

Multilayer Ceramic Capacitors

RELIABILITY DATA

1. Operating Temperature Range

Specified Value	Temperature Compensating(Class1)	Standard	-55 to +125°C	
		High Frequency Type		
Specified Value	High Permittivity (Class2)		Specification	Temperature Range
		BJ	B	-25 to +85°C
			X5R	-55 to +85°C
		B7	X7R	-55 to +125°C
		C6	X6S	-55 to +105°C
		C7	X7S	-55 to +125°C
		LD(※)	X5R	-55 to +85°C
		F	F	-25 to +85°C
Y5V	-30 to +85°C			

Note: ※LD Low distortion high value multilayer ceramic capacitor

2. Storage Conditions

Specified Value	Temperature Compensating(Class1)	Standard	-55 to +125°C	
		High Frequency Type		
Specified Value	High Permittivity (Class2)		Specification	Temperature Range
		BJ	B	-25 to +85°C
			X5R	-55 to +85°C
		B7	X7R	-55 to +125°C
		C6	X6S	-55 to +105°C
		C7	X7S	-55 to +125°C
		LD(※)	X5R	-55 to +85°C
		F	F	-25 to +85°C
Y5V	-30 to +85°C			

Note: ※LD Low distortion high value multilayer ceramic capacitor

3. Rated Voltage

Specified Value	Temperature Compensating(Class1)	Standard	50VDC, 25VDC, 16VDC
		High Frequency Type	50VDC, 25VDC, 16VDC
	High Permittivity (Class2)		50VDC, 35VDC, 25VDC, 16VDC, 10VDC, 6.3VDC, 4VDC, 2.5VDC

4. Withstanding Voltage (Between terminals)

Specified Value	Temperature Compensating(Class1)	Standard	No breakdown or damage
		High Frequency Type	
	High Permittivity (Class2)		
Test Methods and Remarks		Class 1	Class 2
	Applied voltage	Rated voltage × 3	Rated voltage × 2.5
	Duration	1 to 5 sec.	
	Charge/discharge current	50mA max.	

5. Insulation Resistance

Specified Value	Temperature Compensating(Class1)	Standard	10000 MΩ min.
		High Frequency Type	
	High Permittivity (Class2) Note 1		C ≤ 0.047 μF : 10000 MΩ min. C > 0.047 μF : 500MΩ · μF
Test Methods and Remarks	Applied voltage	: Rated voltage	
	Duration	: 60 ± 5 sec.	
	Charge/discharge current	: 50mA max.	

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

6. Capacitance (Tolerance)					
Specified Value	Temperature Compensating(Class1)	Standard	C□	0.2pF ≤ C ≤ 5pF : ±0.25pF	
			U□	0.2pF ≤ C ≤ 10pF : ±0.5pF	
	SL	C > 10pF : ±5% or ±10%			
High Permittivity (Class2)	High Frequency Type	CH	0.2pF ≤ C ≤ 2pF	: ±0.1pF	
			C > 2pF	: ±5%	
High Permittivity (Class2)			BJ, B7, C6, C7, LD(※) : ±10% or ±20%, F : +80/-20% Note: ※LD Low distortion high value multilayer ceramic capacitor		
Test Methods and Remarks			Class 1		
			Standard	High Frequency Type	
	Preconditioning		None		
	Measuring frequency		1MHz ± 10%		
	Measuring voltage Note		0.5 to 5Vrms		
Bias application		None			
		Class 2			
		C ≤ 10 μF	C > 10 μF		
Preconditioning		Thermal treatment (at 150°C for 1hr) Note 2			
Measuring frequency		1kHz ± 10%			
Measuring voltage Note		1 ± 0.2Vrms			
Bias application		0.5 ± 0.1Vrms			

7. Q or Dissipation Factor					
Specified Value	Temperature Compensating(Class1)	Standard	C < 30pF : Q ≥ 400 + 20C C ≥ 30pF : Q ≥ 1000 (C: Nominal capacitance)		
			High Frequency Type	Refer to detailed specification	
	High Permittivity (Class2) Note 1		BJ, B7, C6, C7: 2.5% max., F: 7% max.		
Test Methods and Remarks			Class 1		
			Standard	High Frequency Type	
	Preconditioning		None		
	Measuring frequency		1MHz ± 10%		
	Measuring voltage Note 1		0.5 to 5Vrms		
Bias application		None			
		Class 2			
		C ≤ 10 μF	C > 10 μF		
Preconditioning		Thermal treatment (at 150°C for 1hr) Note 2			
Measuring frequency		1kHz ± 10%			
Measuring voltage Note 1		1 ± 0.2Vrms			
Bias application		0.5 ± 0.1Vrms			
High Frequency Type		Measuring equipment : HP4291A			
Measuring equipment		Measuring jig : HP16192A			

8. Temperature Characteristic (Without voltage application)				
Specified Value	Temperature Compensating(Class1)	Standard	Temperature Characteristic [ppm/°C]	
			C□ : 0	CG, CH, CJ, CK
	U□ : -750	UJ, UK	Tolerance [ppm/°C]	
High Permittivity (Class2)	High Frequency Type	CH	Temperature Characteristic [ppm/°C]	
			C□ : 0	H : ±60
		SL : +350 to -1000		
		Note : ※LD Low distortion high value multilayer ceramic capacitor		
Test Methods and Remarks	Class 1			
	Capacitance at 20°C and 85°C shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.			
	$\frac{(C_{85} - C_{20})}{C_{20} \times \Delta T} \times 10^6 (\text{ppm}/^\circ\text{C}) \quad \Delta T = 65$			
	Class 2			
	Capacitance at each step shall be measured in thermal equilibrium, and the temperature characteristic shall be calculated from the following equation.			
	Step	B, F	X5R, X7R, X6S, X7S, Y5V	
	1	Minimum operating temperature		
	2	20°C	25°C	
	3	Maximum operating temperature		

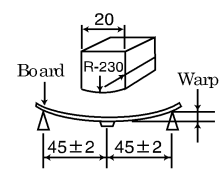
► This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

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

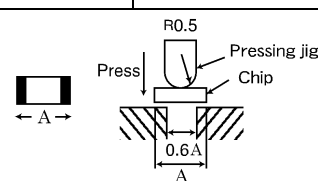
C : Capacitance in Step 1 or Step 3
C2 : Capacitance in Step 2

9. Deflection

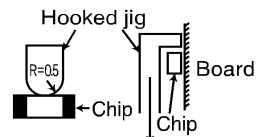
Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 5\%$ or ± 0.5 pF, whichever is larger.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within ± 0.5 pF
	High Permittivity (Class2)		Appearance : No abnormality Capacitance change : Within $\pm 12.5\%$ (BJ, B7, C6, C7,LD(※)) Within $\pm 30\%$ (F) Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks	<table border="1"> <thead> <tr> <th colspan="2">Multilayer Ceramic Capacitors</th> </tr> <tr> <th>042, 063, ※105 Type</th> <th>The other types</th> </tr> </thead> <tbody> <tr> <td>Board</td> <td>Glass epoxy-resin substrate</td> </tr> <tr> <td>Thickness</td> <td>0.8mm / 1.6mm</td> </tr> <tr> <td>Warp</td> <td>1mm</td> </tr> <tr> <td>Duration</td> <td>10 sec.</td> </tr> </tbody> </table>		Multilayer Ceramic Capacitors		042, 063, ※105 Type	The other types	Board	Glass epoxy-resin substrate	Thickness	0.8mm / 1.6mm	Warp	1mm	Duration	10 sec.	 <p>(Unit: mm) Capacitance measurement shall be conducted with the board bent</p>
	Multilayer Ceramic Capacitors														
042, 063, ※105 Type	The other types														
Board	Glass epoxy-resin substrate														
Thickness	0.8mm / 1.6mm														
Warp	1mm														
Duration	10 sec.														
<p>※105 Type thickness, C: 0.2mm ,P: 0.3mm.</p>															

10. Body Strength

Specified Value	Temperature Compensating(Class1)	Standard	—
		High Frequency Type	No mechanical damage.
	High Permittivity (Class2)		—
Test Methods and Remarks	High Frequency Type Applied force : 5N Duration : 10 sec.		

11. Adhesive Strength of Terminal Electrodes

Specified Value	Temperature Compensating(Class1)	Standard	No terminal separation or its indication.								
		High Frequency Type									
	High Permittivity (Class2)										
Test Methods and Remarks	<table border="1"> <thead> <tr> <th colspan="2">Multilayer Ceramic Capacitors</th> </tr> <tr> <th>042, 063 Type</th> <th>105 Type or more</th> </tr> </thead> <tbody> <tr> <td>Applied force</td> <td>2N / 5N</td> </tr> <tr> <td>Duration</td> <td>30±5 sec.</td> </tr> </tbody> </table>		Multilayer Ceramic Capacitors		042, 063 Type	105 Type or more	Applied force	2N / 5N	Duration	30±5 sec.	
Multilayer Ceramic Capacitors											
042, 063 Type	105 Type or more										
Applied force	2N / 5N										
Duration	30±5 sec.										

12. Solderability

Specified Value	Temperature Compensating(Class1)	Standard	At least 95% of terminal electrode is covered by new solder.
		High Frequency Type	
	High Permittivity (Class2)		
Test Methods and Remarks		Eutectic solder	Lead-free solder
	Solder type	H60A or H63A	Sn-3.0Ag-0.5Cu
	Solder temperature	230±5°C	245±3°C
	Duration	4±1 sec.	

▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

13. Resistance to Soldering

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 2.5\%$ Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 7.5\%$ (BJ, B7, C6, C7, LD(※)) Within $\pm 20\%$ (F) Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals): No abnormality Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks	Class 1			
		042, 063 Type	105 Type	
	Preconditioning	None		
	Preheating	150°C, 1 to 2 min.	80 to 100°C, 2 to 5 min. 150 to 200°C, 2 to 5 min.	
	Solder temp.	270 \pm 5°C		
	Duration	3 \pm 0.5 sec.		
	Recovery	6 to 24 hrs (Standard condition) Note 5		
	Class 2			
		042, 063 Type	105, 107, 212 Type	316, 325 Type
	Preconditioning	Thermal treatment (at 150°C for 1 hr) Note 2		
	Preheating	150°C, 1 to 2 min.	80 to 100°C, 2 to 5 min. 150 to 200°C, 2 to 5 min.	80 to 100°C, 5 to 10 min. 150 to 200°C, 5 to 10 min.
	Solder temp.	270 \pm 5°C		
	Duration	3 \pm 0.5 sec.		
	Recovery	24 \pm 2 hrs (Standard condition) Note 5		

14. Temperature Cycle (Thermal Shock)

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger. Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 0.25\text{pF}$ Q : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 7.5\%$ (BJ, B7, C6, C7, LD(※)) Within $\pm 20\%$ (F) Dissipation factor : Initial value Insulation resistance : Initial value Withstanding voltage (between terminals) : No abnormality Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks	Class 1		Class 2		
	Preconditioning	None		Thermal treatment (at 150°C for 1 hr) Note 2	
	1 cycle	Step	Temperature(°C)	Time(min.)	
		1	Minimum operating temperature	30 \pm 3	
		2	Normal temperature	2 to 3	
		3	Maximum operating temperature	30 \pm 3	
4	Normal temperature	2 to 3			
Number of cycles	5 times				
Recovery	6 to 24 hrs (Standard condition) Note 5		24 \pm 2 hrs (Standard condition) Note 5		

► This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification.
For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

15. Humidity (Steady State)

Specified Value	Temperature Compensating(Class1)	Standard	Appearance	: No abnormality	
			Capacitance change	: Within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever is larger.	
	High Frequency Type	Standard	Q	: $C < 10\text{pF}$: $Q \geq 200 + 10C$ $10 \leq C < 30\text{pF}$: $Q \geq 275 + 2.5C$ $C \geq 30\text{pF}$: $Q \geq 350$ (C: Nominal capacitance)	
Insulation resistance			: 1000 M Ω min.		
High Permittivity (Class2) Note 1	Standard	High Frequency Type	Appearance	: No abnormality	
			Capacitance change	: Within $\pm 12.5\%$ (BJ, B7, C6, C7, LD(※)) Within $\pm 30\%$ (F)	
High Permittivity (Class2) Note 1	Standard	High Frequency Type	Dissipation factor	: 5.0% max. (BJ, B7, C6, C7, LD(※)) 11.0% max. (F)	
			Insulation resistance	: 50 M Ω μF or 1000 M Ω whichever is smaller. Note: ※LD Low distortion high value multilayer ceramic capacitor	
Test Methods and Remarks		Class 1		Class 2	
		Standard	High Frequency Type	All items	
		Preconditioning	None		Thermal treatment (at 150°C for 1 hr) Note 2
		Temperature	40 \pm 2°C	60 \pm 2°C	40 \pm 2°C
		Humidity	90 to 95%RH		90 to 95%RH
		Duration	500+24/-0 hrs		500+24/-0 hrs
		Recovery	6 to 24 hrs (Standard condition) Note 5		24 \pm 2 hrs (Standard condition) Note 5

16. Humidity Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance	: No abnormality	
			Capacitance change	: Within $\pm 7.5\%$ or $\pm 0.75\text{pF}$, whichever is larger.	
	High Frequency Type	Standard	Q	: $C < 30\text{pF}$: $Q \geq 100 + 10C/3$ $C \geq 30\text{pF}$: $Q \geq 200$ (C: Nominal capacitance)	
Insulation resistance			: 500 M Ω min.		
High Permittivity (Class2) Note 1	High Frequency Type	Standard	Appearance	: No abnormality	
			Capacitance change	: $C \leq 2\text{pF}$: Within ± 0.4 pF $C > 2\text{pF}$: Within ± 0.75 pF (C: Nominal capacitance)	
High Permittivity (Class2) Note 1	High Frequency Type	Standard	Insulation resistance	: 500 M Ω min.	
			High Permittivity (Class2) Note 1	Standard	Appearance
High Permittivity (Class2) Note 1	Standard	Capacitance change			: Within $\pm 12.5\%$ (BJ, B7, C6, C7, LD(※)) Within $\pm 30\%$ (F)
		High Permittivity (Class2) Note 1	Standard	Dissipation factor	: 5.0% max. (BJ, B7, C6, C7, LD(※)) 11.0% max. (F)
High Permittivity (Class2) Note 1	Standard			Insulation resistance	: 25 M Ω μF or 500 M Ω , whichever is smaller. Note: ※LD Low distortion high value multilayer ceramic capacitor
		Test Methods and Remarks		Class 1	
Standard	High Frequency Type			All items	
Preconditioning	None			Voltage treatment (Rated voltage are applied for 1 hour at 40°C) Note 3	
Temperature	40 \pm 2°C			60 \pm 2°C	40 \pm 2°C
Humidity	90 to 95%RH			90 to 95%RH	
Duration	500+24/-0 hrs			500+24/-0 hrs	
Applied voltage	Rated voltage			Rated voltage	
Charge/discharge current	50mA max.		50mA max.		
Recovery	6 to 24 hrs (Standard condition) Note 5		24 \pm 2 hrs (Standard condition) Note 5		

► This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our specification.
For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our Web site (<http://www.ty-top.com/>).

17. High Temperature Loading

Specified Value	Temperature Compensating(Class1)	Standard	Appearance : No abnormality Capacitance change : Within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever is larger. Q : $C < 10\text{pF}$: $Q \geq 200 + 10C$ $10 \leq C < 30\text{pF}$: $Q \geq 275 + 2.5C$ $C \geq 30\text{pF}$: $Q \geq 350$ (C: Nominal capacitance) Insulation resistance : $1000 \text{ M}\Omega$ min.
		High Frequency Type	Appearance : No abnormality Capacitance change : Within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever is larger. Insulation resistance : $1000 \text{ M}\Omega$ min.
	High Permittivity (Class2) Note 1		Appearance : No abnormality Capacitance change : Within $\pm 12.5\%$ (BJ, B7, C6, C7, LD(※)) Within $\pm 30\%$ (F) Dissipation factor : 5.0% max.(BJ, B7, C6, C7, LD(※)) 11.0% max.(F) Insulation resistance : $50 \text{ M}\Omega \mu\text{F}$ or $1000 \text{ M}\Omega$, whichever is smaller. Note: ※LD Low distortion high value multilayer ceramic capacitor

Test Methods and Remarks		Class 1		Class 2		
		Standard	High Frequency Type	BJ, LD(※), F	C6	B7, C7
	Preconditioning	None		Voltage treatment (Twice the rated voltage shall be applied for 1 hour at 85°C, 105°C or 125°C) Note 3, 4		
	Temperature	Maximum operating temperature		Maximum operating temperature		
	Duration	1000 + 48 / - 0 hrs		1000 + 48 / - 0 hrs		
	Applied voltage	Rated voltage $\times 2$ Note 4		Rated voltage $\times 2$ Note 4		
	Charge/discharge current	50mA max.		50mA max.		
	Recovery	6 to 24hr (Standard condition) Note 5		24 \pm 2 hrs (Standard condition) Note 5		

Note: ※LD Low distortion high value multilayer ceramic capacitor

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 $150 \pm 0 / - 10^\circ\text{C}$ for an hour and kept at room temperature for 24 ± 2 hours.

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 ± 2 hours.

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°C, 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: $20 \pm 2^\circ\text{C}$, Relative humidity: 60 to 70 % RH, Air pressure: 86 to 106kPa Unless otherwise specified, all the tests are conducted under the "standard condition".