

Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

multicompPRO

**RoHS
Compliant**



Description

The resistors middle and high voltage series MLCC is designed by a special internal electrode pattern, which can reduce voltage concentrations by distributing voltage gradients throughout the entire capacitor. This special design also affords increased capacitance values in a given case size and voltage rating.

Capacitors with X7R dielectrics are not intended for AC line filtering applications. Capacitors may require protective surface coating to prevent external arcing.

Features

- High voltage in a given case size.
- High stability and reliability.

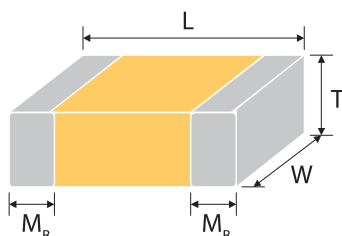
Application

- Snubbers in high frequency power converters.
- High voltage coupling/DC blocking.
- DC-DC converters.
- Back-lighting inverters

How To Order

1808 Size	N Dielectric	100 Capacitance	J Tolerance	202 Rated Voltage	C Termination	I Packaging style
Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532)	N=NP0 (C0G) B=X7R F=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. Eg.: 0R5=0.5pF 1R0=1.0pF 100 = 10×10 ¹⁰ = 10pF	B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 201=200V DC 251=250V DC 401=400V DC 451=450V DC 501=500V DC 631=630V DC 102=1000V DC 152=1500V DC 202=2000V DC 252=2500V DC 302=3000V DC 402=4000V DC	C=Cu/Ni/Sn	T=7" reeled G=13" reeled

External Dimensions



The outline of MLCC

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M _B (mm)
0402 (1005)	1 ±0.05	0.5 ±0.05	0.5 ±0.05	N	#	0.25 +0.05/-0.1
0603 (1608)	1.6 ±0.1	0.8 ±0.1	0.8 ±0.07	S	-	0.4 ±0.15
	1.6 +0.15/-0.1	0.8 +0.15/-0.1	0.8 +0.15/-0.1	X	-	
0805 (2012)	2 ±0.15	1.25 ±0.1	0.6 ±0.1	A	-	0.5 ±0.2
			0.8 ±0.1	B		
			1.25 ±0.1	D		
	2 ±0.2	1.25 ±0.2	1.25 ±0.2	I	#	

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Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M _B (mm)
1206 (3216)	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1	B	#	0.6 ±0.2 (0.5±0.25)*
			0.95 ±0.1	C		
			1.25 ±0.1	D		
	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2	G		
	3.2 +0.3/-0.1	1.6 +0.3/-0.1	1.6 +0.3/-0.1	P		
1210 (3225)	3.2 ±0.3	2.5 ±0.2	0.95 ±0.1	C	#	0.75 ±0.25
			1.25 ±0.1	D	#	
	3.2 ±0.4	2.5 ±0.3	1.6 ±0.2	G	#	
			2 ±0.2	K	#	
			2.5 ±0.3	M	#	
	3.2 ±0.6**	2.5 ±0.5**	2.5 ±0.5**			
1808 (4520)	4.5 +0.5/-0.3	2.03 ±0.25	1.25 ±0.1	D	#	0.5 ±0.25
			2 ±0.2	K	#	
1812 (4532)	4.5 +0.5/-0.3	3.2 ±0.3	1.25 ±0.1	D	#	0.5 ±0.25
			1.6 ±0.2	G	#	
			2 ±0.2	K	#	
		3.2 ±0.4	2.5 ±0.3	M	#	
			2.8 ±0.3	U	#	

Reflow soldering only is recommended.

*For 1206_1000V ~3000V products.

** For 1210_100V: Cap > 1μF, 250V: Cap >0. 47μF, 400V~630V: Cap >0.22μF.

General Electrical Data

Dielectric	NP0	X7R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1808, 1812		0805, 1206, 1210, 1812
Capacitance range*	0.5pF to 0.033μF	100pF to 1μF	0.01μF to 0.68μF
Capacitance tolerance***	Cap≤5pF: C (±0.25pF) 5pF<Cap<10pF: D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%),K (±10%)	K (±10%), M (±20%)	Z (-20/+80%)
Rated voltage (WVDC)	200V to 4000V		200V, 250V
Q/DF*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	DF≤2.5%	DF≤5%
Insulation resistance at Ur**	Ur=200~630V: ≥10GΩ or RxC≥100Ω-F whichever is smaller Ur=1000~3000V: ≥10GΩ		
Dielectric Strength	200~300V: ≥2 × WVDC; 400V~450V: ≥1.2 × WVDC 500~999V: ≥1.5 × WVDC; 1000~3000V: ≥1.2 × WVDC 4000: ≥1.1 × WVDC		
Operating temperature	-55°C to +125°C		-25°C to +85°C
Capacitance characteristic	±30ppm	±15%	+30/-80%
Termination	Ni/Sn (lead-free termination)		

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

NP0: Apply $1 \pm 0.2V_{rms}$, $1MHz \pm 10\%$ for $Cap \leq 1000pF$ and $1 \pm 0.2V_{rms}$, $1kHz \pm 10\%$ for $Cap > 1000pF$,
25°C at ambient temperature

X7R, X5R: Apply $1 \pm 0.2V_{rms}$, $1kHz \pm 10\%$, at 25°C ambient temperature.

Y5V: Apply $1 \pm 0.2V_{rms}$, $1kHz \pm 10\%$, at 20°C ambient temperature.

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

Capacitance Range (Middle Voltage - 200V to 630V)

NP0 Dielectric

Dielectric		NP0																							
Size		0402		0603		0805				1206				1210				1808		1812					
Rated Voltage (V DC)		200	250	200	250	200	250	500	630	200	250	500	630	200	250	500	630	500	630	200	250	500	630		
Capacitance	0.5pF (0R5)	N	N	S	S	A	A	A	A																
	1.0pF (1R0)	N	N	S	S	A	A	A	A																
	1.2pF (1R2)	N	N	S	S	A	A	A	A																
	1.5pF (1R5)	N	N	S	S	A	A	A	A	B	B	B	B												
	1.8pF (1R8)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	2.2pF (2R2)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	2.7pF (2R7)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	3.3pF (3R3)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	3.9pF (3R9)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	4.7pF (4R7)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	5.6pF (5R6)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	6.8pF (6R8)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	8.2pF (8R2)	N	N	S	S	A	A	A	A	B	B	B	B					D	D						
	10pF (100)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	12pF (120)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	15pF (150)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	18pF (180)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	22pF (220)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	27pF (270)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	33pF (330)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	39pF (390)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	47pF (470)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	56pF (560)	N	N	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	68pF (680)	N		S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	82pF (820)	N		S	S	A	A	B	B	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	100pF (101)	N		S	S	A	B	B	B	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	120pF (121)			S	S	A	B	D	D	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	150pF (151)			S	S	B	D	D	D	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	180pF (181)			S	S	B	D	D	D	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	220pF (221)			S	S	D	D	D	D	B	B	B	B	C	C	C	C	D	D	D	D	D	D		
	270pF (271)			X	X	D	D	D	D	B	C	C	C	C	C	C	C	K	K	D	D	D	D		
	330pF (331)			X	X	D	D	D	D	B	C	C	C	C	C	C	C	K	K	D	D	D	D		
	390pF (391)			X	X	D	D	D	D	B	C	C	C	C	C	C	C	K	K	D	D	D	D		

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Dielectric		NP0																							
Size		0402		0603		0805				1206				1210				1808		1812					
Rated Voltage (V DC)		200	250	200	250	200	250	500	630	200	250	500	630	200	250	500	630	500	630	200	250	500	630		
Capacitance	470pF (471)			X	X	D	D	I	I	C	C	C	C	C	C	C	C	K	K	D	D	D	D		
	560pF (561)			X	X	D	D	I	I	C	D	D	D	C	C	C	C	K	K	D	D	D	D		
	680pF (681)					D	D	I	I	C	D	D	D	C	C	C	C	K	K	D	D	D	D		
	820pF (821)					D	D	I	I	C	G	G	G	C	C	C	C	K	K	D	D	D	D		
	1,000pF (102)					D	D	I	I	C	G	G	G	D	D	D	D	K	K	D	D	D	D		
	1,200pF (122)					D	D			C	G	G	G	D	D	D	D	K	K	D	D	D	D		
	1,500pF (152)					D	D			D	G	G	G	D	D	D	D	K	K	D	D	D	D		
	1,800pF (182)					D	D			D	G	G	G	D	D	D	D	K	K	D	D	D	D		
	2,200pF (222)					D	D			D	G	G	G	D	D	D	D	K	K	D	D	D	D		
	2,700pF (272)									D	G			D	D	D	D			D	D	D	D		
	3,300pF (332)									D	G			D	D	D	D			D	D	D	D		
	3,900pF (392)									D	G			D	D	D	D			D	D				
	4,700pF (472)									D	G			G	G					D	D				
	5,600pF (562)													G	G					D	D				
	6,800pF (682)													G	G					D	D				
	8,200pF (822)													G	G										
	0.010μF (103)													G	G										
	0.022μF (223)													M	M										
	0.033μF (333)													M	M										

X7R Dielectric

Dielectric		X7R																											
Size		0603		0805				1206						1210						1808		1812							
Rated Voltage (V DC)		200	250	200	250	500	630	200	250	400	450	500	630	200	250	400	450	500	630	500	630	200	250	500	630				
Capacitance	100pF (101)	X	X	B	B	B	B	D	D			D	D	D	D			D	D										
	120pF (121)	X	X	B	B	B	B	D	D			D	D	D	D			D	D										
	150pF (151)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	180pF (181)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	220pF (221)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	270pF (271)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	330pF (331)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	390pF (391)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	470pF (471)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	560pF (561)	X	X	B	B	B	B	D	D			D	D	D	D			D	D	D	D								
	680pF (681)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D								
	820pF (821)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D								
	1,000pF (102)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D				
	1,200pF (122)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D				
	1,500pF (152)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D				
	1,800pF (182)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D				
	2,200pF (222)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D				

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Dielectric		X7R																							
Size		0603		0805				1206						1210						1808		1812			
Rated Voltage (V DC)		200	250	200	250	500	630	200	250	400	450	500	630	200	250	400	450	500	630	500	630	200	250	500	630
Capacitance	2,700pF (272)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D
	3,300pF (332)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D
	3,900pF (392)	X	X	B	B	B	B	D	D			D	D	C	C			D	D	D	D	D	D	D	D
	4,700pF (472)	X	X	B	B	D	D	D	D			D	D	C	C			D	D	D	D	D	D	D	D
	5,600pF (562)	X	X	D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	6,800pF (682)	X	X	D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	8,200pF (822)	X	X	D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	0.010μF (103)	X	X	D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	0.012μF (123)			D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	0.015μF (153)			D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	0.018μF (183)			D	D	D	D	D	D			D	D	C	C			D	D	K	K	D	D	D	D
	0.022μF (223)			D	D	D	D	D	D			G	G	C	C			D	D	K	K	D	D	D	D
	0.027μF (273)			D	D			D	D			G	G	C	C			G	G	K	K	D	D	D	D
	0.033μF (333)			D	D			G	G			G	G	C	C			G	G	K	K	D	D	D	D
	0.039μF (393)			D	D			G	G			G	G	C	C			G	G	K	K	D	D	D	D
	0.047μF (473)			D	D			G	G			G	G	D	D			G	G	K	K	D	D	D	D
	0.056μF (563)			D	D			G	G			G	G	D	D			G	G	K	K	D	D	K	K
	0.068μF (683)			D	D			G	G	G	G			G	G			K	K	K	K	D	D	K	K
	0.082μF (823)			D				G	G	G	G			G	G			K	K	K	K	D	D	K	K
	0.10μF (104)			D				G	G	G	G			G	G			K	K			D	D	K	K
	0.12μF (124)													G	G	M	M	M	M			D	D	M	M
	0.15μF (154)													M	M	M	M	M	M			K	K	M	M
	0.18μF (184)													M	M	M	M					K	K	M	M
	0.22μF (224)													M	M	M	M					K	K	M	M
	0.27μF (274)													M	M	M	M					K	K	M	
	0.33μF (334)													M	M	M	M					K	K	M	
	0.39μF (394)													M	M							K	K	M	
	0.47μF (474)													M	M							K	K	M	
	0.56μF (564)													M	M							M	M		
	0.68μF (684)													M	M							M	M		
	0.84μF (844)																					M	M		
	1.0μF (105)																					M	M		

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

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Y5V Dielectric

Dielectric		Y5V							
Size		0805		1206		1210		1812	
Rated Voltage (V DC)		200	250	200	250	200	250	200	250
Capacitance	0.010μF (103)	B	B	B	B	C	C	D	D
	0.015μF (153)	B	B	B	B	C	C	D	D
	0.022μF (223)	B	B	B	B	C	C	D	D
	0.033μF (333)	B	B	B	B	C	C	D	D
	0.047μF (473)	B	B	B	B	C	C	D	D
	0.068μF (683)	B	B	B	B	C	C	D	D
	0.10μF (104)			B	B	C	C	D	D
	0.15μF (154)			C	C	C	C	D	D
	0.22μF (224)							D	D
	0.33μF (334)							D	D
	0.47μF (474)							D	D
	0.68μF (684)							D	D
	1.0μF (105)								

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

Capacitance Range (High Voltage - 1kV to 4kV)

NP0 Dielectric

Dielectric		NP0																
Size		0805	1206			1210			1808					1812				
Rated Voltage		1000	1000	1500	2000	1000	1500	2000	1000	1500	2000	3000	4000	1000	1500	2000	3000	4000
Capacitance	0.5pF (0R5)	D																
	1.0pF (1R0)	D																
	1.2pF (1R2)	D																
	1.5pF (1R5)	D	B	B	B													
	1.8pF (1R8)	D	B	B	B													
	2.0pF (2R0)	D	B	B	B				D	D	D	D	D					
	2.2pF (2R2)	D	B	B	B				D	D	D	D	D					
	2.7pF (2R7)	D	B	B	B				D	D	D	D	D					
	3.3pF (3R3)	D	B	B	B				D	D	D	D	D					
	3.9pF (3R9)	D	B	B	B				D	D	D	D	D					
	4.7pF (4R7)	D	B	B	B				D	D	D	D	D					
	5.6pF (5R6)	D	B	B	B				D	D	D	D	D					
	6.8pF (6R8)	D	B	B	B				D	D	D	D	D					
	8.2pF (8R2)	D	B	B	B				D	D	D	D	D					
	10pF (100)	D	B	B	B	C	C	C	D	D	D	D	D	D	D	D	D	D
	12pF (120)	D	B	B	B	C	C	C	D	D	D	D	D	D	D	D	D	D
	15pF (150)	D	B	B	B	C	C	C	D	D	D	D	D	D	D	D	D	D
	18pF (180)	D	B	B	B	C	C	C	D	D	D	D	D	D	D	D	D	D
	22pF (220)	D	B	B	B	C	C	C	D	D	D	D	G	D	D	D	D	D
	27pF (270)	D	B	B	B	C	C	C	D	D	D	D	G	D	D	D	D	D
	33pF (330)	D	B	C	C	C	C	C	D	D	D	D	K	D	D	D	D	D

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Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

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Dielectric		NPO																	
Size		0805	1206				1210			1808					1812				
Rated Voltage		1000	1000	1500	2000	1000	1500	2000	1000	1500	2000	3000	4000	1000	1500	2000	3000	4000	
Capacitance	39pF (390)	D	B	C	C	C	C	C	D	D	D	D	K	D	D	D	D	D	
	47pF (470)	D	C	C	C	C	C	C	D	D	D	D		D	D	D	D	G	
	56pF (560)	D	C	D	D	C	D	D	D	D	D	D		D	D	D	D	G	
	68pF (680)	D	C	D	D	C	D	D	D	D	D	D		D	D	D	D	K	
	82pF (820)	D	D	D	D	C	D	D	D	D	D	D		D	D	D	D	K	
	100pF (101)	D	D	D	D	D	D	D	D	D	K	K		D	D	D	D		
	120pF (121)	D	D	G	G	D	D	D	D	D	K	K		D	D	D	D		
	150pF (151)	D	D	G	G	D	G	G	D	K	K	K		D	D	D	D		
	180pF (181)	D	G	G	G	D	G	G	D	K	K	K		D	D	K	K		
	220pF (221)	D	G	G	G	G	G	G	D	K	K	K		D	D	K	K		
	270pF (271)	D	G	P	P	G	K	K	K	K	K	K		D	K	K	K		
	330pF (331)	D	G	P	P	G	K	K	K	K	K	K		D	K	K	K		
	390pF (391)	D	G	P	P	G	M	M	K	K	K			D	K	K	K		
	470pF (471)		G			G	M	M	K	K	K			K	K	K	K		
	560pF (561)		G			G			K	K	K			K	K	K			
	680pF (681)		G			G			K	K	K			K	K	K			
	820pF (821)		G			G			K					K	K	K			
	1,000pF (102)		G			G			K					K	K	K			
	1,200pF (122)					G								K					
	1,500pF (152)					K								K					
	1,800pF (182)					M								K					
	2,200pF (222)					M								K					
	2,700pF (272)					M								K					
	3,300pF (332)					M								K					
	3,900pF (392)					M								M					

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

X7R Dielectric

Dielectric		X7R																	
Size		0805	1206				1210			1808					1812				
Rated Voltage		1000	1000	1500	2000	2500	1000	1500	2000	1000	1500	2000	3000	4000	1000	1500	2000	3000	4000
Capacitance	100pF (101)	B	D	D	D	D	D	D	D										
	120pF (121)	B	D	D	D	D	D	D	D										
	150pF (151)	B	D	D	D	D	D	D	D	D	D	D	D	K					
	180pF (181)	B	D	D	D	D	D	D	D	D	D	D	D	K					
	220pF (221)	B	D	D	D	D	D	D	D	D	D	D	D	K					
	270pF (271)	B	D	D	D	D	D	D	D	D	D	D	D	K	D	D	D	K	K
	330pF (331)	B	D	D	D	D	D	D	D	D	D	D	K	K	D	D	D	K	K
	390pF (391)	B	D	D	D	D	D	D	D	D	D	D	K	K	D	D	D	K	K
	470pF (471)	B	D	D	D	D	D	D	D	D	D	D	K	K	D	D	D	K	K
	560pF (561)	B	D	D	D	D	D	D	D	D	D	D	K	K	D	D	D	K	K
	680pF (681)	B	D	D	D	D	D	D	D	D	D	D	K	K	D	D	D	K	K
	820pF (821)	B	D	D	D	D	D	D	D	D	D	D	K	K	D	D	D	K	K

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Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

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Dielectric		X7R																	
Size		0805	1206				1210			1808					1812				
Rated Voltage		1000	1000	1500	2000	2500	1000	1500	2000	1000	1500	2000	3000	4000	1000	1500	2000	3000	4000
	1,000pF (102)	B	D	D	D	D	D	D	D	D	K	K	K	K	D	D	D	K	K
	1,200pF (122)	B	D	G	G	G	D	M	M	D	K	K	K		D	D	D	K	M
	1,500pF (152)	D	D	G	G	G	D	M	M	D	K	K	K		D	D	D	K	M
	1,800pF (182)	D	D	G	G	G	D	M	M	D	K	K	K		D	D	D	M	M
	2,200pF (222)	D	D	G	G	G	D	M	M	D	K	K			D	D	D	M	
	2,700pF (272)	D	D	G	G		D	M	M	D	K	K			D	D	D	M	
	3,300pF (332)	D	D	G	G		D	M	M	D	K	K			D	K	K	M	
	3,900pF (392)	D	D	G			G	M	M	D	K	K			D	K	K		
	4,700pF (472)	D	D	G			G	M	M	D	K	K			D	K	K		
	5,600pF (562)	D	D	G			G	M	M	K	K	K			D	M	M		
	6,800pF (682)	D	D	G			G	M	M	K	K	K			D	M	M		
	8,200pF (822)	D	D				G	M	M	K					D	M	M		
	0.010μF (103)		D				G			K					D	M	M		
	0.012μF (123)		G				G			K					K				
	0.015μF (153)		G				G			K					K				
	0.018μF (183)						G			K					M				
	0.022μF (223)						G			K					M				
	0.033μF (333)						K			K					M				
	0.047μF (473)						M			K					M				
	0.056μF (563)						M			K					M				
	0.068μF (683)						M								M				
	0.10μF (104)														M				

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

Packaging Dimension and Quantity

Size	Thickness/Symbol (mm)		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402	0.5 ±0.05	N	10k	50k	-	-
0603	0.8 ±0.07	S	4k	15k	-	-
	0.8 +0.15/-0.1	X	4k	15k		
0805	0.6 ±0.1	A	4k	15k	-	-
	0.8 ±0.1	B	4k	15k	-	-
	1.25 ±0.1	D	-	-	3k	10k
1206	0.8 ±0.1	B	4k	15k	-	-
	0.95 ±0.1	C	-	-	3k	10k
	1.25 ±0.1	D	-	-	3k	10k
	1.6 ±0.2	G	-	-	2k	10k

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Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

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Size	Thickness/Symbol (mm)		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
1210	0.95 ±0.1	C	-	-	3k	10k
	1.25 ±0.1	D	-	-	3k	10k
	1.6 ±0.2	G	-	-	2k	-
	2 ±0.2	K	-	-	1k	6k
	2.5 ±0.3	M	-	-	1k	6k
1808	1.25 ±0.1	D	-	-	2k	10k
	2 ±0.2	K	-	-	1k	6k
1812	1.25 ±0.1	D	-	-	1k	5k
	1.6 ±0.2	G	-	-	1k	-
	2 ±0.2	K	-	-	1k	-
	2.5 ±0.3	M	-	-	0.5k	3k

Reliability Test Conditions and Requirements

Item	Test Condition		Requirements
Visual and Mechanical	-		No remarkable defect. Dimensions to conform to individual specification sheet.
Capacitance	Test temp.: Room Temperature.		Shall not exceed the limits given in the detailed spec.
Q/ D.F. (Dissipation Factor)	Class I: (NP0) Cap≤1000pF, 1.0±0.2Vrms, 1MHz±10% Cap>1000pF, 1.0±0.2Vrms, 1kHz±10% Class II: (X7R, Y5V) 1.0±0.2Vrms, 1kHz±10% *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.		NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R: ≤2.5% Y5V: ≤5.0%
Dielectric Strength	To apply voltage: 200V~300V ≥2 times V DC 400V~450V ≥1.2 times V DC 500V~999V ≥1.5 times V DC 1000V~3000V ≥1.2 times V DC 4000V ≥1.1 times V DC Duration: 1 to 5 sec. Charge & discharge current less than 50mA.		No evidence of damage or flash over during test.
Insulation Resistance	Rated voltage: 200~630V	To apply rated voltage (500V max.) for 60 sec.	≥10GΩ or RxC≥100Ω-F whichever is smaller
	Rated voltage: ≥630V	To apply 500V for 60 sec.	

Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

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Item	Test Condition	Requirements																
Temperature Coefficient	With no electrical load.																	
	<table><tr><td>T.C.</td><td>Operating Temp</td></tr><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></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><tr><td>T.C.</td><td>Capacitance Change</td></tr><tr><td>NP0</td><td>Within ±30ppm/°C</td></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>Y5V</td><td>Within +30%/-80%</td></tr></table>	T.C.	Capacitance Change	NP0	Within ±30ppm/°C	X7R	Within ±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 ±30ppm/°C																	
X7R	Within ±15%																	
Y5V	Within +30%/-80%																	
	Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.																	
Adhesive Strength of Termination	Pressurizing force: 5N (≤0603) and 10N (>0603) Test time: 10±1 sec.	No remarkable damage or removal of the terminations.																
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 24±2 hrs at room temp. Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	No remarkable damage. Cap change and Q/D.F.: To meet initial spec.																
Solderability	Solder temperature: 235±5°C Dipping time: 2±0.5 sec.	95% min. coverage of all metalized area.																
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. Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr 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: NP0: within ±5.0% or ±0.5pF whichever is larger. X7R: 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.)																
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): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	No remarkable damage. Cap change: NP0: within ±2.5% or ±0.25pF whichever is larger. X7R: within ±7.5% Y5V: within ±20% Q/D.F., I.R. and dielectric strength: To meet initial requirements. 25% max. leaching on each edge.																

Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

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Item	Test Condition	Requirements															
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±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> </tbody> </table> Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	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: NP0: within ±2.5% or ±0.25pF whichever is larger. X7R: within ±7.5% Y5V: within ±20% 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															
2	Room temp.	2~3															
3	Max. operating temp. +3/-0	30±3															
4	Room temp.	2~3															
Humidity (Damp Heat) Steady State	Test temp.: 40±2°C Humidity: 90~95% RH Test time: 500+24/-0hrs. Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	No remarkable damage. Cap change: NP0: within ±5.0% or ±0.5pF whichever is larger. X7R: within ±12.5% Y5V: within ±30% Q/D.F. value: NP0: Cap≥30pF, Q≥350; 10pF≤Cap<30pF, Q≥275+2.5C Cap<10pF; Q≥200+10C X7R: ≤3.0% Y5V: ≤7.5% I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.															
Humidity (Damp Heat) Load	Test temp.: 40±2°C Humidity: 90~95%RH Test time: 500+24/-0 hrs. To apply voltage: rated voltage (Max. 500V) Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	No remarkable damage. Cap change: NP0: within ±7.5% or ±0.75pF whichever is larger. X7R: within ±12.5% Y5V: within ±30% Q/D.F. value: NP0: Cap≥30pF, Q≥200; Cap<30pF, Q≥100+10/3C X7R: ≤3.0% Y5V: ≤7.5% I.R.: ≥500MΩ or RxC≥25Ω-F whichever is smaller.															

Multilayer Ceramic Capacitors

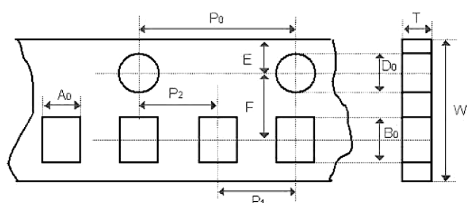
Middle & High Voltage Series (200V to 4kV)

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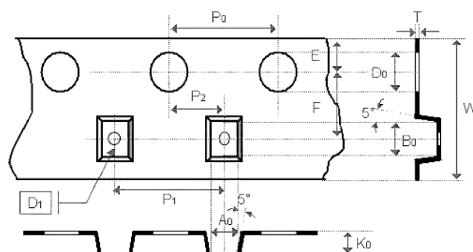
Item	Test Condition	Requirements
High Temperature Load (Endurance)	Test temp.: NP0, X7R: $125\pm 3^{\circ}\text{C}$ Y5V: $85\pm 3^{\circ}\text{C}$ To apply voltage: (1) 1206/NP0 (3kV) $\geq 1.5\text{pF}$: 100% of rated voltage. (2) 200V~300V: 200% of rated voltage. (3) 400V~450V: 120% of rated voltage. (4) 500V: 150% of rated voltage. (5) 630V~3000V: 120% of rated voltage. (6) 4000V: 110% of rated voltage. * Test time: 1000+24/-0 hrs. * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp. Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.	No remarkable damage. Cap change: NP0: within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger. X7R: within $\pm 12.5\%$ Y5V: within $\pm 30\%$ Q/D.F. value: NP0: Cap $\geq 30\text{pF}$, Q ≥ 350 $10\text{pF} \leq \text{Cap} < 30\text{pF}$, Q $\geq 275+2.5\text{C}$ Cap $< 10\text{pF}$, Q $\geq 200+10\text{C}$ X7R: $\leq 3.0\%$ Y5V: $\leq 7.5\%$ I.R.: $\geq 1\text{G}\Omega$ or $\text{RxC} \geq 50\Omega\text{-F}$ whichever is smaller.

Appendices

Tape & Reel Dimensions



The dimension of paper tape



The dimension of plastic tape

Size	0201	0402	0603	0805			1206			1210			1808	1812	
Thickness	L	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D,G,K	M	D,F,G,K	D,F,G,K	M,U
A ₀	0.39 +/-0.07	0.70 +/-0.2	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	< 2.30	< 3.05	< 3.05	< 3.20	< 2.50	< 3.90	< 3.90
B ₀	0.69 +/-0.07	1.20 +/-0.2	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	< 3.95	< 5.30	< 5.30	< 5.30
T	≤ 0.5	≤ 0.8	≤ 1.2	≤ 1.15	≤ 1.3	0.23 +/-0.1	≤ 1.3	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K ₀	-	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.00	< 2.50	< 2.50	< 3.50
W	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20
P ₀	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10
10xP ₀	40.00 +/-0.10	40.00 +/-0.10	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20

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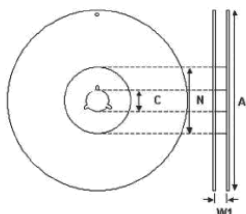
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Multilayer Ceramic Capacitors

Middle & High Voltage Series (200V to 4kV)

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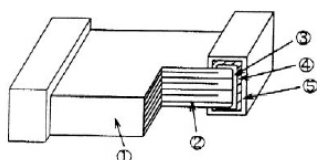
Size	0201	0402	0603	0805			1206			1210			1808	1812	
Thickness	L	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D,G,K	M	D,F,G,K	D,F,G,K	M,U
P1	2.00 +/-0.05	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10
P2	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
D0	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.50 +0.1/-0	1.55 +/-0.05	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D1	-	-	-	-	-	1.00 +/-0.10	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
E	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	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	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10



The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1808, 1812
Reel size	7"	10"	13"	7"
C	13 +0.5/-0.2	13 +0.5/-0.2	13 +0.5/-0.2	13 +0.5/-0.2
W1	10 +1.5/-0	8.4 +1.5/-0	8.4 +1.5/-0	12.4 +2.0/-0
A	178 ±1	250 ±1	330 ±1	178 ±1
N	60 +1.0/-0	100 ±1	100 ±1	60.5 ±1

Constructions



No.	Name	NPO, X7R, Y5V
1	Ceramic material	BaTiO ₃ based
2	Inner electrode	Ni
3	Termination	Inner layer
4		Middle layer
5		Outer layer

Storage and handling conditions

- (1) To store products at 5°C 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:

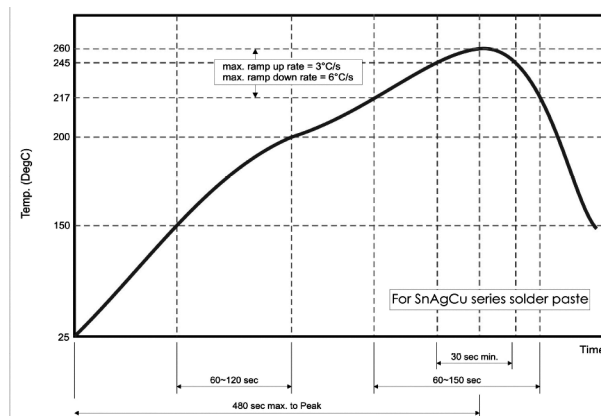
- The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- In corrosive atmosphere, solderability might be degraded, and 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.

Newark.com/multicomp-pro
Farnell.com/multicomp-pro
sg.element14.com/b/multicomp-pro

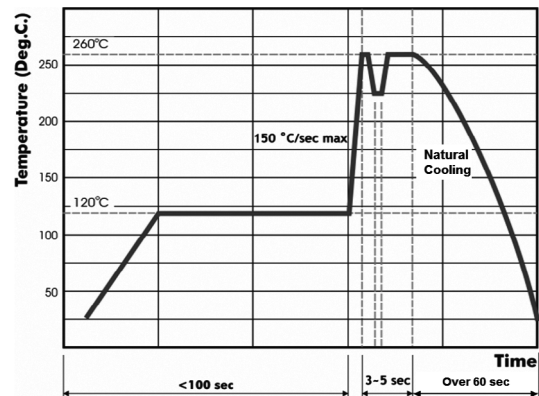
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Recommended Soldering Conditions

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 N₂ within oven are recommended.



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



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

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