

MULTILAYER CERAMIC CAPACITORS

Ultra High Q & Low ESR Series (GUQ)



1. INTRODUCTION

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.

Calchip GUQ series MLCC is used at high frequencies and generally have a small temperature coefficient of capacitance, typical within the +/-30ppm/C required for NPO (COG) classification and have excellent conductivity internal electrode. Thus, Calchip GUQ

2. FEATURES

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

3. APPLICATIONS

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

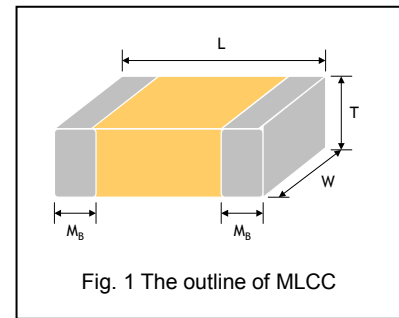
HOW TO ORDER

GUQ	10	CG	101	J	250	N	T
SERIES	SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	VOLTAGE	TERMINATION	PACKAGING
GUQ=Ultra High Q & Low ESR	02=0201 04=0402 10=0603 21=0805	CG = NPO (COG)	Two significant digits followed by no. of zeros. An R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 100=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. 25=25 VDC 50=50 VDC 100=100 VDC 250=250 VDC	N=Cu/Ni/Sn	T = 7" reel TD = 13 reel

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (mm)
0201 (0603)	0.60±0.03	0.30±0.03	0.30±0.03	L #	0.15±0.05
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N #	0.25+0.05/-0.10
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15
0805 (2012)	2.00±0.20	1.25±0.20	0.85±0.10	T	0.50±0.20

Reflow soldering only is recommended.



6. GENERAL ELECTRICAL DATA

Dielectric	NPO
Size	0201, 0402, 0603, 0805
Capacitance*	0201: 0.1pF to 33pF; 0402: 0.1pF to 22pF; 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
Q*	Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C
Insulation resistance at U_r	≥10GΩ
Operating temperature	-55 to +125°C
Capacitance change	±30ppm/°C; 0201Cap≥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.

7. CAPACITANCE RANGE

DIELECTRIC		NP0											Tolerance
SIZE		0201			0402		0603			0805			
RATED VOLTAGE (VDC)		6.3	10	25	50	100	50	100	250	50	100	250	
Capacitance	0.1pF (0R1)	L	L	L	N	N							B
	0.2pF (0R2)	L	L	L	N	N							A, B
	0.3pF (0R3)	L	L	L	N	N	S	S	S	T	T	T	A, B
	0.4pF (0R4)	L	L	L	N	N	S	S	S	T	T	T	A, B
	0.5pF (0R5)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	0.6pF (0R6)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	0.7pF (0R7)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	0.8pF (0R8)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	0.9pF (0R9)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	1.0pF (1R0)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	1.2pF (1R2)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	1.5pF (1R5)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	1.8pF (1R8)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	2.2pF (2R2)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	2.7pF (2R7)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	3.3pF (3R3)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	3.9pF (3R9)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	4.7pF (4R7)	L	L	L	N	N	S	S	S	T	T	T	A, B, C
	5.6pF (5R6)	L	L	L	N	N	S	S	S	T	T	T	B, C, D
	6.8pF (6R8)	L	L	L	N	N	S	S	S	T	T	T	B, C, D
	8.2pF (8R2)	L	L	L	N	N	S	S	S	T	T	T	B, C, D
	10pF (100)	L	L	L	N	N	S	S	S	T	T	T	F, G, J
	11pF (110)	L	L	L	N		S	S	S	T	T	T	F, G, J
	12pF (120)	L	L	L	N		S	S	S	T	T	T	F, G, J
	13pF (130)	L	L	L	N		S	S	S	T	T	T	F, G, J
	15pF (150)	L	L	L	N		S	S	S	T	T	T	F, G, J
	16pF (160)	L	L	L	N		S	S	S	T	T	T	F, G, J
	18pF (180)	L	L	L	N		S	S	S	T	T	T	F, G, J
	20pF (200)	L	L	L	N		S	S	S	T	T	T	F, G, J
	22pF (220)	L	L	L	N		S	S	S	T	T	T	F, G, J
24pF (240)	L	L	L			S	S	S	T	T	T	F, G, J	
27pF (270)	L	L	L			S	S	S	T	T	T	F, G, J	
30pF (300)	L	L	L			S	S	S	T	T	T	F, G, J	
33pF (330)	L	L	L			S	S	S	T	T	T	F, G, J	
36pF (360)						S	S	S	T	T	T	F, G, J	
39pF (390)						S	S	S	T	T	T	F, G, J	
43pF (430)						S	S	S	T	T	T	F, G, J	
47pF (470)						S	S	S	T	T	T	F, G, J	
56pF (560)									T	T	T	F, G, J	
68pF (680)									T	T	T	F, G, J	
82pF (820)									T	T	T	F, G, J	
100pF (101)									T	T	T	F, G, J	

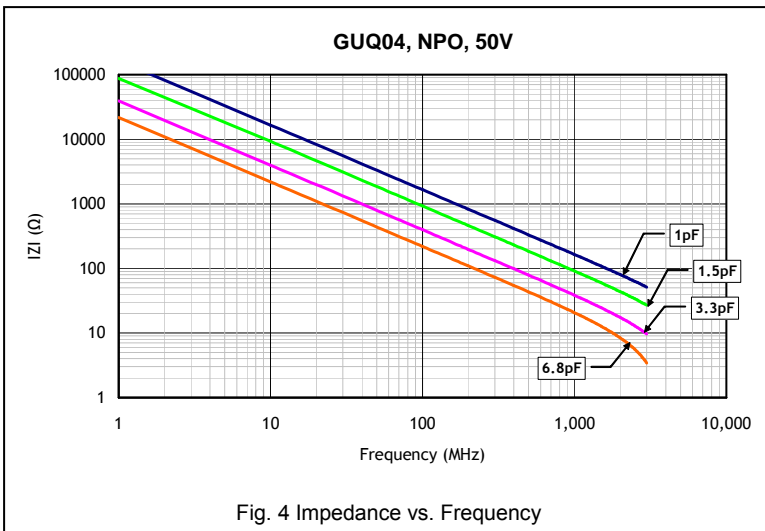
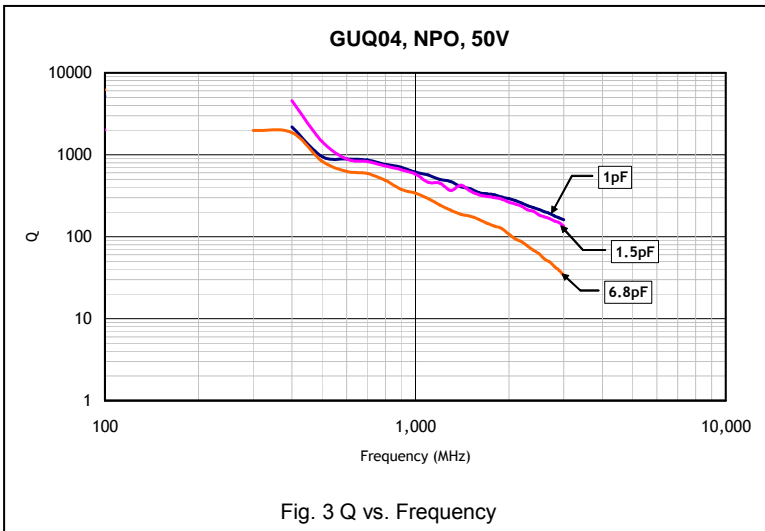
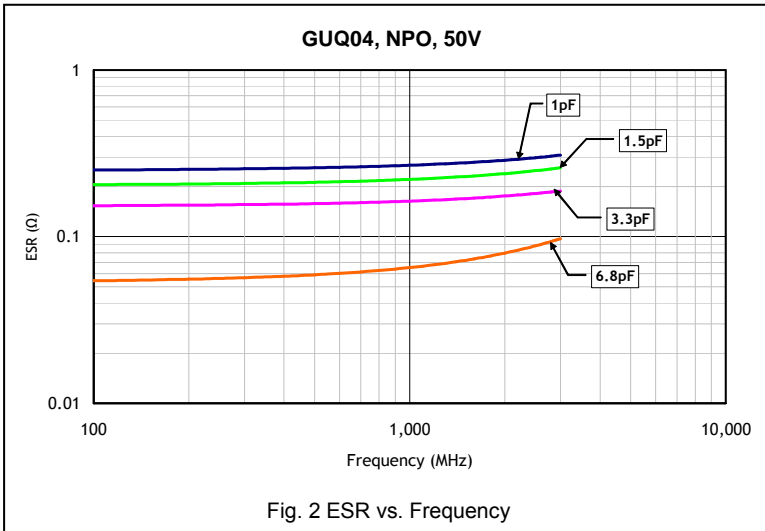
1. The letter in cell is expressed the symbol of product thickness.
2. CCE provide E96 (IEC-63) product range with which capacitance≤10pF.
3. For more information about products with special capacitance or other data, please contact CCE local representative.

8. PACKAGING DIMENSION AND QUANTITY

Size	Thickness (mm)/Symbol	Paper tape	
		7" reel	13" reel
0201 (0603)	0.30±0.03 L	15k	70k
0402 (1005)	0.50±0.05 N	10k	50k
0603 (1608)	0.80±0.07 S	4k	15k
0805 (2012)	0.85±0.10 T	4k	15k

Unit: pieces

9. ELECTRICAL CHARACTERISTICS



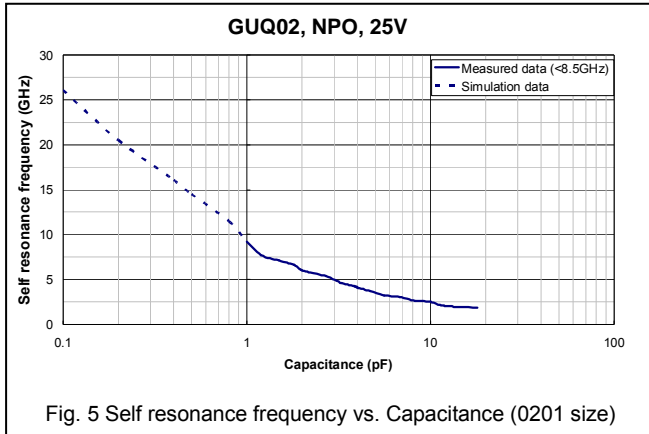


Fig. 5 Self resonance frequency vs. Capacitance (0201 size)

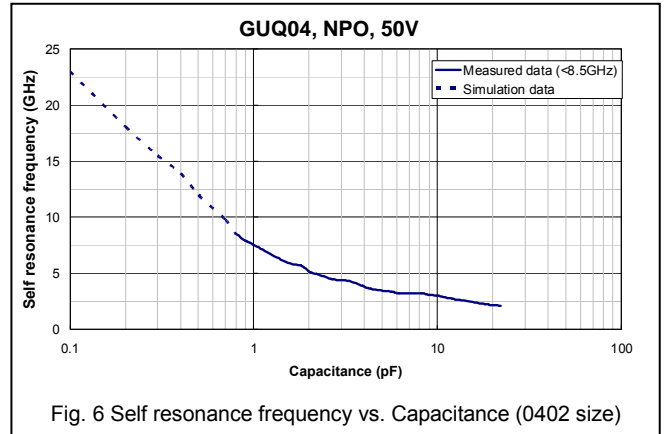


Fig. 6 Self resonance frequency vs. Capacitance (0402 size)

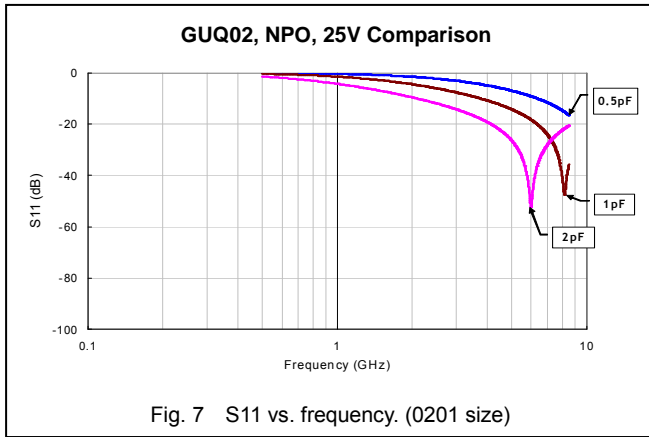


Fig. 7 S11 vs. frequency. (0201 size)

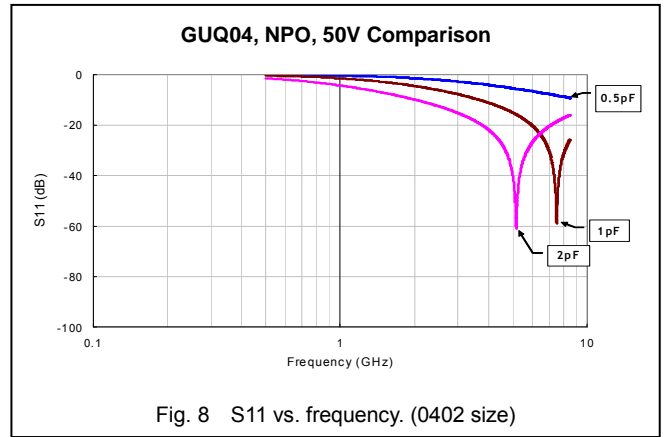


Fig. 8 S11 vs. frequency. (0402 size)

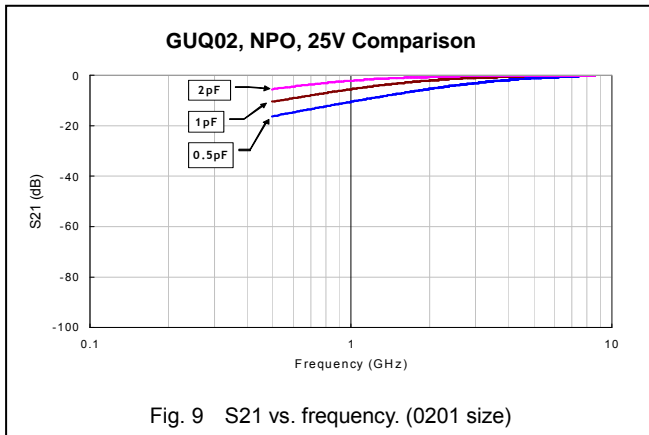


Fig. 9 S21 vs. frequency. (0201 size)

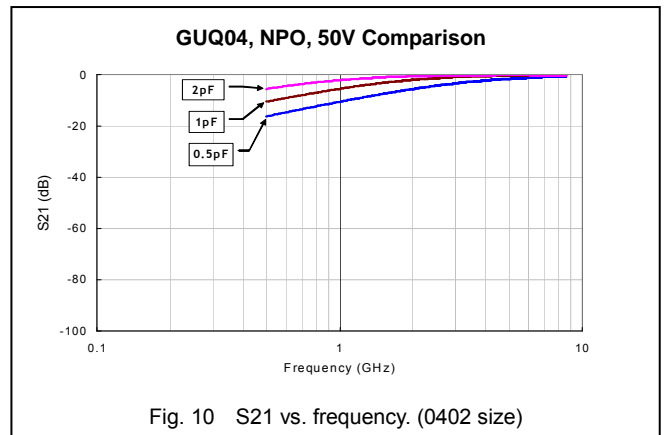


Fig. 10 S21 vs. frequency. (0402 size)

10. 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	1.0±0.2Vrms, 1MHz±10%	Shall not exceed the limits given in the detailed spec.															
3.	Q/ D.F. (Dissipation Factor)	At 25°C ambient temperature.	Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C															
4.	Dielectric Strength	To apply voltage: ≤100V, ≥250% of rated voltage. 250V, ≥200% 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; 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.)	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.	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" data-bbox="363 1675 845 1825"> <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> 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																

No.	Item	Test Condition	Requirements												
13.	Humidity (Damp Heat) Steady State	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 												
15.	High Temperature Load (Endurance)	<ul style="list-style-type: none"> Test temp.: 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. 	<ul style="list-style-type: none"> 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±0.1 GHz.	<table border="1"> <thead> <tr> <th></th> <th>0201, 0402</th> <th>0603</th> </tr> </thead> <tbody> <tr> <td>0.5pF≤Cap≤1pF: < 350mΩ</td> <td></td> <td>0.3pF≤Cap≤1pF: < 1500mΩ</td> </tr> <tr> <td>1pF<Cap≤5pF: < 300mΩ</td> <td></td> <td>1pF<Cap≤10pF: < 250mΩ</td> </tr> <tr> <td>5pF<Cap≤22pF: < 250mΩ</td> <td></td> <td>10pF<Cap≤47pF: < 200mΩ</td> </tr> </tbody> </table>		0201, 0402	0603	0.5pF≤Cap≤1pF: < 350mΩ		0.3pF≤Cap≤1pF: < 1500mΩ	1pF<Cap≤5pF: < 300mΩ		1pF<Cap≤10pF: < 250mΩ	5pF<Cap≤22pF: < 250mΩ		10pF<Cap≤47pF: < 200mΩ
	0201, 0402	0603													
0.5pF≤Cap≤1pF: < 350mΩ		0.3pF≤Cap≤1pF: < 1500mΩ													
1pF<Cap≤5pF: < 300mΩ		1pF<Cap≤10pF: < 250mΩ													
5pF<Cap≤22pF: < 250mΩ		10pF<Cap≤47pF: < 200mΩ													

APPENDIXES

■ Tape & reel dimensions

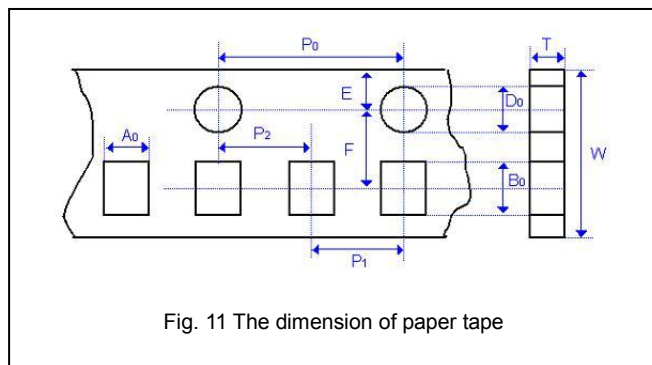


Fig. 11 The dimension of paper tape

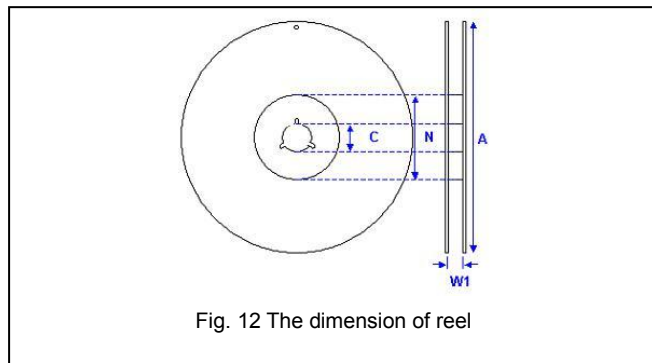


Fig. 12 The dimension of reel

Size	0201	0402	0603	0805
Thickness	L	N	S	T
A ₀	0.37±0.03	0.62±0.05	1.00 +0.05/-0.1	1.50±0.10
B ₀	0.67±0.03	1.12±0.05	1.80±0.10	2.30±0.10
T	0.42±0.03	0.60±0.05	0.95±0.05	0.95±0.05
K ₀	-	-	-	-
W	8.00±0.10	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	4.00±0.10
10xP ₀	40.0±0.10	40.0±0.10	40.0±0.20	40.0±0.20
P ₁	2.00±0.05	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	2.00±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	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05

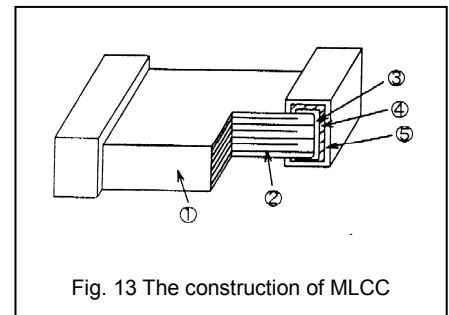
Size	0201, 0402, 0603, 0805	
Reel size	7"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0
A	178.0±1.0	330.0±1.0
N	60.0+1.0/-0	100±1.0

Cross Reference

Size	WV	Walsin	Murata	Samsung	Johanson	ATC
0201	25V	RF03****250**	GJM03***1E*****	CL03****A*G***	250R05S*****	-
0402	50V	RF15****500**	GJM15***1H*****	CL05****B*G***	500R07S*****	-
	200V	-	-	-	-	600L****200**
0603	50V	RF18****500**	GQM18***1H*****	-	-	-
	100V	RF18****101**	GQM18***2A*****	-	-	-
	250V	RF18****251**	GQM18***2E*****	-	251R14S*****	600S****250**
0805	250V	RF21****251**	GQM21***2E*****	-	251R15S*****	600F****250**

Constructions

No.	Name	NP0	
①	Ceramic material	BaTiO ₃ based	
②	Inner electrode	Cu	
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)



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. 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 N₂ within oven are recommended.

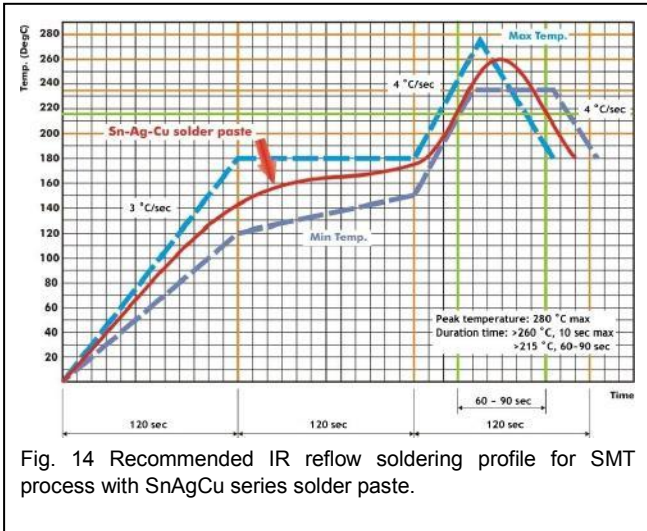


Fig. 14 Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste.

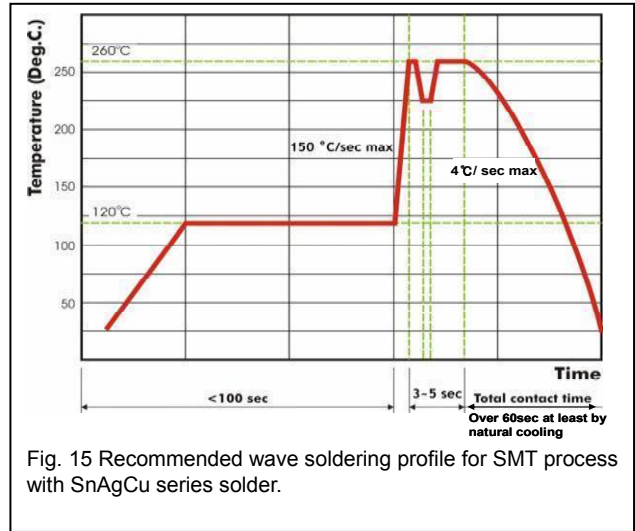


Fig. 15 Recommended wave soldering profile for SMT process with SnAgCu series solder.