APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination MLCC for Automotive

Qualified to AEC-Q200 & VW80808 (VT series)

0603 Size, 100nF, 50V

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 VT series MLCC is made by X7R dielectric and which provides product with high electrical precision, stability and reliability. Besides, VT series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications. The VT series is AEC-Q200 & VW80808 compliant.

2. FEATURES

a. MLCC's terminations are with a soft & flexible polymer layer to withstand high bending stress in SMT line.
b. AEC-Q200 qualified, 5mm bending strength guaranteed.
c. VW 80808 specification compliant.
d. Lead-free, RoHS compliant

3. APPLICATIONS

a. Automotive, power supply and related industries.
b. Applicable for automotive electronic components in electric, electronic, sensors, and final control elements and mechatronic control units.
c. The other mechanical stress concerned products or the set having a high probability of fall.
d. Prevention of ceramic body cracks by board bending.

4. HOW TO ORDER

VT	18	B	104	K	500	C	T
Series	**Size**	**Dielectric**	**Capacitance**	**Tolerance**	**Rated voltage**	**Termination**	**Packaging style**
VT= Soft Termination MLCC for Automotive (VT series) Qualified to AEC-Q200 & VW 80808	**18**=0603 (1608)	**B**=X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. 104=10x10^4 =100nF	**J**=±5% **K**=±10% **M**=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. **500**=50 VDC	**C**= Cu+Conductive resin /Ni /Sn	**T**=7" reeled **G**=13" reeled

5. DIMENSION

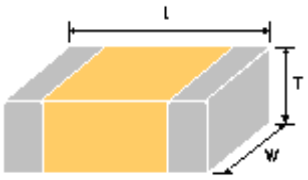


Fig. 1 The outline of MLCC

Size Inch (mm)	L (mm)	W (mm)	T (mm)
0603 (1608)	1.60±0.30	0.80±0.30	0.80±0.30

6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	0603
Capacitance range*	100nF
Capacitance tolerance**	K=±10%
Rated voltage (WVDC)	50V
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. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape	
			7" reel	13" reel
0603 (1608)	0.80±0.30	X	4k	15k

Unit: pieces

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Pre-and Post-Stress Electrical Test</td><td>---</td><td></td></tr>
<tr><td>2.</td><td>High Temperature Exposure (Storage)
MIL-STD-202
Method 108</td><td>* Test temp.: 150±3℃
* Unpowered.
* Test time: 1000+24/-0 hrs.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change：within ±10%
* D.F. value: ≦6%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>3.</td><td>Temperature Cycling
JESD22
Method JA-104</td><td>* Conduct 1000 cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>-55℃ +0/-3</td><td>5±1</td></tr>
<tr><td>2</td><td>+125℃ +3/-0</td><td>5±1</td></tr>
</table>
* 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.</td><td> No remarkable damage.
* Cap change：within ±10%
* D.F. value: ≦6%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></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：within ±12.5%
* D.F. value: ≦6%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Biased Humidity
MIL-STD-202
Method 103</td><td>* 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.</td><td>* No remarkable damage.
* Cap change：within ±12.5%
* D.F. value: ≦6%
* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</td></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：within ±12.5%
* D.F. value: ≦6%
* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.</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.

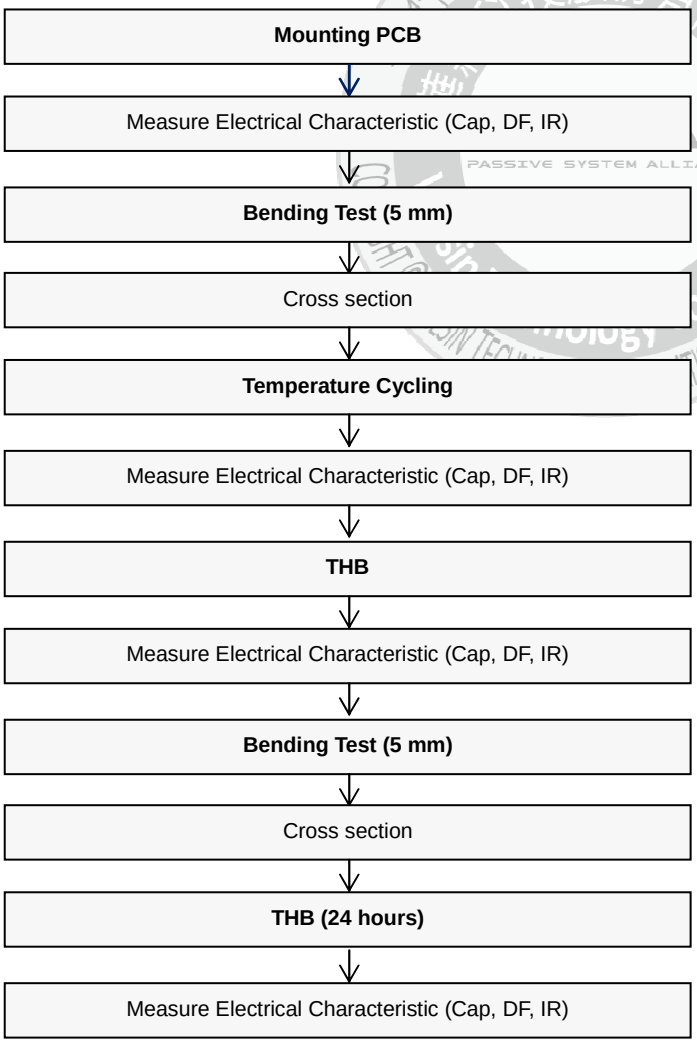
<table>
<tr><th>No.</th><th>AEC-Q200
Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>10.</td><td>Resistance to Solvents
MIL-STD-202
Method 215</td><td>* Temperature: 25±5℃
* Time: 3+0.5/-0 min.
* Solvent: Iso-propyl alcohol.</td><td>* No remarkable damage.
* Cap change：within the specified tolerance.
* D.F. value: ≦3%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>11.</td><td>Mechanical Shock
MIL-STD-202
Method 213</td><td>* 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)</td><td>* No remarkable damage.
* Cap change：within the specified tolerance.
* D.F. value: ≦3%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>12.</td><td>Vibration
MIL-STD-202
Method 204</td><td>* Vibration frequency: 10~2000 Hz/min.
(5g's for 20 min)
* Total amplitude: 1.5mm
* 12 cycles each of 3 orientations (36 times)</td><td>* No remarkable damage.
* Cap change：within the specified tolerance.
* D.F. value: ≦3%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>13.</td><td>Resistance to Soldering Heat
MIL-STD-202
Method 210</td><td>* Solder temperature: 260±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.</td><td>* No remarkable damage.
* Cap change：within ±7.5%.
* D.F. value: ≦3%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>14</td><td>Thermal Shock
MIL-STD-202
Method 107</td><td>* Conduct 300 cycles according to the temperatures and time.
<table><tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>-55℃ +0/-3</td><td>15±3</td></tr><tr><td>2</td><td>+125℃ +3/-0</td><td>15±3</td></tr></table>* 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.</td><td>* No remarkable damage.
* Cap change：within ±10%
* D.F. value: ≦6%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>15.</td><td>ESD
AEC-Q200-002</td><td>Per AEC-Q200-002</td><td>* No remarkable damage.
* Cap change：within the specified tolerance.
* D.F. value: ≦3%
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
<tr><td>16.</td><td>Solderability
J-STD-002
JESD22-B102E</td><td>* 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.</td><td>All terminations shall exhibit a continuous solder coating free from defects from a minimum of 75% of the critical surface area of any individual termination.</td></tr>
<tr><td rowspan="2">17.</td><td rowspan="2">Electrical Characterization</td><td>* Capacitance
* Q/ D.F. (Dissipation Factor)
*Test temp.: Room Temperature.
Class II: (X7R)
Cap ≤10μF, 1.0±0.2Vrms，1KHz±10%</td><td>* Cap change：within the specified tolerance.
* D.F. value: ≦3%</td></tr>
<tr><td>* Insulation Resistance
*Test temp.: Room Temperature.
To apply rated voltage(500V max.) for max. 120 sec.</td><td> IR. ≥10GΩ or RxC≥500Ω-F whichever is smaller.</td></tr>
</table>

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

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements
	Electrical Characterization	* Dielectric Strength To apply voltage: 2.5 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: Within ±15%
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：within ±12.5% (This capacitance change means the change of capacitance ur substrate from the capacitance measured before the test.)
19.	**Terminal Strength** AEC-Q200-006	* Pressurizing force：10N(0603) * Test time: 60±1 sec.	* No remarkable damage. * Cap change：within the specified tolerance. * D.F. value: ≦3%
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)

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

VW 80808 Specification Test Flowchart



APPENDIXES

◙ Tape & reel dimensions

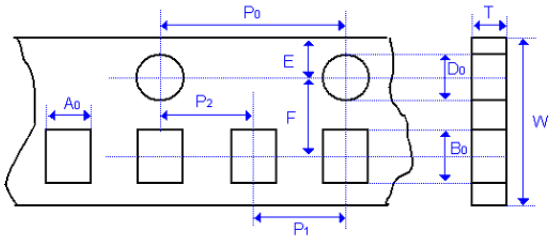


Fig. 2 The dimension of paper tape

Size	0603
Thickness	S,H,X
A_0	1.05 +/-0.30
B_0	1.80 +/-0.30
T	≦1.20
K_0	-
W	8.00 +/-0.10
P_0	4.00 +/-0.10
$10xP_0$	40.00 +/-0.20
P_1	4.00 +/-0.10
P_2	2.00 +/-0.05
D_0	1.55 +/-0.05
D_1	-
E	1.75 +/-0.05
F	3.50 +/-0.05

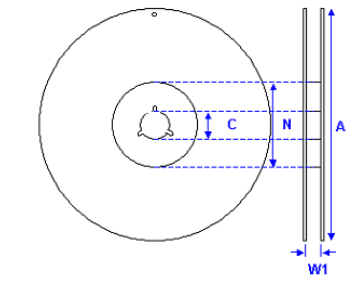
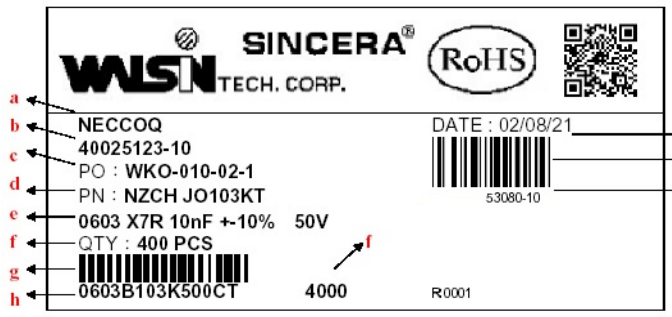


Fig. 3 The dimension of reel

Size	0603	
Reel size	7”	13”
C	13.0±0.5	13.0±0.5
W_1	10.0±1.5	10.0±1.5
A	178.0±2.0	330.0±2.0
N	60.0+1.0/-0	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	Termination	Inner layer	Cu + Conductive Resin
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

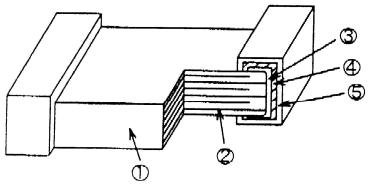


Fig. 4 The construction of MLCC

◙ 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.

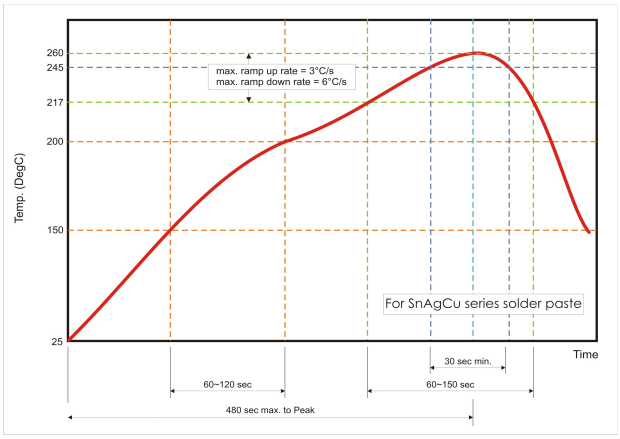


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

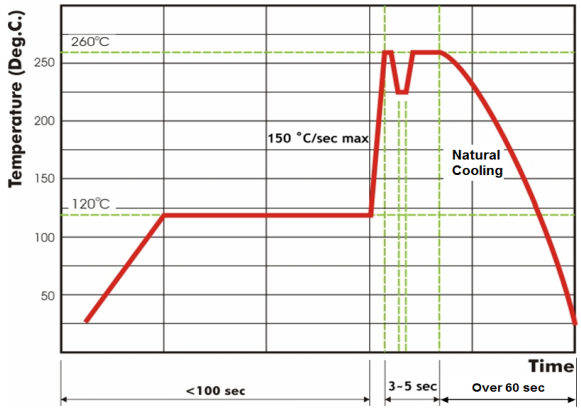


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.