

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MT)

Qualified to AEC-Q200

0201 to 1210 Sizes (10V to 1000V)

NP0, X7R Dielectrics

Halogen Free & RoHS Compliance

\*Contents in this sheet are subject to change without prior notice.

**Multilayer Ceramic 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's MT series MLCC is made by NP0,X7R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MT series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications.

**2. FEATURES**

- a. A wide selection of sizes is available (0201 to 0805).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).
- d. The MT series meet AEC-Q200 requirement.

**3. APPLICATIONS**

- a. For Navigation & Information equipments.
- b. For entertainment equipments
- c. For comfortable equipments.
- d. For Automotive electronic equipment.

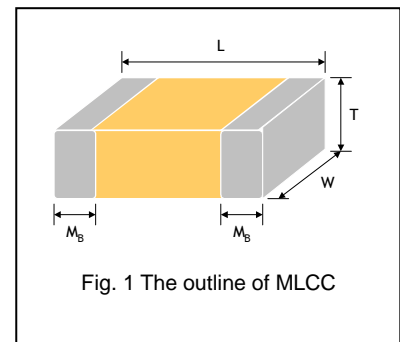
**4. HOW TO ORDER**

<b>MT</b>	<b>18</b>	<b>N</b>	<b>102</b>	<b>J</b>	<b>500</b>	<b>C</b>	<b>I</b>
<b>Series</b>	<b>Size</b>	<b>Dielectric</b>	<b>Capacitance</b>	<b>Tolerance</b>	<b>Rated voltage</b>	<b>Termination</b>	<b>Packaging style</b>
MT= Automotive safe concern (with AEC-Q200 qualification)	03=0201 (0603) 15=0402 (1005) 18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225)	N=NP0 (COG) 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 102=10x10 <sup>2</sup> =1000pF	A=±0.05pF B=±0.1pF C=±0.25pF D=±0.5pF 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. <b>100</b> =10 VDC <b>160</b> =16 VDC <b>250</b> =25 VDC <b>500</b> =50 VDC <b>101</b> =100 VDC <b>201</b> =200 VDC <b>251</b> =250 VDC <b>501</b> =500 VDC <b>631</b> =630 VDC <b>102</b> =1000 VDC	C=Cu/Ni/Sn	T=7" reeled G=13" reeled

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**5. EXTERNAL DIMENSIONS**

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M <sub>B</sub> (mm)
0201 (0603)	0.60±0.03	0.30±0.03	0.30±0.03	L #	0.15±0.05
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N #	0.25 +0.05/-0.10
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15
	1.60 +0.15/-0.10	0.80 +0.15/-0.10	0.80 +0.15/-0.10	X	
0805 (2012)	2.00±0.15	1.25±0.10	0.60±0.10	A	0.50±0.20
			0.80±0.10	B	
	1.25±0.10	D #			
	1.25±0.20	I #			
1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	B	0.60±0.20
			0.95±0.10	C	
			1.25±0.10	D #	
	3.20±0.20	1.60±0.20	1.15±0.15	J #	
	1.60±0.20		G #		
	3.20+0.3/-0.1		1.60+0.30/-0.10	P #	
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C #	0.75±0.25
			1.25±0.10	D #	
	3.20±0.40	2.50±0.30	1.60±0.20	G #	
			2.00±0.20	K #	
			2.50±0.30	M #	



# Reflow soldering only is recommended.

**6. GENERAL ELECTRICAL DATA**

<b>Dielectric</b>	NPO	X7R
<b>Size</b>	0201, 0402, 0603, 0805, 1206, 1210	0402, 0603, 0805, 1206
<b>Capacitance range*</b>	0.1pF to 0.047uF	100pF to 2.2uF
<b>Capacitance tolerance**</b>	Cap≤5pF <sup>#1</sup> : A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)	J (±5%), K (±10%), M (±20%)
<b>Rated voltage (WVDC)</b>	10V, 16V, 25V, 50V, 100V, 200V, 250, 500, 630, 1000	
<b>Operating temperature</b>	-55 to +125°C	
<b>Capacitance characteristic</b>	±30ppm/°C	±15%
<b>Termination</b>	Ni/Sn (lead-free termination)	

#1: NPO, 0.1pF product only provide B tolerance.

\* 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  
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 a mbient condition for 24±2 hours before measurement.

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**7. CAPACITANCE RANGE**

**NP0 Dielectric**

DIELECTRIC		NP0																
SIZE		0201					0402					0603						
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	200	250
Capacitance	0.1pF (0R1)	L	L	L	L	L	N	N	N	N	N							
	0.2pF (0R2)	L	L	L	L	L	N	N	N	N	N							
	0.3pF (0R3)	L	L	L	L	L	N	N	N	N	N							
	0.4pF (0R4)	L	L	L	L	L	N	N	N	N	N							
	0.5pF (0R5)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.6pF (0R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.7pF (0R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.8pF (0R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.9pF (0R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.0pF (1R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.2pF (1R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.5pF (1R5)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.8pF (1R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.0pF (2R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.2pF (2R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.7pF (2R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.0pF (3R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.3pF (3R3)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.9pF (3R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	4.0pF (4R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	4.7pF (4R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	5.0pF (5R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	5.6pF (5R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	6.0pF (6R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	6.8pF (6R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	7.0pF (7R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	8.0pF (8R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	8.2pF (8R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	9.0pF (9R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	10pF (100)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	12pF (120)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	15pF (150)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	18pF (180)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	22pF (220)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	27pF (270)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	33pF (330)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	39pF (390)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	47pF (470)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	56pF (560)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	68pF (680)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	82pF (820)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	100pF (101)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	120pF (121)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
150pF (151)						N	N	N	N	N	S	S	S	S	S	S	S	
180pF (181)						N	N	N	N	N	S	S	S	S	S	S	S	
220pF (221)						N	N	N	N	N	S	S	S	S	S	S	S	
270pF (271)						N	N	N	N	N	S	S	S	S	S	X	X	
330pF (331)						N	N	N	N	N	S	S	S	S	S	X	X	
390pF (391)						N	N	N	N	N	S	S	S	S	S	X	X	
470pF (471)						N	N	N	N	N	S	S	S	S	S	X	X	
560pF (561)						N	N	N	N	N	S	S	S	S	S			
680pF (681)						N	N	N	N	N	S	S	S	S	S			
820pF (821)						N	N	N	N	N	S	S	S	S	S			
1,000pF (102)						N	N	N	N	N	S	S	S	S	S			
1,200pF (122)											X	X	X	X				
1,500pF (152)											X	X	X	X				
1,800pF (182)											X	X	X	X				
2,200pF (222)											X	X	X	X				
2,700pF (272)											X	X	X	X				
3,300pF (332)											X	X	X	X				
3,900pF (392)																		
4,700pF (472)																		
5,600pF (562)																		
6,800pF (682)																		
8,200pF (822)																		
0.01μF (103)																		

\* NP0, 0.1pF product only provide B tolerance.

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.

Multilayer Ceramic Capacitors

**NP0 Dielectric**

DIELECTRIC		NP0								
SIZE		0805								
RATED VOLTAGE		10	16	25	50	100	200	250	500	630
Capacitance	0.5pF (0R5)	A	A	A	A	A	A	A	A	A
	0.6pF (0R6)	A	A	A	A	A	A	A	A	A
	0.7pF (0R7)	A	A	A	A	A	A	A	A	A
	0.8pF (0R8)	A	A	A	A	A	A	A	A	A
	0.9pF (0R9)	A	A	A	A	A	A	A	A	A
	1.0pF (1R0)	A	A	A	A	A	A	A	A	A
	1.2pF (1R2)	A	A	A	A	A	A	A	A	A
	1.5pF (1R5)	A	A	A	A	A	A	A	A	A
	1.8pF (1R8)	A	A	A	A	A	A	A	A	A
	2.2pF (2R2)	A	A	A	A	A	A	A	A	A
	2.7pF (2R7)	A	A	A	A	A	A	A	A	A
	3.3pF (3R3)	A	A	A	A	A	A	A	A	A
	3.9pF (3R9)	A	A	A	A	A	A	A	A	A
	4.7pF (4R7)	A	A	A	A	A	A	A	A	A
	5.6pF (5R6)	A	A	A	A	A	A	A	A	A
	6.8pF (6R8)	A	A	A	A	A	A	A	A	A
	8.2pF (8R2)	A	A	A	A	A	A	A	A	A
	10pF (100)	A	A	A	A	A	A	A	A	A
	12pF (120)	A	A	A	A	A	A	A	A	A
	15pF (150)	A	A	A	A	A	A	A	A	A
	18pF (180)	A	A	A	A	A	A	A	A	A
	22pF (220)	A	A	A	A	A	A	A	A	A
	27pF (270)	A	A	A	A	A	A	A	A	A
	33pF (330)	A	A	A	A	A	A	A	A	A
	39pF (390)	A	A	A	A	A	A	A	A	A
	47pF (470)	A	A	A	A	A	A	A	A	A
	56pF (560)	A	A	A	A	A	A	A	A	A
	68pF (680)	A	A	A	A	A	A	A	A	A
	82pF (820)	A	A	A	A	A	A	A	B	B
	100pF (101)	A	A	A	A	A	B	B	B	B
	120pF (121)	A	A	A	A	A	B	B	D	D
	150pF (151)	A	A	A	A	A	D	D	D	D
	180pF (181)	A	A	A	A	A	D	D	D	D
	220pF (221)	A	A	A	A	A	D	D	D	D
	270pF (271)	A	A	A	A	A	D	D	D	D
	330pF (331)	A	A	A	A	A	D	D	D	D
	390pF (391)	B	B	B	B	B	D	D	D	D
	470pF (471)	B	B	B	B	B	D	D	I	I
	560pF (561)	B	B	B	B	B	D	D	I	I
	680pF (681)	B	B	B	B	B	D	D	I	I
820pF (821)	B	B	B	B	B	D	D	I	I	
1,000pF (102)	B	B	B	B	B	D	D	I	I	
1,200pF (122)	B	B	B	B	B	D	D			
1,500pF (152)	B	B	B	B	B	D	D			
1,800pF (182)	B	B	B	B	B	D	D			
2,200pF (222)	B	B	B	B	B	D	D			
2,700pF (272)	D	D	D	D	D					
3,300pF (332)	D	D	D	D	D					
3,900pF (392)	D	D	D	D	D					
4,700pF (472)	D	D	D	D	D					
5,600pF (562)	D	D	D	D	D					
6,800pF (682)	D	D	D	D	D					
8,200pF (822)	D	D	D	D	D					
0.01μF (103)	D	D	D	D	D					

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.

Multilayer Ceramic Capacitors

**NP0 Dielectric**

DIELECTRIC		NP0									
SIZE		1206									
RATED VOLTAGE		10	16	25	50	100	200	250	500	630	1000
Capacitance	1.0pF (1R0)										
	1.2pF (1R2)	B	B	B	B	B	B	B	B	B	
	1.5pF (1R5)	B	B	B	B	B	B	B	B	B	B
	1.8pF (1R8)	B	B	B	B	B	B	B	B	B	B
	2.2pF (2R2)	B	B	B	B	B	B	B	B	B	B
	2.7pF (2R7)	B	B	B	B	B	B	B	B	B	B
	3.3pF (3R3)	B	B	B	B	B	B	B	B	B	B
	3.9pF (3R9)	B	B	B	B	B	B	B	B	B	B
	4.7pF (4R7)	B	B	B	B	B	B	B	B	B	B
	5.6pF (5R6)	B	B	B	B	B	B	B	B	B	B
	6.8pF (6R8)	B	B	B	B	B	B	B	B	B	B
	8.2pF (8R2)	B	B	B	B	B	B	B	B	B	B
	10pF (100)	B	B	B	B	B	B	B	B	B	B
	12pF (120)	B	B	B	B	B	B	B	B	B	B
	15pF (150)	B	B	B	B	B	B	B	B	B	B
	18pF (180)	B	B	B	B	B	B	B	B	B	B
	22pF (220)	B	B	B	B	B	B	B	B	B	D
	27pF (270)	B	B	B	B	B	B	B	B	B	D
	33pF (330)	B	B	B	B	B	B	B	B	B	D
	39pF (390)	B	B	B	B	B	B	B	B	B	D
	47pF (470)	B	B	B	B	B	B	B	B	B	D
	56pF (560)	B	B	B	B	B	B	B	B	B	D
	68pF (680)	B	B	B	B	B	B	B	B	B	D
	82pF (820)	B	B	B	B	B	B	B	B	B	D
	100pF (101)	B	B	B	B	B	B	B	B	B	D
	120pF (121)	B	B	B	B	B	B	B	B	B	D
	150pF (151)	B	B	B	B	B	B	B	B	B	D
	180pF (181)	B	B	B	B	B	B	B	B	B	G
	220pF (221)	B	B	B	B	B	B	B	B	B	G
	270pF (271)	B	B	B	B	B	B	C	C	C	G
	330pF (331)	B	B	B	B	B	B	C	C	C	G
	390pF (391)	B	B	B	B	B	B	C	C	C	G
	470pF (471)	B	B	B	B	B	C	C	C	C	G
	560pF (561)	B	B	B	B	B	C	D	D	D	G
	680pF (681)	B	B	B	B	B	C	D	D	D	G
	820pF (821)	B	B	B	B	B	C	G	G	G	G
	1,000pF (102)	B	B	B	B	B	C	G	G	G	G
	1,200pF (122)	B	B	B	B	B	C	G	G	G	
	1,500pF (152)	B	B	B	B	B	D	G	G	G	
	1,800pF (182)	B	B	B	B	B	D	G	G	G	
2,200pF (222)	B	B	B	B	B	D	G	G	G		
2,700pF (272)	B	B	B	B	B	D	G	G	G		
3,300pF (332)	B	B	B	B	B	D	G	G	G		
3,900pF (392)	B	B	B	B	B	D	G	G	G		
4,700pF (472)	B	B	B	B	B	D	G	G	G		
5,600pF (562)	B	B	B	B	B						
6,800pF (682)	C	C	C	C	C						
8,200pF (822)	D	D	D	D	D						
0.01μF (103)	D	D	D	D	D						

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Multilayer Ceramic Capacitors

**NP0 Dielectric**

DIELECTRIC		NP0									
SIZE		1210									
RATED VOLTAGE		10	16	25	50	100	200	250	500	630	1000
Capacitance	10pF (100)	C	C	C	C	C	C	C	C	C	C
	12pF (120)	C	C	C	C	C	C	C	C	C	C
	15pF (150)	C	C	C	C	C	C	C	C	C	C
	18pF (180)	C	C	C	C	C	C	C	C	C	C
	22pF (220)	C	C	C	C	C	C	C	C	C	C
	27pF (270)	C	C	C	C	C	C	C	C	C	C
	33pF (330)	C	C	C	C	C	C	C	C	C	C
	39pF (390)	C	C	C	C	C	C	C	C	C	C
	47pF (470)	C	C	C	C	C	C	C	C	C	C
	56pF (560)	C	C	C	C	C	C	C	C	C	C
	68pF (680)	C	C	C	C	C	C	C	C	C	C
	82pF (820)	C	C	C	C	C	C	C	C	C	C
	100pF (101)	C	C	C	C	C	C	C	C	C	D
	120pF (121)	C	C	C	C	C	C	C	C	C	D
	150pF (151)	C	C	C	C	C	C	C	C	C	D
	180pF (181)	C	C	C	C	C	C	C	C	C	D
	220pF (221)	C	C	C	C	C	C	C	C	C	G
	270pF (271)	C	C	C	C	C	C	C	C	C	G
	330pF (331)	C	C	C	C	C	C	C	C	C	G
	390pF (391)	C	C	C	C	C	C	C	C	C	G
	470pF (471)	C	C	C	C	C	C	C	C	C	G
	560pF (561)	C	C	C	C	C	C	C	C	C	G
	680pF (681)	C	C	C	C	C	C	C	C	C	G
	820pF (821)	C	C	C	C	C	C	C	C	C	G
	1,000pF (102)	C	C	C	C	C	C	D	D	D	G
	1,200pF (122)	C	C	C	C	C	C	D	D	D	
	1,500pF (152)	C	C	C	C	C	C	D	D	D	
	1,800pF (182)	C	C	C	C	C	C	D	D	D	
	2,200pF (222)	C	C	C	C	C	C	D	D	D	
	2,700pF (272)	C	C	C	C	C	C	D	D	D	
	3,300pF (332)	C	C	C	C	C	C	D	D	D	
	3,900pF (392)	C	C	C	C	C	C	D	D	D	
	4,700pF (472)	C	C	C	C	C	C	G	G		
	5,600pF (562)	C	C	C	C	C	C	G	G		
	6,800pF (682)	C	C	C	C	C	C	G	G		
	8,200pF (822)	C	C	C	C	C	C	G	G		
	0.010μF (103)	C	C	C	C	C	C	G	G		
	0.012μF (123)	D	D	D	D	D	D				
	0.015μF (153)	D	D	D	D	D	D				
	0.018μF (183)	K	K	K	K	K	K				
0.022μF (223)	K	K	K	K	K	K					
0.027μF (273)	K	K	K	K	K	K					
0.033μF (333)	K	K	K	K	K	K					
0.039μF (393)	K	K	K	K	K	K					
0.047μF (473)	K	K	K	K	K	K					

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2. For more information about products with special capacitance or other data, please contact WTC local representative.

Multilayer Ceramic Capacitors

**X7R Dielectric**

DIELECTRIC		X7R												
SIZE		0201				0402				0603				
RATED VOLTAGE		10	16	25	50	10	16	25	50	10	16	25	50	100
Capacitance	100pF (101)	L	L	L	L	N	N	N	N	S	S	S	S	S
	120pF (121)	L	L	L	L	N	N	N	N	S	S	S	S	S
	150pF (151)	L	L	L	L	N	N	N	N	S	S	S	S	S
	180pF (181)	L	L	L	L	N	N	N	N	S	S	S	S	S
	220pF (221)	L	L	L	L	N	N	N	N	S	S	S	S	S
	270pF (271)	L	L	L	L	N	N	N	N	S	S	S	S	S
	330pF (331)	L	L	L	L	N	N	N	N	S	S	S	S	S
	390pF (391)	L	L	L	L	N	N	N	N	S	S	S	S	S
	470pF (471)	L	L	L	L	N	N	N	N	S	S	S	S	S
	560pF (561)	L	L	L	L	N	N	N	N	S	S	S	S	S
	680pF (681)	L	L	L	L	N	N	N	N	S	S	S	S	S
	820pF (821)	L	L	L	L	N	N	N	N	S	S	S	S	S
	1,000pF (102)	L	L	L	L	N	N	N	N	S	S	S	S	S
	1,200pF (122)	L	L	L		N	N	N	N	S	S	S	S	S
	1,500pF (152)	L	L	L		N	N	N	N	S	S	S	S	S
	1,800pF (182)	L	L	L		N	N	N	N	S	S	S	S	S
	2,200pF (222)	L	L	L		N	N	N	N	S	S	S	S	S
	2,700pF (272)	L	L	L		N	N	N	N	S	S	S	S	S
	3,300pF (332)	L	L	L		N	N	N	N	S	S	S	S	S
	3,900pF (392)	L	L	L		N	N	N	N	S	S	S	S	S
	4,700pF (472)	L	L	L		N	N	N	N	S	S	S	S	S
	5,600pF (562)	L	L	L		N	N	N	N	S	S	S	S	S
	6,800pF (682)	L				N	N	N	N	S	S	S	S	S
	8,200pF (822)	L				N	N	N	N	S	S	S	S	S
	0.010μF (103)	L				N	N	N	N	S	S	S	S	S
	0.012μF (123)					N	N	N		S	S	S	S	X
	0.015μF (153)					N	N	N		S	S	S	S	X
	0.018μF (183)					N	N	N		S	S	S	S	X
	0.022μF (223)					N	N	N		S	S	S	S	X
	0.027μF (273)					N	N	N		S	S	S	S	X
	0.033μF (333)					N	N	N		S	S	S	X	X
	0.039μF (393)					N	N	N		S	S	S	X	X
	0.047μF (473)					N	N	N		S	S	S	X	X
0.056μF (563)					N	N	N		S	S	S	X		
0.068μF (683)					N	N	N		S	S	S	X		
0.082μF (823)					N	N	N		S	S	S	X		
0.10μF (104)					N	N	N		S	S	S	X		
0.12μF (124)									X	X	X			
0.15μF (154)									X	X	X	X		
0.18μF (184)									X	X	X			
0.22μF (224)									X	X	X	X		
0.33μF (334)									X	X	X	X		

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Multilayer Ceramic Capacitors

**X7R Dielectric**

DIELECTRIC		X7R																	
SIZE		0805								1206									
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	10	16	25	50	100	200	250	500	630
Capacitance	100pF (101)	B	B	B	B	B	B	B	B	B						D	D	D	D
	120pF (121)	B	B	B	B	B	B	B	B	B						D	D	D	D
	150pF (151)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	180pF (181)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	220pF (221)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	270pF (271)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	330pF (331)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	390pF (391)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	470pF (471)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	560pF (561)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	680pF (681)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	820pF (821)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,000pF (102)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,200pF (122)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,500pF (152)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,800pF (182)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	2,200pF (222)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	2,700pF (272)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	3,300pF (332)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	3,900pF (392)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	4,700pF (472)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	5,600pF (562)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	6,800pF (682)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	8,200pF (822)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	0.010μF (103)	B	B	B	B	B	D	D	D	D	B	B	B	B	B	D	D	D	D
	0.012μF (123)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.015μF (153)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.018μF (183)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.022μF (223)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.027μF (273)	B	B	B	B	D					B	B	B	B	B				
	0.033μF (333)	B	B	B	B	D					B	B	B	B	B				
	0.039μF (393)	B	B	B	B	D					B	B	B	B	B				
	0.047μF (473)	B	B	B	B	D					B	B	B	B	B				
	0.056μF (563)	B	B	B	B	D					B	B	B	B	B				
	0.068μF (683)	B	B	B	B	D					B	B	B	B	B				
	0.082μF (823)	B	B	B	B	D					B	B	B	B	D				
	0.10μF (104)	B	B	B	B	D					B	B	B	B	D				
	0.12μF (124)	B	B	B	D						B	B	B	B	D				
	0.15μF (154)	D	D	D	D						C	C	C	C	G				
	0.18μF (184)	D	D	D	D						C	C	C	C	G				
0.22μF (224)	D	D	D	D						C	C	C	C	G					
0.27μF (274)	D	D	D	I						C	C	C	D						
0.33μF (334)	D	D	D	I						C	C	C	D						
0.39μF (394)	D	D	D	I						C	C	J	P						
0.47μF (474)	D	D	D	I						J	J	J	P						
0.56μF (564)	D	D	D							J	J	J	P						
0.68μF (684)	D	D	D	I						J	J	J	P						
0.82μF (824)	D	D	D							J	J	J	P						
1.0μF (105)	D	D	D	I						J	J	J	P						
2.2μF (225)																			
4.7μF (475)																			
10μF (106)																			

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Multilayer Ceramic Capacitors

**X7R Dielectric**

DIELECTRIC		X7R							
SIZE		1210							
RATED VOLTAGE (VDC)		10	16	25	50	100	250	500	1000
Capacitance	100pF (101)						D	D	D
	120pF (121)						D	D	D
	150pF (151)						D	D	D
	180pF (181)						D	D	D
	220pF (221)						D	D	D
	270pF (271)						D	D	D
	330pF (331)						D	D	D
	390pF (391)						D	D	D
	470pF (471)						D	D	D
	560pF (561)						D	D	D
	680pF (681)						C	D	D
	820pF (821)						C	D	D
	1,000pF (102)	C	C	C	C	C	C	D	D
	1,200pF (122)	C	C	C	C	C	C	D	D
	1,500pF (152)	C	C	C	C	C	C	D	D
	1,800pF (182)	C	C	C	C	C	C	D	D
	2,200pF (222)	C	C	C	C	C	C	D	D
	2,700pF (272)	C	C	C	C	C	C	D	D
	3,300pF (332)	C	C	C	C	C	C	D	D
	3,900pF (392)	C	C	C	C	C	C	D	G
	4,700pF (472)	C	C	C	C	C	C	D	G
	5,600pF (562)	C	C	C	C	C	C	D	G
	6,800pF (682)	C	C	C	C	C	C	D	G
	8,200pF (822)	C	C	C	C	C	C	D	G
	0.010μF (103)	C	C	C	C	C	C	D	G
	0.012μF (123)	C	C	C	C	C	C	D	
	0.015μF (153)	C	C	C	C	C	C	D	
	0.018μF (183)	C	C	C	C	C	C	D	
	0.022μF (223)	C	C	C	C	C	C	D	
	0.027μF (273)	C	C	C	C	C	C		
	0.033μF (333)	C	C	C	C	C	C		
	0.039μF (393)	C	C	C	C	C	C		
	0.047μF (473)	C	C	C	C	C	D		
	0.056μF (563)	C	C	C	C	C			
	0.068μF (683)	C	C	C	C	C			
	0.082μF (823)	C	C	C	C	C			
	0.10μF (104)	C	C	C	C	C			
	0.12μF (124)	C	C	C	C				
	0.15μF (154)	C	C	C	C				
	0.18μF (184)	C	C	C	C				
0.22μF (224)	C	C	C	C					
0.27μF (274)	C	C	C	C					
0.33μF (334)	C	C	C	D					
0.39μF (394)	C	C	C	D					
0.47μF (474)	C	C	C	D					
0.56μF (564)	D	D	D	D					
0.68μF (684)	D	D	D	D					
0.82μF (824)	D	D	D	D					
1.0μF (105)	D	D	D	D					
1.5μF (155)		K							
2.2μF (225)		K							
4.7μF (475)									
10μF (106)									

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Multilayer Ceramic Capacitors

**8. PACKAGING STYLE AND QUANTITY**

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.03	L	15k	70k	-	-
0402 (1005)	0.50±0.05	N	10k	50k	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80+0.15/-0.10	X	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
	1.25±0.20	I	-	-	3k	10k
1206 (3216)	0.80±0.10	B	4k	15k	-	-
	0.95±0.10	C	-	-	3k	10k
	1.15±0.15	J	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	10k
	1.60+0.30/-0.10	P	-	-	2k	9k
1210 (3225)	0.95±0.10	C	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	-
	2.00±0.20	K	-	-	1k	6k
	2.50±0.30	M	-	-	1k	6k

Unit: pieces



Multilayer Ceramic Capacitors

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																								
1.	Pre-and Post-Stress Electrical Test	---																																									
2.	High Temperature Exposure (Storage) MIL-STD-202 Method 108	* Test temp.: 150±3°C * Unpowered. * Test time: 1000+24/-0 hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change : NPO: within ±2.5% or ±0.25pF whichever is larger. X7R: within ±10.00%. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R: <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="3">≥100V</td> <td rowspan="3">≤3%</td> <td>≤6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤7.5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤20% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤3%</td> <td>≤6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤5%</td> <td>≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤14% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤20% 0402 ≥ 0.47μF</td> </tr> <tr> <td>≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤7.5%</td> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤15%</td> <td>≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>--</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥100V	≤3%	≤6% 1206 ≥ 0.47μF	≤7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤20% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤3%	≤6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤5%	≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤14% 0603 ≥ 0.33μF	25V	≤5%	≤15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤20% 0402 ≥ 0.47μF	≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤5%	≤15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF	10V	≤7.5%	≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	≤15%	≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	4V	≤20%	--
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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



Multilayer Ceramic Capacitors

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4.	<b>Destructive Physical Analysis</b> EIA-469	Per EIA-469	No defects or abnormalities																																						
5.	<b>Moisture Resistance</b> MIL-STD-202 Method 106	* Test temp.: 25~65°C * Humidity: 80~100% RH * Test time: 10 cycles, t=24hrs/cycle. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change : NPO: within ±3.0% or 0.30pF whichever is larger X7R: within ±12.5%. * Q/D.F. value: NPO: More than 30pF Q≥350 ; 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C X7R: <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="3">≥ 100V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5% 0603 ≥ 0.068μF;0805 &gt; 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20% 0805 ≥ 0.22μF;1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.01μF;1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.012μF;0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 5%</td> <td>≤ 20% 0603 ≥ 1μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF</td> </tr> <tr> <td>≤ 14% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 5%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF;</td> </tr> <tr> <td>0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 5%</td> <td>0201 ≥ 0.022μF;0402 ≥ 0.033μF;</td> </tr> <tr> <td>0603 &gt; 0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.22μF;</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 7.5%</td> <td>0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 15%</td> <td>0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF</td> </tr> <tr> <td>4V ≤ 20% --- ---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF	≤ 7.5% 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF	≤ 20% 0805 ≥ 0.22μF;1210 ≥ 3.3μF	50V	≤ 3%	≤ 6% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 10% 0201 ≥ 0.01μF;1210 ≥ 3.3μF	≤ 20% 0402 ≥ 0.012μF;0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF	35V	≤ 5%	≤ 20% 0603 ≥ 1μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	≤ 10% 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF	≤ 14% 0603 ≥ 0.33μF	25V	≤ 5%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF;	0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF	≤ 20% 0402 ≥ 0.47μF	≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	16V	≤ 5%	0201 ≥ 0.022μF;0402 ≥ 0.033μF;	0603 > 0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF	≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.22μF;	10V	≤ 7.5%	0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF	≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF	≤ 15% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF;	6.3V	≤ 15%	0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF	4V ≤ 20% --- ---
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Multilayer Ceramic Capacitors

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6.	<b>Biased Humidity</b> MIL-STD-202 Method 103	* Test temp.: 85±3°C * Humidity: 85%RH * Test time: 1000+24/-0 hrs. * To apply voltage : rated voltage and 1.3~1.5Vdc. (add 100k ohm resistor) * Before initial measurement (Class II only) : To apply test voltage for 1hr at test temp. 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: NPO: within ±3.0% or 0.30pF whichever is larger. X7R: within ±12.5% * Q/D.F. value: NPO: C≥30pF , Q≥200 ; C<30pF , Q≥100+10/3C X7R:																																																										
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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.



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7.	Operational Life MIL-STD-202 Method 108	* Test temp.: 125±3°C * To apply voltage: (1) 10V≤Ur≤250V:200% of rated voltage. (2) 150% of rated voltage: a) 500V b) 0603/X7R/50V/Cap.>0.1μF c) 0805/X7R/50V/Cap.≥0.68μF (3) 630V≤Ur≤1000V:120% of rated voltage. * Test time: 1000+24/0 hrs. * Before initial measurement (X7R only): Apply test voltage for 1 hr at 125°C. Remove and let 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: NPO: within ±3.0% or ±0.3pF whichever is larger X7R: within ±12.5%. * Q/D.F. value: NPO: More than 30pF, Q≥350 ; 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C X7R:																																			
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8.	External Visual MIL-STD-883 Method 2009	Visual inspection	No remarkable defect.																																			
9.	Physical Dimension JESD22 Method JB-100	Using by calipers	Within the specified dimensions																																			

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No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																						
10.	Resistance to Solvents MIL-STD-202 Method 215	* Temperature: 25±5°C * Time: 3+0.5/-0 min. * Solvent: Iso-propyl alcohol.	* No remarkable damage. * Cap.: within the specified tolerance. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:																																																						
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Rated voltage		Insulation Resistance																																																							
100V: 1210≥3.3μF		RxC≥50 Ω·F.																																																							
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\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements
11.	Mechanical Shock MIL-STD-202 Method 213	* Peak value: 1500g's.	* No remarkable damage.
		* Wave: 1/2 sine.	* Cap.: within the specified tolerance.
		* Velocity: 15.4 ft/sec	* Q/D.F. value:
		* Three shocks in each direction should be applied along	NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.
		3 mutually perpendicular axes of the test specimen	X7R:
		(18 shocks)	
			Rated vol. D.F. ≤ Exception of D.F. ≤
			≥ 100V ≤ 2.5% ≤ 3% 1206 ≥ 0.47μF
			≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF
			≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF
			50V ≤ 2.5% ≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
			≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF
			≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
			35V ≤ 3.5% ≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
			≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF
	25V ≤ 3.5% ≤ 7% 0603 ≥ 0.33μF		
	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF		
	≤ 12.5% 0402 ≥ 0.47μF		
	16V ≤ 3.5% ≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF		
	≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF		
	10V ≤ 5% ≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF		
	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF		
	6.3V ≤ 10% ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF		
	≤ 20% 0402 ≥ 2.2μF		
	4V ≤ 15% ---		
	* I.R.: ≥10GΩ or RxC≥500Ω·F whichever is smaller.		
	Class II (X7R)		
	Rated voltage Insulation Resistance		
	100V: All X7R	10GΩ or RxC≥100 Ω·F whichever is smaller.	
	50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF		
	35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF		
	25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF		
	16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF		
	10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF		
	6.3V; 4V; Size≥1812		
	Rated voltage Insulation Resistance		
	100V: 1210≥3.3μF	RxC≥50 Ω·F.	
	50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF; 1206≥10μF		
	35V: 0603≥1μF;		
	25V: 0201≥0.1μF; 0402≥2.2μF; 0603≥10μF; 0805≥10μF; 1206≥22μF		
	16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF		
	10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF		
	6.3V: 0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF		
	4V: 0603≥22μF; 0805≥47μF; 1206≥100μF		

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

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																						
12.	Vibration MIL-STD-202 Method 204	* Vibration frequency: 10~2000 Hz/min. (5g's for 20 min) * Total amplitude: 1.5mm * 12 cycles each of 3 orientations (36 times)	No remarkable damage. * Cap.: within the specified tolerance. * Q/D.F. value: NPO:Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 10%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>35V</td> <td>≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>10V</td> <td>≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V	≤ 3.5%	≤ 12.5%	0402 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 10%	0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	4V	≤ 15%	≤ 20%	0402 ≥ 2.2μF
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Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																										
13.	<b>Resistance to Soldering Heat</b> MIL-STD-202 Method 210	* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Before initial measurement (X7R 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: NPO: within ±2.5% or 0.25pF whichever is larger X7R: within ±7.5% * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:																																																										
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Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements		
15.	ESD AEC-Q200-002	Per AEC-Q200-002	No remarkable damage.		
			Cap.: within the specified tolerance.		
			Q/D.F. value:		
			NPO: Cap $\geq$ 30pF, Q $\geq$ 1000 ; Cap $<$ 30pF, Q $\geq$ 400+20C.		
			X7R:		
			Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$
			$\geq$ 100V	$\leq$ 2.5%	$\leq$ 3% 1206 $\geq$ 0.47 $\mu$ F $\leq$ 5% 0603 $\geq$ 0.068 $\mu$ F; 0805 $>$ 0.1 $\mu$ F; 1206 $\geq$ 1 $\mu$ F; 1210 $\geq$ 2.2 $\mu$ F $\leq$ 10% 0805 $>$ 0.22 $\mu$ F; 1210 $\geq$ 3.3 $\mu$ F
			50V	$\leq$ 2.5%	$\leq$ 3% 0201(50V); 0603 $\geq$ 0.047 $\mu$ F; 0805 $\geq$ 0.18 $\mu$ F; 1206 $\geq$ 0.47 $\mu$ F $\leq$ 5% 0201 $\geq$ 0.01 $\mu$ F; 1210 $\geq$ 3.3 $\mu$ F
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			35V	$\leq$ 3.5%	$\leq$ 5% 0201 $\geq$ 0.01 $\mu$ F; 0805 $\geq$ 1 $\mu$ F; 1210 $\geq$ 10 $\mu$ F $\leq$ 7% 0603 $\geq$ 0.33 $\mu$ F
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					$\leq$ 10% 0201 $\geq$ 0.01 $\mu$ F; 0402 $\geq$ 0.033 $\mu$ F; 0603 $\geq$ 0.15 $\mu$ F; 0805 $\geq$ 0.68 $\mu$ F; 1206 $\geq$ 2.2 $\mu$ F; 1210 $\geq$ 4.7 $\mu$ F
			25V	$\leq$ 3.5%	$\leq$ 10% 0201 $\geq$ 0.022 $\mu$ F; 0402 $\geq$ 0.22 $\mu$ F; 0603 $>$ 0.47 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 22 $\mu$ F $\leq$ 10% 0201 $\geq$ 0.012 $\mu$ F; 0402 $\geq$ 0.22 $\mu$ F; 0603 $\geq$ 0.33 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 2.2 $\mu$ F; 1210 $\geq$ 22 $\mu$ F $\leq$ 15% 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F
					$\leq$ 15% 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0603 $\geq$ 10 $\mu$ F; 0805 $\geq$ 4.7 $\mu$ F; 1206 $\geq$ 47 $\mu$ F; 1210 $\geq$ 100 $\mu$ F $\leq$ 20% 0402 $\geq$ 2.2 $\mu$ F
$\leq$ 20% 0402 $\geq$ 2.2 $\mu$ F					
6.3V	$\leq$ 10%	$\leq$ 15% 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0603 $\geq$ 10 $\mu$ F; 0805 $\geq$ 4.7 $\mu$ F; 1206 $\geq$ 47 $\mu$ F; 1210 $\geq$ 100 $\mu$ F $\leq$ 20% 0402 $\geq$ 2.2 $\mu$ F			
4V	$\leq$ 15%	---			
* I.R.: $\geq$ 10G $\Omega$ or Rx $C \geq$ 500 $\Omega \cdot F$ whichever is smaller.					
Class II (X7R)					
Rated voltage		Insulation Resistance			
100V: All X7R		10G $\Omega$ or Rx $C \geq$ 100 $\Omega \cdot F$ whichever is smaller.			
50V: 0402 $>$ 0.01 $\mu$ F; 0603 $\geq$ 1 $\mu$ F; 0805 $\geq$ 1 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 4.7 $\mu$ F					
35V: 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 2.2 $\mu$ F; 1210 $\geq$ 10 $\mu$ F					
25V: 0402 $\geq$ 1 $\mu$ F; 0603 $\geq$ 2.2 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 10 $\mu$ F; 1210 $\geq$ 10 $\mu$ F					
16V: 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 0.22 $\mu$ F; 0603 $\geq$ 1 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 10 $\mu$ F; 1210 $\geq$ 47 $\mu$ F					
10V: 0201 $\geq$ 47nF; 0402 $\geq$ 0.47 $\mu$ F; 0603 $\geq$ 0.47 $\mu$ F; 0805 $\geq$ 2.2 $\mu$ F; 1206 $\geq$ 4.7 $\mu$ F; 1210 $\geq$ 47 $\mu$ F					
6.3V, 4V; Size $\geq$ 1812					
Rated voltage		Insulation Resistance			
100V: 1210 $\geq$ 3.3 $\mu$ F		Rx $C \geq$ 50 $\Omega \cdot F$ .			
50V: 0402 $\geq$ 0.1 $\mu$ F; 0603 $\geq$ 2.2 $\mu$ F; 0805 $\geq$ 10 $\mu$ F; 1206 $\geq$ 10 $\mu$ F					
35V: 0603 $\geq$ 1 $\mu$ F;					
25V: 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 2.2 $\mu$ F; 0603 $\geq$ 10 $\mu$ F; 0805 $\geq$ 10 $\mu$ F; 1206 $\geq$ 22 $\mu$ F					
16V: 0603 $\geq$ 10 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0201 $\geq$ 0.22 $\mu$ F					
10V: 0201 $>$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0603 $\geq$ 10 $\mu$ F; 0805 $\geq$ 47 $\mu$ F					
6.3V: 0201 $\geq$ 0.1 $\mu$ F; 0402 $\geq$ 1 $\mu$ F; 0603 $>$ 4.7 $\mu$ F; 0805 $\geq$ 47 $\mu$ F; 1206 $\geq$ 10 $\mu$ F					
4V: 0603 $\geq$ 22 $\mu$ F; 0805 $\geq$ 47 $\mu$ F; 1206 $\geq$ 100 $\mu$ F					
16.	Solderability J-STD-002 JESD22-B102E	* Condition A Un-mounted chips 4hrs / 155°C* dry then completely immersed for 5 $\pm$ 0.5 sec in solder bath at 235 $\pm$ 5°C.	All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination.		
		* Condition B Un-mounted chips steam 8 hrs then completely immersed for 10 $\pm$ 1sec in solder bath at 215+5/-0°C.			
		* Condition C Un-mounted chips steam 8 hrs then completely immersed for 10 $\pm$ 1 sec. in solder bath at 260+0/-5°C.			

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



Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																																																
17.	<b>Electrical Characterization</b> * Capacitance * Q/ D.F. (Dissipation Factor) *Test temp.: Room Temperature. Class I: (NP0) Cap≤1000pF 1.0±0.2Vrms, 1MHz±10% Cap>1000pF 1.0±0.2Vrms, 1KHz±10% Class II: (X7R) Cap ≤10μF, 1.0±0.2Vrms · 1KHz±10% Cap > 10μF, 0.5±0.2Vrms · 120Hz±20%  * Insulation Resistance *Test temp.: Room Temperature. *To apply rated voltage(500V max.) for max. 120 sec.  * Dielectric Strength To apply voltage: ≤ 100                    ≥2.5 times VDC 200V~300V            ≥2 times VDC 400V~450V            ≥1.2 times VDC 500V~999V            ≥1.5 times VDC 1000V~3000V        ≥1.2 times VDC , duration 1~5 sec, charge and discharge current less than 50mA. * Temperature Coefficient (with no electrical load) Operation temperature: -55~125°C at 25°C	* Capacitance within the specified tolerance. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0603 ≥ 0.068μF;0805 &gt; 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 10%</td> <td>0805 &gt; 0.22μF;1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF;1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF;0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF;0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.022μF; 0402 ≥ 0.22μF;0603 &gt; 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF	≤ 10%	0805 > 0.22μF;1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3%	0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF;1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF;0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF	25V	≤ 3.5%	≤ 10%	0201 ≥ 0.1μF;0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5%	0402 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10%	0201 ≥ 0.022μF; 0402 ≥ 0.22μF;0603 > 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF	≤ 15%	0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF	6.3V	≤ 10%	≤ 15%	0402 ≥ 2.2μF	≤ 20%	0402 ≥ 2.2μF	4V	≤ 15%	---	---	* IR. ≥10GΩ or RxC≥500Ω·F whichever is smaller. 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Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																											
18.	<b>Board Flex</b> AEC-Q200-005	* 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 3mm (2mm for X7R) and then the pressure shall be maintained for 60±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change : NPO: 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.)																																											
19.	<b>Terminal Strength</b> AEC-Q200-006	* Pressurizing force : 2N (0201 & 0402), 10N(0603), 18N(≥0805). * Test time: 60±1 sec.	* No remarkable damage or removal of the terminations. * Capacitance within the specified tolerance. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R: <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="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 10% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 12.5% 0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 &gt; 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>-- --</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>-- --</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤ 15%</td> <td>-- --</td> </tr> <tr> <td>-- --</td> </tr> <tr> <td>-- --</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 2.5%	≤ 3% 1206 ≥ 0.47μF	≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7% 0603 ≥ 0.33μF	25V	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5% 0402 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF	10V	≤ 5%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 20% 0402 ≥ 2.2μF	-- --	6.3V	≤ 10%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 20% 0402 ≥ 2.2μF	-- --	4V	≤ 15%	-- --	-- --	-- --
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20	<b>Beam Load Test</b> AEC-Q200-003	* Break strength test * Beam speed: 2.5±0.25 mm/sec	The chip endure following force * Chip length ≤2.5mm: Thickness >0.5mm (20N), ≤0.5mm (8N) * Chip length ≥3.2mm: Thickness ≥1.25mm (54.5N), <1.25mm (15N)																																											

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



Multilayer Ceramic Capacitors

**APPENDICES**

■ Tape & reel dimensions

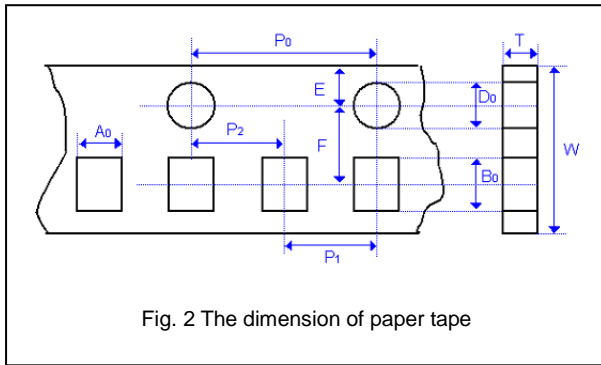


Fig. 2 The dimension of paper tape

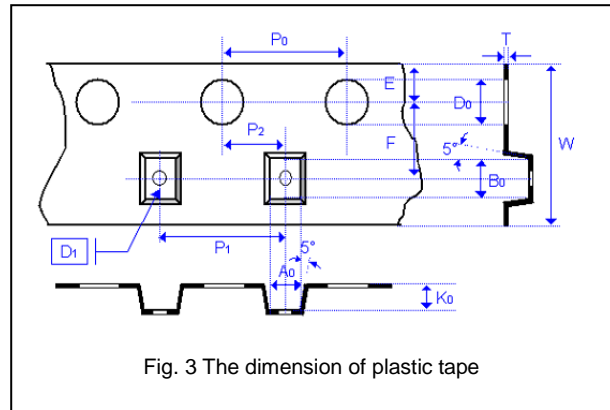


Fig. 3 The dimension of plastic tape

Size	0201	0402	0603	0805			1206			1210		
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
A <sub>0</sub>	0.40 +/-0.10	0.70 +/-0.20	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
B <sub>0</sub>	0.70 +/-0.10	1.20 +/-0.20	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	< 4.00
T	≤ 0.55	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	≤ 1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1
K <sub>0</sub>	-	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20
W	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30
P <sub>0</sub>	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 <sub>0</sub>	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
P <sub>1</sub>	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
P <sub>2</sub>	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
D <sub>0</sub>	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	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D <sub>1</sub>	-	-	-	-	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-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	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

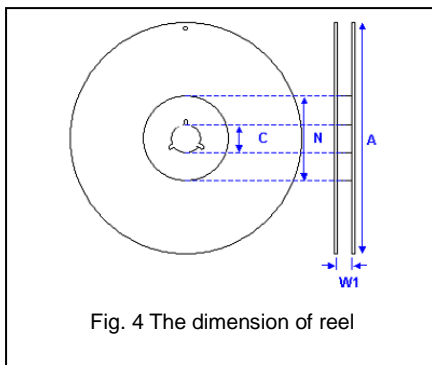
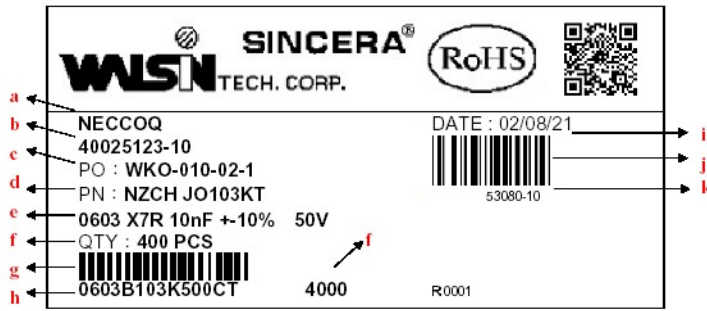


Fig. 4 The dimension of reel

Size	0201, 0402, 0603, 0805, 1206, 1210		
Reel size	7"	10"	13"
C	13.0±0.5	13.0±0.5	13.0±0.5
W <sub>1</sub>	10.0±1.5	10.0±1.5	10.0±1.5
A	178.0±2.0	250.0±2.0	330.0±2.0
N	60.0+1.0/-0	50 min	50 min

**Multilayer Ceramic Capacitors**

**Example 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

\*Customized label is available upon request

**Constructions**

No.	Name	NPO,	X7R
①	Ceramic material	CaZrO <sub>3</sub> based	BaTiO <sub>3</sub> based
②	Inner electrode	Ni	
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

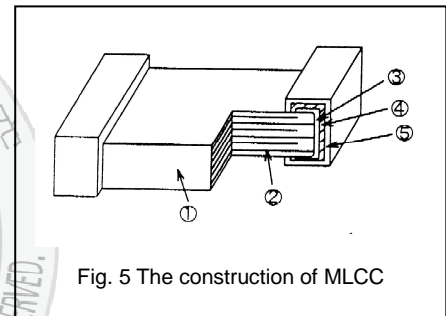


Fig. 5 The construction of MLCC

**Storage and handling conditions**

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions; MSL Level 1.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

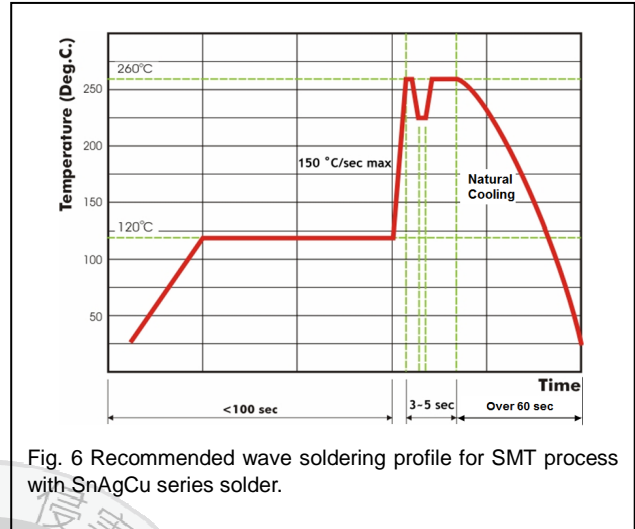
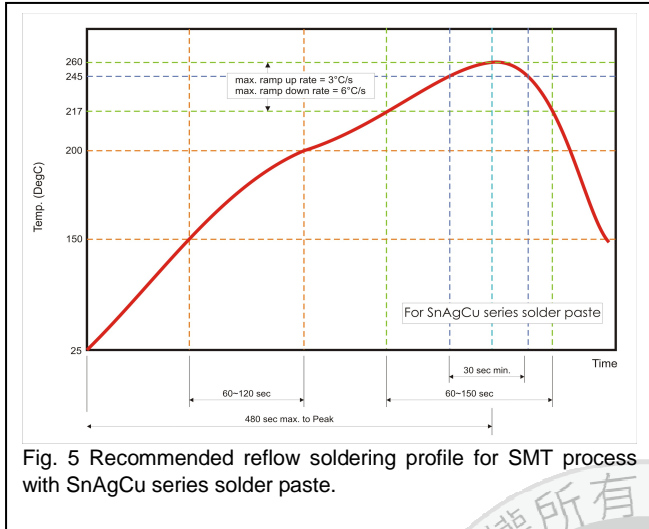
Cautions:

- a. 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.)
- b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- c. 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.

Multilayer Ceramic Capacitors

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<sub>2</sub> within oven are recommended.



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[NMC0805X7R224K16TRPLPF](#) [NMC1206X7R102K50TRPF](#) [NMC1206X7R106K10TRPLPF](#) [NMC1206X7R475K10TRPLPF](#) [NMC-](#)  
[Q0402NPO8R2D200TRPF](#) [C1608C0G2A221J](#) [C1608X7R1E334K](#) [C2012C0G2A472J](#) [2220J2K00562KXT](#) [CDR33BX104AKUR](#)  
[CDR33BX683AKUS](#) [CGA3E1X7R1C684K](#) [CL10C0R8BB8ANNC](#) [C1005X5R0G225M](#) [C2012X7R2E223K](#) [C3216C0G2J272J](#)  
[D55342E07B35E7R-T/R](#) [NMC0402X7R562J25TRPF](#) [NMC0603NPO102J25TRPF](#) [NMC1206X7R332K50TRPF](#) [726632-1](#)  
[CGA6M3X7R1H225K](#) [CGA5L2X7R2A105K](#) [CGA3E2X8R1H223K](#) [CDR33BX823AKUR\M500](#) [CDR35BX474AKUR\M500](#)  
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[NMC0402X5R224K10TRPF](#) [NMC0603X7R104J25TRPF](#) [NMC0603X7R223K25TRPF](#) [NMC0805NPO100J50TRPF](#)  
[NMC0805X7R104M50TRPF](#)