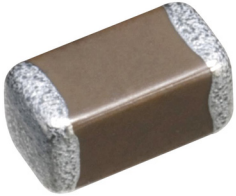


SMD Multilayer Ceramic Capacitors **multicomp**PRO

**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. This 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 NP0 (C0G) & X8G classification and have excellent conductivity internal electrode. Thus, This 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

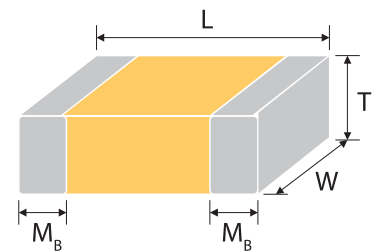
Applications

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

External Dimensions:

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B min (mm)
0402 (1005)	1 \pm 0.05	0.5 \pm 0.05	0.5 \pm 0.05 N	#	0.25+0.05/-0.1

Reflow soldering only is recommended.



The outline of MLCC

General Electrical Data:

Dielectric	NP0
Size	0402 (1005)
Capacitance*	0.1pF to 1000pF
Capacitance tolerance	Cap<10pF: A ($\pm 0.05\text{pF}$), B ($\pm 0.1\text{pF}$), C ($\pm 0.25\text{pF}$), D ($\pm 0.5\text{pF}$) Cap $\geq 10\text{pF}$: F ($\pm 1\%$), G ($\pm 2\%$), J ($\pm 5\%$)
Rated voltage (WVDC)	6.3V, 10V, 25V, 50V, 100V, 200V, 250V, 500V, 1500V
Q*	01005, 0201, 0402/25V~50V: Cap<30pF: Q $\geq 400+20\text{C}$; Cap $\geq 30\text{pF}$: Q ≥ 1000 0402/100V~200V, 0603, 0805, 0505, 1111: Cap<30pF: Q $\geq 800+20\text{C}$; Cap $\geq 30\text{pF}$: Q ≥ 1400
Insulation resistance at U _r	$\geq 10\text{G}\Omega$ or $\text{RxC} \geq 100\Omega\cdot\text{F}$ whichever is smaller.
Operating temperature	-55 $^\circ\text{C}$ to +125 $^\circ\text{C}$
Capacitance change	$\pm 30\text{ppm}/^\circ\text{C}$
Termination	Ni/Sn (lead-free termination)

* Measured at 1 $\pm 0.2\text{Vrms}$, 1MHz $\pm 10\%$ for Cap $\leq 1,000\text{pF}$ and 1 $\pm 0.2\text{Vrms}$, 1kHz $\pm 10\%$ for Cap $> 1,000\text{pF}$, 25 $^\circ\text{C}$ at ambient temperature for NP0.

* Measured at 1.0 $\pm 0.2\text{Vrms}$, 1.0kHz $\pm 10\%$ for C $\leq 10\mu\text{F}$; 0.5 $\pm 0.2\text{Vrms}$, 120Hz $\pm 20\%$ for C $> 10\mu\text{F}$, 30~70% related humidity, 25 $^\circ\text{C}$ ambient temperature for X7R.

** Preconditioning for Class II MLCC : Perform a heat treatment at 150 $\pm 10^\circ\text{C}$ for 1 hour, then leave in ambient condition for 24 ± 2 hours before measurement.

SMD Multilayer Ceramic Capacitors **multicomp**PRO

Capacitance Range (NP0)

Dielectric		NP0				
Size		0402				Tolerance
Rated Voltage (V DC)		25	50	100	200	
Capacitance	0.1pF (0R1)	N	N	N	N	A, B
	0.2pF (0R2)	N	N	N	N	A, B
	0.3pF (0R3)	N	N	N	N	A, B
	0.4pF (0R4)	N	N	N	N	A, B
	0.5pF (0R5)	N	N	N	N	A, B, C
	0.6pF (0R6)	N	N	N	N	A, B, C
	0.7pF (0R7)	N	N	N	N	A, B, C
	0.75pF (R75)	N	N	N	N	A, B, C
	0.8pF (0R8)	N	N	N	N	A, B, C
	0.9pF (0R9)	N	N	N	N	A, B, C
	1.0pF (1R0)	N	N	N	N	A, B, C
	1.1pF (1R1)	N	N	N	N	A, B, C
	1.2pF (1R2)	N	N	N	N	A, B, C
	1.3pF (1R3)	N	N	N	N	A, B, C
	1.4pF (1R4)	N	N	N	N	A, B, C
	1.5pF (1R5)	N	N	N	N	A, B, C
	1.6pF (1R6)	N	N	N	N	A, B, C
	1.8pF (1R8)	N	N	N	N	A, B, C
	2.0pF (2R0)	N	N	N	N	A, B, C
	2.2pF (2R2)	N	N	N	N	A, B, C
	2.4pF (2R4)	N	N	N	N	A, B, C
	2.5pF (2R5)	N	N	N	N	A, B, C
	2.6pF (2R6)	N	N	N	N	A, B, C
	2.7pF (2R7)	N	N	N	N	A, B, C
	2.8pF (2R8)	N	N	N	N	A, B, C
	2.9pF (2R9)	N	N	N	N	A, B, C
	3.0pF (3R0)	N	N	N	N	A, B, C
	3.1pF (3R1)	N	N	N	N	A, B, C
	3.2pF (3R2)	N	N	N	N	A, B, C
	3.3pF (3R3)	N	N	N	N	A, B, C
	3.4pF (3R4)	N	N	N	N	A, B, C
	3.5pF (3R5)	N	N	N	N	A, B, C
3.6pF (3R6)	N	N	N	N	A, B, C	
	3.7pF (3R7)	N	N	N	N	A, B, C

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

SMD Multilayer Ceramic Capacitors **multicomp**PRO

Dielectric		NP0				
Size		0402				Tolerance
Rated Voltage (V DC)		25	50	100	200	
Capacitance	3.8pF (3R8)	N	N	N	N	A, B, C
	3.9pF (3R9)	N	N	N	N	A, B, C
	4.0pF (4R0)	N	N	N	N	A, B, C
	4.1pF (4R1)	N	N	N	N	A, B, C
	4.2pF (4R2)	N	N	N	N	A, B, C
	4.3pF (4R3)	N	N	N	N	A, B, C
	4.4pF (4R4)	N	N	N	N	A, B, C
	4.5pF (4R5)	N	N	N	N	A, B, C
	4.6pF (4R6)	N	N	N	N	A, B, C
	4.7pF (4R7)	N	N	N	N	A, B, C
	4.8pF (4R8)	N	N	N	N	A, B, C
	4.9pF (4R9)	N	N	N	N	A, B, C
	5.0pF (5R0)	N	N	N	N	A, B, C
	5.1pF (5R1)	N	N	N	N	A, B, C, D
	5.2pF (5R2)	N	N	N	N	A, B, C, D
	5.3pF (5R3)	N	N	N	N	A, B, C, D
	5.4pF (5R4)	N	N	N	N	A, B, C, D
	5.5pF (5R5)	N	N	N	N	A, B, C, D
	5.6pF (5R6)	N	N	N	N	A, B, C, D
	5.7pF (5R7)	N	N	N	N	A, B, C, D
	5.8pF (5R8)	N	N	N	N	A, B, C, D
	5.9pF (5R9)	N	N	N	N	A, B, C, D
	6.0pF (6R0)	N	N	N	N	A, B, C, D
	6.1pF (6R1)	N	N	N	N	A, B, C, D
	6.2pF (6R2)	N	N	N	N	A, B, C, D
	6.3pF (6R3)	N	N	N	N	A, B, C, D
	6.4pF (6R4)	N	N	N	N	A, B, C, D
	6.5pF (6R5)	N	N	N	N	A, B, C, D
	6.6pF (6R6)	N	N	N	N	A, B, C, D
	6.7pF (6R7)	N	N	N	N	A, B, C, D
	6.8pF (6R8)	N	N	N	N	A, B, C, D
	6.9pF (6R9)	N	N	N	N	A, B, C, D
	7.0pF (7R0)	N	N	N	N	A, B, C, D
	7.1pF (7R1)	N	N	N	N	A, B, C, D

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

SMD Multilayer Ceramic Capacitors **multicomp**PRO

Dielectric		NPO				
Size		0402				Tolerance
Rated Voltage (V DC)		25	50	100	200	
Capacitance	7.2pF (7R2)	N	N	N	N	A, B, C, D
	7.3pF (7R3)	N	N	N	N	A, B, C, D
	7.4pF (7R4)	N	N	N	N	A, B, C, D
	7.5pF (7R5)	N	N	N	N	A, B, C, D
	7.6pF (7R6)	N	N	N	N	A, B, C, D
	7.7pF (7R7)	N	N	N	N	A, B, C, D
	7.8pF (7R8)	N	N	N	N	A, B, C, D
	7.9pF (7R9)	N	N	N	N	A, B, C, D
	8.0pF (8R0)	N	N	N	N	A, B, C, D
	8.1pF (8R1)	N	N	N	N	A, B, C, D
	8.2pF (8R2)	N	N	N	N	A, B, C, D
	8.3pF (8R3)	N	N	N	N	A, B, C, D
	8.4pF (8R4)	N	N	N	N	A, B, C, D
	8.5pF (8R5)	N	N	N	N	A, B, C, D
	8.6pF (8R6)	N	N	N	N	A, B, C, D
	8.7pF (8R7)	N	N	N	N	A, B, C, D
	8.8pF (8R8)	N	N	N	N	A, B, C, D
	8.9pF (8R9)	N	N	N	N	A, B, C, D
	9.0pF (9R0)	N	N	N	N	A, B, C, D
	9.1pF (9R1)	N	N	N	N	A, B, C, D
	9.2pF (9R2)	N	N	N	N	A, B, C, D
	9.3pF (9R3)	N	N	N	N	A, B, C, D
	9.4pF (9R4)	N	N	N	N	A, B, C, D
	9.5pF (9R5)	N	N	N	N	A, B, C, D
	9.6pF (9R6)	N	N	N	N	A, B, C, D
	9.7pF (9R7)	N	N	N	N	A, B, C, D
	9.8pF (9R8)	N	N	N	N	A, B, C, D
	9.9pF (9R9)	N	N	N	N	A, B, C, D
	10pF (100)	N	N	N	N	F,G, J
	11pF (110)	N	N	N	N	F,G, J
	12pF (120)	N	N	N	N	F,G, J
	13pF (130)	N	N	N	N	F,G, J
	15pF (150)	N	N	N	N	F,G, J
	16pF (160)	N	N	N	N	F,G, J
	18pF (180)	N	N	N	N	F,G, J

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

SMD Multilayer Ceramic Capacitors **multicomp**PRO

Dielectric		NP0				
Size		0402				Tolerance
Rated Voltage (V DC)		25	50	100	200	
Capacitance	20pF (200)	N	N	N	N	F,G, J
	22pF (220)	N	N	N	N	F,G, J
	24pF (240)	N	N	N	N	F,G, J
	27pF (270)	N	N	N	N	F,G, J
	30pF (300)	N	N	N	N	F,G, J
	33pF (330)	N	N	N	N	F,G, J
	36pF (360)	N	N	N		F,G, J
	39pF (390)	N	N	N		F,G, J
	43pF (430)	N	N	N		F,G, J
	47pF (470)	N	N	N		F,G, J
	56pF (560)	N	N	N		F,G, J
	68pF (680)	N	N			F,G, J
	82pF (820)	N	N			F,G, J
	100pF (101)	N	N			F,G, J

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

Electrical Characteristics

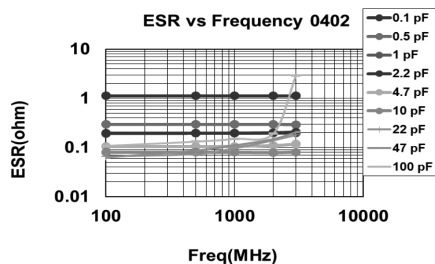


Fig. 3 ESR vs. Frequency (0402 size)

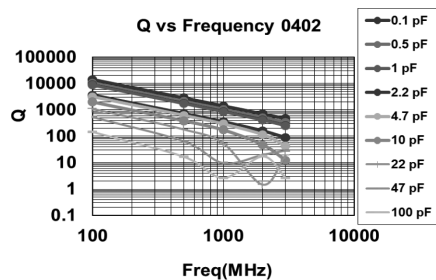


Fig. 5 Q vs. Frequency (0402 size)

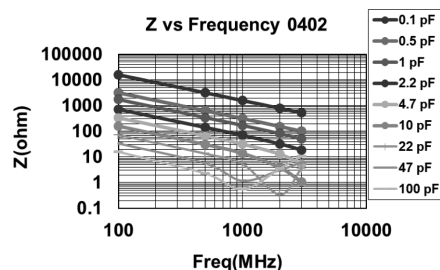


Fig. 7 Impedance vs. Frequency (0402 size)

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	* $1.0 \pm 0.2V_{rms}$, $1MHz \pm 10\%$ * Test temp.: Room Temperature.	* Shall not exceed the limits given in the detailed spec.
3	Q/ D.F. (Dissipation Factor)		* 01005, 0201, 0402/25V~50V: Cap<30pF, Q \geq 400+20C; Cap \geq 30pF, Q \geq 1000 * 0402/100V~200V, 0603, 0805, 0505, 1111: Cap<30pF: Q \geq 800+20C; Cap \geq 30pF: Q \geq 1400
4	Dielectric Strength	* To apply voltage: $\leq 100V$: 250% of rated voltage.(RF02: 300% of rated voltage.) 200V ~ 300V : 200% 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.	* No evidence of damage or flash over during test.
5	Insulation Resistance	* Test temp.: Room Temperature. $\leq 100V$: To apply rated voltage for max. 120 sec. $\geq 200V$: To apply rated voltage (500V max.) for 60 sec.	$\geq 10G\Omega$ or $RxC \geq 100\Omega \cdot F$ whichever is smaller
6	Temperature Coefficient	* With no electrical load. * Operating temperature: NP0: -55~125°C at 25°C	* Capacitance change: within $\pm 30ppm/^{\circ}C$;
7	Adhesive Strength of Termination	* Pressurizing force: 01005: 1N * 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.) * Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.
9	Solderability	* Solder temperature: $235 \pm 5^{\circ}C$ * 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: within $\pm 5.0\%$ or $\pm 0.5pF$ 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: $260 \pm 5^{\circ}C$ * Dipping time: 10 ± 1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * 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.	* No remarkable damage. * Cap change: within $\pm 2.5\%$ or $\pm 0.25pF$ whichever is larger. * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

SMD Multilayer Ceramic Capacitors **multicomp**PRO

No	Item	Test Condition	Requirements															
12	Temperature Cycle	<div>Conduct the five cycles according to the temperatures and time.</div> <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table> <div>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.</div>	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	<div>* No remarkable damage.</div> <div>* Cap change: within ±2.5% or ±0.25pF whichever is larger.</div> <div>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</div>
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	<div>* Test temp.: 40±2°C</div> <div>* Humidity: 90~95% RH</div> <div>* Test time: 500+24/-0hrs.</div> <div>* 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.</div>	<div>* No remarkable damage.</div> <div>* Cap change: within ±5.0% or ±0.5pF whichever is larger.</div> <div>* Q/D.F. value: Cap≥30pF, Q≥350; 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF; Q≥200+10C</div> <div>* I.R.: ≥1GΩ.</div>															
14	Humidity (Damp Heat) Load	<div>* Test temp.: 40±2°C</div> <div>* Humidity: 90~95%RH</div> <div>* Test time: 500+24/-0 hrs.</div> <div>* To apply voltage: rated voltage (MAX. 500V)</div> <div>* 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.</div>	<div>* No remarkable damage.</div> <div>* Cap change: within ±7.5% or ±0.75pF whichever is larger.</div> <div>* Q/D.F. value: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C</div> <div>* I.R.: ≥500MΩ.</div>															
15	High Temperature Load (Endurance)	<div>* Test temp.: NP0: 125±3°C X8G: 150±3°C</div> <div>* To apply voltage:</div> <div>(1) 10V≤Ur<500V: 200% of rated voltage.</div> <div>(2) ≤6.3V or 500V: 150% of rated voltage.</div> <div>(3) Ur≥630V: 120% of rated voltage.</div> <div>* Test time: 1000+24/-0 hrs.</div> <div>* 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</div>	<div>* No remarkable damage.</div> <div>* Cap change: within ±3.0% or ±0.3pF whichever is larger.</div> <div>* Q/D.F. value: Cap≥30pF, Q≥350 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF, Q≥200+10C</div> <div>* I.R.: ≥1GΩ.</div>															
16	ESR	<div>The ESR should be measured at room temperature and tested at frequency 1±0.1 GHz.</div> <div>The ESR should be measured at room temperature and tested at frequency 500±50 MHz.</div>	<div>0.2pF≤Cap≤1pF:< 700mΩ/pF</div> <div>1pF<Cap≤2pF:< 600mΩ</div> <div>2pF<Cap≤5pF:< 500mΩ</div> <div>5pF<Cap≤10pF:< 300mΩ</div> <div>10pF<Cap≤22pF:< 350mΩ</div> <div>0201, 22pF≤Cap≤33pF: < 300mΩ</div> <div>1111, 100pF<Cap≤1000pF: < 150mΩ</div>															

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Tape & Reel Dimensions

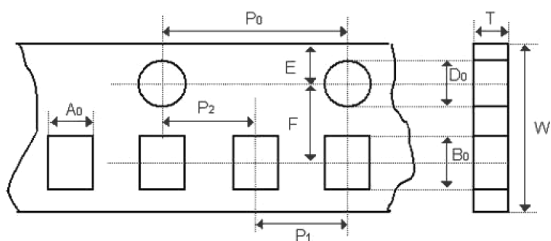


Fig. 21 The dimension of paper tape

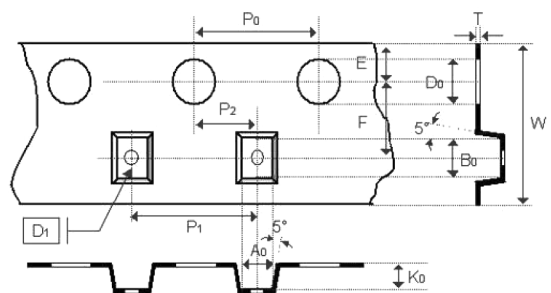


Fig. 22 The dimension of plastic tape

Size	0402
Chip Thickness	N
A ₀	0.7 +/-0.2
B ₀	1.2 +/-0.2
T	≤0.8
K ₀	--
W	8 +/-0.3
P ₀	4 +/-0.1
10xP ₀	40 +/-0.1
P ₁	2 +/-0.05
P ₂	2 +/-0.05
D ₀	1.5 +/-0.1/-0
D ₁	--
E	1.75 +/-0.1
F	3.5 +/-0.05

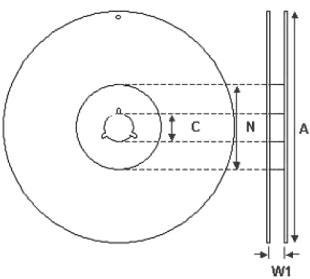


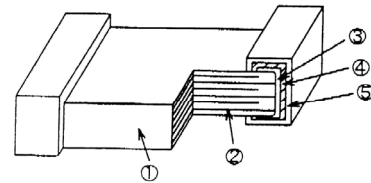
Fig. 23 The dimension of reel

Size	0402	
Reel size	7"	13"
C	13 ±0.5	
W ₁	10 ±1.5	
A	178 ±2	330 ±2
N	60 +1/-0	50 min

SMD Multilayer Ceramic Capacitors **multicomp**PRO

Appendixes

No.	Name		NP0
1	Ceramic material		Hi-Q dielectric ceramic
2	Inner electrode		Cu
3	Termination	Inner layer	Cu
4		Middle layer	Ni
5		Outer layer	Sn (Matt)



The construction of MLCC

Storage and handling conditions

- (1) To store products at 5 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 N₂ within oven are recommended.

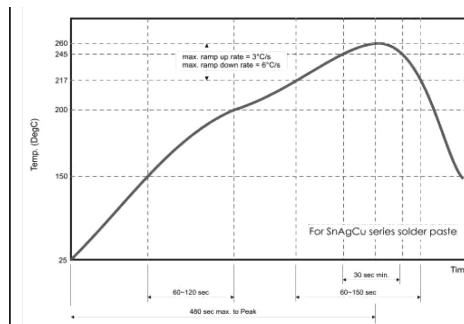


Fig. 25 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

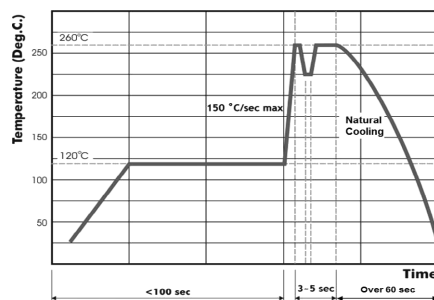


Fig. 26 Recommended wave soldering profile for SMT process with SnAgCu series solder.

Part Number Table

Description	Part Number
SMD Multilayer Ceramic Capacitors, 0402, NPO, 10pF, 1%, 50V	MCRF15N100F500CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 100pF, 1%, 25V	MCRF15N101F250CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 12pF, 1%, 50V	MCRF15N120F500CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 22pF, 1%, 50V	MCRF15N220F500CT

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