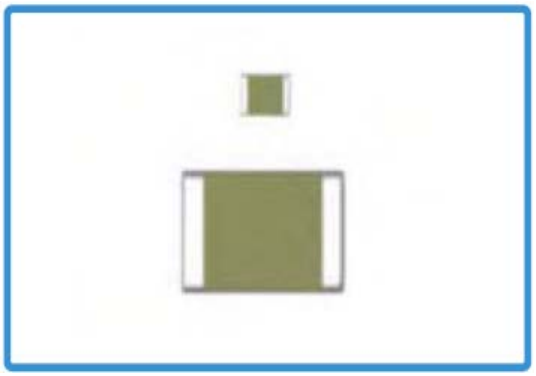
Multilayer Ceramic Capacitors

HQ Series (High Q)

MERITEK

Feature



- Surface mount device with high reliability
- Hi-Q and low ESR at high frequencies
- Low capacitance with tight tolerance
- Excellent temperature characteristics

Part Numbering System

HQ 0603 CG 4R7 B 500

Meritek Series

Chip Size: 0402 / 0603 / 0805

Dielectric: CG=C0G (NPO)

Capacitance

Capacitance expressed in Pico farads (pF).
First two digits are significant figures.
Third digit denotes number of zeros.
'R' denotes decimal point for values less than 10 pF
ie. 4R7=4.2pF, 101=100pF

Tolerance

Code	B	C	D	F	F	J
Value	±0.1pF	±0.25pF	±0.5pF	±1%	±2%	±5%

Rated Voltage

Code	160	250	500	101	201	251	501	631
Value	$16V_{DC}$	$25V_{DC}$	$50V_{DC}$	$100V_{DC}$	$200V_{DC}$	$250V_{DC}$	$500V_{DC}$	$630V_{DC}$

Dimensions

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		M_B (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	0.25
					-0.5
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15
	1.60 +0.15/-0.10	0.80 +0.15/-0.10	0.80 +0.15/-0.10	X	
0805 (2012)	2.00±0.15	1.25±0.10	0.60±0.10	A	0.50±0.20
			0.80±0.10	B	
			1.25±0.10	D	

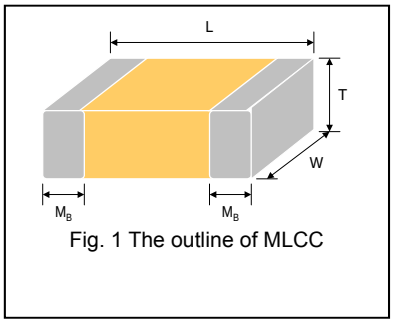


Fig. 1 The outline of MLCC

Constructions

No.	Name		NP0
①	Ceramic material		$BaTiO_3$ based
②	Inner electrode		AgPd alloy
③	Termination	Inner layer	Ag or Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

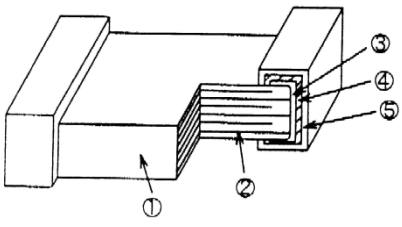


Fig. 11 The construction of MLCC

Capacitance Range

DIELECTRIC		NP0												
SIZE		0402			0603				0805					
		16	25	50	16	25	50	100	50	100	200	250	500	630
Capacitance	0.5pF (0R5)	N^	N^	N^	S^	S^	S^	S^	B	B				
	0.6pF (0R6)	N^	N^	N^	S^	S^	S^	S^	B	B				
	0.7pF (0R7)	N^	N^	N^	S^	S^	S^	S^	B	B				
	0.8pF (0R8)	N^	N^	N^	S^	S^	S^	S^	B	B				
	0.9pF (0R9)	N^	N^	N^	S^	S^	S^	S^	B	B				
	1.0pF (1R0)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	1.2pF (1R2)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	1.5pF (1R5)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	1.8pF (1R8)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	2.2pF (2R2)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	2.7pF (2R7)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	3.3pF (3R3)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	3.9pF (3R9)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	4.7pF (4R7)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	5.6pF (5R6)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	6.8pF (6R8)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	8.2pF (8R2)	N^	N^	N^	S^	S^	S^	S^	B	B	B	B	B	B
	10pF (100)	N	N	N	S	S	S	S	B	B	B	B	B	B
	12pF (120)	N	N	N	S	S	S	S	B	B	B	B	B	B
	15pF (150)	N	N	N	S	S	S	S	B	B	B	B	B	B
	18pF (180)	N	N	N	S	S	S	S	B	B	B	B	B	B
	22pF (220)	N	N	N	S	S	S	S	B	B	B	B	B	B
	27pF (270)	N	N	N	S	S	S	S	B	B	B	B	B	B
	33pF (330)	N	N	N	S	S	S	S	B	B	B	B	B	B
	39pF (390)	N	N	N	S	S	S	S	B	B	B	B	B	B
	47pF (470)	N	N	N	S	S	S	S	B	B	B	B	B	B
	56pF (560)	N	N	N	S	S	S	S	B	B	B	B	B	B
	68pF (680)	N	N	N	S	S	S	S	B	B	B	B	B	B
	82pF (820)	N	N	N	S	S	S	S	B	B	B	B	B	B
	100pF (101)	N	N	N	S	S	S	S	B	B	B	B	B	B
	120pF (121)	N	N	N	S	S	S	S	D	D	D	D	D	D
	150pF (151)	N	N	N	S	S	S	S	D	D	D	D	D	D
	180pF (181)	N	N	N	S	S	S	S			D	D	D	D
	220pF (221)	N	N	N	S	S	S	S			D	D	D	D
	270pF (271)	N	N	N	S	S	S	S			D	D	D	D
	330pF (331)	N	N	N	S	S	S	S			D	D	D	D
	390pF (391)	N	N	N	S	S	S	S			D	D	D	D
	470pF (471)	N	N	N	S	S	S	S						
	560pF (561)				S	S	S	S						
	680pF (681)				S	S	S	S						
	820pF (821)				S	S	S	S						
	1,000pF (102)				S	S	S	S						
	1,200pF (122)				X	X	X							
	1,500pF (152)				X	X	X							
	1,800pF (182)				X	X	X							
	2,200pF (222)				X	X	X							
	2,700pF (272)				X	X	X							
	3,300pF (332)				X	X	X							

1. 0402, Capacitance <0.5pF: On request.
2. The letter in cell with "^" mark is expressed product with Ag/Ni/Sn terminations.
3. The letter in cell is expressed the symbol of product thickness.

Electrical Characteristics

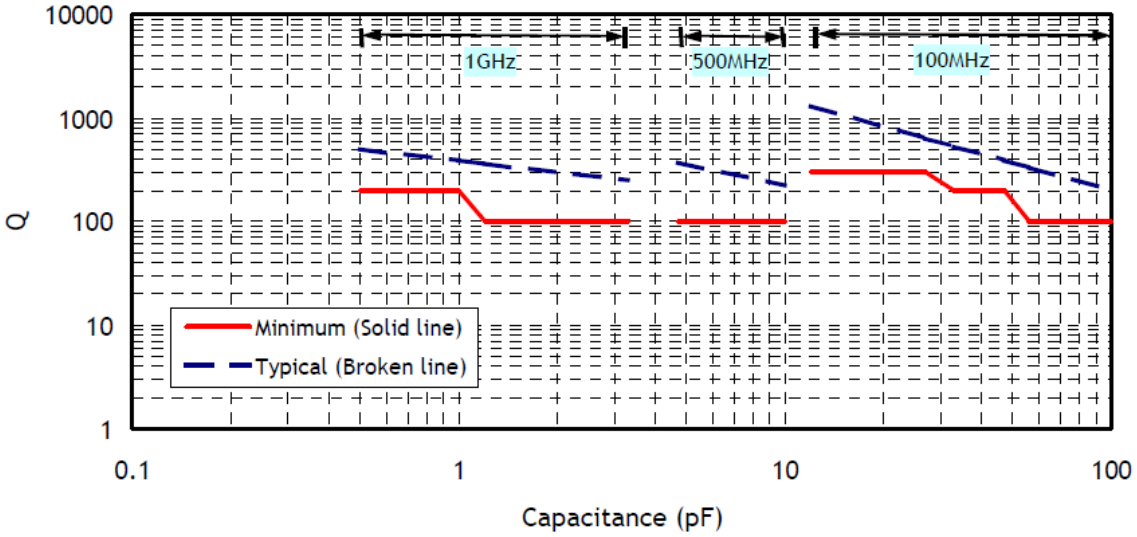


Fig. 2 Q factor specification vs. Specific frequency for 0402

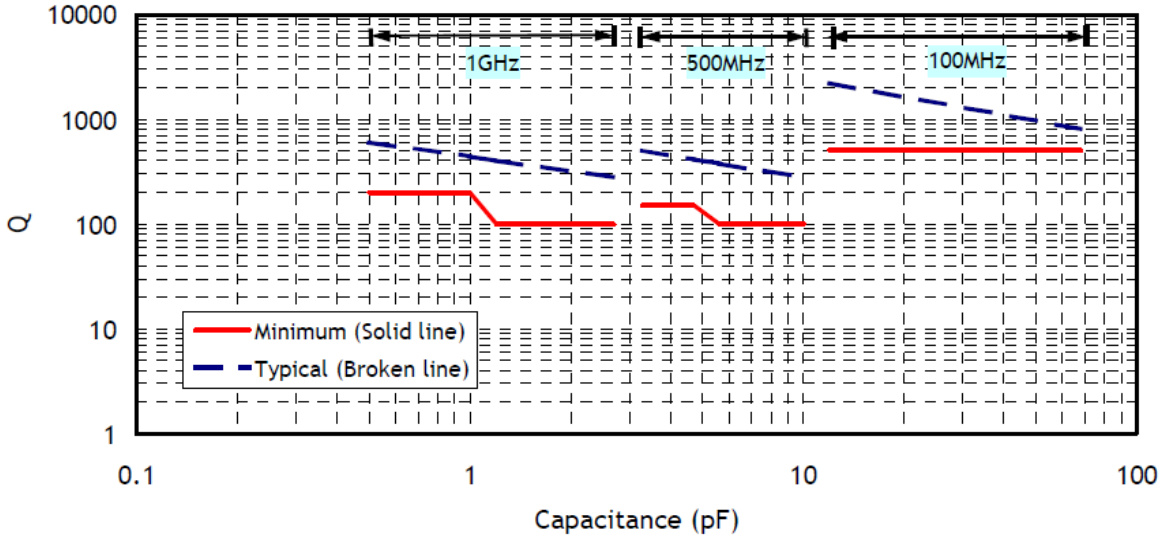


Fig. 3 Q factor specification vs. Specific frequency for 0603

Typical ESR vs. Frequency

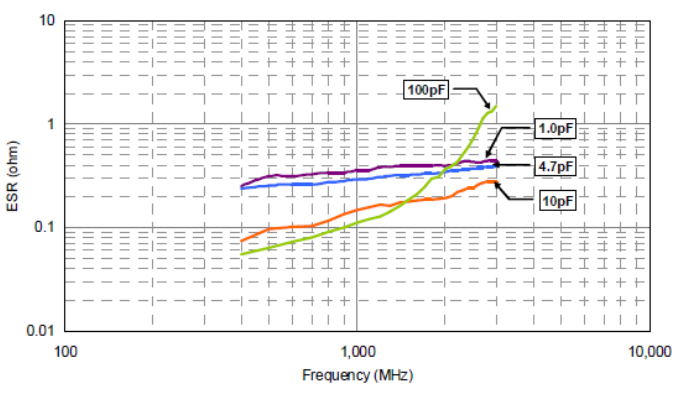


Fig. 4 ESR vs. Frequency 0402

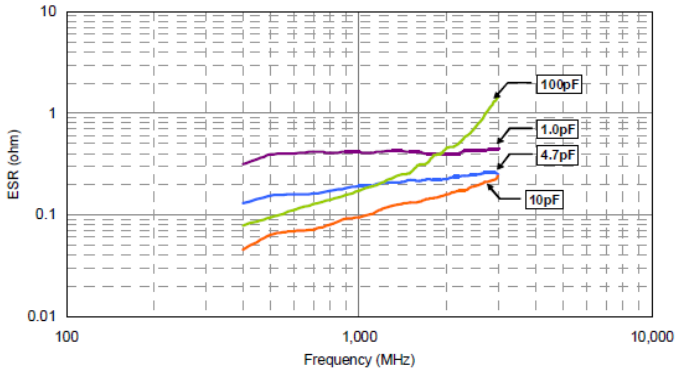


Fig. 5 ESR vs. Frequency 0603

Typical Impedance vs. Frequency

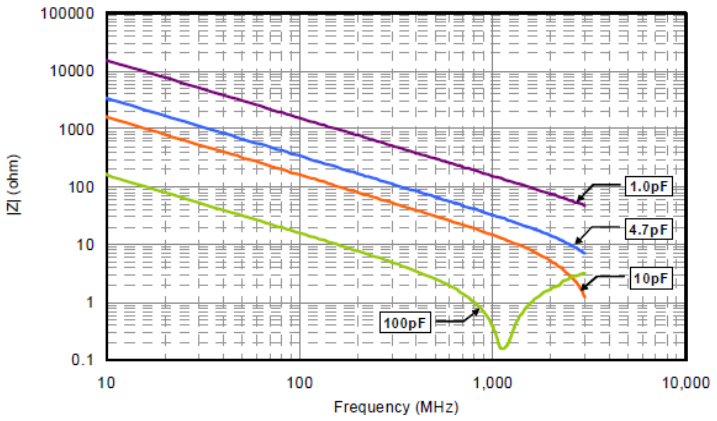


Fig. 6 Impedance vs. Frequency 0402

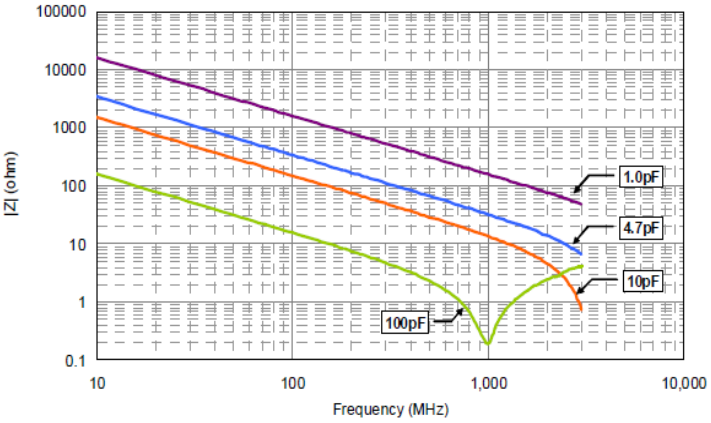


Fig. 7 Impedance vs. Frequency 0603

SRF vs. Capacitance

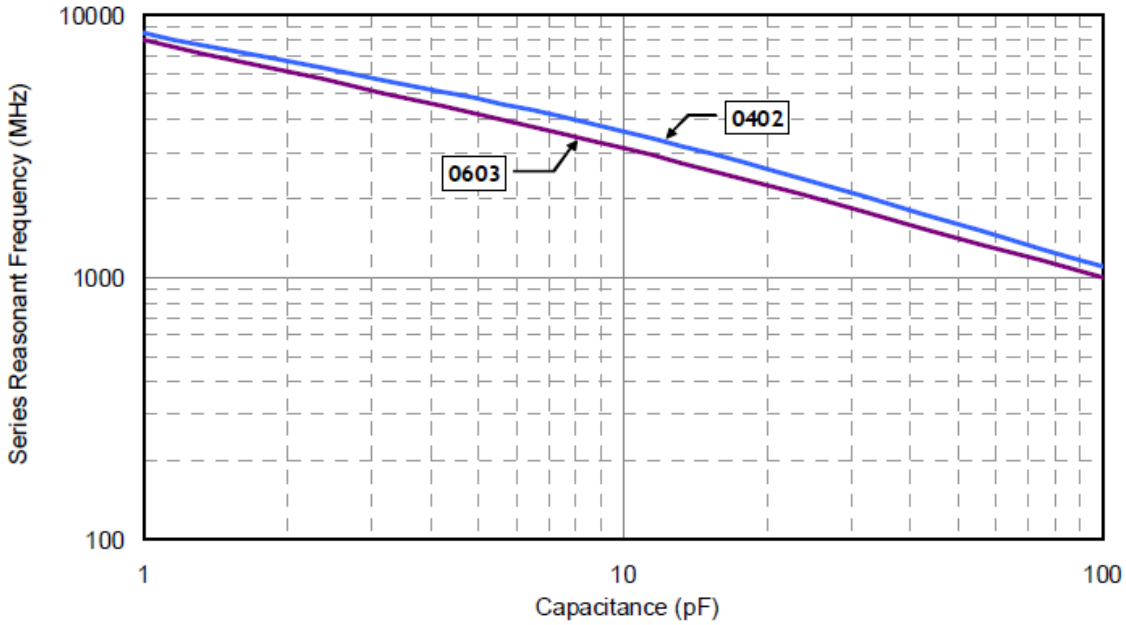


Fig. 8 SRF vs. Capacitance

Reliability Test Conditions and Requirements

No.	Item	Test Conditions	Requirements
1.	**Visual and Mechanical**	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.
2.	**Capacitance**	Cap≤1000pF, 1.0±0.2Vrms, 1MHz±10% Cap>1000pF, 1.0±0.2Vrms, 1KHz±10% At 25°C ambient temperature.	* Shall not exceed the limits given in the detailed spec.
3.	**Q/ D.F. (Dissipation Factor)**		* NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C

No.	Item	Test Conditions	Requirements
4.	**Dielectric Strength**	* To apply voltage: 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.
5.	**Insulation Resistance**	To apply rated voltage for max. 120 sec.	≥10GΩ
6.	**Temperature Coefficient**	With no electrical load. Operating temperature: -55~125°C at 25°C	* Capacitance change: within ±30ppm/°C
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 hours each in three mutually perpendicular directions.)	* 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.
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: 270±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Measurement to be made after keeping at room temp for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).	* 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. 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 * 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.
13.	**Humidity (Damp Heat) Steady State**	* Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * 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: NP0: 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 * 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: NP0: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C * I.R.: ≥500MΩ.

No.	Item	Test Conditions	Requirements
15.	**High Temperature Load (Endurance)**	* Test temp.: NP0, X7R: 125±3°C * To apply voltage: 200% of rated voltage. * Test time: 1000+24/-0 hrs. * 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: NP0: Cap≥30pF, Q≥350 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF, Q≥200+10C * I.R.: ≥1GΩ.

Packaging Dimension and Quality

Size	Thickness (mm)		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402	0.50±0.05	N	10K	20K		
0603	0.80±0.07	S	4K	15K		
	0.80 +0.15/-0.10	X				
0805	0.60±0.10	A	4k	15k		
	0.80±0.10	B	4k	15k		
	1.25±0.10	D			3K	10K

Tape & Reel Dimensions

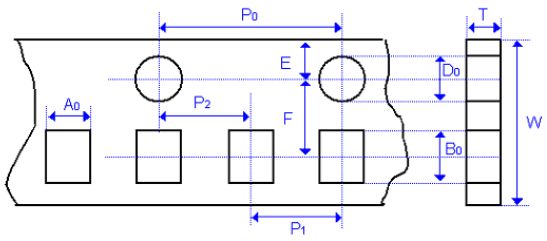


Fig. 9 The dimension of paper tape

Size	0402	0603	0805
Thickness	N	S,X	A
A_0	0.62±0.05	1.02±0.05	1.50±0.10
B_0	1.12±0.05	1.82±0.05	2.30±0.10
T	0.60±0.05	0.95±0.05	0.75±0.05
K_0	-	-	-
W	8.00±0.10	8.00±0.10	8.00±0.10
P_0	4.00±0.10	4.00±0.10	4.00±0.10
$10xP_0$	40.0±0.10	40.0±0.10	40.0±0.10
P_1	2.00±0.05	4.00±0.10	4.00±0.10
P_2	2.00±0.05	2.00±0.05	2.00±0.05
D_0	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
F	3.50±0.05	3.50±0.05	3.50±0.05

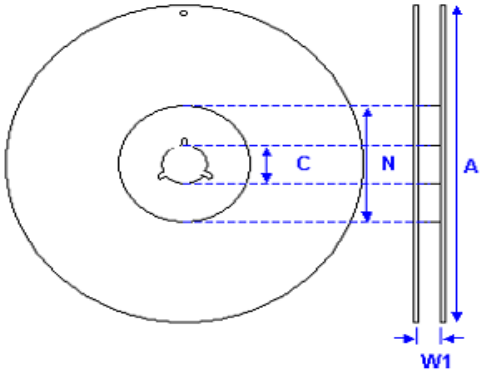


Fig. 10 The dimension of reel

Size	0402, 0603,0805	
Reel size	7"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2
W_1	8.4+1.5/-0	8.4+1.5/-0
A	178.0±0.10	330.0±1.0
N	60.0+1.0/-0	100±1.0

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 solder ability in case of shelf life extension is needed.

Cautions:

a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
b. To store products on the shelf and avoid exposure to moisture.
c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

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.

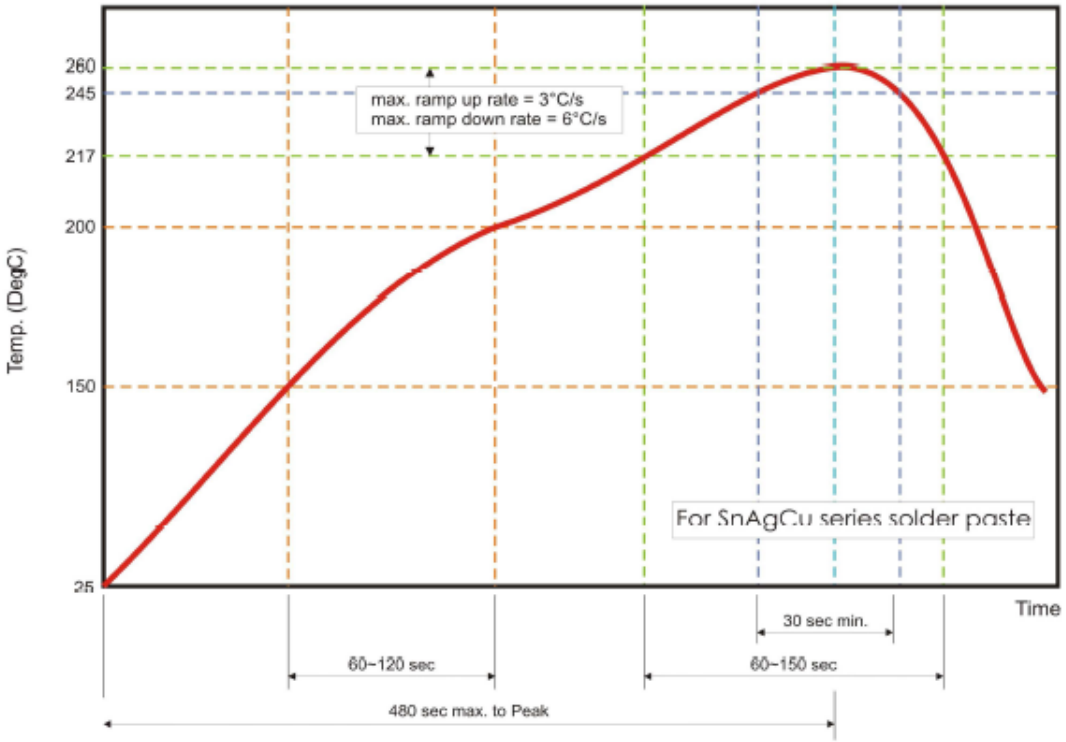


Fig. 12 Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste.

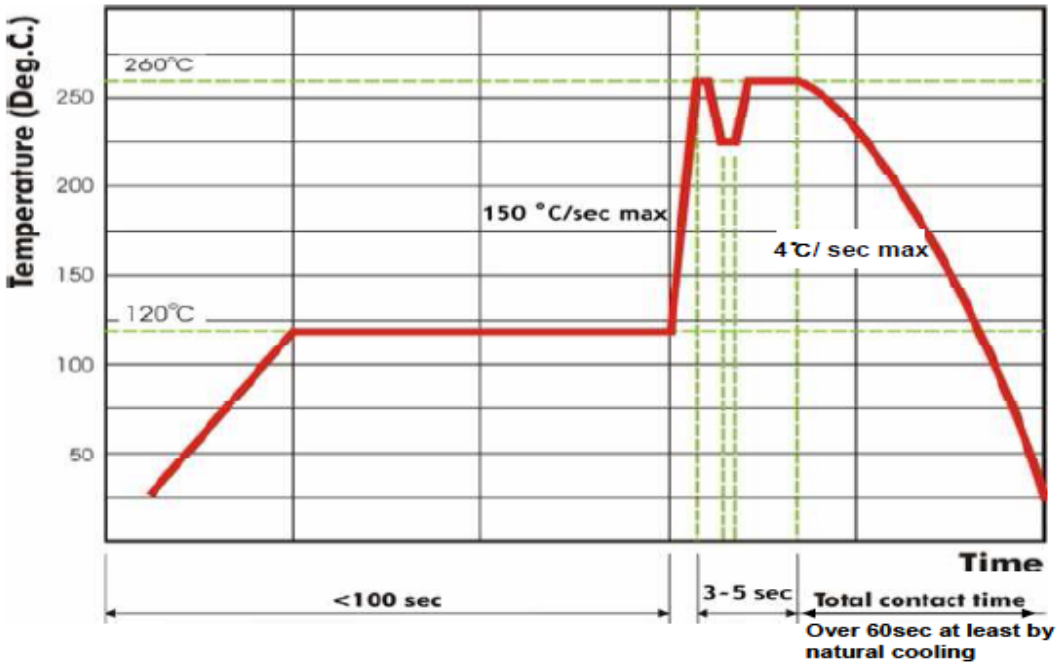


Fig. 13 Recommended wave soldering profile for SMT process with SnAgCu series solder.