

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MT)

Qualified to AEC-Q200

0402 to 1210 Sizes (10V to 630V)

NP0, X7R Dielectrics

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 (0402 to 0805).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- The MT series meet AEC-Q200 requirement.

3. APPLICATIONS

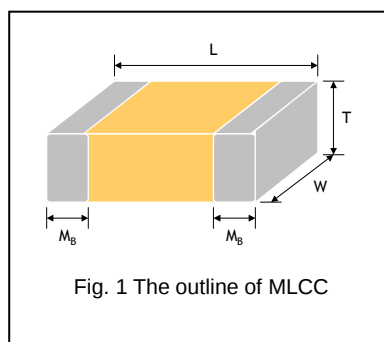
- For Navigation & Information equipments.
- For entertainment equipments
- For comfortable equipments.
- For Automotive electronic equipment.

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>
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging style
MT= Automotive safe concern (with AEC-Q200 qualification)	15=0402 (1005) 18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225)	N=NP0 (C0G) 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	C=Cu/Ni/Sn	T=7" reeled R=7" reeled (2mm pitch for 0603 size; paper tape) G=13" reeled

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	#
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	
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	
			1.15±0.15	J	
	3.20±0.20	1.60±0.20	1.60±0.20	G	
			1.60±0.30/-0.10	P	
1210 (3225)	3.20±0.40	2.50±0.20	0.95±0.10	C	0.75±0.25
			1.25±0.10	D	



Reflow soldering only is recommended.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R
Size	0402, 0603, 0805, 1206, 1210	0402, 0603, 0805, 1206
Capacitance range*	0.5pF to 0.01μF	100pF to 1μF
Capacitance tolerance**	Cap≤5pF: 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%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250, 500, 630	10V, 16V, 25V, 50V
Insulation resistance at U _r	≥10GΩ or R _x C≥500Ω×F whichever is less	
Operating temperature	-55 to +125°C	
Capacitance characteristic	±30ppm/°C	±15%
Termination	Ni/Sn (lead-free termination)	

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

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

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

7. CAPACITANCE RANGE

NP0 Dielectric

DIELECTRIC		NP0														
SIZE		0402				0603						0805				
RATED VOLTAGE		10	16	25	50	10	16	25	50	100	200	10	16	25	50	100
Capacitance	0.5pF (0R5)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	0.6pF (0R6)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	10pF (100)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	12pF (120)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	15pF (150)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	18pF (180)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	22pF (220)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	27pF (270)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	33pF (330)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	39pF (390)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	47pF (470)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	56pF (560)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	68pF (680)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	82pF (820)	N	N	N	N	S	S	S	S	S	S	A	A	A	A	A
	100pF (101)	N	N	N	N	S	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)											B	B	B	B	
	1,500pF (152)											B	B	B	B	
	1,800pF (182)											B	B	B	B	
	2,200pF (222)											B	B	B	B	
	2,700pF (272)											D	D	D	D	
	3,300pF (332)											D	D	D	D	
	3,900pF (392)											D	D	D	D	
	4,700pF (472)											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.

DIELECTRIC		NP0							
SIZE		1206							1210
RATED VOLTAGE		10	16	25	50	100	250	500	630
Capacitance	1.0pF (1R0)								
	1.2pF (1R2)	B	B	B	B	B	B	B	B
	1.5pF (1R5)	B	B	B	B	B	B	B	B
	1.8pF (1R8)	B	B	B	B	B	B	B	B
	2.2pF (2R2)	B	B	B	B	B	B	B	B
	2.7pF (2R7)	B	B	B	B	B	B	B	B
	3.3pF (3R3)	B	B	B	B	B	B	B	B
	3.9pF (3R9)	B	B	B	B	B	B	B	B
	4.7pF (4R7)	B	B	B	B	B	B	B	B
	5.6pF (5R6)	B	B	B	B	B	B	B	B
	6.8pF (6R8)	B	B	B	B	B	B	B	B
	8.2pF (8R2)	B	B	B	B	B	B	B	B
	10pF (100)	B	B	B	B	B	B	B	B
	12pF (120)	B	B	B	B	B	B	B	B
	15pF (150)	B	B	B	B	B	B	B	B
	18pF (180)	B	B	B	B	B	B	B	B
	22pF (220)	B	B	B	B	B	B	B	B
	27pF (270)	B	B	B	B	B	B	B	B
	33pF (330)	B	B	B	B	B	B	B	B
	39pF (390)	B	B	B	B	B	B	B	B
	47pF (470)	B	B	B	B	B	B	B	B
	56pF (560)	B	B	B	B	B	B	B	B
	68pF (680)	B	B	B	B	B	B	B	B
	82pF (820)	B	B	B	B	B	B	B	B
	100pF (101)	B	B	B	B	B	B	B	B
	120pF (121)	B	B	B	B	B	B	B	B
	150pF (151)	B	B	B	B	B	B	B	B
	180pF (181)	B	B	B	B	B	B	B	B
	220pF (221)	B	B	B	B	B	B	B	B
	270pF (271)	B	B	B	B	B	C	C	C
	330pF (331)	B	B	B	B	B	C	C	C
	390pF (391)	B	B	B	B	B	C	C	C
	470pF (471)	B	B	B	B	B	C	C	C
	560pF (561)	B	B	B	B	B	D	D	D
	680pF (681)	B	B	B	B	B	D	D	D
	820pF (821)	B	B	B	B	B	G	G	G
	1,000pF (102)	B	B	B	B	B	G	G	G
	1,200pF (122)	B	B	B	B	B	G	G	G
	1,500pF (152)	B	B	B	B	B	G	G	G
	1,800pF (182)	B	B	B	B	B	G	G	G
	2,200pF (222)	B	B	B	B	B	G	G	G
	2,700pF (272)	B	B	B	B	B			
	3,300pF (332)	B	B	B	B	B			
	3,900pF (392)	B	B	B	B	B			
	4,700pF (472)	B	B	B	B	B			
	5,600pF (562)	B	B	B	B	B			
	6,800pF (682)	C	C	C	C	C			
	8,200pF (822)	D	D	D	D	D			
	0.010μF (103)	D	D	D	D	D			
	0.012μF (123)								
	0.015μF (153)								
	0.018μF (183)								
	0.022μF (223)								
	0.027μF (273)								
	0.033μF (333)								
	0.039μF (393)								

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X7R Dielectric

DIELECTRIC		X7R																
SIZE		0402				0603				0805				1206				
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	100
Capacitance	100pF (101)	N	N	N	N	S	S	S	S	B	B	B	B					
	120pF (121)	N	N	N	N	S	S	S	S	B	B	B	B					
	150pF (151)	N	N	N	N	S	S	S	S	B	B	B	B					
	180pF (181)	N	N	N	N	S	S	S	S	B	B	B	B					
	220pF (221)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	270pF (271)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	330pF (331)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	390pF (391)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	470pF (471)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	560pF (561)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	680pF (681)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	820pF (821)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	1,000pF (102)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	1,200pF (122)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	1,500pF (152)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	1,800pF (182)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	2,200pF (222)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	2,700pF (272)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	3,300pF (332)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	3,900pF (392)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	4,700pF (472)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	5,600pF (562)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	6,800pF (682)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	8,200pF (822)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	0.010μF (103)	N	N	N	N	S	S	S	S	B	B	B	B	B	B	B	B	B
	0.012μF (123)					S	S	S	S	B	B	B	B	B	B	B	B	B
	0.015μF (153)					S	S	S	S	B	B	B	B	B	B	B	B	B
	0.018μF (183)					S	S	S	S	B	B	B	B	B	B	B	B	B
	0.022μF (223)					S	S	S	S	B	B	B	B	B	B	B	B	B
	0.027μF (273)					S	S	S	S	B	B	B	B	B	B	B	B	B
	0.033μF (333)					S	S	S	X	B	B	B	B	B	B	B	B	B
	0.039μF (393)					S	S	S	X	B	B	B	B	B	B	B	B	B
	0.047μF (473)					S	S	S	X	B	B	B	B	B	B	B	B	B
	0.056μF (563)					S	S	S	X	B	B	B	B	B	B	B	B	B
	0.068μF (683)					S	S	S	X	B	B	B	B	B	B	B	B	B
	0.082μF (823)					S	S	S	X	B	B	B	B	B	B	B	B	
	0.10μF (104)					S	S	S	X	B	B	B	B	B	B	B	B	
	0.12μF (124)									B	B	B	D	B	B	B	B	
	0.15μF (154)									D	D	D	D	C	C	C	C	
	0.18μF (184)									D	D	D	D	C	C	C	C	
	0.22μF (224)									D	D	D	D	C	C	C	C	
	0.27μF (274)													C	C	C	D	
	0.33μF (334)													C	C	C	D	
	0.39μF (394)													C	C	J	P	
	0.47μF (474)													J	J	J	P	
	0.56μF (564)													J	J	J	P	
	0.68μF (684)													J	J	J	P	
	0.82μF (824)													J	J	J	P	
	1.0μF (105)													J	J	J	P	

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8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
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

Unit: pieces

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><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></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% 1210 ≥ 4.7μF</td></tr><tr><td>≤ 20% 0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td></tr><tr><td>35V</td><td>≤ 5%</td><td>≤ 20% 0603 ≥ 1μF;0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 5%</td><td>≤ 10% 0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 14% 0603 ≥ 0.33μF;1206 ≥ 4.7μF</td></tr><tr><td>≤ 15% 0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤ 5%</td><td>≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr><tr><td>≤ 15% 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤ 7.5%</td><td>≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.33μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 20% 0201 ≥ 0.1μF ;0402 ≥ 1μF; TT series</td></tr><tr><td>6.3V</td><td>≤ 15%</td><td>≤ 30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td></tr></table> * I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller. Class II (X7R) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td></tr><tr><td>50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201 ≥ 0.1uF;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 ; TT series</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 50V	≤ 3%	≤ 6% 0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 10% 1210 ≥ 4.7μF	≤ 20% 0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	35V	≤ 5%	≤ 20% 0603 ≥ 1μF;0805≥2.2μF;1210 ≥ 10μF	25V	≤ 5%	≤ 10% 0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF	≤ 14% 0603 ≥ 0.33μF;1206 ≥ 4.7μF	≤ 15% 0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	16V	≤ 5%	≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 15% 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	10V	≤ 7.5%	≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.33μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 20% 0201 ≥ 0.1μF ;0402 ≥ 1μF; TT series	6.3V	≤ 15%	≤ 30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series	4V	≤ 20%	---	Rated voltage	Insulation Resistance	100V: X7R	1GΩ or RxC ≥ 10 Ω-F whichever is smaller.	50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	35V:0805≥2.2μF;1210 ≥ 10μF	25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	16V: 0201 ≥ 0.1uF;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 ; TT series
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3.	Temperature Cycling JESD22 Method JA-104	* Conduct 1000 cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>-55°C +0/-3</td><td>5±1</td></tr><tr><td>2</td><td>+125°C +3/-0</td><td>5±1</td></tr></table>	Step	Temp. (°C)	Time (min.)	1	-55°C +0/-3	5±1	2	+125°C +3/-0	5±1	* No remarkable damage. * Cap change : NPO: within ±2.5% or 0.25pF whichever is larger. X7R: within ±10.0%. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:																																	
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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.	* 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																																												
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10V	≤7.5%	≤15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF																																												
		≤20%	0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series																																												
6.3V	≤15%	≤30%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series																																												
4V	≤20%	---	---																																												
* 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: 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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No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																
7.	Operational Life MIL-STD-202 Method 108	* Test temp.: 125±3℃ * To apply voltage: full rated voltage. * Test time: 1000+24/-0 hrs. * Before initial measurement (X7R only): Apply rated voltage for 1 hr at 125℃ . 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																																
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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																																

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:																																													
			Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 5%	1210 ≥ 4.7μF	≤ 10%	0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF; 1210 ≥ 10μF	25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	≤ 10%	0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF ; 1210 ≥ 22μF ; TT series	16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.33μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF 1206 ≥ 2.2μF;1210 ≥ 22μF; TT series	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF; TT series	≤ 20%	0402 ≥ 2.2μF	4V	≤ 15%	---	---
			Rated vol.	D.F. ≤	Exception of D.F. ≤																																											
			≥ 50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF																																										
					≤ 5%	1210 ≥ 4.7μF																																										
					≤ 10%	0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series																																										
			35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF; 1210 ≥ 10μF																																										
			25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF																																										
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					≤ 10%	0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF ; 1210 ≥ 22μF ; TT series																																										
			16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF																																										
					≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series																																										
			10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.33μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF 1206 ≥ 2.2μF;1210 ≥ 22μF; TT series																																										
					≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF																																										
			6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF; TT series																																										
					≤ 20%	0402 ≥ 2.2μF																																										
			4V	≤ 15%	---	---																																										
			* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.																																													
			Class II (X7R)																																													
			Rated voltage		Insulation Resistance																																											
			100V: X7R		10GΩ or RxC ≥ 100 Ω-F whichever is smaller.																																											
50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF																																																
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6.3V ; 4V ; TT series																																																

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:					
			NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.					
			X7R:					
			Rated vol.	D.F. ≤	Exception of D.F. ≤			
			≥ 50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF		
					≤ 5%	1210 ≥ 4.7μF		
					≤ 10%	0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series		
			35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF; 1210 ≥ 10μF		
			25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF		
					≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF		
					≤ 10%	0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF ; 1210 ≥ 22μF ; TT series		
			16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF		
					≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series		
			10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.33μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF;1210 ≥ 22μF; TT series		
					≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF		
			6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF; TT series		
					≤ 20%	0402 ≥ 2.2μF		
			4V	≤ 15%	---	---		
			* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.					
Class II (X7R)								
Rated voltage					Insulation Resistance			
100V: X7R					10GΩ or RxC ≥ 100 Ω-F whichever is smaller.			
50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF								
35V:0805≥2.2μF;1210 ≥ 10μF								
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF								
16V: 0201 ≥ 0.1uF;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 ; TT series								

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><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></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>1210 ≥ 4.7μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td></tr><tr><td>35V</td><td>≤ 3.5%</td><td>≤ 10%</td><td>0603 ≥ 1μF;0805≥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; 1206 ≥ 4.7μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF ; 1210 ≥ 22μF ; TT series</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤ 3.5%</td><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 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.012μF;0402 ≥ 0.33μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF;1210 ≥ 22μF; TT series</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">≤ 10%</td><td>≤ 15%</td><td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF; TT series</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 2.2μF</td></tr><tr><td>4V</td><td>≤ 15%</td><td>---</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 5%	1210 ≥ 4.7μF	≤ 10%	0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF; 1210 ≥ 10μF	25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	≤ 10%	0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF ; 1210 ≥ 22μF ; TT series	16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.33μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF;1210 ≥ 22μF; TT series	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF; TT series	≤ 20%	0402 ≥ 2.2μF	4V	≤ 15%	---	---
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≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF																																																
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Class II (X7R)																																																	
<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="8">10GΩ or RxC ≥ 100 Ω-F whichever is smaller.</td></tr><tr><td>50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201 ≥ 0.1uF;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 ; TT series</td></tr><tr><td></td></tr></table>	Rated voltage	Insulation Resistance	100V: X7R	10GΩ or RxC ≥ 100 Ω-F whichever is smaller.	50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	35V:0805≥2.2μF;1210 ≥ 10μF	25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	16V: 0201 ≥ 0.1uF;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 ; TT series																																							
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6.3V ; 4V ; TT series																																																	

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements					
13.	Resistance to Soldering Heat MIL-STD-202 Method 210	* Solder temperature: 270±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:					
			Rated vol.	D.F. ≤	Exception of D.F. ≤			
			≥ 50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF		
					≤ 5%	1210 ≥ 4.7μF		
					≤ 10%	0402 ≥ 0.1μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series		
			35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1210 ≥ 10μF		
			25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF		
					≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF		
					≤ 10%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF ; 1210 ≥ 22μF ; TT series		
			16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF		
					≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series		
			10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; TT series		
					≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF		
			6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ; 1210 ≥ 100μF; TT series		
					≤ 20%	0402 ≥ 2.2μF		
			4V	≤ 15%	---	---		
			* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.					
			Class II (X7R)					
			Rated voltage					Insulation Resistance
100V: X7R					10GΩ or RxC ≥ 100 Ω-F whichever is smaller.			
50V: 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF								
35V: 0805 ≥ 2.2μF; 1210 ≥ 10μF								
25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF								
16V: 0201 ≥ 0.1uF; 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 ; TT series								

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																															
14	Thermal Shock MIL-STD-202 Method 107	* Conduct 300 cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>-55°C +0/-3</td><td>15±3</td></tr><tr><td>2</td><td>+125°C +3/-0</td><td>15±3</td></tr></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	-55°C +0/-3	15±3	2	+125°C +3/-0	15±3	* No remarkable damage. * Cap change : NPO: within ±2.5% or 0.25pF whichever is larger X7R: within ±10.0% * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 50V</td><td rowspan="3">≤ 3%</td><td>≤ 6%</td><td>0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>≤ 10%</td><td>1210 ≥ 4.7μF</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td></tr><tr><td>35V</td><td>≤ 5%</td><td>≤ 20%</td><td>0603 ≥ 1μF;0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 14%</td><td>0603 ≥ 0.33μF;1206 ≥ 4.7μF</td></tr><tr><td>≤ 15%</td><td>0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</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;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤ 7.5%</td><td>≤ 15%</td><td>0201 ≥ 0.012μF;0402 ≥ 0.33μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 20%</td><td>0201 ≥ 0.1μF ;0402 ≥ 1μF; TT series</td></tr><tr><td>6.3V</td><td>≤ 15%</td><td>≤ 30%</td><td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td><td>---</td></tr></table> * I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller. Class II (X7R) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td></tr><tr><td>50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201 ≥ 0.1uF;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 ; TT series</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 3%	≤ 6%	0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 10%	1210 ≥ 4.7μF	≤ 20%	0402 ≥ 0.1μF;0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	35V	≤ 5%	≤ 20%	0603 ≥ 1μF;0805≥2.2μF;1210 ≥ 10μF	25V	≤ 5%	≤ 10%	0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF	≤ 14%	0603 ≥ 0.33μF;1206 ≥ 4.7μF	≤ 15%	0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	16V	≤ 5%	≤ 10%	0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 15%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	10V	≤ 7.5%	≤ 15%	0201 ≥ 0.012μF;0402 ≥ 0.33μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 20%	0201 ≥ 0.1μF ;0402 ≥ 1μF; TT series	6.3V	≤ 15%	≤ 30%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series	4V	≤ 20%	---	---	Rated voltage	Insulation Resistance	100V: X7R	1GΩ or RxC ≥ 10 Ω-F whichever is smaller.	50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	35V:0805≥2.2μF;1210 ≥ 10μF	25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	16V: 0201 ≥ 0.1uF;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 ; TT series
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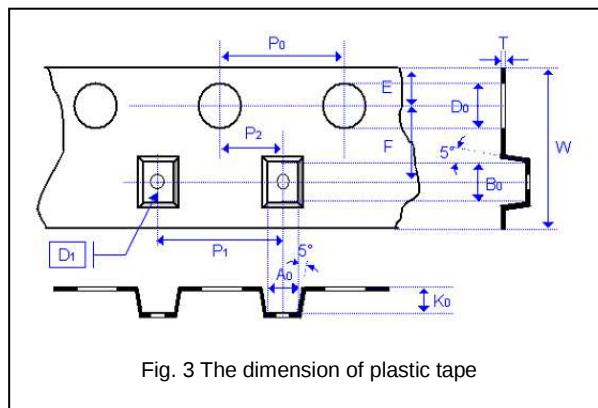
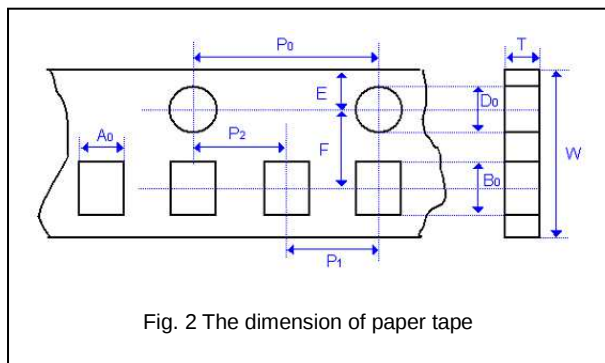
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16.	Solderability J-STD-002 JESD22-B102E	* Condition A Un-mounted chips 4hrs / 155°C*dry then completely immersed for 5±0.5 sec in solder bath at 245±5°C.	All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination.																																														
		* Condition B Un-mounted chips steam 8 hrs then completely immersed for 10±1sec in solder bath at 220+5/-0°C.																																															
		* Condition C Un-mounted chips steam 8 hrs then completely immersed for 10±1 sec. in solder bath at 260+0/-5°C.																																															

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17.	Electrical Characterization	* Capacitance	* Capacitance within the specified tolerance.																																														
		* Q/ D.F. (Dissipation Factor)	* Q/D.F. value:																																														
		Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%	NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.																																														
		Cap>1000pF 1.0±0.2Vrms, 1KHz±10%	X7R:																																														
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* Dielectric Strength	* Dielectric strength																																																
To apply 250% of rated voltage, duration 1~5 sec, charge and discharge current less than 50mA.	No evidence of damage or flash over during test.																																																
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Operation temperature: -55~125°C at 25°C	Capacitance Change: NPO: Within ±30ppm/°C X7R: Within ±15%																																																

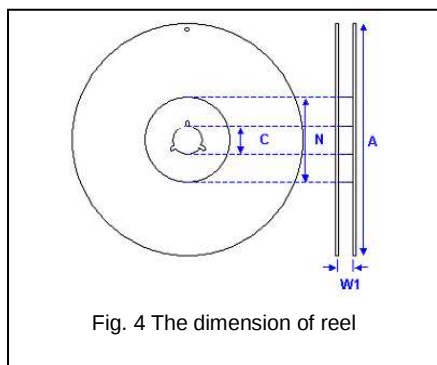
No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																															
18.	Board Flex AEC-Q200-005	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 3mm (2mm for X7R) and then the pressure shall be maintained for 5±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.	Terminal Strength AEC-Q200-006	* Pressurizing force : 2N (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:																															
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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)																															

APPENDIXES

■ Tape & reel dimensions

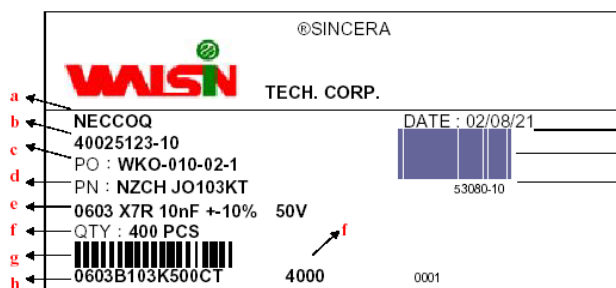


Size	0402	0603	0805			1206			1210
Thickness	N	S, X	A	B	C, D, I	B	C, J, D	G	C, D
A ₀	0.62±0.05	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97
B ₀	1.12±0.05	1.80±0.05	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73
T	0.60±0.05	0.95±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05
K ₀	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
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
10xP ₀	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10
P ₁	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
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
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05
D ₁	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	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



Size	0402, 0603, 0805, 1206, 1210		
Reel size	7"	10"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0
A	178.0±0.10	250.0±1.0	330.0±1.0
N	60.0+1.0/-0	100.0±1.0	100±1.0

■ Description 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

■ Constructions

No.	Name		NP0, X7R
①	Ceramic material		BaTiO ₃ based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

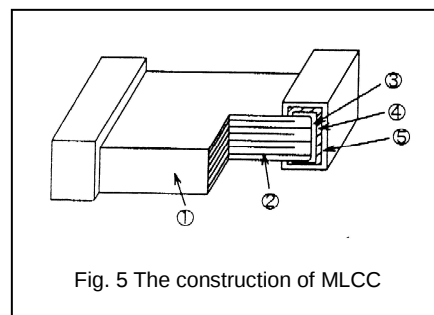


Fig. 5 The construction of MLCC

■ Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (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 N_2 within oven are recommended.

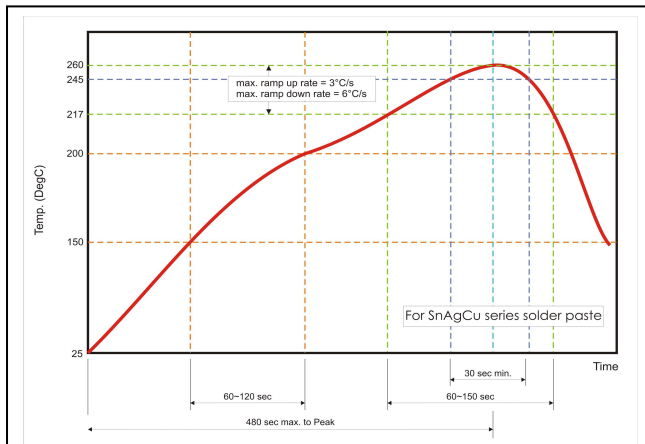


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

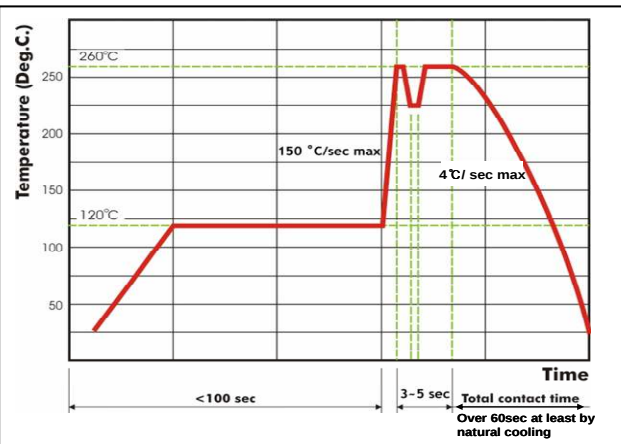


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.