

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination MLCC for Automotive (ST series)

Qualified to AEC-Q200

0603 to 1210 Sizes (10V to 100V)

X7R Dielectric

Halogen Free & RoHS Compliance

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

1. DESCRIPTION

WTC Soft Termination Chip Multilayer Ceramic Capacitors for Automotive is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.

WTC's ST series MLCC is made by X7R dielectric and which provides product with high electrical precision, stability and reliability. Besides, ST series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications. The ST series is AEC-Q200 compliant.

2. FEATURES

- MLCC's terminations are with a soft & flexible polymer layer to withstand high bending stress in SMT line.
- High reliability: AEC-Q200.

3. APPLICATIONS

- Automotive, power supply and related industries. .
- The other mechanical stress concerned products or the set having a high probability of fall.
- Prevention of ceramic body cracks by board bending.

4. HOW TO ORDER

<u>ST</u>	<u>18</u>	<u>B</u>	<u>102</u>	<u>K</u>	<u>500</u>	<u>C</u>	<u>I</u>
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging style
ST= Soft Termination MLCC for Automotive (ST series) Qualified to AEC-Q200	18=0603 (1608) 21=0805 (2012) 32=1210 (3225)	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	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	C= Cu+Conductive resin /Ni /Sn	T=7" reeled G=13" reeled

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M _B (mm)
0603 (1608)	1.60±0.20	0.80±0.10	0.80±0.07	S		0.40±0.15
	1.60±0.30	0.80±0.30	0.80±0.30	X		
0805 (2012)	2.00±0.20	1.25±0.10	1.25±0.10	D	#	0.50±0.20
1210 (3225)	3.20±0.60	2.50±0.50	2.50±0.50	M	#	0.75±0.25

Reflow soldering only is recommended.

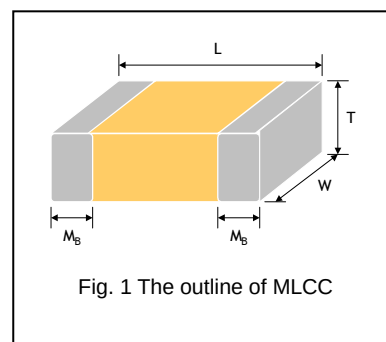


Fig. 1 The outline of MLCC

Multilayer Ceramic Capacitors

6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	0603, 0805, 1210
Capacitance range*	1000pF to 2.2μF
Capacitance tolerance**	J (±5%), K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V
Operating temperature	-55 to +125°C
Capacitance characteristic	±15%
Termination	Ni/Sn (lead-free termination)

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

Measured at 1.0±0.2Vrms, 30~70% related humidity, 25°C ambient temperature for X7R.

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

7. CAPACITANCE RANGE

DIELECTRIC		X7R								
SIZE		0603				0805				1210
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	100
Capacitance	1,000pF (102)	S	S	S	S	D	D	D	D	
	1,200pF (122)	S	S	S	S	D	D	D	D	
	1,500pF (152)	S	S	S	S	D	D	D	D	
	1,800pF (182)	S	S	S	S	D	D	D	D	
	2,200pF (222)	S	S	S	S	D	D	D	D	
	2,700pF (272)	S	S	S	S	D	D	D	D	
	3,300pF (332)	S	S	S	S	D	D	D	D	
	3,900pF (392)	S	S	S	S	D	D	D	D	
	4,700pF (472)	S	S	S	S	D	D	D	D	
	5,600pF (562)	S	S	S	S	D	D	D	D	
	6,800pF (682)	S	S	S	S	D	D	D	D	
	8,200pF (822)	S	S	S	S	D	D	D	D	
	0.010μF (103)	S	S	S	S	D	D	D	D	
	0.012μF (123)	S	S	S	S	D	D	D	D	
	0.015μF (153)	S	S	S	S	D	D	D	D	
	0.018μF (183)	S	S	S	S	D	D	D	D	
	0.022μF (223)	S	S	S	S	D	D	D	D	
	0.027μF (273)	S	S	S	S	D	D	D	D	
	0.033μF (333)	S	S	S	X	D	D	D	D	
	0.039μF (393)	S	S	S	X	D	D	D	D	
	0.047μF (473)	S	S	S	X	D	D	D	D	
	0.056μF (563)	S	S	S	X	D	D	D	D	
	0.068μF (683)	S	S	S	X	D	D	D	D	
	0.082μF (823)	S	S	S	X	D	D	D	D	
	0.10μF (104)	S	S	S	X	D	D	D	D	
	0.12μF (124)	X	X	X						
	0.15μF (154)	X	X	X						
	0.18μF (184)	X	X	X						
	0.22μF (224)	X	X	X						
	2.2μF (225)									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.

Multilayer Ceramic Capacitors

8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80±0.30	X	4k	15k	-	-
0805 (2012)	1.25±0.10	D	-	-	3k	10k
1210 (3225)	2.50±0.50	M	-	-	1k	6k

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℃ * 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:		
			Rated vol.	D.F.≤	Exception of D.F. ≤
			≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF ≤ 7.5% 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF ≤ 20% 0805 > 0.22μF;1210 ≥ 3.3μF
			50V	≤ 3%	≤ 6% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF ≤ 10% 0201 ≥ 0.01μF;1210 ≥ 3.3μF
			35V	≤ 5%	≤ 20% 0402 ≥ 0.012μF;0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF ≤ 10% 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF
			25V	≤ 5%	≤ 14% 0603 ≥ 0.33μF ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF ≤ 20% 0402 ≥ 0.47μF
			16V	≤ 5%	≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF ≤ 15% 0201 ≥ 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; 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF ≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF
			6.3V	≤ 15%	≤ 30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF
			4V	≤ 20%	---
			* I.R.: ≥10GΩ or RxC≥500Ω·F whichever is smaller. Class II (X7R)		
			Rated voltage		Insulation Resistance
			100V: All X7R		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 ≥ 0.1uF; 0402≥0.22μF; 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					

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

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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><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> * 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	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:.. <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 3%</td><td>≤ 6% 1206 ≥ 0.47μF</td></tr><tr><td>≤ 7.5% 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF</td></tr><tr><td>≤ 20% 0805 > 0.22μF;1210 ≥ 3.3μF</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤ 3%</td><td>≤ 6% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF</td></tr><tr><td>≤ 10% 0201 ≥ 0.01uF;1210 ≥ 3.3μF</td></tr><tr><td>≤ 20% 0402 ≥ 0.012μF;0603>0.1μF; 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="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</td></tr><tr><td>≤ 15% 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">≤ 5%</td><td>≤ 20% 0402 ≥ 0.47μF</td></tr><tr><td>≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr><tr><td>≤ 15% 0201 ≥ 0.022μF;0402 ≥ 0.033μF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF</td></tr><tr><td>10V</td><td>≤ 7.5%</td><td>≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.22μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</td></tr><tr><td rowspan="3">6.3V</td><td rowspan="3">≤ 15%</td><td>≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF</td></tr><tr><td>≤ 30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td></tr></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: All X7R</td><td rowspan="6">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 ≥ 0.1uF; 0402≥0.22μF; 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</td><td></td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF	≤ 7.5% 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF	≤ 20% 0805 > 0.22μF;1210 ≥ 3.3μF	50V	≤ 3%	≤ 6% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 10% 0201 ≥ 0.01uF;1210 ≥ 3.3μF	≤ 20% 0402 ≥ 0.012μF;0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF	35V	≤ 5%	≤ 20% 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	25V	≤ 5%	≤ 10% 0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF	≤ 14% 0603 ≥ 0.33μF	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF	16V	≤ 5%	≤ 20% 0402 ≥ 0.47μF	≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 15% 0201 ≥ 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; 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF	6.3V	≤ 15%	≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF	≤ 30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF	4V	≤ 20%	---	Rated voltage	Insulation Resistance	100V: All X7R	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 ≥ 0.1uF; 0402≥0.22μF; 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	
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Approval Sheet

16V	≤5%
10V	≤7.5%
6.3V	≤15%
4V	≤20%

* I.R.: ≥10GΩ or R

Class II (X7R)

Rated voltage
100V: All X7R
50V: 0402>0.01μF, 0805>0.02μF, 1206>0.05μF, 1210>0.1μF, 1812>0.1μF, 2512>0.1μF, 3216>0.1μF, 3225>0.1μF, 3235>0.1μF, 3242>0.1μF, 3250>0.1μF, 3263>0.1μF, 3276>0.1μF, 3290>0.1μF, 3296>0.1μF, 32102>0.1μF, 32162>0.1μF, 32252>0.1μF, 32322>0.1μF, 32422>0.1μF, 32502>0.1μF, 32632>0.1μF, 32762>0.1μF, 32902>0.1μF, 32962>0.1μF, 32103>0.1μF, 32163>0.1μF, 32253>0.1μF, 32323>0.1μF, 32423>0.1μF, 32503>0.1μF, 32633>0.1μF, 32763>0.1μF, 32903>0.1μF, 32963>0.1μF, 32104>0.1μF, 32164>0.1μF, 32254>0.1μF, 32324>0.1μF, 32424>0.1μF, 32504>0.1μF, 32634>0.1μF, 32764>0.1μF, 32904>0.1μF, 32964>0.1μF, 32105>0.1μF, 32165>0.1μF, 32255>0.1μF, 32325>0.1μF, 32425>0.1μF, 32505>0.1μF, 32635>0.1μF, 32765>0.1μF, 32905>0.1μF, 32965>0.1μF, 32106>0.1μF, 32166>0.1μF, 32256>0.1μF, 32326>0.1μF, 32426>0.1μF, 32506>0.1μF, 32636>0.1μF, 32766>0.1μF, 32906>0.1μF, 32966>0.1μF, 32107>0.1μF, 32167>0.1μF, 32257>0.1μF, 32327>0.1μF, 32427>0.1μF, 32507>0.1μF, 32637>0.1μF, 32767>0.1μF, 32907>0.1μF, 32967>0.1μF, 32108>0.1μF, 32168>0.1μF, 32258>0.1μF, 32328>0.1μF, 32428>0.1μF, 32508>0.1μF, 32638>0.1μF, 32768>0.1μF, 32908>0.1μF, 32968>0.1μF, 32109>0.1μF, 32169>0.1μF, 32259>0.1μF, 32329>0.1μF, 32429>0.1μF, 32509>0.1μF, 32639>0.1μF, 32769>0.1μF, 32909>0.1μF, 32969>0.1μF, 32110>0.1μF, 321610>0.1μF, 322510>0.1μF, 323210>0.1μF, 324210>0.1μF, 325010>0.1μF, 326310>0.1μF, 327610>0.1μF, 329010>0.1μF, 329610>0.1μF, 32112>0.1μF, 321612>0.1μF, 322512>0.1μF, 323212>0.1μF, 324212>0.1μF, 325012>0.1μF, 326312>0.1μF, 327612>0.1μF, 329012>0.1μF, 329612>0.1μF, 32115>0.1μF, 321615>0.1μF, 322515>0.1μF, 323215>0.1μF, 324215>0.1μF, 325015>0.1μF, 326315>0.1μF, 327615>0.1μF, 329015>0.1μF, 329615>0.1μF, 32120>0.1μF, 321620>0.1μF, 322520>0.1μF, 323220>0.1μF, 324220>0.1μF, 325020>0.1μF, 326320>0.1μF, 327620>0.1μF, 329020>0.1μF, 329620>0.1μF, 32125>0.1μF, 321625>0.1μF, 322525>0.1μF, 323225>0.1μF, 324225>0.1μF, 325025>0.1μF, 326325>0.1μF, 327625>0.1μF, 329025>0.1μF, 329625>0.1μF, 32130>0.1μF, 321630>0.1μF, 322530>0.1μF, 323230>0.1μF, 324230>0.1μF, 325030>0.1μF, 326330>0.1μF, 327630>0.1μF, 329030>0.1μF, 329630>0.1μF, 32135>0.1μF, 321635>0.1μF, 322535>0.1μF, 323235>0.1μF, 324235>0.1μF, 325035>0.1μF, 326335>0.1μF, 327635>0.1μF, 329035>0.1μF, 329635>0.1μF, 32140>0.1μF, 321640>0.1μF, 322540>0.1μF, 323240>0.1μF, 324240>0.1μF, 325040>0.1μF, 326340>0.1μF, 327640>0.1μF, 329040>0.1μF, 329640>0.1μF, 32145>0.1μF, 321645>0.1μF, 322545>0.1μF, 323245>0.1μF, 324245>0.1μF, 325045>0.1μF, 326345>0.1μF, 327645>0.1μF, 329045>0.1μF, 329645>0.1μF, 32150>0.1μF, 321650>0.1μF, 322550>0.1μF, 323250>0.1μF, 324250>0.1μF, 325050>0.1μF, 326350>0.1μF, 327650>0.1μF, 329050>0.1μF, 329650>0.1μF, 32155>0.1μF, 321655>0.1μF, 322555>0.1μF, 323255>0.1μF, 324255>0.1μF, 325055>0.1μF, 326355>0.1μF, 327655>0.1μF, 329055>0.1μF, 329655>0.1μF, 32160>0.1μF, 321660>0.1μF, 322560>0.1μF, 323260>0.1μF, 324260>0.1μF, 325060>0.1μF, 326360>0.1μF, 327660>0.1μF, 329060>0.1μF, 329660>0.1μF, 32165>0.1μF, 321665>0.1μF, 322565>0.1μF, 323265>0.1μF, 324265>0.1μF, 325065>0.1μF, 326365>0.1μF, 327665>0.1μF, 329065>0.1μF, 329665>0.1μF, 32170>0.1μF, 321670>0.1μF, 322570>0.1μF, 323270>0.1μF, 324270>0.1μF, 325070>0.1μF, 326370>0.1μF, 327670>0.1μF, 329070>0.1μF, 329670>0.1μF, 32175>0.1μF, 321675>0.1μF, 322575>0.1μF, 323275>0.1μF, 324275>0.1μF, 325075>0.1μF, 326375>0.1μF, 327675>0.1μF, 329075>0.1μF, 329675>0.1μF, 32180>0.1μF, 321680>0.1μF, 322580>0.1μF, 323280>0.1μF, 324280>0.1μF, 325080>0.1μF, 326380>0.1μF, 327680>0.1μF, 329080>0.1μF, 329680>0.1μF, 32185>0.1μF, 321685>0.1μF, 322585>0.1μF, 323285>0.1μF, 324285>0.1μF, 325085>0.1μF, 326385>0.1μF, 327685>0.1μF, 329085>0.1μF, 329685>0.1μF, 32190>0.1μF, 321690>0.1μF, 322590>0.1μF, 323290>0.

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Multilayer Ceramic Capacitors

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:																																																													
			<table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 3%</td><td>≤ 6%</td><td>1206 ≥ 0.47μF</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="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>0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td rowspan="3">35V</td><td rowspan="3">≤ 5%</td><td>≤ 20%</td><td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 10%</td><td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 14%</td><td>0603 ≥ 0.33μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 5%</td><td>≤ 15%</td><td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 0.47μF</td></tr><tr><td>≤ 10%</td><td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr><tr><td rowspan="3">16V</td><td rowspan="3">≤ 5%</td><td>≤ 15%</td><td>0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 20%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤ 7.5%</td><td>≤ 15%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 30%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td>≤ 20%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">≤ 15%</td><td>≤ 30%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td></tr><tr><td>≤ 20%</td><td>---</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 3%	≤ 6%	1206 ≥ 0.47μF	≤ 7.5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 3%	≤ 6%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 10%	0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤ 20%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 5%	≤ 20%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 10%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 14%	0603 ≥ 0.33μF	25V	≤ 5%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 20%	0402 ≥ 0.47μF	≤ 10%	0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤ 5%	≤ 15%	0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 20%	0201 ≥ 0.1μF; 0402 ≥ 1μF	10V	≤ 7.5%	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 30%	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 20%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	≤ 15%	≤ 30%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 20%	---	4V	≤ 20%	---
			Rated vol.	D.F. ≤	Exception of D.F. ≤																																																											
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		≤ 20%	---																																																													
4V	≤ 20%	---																																																														
* I.R.: ≥1GΩ or RxC≥50Ω·F whichever is smaller. Class II (X7R) for rated voltage test																																																																
<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R</td><td rowspan="7">500MΩ or RxC ≥ 5 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 ≥ 0.1uF; 0402≥0.22μF; 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</td></tr></table>			Rated voltage	Insulation Resistance	100V: All X7R	500MΩ or RxC ≥ 5 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 ≥ 0.1uF; 0402≥0.22μF; 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																																																				
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6.3V ; 4V																																																																

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

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																								
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 X7R:																																																								
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8.	External Visual MIL-STD-883 Method 2009	Visual inspection	No remarkable defect.																																																								
9.	Physical Dimension JESD22 Method JB-100	Using by calipers	Within the specified dimensions																																																								

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

Multilayer Ceramic Capacitors

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

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																								
11.	Mechanical Shock MIL-STD-202 Method 213	* Peak value: 1500g's.	* No remarkable damage.																																																								
		* Wave: 1/2 sine.	* Cap.: within the specified tolerance.																																																								
		* Velocity: 15.4 ft/sec	* Q/D.F. value:																																																								
		* Three shocks in each direction should be applied along	NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.																																																								
		3 mutually perpendicular axes of the test specimen	X7R:																																																								
		(18 shocks)	<table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0603 ≥ 0.068μF;0805 > 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="3">50V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01uF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.012μF;0603>0.1μF; 0805>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="2">35V</td><td rowspan="2">≤ 3.5%</td><td>≤ 10%</td><td>0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤ 3.5%</td><td>≤ 7%</td><td>0603 ≥ 0.33μF</td></tr><tr><td rowspan="3">≤ 10%</td><td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 12.5%</td><td>0402 ≥ 0.47μF</td></tr><tr><td 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 ≥ 0.022μF; 0402 ≥ 0.22uF;0603>0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</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</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. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF	≤ 10%	0805 > 0.22μF;1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01uF; 1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF;0603>0.1μF; 0805>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF	25V	≤ 3.5%	≤ 7%	0603 ≥ 0.33μF	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5%	0402 ≥ 0.47μF	16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 10%	0201 ≥ 0.022μF; 0402 ≥ 0.22uF;0603>0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF	≤ 20%	0402 ≥ 2.2μF	4V	≤ 15%	---	---
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6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF																																																								
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4V	≤ 15%	---	---																																																								
* I.R.: ≥10GΩ or Rx≥500Ω·F whichever is smaller.																																																											
Class II (X7R)																																																											
Rated voltage		Insulation Resistance																																																									
100V: All X7R		10GΩ or Rx≥100 Ω·F whichever is smaller.																																																									
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF																																																											
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10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF																																																											
6.3V ; 4V		Insulation Resistance																																																									
Rated voltage																																																											
100V: 1210≥3.3μF			Rx≥50 Ω·F.																																																								
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																						
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.																																																						
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			<table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0603 ≥ 0.068μF;0805 > 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="3">50V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01uF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.012μF;0603>0.1μF; 0805>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td>35V</td><td>≤ 3.5%</td><td>≤ 10%</td><td>0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤ 3.5%</td><td>≤ 5%</td><td>0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF</td></tr><tr><td>≤ 7%</td><td>0603 ≥ 0.33μF</td></tr><tr><td>≤ 10%</td><td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 12.5%</td><td>0402 ≥ 0.47μF</td></tr><tr><td>16V</td><td>≤ 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 rowspan="2">10V</td><td rowspan="2">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.022μF; 0402 ≥ 0.22uF;0603>0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td>6.3V</td><td>≤ 10%</td><td>≤ 15%</td><td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF</td></tr><tr><td rowspan="2">4V</td><td rowspan="2">≤ 15%</td><td>≤ 20%</td><td>0402 ≥ 2.2μF</td></tr><tr><td>---</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF	≤ 10%	0805 > 0.22μF;1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01uF; 1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF;0603>0.1μF; 0805>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5%	0402 ≥ 0.47μF	16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.022μF; 0402 ≥ 0.22uF;0603>0.47μF; 0805 ≥ 2.2μF;1206 ≥ 4.7μF; 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	4V	≤ 15%	≤ 20%	0402 ≥ 2.2μF	---	---
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Class II (X7R)																																																									
Rated voltage		Insulation Resistance																																																							
100V: All X7R		10GΩ or Rx≥100 Ω·F whichever is smaller.																																																							
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6.3V ; 4V		Rx≥50 Ω·F.																																																							
Rated voltage																																																									
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																																															
13.	Resistance to Soldering Heat MIL-STD-202 Method 210	* Solder temperature: 270±5℃ * Dipping time: 10±1 sec * Before initial measurement (X7R only): Perform 150+0/-10℃ 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: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0603 ≥ 0.068μF; 0805 > 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="3">50V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>0201(50V): 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01uF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td rowspan="3">35V</td><td rowspan="3">≤ 3.5%</td><td>≤ 10%</td><td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 7%</td><td>0603 ≥ 0.33μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 3.5%</td><td>≤ 10%</td><td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 12.5%</td><td>0402 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤ 3.5%</td><td>≤ 10%</td><td>0201 ≥ 0.022μF; 0402 ≥ 0.22uF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</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</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> * 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: All X7R</td><td rowspan="7">10GΩ or RxC≥100 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: 0805≥2.2μF; 1206 ≥ 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≥0.1μF; 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</td></tr><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: 1210≥3.3μF</td><td rowspan="8">RxC≥50 Ω·F.</td></tr><tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF; 1206≥10μF</td></tr><tr><td>35V: 0603≥1μF;</td></tr><tr><td>25V: 0201≥0.1μF; 0402≥2.2μF; 0603≥10μF; 0805≥10μF; 1206≥22μF</td></tr><tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr><tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF</td></tr><tr><td>6.3V: 0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF</td></tr><tr><td>4V: 0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3%	0201(50V): 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01uF; 1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF	25V	≤ 3.5%	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5%	0402 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10%	0201 ≥ 0.022μF; 0402 ≥ 0.22uF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF	≤ 20%	0402 ≥ 2.2μF	4V	≤ 15%	---	---	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	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
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																				
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>Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 3%</td><td>≤ 6% 1206 ≥ 0.47μF</td></tr><tr><td>≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td></tr><tr><td>≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤ 3%</td><td>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>≤ 10% 0201 ≥ 0.01uF; 1210 ≥ 4.7μF</td></tr><tr><td>≤ 20% 0402 ≥ 0.012μF; 0603>0.1μF; 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; 0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 14% 0603 ≥ 0.33μF</td></tr><tr><td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 20% 0402 ≥ 0.47μF</td></tr><tr><td>16V</td><td>≤ 5%</td><td>≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤ 7.5%</td><td>≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td>≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</td></tr></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: All X7R</td><td rowspan="7">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 ≥ 0.1uF; 0402≥0.22μF; 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</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF	≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 3%	≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 10% 0201 ≥ 0.01uF; 1210 ≥ 4.7μF	≤ 20% 0402 ≥ 0.012μF; 0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 5%	≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	25V	≤ 5%	≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 14% 0603 ≥ 0.33μF	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 20% 0402 ≥ 0.47μF	16V	≤ 5%	≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	10V	≤ 7.5%	≤ 15% 0201 ≥ 0.022μF; 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	4V	≤ 20%	---	Rated voltage	Insulation Resistance	100V: All X7R	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 ≥ 0.1uF; 0402≥0.22μF; 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
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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																								
15.	ESD AEC-Q200-002	Per AEC-Q200-002	* No remarkable damage.																																																								
			* Cap.: within the specified tolerance.																																																								
			* Q/D.F. value:																																																								
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Multilayer Ceramic Capacitors

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements																																																																			
17.	Electrical Characterization	* Capacitance * Q/ D.F. (Dissipation Factor) *Test temp.: Room Temperature. Class I: (NPO) Cap≤1000pF 1.0±0.2Vrms, 1MHz±10% Cap>1000pF 1.0±0.2Vrms, 1KHz±10% Class II: (X7R) Cap ≤10μF, 1.0±0.2Vrms · 1KHz±10% Cap > 10μF, 0.5±0.2Vrms · 120Hz±20% * Insulation Resistance *Test temp.: Room Temperature. *To apply rated voltage(500V max.) for max. 120 sec. * Dielectric Strength To apply voltage: <table><tr><td>≤ 100</td><td>≥2.5 times VDC</td></tr><tr><td>200V~300V</td><td>≥2 times VDC</td></tr><tr><td>400V~450V</td><td>≥1.2 times VDC</td></tr><tr><td>500V~999V</td><td>≥1.5 times VDC</td></tr><tr><td>1000V~3000V</td><td>≥1.2 times VDC</td></tr></table> , duration 1~5 sec, charge and discharge current less than 50mA. * Temperature Coefficient (with no electrical load) Operation temperature: -55~125℃ at 25℃	≤ 100	≥2.5 times VDC	200V~300V	≥2 times VDC	400V~450V	≥1.2 times VDC	500V~999V	≥1.5 times VDC	1000V~3000V	≥1.2 times VDC	* Capacitance 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>Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3% 1206 ≥ 0.47μF</td></tr><tr><td>≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF</td></tr><tr><td>≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 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 ≥ 0.47μF</td></tr><tr><td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤ 5%</td><td>≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>6.3V</td><td>≤ 10%</td><td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td rowspan="2">4V</td><td rowspan="2">≤ 15%</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></table> * IR. ≥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: All X7R</td><td rowspan="7">10GΩ or RxC≥100 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: 0805≥2.2μF; 1206 ≥ 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≥0.1μF; 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</td></tr><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: 1210≥3.3μF</td><td rowspan="7">RxC≥50 Ω·F.</td></tr><tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF; 1206≥10μF</td></tr><tr><td>35V: 0603≥1μF;</td></tr><tr><td>25V: 0201≥0.1μF; 0402≥2.2μF; 0603≥10μF; 0805≥10μF; 1206≥22μF</td></tr><tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr><tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF</td></tr><tr><td>6.3V: 0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF</td></tr><tr><td>4V: 0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr></table> * Dielectric strength No evidence of damage or flash over during test. * Temperature Coefficient Capacitance Change: NPO: Within ±30ppm/℃ X7R: Within ±15%	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 2.5%	≤ 3% 1206 ≥ 0.47μF	≤ 5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	25V	≤ 3.5%	≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7% 0603 ≥ 0.33μF	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V	≤ 3.5%	≤ 12.5% 0402 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	10V	≤ 5%	≤ 10% 0201 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	6.3V	≤ 10%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF	4V	≤ 15%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 20% 0402 ≥ 2.2μF	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	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
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* "Room condition" Temperature: 15 to 35℃, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

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 5 mm and then the pressure shall be maintained for 60±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change : NPO: within ±5% or 0.5pF whichever is larger X7R: within ±12.5% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)																																																																
19.	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: 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">≥ 100V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0603 ≥ 0.068μF; 0805 > 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="3">50V</td><td rowspan="3">≤ 2.5%</td><td>≤ 3%</td><td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01uF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td rowspan="3">35V</td><td rowspan="3">≤ 3.5%</td><td>≤ 10%</td><td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>≤ 7%</td><td>0603 ≥ 0.33μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 3.5%</td><td>≤ 10%</td><td>0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 12.5%</td><td>0402 ≥ 0.47μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr><tr><td rowspan="3">16V</td><td rowspan="3">≤ 3.5%</td><td>≤ 10%</td><td>0201 ≥ 0.022μF; 0402 ≥ 0.22uF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 10%</td><td>0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF</td></tr><tr><td>≤ 20%</td><td>0402 ≥ 2.2μF</td></tr><tr><td>---</td><td>---</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">≤ 10%</td><td>≤ 15%</td><td>---</td></tr><tr><td>---</td><td>---</td></tr><tr><td rowspan="2">4V</td><td rowspan="2">≤ 15%</td><td>---</td><td>---</td></tr><tr><td>---</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01uF; 1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF	25V	≤ 3.5%	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5%	0402 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10%	0201 ≥ 0.022μF; 0402 ≥ 0.22uF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF	≤ 20%	0402 ≥ 2.2μF	---	---	6.3V	≤ 10%	≤ 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℃, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

APPENDIXES

■ Tape & reel dimensions

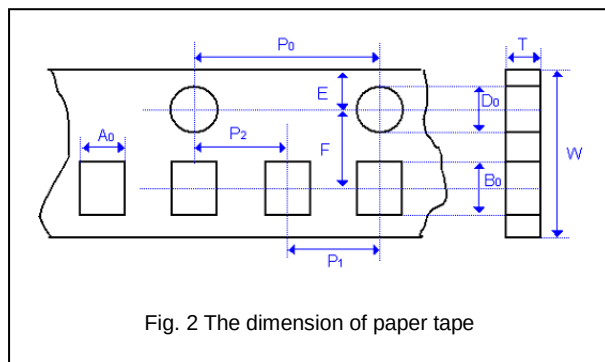


Fig. 2 The dimension of paper tape

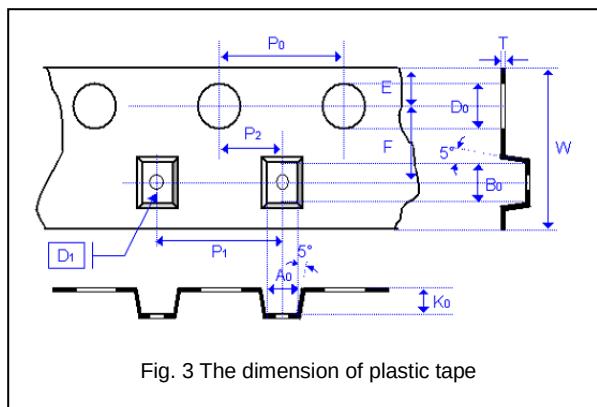


Fig. 3 The dimension of plastic tape

Size	0603	0805			1206			1210		
Thickness	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D,G,K	M
A ₀	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	< 2.30	< 3.05	< 3.05	< 3.20
B ₀	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	< 4.00
T	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	≤ 1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1
K ₀	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 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
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
10xP ₀	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	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10
P 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
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
D ₁	-	-	-	1.00 +/-0.10	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10
E	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10
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

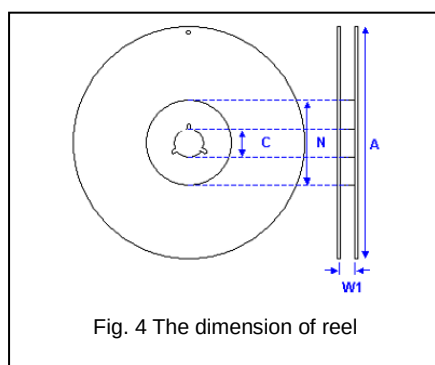
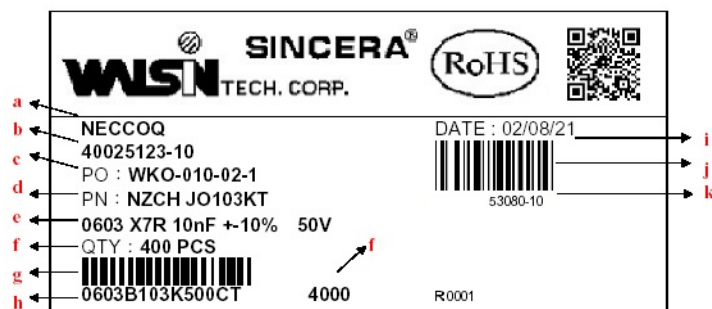


Fig. 4 The dimension of reel

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

Example of customer label



*Customized label is available upon request

- 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	X7R
①	Ceramic material	BaTiO ₃ based
②	Inner electrode	Ni
③	Inner layer	Cu + Conductive Resin
④	Middle layer	Ni
⑤	Outer layer	Sn (Matt)

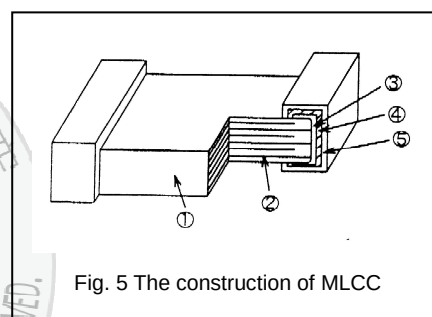


Fig. 5 The construction of MLCC

Storage and handling conditions

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

Cautions:

- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

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.

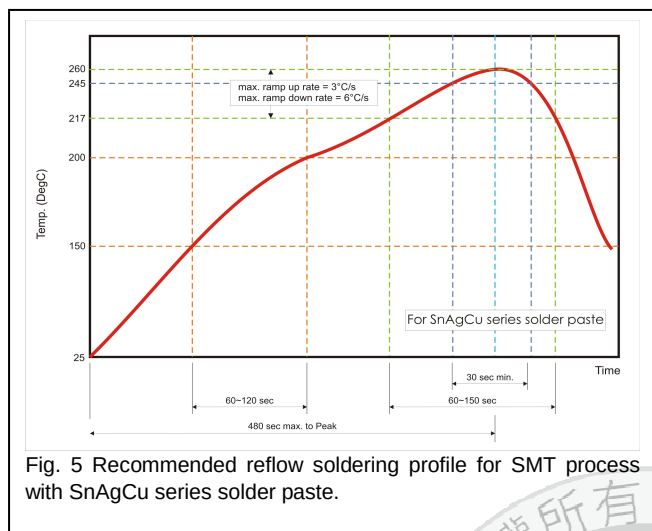


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

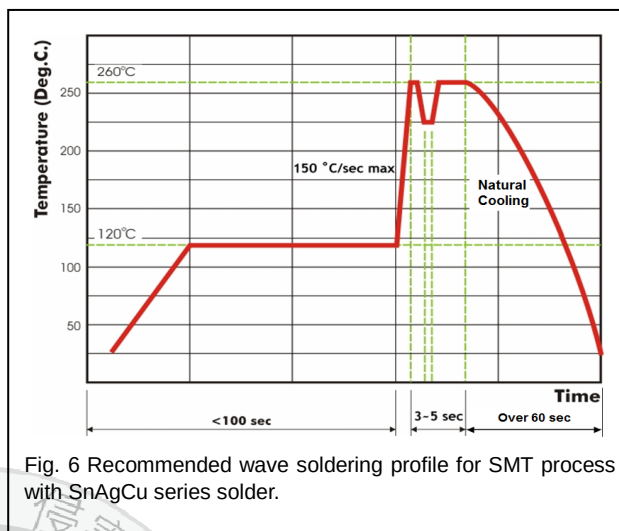


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.

