SMD Multilayer Ceramic Capacitors

RoHS Compliant

Description

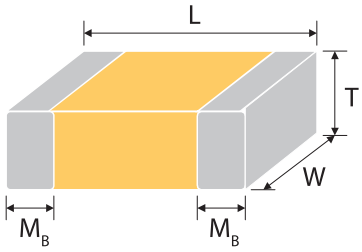
This soft termination series MLCC is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.

Features

- MLCC's termination are with a soft & flexible polymer layer to withstand high bending stress in SMT line.

Applications

- Power supply and related industries.
- Lighting industry.
- The other mechanical stress concerned products.



The outline of MLCC

External Dimensions

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M_B (mm)
0603 (1608)	1.6 ±0.2	0.8 ±0.1	0.8 ±0.07	S		0.4 ±0.15
	1.6 ±0.3	0.8 ±03	0.8 ±0.3	X		
0805 (2012)	2 ±0.2	1.25 ±0.1	0.6 ±0.1	A		0.5 ±0.2
			0.8 ±0.1	B		
			1.25 ±0.1	D	#	
	2 ±0.3	1.25 ±0.3	0.25 ±0.3	I		
1206 (3216)	3.2 +0.4/-0.1	1.6 ±0.15	0.8 ±0.1	B		0.6 ±0.2 (0.5 ±0.25)*
			0.95 ±0.1	C	#	
			1.15 ±0.15	J		
			1.25 ±0.1	D		
	3.2 +0.4/-0.1	1.6 ±0.2	1.6 ±0.2	G		
	3.2 ±0.5	1.6 ±0.5	1.6 ±0.5	P		
1210 (3225)	3.2 ±0.4	2.5 ±0.2	0.95 ±0.1	C		0.75 ±0.25
			1.6 ±0.2	D		
	3.2 ±0.6	2.5 ±0.5	2 ±0.2	G		
			2.5 ±0.5	K		

Reflow soldering only is recommended.

* For 1206≥1000V, 1812_200V~4000V products.

General Electrical Data:

Dielectric	X7R
Size	**0603, 0805, 1206, 1210,**
Capacitance range*	100pF to 47µF
Capacitance tolerance**	K (±10%), M (±20%)
Rated voltage (WVDC)	6.3V to 4000V
Operating temperature	-55 to +125°C
Capacitance characteristic	±15%
Termination	Ni/Sn (lead-free termination)

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

X7R: Apply 1.0±0.2Vrms, 1kHz±10%, at 25°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.

X7R Dielectric 0603, 0805, 1206, 1210Sizes

Dielectric		**X7R**					
SIZE		**0603**	**0805**			**1206**	**1210**
Rated Voltage (VDC)		**16**	**16**	**50**	**1000**	**2000**	**25**
	100pF (101)	S	D	D	B	D	
	120pF (121)	S	D	D	B	D	
	150pF (151)	S	D	D	B	D	
	180pF (181)	S	D	D	B	D	
	220pF (221)	S	D	D	B	D	
	270pF (271)	S	D	D	B	D	
	330pF (331)	S	D	D	B	D	
	390pF (391)	S	D	D	B	D	
	470pF (471)	S	D	D	B	D	
	560pF (561)	S	D	D	B	D	
	680pF (681)	S	D	D	B	D	
	820pF (821)	S	D	D	B	D	
	1,000pF (102)	S	D	D	B	D	C
	1,200pF (122)	S	D	D	B	G	C
	1,500pF (152)	S	D	D	D	G	C
	1,800pF (182)	S	D	D	D	G	C
	2,200pF (222)	S	D	D	D	G	C
	2,700pF (272)	S	D	D		G	C
	3,300pF (332)	S	D	D		G	C
	3,900pF (392)	S	D	D			C
	4,700pF (472)	S	D	D			C

Dielectric		X7R					
SIZE		0603	0805			1206	1210
Rated Voltage (VDC)		16	16	50	1000	2000	25
	5,600pF (562)	S	D	D			C
	6,800pF (682)	S	D	D			C
	8,200pF (822)	S	D	D			C
	0.010µF (103)	S	D	D			C
	0.012µF (123)	S	D	D			C
	0.015µF (153)	S	D	D			C
	0.018µF (183)	S	D	D			C
	0.022µF (223)	S	D	D			C
	0.027µF (273)	S	D	D			C
	0.033µF (333)	S	D	D			C
	0.039µF (393)	S	D	D			C
	0.047µF (473)	S	D	D			C
	0.056µF (563)	S	D	D			C
	0.068µF (683)	S	D	D			C
	0.082µF (823)	S	D	D			C
	0.10µF (104)	S	D	D			C
	0.12µF (124)	S	D	D			C
	0.15µF (154)	S	D	D			C
	0.18µF (184)	S	D	D			C
	0.22µF (224)	S	D	D			C
	0.27µF (274)	X	I	I			C
	0.33µF (334)	X	I	I			C
	0.39µF (394)	X	I	I			C
	0.47µF (474)	X	I	I			C
	0.56µF (564)	X	I				D
	0.68µF (684)	X	I				D
	0.82µF (824)	X	I				D
	1.0µF (105)	X	I	I			D
	1.5µF (155)		I				G
	2.2µF (225)		I				G
	3.3µF (335)						G
	4.7µF (475)		I				K
	6.8µF (685)						
	10µF (106)						M
	22µF (226)						M

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

Reliability Test Conditions And Requirements

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1</td><td>Visual and Mechanical</td><td>-</td><td>* No remarkable defect.
* Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2</td><td>Capacitance</td><td rowspan="2">*Test temp.: Room Temperature.
*Class I: (NP0)
≤1000pF, 1 ±0.2Vrms, 1MHz±10%
>1000pF, 1 ±0.2Vrms, 1KHz±10%
Class II: (X7R)
C≤10μF, 1 ±0.2Vrms, 1KHz±10% **
C>10μF, 0.5±0.2Vrms, 120Hz±20%

** Test condition: 0.5±0.2Vrms, 1KHz±10%
X7R:
0805=106(6.3V), 0603/475(6.3V)
X5R:
0201≥224 (6.3V,10V,16V)#1,
0402≥475 (6.3V,16V), 0402≥225(10V),
0603=106 (6.3V)
TT18X≥475(10V) , TT15X series
X6S:
0201/474(4V),0201>104 (6.3V,10V),
0402≥225 (6.3V),
0402/475 (10V), 0603/106 (6.3V),
X7S:
0402/225(6.3V)

#1 Excluding
X5R/0201/105(6.3V);225(10V) ,
0402X475M6R3
(1.0±0.2Vrms, 1KHz±10%)
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</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>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤2.5%</td><td>≤3%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤3.5%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤5%</td><td>0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF;</td></tr>
<tr><td>≤10%</td><td>0805>0.22μF; 1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤2.5%</td><td>≤3%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤3.5%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤5%</td><td>0201≥0.01uF; 1210≥3.3μF</td></tr>
<tr><td>≤10%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td>0603≥1μF;0805≥2.2μF;1206≥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</td></tr>
<tr><td>≤10%</td><td>0201≥0.1μF; 0402≥0.056μF;0603≥0.47μF;
0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr>
<tr><td>≤12.5%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF; 0402≥0.033μF; 0603≥0.15μF;
0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.022μF;0402≥0.033μF;
0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0201/X7R≥0.022μF; 0402≥0.15uF;
0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</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</td></tr>
<tr><td>≤20%</td><td>0402≥2.2μF</td></tr>
<tr><td>4V</td><td>≤15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: 10GΩ or RxC500Ω-F whichever is smaller.
Class II (X7R)</td></tr>
<tr><td>4.</td><td>Dielectric Strength</td><td>*To apply voltage:
≤100V: 250% of rated voltage.
200V ~ 300V: 200% of rated voltage.
400V ~ 450V: 120% of rated voltage.
500V ~ 999V: 150% of rated voltage.
1000V ~ 3000V: 120% of rated voltage.
4000V: 110% of rated voltage.
*Duration: 1 to 5 sec.
Charge & discharge current less than 50mA.</td><td> No evidence of damage or flash over during test.</td></tr>
</table>

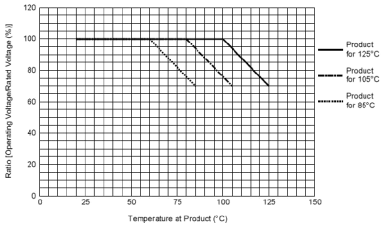
<table>
<tr><th>No</th><th>Item</th><th colspan="2">Test Condition</th><th>Requirements</th></tr>
<tr><td rowspan="3">5.</td><td rowspan="3">Insulation Resistance</td><td colspan="2" rowspan="2">*Test temp.: Room Temperature.
*To apply rated voltage for MAX. 120sec.</td><td>10GΩ or RxC≥500Ω-F whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; TT series; Size≥1812</td></tr>
</table></td></tr>
<tr><td>Rated voltage: 200~630V</td><td>To apply rated voltage (500V max.) for 60 sec.</td><td rowspan="2">≥10GΩ or RxC≥100Ω-F whichever is smaller</td></tr>
<tr><td>Rated voltage: >630V</td><td>To apply 500V for 60 sec.</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 Temp</th></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td></tr>
</table>
<table>
<tr><th>0603</th></tr>
<tr><td>Cap<1μF: 1V</td></tr>
<tr><td>1μF≤Cap≤4.7μF: 0.5V
0603X106-10V: 0.5V</td></tr>
<tr><td>Cap>4.7μF: 0.2V</td></tr>
<tr><th>0805</th></tr>
<tr><td>Cap<10μF: 1V</td></tr>
<tr><td>Cap=10μF: 0.5V
0805B475/6.3V~25V: 0.5V</td></tr>
<tr><td>Cap>10μF: 0.2V</td></tr>
<tr><th>1206/1210</th></tr>
<tr><td>Caps≤10μF: 1V</td></tr>
<tr><td>10μF<Caps≤100μF: 0.5V</td></tr>
<tr><td>Cap>100μF: 0.2V
1206X107-6.3V: 0.2V
1210S107-6.3V: 0.2V</td></tr>
</table></td><td>
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
</table></td></tr>
<tr><td>7.</td><td>Adhesive Strength of Termination</td><td colspan="2">* Pressurizing force: 2N (0201) and 5N (≤0603) and 10N (>0603)
* Test time: 10±1 sec.</td><td>* No remarkable damage or removal of the terminations.</td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>8.</td><td>Vibration Resistance</td><td>* Vibration frequency: 10~55 Hz/min.
* Total amplitude: 1.5mm
* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</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>* Solder temperature: 235±5°C
* Dipping time: 2±0.5 sec.</td><td>* 75% min. coverage of all metalized area.</td></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 5 mm and then the pressure shall be maintained for 5±1 sec.
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr 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:
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): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td> No remarkable damage.
* Cap change:
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>15±3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>15±3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td></td></tr>
<tr><td>4</td><td>Room temp.</td><td></td></tr>
</table>
*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.
* Cap change:
X7R: within ±7.5%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></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): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.
* Cap change:
X7R: ≥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%;
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C<30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤7.5%</td><td>0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF;</td></tr>
<tr><td>≤20%</td><td>0805>0.22μF; 1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.01uF; 1210≥3.3μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥Z 10μF*</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries
0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;
1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr>
<tr><td>≤20%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF;
0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402≥0.22μF (0402/X7R≥0.15μF);
0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);
0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">1GΩ or RxC≥10 Ω-F whichever is smaller</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; TT series; Size≥1812</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>14.</td><td>Humidity (Damp Heat) Load</td><td>*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 de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>
* No remarkable damage.
* Cap change:
X7R: ≥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%;
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C<30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤7.5%</td><td>0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF;</td></tr>
<tr><td>≤20%</td><td>0805>0.22μF; 1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.01uF; 1210≥3.3μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥Z
10μF*</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries
0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;
1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr>
<tr><td>≤20%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF;
0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402≥0.22μF (0402/X7R≥0.15μF);
0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);
0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="6">500MΩ or RxC≥5 Ω-F whichever is smaller</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; TT series; Size≥1812</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>
* Test temp.:
NP0, X7R/X7E/X7S: 125±3°C
X6S: 105±3°C
X5R: 85±3°C
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="2">0603</td><td rowspan="2">X7R</td><td>4V</td><td>C≥22μF</td></tr>
<tr><td>6.3V,10V</td><td>C≥4.7μF#1</td></tr>
<tr><td></td><td>X5R/X7R/ X6S/X7S</td><td>35V</td><td>C≥1.0μF</td></tr>
<tr><td rowspan="3">0805</td><td rowspan="3">X5R/X7R/ X6S/X7S</td><td>4V</td><td>C≥47μF</td></tr>
<tr><td>63V</td><td>C≥68μF</td></tr>
<tr><td>10V,50V</td><td>C≥10μF</td></tr>
<tr><td></td><td>X7R</td><td>16V,25V</td><td>C≥10μF</td></tr>
<tr><td>1206</td><td>X7R</td><td>≤6.3V</td><td>C≥47μF</td></tr>
<tr><td rowspan="2">1210</td><td>X7R</td><td>16V</td><td>C≥47μF</td></tr>
<tr><td>X7R</td><td>100V</td><td>C≥3.3μF</td></tr>
</table>
**1WV items must follow de-rating conditions.
#1. 0603X106(10V)&0603S106(4V&6.3V):150% of rated voltage
(2) 150% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="2">0603</td><td rowspan="2">X7R</td><td>50V</td><td>C>0.1μF</td></tr>
<tr><td>25V</td><td>C=1.0μF</td></tr>
<tr><td></td><td>X5R/X7R/ X6S/X7S</td><td>10V,16V</td><td>C≥1.0μF</td></tr>
<tr><td rowspan="4">0805</td><td rowspan="4">X5R/X7R/ X6S/X7S</td><td>100V</td><td>C≥0.47μF</td></tr>
<tr><td>50V</td><td>C≥0.68μF</td></tr>
<tr><td>35V</td><td>C≥2.2μF</td></tr>
<tr><td>10V,25V</td><td>C≥4.7μF</td></tr>
<tr><td></td><td>X7R</td><td>16V,25V</td><td>C≥10μF</td></tr>
<tr><td>1206</td><td rowspan="2">X7R</td><td>100V</td><td>C≥1μF</td></tr>
<tr><td></td><td>50V</td><td>C≥2.2μF</td></tr>
<tr><td>1210</td><td>X7R</td><td>50V~100V</td><td>C≥2.2μF</td></tr>
</table>
(3)≤6.3V or C≥10μF: 150% of rated voltage.
(4) 10V~250V: 200% of rated voltage.
(5) 400V~450V: 120% of rated voltage.
(6) 500V: 150% of rated voltage.
(7) 630V~3000V:120% of rated voltage, Excluding 1210/X7R/103/2KV(110% of rated voltage) &1812N472&1812N562(1KV): 100% of rated voltage.
(8) 4000V: 110% of rated voltage
* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
** De-rating conditions:
</td><td>
* No remarkable damage.
* Cap change:
X7R: ≥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%;
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C<30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S, X7S
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤7.5%</td><td>0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF;</td></tr>
<tr><td>≤20%</td><td>0805>0.22μF; 1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.01uF; 1210≥3.3μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥Z 10μF*</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries 0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr>
<tr><td>≤20%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402≥0.22μF (0402/X7R≥0.15μF); 0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="6">1GΩ or RxC≥10 Ω-F whichever is smaller</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; TT series; Size≥1812</td></tr>
</table>
</td></tr>
</table>

No	Item	Test Condition	Requirements
			**De-rating conditions: 

APPENDIXES

Tape & reel dimensions

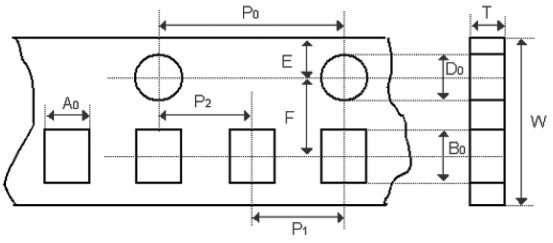


Fig. 2 The dimension of paper tape

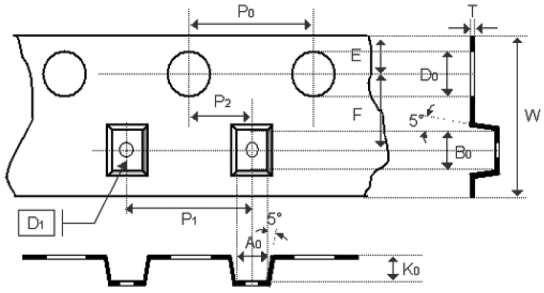


Fig. 3 The dimension of plastic tape

Size	0603	0805			1206			1210	
Thickness	S, X	A,H	B,T	D,I	B,T	C,J,D	G,P	C,D G,K	M
A0	1.05 +/-0.3	1.5 +/-0.2	1.5 +/-0.2	< 1.8	1.9 +/-0.5	< 2	<2.3	< 3.05	< 3.2
B0	1.8 +/-0.3	2.3 +/-0.2	2.3 +/-0.2	< 2.7	3.5 +/-0.5	< 3.7	< 4	< 3.8	<4
T	≤1.2	≤1.15	≤1.2	0.23 +/-0.1	≤1.2	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1
K0	-	-	-	< 2.5	-	< 2.5	< 2.5	< 2.5	< 3.2
W	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3
P0	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1
10xP0	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2
P1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1
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
D0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0
D1	-	-	-	1 +/-0.1	-	1 +/-0.1	1 +/-0.1	1 +/-0.1	1 +/-0.1
E	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	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

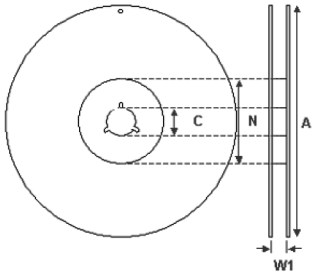
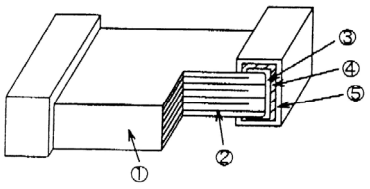


Fig. 4 The dimension of reel

Size	0603, 0805, 1206, 1210			1808 to 2225	
Reel size	7”	10”	13”	7”	13”
C	13 ±0.5	13 ±0.5	13 ±0.5	13 ±0.5	13 ±0.5
W_1	10 ±1.5	10 ±1.5	10 ±1.5	12.4 +2/-0	12.4 +2 /-0
A	178 ±2	250 ±2	330 ±2	178 ±2	330 ±2
N	60 +1/-0	50 min	50 min	60+1.0/-0	100 ±2

Constructions

No.	Name		NP0	X7R
1	Ceramic material		$CaZrO_3$ based	$BaTiO_3$ based
2	Inner electrode		Ni	
3	Termination	Inner layer	Cu + Ag Polymer	
4		Middle layer	Ni	
5		Outer layer	Sn	



The construction of MLCC

Application Notes

Storage and handling conditions

(1) To store products at 5°C to 40°C ambient temperature and 20% to 70%. related humidity conditions; MSL Level 1.

(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.

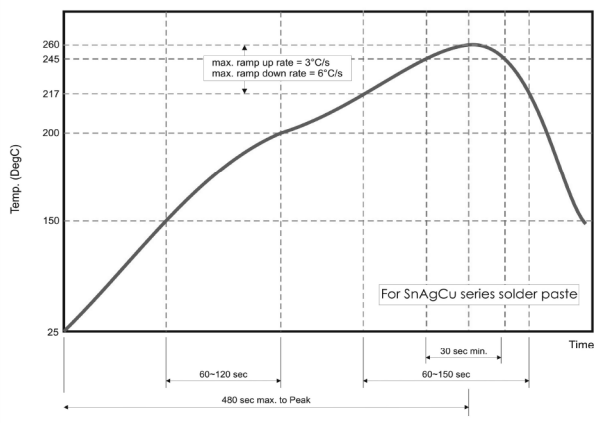


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

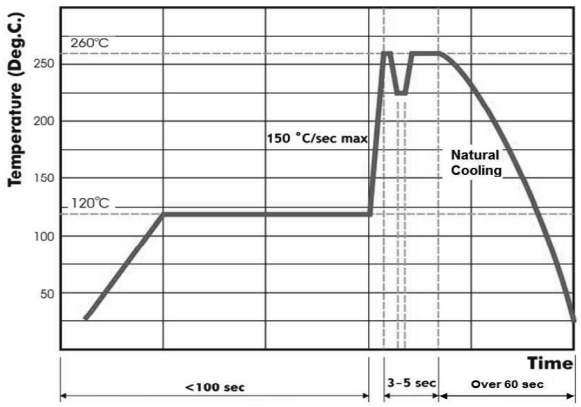


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

Part Number Table

Description	Part Number
SMD Multilayer Ceramic Capacitors, Soft Termination, 0603, X7R, 1uF, 5%, 16V	MCSH18B105J160CT
SMD Multilayer Ceramic Capacitors, Soft Termination, 0805, X7R, 1nF, 10%, 1KV	MCSH21B102K102CT
SMD Multilayer Ceramic Capacitors, Soft Termination, 0805, X7R, 100nF, 5%, 50V	MCSH21B104J500CT
SMD Multilayer Ceramic Capacitors, Soft Termination, 0805, X7R, 1uF, 10%, 16V	MCSH21B105K160CT
SMD Multilayer Ceramic Capacitors, Soft Termination, 0805, X7R, 4.7uF, 10%, 16V	MCSH21B475K160CT
SMD Multilayer Ceramic Capacitors, Soft Termination, 1206, X7R, 1nF, 10%, 2KV	MCSH31B102K202CT
SMD Multilayer Ceramic Capacitors, Soft Termination, 1210, X7R, 10uF, 10%, 25V	MCSH32B106K250CT