High Reliability Application Multilayer Ceramic Capacitors

■RELIABILITY DATA

1. Operating Temperature Range	
Specified Value	X7R(－55℃ to ＋125℃)
Test Methods and Remarks	Continuous use is available in this range. (reference temperature : 25℃)

2.Highest Operating temperature Range	
Specified Value	X7R(－55℃ to ＋125℃)
Test Methods and Remarks	Maximum ambient temperature at which capacitors can be continuously used with rated voltage applied.

3. Rated Voltage	
Specified Value	Please refer to the page of the "PART NUMBERS".
Test Methods and Remarks	Continuous maximum applied voltage. If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages should be lower than the rated voltage of the capacitor.

4. Shape and Dimensions	
Specified Value	Please refer to the page of the "EXTERNAL DIMENSIONS".

5. Heat Treatment (Class Ⅱ)	
Test Methods and Remarks	Initial value shall be measured after test sample is heat－treated at 150＋0/－10℃ for an hour and kept at room temperature for 24 ± 2 hours.

6. Voltage Treatment (Class Ⅱ)	
Test Methods and Remarks	Initial value shall be measured after test sample is voltage－treated for an hour at temperature and voltage which are specified as test conditions, and kept at room temperature for 24 ±2 hours.

7. Dielectric Withstanding Voltage (between terminals)	
Specified Value	No abnormality.
Test Methods and Remarks	Applied voltage : Rated voltage × 2.5 Duration : 1 to 5 seconds. Charging and discharging current shall be 50mA max.

8. Insulation Resistance	
Specified Value	Larger than whichever smaller of 500 MΩ・μF or 10^4 MΩ
Test Methods and Remarks	Applied voltage : Rated voltage Duration : 60±5 seconds. Charging and discharging current shall be 50mA max.

9. Capacitance and Tolerance	
Specified Value	Please refer to the page of the "PART NUMBERS".
Test Methods and Remarks	Measurement frequency : 1kHz±10%(C≦10μF) Measurement voltage : 1±0.2Vrms(C≦10μF) 0.5±0.1V(6.3V rated voltage) Heat treatment specified in No.5 of the specification shall be conducted prior to measurement.
10. Q or Dissipation factor (tan δ)	
Specified Value	Please refer to the page of the "PART NUMBERS".
Test Methods and Remarks	Measurement frequency : 1kHz±10%(C≦10μF) Measurement voltage : 1±0.2Vrms(C≦10μF) 0.5±0.1V(6.3V rated voltage) Heat treatment specified in No.5 of the specification shall be conducted prior to measurement. NO DC bias is applied.

11. Temperature Characteristic (without DC bias)

Specified Value

X7R(−55℃ to +125℃):±15%

Test Methods and Remarks

Confirming to EIA RS−198−D (1991)
Heat treatment specified in No.5 of the specification shall be conducted prior to measurement.
Change of the maximum capacitance deviation in step 1 to 5.

step	Temperature(℃)
1	+25
2	Minimum operating temperature
3	+25
4	Maximum operating temperature
5	+25

12. Adhesive Force of Terminal Electrodes

Specified Value

Appearance:Terminal electrodes shall be no exfoliation or a sign of exfoliation.

Test Methods and Remarks

Solder lands refer to fig.1.

	1608 size	larger than 2012 size
Applying force	5N	10N
Duration	30±5 seconds.	
Board	Glass epoxy-resin substrate	
Thickness	1.6mm	

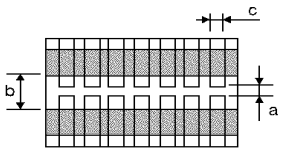


Fig.1

	Case size			
Dimension	1608	2012	3216	3225
a	1.0	1.2	2.2	2.2
b	3.0	4.0	5.0	5.0
c	1.2	1.65	2.0	2.9

13. Vibration

Specified Value

Appearance : No abnormality
Capacitance change : Initial value shall be satisfied.
Dissipation factor : Initial value shall be satisfied.
Insulation resistance : Initial value shall be satisfied.

Test Methods and Remarks

Heat treatment specified in No.5 of the specification shall be conducted prior to test. Measurement shall be conducted after test sample is heat treated as specified in No.5.
Solder lands refer to figure 1.
Direction of the vibration test : X, Y, Z each of 3 orientations for 2 hours respectively (total 6 hours)
Vibrationfrequency : 10 to 55 to 10Hz (1 minutes each)
Total amplitude : 1.5 mm
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

14. Resistance to Soldering Heat

Specified Value

Appearance : No abnormality
Capacitance change : ≦±7.5%
Dissipation factor : Initial value shall be satisfied.
Insulation resistance : Initial value shall be satisfied.
Dielectric withstanding voltage (between terminals) : No abnormality

Test Methods and Remarks

Heat treatment specified in No.5 of the specification shall be conducted prior to test.
Immerse test sample in an solder solution (Sn-3Ag-0.5Cu).
Soldering temperature : 270℃±5℃
Duration : 3±0.5 seconds
Soaking position : Test sample is soaked until the termnal electrode is covered in solder solution.
Preheating condition : 3216 size or smaller size:120 to 150℃ for 1 minute,
3225 size:100 to 120℃ for 1 minute, 170 to 200℃ for 1 minute.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

15. Solderability

Specified Value

More than 95% of terminal electrode shall be covered with fresh solder.

Test Methods and Remarks

Heat treatment specified in No.5 of the specification shall be conducted prior to test.
Immerse test sample in an solder solution(Sn-3Ag-0.5Cu).
Soldering temperature : 245℃±5℃
Duration : 4±1 seconds
Dipping position : Test sample is immersed until the terminal electrode is covered in solder solution.

16. Thermal shock

Specified Value

Appearance	: No abnormality
Capacitance change	: ≦±7.5%
Dissipation factor	: Initial value shall be satisfied.
Insulation resistance	: Initial value shall be satisfied.
Dielectric withstanding voltage	(between terminals) : No abnormality

Test Methods and Remarks

Heat treatment specified in No.5 of the specification shall be conducted prior to test.
Measurement shall be conducted after test sample is heat treated as specified in No.5.
condition of the one cycle (Air−Air)

Step	Temperature(℃)	Time(min.)	Transfer time
1	Minimum usage temperature	15	within 20 seconds
2	Maximum usage temperature	15	within 20 seconds

Test cycles:100 times.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

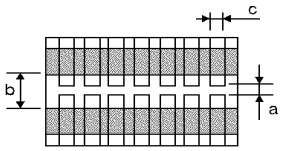


Fig.2

	Case size			
Dimension	1608	2012	3216	3225
a	0.6	0.8	2.0	2.0
b	2.2	3.0	4.4	4.4
c	0.9	1.3	1.7	2.6

17. Humidity Loading

Specified Value Note1

Appearance	: No abnormality
Capacitance change	: ±12.5%
Dissipation factor	: 5.0%max.
Insulation resistance	: Larger than whichever smaller of 25MΩ・μF or 500MΩ

Test Methods and Remarks

Test condition	: 85℃/85%RH.
Duration	: 1000 +48/−0 hours.
DC bias	: Applied rated voltage.

Voltage treatment specified in No.6 of the specification shall be conducted prior to test.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

18. High Temperature Loading

Specified Value Note1

Appearance	: No abnormality
Capacitance change	: ≦±12.5%
Dissipation factor	: 5.0%max.
Insulation resistance	: Larger than whichever smaller of 25MΩ・μF or 500MΩ

Test Methods and Remarks

Voltage treatment specified in No.6 of the specification shall be conducted prior to test.
Test sample shall be put in thermostatic oven with maximum temperature.

Applied voltage	: Rated voltage x 2
Duration	: 1000 +48/−0 hours.

Charging and discharging current shall be 50mA or less.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

19. Resistance to Flexure of substrate

Specified Value

Appearance	: No abnormality
Capacitance change	: ≦±12.5%
Dissipation factor	: 5.0%max.
Insulation resistance	: Initial value shall be satisfied.

Test Methods and Remarks

Warp	: 1mm
Testing board	: Grass epoxy − resin substrate
Thickness	: 1.6mm
Test board and solder lands	: Refer to fig. 3.

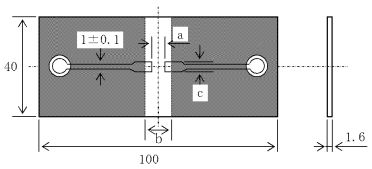


Fig.3

	Case size			
Dimension	1608	2012	3216	3225
a	0.6	0.8	2.0	2.0
b	2.2	3.0	4.4	4.4
c	0.9	1.3	1.7	2.6

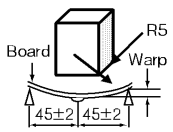


Fig.4

Measurement shall be made with board in the bent position.(fig.4)

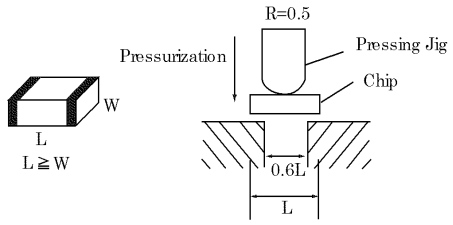
20. High Temperature Exposure	
Specified Value Note1	Appearance : No abnormality Capacitance change : ≦±12.5% Dissipation factor : 5.0%max. Insulation resistance : Larger than whichever smaller of 500MΩ・μF or 10000MΩ
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test. Test sample shall be put in thermostatic oven with maximum temperature. Duration : 1000 ＋48/－0 hours. Initial value shall be measured after test sample is heat－treated specified No.5. Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

21. Temperature Cycling	
Specified Value Note1	Appearance : No abnormality Capacitance change : ≦±7.5% Dissipation factor : Initial value shall be satisfied Insulation resistance : Initial value shall be satisfied
Test Methods and Remarks	Heat treatment specified in No.5 of the specification shall be conducted prior to test. Measurement shall be conducted after test sample is heat treated as specified in No.5. condition of the one cycle

Step	Temperature(℃)	Time(min.)
1	Minimum usage temperature	30±3
2	＋25	2 to 3
3	Maximum usage temperature	30±3
4	＋25	2 to 3

Test cycles:200 times
Solder lands refer to fig. 2.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

22. Body strength	
Specified Value	No mechanical damage
Test Methods and Remarks	Applying force : 10N Applying time : 10 seconds



Note 1 The figures indicate typical specifications. Please refer to individual specifications in detail.