

Medium Voltage Multilayer Ceramic Chip Capacitors

1. INTRODUCTION

Medium voltage multilayer ceramic chip capacitors are manufactured by using green materials without lead and cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

2. FEATURES

- a. High Voltage in a given case size.
- b. High reliability and stability.
- c. RoHS compliant.

3. APPLICATIONS

- a. DC to DC converter.
- b. High voltage coupling/DC blocking.
- c. Back-Lighting inverters.
- d. Sunbbers in high frequency power convertors.

4.HOW TO ORDER

COG	1206	100	J	3A	N	R
<u>DIELECTRIC</u>	<u>SIZE</u>	<u>CAPACITANCE</u>	<u>TOLERANCE</u>	<u>RATED VOLTAGE</u>	<u>TERMINATION CODE</u>	<u>PACKING CODE</u>
NPO=COG	0402	1PF = 1R0	A=±0.05PF	2A=100V	N=NICKEL BARRIER	B=BULK R=TAPED ON REEL
X7R = BX	0603	1.5PF = 1R5	B=±0.1PF	2D=200V		
Y5V=Y5V	0805	2.2PF =2R2	C=±0.25PF	2E=250V		
	1206	100PF=101	D=±0.5PF	2H=500V		
	1210	120PF=121	F=±1%			
	1812	10nF=103	G=±2%			
	1825	100nF= 104	J=±5%			
	2220		K=±10%			
	2225		M=±20%			

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5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Tmax (mm)	M _B min (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.55	0.15
0603 (1608)	1.60±0.10	0.80±0.10	0.95	0.20
	1.60+0.15/-0.10	0.80±0.15		
0805 (2012)	2.00±0.20	1.25±0.20	1.45	0.30
1206 (3216)	3.20±0.20	1.60±0.20	1.80	0.30
1210 (3225)	3.20±0.40	2.50±0.30	2.80	0.30
1808 (4520)	4.50±0.40	2.00±0.20	2.20	0.26
1812 (4532)	4.50±0.40	3.20±0.30	2.80	0.26
1825 (4563)	4.60±0.30	6.30±0.40	3.00	0.26
2220 (5750)	5.70±0.40	5.00±0.40	3.00	0.30
2225 (5763)	5.70±0.40	6.30±0.40	3.00	0.30

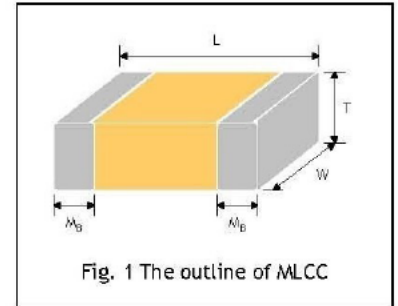


Fig. 1 The outline of MLCC

Reflow soldering only is recommended if the thickness is thicker than 1.05mm except 0402

6. GENERAL ELECTRICAL DATA

Dielectric	NPO	X7R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812	0402, 0603, 0805, 1206, 1210, 1812, 2220, 2225	0402, 0603, 0805, 1206, 1210, 1812
Capacitance range*	0.5pF to 33nF	100pF to 2.2μF	10nF to 1.0μF
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%)	Z (-20/+80%)
Rated voltage (WVDC)	100V, 200V, 250V, 500V, 630V	100V, 200V, 250V, 500V, 630V	100V, 200V, 250V
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	≤2.5%	≤5%
Insulation resistance at U _R **	≥100GΩ or R·C≥1000 whichever is smaller	≥10GΩ or R·C≥100Ω·F whichever is smaller	
Operating temperature	-55 to +125°C		-25 to +85°C
Capacitance characteristic	±30ppm / °C	±15%	+30/-80%
Termination	Cu (or Ag)/Ni/Sn (lead-free termination)		

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

NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature

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

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

**Measured at 500VDC for 60 sec, for U_R>500VDC

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7.CAPACITANCE RANGE (NP0 Dielectric)

7-1. 0402, 0603, 0805, 1206 Sizes.

DIELECTRIC	SIZE	NP0											
		0402		0603		0805			1206				
RATED VOLTAGE (VDC)		100	100	100	200	250	500	630	100	200	250	500	630
Capacitance	0.5pF (0R5)												
	0.6pF (0R6)												
	0.7pF (0R7)												
	0.8pF (0R8)												
	0.9pF (0R9)												
	1.0pF (1R0)												
	1.2pF (1R2)												
	1.5pF (1R5)												
	1.8pF (1R8)												
	2.2pF (2R2)												
	2.7pF (2R7)												
	3.3pF (3R3)												
	3.9pF (3R9)												
	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)												
	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)													
1,200pF (122)													
1,500pF (152)													
1,800pF (182)													
2,200pF (222)													
2,700pF (272)													
3,300pF (332)													
3,900pF (392)													
4,700pF (472)													
5,600pF (562)													
6,800pF (682)													
8,200pF (822)													
0.010μF (103)													

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7-1. 1210, 1812 Sizes

Capacitance	DIELECTRIC	NP0									
	SIZE	1210					1812				
	RATED VOLTAGE (VDC)	100	200	250	500	630	100	200	250	500	630
1.0pF (1R0)											
1.2pF (1R2)											
1.5pF (1R5)											
1.8pF (1R8)											
2.2pF (2R2)											
2.7pF (2R7)											
3.3pF (3R3)											
3.9pF (3R9)											
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)											
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)											
1,200pF (122)											
1,500pF (152)											
1,800pF (182)											
2,200pF (222)											
2,700pF (272)											
3,300pF (332)											
3,900pF (392)											
4,700pF (472)											
5,600pF (562)											
6,800pF (682)											
8,200pF (822)											
0.010μF (103)											
0.012μF (123)											
0.015μF (153)											
0.018μF (183)											
0.022μF (223)											
0.027μF (273)											
0.033μF (333)											
0.039μF (393)											

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8. CAPACITANCE RANGE (X7R Dielectric)

8.1 0603, 0805, 1206, 1210 Sizes

DIELECTRIC	SIZE	X7R																
		0603			0805				1206					1210				
RATED VOLTAGE (VDC)		100	200	250	100	200	250	500	100	200	250	500	630	100	200	250	500	630
100pF (101)																		
120pF (121)																		
150pF (151)																		
180pF (181)																		
220pF (221)																		
270pF (271)																		
330pF (331)																		
390pF (391)																		
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560pF (561)																		
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1,200pF (122)																		
1,500pF (152)																		
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2,700pF (272)																		
3,300pF (332)																		
3,900pF (392)																		
4,700pF (472)																		
5,600pF (562)																		
6,800pF (682)																		
8,200pF (822)																		
0.010μF (103)																		
0.012μF (123)																		
0.015μF (153)																		
0.018μF (183)																		
0.022μF (223)																		
0.027μF (273)																		
0.033μF (333)																		
0.039μF (393)																		
0.047μF (473)																		
0.056μF (563)																		
0.068μF (683)																		
0.082μF (823)																		
0.10μF (104)																		
0.12μF (124)																		
0.15μF (154)																		
0.18μF (184)																		
0.22μF (224)																		
0.27μF (274)																		
0.33μF (334)																		
0.39μF (394)																		
0.47μF (474)																		
0.56μF (564)																		
0.68μF (684)																		
0.82μF (824)																		
1.0μF (105)																		

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8-2. 1808, 1812, 2220, 2225 Sizes

DIELECTRIC	SIZE	X7R																
		1808				1812				2220				2225				
RATED VOLTAGE (VDC)		100	200	250	500	100	200	250	500	630	100	200	250	500	100	200	250	500
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)																	
	1,200pF (122)																	
	1,500pF (152)																	
	1,800pF (182)																	
	2,200pF (222)																	
	2,700pF (272)																	
	3,300pF (332)																	
	3,900pF (392)																	
	4,700pF (472)																	
	5,600pF (562)																	
	6,800pF (682)																	
	8,200pF (822)																	
	0.010μF (103)																	
	0.012μF (123)																	
	0.015μF (153)																	
	0.018μF (183)																	
	0.022μF (223)																	
	0.027μF (273)																	
	0.033μF (333)																	
	0.039μF (393)																	
	0.047μF (473)																	
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	0.15μF (154)																	
	0.18μF (184)																	
0.22μF (224)																		
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0.47μF (474)																		
0.56μF (564)																		
0.68μF (684)																		
0.82μF (824)																		
1.0μF (105)																		
1.2μF (125)																		
1.5μF (155)																		
1.8μF (185)																		
2.2μF (225)																		

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9. CAPACITANCE RANGE (Y5V Dielectric)

9-1. 0805, 1206, 1210, 1812 Sizes

DIELECTRIC SIZE		Y5V											
RATED VOLTAGE(VDC)		0805			1206			1210			1812		
		100	200	250	100	200	250	100	200	250	100	200	250
Capacitance	0.010 μ F (103)												
	0.015 μ F (153)												
	0.022 μ F (223)												
	0.033 μ F (333)												
	0.047 μ F (473)												
	0.068 μ F (683)												
	0.10 μ F (104)												
	0.15 μ F (154)												
	0.18 μ F (184)												
	0.22 μ F (224)												
	0.33 μ F (334)												
	0.47 μ F (474)												
	0.68 μ F (684)												
	1.0 μ F (105)												

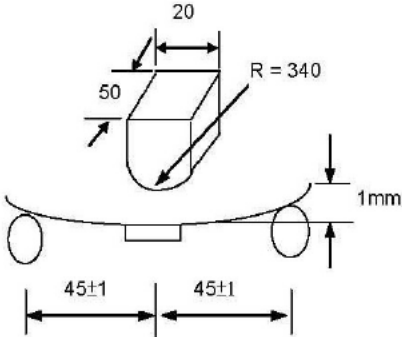
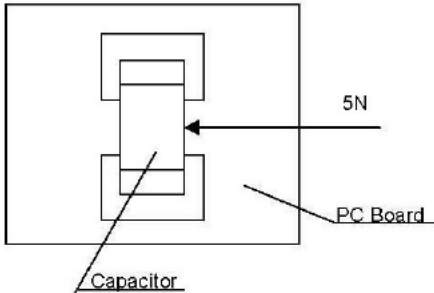
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10. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

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	Class I: (NP0)	* Shall not exceed the limits given in the detailed spec.																
3.	Q/ D.F. (Dissipation Factor)	Cap \leq 1000pF, 1.0 \pm 0.2Vrms, 1MHz \pm 10% Cap $>$ 1000pF, 1.0 \pm 0.2Vrms, 1KHz \pm 10% Class II: (X7R, Y5V) 1.0 \pm 0.2Vrms, 1kHz \pm 10%	NP0: Cap \geq 30pF, Q \geq 1000; Cap $<$ 30pF, Q \geq 400+20C X7R: \leq 2.5% Y5V: \leq 5.0%																
4.	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NP0</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°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	NP0	-55~125°C at 25°C	X7R	-55~125°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>NP0</td> <td>Within \pm30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within \pm15%</td> </tr> <tr> <td>Y5V</td> <td>Within +30%/ -80%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	NP0	Within \pm 30ppm/°C	X7R	Within \pm 15%	Y5V	Within +30%/ -80%
T.C.	Operating Temp																		
NP0	-55~125°C at 25°C																		
X7R	-55~125°C at 25°C																		
Y5V	-25~85°C at 20°C																		
T.C.	Capacitance Change																		
NP0	Within \pm 30ppm/°C																		
X7R	Within \pm 15%																		
Y5V	Within +30%/ -80%																		
5.	Insulation Resistance	UR=100V: To apply voltage at UR for max. 120 sec. UR $>$ 100V: To apply voltage at UR (500V max.) for 60 sec.	Class I (NP0) : \geq 100G Ω or Rx \leq 1000 Ω -F whichever is smaller. Class II (X7R, Y5V) : \geq 10G Ω or Rx \leq 100 Ω -F whichever is smaller.																
6.	Dielectric Strength	* To apply voltage: 100V =2.5 times of UR 200V/250V =2 times of UR 500V/630V =1.5 times of UR * Duration: 1 to 5 sec.	* No evidence of damage or flashover during test.																
7.	Solderability	* Solder temperature: 245 \pm 5°C * Dipping time: 5 \pm 0.5 sec.	75% min. coverage of all metalized area.																
8.	Resistance to Soldering Heat	* Solder temperature: 260 \pm 5°C * Dipping time: 10 \pm 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 \pm 0/-10°C for 1 hr and then set for 48 \pm 4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs (Class I) or 48 \pm 4 hrs (Class II).	* No remarkable damage. * Cap change: NP0: within \pm 2.5% or \pm 0.25pF whichever is larger. X7R: within \pm 7.5% Y5V: within \pm 20% * 25% max. leaching on each edge.																
9.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30\pm3</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\pm3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> * Before initial measurement (Class II only): Perform 150 \pm 0/-10°C for 1 hr and then set for 48 \pm 4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs (Class I) or 48 \pm 4 hrs (Class II).	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30 \pm 3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30 \pm 3	4	Room temp.	2~3	* No remarkable damage. * Cap change : NP0: within \pm 2.5% or \pm 0.25pF whichever is larger. X7R: within \pm 15% Y5V: within \pm 20% * Q/D.F.: NP0: \leq 2.0 \times Initial requirement X7R: \leq 1.5 \times Initial requirement Y5V: \leq 1.5 \times Initial requirement * I.R. \geq 0.25 \times initial requirements.	
Step	Temp. (°C)	Time (min.)																	
1	Min. operating temp. +0/-3	30 \pm 3																	
2	Room temp.	2~3																	
3	Max. operating temp. +3/-0	30 \pm 3																	
4	Room temp.	2~3																	
10.	Humidity (Damp Heat) Steady State	* Test temp.: 40 \pm 2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs (Class I) or 48 \pm 4 hrs (Class II).	* No remarkable damage. * Cap change: NP0 : within \pm 5% or \pm 2pF whichever is larger X7R : within \pm 15% Y5V : within \pm 30% * Q/D.F Value: NP0: Cap \geq 30pF :Q \geq 350; 10pF \leq Cap $<$ 30pF :Q \geq 275+2.5C; Cap $<$ 10pF :Q \geq 200+10C X7R: \leq 7.0% Y5V: \leq 7.5% * I.R.: \geq 1G Ω or Rx \leq 50 Ω -F whichever is smaller.																

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10. RELIABILITY TEST CONDITIONS AND REQUIREMENTS (Cont.)

No.	Item	Test Condition	Requirements
11.	High Temperature Load (Endurance)	<p>* Test temp.: NP0, X7R: 125±3°C Y5V: 85±3°C</p> <p>* To apply voltage: (1) $U_R < 500V$: 200% of rated voltage. (2) $U_R = 500V$: 150% of rated voltage. (3) $U_R = 630V$: 120% of rated voltage.</p> <p>* Test time: 1000+24/-0 hrs.</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p>	<p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±5% or ±2pF whichever is larger X7R: within ±15% Y5V: within ±30%</p> <p>* Q/D.F Value: NP0: Cap ≥ 30pF : Q ≥ 350; 10pF ≤ Cap < 30pF : Q ≥ 275+2.5C; Cap < 10pF : Q ≥ 200+10C</p> <p>X7R: ≤ 7.0% Y5V: ≤ 7.5%</p> <p>* I.R.: ≥ 1GΩ or $R_x C \geq 50\Omega \cdot F$ whichever is smaller.</p>
12.	Resistance to Flexure of Substrate	<p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm.</p> 	<p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±10% X7R: within ±12.5% Y5V: within ±30%</p> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p>
13.	Adhesive Strength of Termination	<p>* Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 second.</p> 	<p>* No remarkable damage or removal of the terminations.</p>