APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

1825, 2220 & 2225 Sizes

NP0, X7R Dielectrics

Halogen Free & RoHS Compliance

PSA
PASSIVE SYSTEM ALLIANCE
Walsin Technology Corporation
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1. HOW TO ORDER

2220	B	104	K	500	C	T
Size	**Dielectric**	**Capacitance**	**Tolerance**	**Rated voltage**	**Termination**	**Packaging style**
Inch (mm) **1825** (4563) **2220** (5750) **2225** (5763)	**N**=NP0 **B**=X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 104=10x10^4 =100nF	**F**=±1% **G**=±2% **J**=±5% **K**=±10% **M**=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. **250**= 25 VDC **500**= 50 VDC **101**= 100 VDC **251=** 250 VDC **501=** 500 VDC **631**= 630 VDC **102=** 1000 VDC **152=** 1500 VDC **202=** 2000 VDC **252=** 2500 VDC **302=** 3000 VDC **402=** 4000 VDC	**C**=Cu/Ni/Sn **M**=Surface coating, Cu/Ni/Sn	**T**=7" reeled **L**=13" reeled

2. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T(mm) (Symbol)	M_B min (mm)
1825 (4563)	4.50±0.40 4.50 +0.50/-0.30#1	6.30±0.40	2.00±0.20 (K) 2.50±0.30 (M) 2.80±0.30 (U) 3.10±0.30 (R)	0.40~1.10
2220 (5750)	5.70±0.40	5.00±0.40		0.50~1.20
2225 (5763)	5.70±0.40	6.30±0.40		0.50~1.20

Reflow soldering only is recommended.
#1.For 1825 _200V~4000V products.

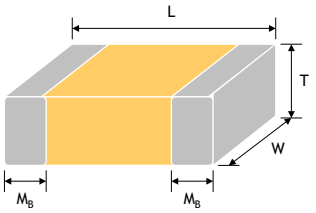


Fig. 1 The outline of MLCC

3. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R
Size	1825, 2220, 2225	
Capacitance*	10pF to 0.1μF	1000pF to 47μF
Capacitance tolerance	F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)
Rated voltage (WVDC)	25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V, 1500V, 2000V, 2500V, 3000V, 4000V	
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Cap<4.7μF: ≤2.5% Cap≥4.7μF: ≤3.5%
Operating temperature	-55 to +125°C	
Capacitance characteristic	±30ppm	±15%
Termination	Ni/Sn (lead-free termination)	

*Measured at 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 for NP0.
*Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature for X7R.
** 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.

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4. CAPACITANCE RANGE

4-1 NP0 Dielectric

DIELECTRIC		NP0																								
SIZE		1825									2220										2225								
RATED VOLTAGE (VDC)		50	100	200 250	500	630	1000	2000	3000	4000	50	100	200 250	500	630	1000	2000	3000	4000	50	100	200 250	500	630	1000	2000	3000	4000
Capacitance	10pF (100)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	12pF (120)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	15pF (150)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	18pF (180)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	22pF (220)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	27pF (270)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	33pF (330)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	39pF (390)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	47pF (470)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	56pF (560)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	68pF (680)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	82pF (820)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	100pF (101)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	120pF (121)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	
	150pF (151)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	
	180pF (181)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	
	220pF (221)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	
	270pF (271)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	
	330pF (331)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	
	390pF (391)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	
	470pF (471)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	
	560pF (561)	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	
	680pF (681)	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	
	820pF (821)	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	M		K	K	K	K	K	K	M	M	
	1,000pF (102)	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	M		K	K	K	K	K	K	M	M	
	1,200pF (122)	K	K	K	K	K	K	K			K	K	K	K	K	M	M	M		K	K	K	K	K	K	M		
	1,500pF (152)	K	K	K	K	K	K	M			K	K	K	K	K	M	M	M		K	K	K	K	K	K	M		
	1,800pF (182)	K	K	K	K	K	K	M			K	K	K	K	K	M	M			K	K	K	K	K	K	M		
	2,200pF (222)	K	K	K	K	K	K	M			K	K	K	K	K	M	M			K	K	K	K	K	K	M		
	2,700pF (272)	K	K	K	K	K	K	M			K	K	K	K	K	M	M			K	K	K	K	K	K	M		
	3,300pF (332)	K	K	K	K	K	K	M			K	K	K	K	K	M	M			K	K	K	K	K	K	M		
	3,900pF (392)	K	K	K	K	K	M	M			K	K	K	K	K	M	M			K	K	K	K	K	K	M		
	4,700pF (472)	K	K	K	K	K	M	M			K	K	K	K	K	M	M			K	K	K	K	K	K	M		
	5,600pF (562)	K	K	K	K	K	M				K	K	K	K	K	M				K	K	K	K	K	M	M		
	6,800pF (682)	K	K	K	K	K	M				K	K	K	K	K	M				K	K	K	K	K	M	M		
	8,200pF (822)	K	K	K	K	K	M				K	K	K	K	K	M				K	K	K	K	K	M	M		
	0.010uF (103)	K	K	K	K	K	M				K	K	K	K	K	M				K	K	K	K	K	M	M		
	0.012μF (123)	K	K	K	K	K					K	K	K	K	K					K	K	K	K	K				
	0.015μF (153)	K	K	K	K	K					K	K	K	K	K					K	K	K	K	K				
	0.018μF (183)	K	K	K	K	K					K	K	K	K	K					K	K	K	K	K				
	0.022μF (223)	K	K	K	K	K					K	K	K	K	K					K	K	K	K	K				
	0.027μF (273)	K	K	K	K	K					K	K	K	K	K					K	K	K	K	K				
	0.033μF (333)	K	K	K	K	K					K	K	K	K	K					K	K	K	K	K				
	0.039μF (393)	K	K	K	M	M					K	K	K	K	K					K	K	K	K	K				
	0.047μF (473)	K	K	K							K	K	M	M	M					K	K	K	K	K				
	0.056μF (563)	K	K	M							K	K	M	M	M					K	K	M	M	M				
	0.068μF (683)	K	K	M							K	K	M	U	U					K	K	M	M	M				
	0.082μF (823)	K	M								M	M		U	U					K	K	M	M					
	0.1μF (104)	M	M								M	M		U	U					K	M	M						
	0.12μF (124)																											
	0.15μF (154)																											
	0.18μF (184)																											
	0.22μF (224)																											
	0.27μF (274)																											

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.
3. "+" mark only supply "surface coating" products

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4-2 X7R Dielectric

DIELECTRIC		X7R																					
SIZE		1825											2220										
RATED VOLTAGE (VDC)		50	100	200	250	500	630	1000	1500	2000	3000	4000	25	50	100	200 250	500	630	1000	1500	2000	2500	3000	4000
Capacitance	270pF (271)											K												K
	330pF (331)											K												K
	390pF (391)											K												K
	470pF (471)											K												K
	560pF (561)											K												K
	680pF (681)											K												K
	820pF (821)											K												K
	1,000pF (102)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	1,200pF (122)	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	K	K	K	K	K	M
	1,500pF (152)	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	K	K	K	K	K	M
	1,800pF (182)	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	K	K	K	K	K	M
	2,200pF (222)	K	K	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	K	K	K	
	2,700pF (272)	K	K	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	K	K	K	
	3,300pF (332)	K	K	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	K	K	K	
	3,900pF (392)	K	K	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	K	K	K	
	4,700pF (472)	K	K	K	K	K	K	K	K	K	K		K	K	K	K	K	K	K	K	K	K	K	
	5,600pF (562)	K	K	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	K	K	K	
	6,800pF (682)	K	K	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	K	K	M	M	
	8,200pF (822)	K	K	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	M	M	M	M	
	0.010μF (103)	K	K	K	K	K	K	K	K	K	M		K	K	K	K	K	K	K	M	M	M	M	
	0.012μF (123)	K	K	K	K	K	K	K	M	M	U		K	K	K	K	K	K	K	M	M	U	U	
	0.015μF (153)	K	K	K	K	K	K	K	M	M	U		K	K	K	K	K	K	K	M	M	U	U	
	0.018μF (183)	K	K	K	K	K	K	K	M	M	U		K	K	K	K	K	K	K	U	U	U	U	
	0.022μF (223)	K	K	K	K	K	K	K	M	M			K	K	K	K	K	K	K	U	U			
	0.027μF (273)	K	K	K	K	K	K	K	U	U			K	K	K	K	K	K	K	U	U			
	0.033μF (333)	K	K	K	K	K	K	K	U	U			K	K	K	K	K	K	K	U	U			
	0.039μF (393)	K	K	K	K	K	K	K	U	U			K	K	K	K	K	K	K	U	U			
	0.047μF (473)	K	K	K	K	K	K	K	U	U			K	K	K	K	K	K	K	U	U			
	0.056μF (563)	K	K	K	K	K	K	K					K	K	K	K	K	K	K	U	U			
	0.068μF (683)	K	K	K	K	K	K	K					K	K	K	K	K	K	M					
	0.082μF (823)	K	K	K	K	K	K	M					K	K	K	K	K	K	M					
	0.10μF (104)	K	K	K	K	K	K	M					K	K	K	K	K	K	M					
	0.12μF (124)	K	K	K	K	K	K						K	K	K	K	K	K	M					
	0.15μF (154)	K	K	K	K	K	K						K	K	K	K	K	K	U					
	0.18μF (184)	K	K	K	K	K	K						K	K	K	K	K	K	U					
	0.22μF (224)	K	K	K	K	K	K						K	K	K	K	K	K	U					
	0.27μF (274)	K	K	K	K	K	K						K	K	K	K	K	K						
	0.33μF (334)	K	K	K	K	K	K						K	K	K	K	K	K						
	0.39μF (394)	K	K	K	K	K	K						K	K	K	K	K	K						
	0.47μF (474)	K	K	K	K	K	K						K	K	K	K	K	K						
	0.56μF (564)	K	K	K	K	M	M						K	K	K	K	M	M						
	0.68μF (684)	K	K	K	K								K	K	K	K	M	M						
	0.82μF (824)	K	K	K	K								K	K	K	K	U	U						
	1.0μF (105)	K	K	K	K								K	K	K	K	U	U						
	1.5μF (155)	K	K										K	K	K	M								
	2.2μF (225)	K	K										K	K	K	M								
	3.3μF (335)	K	K										K	K	K									
	4.7μF (475)	K	K										K	K	M									
	6.8μF (685)												M	M	M									
	10μF (106)												M	M	M									
	15μF (156)												U	U	U									
	22μF (226)												U	U	R									
	47μF (476)												R											

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DIELECTRIC		X7R												
SIZE		2211	2225											
RATED VOLTAGE (VDC)		4000	25	50	100	200	250	500	630	1000	1500	2000	3000	4000
Capacitance	270pF (271)	K+												
	330pF (331)	K+												
	390pF (391)	K+												
	470pF (471)	K+												
	560pF (561)	K+												
	680pF (681)	K+												
	820pF (821)	K+												
	1,000pF (102)	K+	K	K	K	K	K	K	K	K	K	K	K	K
	1,200pF (122)	M+	K	K	K	K	K	K	K	K	K	K	K	M
	1,500pF (152)	M+	K	K	K	K	K	K	K	K	K	K	K	M
	1,800pF (182)	M+	K	K	K	K	K	K	K	K	K	K	K	M
	2,200pF (222)		K	K	K	K	K	K	K	K	K	K	K	
	2,700pF (272)		K	K	K	K	K	K	K	K	K	K	K	
	3,300pF (332)		K	K	K	K	K	K	K	K	K	K	K	
	3,900pF (392)		K	K	K	K	K	K	K	K	K	K	K	
	4,700pF (472)		K	K	K	K	K	K	K	K	K	K	K	
	5,600pF (562)		K	K	K	K	K	K	K	K	K	K	M	
	6,800pF (682)		K	K	K	K	K	K	K	K	K	K	M	
	8,200pF (822)		K	K	K	K	K	K	K	K	K	K	M	
	0.010μF (103)		K	K	K	K	K	K	K	K	K	K	M	
	0.012μF (123)		K	K	K	K	K	K	K	K	M	M	M	
	0.015μF (153)		K	K	K	K	K	K	K	K	M	M	M	
	0.018μF (183)		K	K	K	K	K	K	K	K	M	M	U	
	0.022μF (223)		K	K	K	K	K	K	K	K	M	M		
	0.027μF (273)		K	K	K	K	K	K	K	K	M	M		
	0.033μF (333)		K	K	K	K	K	K	K	K	M	M		
	0.039μF (393)		K	K	K	K	K	K	K	K	M	U		
	0.047μF (473)		K	K	K	K	K	K	K	K	M	U		
	0.056μF (563)		K	K	K	K	K	K	K	K	M	U		
	0.068μF (683)		K	K	K	K	K	K	K	K	M			
	0.082μF (823)		K	K	K	K	K	K	K	K	M			
	0.10μF (104)		K	K	K	K	K	K	K	M	M			
	0.12μF (124)		K	K	K	K	K	K	K	U				
	0.15μF (154)		K	K	K	K	K	K	K	U				
	0.18μF (184)		K	K	K	K	K	K	K	U				
	0.22μF (224)		K	K	K	K	K	K	K	U				
	0.27μF (274)		K	K	K	K	K	K	K					
	0.33μF (334)		K	K	K	K	K	K	K					
	0.39μF (394)		K	K	K	K	K	K	K					
	0.47μF (474)		K	K	K	K	K	K	K					
	0.56μF (564)		K	K	K	K	K	K	K					
	0.68μF (684)		K	K	K	K	K							
	0.82μF (824)		K	K	K	K	K							
	1.0μF (105)		K	K	K	K	K		M					
	1.5μF (155)		K	K	K	M	M							
	2.2μF (225)		K	K	K	M	M							
	3.3μF (335)		K	K	K									
	4.7μF (475)		K	K										
	6.8μF (685)		M	M										
	10μF (106)		U	U										

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5. PACKAGING STYLE AND QUANTITY

Size	Thickness/Symbol (mm)		Plastic tape	
			7" reel	13" reel
1825 (4563) 2220 (5750) 2225 (5763)	2.00±0.20	K	1000	-
	2.50±0.30	M	500	-
	2.80±0.30	U	500	-
	3.10±0.30	R	-	1000

Unit: pieces

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6. 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	*Test temp.: Room Temperature. Class I: (NP0) C≤1000pF, 1.0±0.2Vrms，1MHz±10% C>1000pF, 1.0±0.2Vrms，1KHz±10% Class II: (X7R) C≤10μF, 1.0±0.2Vrms，1KHz±10% C>10μF, 0.5±0.2Vrms，120Hz±20% *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* Shall not exceed the limits given in the detailed spec.
3.	Q/ D.F. (Dissipation Factor)		* Q/DF: NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C. X7R: Cap<4.7μF: ≤2.5% Cap≥4.7μF: ≤3.5%
4.	Dielectric Strength	*To apply voltage (≤100V) 250%. *Duration: 1 to 5 sec. *Charge & discharge current less than 50mA. *To apply voltage: 200V ~ 300V ≥ 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. * For high voltage product over 1000 Vdc, it is required to immerse the chip in an isolation fluid to prevent possible arcing while testing.	* No evidence of damage or flash over during test.
5.	Insulation Resistance	*Test temp.: Room Temperature. U_R≤100V: To apply voltage at U_R for max. 120 sec. U_R>100V: To apply voltage at U_R (500V max.) for 60 sec.	* ≥10GΩ or R•C≥100Ω-F whichever is smaller.
6.	Temperature Coefficient	With no electrical load. T.C. / Operating Temp NP0 / -55~125°C at 25°C X7R / -55~125°C at 25°C	* Capacitance change: NP0: Within ±30ppm/°C. X7R: Within ±15%.
7.	Adhesive Strength of Termination	* Pressurizing force：10N * 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: 245±5°C * 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% or 0.5pF whichever is larger. X7R: within ±12.5%. (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	* 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): Perform 150+0/-10°C for 1 hr and 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 ±2.5% or 0.25pF whichever is larger. X7R: within ±7.5%. * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. 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 * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and 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 ±2.5% or 0.25pF whichever is larger. X7R: within ±7.5%. * Q/D.F.: NP0: To meet initial requirements. X7R: ≤1.5 × Initial requirements. * I.R: To meet initial requirements.

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

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No.	Item	Test Condition	Requirements
13.	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% or 0.5pF whichever is larger. X7R: within ±12.5%. * Q/D.F.: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C. X7R: ≤2 × Initial requirements. * I.R.: ≥1GΩ or R•C≥50Ω-F whichever is smaller.
14.	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: ±7.5% or 0.75pF whichever is larger. X7R: within ±12.5% * Q/D.F.: NP0: More than 30pF,Q≥200;C<30pF, Q≥100+10/3C X7R: ≤2 × Initial requirements. * I.R.: ≥500MΩ or R•C≥5Ω-F whichever is smaller.
15.	High Temperature Load (Endurance)	* Test temp.:125±3°C * To apply voltage: (1) Cap.≥1μF: 150% of rated voltage. Excluding 2220B126~226(100V):120% of rated voltage. (2) Ur≤250V: 200% of rated voltage. (3) 250V<Ur≤500V: 150% of rated voltage. (4) 500V<Ur≤3000V: 120% of rated voltage. (5) 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 ±3% or 0.3pF whichever is larger. X7R: within ±12.5%. * Q/D.F.: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C X7R: ≤2 × Initial requirements. * I.R.: ≥1GΩ or R•C≥50Ω-F whichever is smaller.

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

APPENDIXES

◙ Constructions

No.	Name		NPO	X7R
①	Ceramic material		$CaZrO_3$ based	$BaTiO_3$ based
②	Inner electrode		Ni	
③	Termination	Inner layer	Cu	
④		Middle layer	Ni	
⑤		Outer layer	Sn	

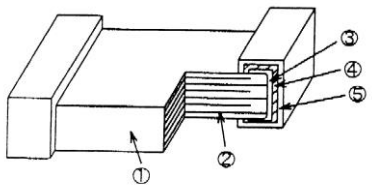
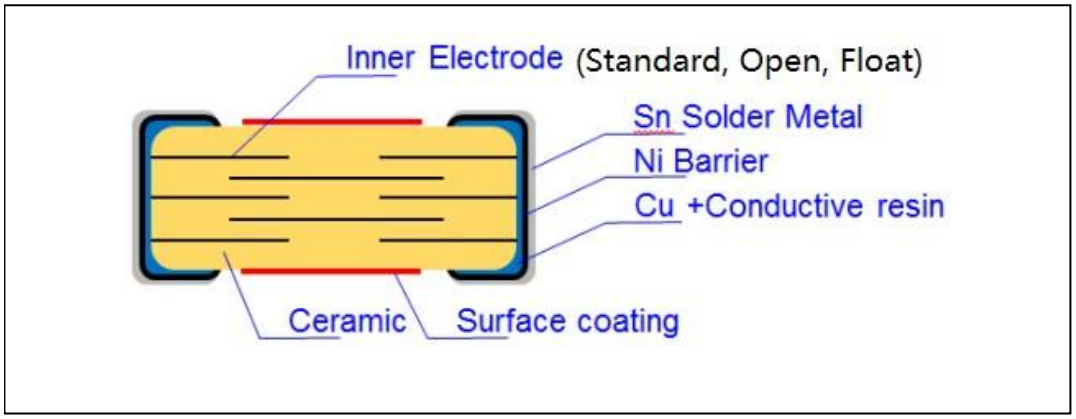


Fig. 2 The construction of MLCC



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◙ Tape & reel dimensions

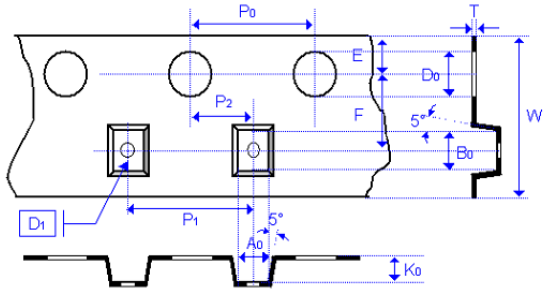


Fig. 3 The dimension of plastic tape

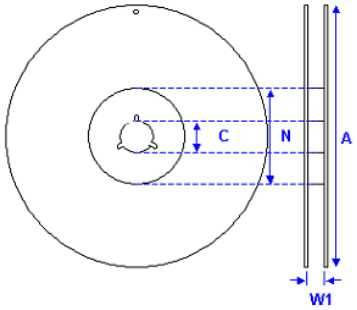


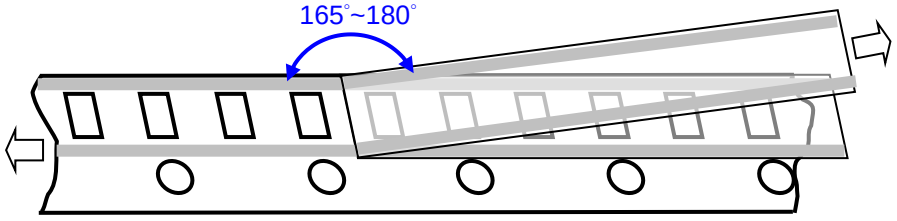
Fig. 4 The dimension of reel

Size	1825		2220			2225	
Chip Thickness	K(2.0)	M(2.5) U(2.8)	K(2.0)	M(2.5) U(2.8)	R(3.1)	K(2.0)	M(2.5) U(2.8)
A_0	< 6.80	< 6.80	< 5.80	< 5.80	< 5.80	< 6.80	< 6.80
B_0	< 5.30	< 5.30	< 6.50	< 6.50	< 6.50	< 6.50	< 6.50
T	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1
K_0	< 2.50	< 3.50	< 2.50	< 3.50	< 4.20	< 2.50	< 3.50
W	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30
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
$10xP_0$	40.00 +/-0.20	40.00 +/-0.20	40.0 +/-0.20	40.0 +/-0.20	40.0 +/-0.20	40.0 +/-0.20	40.0 +/-0.20
P_1	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10
P_2	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
D_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
D_1	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
E	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	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05

Size	1825, 2220, 2225	
Reel size	7”	13”
C	13.0+0.5/-0.2	13.0±0.5
W_1	12.2+2.0/-0	12.2+2.0/-0
A	178.0±1.0	330.0±1.0
N	60.0+1.0/-0	100±1.0

◙ 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.



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APPLICATION NOTES

Storage

To prevent the damage of solderability of terminations, the following storage conditions are recommended : Indoors under 5 ~ 40°C and 20% ~ 70% related humidity conditions; MSL Level 1.
No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.
Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The product is recommended to be used within 12 months after shipment and checked the solderability before use.

Handling

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

Preheat

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 4°C per second and the final preheat temperature should be within 100°C of the soldering temperature for small chips such as 0402, 0603, 0805 and 1206, within 50°C of the soldering temperature for bigger chips such as 1210, 1808, 1812, 1825, 2220 and 2225, etc.

Soldering

Use middy activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

Hand soldering with temperature-controlled iron not exceeding 30 watts and diameter of tip less than 1.2 mm is recommended, tip of iron should not contact the ceramic body directly, and the temperature of iron should be set to not more than 260°C.

For bigger chips such as 1210, 1808, 1812, 2220 and 2225, etc. wave soldering and hand soldering are no recommended.

Refer IPC/JEDEC J-STD-020D Method recommended soldering profiles:

Reflow not sooner than 15 minutes and not longer than 4 hrs after removal from the temperature/humidity chamber, subject the sample to 3 cycle of the appropriate reflow conditions as defined as blow Table description.

Profile Feature	Pb-Free Assembly
Preheat/Soak Temperature Min.($T_{S\ min}$) Temperature Max.($T_{S\ max}$) Time(t_S) from ($T_{S\ min}$ to $T_{S\ max}$)	 150°C 200°C 60 to 120 seconds
Ramp-up rate(T_L to T_P)	3°C/second max.
Liquidous temperature(T_L) Time(t_L) maintained above T_L	217°C 60 to 150 seconds
Peak package body temperature(T_P)	For user T_P must not exceed the Classification temp 260°C For suppliers T_P must equal or exceed the Classification temp 260°C
Time(T_P)* within 5°C of the specified classification temperature(T_C)	30* second
Ramp-down rate (T_P to T_L)	6°C/second max.
Time 25°C to peak temperature 260°C	8 minutes max.

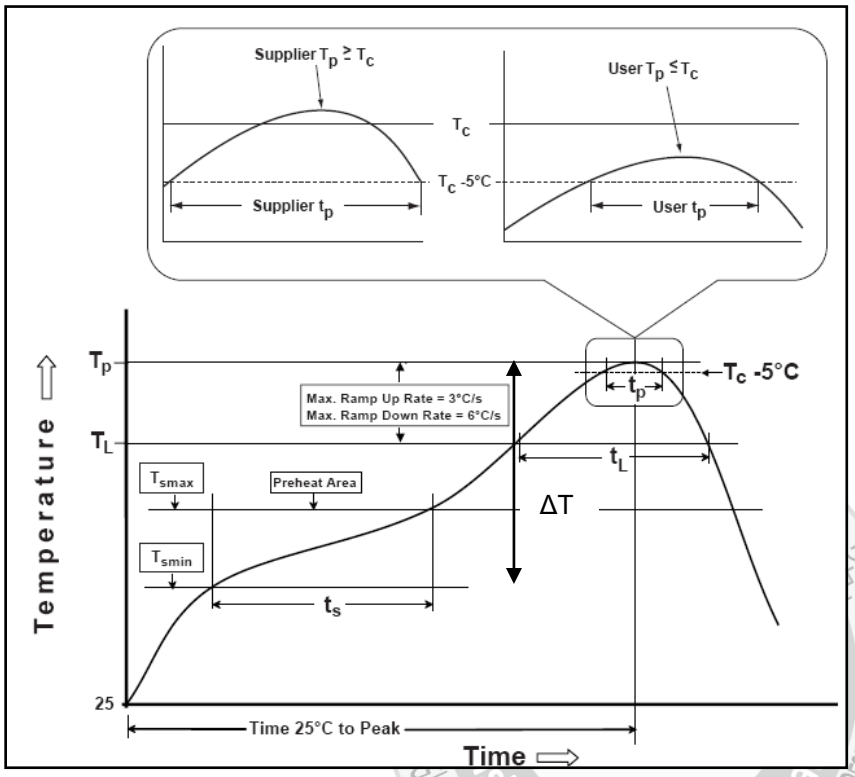
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Lead-free: Soldering temperature = 235 to 260°C, depending on product.

Maximum temperature = Minimum temperature (235°C)+ ΔT+ Tolerance for oven process and measurement(5 ~ 7°C)

Time at peak temperature = 10sec, Dwell above 217°C = 90sec, Ramping rate = 3°C/sec (heating) and 6°C/sec (heating).

Classification Reflow Profiles



Chip Size	ΔT
0805,1206	100 °C
1210, 1808, 1812, 1825, 2211, 2220, 2225	50°C

Soldering	Solder Temp.(T_C)	Soldering Time (t_P)
Reflow	235 – 260 °C	< 15 sec.

Note: For example, T_C is 260°C and time t_P is 15 seconds.

For user: The peak temperature must not exceed 260°C. The time above 255°C must not exceed 15 seconds.

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◙ Cooling

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4°C per second should be used when forced cooling is necessary.

◙ Cleaning

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

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