

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

### 3-Terminal Capacitor Series (FT)

#### Feed Through Type

#### 0402 & 0805 Size (4V to 100V)

#### X7R & X5R Dielectrics

#### Halogen Free & RoHS Compliance

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

## Multilayer Ceramic Capacitors

## Approval Sheet

### 1. DESCRIPTION

This product specification is applied to 3-terminal Capacitor for FT Series used for General Electronic equipment. WTC capacitor Feed Through type are developed to offer designers the opportunity to lower placement costs increase assembly line output through lower component count per board.

### 2. FEATURES

- High density mounting due to mounting space saving.
- Mounting cost saving.
- Increased throughput.

### 3. APPLICATIONS

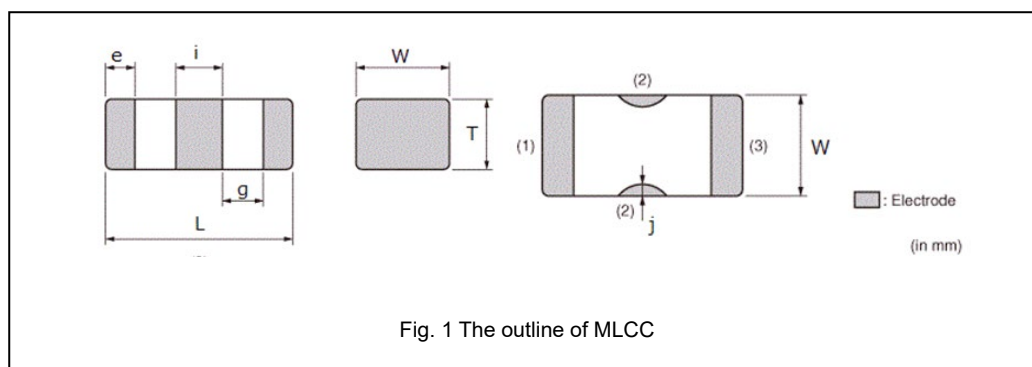
- For use as a bypass for digital and analog signal line noise
- Computer motherboards and peripherals.
- The other common electronic circuits.

### 4. HOW TO ORDER

<u>FT</u>	<u>21</u>	<u>B</u>	<u>474</u>	<u>K</u>	<u>160</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>
FT= Feed Through Capacitor	15=0402 (1005) 21=0805 (2012)	B=X7R X=X5R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 105=10x10 <sup>5</sup> =1000nF P=1μF	K=±10% M=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 2R5=2.5 VDC 4R0=4 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC	C=Cu/Ni/Sn	T=7" reeled

## Multilayer Ceramic Capacitors

### 5. EXTERNAL DIMENSIONS

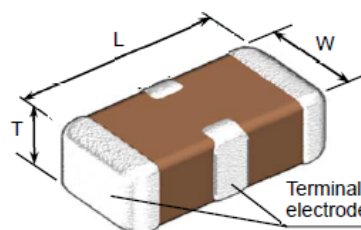
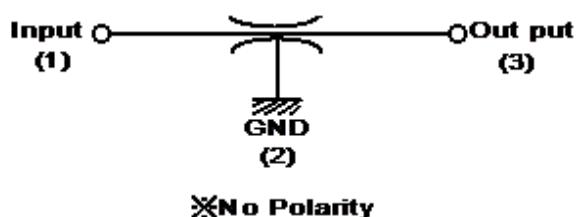


Brand	L (mm)	W (mm)	T (mm)/Symbol	e (mm)	g (mm)	i (mm)	j (mm)
0402	1.00±0.10	0.50±0.20	0.4±0.10 W	0.17±0.10	0.10 min	0.35±0.10	0.15±0.10
0805	2.00±0.20	1.25±0.10	0.85±0.10 T	0.30±0.20	0.40±0.20	0.60±0.20	0.25±0.20

Reflow soldering process only.

### 6. Rated value

a)Equivalent Circuit



WTC PART NO.	Nominal Capacitance	Capacitance Tolerance	DC Rated Voltage	Rated Current (mA)	DC Resistance	Insulation Resistance	Operating Temp. Range
FT15X435M4R0	4.3 uF	±20%	DC4 V	2A(DC)	0.03Ω max	25MΩ min	-55 to 85°C
FT21B103M101	10 nF	±20%	DC100 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B103M500	10 nF	±20%	DC50 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B223M500	22 nF	±20%	DC50 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B473M500	47 nF	±20%	DC50 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B104M250	0.1 uF	±20%	DC25 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B224M160	0.22 uF	±20%	DC16 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B474K160	0.47 uF	±10%	DC16 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B474M160	0.47 uF	±20%	DC16 V	2A(DC)	0.03Ω max	1000MΩ min	-55 to 125°C
FT21B105M160	1 uF	±20%	DC16 V	4A(DC)	0.02Ω max	500MΩ min	-55 to 125°C


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

X7R/X6S/X5R/X7S: Please refer to page 5 "Reliability test conditions and requirements" for detail.

\*\* Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour and then leave in ambient condition for 48±2 hours before measurement.

## Multilayer Ceramic Capacitors

### 7. GENERAL ELECTRICAL DATA

No	Item	Specification	Test Method
1	Capacitor(Cap.)	Shown in Rated value.	Frequency : 1.0±0.1kHz Voltage : 1±0.2V(rms)
2	Insulation Resistance(I.R.)	Shown in Rated value.	Voltage : Rated Voltage Time : 2 minutes max.
3	DC Resistance	As for Direct Current spec of each product, please refer to item 6: Rated value.  Measuring current shall be 100mA max..  	Measured with 100mA max.
4	Withstanding Voltage	Products shall not be damaged.	Test Voltage : Rated Voltage x 300% Time : 1 to 5 s Charge Current : 50 mA max.
5	Operating Temperature	Shown in Rated value.	Includes self-heating
6	Storage Temperature	5 to 40°C at 20 to 70%RH	

\* Measured at 30~70% related humidity.

X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at the conditions of 25°C ambient temperature.

X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at the conditions of 25°C ambient temperature.

\*\* Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 48±2 hours before measurement.

### 8. CAPACITANCE RANGE

SIZE Inch (mm)		FT21 0805(2012)					FT15 0402(1005)
DIELECTRIC		X7R					X5R
RATED VOLTAGE (VDC)		10	16	25	50	100	4
Capacitance	10nF (103)	T	T	T	T	T	
	22nF (223)	T	T	T	T		
	47nF (473)	T	T	T	T		
	0.10μF (104)	T	T	T			
	0.22μF (224)	T	T				
	0.47μF (474)	T	T				
	1μF (105)	T	T				
	4.3μF (435)						W

- The letter in cell is expressed the symbol of product thickness; the capacitance tolerance is "M" only (±20%).
- For more information about products with special capacitance or other data, please contact WTC local representative.

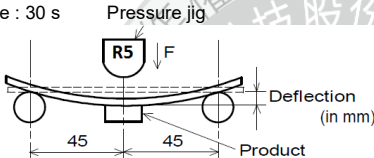
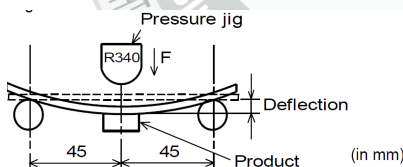
### 9. PACKAGING DIMENSION AND QUANTITY

SIZE Inch (mm)	Thickness/Symbol (mm)		Packing	Packing Unit
0402	0.40±0.10	W	180mm Reel PAPER	10000 pcs./Reel
0805	0.85±0.10	T	180mm Reel PAPER	4000 pcs./Reel

Unit: pieces

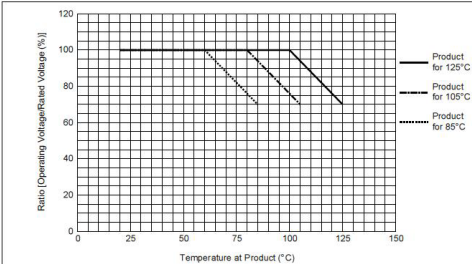
Multilayer Ceramic Capacitors

## 10. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements								
1.	Appearance and Dimensions	Visual Inspection and measured with Slide Calipers.	* No remarkable defect. * Dimensions to conform to individual specification sheet.								
2.	Capacitance	Frequency : 1.0±0.1kHz Voltage : 1±0.2V(rms) Test temp.: Room Temperature.	* Shall not exceed the limits given in the detailed spec.								
3.	Solder ability	* Solder temperature: 240±3°C * Immersion time: 3±1 sec.	90% min. coverage of all metalized area.								
4.	Resistance to Soldering Heat	* Solder temperature: 270±5°C * Dipping time: 10±1 sec * Preheating: 150±10°C, 60 to 90s before immerses the capacitor in a eutectic solder. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 48±4 hrs at room temp. *Cap. /I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 48±4 hrs at room temp.	Meet table 1. Table 1 <table><tr><td>Appearance</td><td>No damaged</td></tr><tr><td>Cap. Change</td><td>Within±7.5%</td></tr><tr><td>I.R.</td><td>Meet the initial rated value.</td></tr><tr><td>DC Resistance</td><td>0.05Ω max</td></tr></table> * 25% max. leaching on each edge.	Appearance	No damaged	Cap. Change	Within±7.5%	I.R.	Meet the initial rated value.	DC Resistance	0.05Ω max
Appearance	No damaged										
Cap. Change	Within±7.5%										
I.R.	Meet the initial rated value.										
DC Resistance	0.05Ω max										
5.	Bending Test	It shall be soldered on the glass-epoxy substrate (100×40×1.0mm). Table 2 Deflection : 2 mm Keeping Time : 30 s  It shall be soldered on the glass-epoxy substrate (100×40×0.8mm).. Table 2 Deflection : 1 mm Keeping Time : 5 s 	Meet table2. Table2 <table><tr><td>Appearance</td><td>No damaged</td></tr><tr><td>Cap. Change</td><td>Within±7.5%</td></tr><tr><td>DC Resistance</td><td>0.05Ω max</td></tr></table>	Appearance	No damaged	Cap. Change	Within±7.5%	DC Resistance	0.05Ω max		
Appearance	No damaged										
Cap. Change	Within±7.5%										
DC Resistance	0.05Ω max										
6.	Adhesive Strength of Termination	* Pressurizing force : 5N (≤0603) and 9.8N (>0603) * Test time: FT21: 30±1 sec. FT15: 5±1 sec.	* No remarkable damage or removal of the terminations.								
7.	Vibration Resistance	* 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 48±4 hrs at room temp. *Cap. Measurement to be made after de-aging at 150°C for 1hr then set for 48±4 hrs at room temp.	Meet Table 3. Table3 <table><tr><td>Appearance</td><td>No damaged</td></tr><tr><td>Capacitance</td><td>Meet the initial rated value</td></tr><tr><td>DC Resistance</td><td>0.05Ω max</td></tr></table>	Appearance	No damaged	Capacitance	Meet the initial rated value	DC Resistance	0.05Ω max		
Appearance	No damaged										
Capacitance	Meet the initial rated value										
DC Resistance	0.05Ω max										

\* "Room condition" Temperature: 15 to  $35^\circ \text{C}$ , Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

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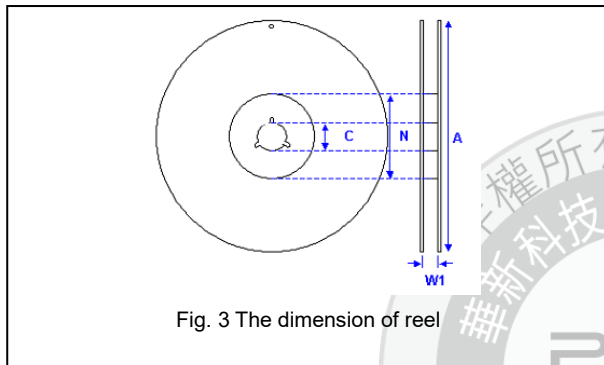
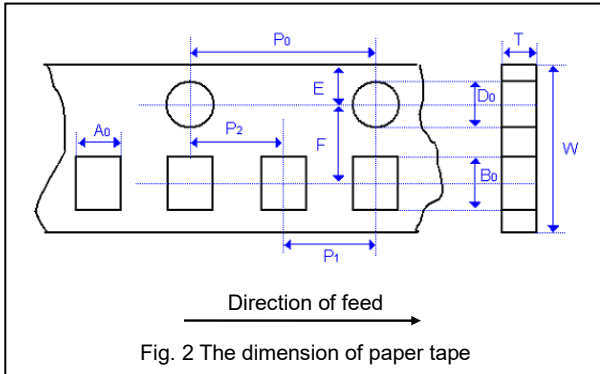
No.	Item	Test Condition	Requirements																							
8.	Temperature Cycling	<p>Conduct the 10 cycles according to the temperatures and time</p> <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><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> <p>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 48±4 hrs at room temp.</p> <p>* Cap. / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 48±4 hrs at room temp.</p> <p>Total of 10 cycles</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>Meet table 4.</p> <p><u>Table 4</u></p> <table><tr><td>Appearance</td><td>No damaged</td></tr><tr><td>Cap. Change</td><td>FT21B: Within±7.5% FT15X: Within±12.5%</td></tr><tr><td>I.R.</td><td>Meet the initial rated value.</td></tr><tr><td>DC Resistance</td><td>0.05Ω max</td></tr></table>	Appearance	No damaged	Cap. Change	FT21B: Within±7.5% FT15X: Within±12.5%	I.R.	Meet the initial rated value.	DC Resistance	0.05Ω max
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I.R.	Meet the initial rated value.																									
DC Resistance	0.05Ω max																									
9.	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 48±4 hrs at room temp.</p> <p>* Cap. / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 48±4 hrs at room temp.</p>	<p>Then measured after exposure in the room condition for 48±4 hours.</p> <p>If it's doubt, the measuring has to be done after 1 hours curing at 150+0 / -10°C and 48±4 hours storage.</p> <p>Meet Table5.</p> <p><u>Table5</u></p> <table><tr><td>Appearance</td><td>No damaged</td></tr><tr><td>Cap. Change</td><td>Within±12.5%</td></tr><tr><td>I.R.</td><td>FT21B: 1GΩ or Rx<math>C \geq 10</math> Ω-F whichever is smaller. FT15X: 5MΩ min.</td></tr><tr><td>DC Resistance</td><td>0.05Ω max</td></tr></table>	Appearance	No damaged	Cap. Change	Within±12.5%	I.R.	FT21B: 1GΩ or Rx $C \geq 10$ Ω-F whichever is smaller. FT15X: 5MΩ min.	DC Resistance	0.05Ω max															
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I.R.	FT21B: 1GΩ or Rx $C \geq 10$ Ω-F whichever is smaller. FT15X: 5MΩ min.																									
DC Resistance	0.05Ω max																									
10.	High Temperature Load (Endurance)	<p>Temperature : Maximum Operating Temperature ± 2 °C</p> <p>Test Voltage : FT21B: Rated Voltage x 200% FT15_: Rated Voltage x 100%**</p> <p>Charge Current : 50 mA max.</p> <p>Time : 1000+48 / -0 hours</p> <p>* Cap. / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 48±4 hrs at room temp.</p> <p>** De-rating conditions:</p> 	<p>Then measured after exposure in the room condition for 48±4 hours.</p> <p>If it's doubt, the measuring has to be done after 1 hours curing at 150+0 / -10°C and 48±4 hours storage.</p> <p>Meet Table6.</p> <p><u>Table6</u></p> <table><tr><td>Appearance</td><td>No damaged</td></tr><tr><td>Cap. Change</td><td>Within±12.5%</td></tr><tr><td>I.R.</td><td>FT21B: 1GΩ or Rx<math>C \geq 10</math> Ω-F whichever is smaller. FT15X: 5MΩ min.</td></tr><tr><td>DC Resistance</td><td>0.05Ω max</td></tr></table>	Appearance	No damaged	Cap. Change	Within±12.5%	I.R.	FT21B: 1GΩ or Rx $C \geq 10$ Ω-F whichever is smaller. FT15X: 5MΩ min.	DC Resistance	0.05Ω max															
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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

## Multilayer Ceramic Capacitors

### APPENDIXES

#### ■ Tape & reel dimensions

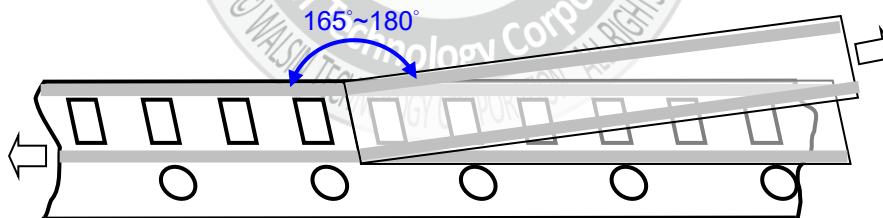


SIZE Inch (mm)	FT15 0402 (1005)	FT21 0805 (2012)
Thickness	W	T
A <sub>0</sub>	0.70 +/-0.20	1.50 +/-0.20
B <sub>0</sub>	1.20 +/-0.20	2.30 +/-0.20
T	≤ 0.80	≤ 1.20
K <sub>0</sub>	-	-
W	8.00 +/-0.30	8.00 +/-0.30
P <sub>0</sub>	4.00 +/-0.10	4.00 +/-0.10
10xP <sub>0</sub>	40.00 +/-0.10	40.00 +/-0.20
P <sub>1</sub>	2.00 +/-0.05	4.00 +/-0.10
P <sub>2</sub>	2.00 +/-0.05	2.00 +/-0.05
D <sub>0</sub>	1.50 +0.10/-0	1.50 +0.1/-0
D <sub>1</sub>	-	-
E	1.75 +/-0.10	1.75 +/-0.10
F	3.50 +/-0.05	3.50 +/-0.05

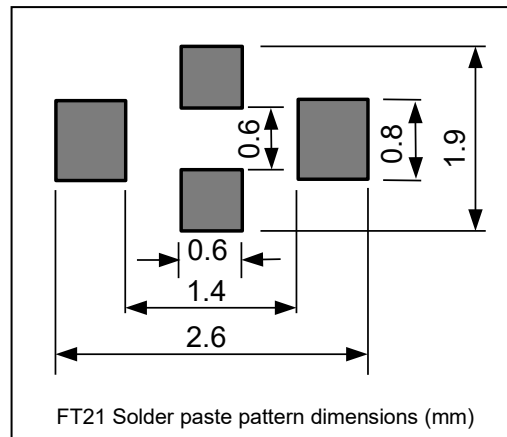
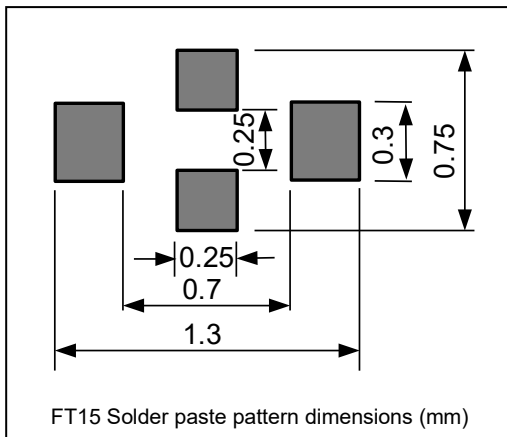
Reel size	7"
C	13.0±0.5
W <sub>1</sub>	10.0±1.5
A	178.0±2.0
N	60.0+1.0/-0

#### ■ Peeling force (EIA-481)

Peel-off force should be in the range of 10 grams to 100 grams at a peel-off speed of 300±10 mm/min.



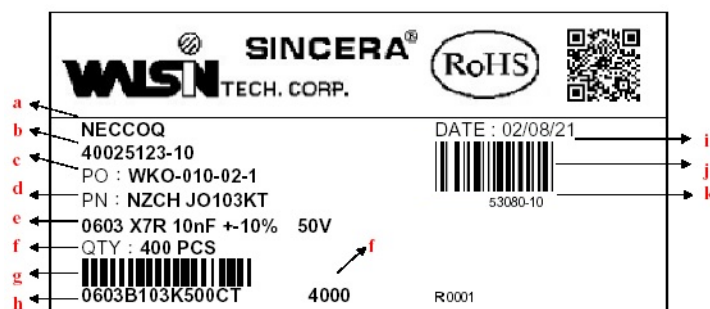
#### ■ Guideline of solder paste





## Multilayer Ceramic Capacitors

### Example 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

\*Customized label is available upon request

### Constructions

No.	Name	X7R, X5R
①	Ceramic material	BaTiO <sub>3</sub> based
②	Inner electrode	Ni
③	Inner layer	Cu
④	Middle layer	Ni
⑤	Outer layer	Sn

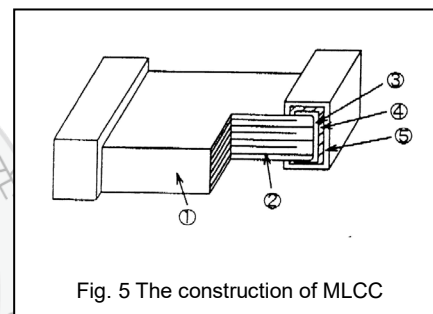


Fig. 5 The construction of MLCC

### Storage and handling conditions

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



## Multilayer Ceramic Capacitors

### 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.

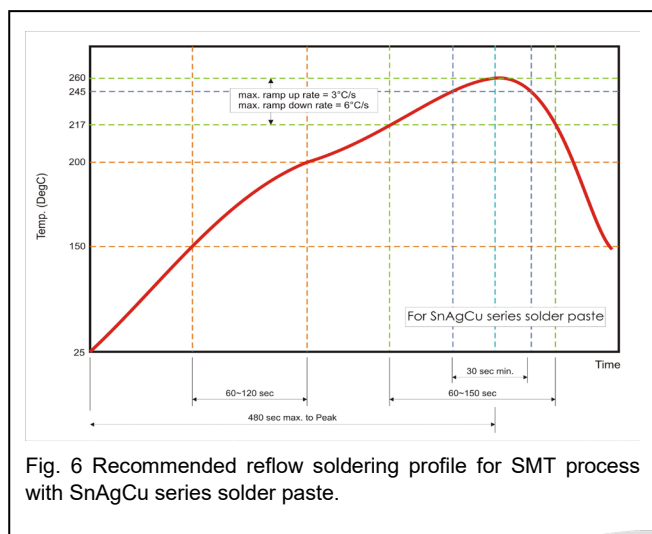


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

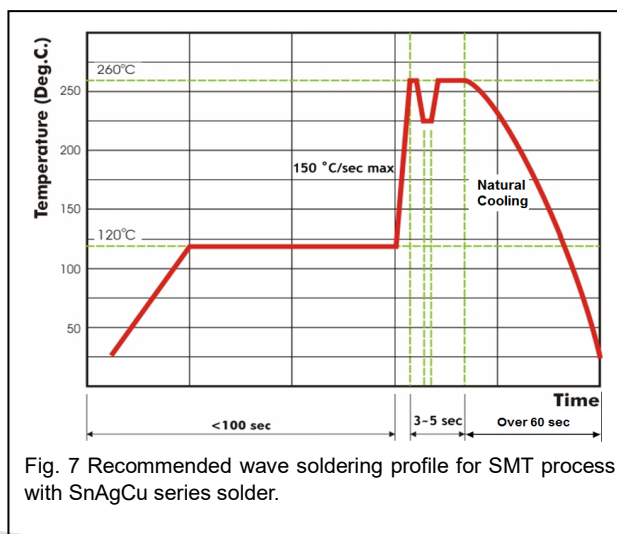


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

