF
		≤10%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series
		≤12.5%	0402 ≥ 1μF
16V	≤3.5%	≤5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
		≤10%	0201 ≥ 0.1μF; 0402 ≥ 0.47μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
10V	≤5%	≤10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; TT series
		≤15%	0201 ≥ 0.1μF; 0402 ≥ 1μF
6.3V	≤10%	≤15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series
		≤20%	0402 ≥ 2.2μF
4V	≤15%	-	-

**Y5V**

Rated vol.	D.F. ≤	Exception of D.F. ≤	
≥50V	5%	7%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF
35V	7%	-	-
25V	5%	7%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF
		9%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF
16V (C < 1μF)	7%	9%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF
		12.5%	0402 ≥ 0.22μF
16V (C ≥ 1.0μF)	9%	12.5%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF
10V	12.5%	20%	0402 ≥ 0.47μF
6.3V	20%	-	-

**Packaging Dimension And Quantity:**

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.5 ±0.05	N	10k	50k	-	-
0603 (1608)	0.8 ±0.07	S	4k	15k	-	-
	0.8 +0.15/-0.1	X	4k	15k	-	-
0805 (2012)	0.6 ±0.1	A	4k	15k	-	-
	0.8 ±0.1	B	4k	15k	-	-
	1.25 ±0.1	D	-	-	3k	10k
	1.25 ±0.2	I	-	-	3k	10k
1206 (3216)	0.8 ±0.1	B	4k	15k	-	-
	0.95 ±0.1	C	-	-	3k	10k
	1.15 ±0.15	J	-	-	3k	10k
	1.25 ±0.1	D	-	-	3k	10k
	1.6 ±0.2	G	-	-	2k	10k
	1.6 +0.3/-0.1	P	-	-	2k	9k
1210 (3225)	0.95 ±0.1	C	-	-	3k	10k
	1.25 ±0.1	D	-	-	3k	10k
	1.6 ±0.2	G	-	-	2k	-
	2 ±0.2	K	-	-	1k	6k
	2.5 ±0.3	M	-	-	1k	6k
1812 (4532)	1.25 ±0.1	D	-	-	1k	5k
	2 ±0.2	K	-	-	1k	-

Unit : pieces

**Reliability Test Conditions and Requirements:**

No	Item	Test Condition	Requirements
1	Visual and Mechanical	-	No remarkable defect. Dimensions to conform to individual specification sheet.

No	Item	Test Condition	Requirements																																																																																										
2	Capacitance		*Shall not exceed the limits given in the detailed spec.																																																																																										
		<p>Class I: NPO                      Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%                      Cap&gt;1000pF 1.0±0.2Vrms, 1KHz±10%</p> <p>Class II: X7R, X5R, X6S, Y5V                      Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% **                      Cap&gt;10μF, 0.5±0.2Vrms, 120Hz±20%</p> <p>** Test condition: 0.5±0.2Vrms,                      1KHz±10%                      X7R: 0603≥225(10V),                      0805=106(6.3V&amp;10V)                      X5R: 01R5≥103, 0201≥224                      (6.3V,10V),                      0402≥475 (6.3V), 0402≥225(10V),                      0603=106 (6.3V,10V),                      TT18X ≥475(10V) , TT15X series                      X6S:0201≥224 (6.3V),0402≥225                      (6.3V),</p>	<p>NP0: Cap≥30pF, Q≥1000; Cap&lt;30pF,Q≥400+20C                      X7R,X5R,X6S:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤2.5%</td> <td>≤3%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0805&gt;0.1μF, 0603≥0.068μF</td> </tr> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤2.5%</td> <td>≤3%</td> <td>0201(50V); 0603≥0.047μF; 0805≥0.18μF;1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.1μF; 0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF TT series</td> </tr> <tr> <td>35V</td> <td>≤3.5%</td> <td>≤10%</td> <td>0603≥1μF; 0805≥2.2μF; 1210≥10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF; 1206≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.10μF;0603≥0.47μF;0805≥2.2 μF; 1206≥6.8μF ; 1210≥22μF; TT series</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥1μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0201≥0.012μF 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF; 0402≥1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤10%</td> <td>≤15%</td> <td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF; 1206≥47μF ;1210≥100μF; TT series</td> </tr> <tr> <td>≤20%</td> <td>0402≥2.2μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>5%</td> <td>7%</td> <td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td> </tr> <tr> <td>35V</td> <td>7%</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5%</td> <td>7%</td> <td>0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>9%</td> <td>0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">16V (C&lt;1μF)</td> <td rowspan="2">7%</td> <td>9%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>12.5%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Rated vol.	D.F.≤	Exception of D.F. ≤		≥100V	≤2.5%	≤3%	1206≥0.47μF	≤5%	0805>0.1μF, 0603≥0.068μF	≥50V	≤2.5%	≤3%	0201(50V); 0603≥0.047μF; 0805≥0.18μF;1206≥0.47μF	≤5%	1210≥4.7μF	≤10%	0402≥0.1μF; 0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF TT series	35V	≤3.5%	≤10%	0603≥1μF; 0805≥2.2μF; 1210≥10μF	25V	≤3.5%	≤5%	0201≥0.01μF;0805≥1μF; 1210≥10μF	≤7%	0603≥0.33μF; 1206≥4.7μF	≤10%	0402≥0.10μF;0603≥0.47μF;0805≥2.2 μF; 1206≥6.8μF ; 1210≥22μF; TT series	≤12.5%	0402≥1μF	16V	≤3.5%	≤5%	0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	≤10%	0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series	10V	≤5%	≤10%	0201≥0.012μF 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series	≤15%	0201≥0.1μF; 0402≥1μF	6.3V	≤10%	≤15%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF; 1206≥47μF ;1210≥100μF; TT series	≤20%	0402≥2.2μF	4V	≤15%	-	-	Rated vol.	D.F.≤	Exception of D.F. ≤		≥50V	5%	7%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF	35V	7%	-	-	25V	5%	7%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF	9%	0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF	16V (C<1μF)	7%	9%	0402≥0.068μF; 0603≥0.68μF	12.5%	0402≥0.22μF	16V (C≥1.0μF)	9%	12.5%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF	10V	12.5%	20%	0402≥0.47μF	6.3V	20%	-	-
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No	Item	Test Condition	Requirements																								
4	Dielectric Strength	To apply voltage ( $\leq 100V$ ) 250%. Duration: 1 to 5 sec. Charge and discharge current less than 50mA.	No evidence of damage or flash over during test.																								
5	Insulation Resistance	To apply rated voltage for max. 120 sec.	<p>10GΩ or <math>RxC \geq 500\Omega \cdot F</math> whichever is smaller. Class II (X7R, X5R, X6S, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7">10GΩ or <math>RxC \geq 100\Omega F</math> whichever is smaller.</td> </tr> <tr> <td>50V:0603<math>\geq 1\mu F</math>;0805<math>\geq 1\mu F</math>;1206<math>\geq 4.7\mu F</math>; 1210<math>\geq 4.7\mu F</math></td> </tr> <tr> <td>35V:0805<math>\geq 2.2\mu F</math>;1210<math>\geq 10\mu F</math></td> </tr> <tr> <td>25V:0402<math>\geq 1\mu F</math>;0603<math>\geq 2.2\mu F</math>;0805<math>\geq 2.2\mu F</math>; 1206<math>\geq 10\mu F</math>;1210<math>\geq 10\mu F</math></td> </tr> <tr> <td>16V:0402<math>\geq 0.22\mu F</math>;0603<math>\geq 1\mu F</math>;0805<math>\geq 2.2\mu F</math>; 1206<math>\geq 10\mu F</math>;1210<math>\geq 47\mu F</math></td> </tr> <tr> <td>10V:0201<math>\geq 47nF</math>;0402<math>\geq 0.47\mu F</math>;0603<math>\geq 0.47\mu F</math>; 0805<math>\geq 2.2\mu F</math>; 1206<math>\geq 4.7\mu F</math>;1210<math>\geq 47\mu F</math></td> </tr> <tr> <td>6.3V ; 4V</td> </tr> <tr> <td>50V: 0402<math>\geq 0.1\mu F</math></td> <td rowspan="4">10GΩ or <math>RxC \geq 50 \Omega \cdot F</math> whichever is smaller.</td> </tr> <tr> <td>35V:0603<math>\geq 1\mu F</math></td> </tr> <tr> <td>10V:0603<math>\geq 10\mu F</math></td> </tr> <tr> <td>4V:0603<math>\geq 22\mu F</math>; 0805<math>\geq 47\mu F</math></td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: X7R	10GΩ or $RxC \geq 100\Omega F$ whichever is smaller.	50V:0603 $\geq 1\mu F$ ;0805 $\geq 1\mu F$ ;1206 $\geq 4.7\mu F$ ; 1210 $\geq 4.7\mu F$	35V:0805 $\geq 2.2\mu F$ ;1210 $\geq 10\mu F$	25V:0402 $\geq 1\mu F$ ;0603 $\geq 2.2\mu F$ ;0805 $\geq 2.2\mu F$ ; 1206 $\geq 10\mu F$ ;1210 $\geq 10\mu F$	16V:0402 $\geq 0.22\mu F$ ;0603 $\geq 1\mu F$ ;0805 $\geq 2.2\mu F$ ; 1206 $\geq 10\mu F$ ;1210 $\geq 47\mu F$	10V:0201 $\geq 47nF$ ;0402 $\geq 0.47\mu F$ ;0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ;1210 $\geq 47\mu F$	6.3V ; 4V	50V: 0402 $\geq 0.1\mu F$	10GΩ or $RxC \geq 50 \Omega \cdot F$ whichever is smaller.	35V:0603 $\geq 1\mu F$	10V:0603 $\geq 10\mu F$	4V:0603 $\geq 22\mu F$ ; 0805 $\geq 47\mu F$									
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7	Adhesive Strength of Termination	Pressurizing force: 5N ( $\leq 0603$ ) and 10N ( $>0603$ ) * Test time: 10 $\pm$ 1 sec.	No remarkable damage or removal of the terminations.																								
8	Vibration Resistance	Vibration frequency: 10~55 Hz/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 $\pm$ 2 hrs.	No remarkable damage. Cap change and Q/D.F.: To meet initial spec.																								

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9	Solderability	Solder temperature: 235±5°C Dipping time: 2±0.5 sec.	95% min. coverage of all metalized area.															
10.	Bending Test	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.	No remarkable damage. Cap change: NPO: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)															
11	Resistance to Soldering Heat	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 hr 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: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20% Q/D.F., I.R. and dielectric strength: To meet initial requirements. 25% max. leaching on each edge.															
12	Temperature Cycle	Conduct the five cycles according to the temperatures and time. <table border="1" data-bbox="359 1209 790 1422"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> 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.	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30±3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30±3	4	Room temp.	2~3	No remarkable damage. Cap change: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20% Q/D.F., I.R. and dielectric strength: To meet initial requirements.
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13	Humidity (Damp Heat) Steady State	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.	No remarkable damage. Cap change: NPO: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NPO: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C X7R, X5R, X6S:																																																				
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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. Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C 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: NPO: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NPO: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C																																															

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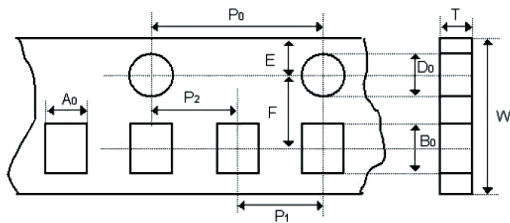
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15.	High Temperature Load (Endurance)	*Test temp.: NPO, X7R/X7E: $125\pm 3^{\circ}\text{C}$ X6S: $105\pm 3^{\circ}\text{C}$ X5R, Y5V: $85\pm 3^{\circ}\text{C}$ *Test time: 1000+24/-0 hrs. *To apply voltage: 1) $\leq$ % of rated voltage. 2) $10V \leq U_r < 500V$ : 200% of rated voltage. 3) $500V$ : 150% of rated voltage. 4) $U_r \geq 630V$ : 120% of rated voltage.	No remarkable damage. Cap change: NPO: $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger X7R, X5R, X6S: $\geq 10V^{**}$ , within $\pm 12.5\%$ ; $\leq 6.3V$ within $\pm 25\%$ ; TT series & C $\geq 1\mu\text{F}$ , within $\pm 25\%$ **10V: 0603 $\geq 4.7\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0201 $\geq 0.1\mu\text{F}$ , within $\pm 25\%$ ; Y5V: $\geq 10V$ , within $\pm 30\%$ ; $\leq 6.3V$ , within $+30/-40\%$ Q/D.F. value: NPO: More than 30pF, Q $\geq 350$ 10pF $\leq C < 30\text{pF}$ , Q $\geq 275+2.5C$ Less than 10pF, Q $\geq 200+10C$											

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25V	7.5%	10%	0402 $\geq$ 0.047 $\mu$ F;0603 $\geq$ 0.1 $\mu$ F; 0805 $\geq$ 0.33 $\mu$ F;1206 $\geq$ 1 $\mu$ F; 1210 $\geq$ 4.7 $\mu$ F																																																																																																	
		15%	0402 $\geq$ 0.068 $\mu$ F; 0603 $\geq$ 0.47 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 22 $\mu$ F																																																																																																	
16V (C $<$ 1 $\mu$ F)	10%	12.5%	0402 $\geq$ 0.068 $\mu$ F; 0603 $\geq$ 0.68 $\mu$ F																																																																																																	
		20%	0402 $\geq$ 0.22 $\mu$ F																																																																																																	
16V (C $\geq$ 1.0 $\mu$ F)	12.5%	20%	0603 $\geq$ 2.2 $\mu$ F; 0805 $\geq$ 3.3 $\mu$ F; 1206 $\geq$ 10 $\mu$ F; 1210 $\geq$ 22 $\mu$ F; 1812 $\geq$ 47 $\mu$ F																																																																																																	
		30%	0402 $\geq$ 0.47 $\mu$ F																																																																																																	
10V	20%	30%	0402 $\geq$ 0.47 $\mu$ F																																																																																																	
6.3V	30%	-	-																																																																																																	

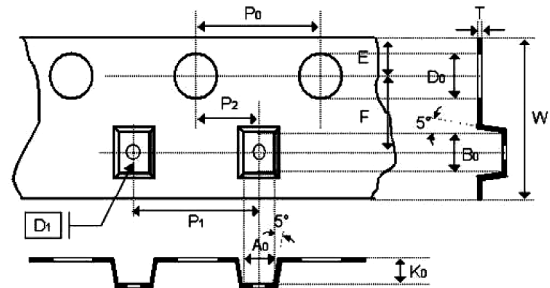
No	Item	Test Condition	Requirements	
15	High Temperature Load (Endurance)	*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24±2 hrs	*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, Y5V)	
			<b>Rated voltage</b>	<b>Insulation Resistance</b>
			100V: X7R	1GΩ or RxC ≥ 10 Ω-F whichever is smaller.
			50V: 0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF	
			35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF	
			25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF	
			16V: 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF	
			10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF;	
1206 ≥ 4.7μF; 1210 ≥ 47μF				
6.3V ; 4V				

### Appendixes

#### Tape & Reel Dimensions

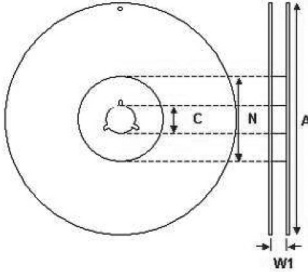


The dimension of paper tape



The dimension of plastic tape

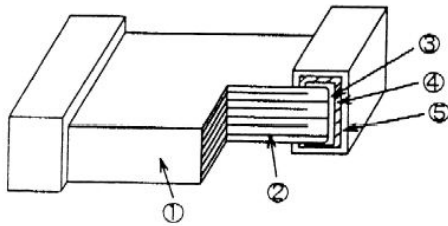
Size	0402	0603	0805			1206			1210		1812
Thickness	N	S, X	A	B	C, D, I	B	C, J, D	G	C, D, G	M	D, K
A0	0.62±0.05	1.02 ±0.05	1.5 ±0.10	1.5 ±0.1	<1.57	2 ±0.1	<1.85	<1.95	<2.97	<2.97	<3.81
B0	1.12±0.05	1.80 ±0.05	2.3 ±0.10	2.3 ±0.1	<2.40	3.5 ±0.1	<3.46	<3.67	<3.73	<3.73	<5.3
T	0.60±0.05	0.95 ±0.05	0.75 ±0.05	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	0.25±0.05
K0	-	-	-	-	<2.50	-	<2.5	<2.5	<2.5	<3	<2.5
W	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.10	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	8 ±0.1	12 ±0.2
P0	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.10	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1
10xP0	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.10	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1	40 ±0.1
P1	2 ±0.05	4 ±0.1	4 ±0.1	4 ±0.10	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	4 ±0.1	8 ±0.1
P2	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05
D0	1.55±0.05	1.55 ±0.05	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	1.5 ±0.05
D1	-	-	-	-	1 ±0.1	-	1 ±0.1	1 ±0.1	1 ±0.1	1 ±0.1	1.5 ±0.1
E	1.75±0.05	1.75 ±0.05	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	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	3.5 ±0.05	3.5 ±0.05	5.5 ±0.05



The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1812
Reel size	7"	10"	13"	7"
C	13 +0.5/-0.2	13 +0.5/-0.2	13 +0.5/-0.2	13 +0.5/-0.2
W <sub>1</sub>	8.4 +1.5/-0	8.4 +1.5/-0	8.4 +1.5/-0	12.4 +2.0/-0
A	178 ±0.10	250 ±1	330 ±1	178 ±0.10
N	60 +1/-0	100 ±1	100 ±1	60 +1.0/-0

**Constructions:**



No.	Name	NPO*	NPO, X7R, Y5V
1	Ceramic material	BaTiO <sub>3</sub> based	
2	Inner electrode	AgPd alloy	Ni
3	Termination	Inner layer	Cu
4		Middle layer	Ni
5		Outer layer	Sn

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

**Storage and handling conditions**

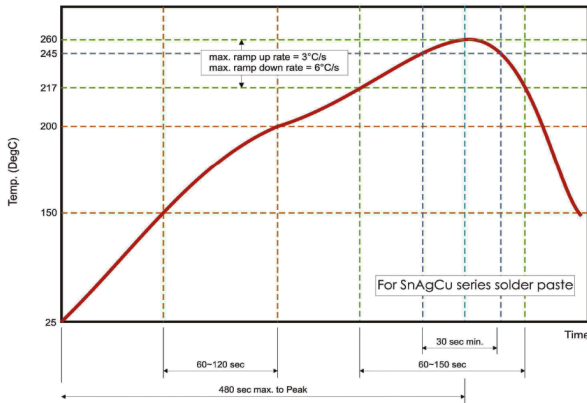
- (1) To store products at 5°C to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

**Cautions:**

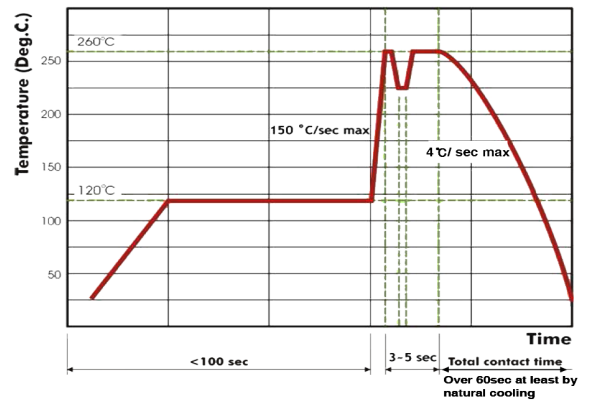
- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded, 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<sub>2</sub> 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.

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