

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Low Profile Series

0603 to 1210 Sizes

X5R & Y5V Dielectrics

RoHS Compliance

CUSTOMER: _____

APPROVAL NO.: _____

ISSUE DATE: _____

APPROVED BY: Hank Chiang

CUSTOMER APPROVAL:

MULTILAYER CERAMIC CAPACITORS

Low Profile 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 TT series MLCC is used in product having thickness concerned generally have high capacitance and thinner product thickness. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

2. FEATURES

- Standard size with thin thickness.
- Small size with high capacitance.
- Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

- For LCD panels.
- For PCMCIA cards.
- For IC packaging and modules.
- Any thickness concerned products.

4. HOW TO ORDER

<u>TT</u>	<u>31</u>	<u>X</u>	<u>225</u>	<u>M</u>	<u>100</u>	<u>C</u>	<u>I</u>
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging style
TT=Low profile	18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225)	X=X5R F=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 225=22x10 ⁵ =2,200,000pF =2.2μF	K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 160=16 VDC	C=Cu/Ni/Sn	T=7" reel (paper tape) P=7" reel (plastic tape)

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Tmax (mm)/Symbol		M _B (mm)
0603(1608)	1.6+0.15/-0.10	0.8+0.15/-0.10	0.60	H	0.50±0.20
0805 (2012)	2.00±0.20	1.25±0.20	0.95	T	0.50±0.20
1206 (3216)	3.20±0.20	1.60±0.20	0.95	T	0.60±0.20
			1.25	J	
1210 (3225)	3.20±0.30	2.50±0.20	0.95	T	0.75±0.25
			1.25	J	
			1.35	D	

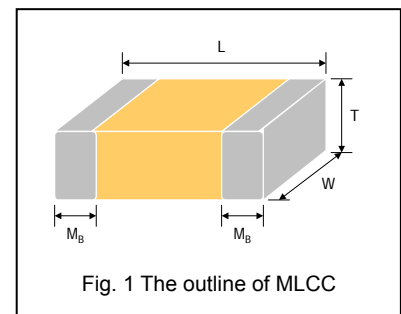


Fig. 1 The outline of MLCC

* Reflow soldering process only is recommended.

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6. GENERAL ELECTRICAL DATA

Dielectric	X5R	Y5V
Size	0603,0805, 1206, 1210	
Capacitance range*	0.22 μ F to 10 μ F	2.2 μ F to 22 μ F
Capacitance tolerance	K (\pm 10%), M (\pm 20%)	Z (-20/+80%)
Rated voltage (WVDC)	6.3V, 10V	10V, 16V
Tan δ *	10V: \leq 5.0% 6.3V: \leq 7.5%	16V: 9.0% 10V: 12.5%
Insulation resistance at Ur	RxC \geq 500 Ω xF	
Operating temperature	-55 to +85°C	-25 to +85°C
Capacitance characteristic	\pm 15%	+30/-80%
Termination	Ni/Sn (lead-free termination)	

* Measured at 1.0 \pm 0.2Vrms, 1.0kHz \pm 10%, 30~70% related humidity, 25°C ambient temperature for X7R, X5R and at 20°C for Y5V.

7. CAPACITANCE RANGE

Dielectric	Size	Capacitance	Tolerance	Rated Voltage (VDC)	Thickness Max (mm)	Part Number
X5R	0603	0.22 μ F	\pm 10%, \pm 20%	10	0.60	TT18X224□100CT
		1.0 μ F	\pm 10%, \pm 20%	10	0.95	TT21X105□100CT
	0805	4.7 μ F	\pm 10%, \pm 20%	6.3	0.95	TT21X475□6R3CT
		2.2 μ F	\pm 10%, \pm 20%	10	0.95	TT31X225□100CT
		4.7 μ F	\pm 10%, \pm 20%	10	0.95	TT31X475□100CT
		10 μ F	\pm 10%, \pm 20%	10	1.30	TT31X106□100CT
	1210	3.3 μ F	\pm 10%, \pm 20%	10	0.95	TT32X335□100CP
		4.7 μ F	\pm 10%, \pm 20%	10	0.95	TT32X475□100CP
Y5V	0805	2.2 μ F	-20/+80%	16	0.95	TT21F225Z160CT
		3.3 μ F	-20/+80%	10	0.95	TT21F335Z100CT
		4.7 μ F	-20/+80%	10	0.95	TT21F475Z100CT
	1206	4.7 μ F	-20/+80%	10	0.95	TT31F475Z100CT
		4.7 μ F	-20/+80%	16	0.95	TT31F475Z160CT
		10 μ F	-20/+80%	10	0.95	TT31F106Z100CT
		10 μ F	-20/+80%	16	1.25	TT31F106Z160CP
	1210	10 μ F	-20/+80%	10	0.95	TT32F106Z100CT

□ Please specify the capacitance tolerance code.

1. This series product is suited to reflow soldering process only.

8. PACKAGING STYLE AND QUANTITY

Size	Thickness Max (mm)/Symbol		7" reel	
			Paper tape	Plastic tape
0603(1608)	0.60	H	4K	-
0805 (2012)	0.95	T	4k	-
1206 (3216)	0.95	T	4k	-
	1.25	J	-	3k
1210 (3225)	0.95	T	-	3k
	1.25	J	-	3k
	1.35	D	-	3k

Unit: pieces

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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	Cap≤10μF, 1.0±0.2Vrms, 1kHz±10%	Shall not exceed the limits given in the detailed spec.																
3.	Q/ D.F. (Dissipation Factor)	Cap>10μF, 0.5±0.2Vrms, 120Hz±20%	X7R/X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> </tr> </thead> <tbody> <tr> <td>25V</td> <td>≤7%</td> </tr> <tr> <td>16V/10V</td> <td>≤10%</td> </tr> <tr> <td>6.3V</td> <td>≤10%</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> </tr> </thead> <tbody> <tr> <td>50V</td> <td>≤5.0%</td> </tr> <tr> <td>25V</td> <td>≤9.0%</td> </tr> <tr> <td>16V/10V</td> <td>≤12.5%</td> </tr> </tbody> </table>	Rated vol.	D.F.	25V	≤7%	16V/10V	≤10%	6.3V	≤10%	Rated vol.	D.F.	50V	≤5.0%	25V	≤9.0%	16V/10V	≤12.5%
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4.	Dielectric Strength	<ul style="list-style-type: none"> 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. Rated voltage: 100~500V To apply rated voltage for 60 sec. Rated voltage: >500V To apply 500V for 60 sec.	≥10GΩ or RxC≥500Ω-F whichever is smaller. ≥10GΩ ≥10GΩ																
6.	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>-55~85°C at 25°C</td> </tr> <tr> <td>Y5V</td> <td>-25~85°C at 20°C</td> </tr> </tbody> </table>	T.C.	Operating Temp	X7R	-55~125°C at 25°C	X5R	-55~85°C at 25°C	Y5V	-25~85°C at 20°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>Within ±15%</td> </tr> <tr> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	X7R	-55~125°C at 25°C	X5R	Within ±15%	Y5V	Within +30%/-80%
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7.	Adhesive Strength of Termination	<ul style="list-style-type: none"> Pressurizing force : 10N Test time: 10±1 sec. 	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.) 	<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. 	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. 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/X5R: within ±12.5% Y5V: within ±30% (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: 270±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 48±4 hrs at room temp. Measurement to be made after keeping at room temp. for 48±4 hrs. (Class II). 	<ul style="list-style-type: none"> No remarkable damage. Cap change: X7R/X5R: within ±7.5% Y5V: within ±20% Q/D.F., I.R. and dielectric strength: To meet initial requirements. 25% max. leaching on each edge. 																

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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>Measurement to be made after keeping at room temp. for 48±4 hrs.</p>	<p>*No remarkable damage.</p> <p>*Cap change : X7R/X5R: ≥10V, within ±12.5% 6.3V, within ±25%</p> <p>Y5V: ≥10V, within ±30% 6.3V, within +30/-40%</p> <p>*Q/D.F. value:</p> <p>X7R/X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">25V</td> <td rowspan="2">5.0%</td> <td>10.0% 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>14.0% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5.0%</td> <td>10.0% 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF</td> </tr> <tr> <td>15.0% 0402 ≥ 0.056μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF, TT series & Cap ≥ 1μF</td> </tr> <tr> <td>6.3V</td> <td>15.0%</td> <td>30.0% 0805 ≥ 10μF; 1210 ≥ 100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10.0% 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>12.5% 0402 ≥ 0.047μF</td> </tr> <tr> <td>16V</td> <td>12.5%</td> <td>---</td> </tr> <tr> <td>10V</td> <td>15.0%</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>30.0%</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V 1GΩ or 50Ω-F whichever is smaller. 6.3V, 10Ω-F</p>	Rated vol.	D.F. ≤	Exception of D.F. ≤	25V	5.0%	10.0% 0805 ≥ 1μF; 1210 ≥ 10μF	14.0% 0603 ≥ 0.33μF	16V	5.0%	10.0% 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF	15.0% 0402 ≥ 0.056μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF, TT series & Cap ≥ 1μF	6.3V	15.0%	30.0% 0805 ≥ 10μF; 1210 ≥ 100μF	Rated vol.	D.F. ≤	Exception of D.F. ≤	25V	7.5%	10.0% 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	12.5% 0402 ≥ 0.047μF	16V	12.5%	---	10V	15.0%	---	6.3V	30.0%	---
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No.	Item	Test Condition	Requirements																																																	
15.	High Temperature Load (Endurance)	<p>Test temp. :</p> <p>X7R: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C</p> <p>To apply voltage:</p> <p>1) 6.3V or C ≥ 10μF: 150% of rated voltage. 10V ≤ Ur < 500V: 200% of rated voltage. 150% of rated voltage for below exception range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0603</td> <td>X5R</td> <td>10V, 16V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>0805</td> <td>X5R</td> <td>10V</td> <td>C ≥ 4.7μF C ≥ 2.2μF & T = 0.85 ± 0.1mm</td> </tr> <tr> <td>1206</td> <td>X5R</td> <td>10V</td> <td>C ≥ 4.7μF & T = 0.85 ± 0.1mm</td> </tr> </tbody> </table> <p>Test time: 1000+24/-0 hrs. *Measurement to be made after keeping at room temp. for 48±4 hrs. (Class II).</p>	Size	Dielectric	Rated voltage	Capacitance range	0603	X5R	10V, 16V	C ≥ 1.0μF	0805	X5R	10V	C ≥ 4.7μF C ≥ 2.2μF & T = 0.85 ± 0.1mm	1206	X5R	10V	C ≥ 4.7μF & T = 0.85 ± 0.1mm	<p>No remarkable damage.</p> <p>Cap change: X7R/X5R: ≥10V, within ±12.5% 6.3V: within ±25% Y5V: ≥10V, within ±30% 6.3V, within +30/-40%</p> <p>Q/D.F. value:</p> <p>X7R/X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">25V</td> <td>10.0%</td> <td>0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>14.0%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td>16V</td> <td>5.0%</td> <td>10.0% 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF</td> </tr> <tr> <td>10V</td> <td>7.5%</td> <td>15.0% 0402 ≥ 0.056μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF, TT series & Cap ≥ 1μF</td> </tr> <tr> <td>6.3V</td> <td>15.0%</td> <td>30.0% 0805 ≥ 10μF; 1210 ≥ 100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10.0% 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>12.5% 0402 ≥ 0.047μF</td> </tr> <tr> <td>16V(C ≥ 1.0μF)</td> <td>12.5%</td> <td>---</td> </tr> <tr> <td>10V</td> <td>15.0%</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>30.0%</td> <td>---</td> </tr> </tbody> </table> <p>I.R.: ≥10V, 1GΩ or 50Ω-F whichever is smaller. 6.3V, 10Ω-F</p>	Rated vol.	D.F. ≤	Exception of D.F. ≤	25V	10.0%	0805 ≥ 1μF; 1210 ≥ 10μF	14.0%	0603 ≥ 0.33μF	16V	5.0%	10.0% 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF	10V	7.5%	15.0% 0402 ≥ 0.056μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF, TT series & Cap ≥ 1μF	6.3V	15.0%	30.0% 0805 ≥ 10μF; 1210 ≥ 100μF	Rated vol.	D.F. ≤	Exception of D.F. ≤	25V	7.5%	10.0% 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	12.5% 0402 ≥ 0.047μF	16V(C ≥ 1.0μF)	12.5%	---	10V	15.0%	---	6.3V	30.0%	---
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MULTILAYER CERAMIC CAPACITORS

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10. APPENDIXES

▣ Tape & reel dimensions

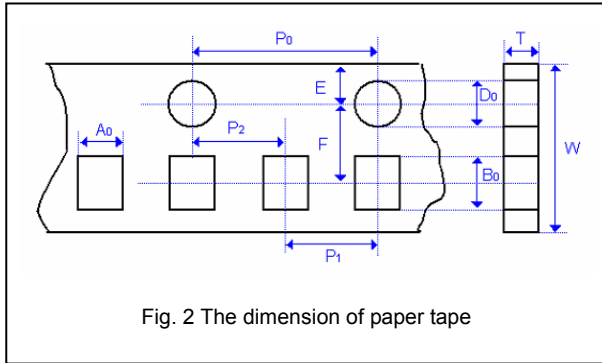


Fig. 2 The dimension of paper tape

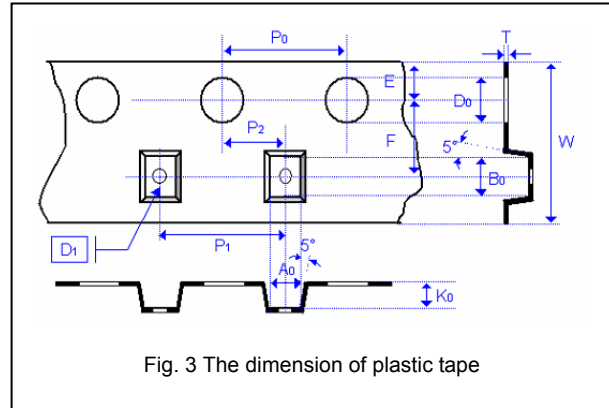


Fig. 3 The dimension of plastic tape

Size	0805	1206		1210	
Thickness	T	T	J	T	J, D
A ₀	1.50±0.10	2.00±0.10	<1.85	<2.97	<2.97
B ₀	2.30±0.10	3.50±0.10	<3.46	<3.73	<3.73
T	0.95±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05
K ₀	-	-	<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
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.100	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
P ₁	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
D ₀	1.55±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
E	1.75±0.05	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

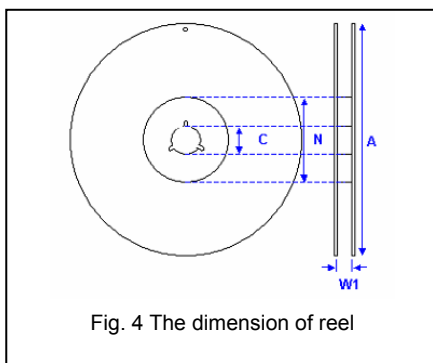


Fig. 4 The dimension of reel

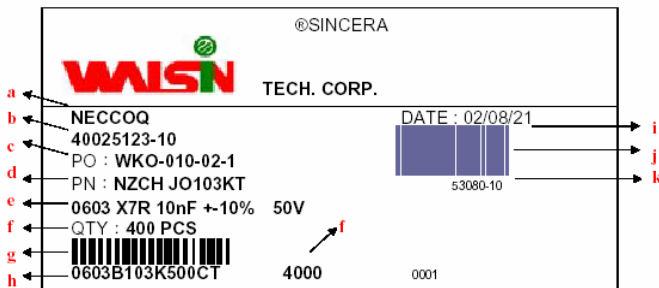
Size	0805, 1206, 1210		
Reel size	7"	10"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0
A	178.0±0.10	250.0±1.0	330.0±1.0
N	60.5±1.0	100.0±1.0	100±1.0

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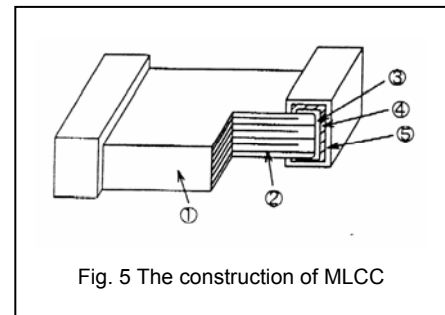
Description of customer label



- 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, X5R, Y5V
①	Ceramic material	BaTiO ₃ based
②	Inner electrode	Ni
③	Termination	Inner layer
④		Middle layer
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 oxidation 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.

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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 N_2 within oven are recommended.

