

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MT)

Qualified to AEC-Q200

0201 to 1210 Sizes (10V to 1000V)

X8G, NP0 & X7R Dielectrics

Halogen Free & RoHS Compliance

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

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

3. APPLICATIONS

- For Navigation & Information equipments.
- For entertainment equipments
- For comfortable equipments.
- For Automotive electronic equipment.

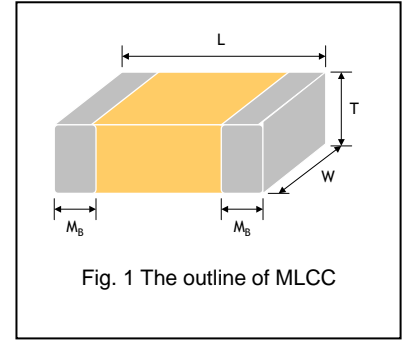
4. HOW TO ORDER

<u>MT</u>	<u>18</u>	<u>N</u>	<u>102</u>	<u>J</u>	<u>500</u>	<u>C</u>	<u>I</u>
<u>Series</u>	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging style</u>
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)	G=X8G 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 ² =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. 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC 201=200 VDC 251=250 VDC 501=500 VDC 631=630 VDC 102=1000 VDC 12E=1250 VCD	C=Cu/Ni/Sn	T=7" reeled G=13" reeled

Multilayer Ceramic Capacitors

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (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 #	
	2.00±0.20 2.00+0.25/-0.2 ^{#4}	1.25±0.20	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 3.30+0.3/-0.1 ^{#1}	1.60+0.3/-0.1	
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 #	
			3.30±0.40 ^{#3}	2.50±0.30	
3.20±0.60 ^{#2}	2.50±0.50 ^{**}	2.50±0.50 ^{**}	M #		



Reflow soldering only is recommended.
 #1 For MT31(100V)/Cap≥0.27μF;MT31(25V&50V)/Cap≥2.7μF products.
 #2 For 1210(200V & 250V)/Cap>0.47μF
 #3 For 1210 / NP0 / 1250V / Cap=10nF
 #4 For 0805 / X7R / 50V / Cap=2.2uF

6. GENERAL ELECTRICAL DATA*

Dielectric	X8G	NP0	X7R
Size	0201, 0402, 0603, 0805, 1206, 1210		
Capacitance range*	0.1pF to 0.015uF	0.1pF to 0.047uF	100pF to 10μF
Capacitance tolerance**	Cap≤5pF ^{#1} : A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF ^{#1} : A (±0.05pF), B (±0.1pF), C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)		J (±5%), K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	10V, 16V, 25V, 50V, 100V, 200V, 250, 500, 630, 1000, 1250	
Operating temperature	-55 to +150°C	-55 to +125°C	
Capacitance characteristic	±30ppm/°C		±15%
Termination	Ni/Sn (lead-free termination)		

#1: X8G/NP0, 0.1pF product only provide B tolerance and 5pF<Cap<10pF products need to check with sales if it can supply A (±0.05pF).
 * Measured at the condition of 30~70% related humidity.
 X8G/NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature
 X7R: Please refer to page 13 "Reliability test conditions and requirements" for detail.
 ** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

7. CAPACITANCE RANGE

X8G Dielectric

DIELECTRIC	X8G														
	SIZE	0402				0603					0805				
	RATED VOLTAGE (VDC)	10	16	25	50	10	16	25	50	100	10	16	25	50	100
Capacitance	0.1pF (0R1)	N	N	N	N										
	0.2pF (0R2)	N	N	N	N										
	0.3pF (0R3)	N	N	N	N										
	0.4pF (0R4)	N	N	N	N										
	0.5pF (0R5)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	120pF (121)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	150pF (151)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	180pF (181)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	220pF (221)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	270pF (271)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	330pF (331)	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	390pF (391)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
470pF (471)	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
560pF (561)	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
680pF (681)	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
820pF (821)	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,000pF (102)	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,200pF (122)					X	X	X	X		B	B	B	B	B	
1,500pF (152)					X	X	X	X		B	B	B	B	B	
1,800pF (182)					X	X	X	X		B	B	B	B	B	
2,200pF (222)					X	X	X	X		B	B	B	B	B	
2,700pF (272)					X	X	X	X		D	D	D	D	D	
3,300pF (332)					X	X	X	X		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		
6,800pF (682)										D	D	D	D		
8,200pF (822)										D	D	D	D		
0.010uF (103)										D	D	D	D		

* X8G: 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

Approval Sheet

X8G Dielectric

DIELECTRIC		X8G								
SIZE		1206				1210				
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	
Capacitance	1.0pF (1R0)									
	1.2pF (1R2)	B	B	B	B					
	1.5pF (1R5)	B	B	B	B					
	1.8pF (1R8)	B	B	B	B					
	2.0pF (2R0)	B	B	B	B					
	2.2pF (2R2)	B	B	B	B					
	2.7pF (2R7)	B	B	B	B					
	3.0pF (3R0)	B	B	B	B					
	3.3pF (3R3)	B	B	B	B					
	3.9pF (3R9)	B	B	B	B					
	4.0pF (4R0)	B	B	B	B					
	4.7pF (4R7)	B	B	B	B					
	5.0pF (5R0)	B	B	B	B					
	5.6pF (5R6)	B	B	B	B					
	6.0pF (6R0)	B	B	B	B					
	6.8pF (6R8)	B	B	B	B					
	7.0pF (7R0)	B	B	B	B					
	8.0pF (8R0)	B	B	B	B					
	8.2pF (8R2)	B	B	B	B					
	9.0pF (9R0)	B	B	B	B					
	10pF (100)	B	B	B	B	C	C	C	C	C
	12pF (120)	B	B	B	B	C	C	C	C	C
	15pF (150)	B	B	B	B	C	C	C	C	C
	18pF (180)	B	B	B	B	C	C	C	C	C
	22pF (220)	B	B	B	B	C	C	C	C	C
	27pF (270)	B	B	B	B	C	C	C	C	C
	33pF (330)	B	B	B	B	C	C	C	C	C
	39pF (390)	B	B	B	B	C	C	C	C	C
	47pF (470)	B	B	B	B	C	C	C	C	C
	56pF (560)	B	B	B	B	C	C	C	C	C
	68pF (680)	B	B	B	B	C	C	C	C	C
	82pF (820)	B	B	B	B	C	C	C	C	C
	100pF (101)	B	B	B	B	C	C	C	C	C
	120pF (121)	B	B	B	B	C	C	C	C	C
	150pF (151)	B	B	B	B	C	C	C	C	C
	180pF (181)	B	B	B	B	C	C	C	C	C
	220pF (221)	B	B	B	B	C	C	C	C	C
	270pF (271)	B	B	B	B	C	C	C	C	C
	330pF (331)	B	B	B	B	C	C	C	C	C
	390pF (391)	B	B	B	B	C	C	C	C	C
	470pF (471)	B	B	B	B	C	C	C	C	C
	560pF (561)	B	B	B	B	C	C	C	C	C
	680pF (681)	B	B	B	B	C	C	C	C	C
	820pF (821)	B	B	B	B	C	C	C	C	C
	1,000pF (102)	B	B	B	B	C	C	C	C	C
1,200pF (122)	B	B	B	B	C	C	C	C	C	
1,500pF (152)	B	B	B	B	C	C	C	C	C	
1,800pF (182)	B	B	B	B	C	C	C	C	C	
2,200pF (222)	B	B	B	B	C	C	C	C	C	
2,700pF (272)	B	B	B	B	C	C	C	C	C	
3,300pF (332)	B	B	B	B	C	C	C	C	C	
3,900pF (392)	B	B	B	B	C	C	C	C	C	
4,700pF (472)	B	B	B	B	C	C	C	C	C	
5,600pF (562)	B	B	B	B	C	C	C	C	C	
6,800pF (682)	C	C	C	C	C	C	C	C	C	
8,200pF (822)	D	D	D	D	C	C	C	C	C	
0.010μF (103)	D	D	D	D	C	C	C	C	C	
0.012μF (123)					D	D	D	D	D	
0.015μF (153)					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

Approval Sheet

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	X	X	
680pF (681)						N	N	N	N	N	S	S	S	S	S	X	X	
820pF (821)						N	N	N	N	N	S	S	S	S	S	X	X	
1,000pF (102)						N	N	N	N	N	S	S	S	S	S	X	X	
1,200pF (122)											X	X	X	X	X	X	X	
1,500pF (152)											X	X	X	X	X	X	X	
1,800pF (182)											X	X	X	X	X	X	X	
2,200pF (222)											X	X	X	X	X			
2,700pF (272)											X	X	X	X	X			
3,300pF (332)											X	X	X	X	X			
3,900pF (392)											X	X	X	X	X			
4,700pF (472)											X	X	X	X	X			
5,600pF (562)											X	X	X	X	X			
6,800pF (682)											X	X	X	X	X			
8,200pF (822)											X	X	X	X	X			
0.01μF (103)											X	X	X	X	X			

* NP0, 0.1pF product only provide B tolerance.

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

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	I	I	
1,500pF (152)	B	B	B	B	B	D	D	I	I	
1,800pF (182)	B	B	B	B	B	D	D	I	I	
2,200pF (222)	B	B	B	B	B	D	D	I	I	
2,700pF (272)	D	D	D	D	D	I	I			
3,300pF (332)	D	D	D	D	D	I	I			
3,900pF (392)	D	D	D	D	D	I	I			
4,700pF (472)	D	D	D	D	D	I	I			
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					
0.012μF (123)	D	D	D	D	D					
0.015μF (153)	D	D	D	D	D					
0.018μF (183)	D	D	D	D	D					
0.022μF (223)	D	D	D	D	D					

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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	G
	1,500pF (152)	B	B	B	B	B	D	G	G	G	G
	1,800pF (182)	B	B	B	B	B	D	G	G	G	G
2,200pF (222)	B	B	B	B	B	D	G	G	G	G	
2,700pF (272)	B	B	B	B	B	D	G	G	G	G	
3,300pF (332)	B	B	B	B	B	D	G	G	G	G	
3,900pF (392)	B	B	B	B	B	D	G	G	G	G	
4,700pF (472)	B	B	B	B	B	D	G	G	G	G	
5,600pF (562)	B	B	B	B	B	G	G	G	G	G	
6,800pF (682)	C	C	C	C	C	G	G	G	G	G	
8,200pF (822)	D	D	D	D	D	G	G	G	G	G	
0.01μF (103)	D	D	D	D	D	G	G	G	G	G	

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NP0 Dielectric

DIELECTRIC		NP0										
SIZE		1210										
RATED VOLTAGE		10	16	25	50	100	200	250	500	630	1000	1250
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	C	D
	120pF (121)	C	C	C	C	C	C	C	C	C	C	D
	150pF (151)	C	C	C	C	C	C	C	C	C	C	D
	180pF (181)	C	C	C	C	C	C	C	C	C	C	D
	220pF (221)	C	C	C	C	C	C	C	C	C	C	G
	270pF (271)	C	C	C	C	C	C	C	C	C	C	G
	330pF (331)	C	C	C	C	C	C	C	C	C	C	G
	390pF (391)	C	C	C	C	C	C	C	C	C	C	G
	470pF (471)	C	C	C	C	C	C	C	C	C	C	G
	560pF (561)	C	C	C	C	C	C	C	C	C	C	G
	680pF (681)	C	C	C	C	C	C	C	C	C	C	G
	820pF (821)	C	C	C	C	C	C	C	C	C	C	G
	1,000pF (102)	C	C	C	C	C	C	D	D	D	D	G
	1,200pF (122)	C	C	C	C	C	D	D	D	D	D	K
	1,500pF (152)	C	C	C	C	C	D	D	D	D	D	K
	1,800pF (182)	C	C	C	C	C	D	D	D	D	D	K
	2,200pF (222)	C	C	C	C	C	D	D	D	D	D	K
	2,700pF (272)	C	C	C	C	C	D	D	D	D	D	K
	3,300pF (332)	C	C	C	C	C	D	D	D	D	D	K
	3,900pF (392)	C	C	C	C	C	D	D	D	D	D	K
	4,700pF (472)	C	C	C	C	C	G	G	G	G	G	K
	5,600pF (562)	C	C	C	C	C	G	G	G	G	G	K
	6,800pF (682)	C	C	C	C	C	G	G	G	G	G	K
	8,200pF (822)	C	C	C	C	C	G	G	G	G	G	K
	0.010μF (103)	C	C	C	C	C	G	G	K	K	M	M
	0.012μF (123)	D	D	D	D	D	K	K	M	M	M	
	0.015μF (153)	D	D	D	D	D	K	K	M	M	M	
	0.018μF (183)	K	K	K	K	K			M	M		
0.022μF (223)	K	K	K	K	K			M	M			
0.027μF (273)	K	K	K	K	K			M	M			
0.033μF (333)	K	K	K	K	K			M	M			
0.039μF (393)	K	K	K	K	K							
0.047μF (473)	K	K	K	K	K							

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X7R Dielectric

DIELECTRIC		X7R														
SIZE		0201				0402					0603					
RATED VOLTAGE		10	16	25	50	10	16	25	50	100	10	16	25	50	100	
Capacitance	100pF (101)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	120pF (121)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	150pF (151)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	180pF (181)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	220pF (221)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	270pF (271)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	330pF (331)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	390pF (391)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	470pF (471)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	560pF (561)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	680pF (681)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	820pF (821)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	
	1,000pF (102)	L	L	L	L	N	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	N		S	S	S	S	X	
	0.015μF (153)					N	N	N	N		S	S	S	S	X	
	0.018μF (183)					N	N	N	N		S	S	S	S	X	
	0.022μF (223)					N	N	N	N		S	S	S	S	X	
	0.027μF (273)					N	N	N	N		S	S	S	S	X	
	0.033μF (333)					N	N	N	N		S	S	S	X	X	
	0.039μF (393)					N	N	N	N		S	S	S	X	X	
	0.047μF (473)					N	N	N	N		S	S	S	X	X	
	0.056μF (563)					N	N	N	N		S	S	S	X		
	0.068μF (683)					N	N	N	N		S	S	S	X		
0.082μF (823)					N	N	N	N		S	S	S	X			
0.10μF (104)					N	N	N	N		S	S	S	X	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			
0.47μF (474)																
0.68μF (684)																
0.82μF (824)																
1.0μF (105)											X					

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X7R Dielectric

DIELECTRIC SIZE	X7R																	
	0805								1206									
RATED VOLTAGE (VDC)	10	16	25	50	100	200	250	500	630	10	16	25	50	100	200	250	500	630
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	D	D	D	D	B	B	B	B	B	D	D	D	D
6,800pF (682)	B	B	B	B	B	D	D	D	D	B	B	B	B	B	D	D	D	D
8,200pF (822)	B	B	B	B	B	D	D	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	B	D			
0.10μF (104)	B	B	B	B	D					B	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	P				
0.33μF (334)	D	D	D	I						C	C	C	D	P				
0.39μF (394)	D	D	D	I						C	C	J	P	P				
0.47μF (474)	D	D	D	I						J	J	J	P	P				
0.56μF (564)	D	D	D							J	J	J	P	P				
0.68μF (684)	D	D	D	I						J	J	J	P	P				
0.82μF (824)	D	D	D							J	J	J	P	P				
1.0μF (105)	D	D	D	I						J	J	J	P	P				
2.2μF (225)				I									P	P				
4.7μF (475)																		
10μF (106)											P							

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.

X7R Dielectric

DIELECTRIC SIZE		X7R 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		M	M				
4.7μF (475)				M	M				
10μF (106)			M	M					

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.

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	8k
	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 : X8G/NPO: within ±2.5% or ±0.25pF whichever is larger. X7R: within ±10.00%. * Q/D.F. value: X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="4">100V</td> <td rowspan="4">≤ 3%</td> <td>≤ 6%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7%</td> <td>1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 7.5%</td> <td>0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤ 20%</td> <td>0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="4">50V</td> <td rowspan="4">≤ 3%</td> <td>≤ 6%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7%</td> <td>1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 0.047μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF;</td> </tr> <tr> <td>35V</td> <td>≤ 5%</td> <td>≤ 20%</td> <td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤ 5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.01μF (0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*</td> </tr> <tr> <td>≤ 14%</td> <td>0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 0.33μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10%</td> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R</td> </tr> <tr> <td>6.3V</td> <td>≤ 15%</td> <td>≤ 30%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		100V	≤ 3%	≤ 6%	1206 ≥ 0.47μF	≤ 7%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 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	≤ 7%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 10%	0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF	≤ 20%	0402 ≥ 0.047μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF;	35V	≤ 5%	≤ 20%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	25V	≤ 5%	≤ 10%	0201 ≥ 0.01μF (0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*	≤ 14%	0603 ≥ 0.33μF	≤ 15%	0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*	≤ 20%	0402 ≥ 0.33μF	16V	≤ 5%	≤ 10%	0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 15%	0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 7.5%	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 20%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R	6.3V	≤ 15%	≤ 30%	0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	4V	≤ 20%	---	---
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10V	≤ 7.5%	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF																																																										
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4V	≤ 20%	---	---																																																										
			* I.R.: ≥10GΩ or RxC≥500Ω·F whichever is smaller. Class II (X7R)																																																										
			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 ≥ 3.3μF</td> <td rowspan="6" style="text-align: center; vertical-align: middle;">1GΩ or RxC ≥ 10 Ω·F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; Size ≥ 1812</td> <td></td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: All X7R; 1210 ≥ 3.3μF	1GΩ or RxC ≥ 10 Ω·F whichever is smaller.	50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF	35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 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																																																
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements										
3.	Temperature Cycling JESD22 Method JA-104	* Conduct 1000 cycles according to the temperatures and time. <table border="1" style="width: 100%; border-collapse: collapse;"> <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>5±1</td> </tr> <tr> <td>2</td> <td>Max. operating temp +3/-0</td> <td>5±1</td> </tr> </tbody> </table> * 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.	Step	Temp. (°C)	Time (min.)	1	Min. operating temp +0/-3	5±1	2	Max. operating temp +3/-0	5±1	* No remarkable damage. * Cap change : X8G/NPO: within ±2.5% or 0.25pF whichever is larger. X7R: within ±10.0%. * Q/D.F. value: X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:	
			Step	Temp. (°C)	Time (min.)								
			1	Min. operating temp +0/-3	5±1								
			2	Max. operating temp +3/-0	5±1								
			Rated vol.	D.F. ≤	Exception of D.F. ≤								
			≥ 100V	≤ 3%	≤ 6%	1206 ≥ 0.47μF							
					≤ 7%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF							
					≤ 7.5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF							
			50V	≤ 3%	≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF							
					≤ 6%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF							
					≤ 7%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF							
			35V	≤ 5%	≤ 10%	0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF							
					≤ 20%	0402 ≥ 0.047μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF;							
					≤ 20%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF							
			25V	≤ 5%	≤ 10%	0201 ≥ 0.01μF (0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*							
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16V	≤ 5%	≤ 10%	0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF										
		≤ 15%	0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF										
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		≤ 30%	0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF										
6.3V	≤ 15%	---	---										
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Multilayer Ceramic Capacitors

Approval Sheet

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																
4.	Destructive Physical Analysis EIA-469	Per EIA-469	No defects or abnormalities																																																
5.	Moisture Resistance 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.	<p>* No remarkable damage. * Cap change : X8G/NPO: within ±3.0% or 0.30pF whichever is larger X7R: within ±12.5%. * Q/D.F. value: X8G/NPO: More than 30pF Q≥350 ; 10pF≤C<30pF, Q≥275+2.5C Less than 10pF Q≥200+10C X7R:</p> <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="4">≥100V</td> <td rowspan="4">≤3%</td> <td>≤6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤7% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td> </tr> <tr> <td>≤20% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="4">50V</td> <td rowspan="4">≤3%</td> <td>≤6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤7% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤10% 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤20% 0402 ≥ 0.047μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF;</td> </tr> <tr> <td>35V</td> <td>≤5%</td> <td>≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤5%</td> <td>≤10% 0201 ≥ 0.01μF (0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*</td> </tr> <tr> <td>≤14% 0603 ≥ 0.33μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; 0402 ≥ 0.10μF (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*</td> </tr> <tr> <td>≤20% 0402 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF (0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>10V</td> <td>≤7.5%</td> <td>≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603/X5R ≥ 10μF; 01R5/X5R</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> </tbody> </table> <p>* I.R.: ≥10GΩ or RxC ≥ 500Ω·F whichever is smaller. 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No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																								
6.	Biased Humidity 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: X8G/NPO: within ±3.0% or 0.30pF whichever is larger. X7R: within ±12.5% * Q/D.F. value: X8G/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	<p>* Test temp.: Maximum Operating Temperature $\pm 3^{\circ}\text{C}$</p> <p>* To apply voltage: (1) $10\text{V} \leq U_r \leq 250\text{V}$: 200% of rated voltage. (2) 150% of rated voltage: a) 500V b) $\leq 6.3\text{V}$ or $C \geq 10\mu\text{F}$ c)</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td>0402</td> <td>X7R</td> <td>50V</td> <td>$C > 0.01\mu\text{F}$</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X7R</td> <td>$\leq 25\text{V}$</td> <td>$C \geq 1.0\mu\text{F}$</td> </tr> <tr> <td>50V</td> <td>$C > 0.1\mu\text{F}$</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X7R</td> <td>50V</td> <td>$C \geq 0.68\mu\text{F}$</td> </tr> <tr> <td>$\geq 100\text{V}$</td> <td>$C \geq 0.12\mu\text{F}$</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X7R</td> <td>$\leq 50\text{V}$</td> <td>$C > 1.0\mu\text{F}^*$</td> </tr> <tr> <td>100V</td> <td>$C \geq 1.0\mu\text{F}$</td> </tr> <tr> <td rowspan="3">1210</td> <td rowspan="3">X7R</td> <td>$\leq 50\text{V}$</td> <td>$C > 1.0\mu\text{F}$</td> </tr> <tr> <td>100V</td> <td>$C \geq 1.0\mu\text{F}$</td> </tr> <tr> <td>$> 100\text{V}$</td> <td>$C \geq 0.22\mu\text{F}$</td> </tr> <tr> <td rowspan="2">1812</td> <td rowspan="2">X7R</td> <td>$\leq 50\text{V}$</td> <td>$C \geq 4.7\mu\text{F}$</td> </tr> <tr> <td>100V</td> <td>$C \geq 1.0\mu\text{F}$</td> </tr> <tr> <td rowspan="2">1825 2220 2225</td> <td rowspan="2">X7R</td> <td>$\geq 100\text{V}$</td> <td>$C \geq 1.0\mu\text{F}$</td> </tr> <tr> <td>ALL</td> <td>$C \geq 10\mu\text{F}$</td> </tr> </tbody> </table> <p>* Excluding ST31B105/50V \Rightarrow "150% of rated voltage." (3) 400V/450V/630V: 120% of rated voltage. (4) $U_r \geq 1000\text{V}^*$: 110% of rated voltage. Excluding NP0(1kV): 1206/Cap ≤ 102 & 1210/Cap ≤ 153; X7R(1kV)1210/Cap ≤ 103 \Rightarrow "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.</p>	Size	Dielectric	Rated Voltage	Capacitance	0402	X7R	50V	$C > 0.01\mu\text{F}$	0603	X7R	$\leq 25\text{V}$	$C \geq 1.0\mu\text{F}$	50V	$C > 0.1\mu\text{F}$	0805	X7R	50V	$C \geq 0.68\mu\text{F}$	$\geq 100\text{V}$	$C \geq 0.12\mu\text{F}$	1206	X7R	$\leq 50\text{V}$	$C > 1.0\mu\text{F}^*$	100V	$C \geq 1.0\mu\text{F}$	1210	X7R	$\leq 50\text{V}$	$C > 1.0\mu\text{F}$	100V	$C \geq 1.0\mu\text{F}$	$> 100\text{V}$	$C \geq 0.22\mu\text{F}$	1812	X7R	$\leq 50\text{V}$	$C \geq 4.7\mu\text{F}$	100V	$C \geq 1.0\mu\text{F}$	1825 2220 2225	X7R	$\geq 100\text{V}$	$C \geq 1.0\mu\text{F}$	ALL	$C \geq 10\mu\text{F}$	<p>* No remarkable damage.</p> <p>* Cap change: X8G/NPO: within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger X7R: within $\pm 12.5\%$.</p> <p>* Q/D.F. value: X8G/NPO: More than 30pF, $Q \geq 350$; 10pF $\leq C < 30\text{pF}$, $Q \geq 275 + 2.5C$ Less than 10pF, $Q \geq 200 + 10C$ X7R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th>Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td rowspan="3">$\geq 100\text{V}$</td> <td rowspan="3">$\leq 3\%$</td> <td>$\leq 6\%$ 1206 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td>$\leq 7\%$ 1812 $\geq 4.7\mu\text{F}$; 1825 $\geq 4.7\mu\text{F}$; 2220 $\geq 4.7\mu\text{F}$; 2225 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 7.5\%$ 0603 $\geq 0.068\mu\text{F}$; 0805 $> 0.1\mu\text{F}$; 1206 $\geq 1\mu\text{F}$; 1210 $\geq 2.2\mu\text{F}$</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">$\leq 3\%$</td> <td>$\leq 6\%$ 0201(50V); 0603 $\geq 0.047\mu\text{F}$; 0805 $\geq 0.18\mu\text{F}$; 1206 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td>$\leq 7\%$ 1812 $\geq 4.7\mu\text{F}$; 1825 $\geq 4.7\mu\text{F}$; 2220 $\geq 4.7\mu\text{F}$; 2225 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$ 0201 $\geq 0.01\mu\text{F}$; 0402 $\geq 0.012\mu\text{F}$; 1210 $\geq 3.3\mu\text{F}$</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">$\leq 5\%$</td> <td>$\leq 20\%$ 0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$ 0201 $\geq 0.01\mu\text{F}$; 0201/X5R = 0.01μF; 0805 $\geq 1\mu\text{F}$; 1210 $\geq 10\mu\text{F}^*$</td> </tr> <tr> <td>$\leq 14\%$ 0603 $\geq 0.33\mu\text{F}$</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">$\leq 5\%$</td> <td>$\leq 15\%$ 0201 $\geq 0.1\mu\text{F}$ (0201/X5R $> 0.01\mu\text{F}$); 0603 $\geq 0.47\mu\text{F}$; 0402 $\geq 0.10\mu\text{F}$ (0402/X7R $\geq 0.056\mu\text{F}$); 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$ (1210/X5R $\geq 10\mu\text{F}$)[*]</td> </tr> <tr> <td>$\leq 20\%$ 0402 $\geq 0.33\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$ 0603 $\geq 0.15\mu\text{F}$; 0805 $\geq 0.68\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">$\leq 5\%$</td> <td>$\leq 15\%$ 0201 $\geq 0.01\mu\text{F}$ (0201/X7R $\geq 0.022\mu\text{F}$); 0402 $\geq 0.033\mu\text{F}$; 0603 $> 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$</td> </tr> <tr> <td>$\leq 15\%$ 0201 $\geq 0.012\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$ (0402/X7R $\geq 0.15\mu\text{F}$); 0603 $\geq 0.33\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 22\mu\text{F}$</td> </tr> <tr> <td>10V</td> <td>$\leq 7.5\%$</td> <td>$\leq 20\%$ 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0603/X5R $\geq 10\mu\text{F}$; 01R5/X5R</td> </tr> <tr> <td>6.3V</td> <td>$\leq 15\%$</td> <td>$\leq 30\%$ 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$ (0402/X6S $\geq 0.47\mu\text{F}$); 0603 $\geq 10\mu\text{F}$; 0805 $\geq 4.7\mu\text{F}$; 1206 $\geq 47\mu\text{F}$; 1210 $\geq 100\mu\text{F}$</td> </tr> <tr> <td>4V</td> <td>$\leq 20\%$</td> <td>--</td> </tr> </tbody> </table> <p>* I.R.: $\geq 1\text{G}\Omega$ or $R_x C \geq 50\Omega \cdot \text{F}$ whichever is smaller. Class II (X7R) <small>PASSIVE SYSTEM ALLIANCE</small></p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R; 1210 $\geq 3.3\mu\text{F}$</td> <td rowspan="6">1GΩ or $R_x C \geq 10 \Omega \cdot \text{F}$ whichever is smaller.</td> </tr> <tr> <td>50V: 0402 $> 0.01\mu\text{F}$; 0603 $\geq 1\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>35V: 0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>25V: 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 2.2\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>16V: 0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 47\mu\text{F}$</td> </tr> <tr> <td>10V: 0201 $\geq 47\text{nF}$; 0402 $\geq 0.47\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 47\mu\text{F}$</td> </tr> <tr> <td>6.3V; 4V; Size ≥ 1812</td> <td></td> </tr> </tbody> </table>	Rated vol.	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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																																																																																													

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

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: X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:			
			Rated vol.	D.F. ≤	Exception of D.F. ≤	
			≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
					≤ 3.5%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF
			50V	≤ 2.5%	≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;
					≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF
					≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
					≤ 3.5%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF
			35V	≤ 2.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF
					≤ 10%	0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
					≤ 3.5%	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 ≥ 0.33μF
≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF					
≤ 10%	0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF					
10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 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		RxC≥50 Ω-F.				
6.3V; 4V; Size≥1812						
Rated voltage						
100V: 1210≥3.3μF						
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.

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements			
11.	Mechanical Shock MIL-STD-202 Method 213	* Peak value: 1500g's. * Wave: 1/2 sine. * Velocity: 15.4 ft/sec * Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks)	* No remarkable damage. * Cap.: within the specified tolerance. * Q/D.F. value: X8G/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 μ F
					\leq 3.5%	1812 \geq 4.7 μ F; 1825 \geq 4.7 μ F; 2220 \geq 4.7 μ F; 2225 \geq 4.7 μ F
			50V	\leq 2.5%	\leq 5%	0603 \geq 0.068 μ F; 0805 $>$ 0.1 μ F; 1206 \geq 1 μ F; 1210 \geq 2.2 μ F;
					\leq 10%	0805 $>$ 0.22 μ F; 1210 \geq 3.3 μ F
					\leq 3%	0201(50V); 0603 \geq 0.047 μ F; 0805 \geq 0.18 μ F; 1206 \geq 0.47 μ F
			35V	\leq 2.5%	\leq 3.5%	1812 \geq 4.7 μ F; 1825 \geq 4.7 μ F; 2220 \geq 4.7 μ F; 2225 \geq 4.7 μ F
					\leq 5%	0201 \geq 0.01 μ F; 0402 \geq 0.012 μ F; 1210 \geq 3.3 μ F
					\leq 10%	0402 $>$ 0.047 μ F; 0603 $>$ 0.1 μ F; 0805/X7R $>$ 0.47 μ F; 1206 \geq 2.2 μ F; 1210 \geq 10 μ F
			25V	\leq 3.5%	\leq 10%	0603 \geq 1 μ F; 0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F; 1210 \geq 10 μ F
					\leq 5%	0201 \geq 0.01 μ F; 0805 \geq 1 μ F; 1210 \geq 10 μ F
					\leq 7%	0603 \geq 0.33 μ F
			16V	\leq 3.5%	\leq 10%	0201 \geq 0.1 μ F; 0402 \geq 0.056 μ F; 0603 \geq 0.47 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F; 1210 \geq 22 μ F
					\leq 12.5%	0402 \geq 0.33 μ F
\leq 5%	0201 \geq 0.01 μ F; 0402 \geq 0.033 μ F; 0603 \geq 0.15 μ F; 0805 \geq 0.68 μ F; 1206 \geq 2.2 μ F; 1210 \geq 4.7 μ F					
10V	\leq 5%	\leq 10%	0201/X7R \geq 0.022 μ F; 0402 \geq 0.15 μ F; 0603 $>$ 0.47 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F; 1210 \geq 22 μ F			
		\leq 15%	0201 \geq 0.012 μ F; 0402 \geq 0.15 μ F; 0603 \geq 0.33 μ F; 0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F; 1210 \geq 22 μ F			
6.3V	\leq 10%	\leq 15%	0201 \geq 0.1 μ F; 0402 \geq 1 μ F; 0603 \geq 10 μ F; 0805 \geq 4.7 μ F; 1206 \geq 47 μ F; 1210 \geq 100 μ F			
		\leq 20%	0402 \geq 2.2 μ F			
4V	\leq 15%	---	---			
* I.R.: \geq 10G Ω or RxC \geq 500 Ω -F whichever is smaller. Class II (X7R)						
Rated voltage		Insulation Resistance				
100V: All X7R		10G Ω or RxC \geq 100 Ω -F whichever is smaller.				
50V: 0402 $>$ 0.01 μ F; 0603 \geq 1 μ F; 0805 \geq 1 μ F; 1206 \geq 4.7 μ F; 1210 \geq 4.7 μ F						
35V: 0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F; 1210 \geq 10 μ F						
25V: 0402 \geq 1 μ F; 0603 \geq 2.2 μ F; 0805 \geq 2.2 μ F; 1206 \geq 10 μ F; 1210 \geq 10 μ F						
16V: 0201 \geq 0.1 μ F; 0402 \geq 0.22 μ F; 0603 \geq 1 μ F; 0805 \geq 2.2 μ F; 1206 \geq 10 μ F; 1210 \geq 47 μ F						
10V: 0201 \geq 47nF; 0402 \geq 0.47 μ F; 0603 \geq 0.47 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F; 1210 \geq 47 μ F		Rx C \geq 50 Ω -F.				
6.3V; 4V; Size \geq 1812						
Rated voltage						
100V: 1210 \geq 3.3 μ F						
50V: 0402 \geq 0.1 μ F; 0603 \geq 2.2 μ F; 0805 \geq 10 μ F; 1206 \geq 10 μ F						
35V: 0603 \geq 1 μ F;						
25V: 0201 \geq 0.1 μ F; 0402 \geq 2.2 μ F; 0603 \geq 10 μ F; 0805 \geq 10 μ F; 1206 \geq 22 μ F						
16V: 0603 \geq 10 μ F; 0402 \geq 1 μ F; 0201 \geq 0.22 μ F						
10V: 0201 $>$ 0.1 μ F; 0402 \geq 1 μ F; 0603 \geq 10 μ F; 0805 \geq 47 μ F						
6.3V: 0201 $>$ 0.1 μ F; 0402 \geq 1 μ F; 0603 $>$ 4.7 μ F; 0805 \geq 47 μ F; 1206 \geq 10 μ F						
4V: 0603 \geq 22 μ F; 0805 \geq 47 μ F; 1206 \geq 100 μ F						

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

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:
			X8G/NPO:Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.
			X7R:
			Rated vol. D.F. ≤ Exception of D.F. ≤
			≥100V ≤2.5% ≤3% 1206≥0.47μF
			≤3.5% 1812≥4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF
			≤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
			≤3.5% 1812≥4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF
			≤5% 0201≥0.01uF; 0402≥0.012μF; 1210≥3.3μF
			≤10% 0402>0.047μF; 0603>0.1μF; 0805/X7R>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≥0.33μF			
16V ≤3.5% ≤5% 0201≥0.01μF; 0402≥0.033μF; 0603≥0.15μF;			
0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF			
≤10% 0201/X7R≥0.022μF; 0402≥0.15uF;			
0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF			
10V ≤5% ≤10% 0201≥0.012μF; 0402≥0.15μF;			
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.

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																					
13.	Resistance to Soldering Heat 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: X8G/NPO: within ±2.5% or 0.25pF whichever is larger X7R: within ±7.5% * Q/D.F. value: X8G/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="4">≥ 100V</td> <td rowspan="4">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;</td> </tr> <tr> <td>≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="4">50V</td> <td rowspan="4">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>35V</td> <td>≤ 3.5%</td> <td>≤ 10% 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% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 3.5%</td> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>10V</td> <td>≤ 5%</td> <td>≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 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>4V</td> <td>≤ 15%</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 2.5%	≤ 3% 1206 ≥ 0.47μF	≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 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	≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF	≤ 10% 0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 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%	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 5%	≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	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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Multilayer Ceramic Capacitors

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14	Thermal Shock MIL-STD-202 Method 107	* Conduct 300 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>15±3</td> </tr> <tr> <td>2</td> <td>Max. operating temp +3/-0</td> <td>15±3</td> </tr> </tbody> </table> * Max. transfer time: 20 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.	Step	Temp. (°C)	Time (min.)	1	Min. operating temp +0/-3	15±3	2	Max. operating temp +3/-0	15±3	* No remarkable damage. * Cap change : X8G/NPO: within ±2.5% or 0.25pF whichever is larger X7R: within ±10.0% * Q/D.F. value: X8G/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="4">≥100V</td> <td rowspan="4">≤2.5%</td> <td>≤3% 1206 ≥0.47μF</td> </tr> <tr> <td>≤3.5% 1812 ≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td> </tr> <tr> <td>≤5% 0603 ≥0.068μF; 0805 >0.1μF; 1206 ≥1μF; 1210 ≥2.2μF;</td> </tr> <tr> <td>≤10% 0805 >0.22μF; 1210 ≥3.3μF</td> </tr> <tr> <td rowspan="4">50V</td> <td rowspan="4">≤2.5%</td> <td>≤3% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF</td> </tr> <tr> <td>≤3.5% 1812 ≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td> </tr> <tr> <td>≤5% 0201 ≥0.01μF; 0402≥0.012μF; 1210 ≥3.3μF</td> </tr> <tr> <td>≤10% 0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td>35V</td> <td>≤3.5%</td> <td>≤10% 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% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF</td> </tr> <tr> <td>≤7% 0603 ≥0.33μF</td> </tr> <tr> <td>≤10% 0201 ≥0.1μF; 0402 ≥0.056μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤3.5%</td> <td>≤12.5% 0402 ≥0.33μF</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="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10% 0201/X7R ≥0.022μF; 0402 ≥0.15μF; 0603>0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF</td> </tr> <tr> <td>≤15% 0201 ≥0.012μF; 0402 ≥0.15μF; 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤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>4V</td> <td>≤15%</td> <td>---</td> </tr> </tbody> </table> * I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller. Class II (X7R)	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥100V	≤2.5%	≤3% 1206 ≥0.47μF	≤3.5% 1812 ≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤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	≤3.5% 1812 ≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤5% 0201 ≥0.01μF; 0402≥0.012μF; 1210 ≥3.3μF	≤10% 0402>0.047μF; 0603>0.1μF; 0805/X7R>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 ≥0.33μF	≤5% 0201 ≥0.01μF; 0402 ≥0.033μF; 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF	10V	≤5%	≤10% 0201/X7R ≥0.022μF; 0402 ≥0.15μF; 0603>0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF	≤15% 0201 ≥0.012μF; 0402 ≥0.15μF; 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF	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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		* Test temp.: Room Temperature.	X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.																																							
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		Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%	<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>≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 ≥ 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 10% 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% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 10% 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% 0402 ≥ 0.33μF</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>≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 > 2.2μF; 1206 > 4.7μF; 1210 > 22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.15μF;</td> </tr> <tr> <td>≤ 15% 0603 > 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 > 22μF</td> </tr> <tr> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 > 100μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 10%</td> <td>≤ 15% 0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 2.5%	≤ 3% 1206 ≥ 0.47μF	≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 5% 0603 ≥ 0.068μF; 0805 ≥ 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;	50V	≤ 2.5%	≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 3.5% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	35V	≤ 3.5%	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF	≤ 10% 0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 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 ≥ 0.33μF	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 > 2.2μF; 1206 > 4.7μF; 1210 > 22μF	10V	≤ 5%	≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.15μF;	≤ 15% 0603 > 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 > 22μF	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 > 100μF	6.3V	≤ 10%	≤ 15% 0402 ≥ 2.2μF	4V	≤ 15%	---
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≥200V: To apply rated voltage (Max.500V) for 60 sec.																																										
* Dielectric Strength	* Dielectric strength																																									
To apply voltage:	No evidence of damage or flash over during test.																																									
≤100 ≥2.5 times VDC																																										
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* For high voltage product over 1000 Vdc, it is required to immerse the chip in an isolation fluid to prevent possible arcing while testing.																																										
* Temperature Coefficient (with no electrical load)	* Temperature Coefficient																																									
Operation temperature: Min. operating temp. to Max. operating temp. at 25°C	Capacitance Change: NPO: Within ±30ppm/°C X7R: Within ±15%																																									

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

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																																											
18.	Board Flex 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 : X8G/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.	Terminal Strength 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: X8G/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="4">≥ 100V</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5%</td> <td>1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 5%</td> <td>0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;</td> </tr> <tr> <td>≤ 10%</td> <td>0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="4">50V</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 3.5%</td> <td>1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="4">35V</td> <td>≤ 3.5%</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>≤ 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="4">25V</td> <td>≤ 3.5%</td> <td>0402 ≥ 0.33μF</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/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="4">16V</td> <td>≤ 3.5%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td rowspan="4">10V</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="4">6.3V</td> <td>≤ 15%</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="4">4V</td> <td>≤ 15%</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 3%	1206 ≥ 0.47μF	≤ 3.5%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 3.5%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF	≤ 10%	0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 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	25V	≤ 3.5%	0402 ≥ 0.33μF	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 10%	0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	16V	≤ 3.5%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 5%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	10V	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 20%	0402 ≥ 2.2μF	---	---	6.3V	≤ 15%	---	---	---	---	---	---	---	4V	≤ 15%	---	---	---	---	---	---	---
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	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF																																																																												
50V	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF																																																																												
	≤ 3.5%	1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF																																																																												
	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF																																																																												
	≤ 10%	0402 > 0.047μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF																																																																												
35V	≤ 3.5%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF																																																																												
	≤ 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																																																																												
25V	≤ 3.5%	0402 ≥ 0.33μF																																																																												
	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF																																																																												
	≤ 10%	0201/X7R ≥ 0.022μF; 0402 ≥ 0.15μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF																																																																												
	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.15μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF																																																																												
16V	≤ 3.5%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF																																																																												
	≤ 5%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF																																																																												
	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF																																																																												
	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF																																																																												
10V	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF																																																																												
	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF																																																																												
	≤ 20%	0402 ≥ 2.2μF																																																																												
	---	---																																																																												
6.3V	≤ 15%	---																																																																												
	---	---																																																																												
	---	---																																																																												
	---	---																																																																												
4V	≤ 15%	---																																																																												
	---	---																																																																												
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20	Beam Load Test 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

APPENDIXES

■ Tape & reel dimensions

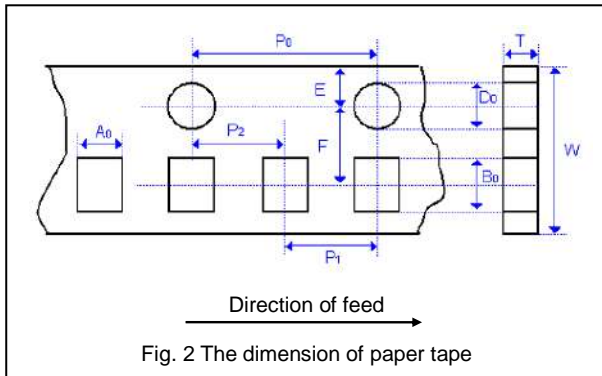


Fig. 2 The dimension of paper tape

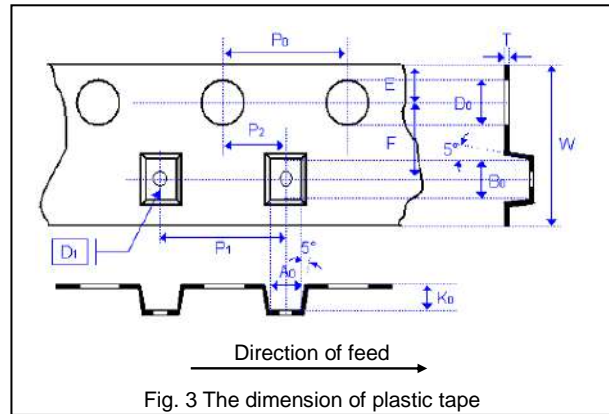


Fig. 3 The dimension of plastic tape

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	0.40 +/-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	< 3.05	< 3.20	< 2.50	< 2.50	< 3.90	< 3.90	< 3.90	
B ₀	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	< 3.80	< 4.00	< 5.30	< 5.30	< 5.30	< 5.30	< 5.30	
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	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	
K ₀	0.44 +/-0.05	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.00	< 2.50	< 3.20	< 2.50	< 2.50	< 2.50	< 2.50	< 3.50	
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	8.00 +/-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	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	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	
P ₁	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	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	
P ₂	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 +/-0.05	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	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 ₁	-	-	-	-	-	+/-0.10	-	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-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	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	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	

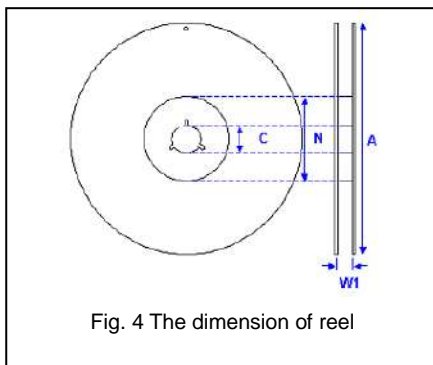
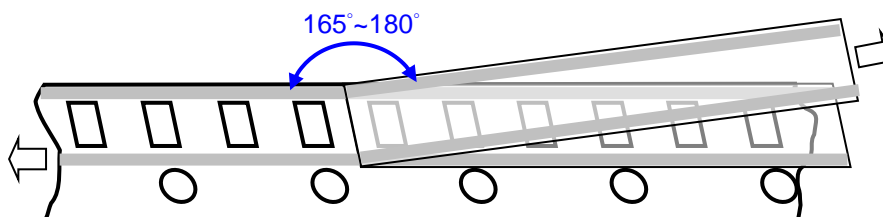


Fig. 4 The dimension of reel

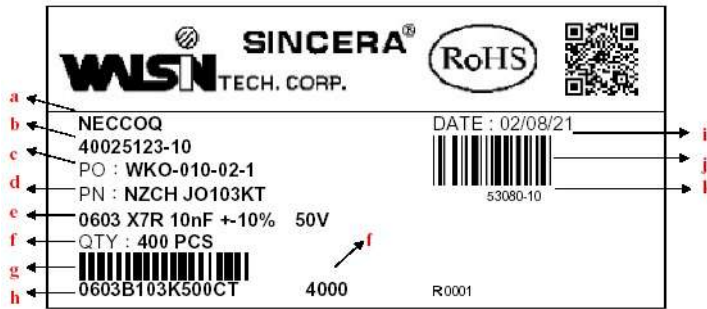
Size	0201, 0402, 0603, 0805, 1206, 1210			1812
Reel size	7"	10"	13"	7"
C	13.0±0.5	13.0±0.5	13.0±0.5	13.0±0.5
W ₁	10.0±1.5	10.0±1.5	10.0±1.5	12.4+2.0/-0
A	178.0±2.0	250.0±2.0	330.0±2.0	178.0±2.0
N	60.0+1.0/-0	50 min	50 min	60.0+1.0/-0

■ 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.



Example of customer label

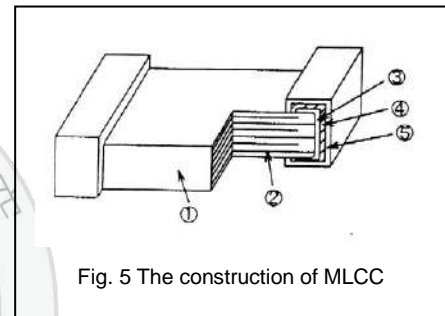


- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

*Customized label is available upon request

Constructions

No.	Name	X8G, NP0	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 (Matt)



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.

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.

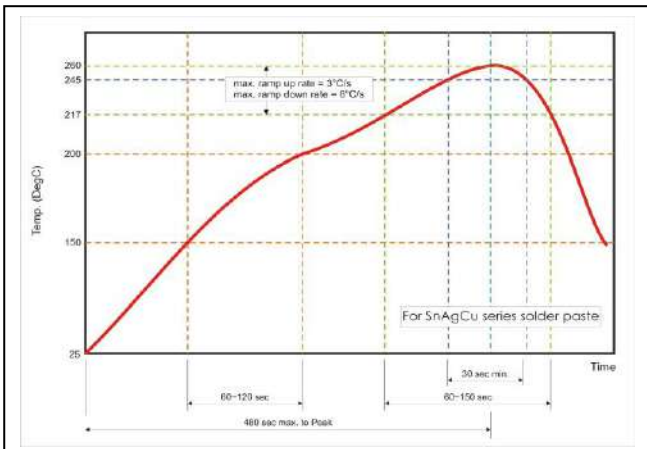


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

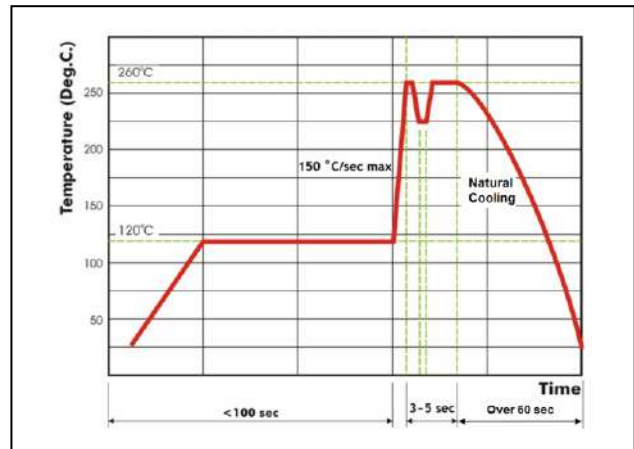


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.

