Medium-High Voltage Multilayer Ceramic Capacitor for Telecommunications Infrastructure and Industrial Equipment
High frequency/Low loss Medium-High Voltage Multilayer Ceramic Capacitor for Telecommunications Infrastructure and Industrial Equipment
Medium-High Voltage Multilayer Ceramic Capacitor for Medical Devices classified as GHTF Class C (Japan Class III)
High frequency/Low loss Medium-High Voltage Multilayer Ceramic Capacitor for Medical Devices classified as GHTF Class C (Japan Class III)

■RELIABILITY DATA

1. Operating Temperature Range	
Specified Value	Temperature Compensating (High Frequency type) CG(C0G) : −55 to +125℃ High permittivity X7R, X7S : −55 to +125℃

2. Storage Temperature Range	
Specified Value	Temperature Compensating (High Frequency type) CG(C0G) : −55 to +125℃ High permittivity X7R, X7S : −55 to +125℃

3. Rated Voltage	
Specified Value	100VDC(Code:H), 250VDC(Code:Q), 630VDC(Code:S)

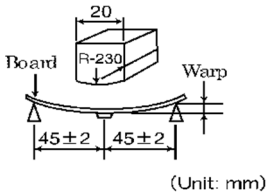
4. Withstanding Voltage(Between terminals)	
Specified Value	No breakdown or damage
Test Methods and Remarks	Applied voltage : Rated voltage(H) ×2.5, Rated voltage(Q) ×2, Rated voltage(S) ×1.2 Duration : 1 to 5sec. Carge/discharge current : 50mA max.

5. Insulation Resistance	
Specified Value	Temperature Compensating (High Frequency type) 10000MΩ min High permittivity 100MΩ μF or 10GΩ, whichever is smaller.
Test Methods and Remarks	Applied voltage : Rated voltage(H, Q), 500V(S) Duration : 60±5sec. Charge/discharge current : 50mA max.

6. Capacitance (Tolerance)	
Specified Value	Temperature Compensating (High Frequency type) C＜0.5pF(±0.05pF or ±0.1pF), 0.5pF≦C＜5pF(±0.1pF or ±0.25pF) 5pF≦C＜10(±0.25pF or ±0.5pF) C≧10pF(±5%)　(C:Nominal capacitance) High permittivity ±10%, ±20%
Test Methods and Remarks	Temperature Compensating (High Frequency type) Measuring frequency : 1MHz±10% Measuring voltage : 0.5 to 5Vrms Bias application : None High permittivity Measuring frequency : 1kHz±10% Measuring voltage : 1±0.2Vrms Bias application : None

7. Q or Dissipation Factor	
Specified Value	Temperature Compensating (High Frequency type) C＜30pF : Q≧800+20C C≧30pF : Q≧1400　(C: Normal Capacitance) High permittivity 3.5%max(H) 2.5%max(Q, S)
Test Methods and Remarks	Temperature Compensating (High Frequency type) Measuring frequency : 1MHz±10% Measuring voltage : 0.5 to 5Vrms Bas application : None High permittivity Measuring frequency : 1kHz±10% Measuring voltage : 1±0.2Vrms Bas application : None

8. Temperature Characteristic of Capacitance	
Specified Value	Temperature Compensating (High Frequency type) CG(C0G) : 0±30ppm(−55 to +125℃) High permittivity X7R :±15%(−55 to +125℃) X7S :±22%(−55 to +125℃)
Test Methods and Remarks	Temperature Compensating (High Frequency type) Capacitance at 25℃ and 85℃ shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation. $\frac{(C_{85}-C_{25})}{C_{25}\times\Delta T}\times10^{6}\times[\mathrm{ppm/℃}]$ High permittivity Capacitance value at each step shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation. Step / Temperature 1 / Minimum operating temperature 2 / 25℃ 3 / Maximum operating temperature $\frac{(C-C_2)}{C_2}\times100(\%)$ C : Capacitance value in Step 1 or Step 3 C2 : Capacitance value in Step 2

9. Deflection	
Specified Value	Temperature Compensating (High Frequency type) Appearance : No abnormality Capacitance change :±5% or ±0.5pF, whichever is larger. High permittivity Appearance : No abnormality Capacitance change : Within±10%
Test Methods and Remarks	Warp : 1mm (Soft Termination type:3mm) Duration : 10sec. Test board : Glass epoxy-resin substrate Thickness : 1.6mm  (Unit: mm) Capacitance measurement shall be conducted with the board bent.

10. Adhesive Strength of Terminal Electrodes	
Specified Value	No terminal separation or its indication.
Test Methods and Remarks	Applied force : 5N Duration : 30±5sec. (Soft Termination type: 10±1sec)

11. Vibration	
Specified Value	Initial performance shall be satisfied.
Test Methods and Remarks	Preconditioning : Thermal treatment (at 150℃ for 1hr) Note1 (Only High permittivity) 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	
Specified Value	Temperature Compensating (High Frequency type) Appearance : No abnormality Capacitance change : Within ±2.5% or ±0.25pF, whichever is larger. Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality High permittivity Appearance : No abnormality Capacitance change : Within±15%(H), ±10%(Q, S) Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
Test Methods and Remarks	Preconditioning : Thermal treatment (at 150℃ for 1hr) Note1 (Only High permittivity) Solder temperature : 270±5℃ Duration : 3±0.5sec. Preheating conditions : 80 to 100℃, 2 to 5 min. 150 to 200℃, 2 to 5min. Recovery : 24±2hrs under the standard condition Note3

14. Temperature Cycle (Thermal Shock)

Specified Value

Temperature Compensating (High Frequency type)

Appearance	: No abnormality
Capacitance change	: Within ±2.5% or ±0.25pF, whichever is larger.
Insulation resistance	: Initial value
Withstanding voltage	(between terminals) : No abnormality

High permittivity

Appearance	: No abnormality
Capacitance change	: Within±15%(H), ±7.5%(Q, S)
Dissipation factor	: Initial value
Insulation resistance	: Initial value
Withstanding voltage	(between terminals) : No abnormality

Test Methods and Remarks

Preconditioning : Thermal treatment (at 150℃ for 1hr) Note1

Conditions for 1 cycle

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

Number of cycles : 50 times

Recovery : 24±2hrs under the standard condition Note3

15. Humidity (Steady state)

Specified Value

Temperature Compensating (High Frequency type)

Appearance	: No abnormality
Capacitance change	: Within ±5% or ±0.5pF, whichever is larger.
Insulation resistance	: 1000MΩmin

High permittivity

Appearance	: No abnormality
Capacitance change	: Within±15%
Dissipation factor	: 7%max(H), 5%max(Q, S).
Insulation resistance	: 25MΩ μF or 1000MΩ, whichever is smaller.

Test Methods and Remarks

Preconditioning	: Thermal treatment(at 150℃ for 1hr) Note1 (Only High permittivity)
Temperature	: 40±2℃
Humidity	: 90 to 95%RH
Duration	: 500 +24/−0 hrs
Recovery	: 24±2hrs under the standard condition Note3

16. Humidity Loading

Specified Value

Temperature Compensating (High Frequency type)

Appearance	: No abnormality
Capacitance change	: C≦2.0pF :±0.4pF 2.0pF＜C＜10pF : ±0.75pF C≧10pF :±7.5% (C: Nominal capacitance)
Insulation resistance	: 500MΩmin

High permittivity

Appearance	: No abnormality
Capacitance change	: Within±15%
Dissipation factor	: 7%max(H), 5%max(Q, S).
Insulation resistance	: 10MΩ μF or 500MΩ, whichever is smaller.

Test Methods and Remarks

Preconditioning	: Voltage treatment Note2 (Only High permittivity)
Temperature	: 60±2℃
Humidity	: 90 to 95%RH
Duration	: 500 +24/−0 hrs
Applied voltage	: Rated voltage
Charge/discharge current	: 50mA max.
Recovery	: 24±2hrs under the standard condition Note3

17. High Temperature Loading	
Specified Value	Temperature Compensating (High Frequency type) Appearance : No abnormality Capacitance change : Within ±3% or ±0.3pF, whichever is larger. Insulation resistance :1000MΩmin High permittivity Appearance : No abnormality Capacitance change : Within±15% Dissipation factor : 7%max(H), 5%max(Q, S). Insulation resistance : 50MΩ μF or 1000MΩ, whichever is smaller.
Test Methods and Remarks	Preconditioning : Voltage treatment Note2 (Only High permittivity) Temperature : Maximum operating temperature Duration : 1000 +24/−0 hrs Applied voltage : Rated voltage×2(H, Q(High frequency / low loss type)) Rated voltage×1.5(Q(Excluding High frequency / low loss type)), Rated voltage×1.2(S) Charge/discharge current : 50mA max. Recovery : 24±2hrs under the standard condition Note3

Note1 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.

Note2 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.

Note3 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".