APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Low Distortion Series (100V to 630V)

1206 Size

X7R Dielectric

RoHS Compliance

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

1. INTRODUCTION

WTC low distortion series MLCC is designed by special materials of ceramic and inner electrodes, which is with lower DF value and lower power consumption in higher frequency applications. This series MLCC is designed specially for using in analog or digital and AC voltage circuits.

2. FEATURES

b. High voltage in a given case size.
c. Low DF value.
d. Low power consumption in AC voltage application.

3. APPLICATIONS

a. AC voltage and high current applications.
b. Lighting and related products.
c. Network communications.

4. HOW TO ORDER

LD	31	B	102	K	201	L	T
Series	**Size**	**Dielectric**	**Capacitance**	**Tolerance**	**Rated voltage**	**Termination**	**Packaging**
LD=Low distortion	**31**=1206 (3216)	**B**=X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 102=10x10^2 =1000pF	**K**=±10% **M**=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. **101**=100 VDC **201**=200 VDC **251**=250 VDC **351**=350 VDC **501**=500 VDC **631**=630 VDC	**L**=Ag/Ni/Sn	**T**=7” reeled **G**=13” reeled

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M_B (mm)
1206 (3216)	3.20±0.15	1.60±0.15	1.25±0.10	D	#	0.60±0.20
	3.20±0.20	1.60±0.20	1.60±0.20	G		

Reflow soldering only is recommended.

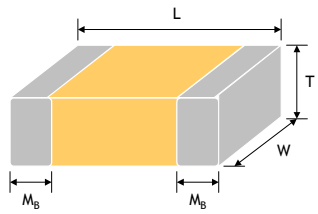


Fig. 1 The outline of MLCC

6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	1206
Capacitance*	150pF to 0.1μF
Capacitance tolerance**	K (±10%), M (±20%)
Rated voltage (WVDC)	100V, 200V, 250V, 350V, 500V, 630V
Tan δ*	100V : ≤1.4% ≥200V : ≤1.0%
Insulation resistance at Ur	≥10GΩ or RxC≥500Ω-F whichever is smaller
Dielectric strength	100 to 350V: ≥2 x WVDC 500V & 630V: ≥1.5 x WVDC
Operating temperature	-55 to +125℃
Capacitance characteristic	±15%
Termination	Ni/Sn (lead-free termination)

* Measured at 25℃ ambient temperature and 30~70% r elated humidity. Apply 1.0±0.2Vrms, 1.0kHz±10%.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10℃ for 1 hour, then leave in a mbient condition for 24±2 hours before measurement.

7. CAPACITANCE RANGE

DIELECTRIC		X7R					
SIZE		1206					
RATED VOLTAGE (VDC)		100	200	250	350	500	630
Capacitance	100pF (101)						
	120pF (121)						
	150pF (151)	D	D	D	D	D	D
	180pF (181)	D	D	D	D	D	D
	220pF (221)	D	D	D	D	D	D
	270pF (271)	D	D	D	D	D	D
	330pF (331)	D	D	D	D	D	D
	390pF (391)	D	D	D	D	D	D
	470pF (471)	D	D	D	D	D	D
	560pF (561)	D	D	D	D	D	D
	680pF (681)	D	D	D	D	D	D
	820pF (821)	D	D	D	D	D	D
	1,000pF (102)	D	D	D	D	D	D
	1,200pF (122)	D	D	D	D	D	D
	1,500pF (152)	D	D	D	D	D	D
	1,800pF (182)	D	D	D	D	D	D
	2,200pF (222)	D	D	D	D	D	D
	2,700pF (272)	D	D	D	D	D	D
	3,300pF (332)	D	D	D	D	D	D
	3,900pF (392)	D	D	D	D	D	D
	4,700pF (472)	D	D	D	D	D	D
	5,600pF (562)	D	D	D	D	D	D
	6,800pF (682)	D	D	D	D	D	D
	8,200pF (822)	D	D	D	D	D	D
	0.010μF (103)	D	D	D	D	D	D
	0.012μF (123)	D	D	D	D	D	D
	0.015μF (153)	D	D	D	D	D	D
	0.018μF (183)	D	D	D	D	G	G
	0.022μF (223)	D	D	D	D	G	G
	0.027μF (273)	D	D	D	D	G	G
	0.033μF (333)	D	D	D	D	G	G
	0.039μF (393)	D	D	D	D		
	0.047μF (473)	D	D	D	D		
	0.056μF (563)	D					
	0.068μF (683)	D					
	0.082μF (823)	D					
	0.1.μF (104)	D					

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

8. PACKAGING DIMENSION AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
1206	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	10k

Unit: pieces

9. 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±0.2Vrms, 1kHz±10%	* Shall not exceed the limits given in the detailed spec.
3.	Q/ D.F. (Dissipation Factor)		100V: D.F. ≤1.4% ≥200V: D.F. ≤1.0%
4.	Dielectric Strength	* To apply voltage: 100 to 350V: ≥2 times VDC 500V to 630V: ≥1.5 times VDC * Cut-off, set at 10mA * TEST= 15 sec. * RAMP=0	* No evidence of damage or flash over during test.
5.	Insulation Resistance	100V, To apply rated voltage for max. 120 sec. ≥200V, To apply rated voltage for 60 sec.	≥10GΩ or RxC≥100Ω-F whichever is smaller. X7R=100V: RxC≥100Ω-F
6.	Temperature Coefficient	With no electrical load. Operating temperature: -55~125°C at 25°C	Within ±15%.
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 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.
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: X7R: 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	* Solder temperature: 260±5℃ * Dipping time: 10±1 sec * Preheating: 120 to 150℃ for 1 minute before imme rse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 24±2 hrs at r oom temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change: X7R: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>12.</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.
<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>
* Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 24±2 hrs at r oom temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change：X7R: within ±7.5%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>13.</td><td>Humidity (Damp Heat) Steady State</td><td>* Test temp.: 40±2℃
* Humidity: 90~95% RH
* Test time: 500+24/-0hrs.
*Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 24±2 hrs at r oom temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change: X7R: within ±12.5%
* Q/D.F. value: X7R: D.F. ≤3.0%
* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.
X7R=100V: RxC≥10Ω-F</td></tr>
<tr><td>14.</td><td>Humidity (Damp Heat) Load</td><td>* 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.</td><td>* No remarkable damage.
* Cap change: X7R: within ±12.5%
* Q/D.F. value: X7R: D.F. ≤3.0%
* I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.
X7R=100V: RxC≥5Ω-F</td></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>* Test temp.: X7R: 125±3°C
* To apply voltage: 200% 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</td><td> No remarkable damage.
* Cap change: X7R: within ±12.5%
* Q/D.F. value: X7R: D.F. ≤3.0%
* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.
X7R=100V: RxC≥10Ω-F</td></tr>
</table>

APPENDIXES

◙ Tape & reel dimensions

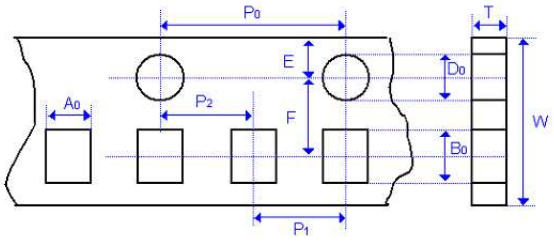


Fig. 2 The dimension of paper tape

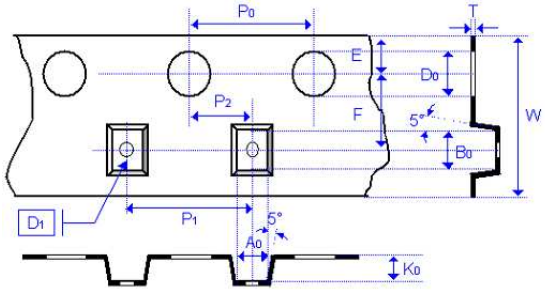


Fig. 3 The dimension of plastic tape

Size	0805		1206			1210		1812
Thickness	B	C, D, I	B	C, D	G	C, D	G	D, K
A_0	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<3.81
B_0	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<3.73	<5.30
T	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05
K_0	-	<2.50	-	<2.50	<2.50	<2.50	<2.50	<2.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.0±0.20
P_0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.100	4.00±0.10	4.00±0.10
$10xP_0$	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10
P_1	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	8.00±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
D_0	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05
D_1	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10
E	1.75±0.05	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	5.50±0.05

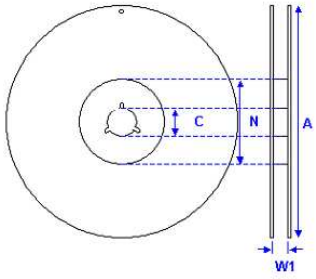
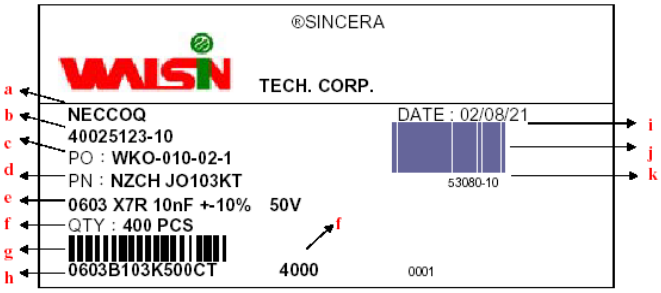


Fig. 4 The dimension of reel

Size	0603, 0805, 1206, 1210			1808, 1812
Reel size	7”	10”	13”	7”
C	13.0+0.5/-0.2	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	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

◙ Description of customer label



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		X7R
①	Ceramic material		$BaTiO_3$ based
②	Inner electrode		AgPd alloy
③	Termination	Inner layer	Ag
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

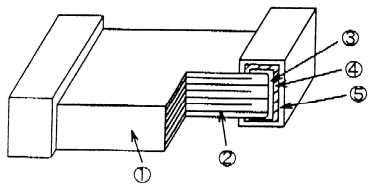


Fig. 5 The construction of MLCC

◙ 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.

◙ 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.

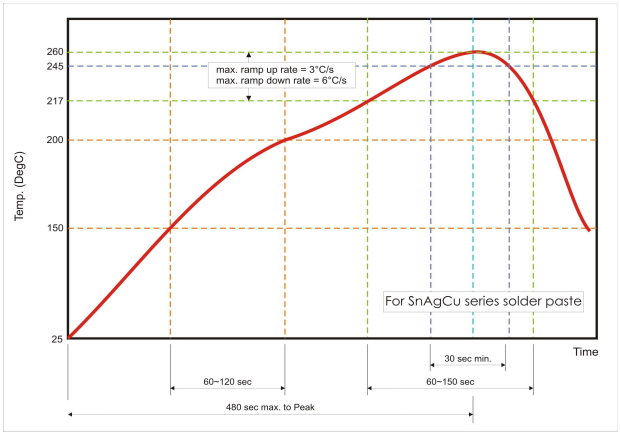


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

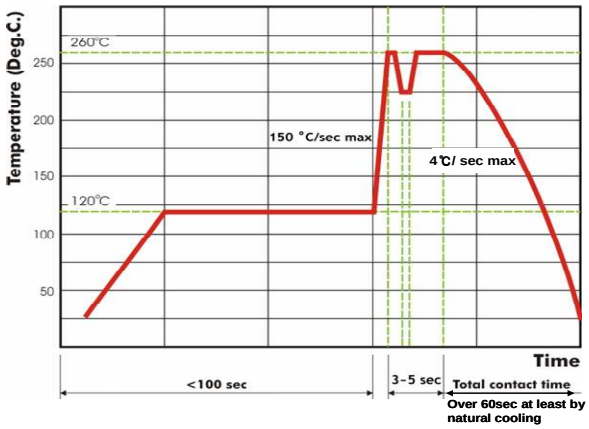


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.