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

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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

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

3. APPLICATIONS

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

4. HOW TO ORDER

ST	18	B	102	K	500	C	T
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) **31**=1206 (3216) **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
1206 (3216)	3.20±0.50	1.60±0.50	1.60±0.50	P	#	0.75±0.25
1210 (3225)	3.20±0.60	2.50±0.50	2.50±0.50	M	#	0.75±0.25

Reflow soldering only is recommended.

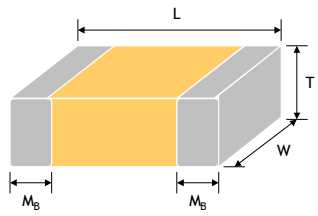

Fig. 1 The outline of MLCC

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6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	0603, 0805, 1206, 1210
Capacitance range*	1000pF to 10μF
Capacitance tolerance**	J (±5%), K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V
Operating temperature	-55 to +125℃
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℃ ambient temperature for X7R.
** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10℃ for 1 hour, then leave in a mbient condition for 24±2 hours before measurement.

7. CAPACITANCE RANGE

DIELECTRIC		X7R										
SIZE		0603				0805				1206	1210	
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	100	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								
	1.0μF (105)											
	2.2μF (225)									P		M
	3.3μF (335)											
	4.7μF (475)										M	M
	10μF (106)										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.

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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
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
1206 (3216)	1.60±0.50	P	-	-	2k	9k
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
		≦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
		≦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℃, Relativ e 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. * 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 ±10.0%. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:.

Step	Temp. (℃)	Time (min.)
1	-55℃ +0/-3	5±1
2	+125℃ +3/-0	5±1

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
		≦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℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

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<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>4.</td><td>Destructive Physical Analysis
EIA-469</td><td>Per EIA-469</td><td>No defects or abnormalities</td></tr>
<tr><td>5.</td><td>Moisture Resistance
MIL-STD-202
Method 106</td><td>* Test temp.: 25~65℃
* Humidity: 80~100% RH
* Test time: 10 cycles, t=24hrs/cycle.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change : NPO: within ±3.0% or 0.30pF whichever is larger
X7R: within ±12.5%.
* Q/D.F. value:
NPO: More than 30pF Q≥350 ; 10pF≤C≤30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></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≧0.01uF;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>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><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 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≧0.022μF;0402≧0.033μF;
0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF;
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>6.3V</td><td>≦15%</td><td>≦30%</td><td>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><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></td></tr>
</table>

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

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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℃ * 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:

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
		≦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.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.
Class II (X7R) for rated voltage test

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	

Class II (X7R) for 1.3~1.5Vdc

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℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

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<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>7.</td><td>Operational Life
MIL-STD-202
Method 108</td><td>* 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.</td><td>* 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:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></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≧0.01uF;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>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><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 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≧0.022μF;0402≧0.033μF;
0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF;
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>6.3V</td><td>≦15%</td><td>≦30%</td><td>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><td>---</td></tr>
</table>
* I.R.: ≥1GΩ or RxC≥50Ω-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></td></tr>
<tr><td>8.</td><td>External Visual
MIL-STD-883
Method 2009</td><td>Visual inspection</td><td>No remarkable defect.</td></tr>
<tr><td>9.</td><td>Physical Dimension
JESD22
Method JB-100</td><td>Using by calipers</td><td>Within the specified dimensions</td></tr>
</table>

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

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No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements
10.	**Resistance to Solvents** MIL-STD-202 Method 215	* Temperature: 25±5℃ * 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. ≦	
≧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
		≦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%	---	---

* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.

Class II (X7R)

Rated voltage	Insulation Resistance
100V: All X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
35V:0805≥2.2μF;1206≧2.2μF;1210≧10μF	
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V ; 4V	

Rated voltage	Insulation Resistance
100V: 1210≥3.3μF	RxC≥50 Ω-F.
50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF	
35V: 0603≥1μF;	
25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF	
16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF	
10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF	
6.3V:0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF	
4V:0603≥22μF; 0805≥47μF; 1206≥100μF	

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

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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. ≦	
≧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
		≦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%	---	---

* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.

Class II (X7R)

Rated voltage	Insulation Resistance
100V: All X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
35V:0805≥2.2μF;1206≧2.2μF;1210≧10μF	
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V ; 4V	

Rated voltage	Insulation Resistance
100V: 1210≥3.3μF	RxC≥50 Ω-F.
50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF	
35V: 0603≥1μF;	
25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF	
16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF	
10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF	
6.3V:0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF	
4V:0603≥22μF; 0805≥47μF; 1206≥100μF	

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

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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:

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
		≦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%	---	---

* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.

Class II (X7R)

Rated voltage	Insulation Resistance
100V: All X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
35V:0805≥2.2μF;1206≧2.2μF;1210≧10μF	
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V ; 4V	

Rated voltage	Insulation Resistance
100V: 1210≥3.3μF	RxC≥50 Ω-F.
50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF	
35V: 0603≥1μF;	
25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF	
16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF	
10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF	
6.3V:0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF	
4V:0603≥22μF; 0805≥47μF; 1206≥100μF	

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

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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:

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
		≦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%	---	---

* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.

Class II (X7R)

Rated voltage	Insulation Resistance
100V: All X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
35V:0805≥2.2μF;1206≧2.2μF;1210≧10μF	
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V ; 4V	

Rated voltage	Insulation Resistance
100V: 1210≥3.3μF	RxC≥50 Ω-F.
50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF	
35V: 0603≥1μF;	
25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF	
16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF	
10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF	
6.3V:0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF	
4V:0603≥22μF; 0805≥47μF; 1206≥100μF	

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

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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. * Max. transfer time: 20 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 ±10.0% * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:

Step	Temp. (℃)	Time (min.)
1	-55℃ +0/-3	15±3
2	+125℃ +3/-0	15±3

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
		≦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℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

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No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements
15.	**ESD** AEC-Q200-002	Per AEC-Q200-002	* No remarkable damage. * Cap.: within the specified tolerance. * Q/D.F. value: NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C. X7R:

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
		≦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%	---	---

* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.

Class II (X7R)

Rated voltage	Insulation Resistance
100V: All X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
35V:0805≥2.2μF;1206≧2.2μF;1210≧10μF	
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V ; 4V	

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	

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 235±5°C. * Condition B Un-mounted chips steam 8 hrs then completely immersed for 10±1sec in solder bath at 215+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.	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.

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

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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: (NP0) Cap≤1000pF 1.0±0.2Vrms, 1MHz±10% Cap>1000pF 1.0±0.2Vrms, 1KHz±10% Class II: (X7R) Cap ≤10μF, 1.0±0.2Vrms，1KHz±10% Cap＞10μF, 0.5±0.2Vrms，120Hz±20%	* Capacitance 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. ≦	
≧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
		≦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%	---	---

	* Insulation Resistance *Test temp.: Room Temperature. *To apply rated voltage(500V max.) for max. 120 sec.	* IR. ≥10GΩ or RxC≥500Ω-F whichever is smaller. Class II (X7R)

Rated voltage	Insulation Resistance
100V: All X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.
50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
35V:0805≥2.2μF;1206≧2.2μF;1210≧10μF	
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	
10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	
6.3V ; 4V	

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	

	* Dielectric Strength To apply voltage: ≦100 ≥2.5 times VDC 200V~300V ≥2 times VDC 400V~450V ≥1.2 times VDC 500V~999V ≥1.5 times VDC 1000V~3000V ≥1.2 times VDC , duration 1~5 sec, charge and discharge current less than 50mA.	* Dielectric strength No evidence of damage or flash over during test.
	* Temperature Coefficient (with no electrical load) Operation temperature: -55~125℃ at 25℃	* Temperature Coefficient Capacitance Change: NPO: Within ±30ppm/℃ X7R: Within ±15%

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

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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:

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
		≦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%	---	---

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℃, Relativ e humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

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APPENDIXES

◙ Tape & reel dimensions

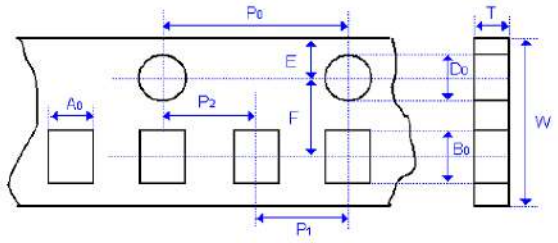

Fig. 2 The dimension of paper tape

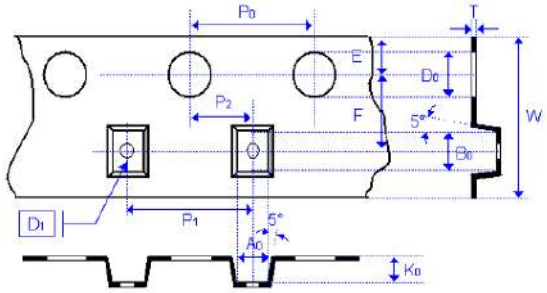

Fig. 3 The dimension of plastic tape

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

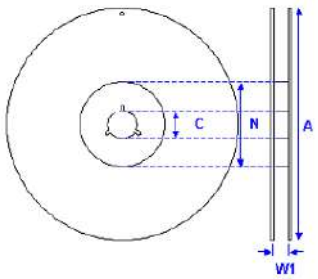

Fig. 4 The dimension of reel

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

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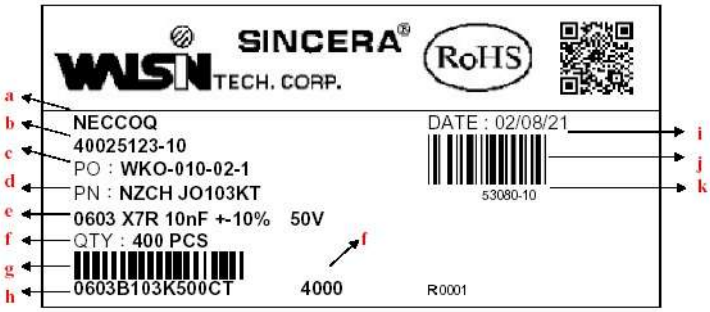
◙ Example of customer label



*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	Termination	Inner layer	Cu + Conductive Resin
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

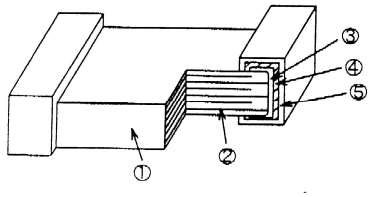


Fig. 5 The construction of MLCC

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◙ 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.

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◙ 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.

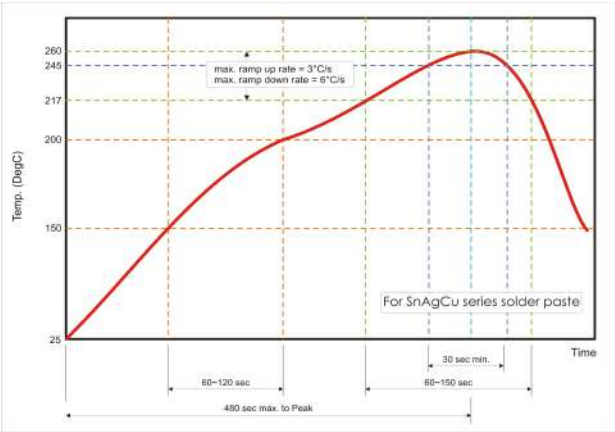

Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

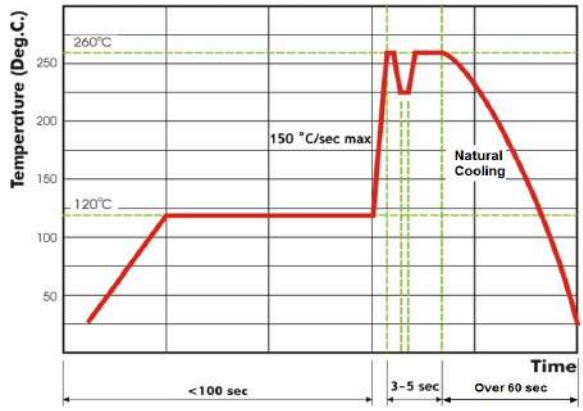

Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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