

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Low Inductance Series

0612 Size, 50V

X7R Dielectric

Halogen Free & RoHS Compliance



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

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.

The total inductance of MLCC is determined by its length to width ratio and by the mutual inductance coupling between its electrodes. The positioning of end terminations is along the length of MLCC to reduce ESR and ESL characteristics of component over conventional products.

2. FEATURES

- a. Standard size with thin thickness.
- b. Small size with high capacitance.
- c. Capacitor with lead-free termination (pure Tin).
- d. MLCC with low ESL performance.

3. APPLICATIONS

- a. IC decoupling.
- b. High-speed microprocessors.
- c. High frequency digital equipments.

4. HOW TO ORDER

<u>0612</u>	<u>B</u>	<u>103</u>	<u>K</u>	<u>500</u>	<u>C</u>	<u>I</u>
<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging</u>
Inch (mm) 0612 (1632)	B=X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 103=10x10 ³ =10nF	K=±10% M=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 500=50x10 ⁰ =50VDC	C=Cu/Ni/Sn	T=7" reeled

5. EXTERNAL DIMENSIONS

<u>Size</u> <u>Inch (mm)</u>	<u>L (mm)</u>	<u>W (mm)</u>	<u>T (mm)/Symbol</u>	<u>T_a min. (mm)</u>	<u>T_b min. (mm)</u>
0612 (1632)	3.20±0.15	1.60±0.15	0.80±0.10	B	0.5

* Reflow soldering process only is recommended.

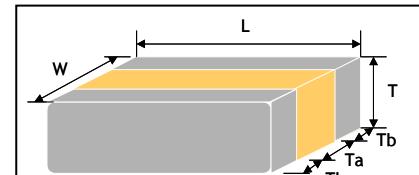


Fig. 1 The outline of MLCC

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6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	0612
Capacitance range*	10nF to 150nF
Capacitance tolerance**	K ($\pm 10\%$), M ($\pm 20\%$)
Rated voltage (WVDC)	50V
Tan δ *	$\leq 2.5\%$
Insulation resistance at Ur	$\geq 10G\Omega$ or $R_x C \geq 500\Omega \times F$ whichever is less
Operating temperature	-55 to +125°C
Capacitance characteristic	$\pm 15\%$
Termination	Ni/Sn (lead-free termination)
ESL	500pH

* Measured at 1.0 ± 0.2 Vrms, 1.0 kHz $\pm 10\%$, 30~70% related humidity, 25°C ambient temperature.

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

7. CAPACITANCE RANGE

DIELECTRIC	X7R
SIZE	0612
RATED VOLTAGE (VDC)	50
10nF (103)	B
12nF (123)	B
15nF (153)	B
18nF (183)	B
22nF (223)	B
27nF (273)	B
33nF (333)	B
39nF (393)	B
47nF (473)	B
56nF (563)	B
68nF (683)	B
82nF (823)	B
100nF (104)	B
120nF (124)	B
150nF (154)	B

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

8. PACKAGING DIMENSION AND QUANTITY

Size	Thickness (mm)/Symbol	7" reel / Paper tape
0612 (1632)	0.80 ± 0.10	B 4k

Unit: pieces

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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)		X7R: ≤2.5%															
4.	Dielectric Strength	* To apply voltage: 250% 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.	X10GΩ or RxC≥500Ω·F whichever is smaller.															
6.	Temperature Coefficient	With no electrical load.	<table border="1"> <tr> <td>T.C.</td> <td>Operating Temp</td> </tr> <tr> <td>X7R</td> <td>-55~125 °C at 25 °C</td> </tr> </table> <table border="1"> <tr> <td>T.C.</td> <td>Capacitance Change</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> </table>	T.C.	Operating Temp	X7R	-55~125 °C at 25 °C	T.C.	Capacitance Change	X7R	Within ±15%							
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X7R	Within ±15%																	
7.	Adhesive Strength of Termination	* Pressurizing force : 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.) * 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 metallized 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 °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): 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.	* 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.															
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table border="1"> <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 °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.	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: X7R: within ±7.5% * 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																
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3	Max. operating temp. +3/-0	30±3																
4	Room temp.	2~3																

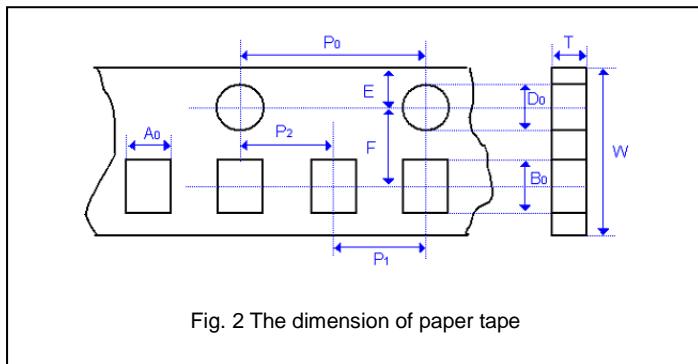
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No.	Item	Test Condition	Requirements
13.	Humidity (Damp Heat) Steady State	<ul style="list-style-type: none"> * Test temp.: $40 \pm 2^\circ\text{C}$ * Humidity: 90-95% RH * Test time: $500+24/-0$ hrs. * Before initial measurement (Class II only): Perform $150+0/-10^\circ\text{C}$ 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. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R: within $\pm 12.5\%$ * Q/D.F. value: X7R: $\le 3.0\%$ * I.R.: $\ge 1\text{G}\Omega$ or $\text{RxC} \ge 50\Omega\text{-F}$ whichever is smaller.
14.	Humidity (Damp Heat) Load	<ul style="list-style-type: none"> * Test temp.: $40 \pm 2^\circ\text{C}$ * 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. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R: within $\pm 12.5\%$ * Q/D.F. value: X7R: $\le 3.0\%$ * I.R.: $\ge 500\text{M}\Omega$ or $\text{RxC} \ge 25\Omega\text{-F}$ whichever is smaller.
15.	High Temperature Load (Endurance)	<ul style="list-style-type: none"> * Test temp.: X7R: $125 \pm 3^\circ\text{C}$ * 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 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R: within $\pm 12.5\%$ * Q/D.F. value: X7R: $\le 3.0\%$ * I.R.: $\ge 1\text{G}\Omega$ or $\text{RxC} \ge 50\Omega\text{-F}$ whichever is smaller.

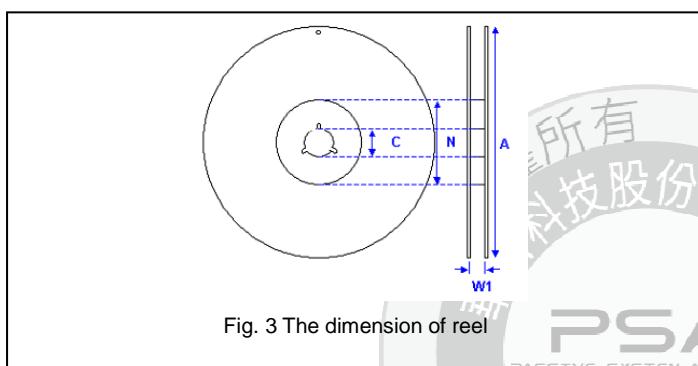


APPENDIXES

□ Tape & reel dimensions

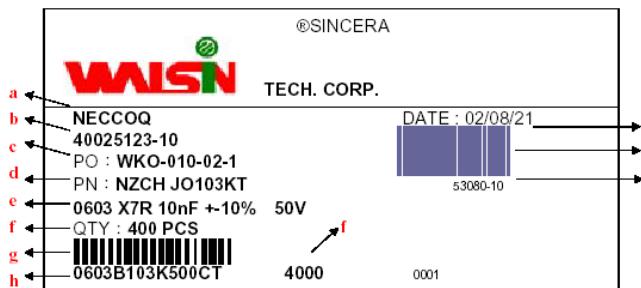


Size	0612
Thickness	B
A_0	2.00 ± 0.10
B_0	3.50 ± 0.10
T	0.95 ± 0.05
K_0	-
W	8.00 ± 0.10
P_0	4.00 ± 0.10
$10 \times P_0$	40.0 ± 0.10
P_1	4.00 ± 0.10
P_2	2.00 ± 0.05
D_0	1.50 ± 0.05
D_1	-
E	1.75 ± 0.10
F	3.50 ± 0.05



Size	1206
Reel size	7"
C	$13.0 \pm 0.5/-0.2$
W_1	$8.4 \pm 1.5/-0$
A	178.0 ± 0.10
N	$60.0 \pm 1.0/-0$

□ 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

Multilayer Ceramic Capacitors

Constructions

No.	Name		X7R
①	Ceramic material		BaTiO ₃ based
②	Inner electrode		AgPd alloy or Ni
③	Termination	Inner layer	Ag or Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

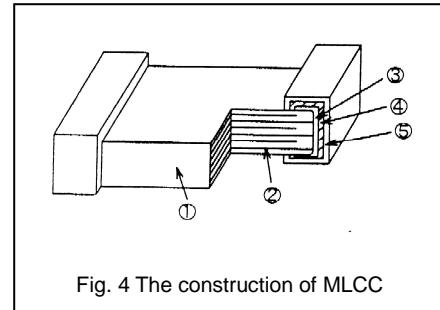


Fig. 4 The construction of MLCC

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:

- 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.)
- In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- 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.

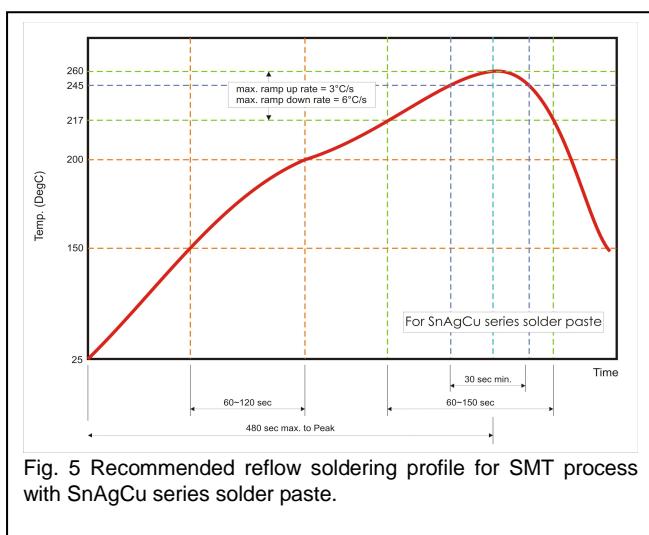


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

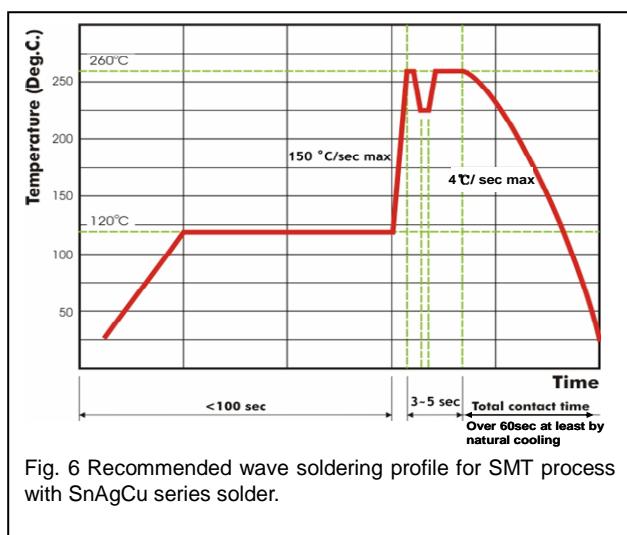


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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