

## 1. INTRODUCTION

MLCC consists of a conducting material and electrodes. To manufacture chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

MLCC is performed by high precision technology achieve high capacitance in unit size and ensure the stability and reliability of products.

## 2. FEATURES

- a. High capacitance in unit size.
- b. High precision dimensional tolerances.
- c. Suitable used in high-accuracy automatic mounting machine

## 3. APPLICATIONS

- a. Miniature microwave module.
- b. Portable equipments  
( ex. Mobile phone, PDA).
- c. High frequency circuits

## 4. HOW TO ORDER

COG	0201	101	J	1H	N	R
<u>DIELECTRIC</u> NPO=COG X7R = BX X5R=X5R	<u>SIZE</u> 0201	<u>CAPACITANCE</u> 1PF = 1R0 1.5PF = 1R5 2.2PF =2R2 100PF=101 120PF=121 10nF=103 100nF= 104	<u>TOLERANCE</u> A=±0.05PF B=±0.1PF C=±0.25PF D=±0.5PF F=±1% G=±2% J=±5% K=±10% M=±20%	<u>RATED VOLTAGE</u> 1A=6.3V 1B=10V 1C=16V 1E=25V 1H=50V	<u>TERMINATION CODE</u> N=NICKEL BARRIER	<u>PACKING CODE</u> B=BULK R=TAPED ON REEL

## 5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)	M <sub>B</sub> (mm)
0201 (0603)	0.60±0.03	0.30±0.03	0.30±0.03	0.15±0.05

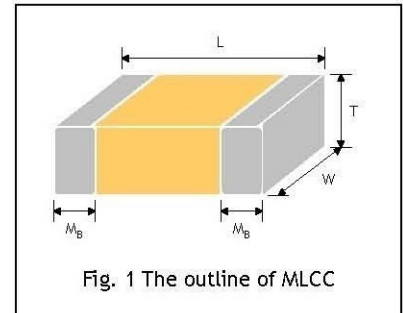


Fig. 1 The outline of MLCC

## 6. GENERAL ELECTRICAL DATA

Size	0201		
Dielectric	NP0	X7R	X5R
Capacitance*	0.3pF to 100pF	100pF to 10nF	100pF to 0.10μF
Capacitance tolerance**	Cap≤5pF: 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%)	J (±5%), K (±10%), M (±20%)	J (±5%),K (±10%), M (±20%)
Rated voltage (WVDC)	16V, 25V, 50V	10V, 16V, 25V, 50V	6.3V,10V, 16V,25V,50V
Tan δ / Q*	Cap<30pF, Q≥400+20C Cap≥30pF, Q≥1000	Ur=50V: ≤3.0% Ur=16V, 25V: ≤3.5% Ur=10V: ≤5.0%	Ur=50V: ≤3.0% Ur=16V, 25V: ≤3.5% Ur=10V: ≤5.0% Ur=6.3V: ≤10%
Insulation resistance at Ur	≥10GΩ	≥10GΩ or RxC≥500ΩxF whichever is less	
Operating temperature	-55 to +125℃		-55 to +85℃
Capacitance change	±30ppm	±15%	
Termination	Ni/Sn (lead-free termination)		

\* Measured at 30~70% related humidity.

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% at the condition of 25°C ambient temperature.

X7R, X5R: Apply 1.0±0.2Vrms, 1.0kHz±10% at the condition 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 24±2 hours before measurement.

## 7. CAPACITANCE RANGE

	SIZE	0201		
	DIELECTRIC	COG		
	RATED VOLTAGE (VDC)	16	25	50
Capacitance	0.3pF (0R3)			
	0.4pF (0R4)			
	0.5pF (0R5)			
	1.0pF (1R0)			
	1.2pF (1R2)			
	1.5pF (1R5)			
	1.8pF (1R8)			
	2.2pF (2R2)			
	2.7pF (2R7)			
	3.0pF (3R0)			
	3.3pF (3R3)			
	3.9pF (3R9)			
	4.0pF (4R0)			
	4.7pF (4R7)			
	5.6pF (5R6)			
	6.8pF (6R8)			
	8.2pF (8R2)			
	10pF (100)			
	12pF (120)			
	15pF (150)			
	18pF (180)			
	22pF (220)			
	27pF (270)			
	33pF (330)			
	39pF (390)			
	47pF (470)			
	56pF (560)			
	68pF (680)			
	82pF (820)			
	100pF (101)			

	SIZE	0201							
	DIELECTRIC	X7R				X5R			
	RATED VOLTAGE (VDC)	10	16	25	50	6.3	10	16	25 50
Capacitance	100pF (101)								
	120pF (121)								
	150pF (151)								
	180pF (181)								
	220pF (221)								
	270pF (271)								
	330pF (331)								
	390pF (391)								
	470pF (471)								
	560pF (561)								
	680pF (681)								
	820pF (821)								
	1,000pF (102)								
	1,500pF (152)								
	2,200pF (222)								
	3,300pF (332)								
	4,700pF (472)								
	6,800pF (682)								
	0.010μF (103)								
	0.015μF (153)								
	0.022μF (223)								
	0.033μF (333)								
	0.047μF (473)								
	0.068μF (683)								
	0.10μF (104)								

## 8. PACKAGING DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape	
		7" reel	13" reel
0201 (0603)	0.30±0.03	15K	-

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	Class I: NP0	* Shall not exceed the limits given in the detailed spec.																
3.	Q/ D.F. (Dissipation Factor)	Cap≤1000pF, 1.0±0.2Vrms, 1MHz±10% Cap>1000pF, 1.0±0.2Vrms, 1KHz±10% Class II: X7R, X5R,Y5V Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% Cap>10μF, 0.5±0.2Vrms, 120Hz±20%	NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R, X5R: <table><tr><th>Rated vol.</th><th>D.F.</th></tr><tr><td>≥50V</td><td>≤3%</td></tr><tr><td>25V</td><td>≤3.5%</td></tr><tr><td>16V</td><td>≤3.5%</td></tr><tr><td>10V</td><td>≤5.0%</td></tr><tr><td>6.3V</td><td>≤10%</td></tr></table>	Rated vol.	D.F.	≥50V	≤3%	25V	≤3.5%	16V	≤3.5%	10V	≤5.0%	6.3V	≤10%				
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6.3V	≤10%																		
4.	Dielectric Strength	* To apply voltage (≤50V) 250%. * 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.	≥10GΩ or RxC≥500Ω-F whichever is smaller. Class II (X5R, X6S, X7R, Y5V) <table><tr><th>Rated voltage</th><th>Insulation resistance</th></tr><tr><td>6.3V</td><td>≥100 Ω-F</td></tr></table>	Rated voltage	Insulation resistance	6.3V	≥100 Ω-F												
Rated voltage	Insulation resistance																		
6.3V	≥100 Ω-F																		
6.	Temperature Coefficient	With no electrical load. <table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>NP0 (C0G)</td><td>-55~125℃ at 25℃</td></tr><tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr><tr><td>X5R</td><td>-55~85℃ at 25℃</td></tr></table>	T.C.	Operating Temp	NP0 (C0G)	-55~125℃ at 25℃	X7R	-55~125℃ at 25℃	X5R	-55~85℃ at 25℃	<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>NP0 (C0G)</td><td>Within ±30ppm/℃</td></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>X5R</td><td>Within ±15%</td></tr></table>	T.C.	Capacitance Change	NP0 (C0G)	Within ±30ppm/℃	X7R	Within ±15%	X5R	Within ±15%
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7.	Adhesive Strength of Termination	* Pressurizing force : 2N * 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.)	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.																
9.	Solderability	* Solder temperature: 235±5℃ * 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: NP0: within ±5.0% or ±0.5pF whichever is larger. X7R, X5R: within ±12.5%  (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)																

# Multilayer Ceramic Chip Capacitors

## Ultra Small Capacitors Series



No.	Item	Test Condition	Requirements															
11.	Resistance to Soldering Heat	<ul style="list-style-type: none"><li>* Solder temperature: 270±5℃</li><li>* Dipping time: 10±1 sec</li><li>* Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.</li><li>* Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48±4 hrs at room temp.</li><li>* Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).</li></ul>	<ul style="list-style-type: none"><li>* No remarkable damage.</li><li>* Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger. X7R, X5R: within ±7.5%</li><li>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</li><li>* 25% max. leaching on each edge.</li></ul>															
12.	Temperature Cycle	<ul style="list-style-type: none"><li>* Conduct the five cycles according to the temperatures and time.</li></ul> <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> <ul style="list-style-type: none"><li>* Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48±4 hrs at room temp.</li><li>* Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).</li></ul>	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	<ul style="list-style-type: none"><li>* No remarkable damage.</li><li>* Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger. X7R, X5R: within ±7.5%</li><li>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</li></ul>
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4	Room temp.	2~3																
13.	Humidity (Steady State)	<ul style="list-style-type: none"><li>* Test temp.: 40±2℃</li><li>* Humidity: 90~95% RH</li><li>* Test time: 500+24/-0hrs.</li><li>* Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).</li></ul>	<ul style="list-style-type: none"><li>* No remarkable damage.</li><li>* Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger.  X7R, X5R: ≥10V, within ±12.5% 6.3V, within ±25%</li><li>* Q/D.F. value: NP0: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥275+2.5C Cap&lt;10pF; Q≥200+10C X7R, X5R:<table><tr><th>Rated vol.</th><th>D.F.</th></tr><tr><td>≥50V</td><td>≤6.0%</td></tr><tr><td>25V</td><td>≤5.0%</td></tr><tr><td>16V</td><td>≤5.0%</td></tr><tr><td>10V</td><td>≤7.5%</td></tr><tr><td>6.3V</td><td>≤15.0%</td></tr></table></li><li>* I.R.: ≥10V, ≥1GΩ or RxC≥50Ω-F whichever is smaller. 6.3V, RxC≥10Ω-F</li></ul>	Rated vol.	D.F.	≥50V	≤6.0%	25V	≤5.0%	16V	≤5.0%	10V	≤7.5%	6.3V	≤15.0%			
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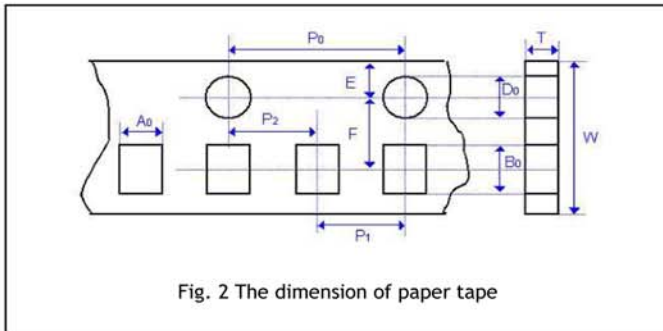
## Ultra Small Capacitors Series



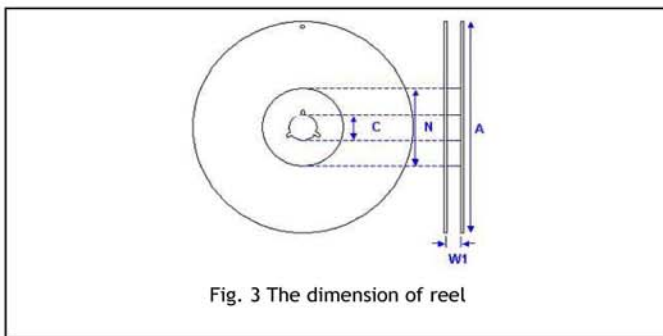
No.	Item	Test Condition	Requirements												
14.	Humidity Load (Damp Heat)	<ul style="list-style-type: none"><li>* Test temp.: 40±2℃</li><li>* Humidity: 90~95%RH</li><li>* Test time: 500+24/-0 hrs.</li><li>* To apply voltage : rated voltage.</li><li>* Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).</li></ul>	<ul style="list-style-type: none"><li>* No remarkable damage.</li><li>* Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger. X7R, X5R: ≥10V, within ±12.5% 6.3V, within ±25%</li><li>* Q/D.F. value: NP0: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥275+2.5C Cap&lt;10pF; Q≥200+10C X7R, X5R:<table><tr><th>Rated vol.</th><th>D.F.</th></tr><tr><td>≥50V</td><td>≤6.0%</td></tr><tr><td>25V</td><td>≤5.0%</td></tr><tr><td>16V</td><td>≤5.0%</td></tr><tr><td>10V</td><td>≤7.5%</td></tr><tr><td>6.3V</td><td>≤15.0%</td></tr></table></li><li>* I.R.: ≥10V, ≥1GΩ or RxC≥25Ω·F whichever is smaller. 6.3V, RxC≥5Ω·F</li></ul>	Rated vol.	D.F.	≥50V	≤6.0%	25V	≤5.0%	16V	≤5.0%	10V	≤7.5%	6.3V	≤15.0%
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6.3V	≤15.0%														
15.	High Temperature Load (Endurance)	<ul style="list-style-type: none"><li>* Test temp.: NP0, X7R: 125±3℃ X5R, Y5V: 85±3℃</li><li>* To apply voltage: (1) 6.3V: 150% of rated voltage. (2) &gt;6.3V: 200% of rated voltage.</li><li>* Test time: 1000+24/-0 hrs.</li><li>* Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).</li></ul>	<ul style="list-style-type: none"><li>* No remarkable damage.</li><li>* Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger. X7R, X5R: ≥10V, within ±12.5% 6.3V, within ±25%</li><li>* Q/D.F. value: NP0: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥275+2.5C Cap&lt;10pF; Q≥200+10C X7R, X5R:<table><tr><th>Rated vol.</th><th>D.F.</th></tr><tr><td>≥50V</td><td>≤6.0%</td></tr><tr><td>25V</td><td>≤5.0%</td></tr><tr><td>16V</td><td>≤5.0%</td></tr><tr><td>10V</td><td>≤7.5%</td></tr><tr><td>6.3V</td><td>≤15.0%</td></tr></table></li><li>* I.R.: ≥10V, ≥1GΩ or RxC≥50Ω·F whichever is smaller. 6.3V, RxC≥10Ω·F</li></ul>	Rated vol.	D.F.	≥50V	≤6.0%	25V	≤5.0%	16V	≤5.0%	10V	≤7.5%	6.3V	≤15.0%
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## 10. APPENDIXES

### ■ Tape & reel dimensions



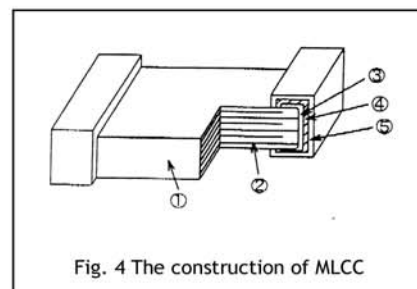
Size	0201
Thickness	$0.30 \pm 0.03$
A <sub>0</sub>	$0.38 \pm 0.05$
B <sub>0</sub>	$0.68 \pm 0.05$
T	$0.42 \pm 0.05$
K <sub>0</sub>	-
W	$8.00 \pm 0.10$
P <sub>0</sub>	$4.00 \pm 0.10$
10xP <sub>0</sub>	$40.0 \pm 0.10$
P <sub>1</sub>	$2.00 \pm 0.05$
P <sub>2</sub>	$2.00 \pm 0.05$
D <sub>0</sub>	$1.55 \pm 0.05$
D <sub>1</sub>	-
E	$1.75 \pm 0.05$
F	$3.50 \pm 0.05$



Size	0201	
Reel size	7"	13"
C	$13.0 \pm 0.5 / -0.2$	$13.0 \pm 0.5 / -0.2$
W <sub>1</sub>	$8.4 \pm 1.5 / -0$	$8.4 \pm 1.5 / -0$
A	$178.0 \pm 0.10$	$330.0 \pm 1.0$
N	$60.0 \pm 1.0 / -0$	$100 \pm 1.0$

### ■ Constructions

No.	Name		NPO	X7R, X5R, Y5V
①	Ceramic material		BaTiO <sub>3</sub> based	
②	Inner electrode		AgPd alloy	Ni
③	Termination	Inner layer	Ag	Cu
④		Middle layer	Ni	
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:

- Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
- To store products on the shelf and avoid exposure to moisture.
- Don't expose products to excessive shock, vibration, direct sunlight and so on.

# Multilayer Ceramic Chip Capacitors

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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.

