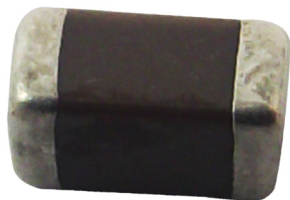


**RoHS
Compliant**



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:

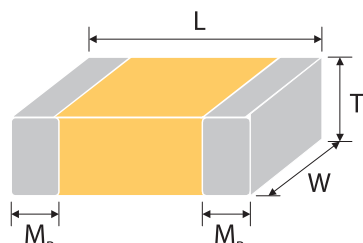
- For general digital circuit
- For power supply bypass capacitors
- For consumer electronics
- For telecommunication

How To Order:

MC	1206	F	104	Z	500	C	T
	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Termination	Packaging style
Multi-comp	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 ⁴ = 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 NP0 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 _B (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 _B (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.

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



No	Item	Test Condition	Requirements																																																						
2	Capacitance		*Shall not exceed the limits given in the detailed spec.																																																						
			NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R,X5R,X6S:																																																						
			<table><tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F. ≤</th></tr><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>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></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%	-	-
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No	Item	Test Condition	Requirements																								
4	Dielectric Strength	To apply voltage (≤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.	10GΩ or RxC≥500Ω·F whichever is smaller. Class II (X7R, X5R, X6S, Y5V) <table><thead><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr></thead><tbody><tr><td>100V: X7R</td><td rowspan="6">10GΩ or RxC≥100ΩF whichever is smaller.</td></tr><tr><td>50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0805≥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: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</td><td rowspan="4">10GΩ or RxC≥50 Ω·F whichever is smaller.</td></tr><tr><td>50V: 0402≥0.1μF</td></tr><tr><td>35V:0603≥1μF</td></tr><tr><td>10V:0603≥10μF</td></tr><tr><td>4V:0603≥22μF; 0805≥47μF</td><td></td></tr></tbody></table>	Rated voltage	Insulation Resistance	100V: X7R	10GΩ or RxC≥100ΩF whichever is smaller.	50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	35V: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	10GΩ or RxC≥50 Ω·F whichever is smaller.	50V: 0402≥0.1μF	35V:0603≥1μF	10V:0603≥10μF	4V:0603≥22μF; 0805≥47μF									
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6	Temperature Coefficient	With no electrical load. <table><thead><tr><th>T.C.</th><th>Operating Temp</th></tr></thead><tbody><tr><td>NPO</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><tr><td>X6S</td><td>-55~105°C at 25°C</td></tr><tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr></tbody></table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X5R	-55~ 85°C at 25°C	X6S	-55~105°C at 25°C	Y5V	-25~ 85°C at 20°C	<table><thead><tr><th>T.C.</th><th>Capacitance Change</th></tr></thead><tbody><tr><td>NPO</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><tr><td>X6S</td><td>Within ±22%</td></tr><tr><td>Y5V</td><td>Within +30%/-80%</td></tr></tbody></table>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X5R	Within ±15%	X6S	Within ±22%	Y5V	Within +30%/-80%
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7	Adhesive Strength of Termination	Pressurizing force: 5N (≤0603) and 10N (>0603) * Test time: 10±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±2 hrs.	No remarkable damage. Cap change and Q/D.F.: To meet initial spec.																								

No	Item	Test Condition	Requirements																		
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: NP0: 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: NP0: 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	<table><tr><td colspan="3">Conduct the five cycles according to the temperatures and time.</td></tr><tr><td>Step</td><td>Temp. (°C)</td><td>Time (min.)</td></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 room temp. Measurement to be made after keeping at room temp. for 24±2 hrs.	Conduct the five cycles according to the temperatures and time.			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: NP0: 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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4	Room temp.	2~3																			

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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: <table> <tr> <th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr> <tr> <td rowspan="2">≥100V</td><td rowspan="2">≤3%</td><td>≤6%</td><td>1206 ≥ 0.47μF</td></tr> <tr> <td>≤7.5%</td><td>0805 > 0.1μF, 0603 ≥ 0.068μF</td></tr> <tr> <td rowspan="3">≥50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr> <tr> <td>≤10%</td><td>1210 ≥ 4.7μF</td></tr> <tr> <td>≤20%</td><td>0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF TT series</td></tr> <tr> <td>35V</td><td>≤5%</td><td>≤20%</td><td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF</td></tr> <tr> <td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td></tr> <tr> <td>≤14%</td><td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td></tr> <tr> <td>≤15%</td><td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td></tr> <tr> <td>≤20%</td><td>0402 ≥ 1μF</td></tr> <tr> <td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr> <tr> <td>≤15%</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">≤7.5%</td><td>≤15%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr> <tr> <td>≤20%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF TT series</td></tr> <tr> <td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td></tr> <tr> <td>4V</td><td>≤20%</td><td>-</td><td>-</td></tr> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥100V	≤3%	≤6%	1206 ≥ 0.47μF	≤7.5%	0805 > 0.1μF, 0603 ≥ 0.068μF	≥50V	≤3%	≤6%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤10%	1210 ≥ 4.7μF	≤20%	0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF TT series	35V	≤5%	≤20%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF	25V	≤5%	≤10%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤14%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	≤15%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	≤20%	0402 ≥ 1μF	16V	≤5%	≤10%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤15%	0201 ≥ 0.1μF; 0402 ≥ 0.47μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	10V	≤7.5%	≤15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤20%	0201 ≥ 0.1μF; 0402 ≥ 1μF TT series	6.3V	≤15%	≤30%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	4V	≤20%	-	-
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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: NP0: ±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: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C																																				

No	Item	Test Condition	Requirements				
14	Humidity (Damp Heat) Load		X7R, X5R, X6S:				
			Rated vol.	D.F.≤	Exception of D.F. ≤		
			≥100V	≤3%	≤6%	1206≥0.47μF	
					≤7.5%	0805>0.1μF, 0603≥0.068μF	
			≥50V	≤3%	≤6%	0201(50V); 0603≥0.047μF; 0805≥0.18μF;1206≥0.47μF	
					≤10%	1210≥4.7μF	
					≤20%	0402≥0.1μF; 0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF TT series	
			35V	≤5%	≤20%	0603≥1μF; 0805≥2.2μF; 1210≥10μF	
			25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF; 1210≥10μF	
					≤14%	0603≥0.33μF; 1206≥4.7μF	
					≤15%	0402≥0.10μF;0603≥0.47μF;0805≥2.2 μF; 1206≥6.8μF ; 1210≥22μF; TT series	
					≤20%	0402≥1μF	
			16V	≤5%	≤10%	0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	
					≤15%	0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series	
			10V	≤7.5%	≤15%	0201≥0.012μF 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series	
					≤20%	0201≥0.1μF; 0402≥1μF	
			6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF; 1206≥47μF :1210≥100μF; TT series	
			4V	≤20%	-	-	
			Y5V:				
			Rated vol.	D.F.≤	Exception of D.F. ≤		
			≥50V	7.5%	10%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF	
			35V	10%	-	-	
			25V	7.5%	10%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF	
					15%	0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF	
			16V (C<1μF)	10%	12.5%	0402≥0.068μF; 0603≥0.68μF	
					20%	0402≥0.22μF	
			16V (C≥1.0μF)	12.5%	20%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF	
10V	20%	30%	0402≥0.47μF				
6.3V	30%	-	-				

No	Item	Test Condition	Requirements	
14	Humidity (Damp Heat) Load		*I.R.: $\geq 10V$, 500M Ω or 25 Ω -F whichever is smaller. Class II (X7R, X5R, X6S, Y5V)	
			Rated voltage	Insulation Resistance
			100V: X7R	1G Ω or Rx $C \geq 10 \Omega$ -F whichever is smaller.
			50V: 0402 $\geq 0.1\mu F$; 0603 $\geq 1\mu F$; 0805 $\geq 1\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 4.7\mu F$	
			35V: 0603 $\geq 1\mu F$; 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	
15.	High Temperature Load (Endurance)	*Test temp.: NP0, X7R/X7E: 125 $\pm 3^{\circ}C$ X6S: 105 $\pm 3^{\circ}C$ X5R, Y5V: 85 $\pm 3^{\circ}C$ *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: NP0: $\pm 3.0\%$ or $\pm 0.3pF$ whichever is larger X7R, X5R, X6S: $\geq 10V^{**}$, within $\pm 12.5\%$; $\leq 6.3V$ within $\pm 25\%$; TT series & C $\geq 1\mu F$, within $\pm 25\%$ **10V: 0603 $\geq 4.7\mu F$; 0402 $\geq 1\mu F$; 0201 $\geq 0.1\mu F$, within $\pm 25\%$; Y5V: $\geq 10V$, within $\pm 30\%$; $\leq 6.3V$, within $+30/-40\%$ Q/D.F. value: NP0: More than 30pF, Q ≥ 350 10pF $\leq C$ <30pF, Q $\geq 275+2.5C$ Less than 10pF, Q $\geq 200+10C$	

No	Item	Test Condition				Requirements			
15	High Temperature Load (Endurance)	5) 100% of rated voltage for below range.				X7R, X5R, X6S:			
		Size	Dielectric	Rated voltage	Capacitance range	Rated vol.	D.F.≤	Exception of D.F. ≤	
		0201	X5R/X7R/X6S	6.3V,10V	C≥0.1μF	≥100V	≤3%	≤6%	1206≥0.47μF
		0402	X5R/X7R/X6S	6.3V,10V	C≥1.0μF			≤7.5%	0805>0.1μF, 0603≥0.068μF
		0603	X5R/X7R/X6S	4V	C≥22μF	≥50V	≤3%	≤6%	0201(50V); 0603≥0.047μF; 0805≥0.18μF;1206≥0.47μF
				6.3V,10V	C≥4.7μF			≤10%	1210≥4.7μF
				35V	C≥1.0μF			≤20%	0402≥0.1μF; 0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF TT series
		0805	X5R/X7R/X6S	4V	C≥47μF	35V	≤5%	≤20%	0603≥1μF; 0805≥2.2μF; 1210≥10μF
				6.3V	C≥22μF				
		1206	X5R/X7R/	6.3V	C≥47μF	25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF; 1210≥10μF
			NP0	3,000V	C≥1.5pF			≤14%	0603≥0.33μF; 1206≥4.7μF
		TT18	Y5V	6.3V,10	C≥2.2μF			≤15%	0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF ; 1210≥22μF; TT series
				6.3V	C≥10μF			≤20%	0402≥1μF
		TT21	Y5V	6.3V	C≥10μF	16V	≤5%	≤10%	0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF;1206≥2.2μF;1210≥4.7μF
		TT31	Y5V	6.3V	C≥22μF			≤15%	0201≥0.1μF; 0402≥0.47μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series
		(6) 150% of rated voltage for below range.				10V	≤7.5%	≤15%	0201≥0.012μF 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series
		Size	Dielectric	Rated voltage	Capacitance range			≤20%	0201≥0.1μF; 0402≥1μF
		0201	X5R/X7R/X6S	16V	C≥0.1μF	6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF; 1206≥47μF ;1210≥100μF; TT series
		0402	X5R/X7R/X6S	50V	C≥0.1μF				
				10V~25V	C≥0.22μF	4V	≤20%	-	-
		Y5V	16V	C≥0.47μF					
		0603	X5R/X7R/X6S	10V,50V	C≥1.0μF	Y5V:			
			Y5V	16V	C≥2.2μF	Rated vol.	D.F.≤	Exception of D.F. ≤	
		0805	X5R/X7R/X6S	10~50V	C≥4.7μF	≥50V	7.5%	10%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF
			X7R	50V	C≥2.2μF	35V	10%	-	-
				100V	C≥0.47μF	25V	7.5%	10%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF
				Y5V	16V			C≥4.7μF	15%
2220	X7R	100V	C≥6.8μF	16V (C<1μF)	10%	12.5%	0402≥0.068μF; 0603≥0.68μF		
				16V (C≥1.0μF)	12.5%	20%	0402≥0.22μF		
				10V	20%	30%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF		
				6.3V	30%	-	0402≥0.47μF		
						-	-		

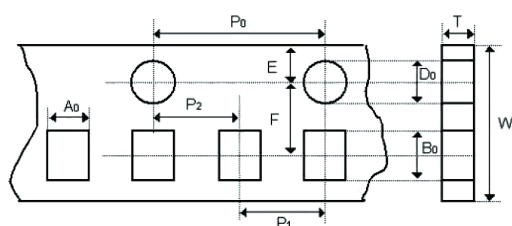
General Purpose Multilayer SMD Ceramic Capacitor
0402 to 1812 Sizes, NPO, X7R & Y5V Dielectrics (10V to 100V)



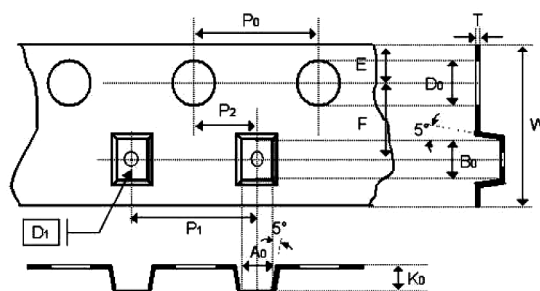
No	Item	Test Condition	Requirements	
15	High Temperature Load (Endurance)	*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24±2 hrs	*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever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

Appendixes

Tape & Reel Dimensions

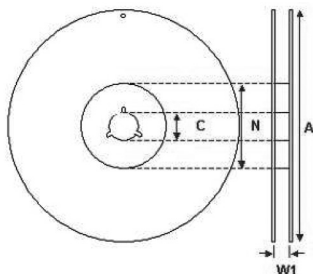


The dimension of paper tape



The dimension of plastic tape

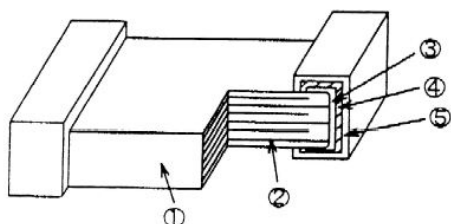
Size	0402	0603	0805			1206			1210		1812
Thickness	N	S, X	A	B	C, D, I	B	C, J, D	G	C, D, G	M	D, K
A0	0.62±0.05	1.02 ±0.05	1.5 ±0.10	1.5 ±0.1	<1.57	2 ±0.1	<1.85	<1.95	<2.97	<2.97	<3.81
B0	1.12±0.05	1.80 ±0.05	2.3 ±0.10	2.3 ±0.1	<2.40	3.5 ±0.1	<3.46	<3.67	<3.73	<3.73	<5.3
T	0.60±0.05	0.95 ±0.05	0.75 ±0.05	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 ₁	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 ₃ based	
2	Inner electrode	AgPd alloy	Ni
3	Termination	Inner layer	Ag
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

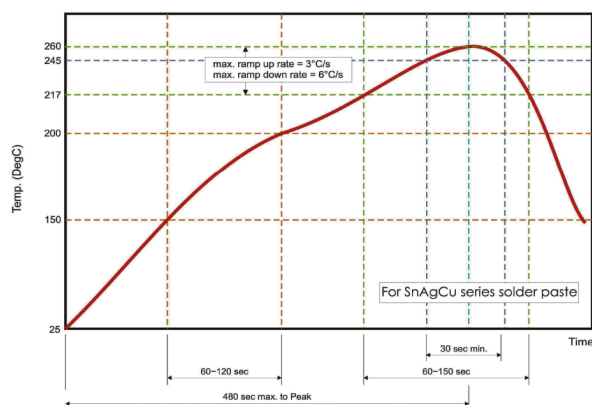
- (1) To store products at 5°C to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

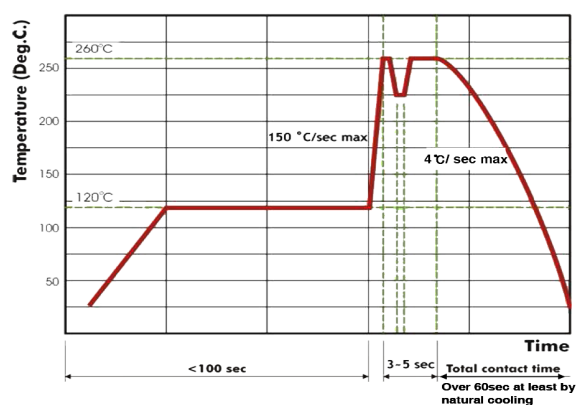
- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded, 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 N₂ 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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