Low distortion design/Audible/Good bias Multilayer Ceramic Capacitors for General Electronic Equipment for Consumer
Low distortion design/Audible/Good bias Multilayer Ceramic Capacitors for Medical Devices classified as GHTF Classes A or B (Japan Classes I or II)

■RELIABILITY DATA

1. Operating Temperature Range			
Specified Value		Specification	Temperature Range
	LD	X5R	−55～＋85℃
	SD	−	−55～＋125℃

2. Storage Temperature Range			
Specified Value		Specification	Temperature Range
	LD	X5R	−55～＋85℃
	SD	−	−55～＋125℃

3. Rated Voltage	
Specified Value	6.3VDC, 10VDC, 16VDC, 25VDC, 35VDC, 50VDC

4. Dielectric Withstanding Voltage （Between terminals）	
Specified Value	No breakdown or damage
Test Methods and Remarks	Applied voltage :Rated voltage×2.5(LD), Rated voltage×3(SD) Duration : 1 to 5 sec. Charge/discharge current : 50mA max.

5. Insulation Resistance	
Specified Value Note 1	10000 MΩ or 500MΩ μF, whichever is smaller
Test Methods and Remarks	Applied voltage : Rated voltage Duration : 60±5 sec. Charge/discharge current : 50mA max.

6. Capacitance （Tolerance）	
Specified Value	±10% or ±20%
Test Methods and Remarks	Measuring frequency : 1kHz±10% Measuring voltage : 1±0.2Vrms Bias application : None

7. Dissipation Factor	
Specified Value	10% max (LD) , 0.1% max (SD)
Test Methods and Remarks	Measuring frequency : 1kHz±10% Measuring voltage : 1±0.2Vrms Bias application : None

8, Temperature Characteristic (Without voltage application)

Specified Value

Specification		Capacitance change	Reference temperature	Temperature Range
LD	X5R	±15%	25℃	−55～+85℃

Test Methods and Remarks

Capacitance at each step shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.

Step	X5R
1	Minimum operating temperature
2	25℃
3	Maximum operating temperature

$$\frac{(C-C_2)}{C_2} \times 100(\%)$$

C :Capacitance value in Step1 or Step3
C_2 :Capacitance value in Step2

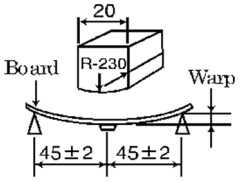
9. Bending Strength

Specified Value

Appearance : No abnormality
Capacitance change : Within±12.5%(LD), Within±5%(SD)

Test Methods and Remarks

Warp : 1mm
Speed : 0.5mm/second
Duration : 10 seconds
Test board : glass epoxy resin substrate
Thickness : 1.6mm



(Unit: mm)

Capacitance measurement shall be conducted with the board bent.

10. Adhesive Force of Terminal Electrodes

Specified Value

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

Test Methods and Remarks

Applied force : 5N
Duration : 30 ±5 seconds

11. Vibration

Specified Value

Initial performance shall be satisfied.

Test Methods and Remarks

Preconditioning : Thermal treatment(at 150℃ for 1hr) Note2 (Only LD)
Frequency range : 10 to 55 Hz
Overall amplitude : 1.5 mm
Sweeping method : 10 to 55 to 10 Hz for 1 min
Two hours each in X, Y, Z directions: 6 hrs in total

12. Solderability

Specified Value

At least 95% of terminal electrode is covered by new solder.

Test Methods and Remarks

	Eutectic solder	Lead-free solder
Solder type	H60A or H63A	Sn-3.0Ag-0.5Cu
Solder temperature	230±5℃	245±3℃
Duration	4±1 sec.	

13. Resistance to Soldering Heat

Specified Value

Appearance : No abnormality
Capacitance change : Within±7.5%(LD), Within±2.5%(SD)
Dissipation factor : Initial value
Insulation resistance : Initial value
Withstanding voltage (between terminals) : No abnormality

Test Methods and Remarks

	LD	
	1608、2012type	3216、3225type
Preconditioning	Thermal treatment (at 150℃ for 1 hr) Note 2	
Preheating conditions	80 to 100℃ 2 to 5 min 150 to 200℃ 2 to 5 min	80 to 100℃ 5 to 10 min 150 to 200℃ 5 to 10 min
Solder temp.	270 ±5℃	
Duration	3 ±0.5 sec.	
Measurement shall be conducted	24±2hrs under the standard condition Note 5	

	SD	
	1005、1608、2012type	3216type
Preheating conditions	80 to 100℃ 2 to 5 min 150 to 200℃ 2 to 5 min	80 to 100℃ 5 to 10 min 150 to 200℃ 5 to 10 min
Solder temp.	270 ±5℃	
Duration	3 ±0.5 sec.	
Measurement shall be conducted	24±2hrs under the standard condition Note 5	

14. Temperature Cycle (Thermal Shock)

Specified Value

Appearance : No abnormality
Capacitance change : Within±7.5%(LD), Within±2.5%(SD)
Dissipation factor : Initial value
Insulation resistance : Initial value
Withstanding voltage (between terminals) : No abnormality

Test Methods and Remarks

	LD	SD
Preconditioning	Thermal treatment (at 150℃ for 1 hr) Note 2	None
1 cycle		
Number of cycles	5 time	
Measurement shall be conducted	24±2hrs under the standard condition Note 5	

Step	temperature(℃)	Time(min.)
1	Minimum operating temperature	30±3 min.
2	Normal temperature	2 to 3 min.
3	Maximum operating temperature	30±3 min.
4	Normal temperature	2 to 3 min.

15. Humidity (Steady state)

Specified Value Note 1

Appearance : No abnormality
Capacitance change : Within±12.5%(LD), ±5% Within(SD)
Dissipation factor : 20%max(LD), 0.5%max(SD)
Insulation resistance : 50MΩ μF or 1000MΩ, whichever is smaller

Test Methods and Remarks

	LD	SD
Preconditioning	Thermal treatment (at 150℃ for 1 hr) Note 2	None
Temperature	40±2℃	
Humidity	90 to 95% RH	
Duration	500 +24/−0 hrs	
Measurement shall be conducted	24 ±2hrs under the standard condition Note 5	

16. Humidity Loading

Specified Value Note 1	Appearance : No abnormality Capacitance change : Within±12.5%(LD), Within±7.5%(SD) Dissipation factor : 20%max(LD), 0.5%max(SD) Insulation resistance : 25MΩ μF or 500MΩ, whichever is smaller

Test Methods and Remarks

	LD	SD
Preconditioning	Voltage treatment (Rated voltage are applied for 1 hour at 40 ℃) Note 3	None
Temperature	40±2℃	
Humidity	90 to 95% RH	
Duration	500 +24/−0 hrs	
Applied voltage	Rated voltage	
Charge/discharge current	50mA max	
Measurement shall be conducted	24 ±2hrs under the standard condition Note 5	

17. High Temperature Loading

Specified Value Note 1	Appearance : No abnormality Capacitance change : Within±12.5%(LD), Within±3%(SD) Dissipation factor : 20%max(LD), 0.35%max(SD) Insulation resistance : 50MΩ μF or 1000MΩ, whichever is smaller

Test Methods and Remarks

	LD	SD
Preconditioning	Voltage treatment (Twice the rated voltage shall be applied for 1 hour at 85℃ or 125℃) Note 3, Note 4	None
Temperature	Maximum operating temperature	
Duration	1000 +48/−0 hrs	
Applied voltage	Rated voltage x 2 Note 4	Rated voltage x 2
Charge/discharge current	50mA max	
Measurement shall be conducted	24 ±2hrs under the standard condition Note 5	

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

Note 2 Thermal treatment : 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±2hours.

Note 3 Voltage treatment : Initial value shall be measured after test sample is voltage-treated for an hour at both the temperature and voltage specified in the test conditions, and kept at room temperature for 24±2hours.

Note 4 150% of rated voltage is applicable to some items. Please refer to their specifications for further information.

Note 5 Standard condition: Temperature: 5 to 35℃, Relative humidity: 45 to 85 % RH, Air pressure: 86 to 106kPa When there are questions concerning measurement results, in order to provide correlation data, the test shall be conducted under the following condition.
Temperature: 20±2℃, Relative humidity: 60 to 70 % RH, Air pressure: 86 to 106kPa Unless otherwise specified, all the tests are conducted under the "standard condition".