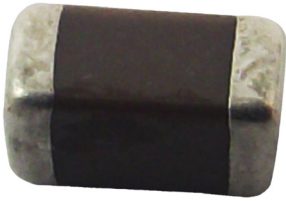


**RoHS
Compliant**



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 RF series MLCC is used at high frequencies generally have a small temperature coefficient of capacitance, typical within the $\pm 30\text{ppm}/^\circ\text{C}$ required for NPO (C0G) classification and have excellent conductivity internal electrode. Thus, WTC RF series MLCC will be with the feature of low ESR and high Q characteristics.

Features:

- High Q and low ESR performance at high frequency.
- Ultra low capacitance to 0.1pF.
- Can offer high precision tolerance to $\pm 0.05\text{pF}$.
- Quality improvement of telephone calls for low power loss and better performance.

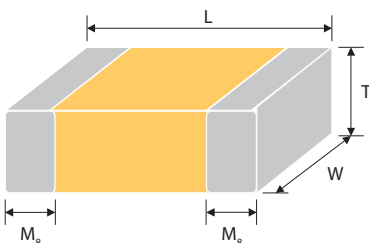
Applications:

- Telecommunication products & equipments: Mobile phone, WLAN, Base station.
- RF module: Power amplifier, VCO.
- Tuners.

How To Order:

<u>MRF</u>	<u>15</u>	<u>N</u>	<u>100</u>	<u>J</u>	<u>500</u>	<u>C</u>	<u>T</u>
	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated Voltage</u>	<u>Termination</u>	<u>Packaging style</u>
M=Type RF = Ultra High Q & Low ESR	03 = 0201 (0603) 15 = 0402 (1005) 18 = 0603 (1608) 21 = 0805 (2012)	N = NPO	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5 = 0.5pF 1R0 = 1pF 100 = 10×10^0 = 10pF	A = $\pm 0.05\text{pF}$ B = $\pm 0.1\text{pF}$ C = $\pm 0.25\text{pF}$ D = $\pm 0.5\text{pF}$ F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$	Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3 = 6.3V DC 100 = 10V DC 250 = 25V DC 500 = 50V DC 101 = 100V DC 251 = 250V DC 501 = 500V DC	C = Cu/Ni/Sn	T = 7" reeled G = 13" reeled

External Dimensions:



The outline of MLCC

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (mm)
0201 (0603)	0.6 \pm 0.03	0.3 \pm 0.03	0.3 \pm 0.03	L #	0.15 \pm 0.05
0402 (1005)	1 \pm 0.05	0.5 \pm 0.05	0.5 \pm 0.05	N #	0.25 +0.05/-0.1
0603 (1608)	1.6 \pm 0.1	0.8 \pm 0.1	0.8 \pm 0.07	S -	0.4 \pm 0.15
0805 (2012)	2 \pm 0.2	1.25 \pm 0.2	0.8 \pm 0.1	T -	0.5 \pm 0.2

Reflow soldering only is recommended.

General Electrical Data:

Dielectric	NP0
Size	0201, 0402, 0603, 0805
Capacitance*	0201: 0.1pF to 33pF; 0402: 0.1pF to 100pF; 0603: 0.3pF to 47pF; 0805: 0.3pF to 100pF
Capacitance tolerance	Cap ≤5pF: A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF <Cap <10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF) Cap ≥10pF: F (±1%), G (±2%), J (±5%)
Rated voltage (WVDC)	6.3V, 10V, 25V, 50V, 100V, 250V, 500V
Q*	Cap ≥30pF, Q ≥1000; Cap <30pF, Q ≥400 +20C
Insulation resistance at Ur	≥10GΩ or R × C ≥100Ω-F whichever is smaller.
Operating temperature	-55°C to +125°C
Capacitance change	±30ppm/°C; 0201 Cap ≥22pF, ±60ppm/°C
Termination	Ni/Sn (lead-free termination)

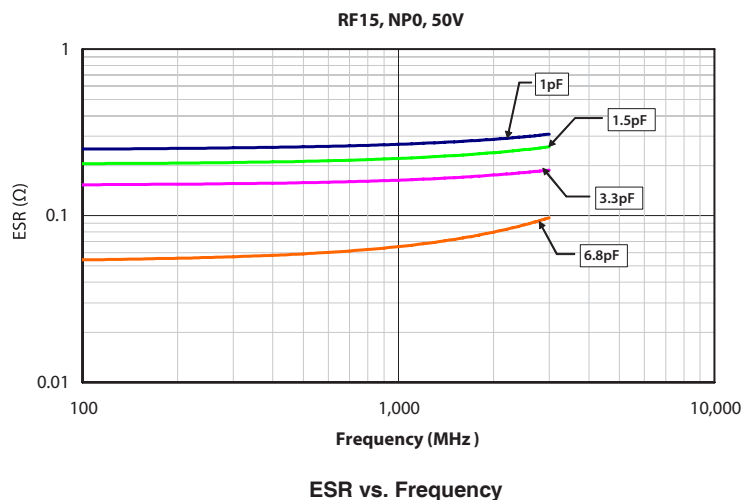
* Measured at the conditions of 25°C ambient temperature and 30~70% related humidity.
 Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF.

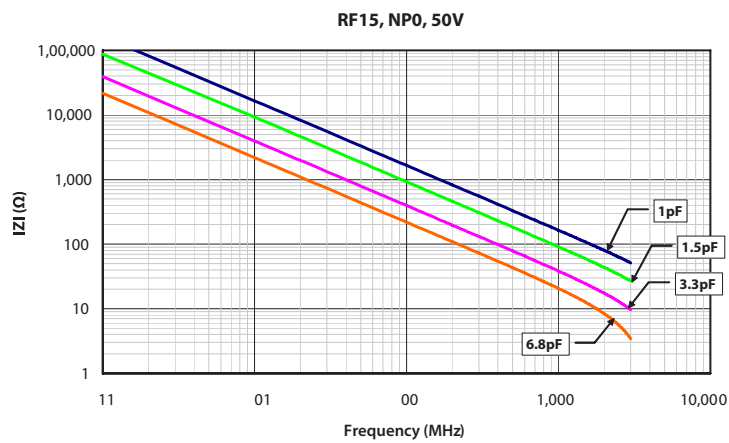
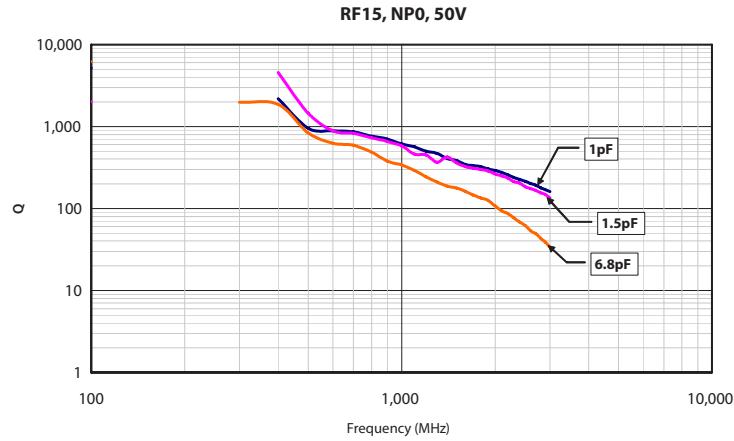
Packaging Dimension and Quantity:

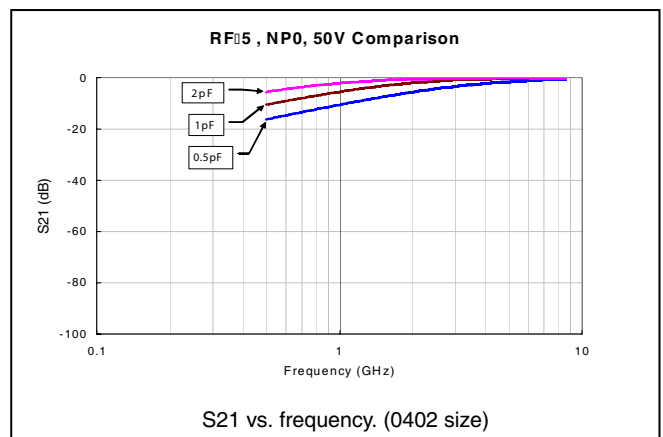
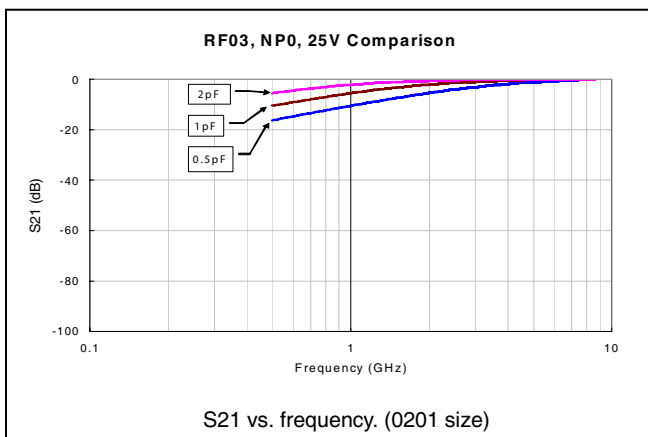
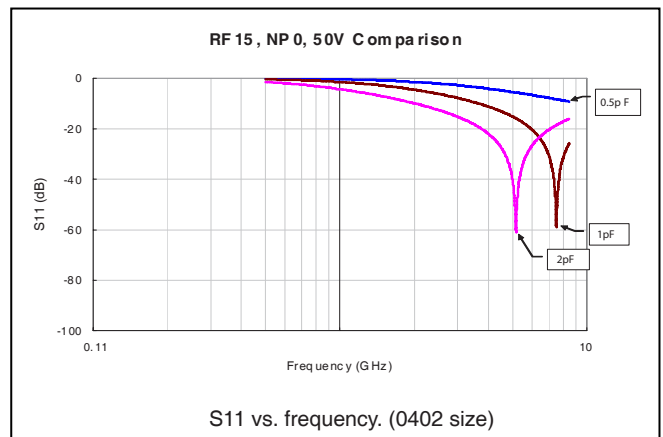
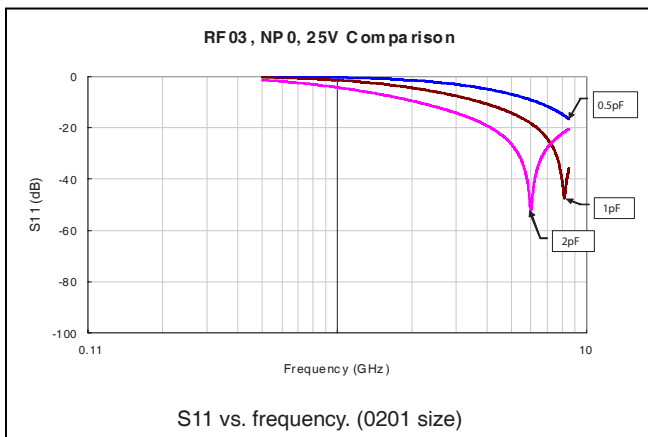
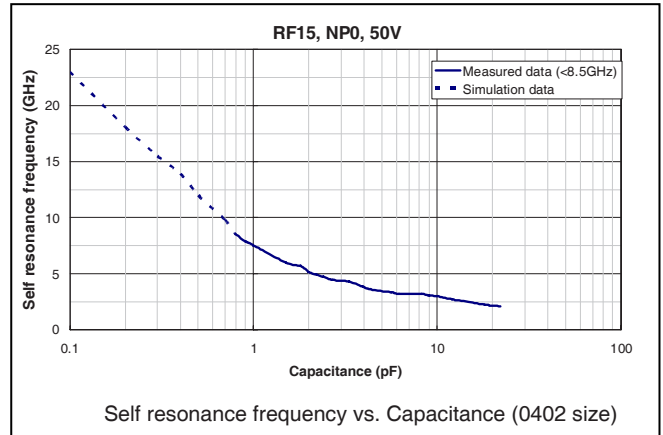
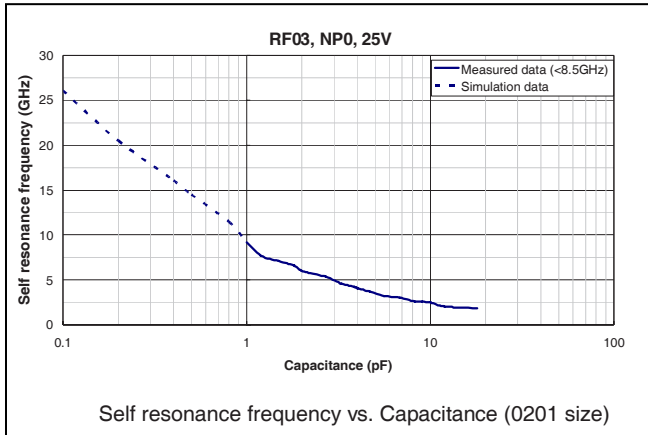
Size	Thickness (mm)/Symbol		Paper tape	
			7" reel	13" reel
0201 (0603)	0.3 ±0.03	L	15k	70k
0402 (1005)	0.5 ±0.05	N	10k	50k
0603 (1608)	0.8 ±0.07	S	4k	15k
0805 (2012)	0.85±0.1	T	4k	15k

Unit : pieces

Electrical Characteristics:







Reliability Test Conditions and Requirements:

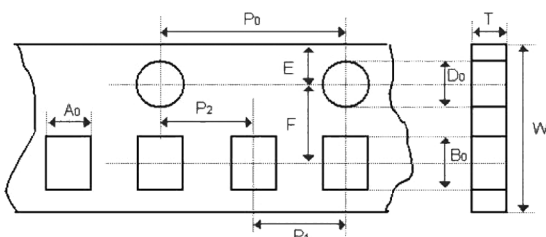
No	Item	Test Condition	Requirements
1	Visual and Mechanical	-	No remarkable defect. Dimensions to conform to individual specification sheet.
2	Capacitance	1 ±0.2Vrms, 1MHz ±10% At 25°C ambient temperature.	Shall not exceed the limits given in the detailed spec.
3	Q/ D.F. (Dissipation Factor)		Cap ≥30pF, Q ≥1000; Cap <30pF, Q ≥400 +20C
4	Dielectric Strength	To apply voltage: ≤100V, ≥250% of rated voltage. Duration: 1 to 5 sec. Charge and discharge current less than 50mA.	No evidence of damage or flash over during test.
		To apply voltage: 200V~300V ≥2 times V DC 500V~999V ≥1.5 times V DC 1000V~3000V ≥1.2 times V DC Cut-off, set at 10mA TEST = 15 sec. RAMP = 0	
5	Insulation Resistance	≤100V : To apply rated voltage 5. Insulation for Max. 120 sec.	≥10GΩ or R × C ≥100Ω -F whichever is smaller
		≥200V :To apply rated voltage (500V Max.) for 60 sec.	
6	Temperature Coefficient	With no electrical load. Operating temperature: -55°C ~ 125°C at 25°C	Capacitance change: within ±30ppm/°C; 0201Cap ≥22pF, within ±60ppm/°C
7	Adhesive Strength of Termination	Pressurizing force : 0201: 2N 0402 & 0603: 5N >0603: 10N 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.
9	Solderability	Solder temperature: 235 ±5°C Dipping time: 2 ±0.5 sec.	95% Min. coverage of all metalized area.

No	Item	Test Condition	Requirements															
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: within ±5.0% or ±0.5pF whichever is larger. (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: within ±2.5% or ±0.25pF whichever is larger. 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"> <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: within ±2.5% or ±0.25pF whichever is larger. Q/D.F., I.R. and dielectric strength: To meet initial requirements.
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																
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: within ±5.0% or ±0.5pF whichever is larger. Q/D.F. value: Cap ≥30pF, Q ≥350; 10pF ≤Cap <30pF, Q ≥275 +2.5C Cap <10pF; Q ≥200 +10C I.R.: ≥1GΩ.															
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: within ±7.5% or ±0.75pF whichever is larger. Q/D.F. value: Cap ≥30pF, Q ≥200; Cap <30pF, Q ≥100 +10/3C I.R.: ≥500MΩ.															

No	Item	Test Condition	Requirements								
15	High Temperature Load (Endurance)	Test temp.: 125±3°C * To apply voltage: (1) 10V ≤Ur<500V: 200% of rated voltage. (2) ≤ 6.3V or 500V: 150% of rated voltage. (3) Ur ≥630V: 120% 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: within ±3.0% or ±0.3pF whichever is larger. Q/D.F. value: Cap ≥30pF, Q ≥350 10pF ≤Cap <30pF, Q ≥275 +2.5C Cap <10pF, Q ≥200 +10C * I.R.: ≥1GΩ.								
16	ESR	The ESR should be measured at room temperature and tested at frequency 1 ±0.1GHz. The ESR should be measured at room temperature and tested at frequency 500 ±50 MHz.	<table border="1"> <thead> <tr> <th>0201</th> <th>0402</th> </tr> </thead> <tbody> <tr> <td>0.1pF ≤Cap ≤1pF: < 350mΩ</td> <td>0.1pF ≤Cap ≤1pF: < 350mΩ</td> </tr> <tr> <td>1pF <Cap ≤5pF: < 300mΩ</td> <td>1pF <Cap ≤5pF: < 300mΩ</td> </tr> <tr> <td>5pF <Cap ≤22pF: < 250mΩ</td> <td>5pF <Cap ≤100pF: < 250mΩ</td> </tr> </tbody> </table>	0201	0402	0.1pF ≤Cap ≤1pF: < 350mΩ	0.1pF ≤Cap ≤1pF: < 350mΩ	1pF <Cap ≤5pF: < 300mΩ	1pF <Cap ≤5pF: < 300mΩ	5pF <Cap ≤22pF: < 250mΩ	5pF <Cap ≤100pF: < 250mΩ
			0201	0402							
0.1pF ≤Cap ≤1pF: < 350mΩ	0.1pF ≤Cap ≤1pF: < 350mΩ										
1pF <Cap ≤5pF: < 300mΩ	1pF <Cap ≤5pF: < 300mΩ										
5pF <Cap ≤22pF: < 250mΩ	5pF <Cap ≤100pF: < 250mΩ										
<table border="1"> <thead> <tr> <th>0603</th> <th>0805</th> </tr> </thead> <tbody> <tr> <td>0.3pF ≤Cap ≤1pF: < 1,500mΩ</td> <td>0.3pF ≤Cap ≤1pF: < 1,500mΩ</td> </tr> <tr> <td>1pF <Cap ≤10pF: < 250mΩ</td> <td>1pF <Cap ≤10pF: < 250mΩ</td> </tr> <tr> <td>10pF <Cap ≤100pF: < 200mΩ</td> <td>Cap >10pF: < 200mΩ</td> </tr> </tbody> </table>	0603	0805	0.3pF ≤Cap ≤1pF: < 1,500mΩ	0.3pF ≤Cap ≤1pF: < 1,500mΩ	1pF <Cap ≤10pF: < 250mΩ	1pF <Cap ≤10pF: < 250mΩ	10pF <Cap ≤100pF: < 200mΩ	Cap >10pF: < 200mΩ			
0603	0805										
0.3pF ≤Cap ≤1pF: < 1,500mΩ	0.3pF ≤Cap ≤1pF: < 1,500mΩ										
1pF <Cap ≤10pF: < 250mΩ	1pF <Cap ≤10pF: < 250mΩ										
10pF <Cap ≤100pF: < 200mΩ	Cap >10pF: < 200mΩ										
			0201, 22pF ≤Cap ≤33pF: < 300mΩ								

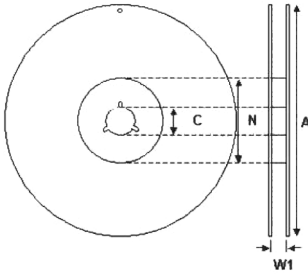
Appendixes

Tape & Reel Dimensions



The dimension of paper tape

Size	0201	0402	0603	0805
Thickness	L	N	S	T
A ₀	0.37 ±0.03	0.62 ±0.05	1 +0.05/-0.1	1.5 ±0.1
B ₀	0.67 ±0.03	1.12 ±0.05	1.8 ±0.1	2.3 ±0.1
T	0.42 ±0.03	0.6 ±0.05	0.95 ±0.05	0.95 ±0.05
K ₀	-	-	-	-
W	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
10 × P ₀	40 ±0.1	40 ±0.1	40 ±0.2	40±0.2
P ₁	2 ±0.05	2 ±0.05	4 ±0.1	4 ±0.1
P ₂	2 ±0.05	2 ±0.05	2 ±0.05	2 ±0.05
D ₀	1.55 ±0.05	1.55 ±0.05	1.55 ±0.05	1.55 ±0.05
D ₁	-	-	-	-
E	1.75 ±0.05	1.75 ±0.05	1.75 ±0.05	1.75 ±0.05
F	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05	3.5 ±0.05

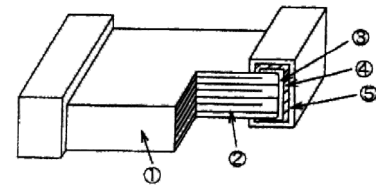


The dimension of reel

Size	0201, 0402, 0603, 0805	
Reel size	7"	13"
C	13 +0.5/-0.2	13 +0.5/-0.2
W ₁	8.4 +1.5/-0	8.4 +1.5/-0
A	178 ±1	330 ±1
N	60 +1/-0	100 ±1

Constructions:

No.	Name	NPO
1	Ceramic material	BaTiO ₃ based
2	Inner electrode	Cu
3	Termination	Inner layer
4		Middle layer
5		Outer layer
		Sn (Matt)



The construction of MLCC

* Partial NPO items are with Ag/Ni/Sn(NME) terminations, please ref to product range for detail.

Storage and handling conditions

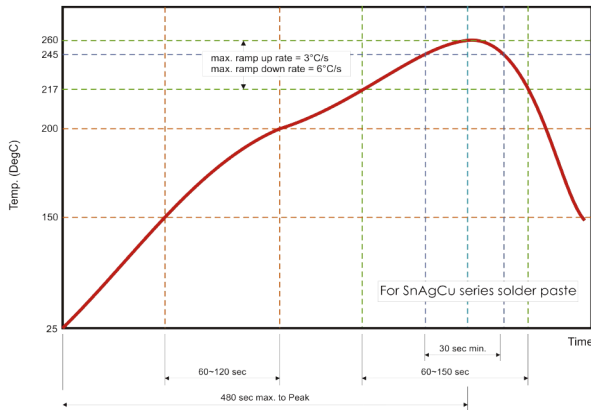
- (1) To store products at 5 to 40 C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

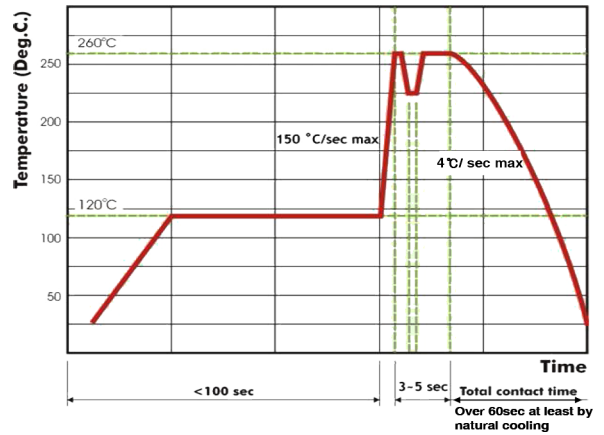
- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded,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