

APPROVAL SHEET

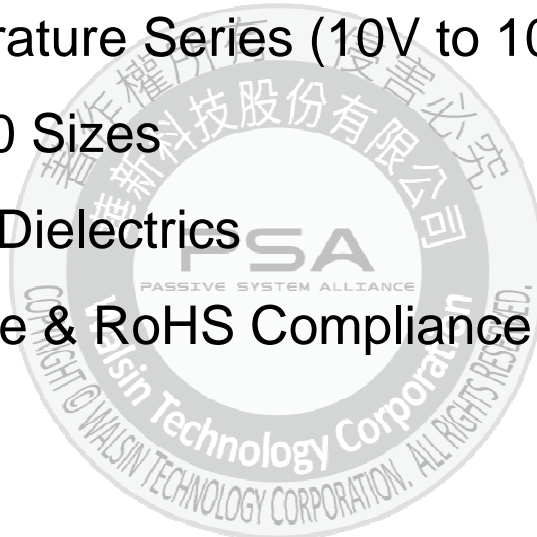
MULTILAYER CERAMIC CAPACITORS

High Temperature Series (10V to 100V)

0402 to 1210 Sizes

X8G & X8R Dielectrics

Halogen Free & RoHS Compliance



*Contents in this sheet are subject to change without prior notice.

Multilayer Ceramic Capacitors

1. 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 HT Series High Temperature Multilayer Ceramic Capacitors is designed with high temperature components by offering maximum operating temperature range and higher reliability performance up to 150°C. These MLC Cs are manufactured with X8G and X8R dielectric materials. They provide a highly reliable capacitor with low loss and stable capacitance over temperature. These MLCCs are ideal for most high temperature and reliability market sectors as well.

2. FEATURES

- a. These products have no polarity.
- b. Their electrostatic capacity temperature response is stable at 15% even in high temperature ranges (up to 150°C).
- c. Larger capacity and smaller size (0402 size) with X8G/X8R characteristics

3. APPLICATIONS

- a. Measuring instruments used in high temperature environments.
- b. For time constants and filter circuitry (up to 125°C).
- c. LCD display
- d. Sensor Module
- e. Smoothing and decoupling applications for other devices that operate at high temperature
- h. Other automotive/industrial sets that must withstand high temperatures

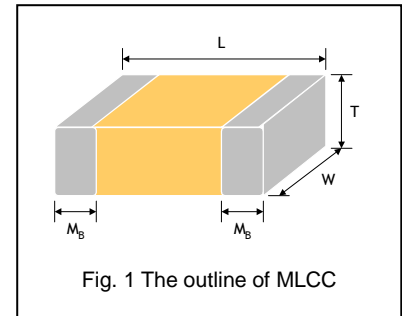
4. HOW TO ORDER

<u>HT</u>	<u>15</u>	<u>G</u>	<u>100</u>	<u>J</u>	<u>500</u>	<u>C</u>	<u>I</u>
<u>Series</u>	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging</u>
HT=High Temperature	15=0402 (1005) 18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225)	G=X8G R=X8R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 100=10x10 ⁰ =10pF	A=±0.05pF B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC	C=Cu/Ni/Sn	T=7" reeled G= 13" reeled

Multilayer Ceramic Capacitors

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	#
0603(1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	0.25
	1.60	0.80	0.80	X	+0.05/-0.10
0805 (2012)	2.00±0.15	1.25±0.10	0.60±0.10	A	0.40±0.15
			0.80±0.10	B	
			1.25±0.10	D	
1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	B	0.50±0.20
			0.95±0.10	C	
			1.25±0.10	D	
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	0.60±0.20
			1.25±0.10	D	



Reflow soldering only is recommended.

6. GENERAL ELECTRICAL DATA

Dielectric	X8G	X8R
Size	0402, 0603, 0805, 1206, 1210	
Capacitance	0.2pF to 0.015μF	100pF to 0.047μF
Capacitance tolerance*	Cap≤5pF: A (±0.05pF), 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%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	
Q/DF*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	DF≤5%
Insulation resistance at U _r **	10GΩ or R _x C≥500Ω·F whichever is smaller	
Operating temperature	-55 to +150°C	
Capacitance characteristic	±30ppm/°C	±15%
Termination	Ni/Sn (lead-free termination)	

* Measured at the condition of 30~70% related humidity.

X8G: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature

X8R: Apply 1.0±0.2Vrms, 1.0kHz±10%, 25°C at ambient temperature

** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour and then leave in ambient condition for 24±2 hours before measurement.

Multilayer Ceramic Capacitors

7. CAPACITANCE RANGE

7-1. X8G Dielectric 0402, 0603, 0805 Sizes

DIELECTRIC	X8G														
	SIZE	0402				0603					0805				
	RATED VOLTAGE (VDC)	10	16	25	50	10	16	25	50	100	10	16	25	50	100
Capacitance	0.1pF (0R1)														
	0.2pF (0R2)	N	N	N	N										
	0.3pF (0R3)	N	N	N	N										
	0.4pF (0R4)	N	N	N	N										
	0.5pF (0R5)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	120pF (121)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	150pF (151)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	180pF (181)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	220pF (221)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	270pF (271)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	330pF (331)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	390pF (391)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	470pF (471)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	560pF (561)					S	S	S	S	S	B	B	B	B	B
680pF (681)					S	S	S	S	S	B	B	B	B	B	
820pF (821)					S	S	S	S	S	B	B	B	B	B	
1,000pF (102)					S	S	S	S	S	B	B	B	B	B	
1,200pF (122)					X	X	X	X		B	B	B	B	B	
1,500pF (152)					X	X	X	X		B	B	B	B	B	
1,800pF (182)					X	X	X	X		B	B	B	B	B	
2,200pF (222)					X	X	X	X		B	B	B	B	B	
2,700pF (272)					X	X	X	X		D	D	D	D	D	
3,300pF (332)					X	X	X	X		D	D	D	D	D	
3,900pF (392)										D	D	D	D	D	
4,700pF (472)										D	D	D	D	D	
5,600pF (562)										D	D	D	D		
6,800pF (682)										D	D	D	D		
8,200pF (822)										D	D	D	D		
0.010uF (103)										D	D	D	D		

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

7-1. X8G Dielectric 1206, 1210 Sizes

DIELECTRIC		X8G								
SIZE		1206				1210				
RATED VOLTAGE (VDC)		10	16	25	50	100	10	16	25	50
		1.0pF (1R0)								
1.2pF (1R2)	B	B	B	B	B					
1.5pF (1R5)	B	B	B	B	B					
1.8pF (1R8)	B	B	B	B	B					
2.0pF (2R0)	B	B	B	B	B					
2.2pF (2R2)	B	B	B	B	B					
2.7pF (2R7)	B	B	B	B	B					
3.0pF (3R0)	B	B	B	B	B					
3.3pF (3R3)	B	B	B	B	B					
3.9pF (3R9)	B	B	B	B	B					
4.0pF (4R0)	B	B	B	B	B					
4.7pF (4R7)	B	B	B	B	B					
5.0pF (5R0)	B	B	B	B	B					
5.6pF (5R6)	B	B	B	B	B					
6.0pF (6R0)	B	B	B	B	B					
6.8pF (6R8)	B	B	B	B	B					
7.0pF (7R0)	B	B	B	B	B					
8.0pF (8R0)	B	B	B	B	B					
8.2pF (8R2)	B	B	B	B	B					
9.0pF (9R0)	B	B	B	B	B					
10pF (100)	B	B	B	B	B	C	C	C	C	
12pF (120)	B	B	B	B	B	C	C	C	C	
15pF (150)	B	B	B	B	B	C	C	C	C	
18pF (180)	B	B	B	B	B	C	C	C	C	
22pF (220)	B	B	B	B	B	C	C	C	C	
27pF (270)	B	B	B	B	B	C	C	C	C	
33pF (330)	B	B	B	B	B	C	C	C	C	
39pF (390)	B	B	B	B	B	C	C	C	C	
47pF (470)	B	B	B	B	B	C	C	C	C	
56pF (560)	B	B	B	B	B	C	C	C	C	
68pF (680)	B	B	B	B	B	C	C	C	C	
82pF (820)	B	B	B	B	B	C	C	C	C	
100pF (101)	B	B	B	B	B	C	C	C	C	
120pF (121)	B	B	B	B	B	C	C	C	C	
150pF (151)	B	B	B	B	B	C	C	C	C	
180pF (181)	B	B	B	B	B	C	C	C	C	
220pF (221)	B	B	B	B	B	C	C	C	C	
270pF (271)	B	B	B	B	B	C	C	C	C	
330pF (331)	B	B	B	B	B	C	C	C	C	
390pF (391)	B	B	B	B	B	C	C	C	C	
470pF (471)	B	B	B	B	B	C	C	C	C	
560pF (561)	B	B	B	B	B	C	C	C	C	
680pF (681)	B	B	B	B	B	C	C	C	C	
820pF (821)	B	B	B	B	B	C	C	C	C	
1,000pF (102)	B	B	B	B	B	C	C	C	C	
1,200pF (122)	B	B	B	B	B	C	C	C	C	
1,500pF (152)	B	B	B	B	B	C	C	C	C	
1,800pF (182)	B	B	B	B	B	C	C	C	C	
2,200pF (222)	B	B	B	B	B	C	C	C	C	
2,700pF (272)	B	B	B	B	B	C	C	C	C	
3,300pF (332)	B	B	B	B	B	C	C	C	C	
3,900pF (392)	B	B	B	B	B	C	C	C	C	
4,700pF (472)	B	B	B	B	B	C	C	C	C	
5,600pF (562)	B	B	B	B	B	C	C	C	C	
6,800pF (682)	C	C	C	C	C	C	C	C	C	
8,200pF (822)	D	D	D	D	D	C	C	C	C	
0.010μF (103)	D	D	D	D	D	C	C	C	C	
0.012μF (123)						D	D	D	D	
0.015μF (153)						D	D	D	D	

1. The letter in cell is expressed the symbol of product thickness.
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7-2. X8R Dielectric 0603, 0805, 1206 Sizes

DIELECTRIC		X8R											
SIZE		0402				0603				0805			
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	100pF (101)	N	N	N	N	S	S	S	S	D	D	D	D
	120pF (121)	N	N	N	N	S	S	S	S	D	D	D	D
	150pF (151)	N	N	N	N	S	S	S	S	D	D	D	D
	180pF (181)	N	N	N	N	S	S	S	S	D	D	D	D
	220pF (221)	N	N	N	N	S	S	S	S	D	D	D	D
	270pF (271)	N	N	N	N	S	S	S	S	D	D	D	D
	330pF (331)	N	N	N	N	S	S	S	S	D	D	D	D
	390pF (391)	N	N	N	N	S	S	S	S	D	D	D	D
	470pF (471)	N	N	N	N	S	S	S	S	D	D	D	D
	560pF (561)	N	N	N	N	S	S	S	S	D	D	D	D
	680pF (681)	N	N	N	N	S	S	S	S	D	D	D	D
	820pF (821)	N	N	N	N	S	S	S	S	D	D	D	D
	1,000pF (102)	N	N	N	N	S	S	S	S	D	D	D	D
	1,200pF (122)	N	N	N	N	S	S	S	S	D	D	D	D
	1,500pF (152)	N	N	N	N	S	S	S	S	D	D	D	D
	1,800pF (182)	N	N	N	N	S	S	S	S	D	D	D	D
	2,200pF (222)	N	N	N	N	S	S	S	S	D	D	D	D
	2,700pF (272)					S	S	S	S	D	D	D	D
	3,300pF (332)					S	S	S	S	D	D	D	D
	3,900pF (392)					S	S	S	S	D	D	D	D
	4,700pF (472)					S	S	S	S	D	D	D	D
	5,600pF (562)					S	S	S	S	D	D	D	D
	6,800pF (682)					S	S	S	S	D	D	D	D
	8,200pF (822)					S	S	S	S	D	D	D	D
	0.010μF (103)					S	S	S	S	D	D	D	D
	0.012μF (123)									D	D	D	D
	0.015μF (153)									D	D	D	D
	0.018μF (183)									D	D	D	D
	0.022μF (223)									D	D	D	D
	0.027μF (273)									D	D	D	D
	0.033μF (333)									D	D	D	D
	0.039μF (393)									D	D	D	D
0.047μF (473)									D	D	D	D	
0.056μF (563)													
0.068μF (683)													
0.082μF (823)													
0.10μF (104)													

1. The letter in cell is expressed the symbol of product thickness.
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8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.50±0.05	N	10,000	50,000	-	-
0603 (1608)	0.80±0.07	S	4,000	15,000	-	-
	0.80+0.15/-0.10	X	4,000	15,000	-	-
0805 (2012)	0.60±0.10	A	4,000	15,000	-	-
	0.80±0.10	B	4,000	15,000	-	-
	1.25±0.10	D	-	-	3,000	10,000
1206 (3216)	0.80±0.10	B	4,000	15,000	-	-
	0.95±0.10	C	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
1210 (3225)	0.95±0.10	C	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000

Unit: pieces

Multilayer Ceramic Capacitors

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements												
1.	Visual and Mechanical	---	<ul style="list-style-type: none"> No remarkable defect. Dimensions to conform to individual specification sheet. 												
2.	Capacitance	<ul style="list-style-type: none"> Class I: (X8G) 	<ul style="list-style-type: none"> Shall not exceed the limits given in the detailed spec. 												
3.	Q/ D.F. (Dissipation Factor)	<ul style="list-style-type: none"> Cap≤1000pF, 1.0±0.2Vrms, 1MHz±10% Cap>1000pF, 1.0±0.2Vrms, 1KHz±10% Class II: (X8R) 1.0±0.2Vrms, 1kHz±10% Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp . 	<ul style="list-style-type: none"> X8G: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X8R: D.F. ≤5% 												
4.	Dielectric Strength	<ul style="list-style-type: none"> To apply voltage (≤100V) 250%. Duration: 1 to 5 sec. Charge and discharge current less than 50mA. 	<ul style="list-style-type: none"> No evidence of damage or flash over during test. 												
5.	Insulation Resistance	<ul style="list-style-type: none"> To apply rated voltage for MAX. 120sec. 	<ul style="list-style-type: none"> 10GΩ or RxC≥500Ω-F whichever is smaller 												
6.	Temperature Coefficient	<ul style="list-style-type: none"> With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>X8G</td> <td>-55~150°C at 25°C</td> </tr> <tr> <td>X8R</td> <td>-55~150°C at 25°C</td> </tr> </tbody> </table> <ul style="list-style-type: none"> Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. 	T.C.	Operating Temp	X8G	-55~150°C at 25°C	X8R	-55~150°C at 25°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>X8G</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X8R</td> <td>Within ±15%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	X8G	Within ±30ppm/°C	X8R	Within ±15%
T.C.	Operating Temp														
X8G	-55~150°C at 25°C														
X8R	-55~150°C at 25°C														
T.C.	Capacitance Change														
X8G	Within ±30ppm/°C														
X8R	Within ±15%														
7.	Adhesive Strength of Termination	<ul style="list-style-type: none"> Pressurizing force : 5N (≤0603) and 10N (>0603) Test time: 10±1 sec. 	<ul style="list-style-type: none"> No remarkable damage or removal of the terminations. 												
8.	Vibration Resistance	<ul style="list-style-type: none"> Vibration frequency: 10~55 Hz/min. Total amplitude: 1.5mm Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. 	<ul style="list-style-type: none"> No remarkable damage. Cap change and Q/D.F.: To meet initial spec. 												
9.	Solderability	<ul style="list-style-type: none"> Solder temperature: 235±5°C Dipping time: 2±0.5 sec. 	<ul style="list-style-type: none"> 95% min. coverage of all metalized area. 												
10.	Bending Test	<ul style="list-style-type: none"> 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. Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. Measurement to be made after keeping at room temp. for 24±2 hrs. 	<ul style="list-style-type: none"> No remarkable damage. Cap change : X8G: within ±5.0% or ±0.5pF whichever is larger. X8R: within ±12.5% (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	<ul style="list-style-type: none"> 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): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp . 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 . 	<ul style="list-style-type: none"> No remarkable damage. Cap change: X8G: within ±2.5% or ±0.25pF whichever is larger. X8R: within ±7.5% Q/D.F., I.R. and dielectric strength: To meet initial requirements. 25% max. leaching on each edge. 												

Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements															
12.	Temperature Cycle	<p>* Conduct the five cycles according to the temperatures and time.</p> <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> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* 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 .</p>	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	<p>No remarkable damage.</p> <p>Cap change : X8G: within ±2.5% or ±0.25pF whichever is larger. X8R: within ±7.5%</p> <p>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p>
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	<p>* Test temp.: 40±2°C</p> <p>* Humidity: 90~95% RH</p> <p>* Test time: 500+24/-0hrs.</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* 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 .</p>	<p>* No remarkable damage.</p> <p>* Cap change: X8G: within ±5.0% or ±0.5pF whichever is larger. X8R: within ±12.5%</p> <p>* Q/D.F. value: X8G: Cap≥30pF, Q≥350; 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF; Q≥200+10C X8R: ≤7.5%</p> <p>* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</p>															
14.	Humidity (Damp Heat) Load	<p>* Test temp.: 40±2°C</p> <p>* Humidity: 90~95%RH</p> <p>* Test time: 500+24/-0 hrs.</p> <p>* To apply voltage : rated voltage</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* 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 .</p>	<p>* No remarkable damage.</p> <p>* Cap change: X8G: within ±7.5% or ±0.75pF whichever is larger. X8R: within ±12.5%</p> <p>* Q/D.F. value: X8G: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C X8R: ≤7.5%</p> <p>* I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.</p>															
15.	High Temperature Load (Endurance)	<p>* Test temp.: X8G, X8R: 150±3°C</p> <p>* To apply voltage: 200% of rated voltage.</p> <p>* Test time: 1000+24/-0 hrs.</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp .</p> <p>* 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 .</p>	<p>* No remarkable damage.</p> <p>* Cap change: X8G: within ±3.0% or ±0.3pF whichever is larger. X8R: within ±12.5%</p> <p>* Q/D.F. value: X8G: Cap≥30pF, Q≥350 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF, Q≥200+10C X8R: ≤7.5%</p> <p>* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</p>															

Multilayer Ceramic Capacitors

APPENDIXES

■ Tape & reel dimensions

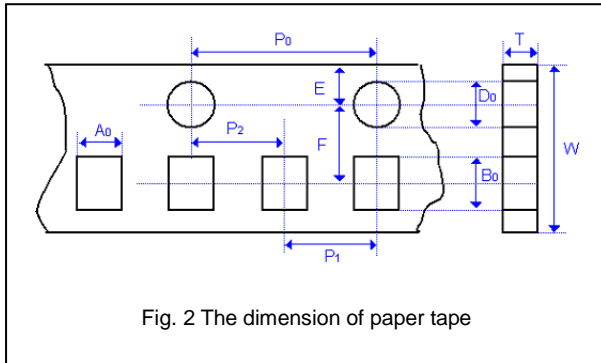


Fig. 2 The dimension of paper tape

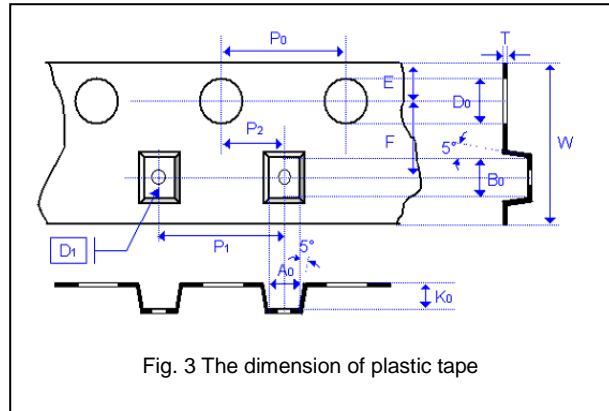


Fig. 3 The dimension of plastic tape

Size	0402	0603	0805			1206			1210		
Thickness	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D,G,K	M
A ₀	0.70 +/-0.20	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	<2.30	< 3.05	< 3.05	< 3.20
B ₀	1.20 +/-0.20	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	< 4.00
T	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	≤ 1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1
K ₀	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20
W	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30
P ₀	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10
10xP ₀	40.00 +/-0.10	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20
P ₁	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	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	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05
D ₀	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D ₁	-	-	-	-	1.00 +/-0.10	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10
E	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10
F	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05

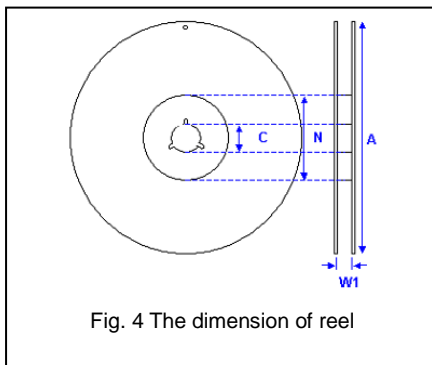
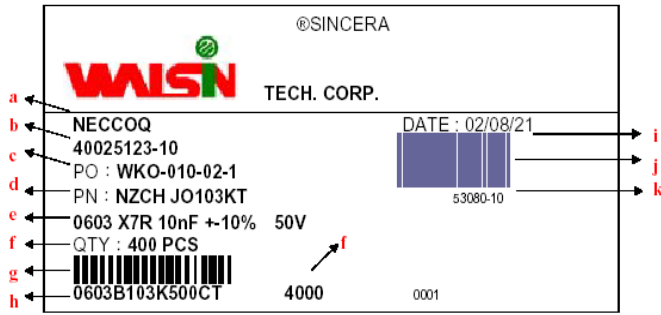


Fig. 4 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210		
Reel size	7"	10"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0
A	178.0±1.0	250.0±1.0	330.0±1.0
N	60.0+1.0/-0	100.0±1.0	100±1.0

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Example of customer label



*Customized label is available upon request

- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

Constructions

No.	Name	X8G	X8R
①	Ceramic material	CaZrO ₃ based	BaTiO ₃ based
②	Inner electrode	Ni	
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn

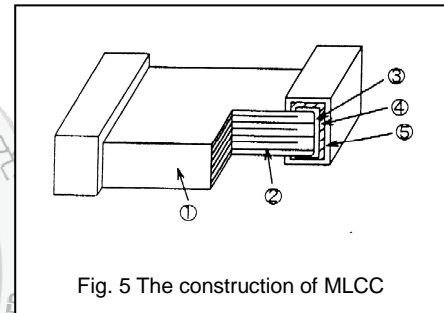


Fig. 5 The construction of MLCC

Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (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.

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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.

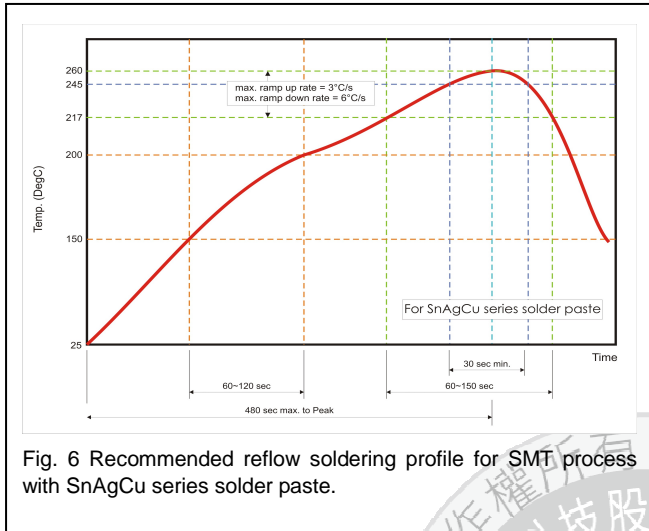


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

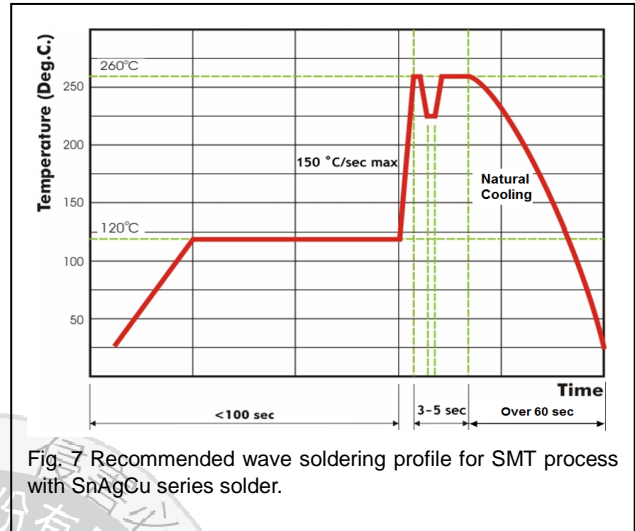


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

