Multilayer Ceramic Capacitors

RELIABILITY DATA

1.Operating Te	.Operating Temperature Range								
	Temperature	Standard	55 to	−55 to +125°C					
	Compensating(Class1)	High Frequency Type	-33 10 4						
				Specification	Temperature Range				
		High Permittivity(Class2)		В	$-25 \text{ to } +85^{\circ}\text{C}$				
Specified				X5R	−55 to +85°C				
Value				X7R	−55 to +125°C				
	High Permittivity (Class2)			X6S	−55 to +105°C				
				X7S	−55 to +125°C				
				X5R	-55 to +85°C				
				LD Low distortion	high value multilayer ceramic capao	sitor			

2. Storage Con	Storage Conditions							
	Temperature	Standard	−55 to +125°C					
	Compensating(Class1)	High Frequency Type	-3310 -					
				Specification	Temperature Range			
	High Permittivity(Class2)		BJ	В	−25 to +85°C			
Specified				X5R	−55 to +85°C			
Value			B7	X7R	-55 to +125°C			
			C6	X6S	-55 to +105°C			
				X7S	-55 to +125°C			
				LD(※) X5R -55 to +85°C				
				Note: XLD Low distortion high value multilayer ceramic capacitor				

3. Rated Voltag	3. Rated Voltage						
	Temperature	Standard	50VDC, 25VDC, 16VDC				
Specified Value	Compensating(Class1)	High Frequency Type	50VDC, 25VDC, 16VDC				
Value	High Permittivity (Class2))	50VDC, 35VDC, 25VDC, 16VDC, 10VDC, 6.3VDC, 4VDC, 2.5VDC				

4. Withstanding	4. Withstanding Voltage(Between terminals)								
Specified Value	Temperature	Standard							
	Compensating(Class1)	High F	requency Type	No breakdown or damage					
	High Permittivity (Class2))							
- .				ass 1	Class 2				
Test Methods and Remarks	Applied voltage Rat			oltage × 3					
	Duration		1 to 5						
	Charge/discharge currer	nt		50mA	max.				

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

6. Capacitance	6. Capacitance (Tolerance)							
				СП	0.2pF≦C≦5pF	: ±0.25pF		
	-	Standard		UΠ	0.2pF≦C≦10pF	: ±0.5pF		
Specified	Temperature Compensating(Class1)			SL	C>10pF	: ±5% or ±10%		
Value		High Frequency Type		CG	0.2pF≦C≦2pF	: ±0.1pF		
					C>2pF	: ±5%		
	High Permittivity(Class2)			$\pm 10\%$ or $\pm 20\%$				
					:s 1	Class 2		
- .		ĺ	Standard	Standard High Frequency Type		C≦10 <i>µ</i> F	C>10 µF	
Test Matheada and	Preconditioning			None		Thermal treatment (at 150°C for 1hr) Note 2		
Methods and Remarks	Measuring frequency		1MHz±10%		1kHz±10%	120±10Hz		
Remarks	Measuring voltage Nte		0.5 to 5Vrms		1±0.2Vrms	0.5±0.1Vrms		
	Bias application					None		

Specified Value	Temperature	Standard		$C < 30pF : Q \ge 400 + 20C$ $C \ge 30pF : Q \ge 1000$ (C:Nominal capacitance)				
	Compensating(Class1)	High Frequency Type		Refer to detailed specification				
	High Permittivity (Class2) Note 1			BJ, B	7, C6, C7:2.5% max.			
			Cla	ss 1	Class 2			
			Standard	I	High Frequency Type	C≦10 <i>µ</i> F	C>10 µF	
	Preconditioning		1		one	Thermal treatment (at 150°C for 1hr) Note 2		
Test	Measuring frequency		1MHz±10%		1GHz	1kHz±10%	120±10Hz	
Methods and	Measuring voltage Note	0.5 to 5Vrms 1±0.2Vrms 0.5±0.1Vrms						
Remarks	Bias application					None		
	High Frequency Type Measuring equipment Measuring jig		4291A 16192A					

8. Temperature	e Characteristic (Without vo	ltage application)						
			Tem	perature Charad	cteristic [ppm/°	C] To	erance [ppm/°C]	1
			C□:	C□: 0 CG			G:±30	
		Standard	<u>и</u> п.	U□ : −750 UJ. UK			J:±120	
	Temperature Compensating(Class1)				,		K:±250	
	Compensating (Class I)		SL :	+350 to -100	00			j
		High Frequency Type	Tem	perature Charad	cteristic [ppm/°	C] Tol	erance [ppm/°C]	
		High Frequency Type	C□ :	0	CG		G:±30	
Specified				Specification	Capacitance	Reference	Temperature Range	
Value					change	temperature	Temperature Range	
			ВJ	В	±10%	20°C	−25 to +85°C	
					±15%	25°C	−55 to +85°C	
	High Permittivity (Class2	B7	X7R	±15%	25°C	-55 to +125°C		
		C6	XS	±22%	25°C	−55 to +105°C		
		C7	X7S	±22%	25°C	−55 to +125°C		
		LD(X)	X5R	±15%	25°C	−55 to +85°C	j	
			Note : 🔅	LD Low disto	ortion high value	multılayer cera	mic capacitor	
	Class 1 Capacitance at 20°C and	95°C shall be measured	ما الم الم	معار معربالله بينا وم		+	iatia aball ba aalaulata.	d fuene the
	following equation.	of C shall be measure	a m therr	nai equilibrium, a	and the tempera	lure character	istic shall be calculated	a from the
	$\frac{(C_{85}-C_{20})}{C_{20}\times\Delta T} \times 10^{6}(\text{ppm/}^{\circ}\text{C}) \qquad \Delta T = 65$							
	-20							
_	Class 2							
Test	Capacitance at each step	shall be measured in the	ermal equ	ilibrium, and the	temperature cha	aracteristic sha	II be calculated from th	e following
Methods and	equation.							
Remarks	Step	В		X5R、X7R、X	ôS、X7S			
	1	Minimum op	erating te					
	2	20°C		25°C				
	3	Maximum op	erating te	emperature				
	(0 - 0)	0		itanaa in Staa 1	au Stan 2			
	$\frac{(C-C_2)}{C_2} \times 1$	00(%) C	-	itance in Step 1 tance in Step 2	or step s			
	02	02						



9. Deflection						
	Temperature		Standard	Appearance Capacitance change	bnormality in $\pm 5\%$ or ± 0.5 pF, whichever is larger.	
Specified Value	C	ompensating(Cla	ss1)	High Frequency Type	Appearance Capacitance change	bnormality in±0.5 pF
	Hi	igh Permittivity((Class2))	Appearance Capacitance change	bnormality in $\pm 12.5\%$
				Multilayer Ceram	nic Capacitors	
			021, 0	042, 063, [※] 105 Type	The other types	
Test		Board		Glass epoxy-re	sin substrate	Board R-230 Warp
Methods and		Thickness		0.8mm	1.6mm	
Remarks		Warp		1mn	n	$\begin{array}{c} \Delta \\ 45\pm2 \\ 45\pm2 \\ 45\pm2 \\ 45\pm2 \\ 1 \end{array}$
Kelliarks		Duration		10 se	ес.	
	'		*105	Type thickness, C: 0.2m	nm ,P: 0.3mm.	(Unit: mm)
						Capacitance measurement shall be conducted

with the board bent

10. Body Stren	10. Body Strength					
0.15.1	Temperature	Standard	_			
Specified Value	Compensating(Class1)	High Frequency Type	No mechanical damage.			
Value	High Permittivity (Class2))	-			
Test Methods and Remarks	High Frequency 105Type Applied force : 5N Duraton : 10 sec.	Fres ← A →	R0.5 Pressing jig Chip Chip 0.6A A			

11. Adhesive St	11. Adhesive Strength of Terminal Electrodes							
	Temperature	Standard						
Specified Value	Compensating(Class1) High Frequency Typ	e No terminal separati	No terminal separation or its indication.				
Value	High Permittivity (Cla	ss2)						
		Multilayer Cera	mic Capacitors	Hooked jig				
Test		021, 042, 063 Type	105 Type or more					
Methods and	Applied force	2N	5N	R=0.5				
Remarks	Duration	30±5	i sec.					

12. Solderability	2. Solderability								
	Temperature	Standard							
Value	Compensating(Class1)	High Frequency Type	At least 95%	by new solder.					
	High Permittivity (Class2))							
- .		Eutectic so	older	Lead-free solder					
Test Methods and	Solder type H60A or H		63A	Sn-3.0Ag-0.5Cu					
Remarks	Solder temperature	230±5°	С	245±3℃					
	Duration		4±1	sec.					

13. Resistance	to Soldering						
Specified Value	Temperature	Standard	Appearance Capacitance change Q Insulation resistance Withstanding voltage	: No abnormality : Within ±2.5% or ±0 : Initial value : Initial value (between terminals)	0.25pF, whichever is larger. : No abnormality		
	Compensating(Class1)	High Frequency Type	Appearance Capacitance change Q Insulation resistance Withstanding voltage	: No abnormality : Within ±2.5% : Initial value : Initial value (between terminals)	: No abnormality		
	High Permittivity(Class2) Note 1		Appearance Capacitance change Dissipation factor Insulation resistance Withstanding voltage	: No abnormality : Within ±7.5% : Initial value : Initial value (between terminals)	: No abnormality		
			Class 1				
		021, 042, 063 Type		105 Туре			
	Preconditioning	None					
	Preheating	150°C, 1 to 2 min.		00°C, 2 to 5 min. 00°C, 2 to 5 min.			
	Solder temp.	270±5°C					
	Duration	3±0.5 sec.					
Test	Recovery	6 to 24 hrs (Standard condition) Note 5					
Methods and Remarks							
Remarks	-	021, 042、063 Type	Class 2 021, 042, 063 Type 105, 107, 212 Type		316, 325, 432 Type		
	Preconditioning	021, 042, 003 Type	021, 042, 063 Type105, 107, 212 Thermal treatment (at 150				
	Preheating	150°C, 1 to 2 min.	80 to 10	00°C, 2 to 5 min. 00°C, 2 to 5 min.	80 to 100°C, 5 to 10 min. 150 to 200°C, 5 to 10 min.		
	Solder temp.		2				
	Duration						
	Recovery	24±2 hrs(Standard condition)Note 5					

14. Temperatu	re Cycle (Thermal Shock)						
	Temperature Compensating(Class1)	Standard	Capacitance change : Q : Insulation resistance :	No abnormality Within $\pm 2.5\%$ or ± 0.25 Initial value Initial value between terminals) : N			
Specified Value		High Frequency Type	Capacitance change Q : Insulation resistance	No abnormality Within ±0.25pF Initial value Initial value between terminals) : N	o abnormality		
	High Permittivity(Class2) Note 1	Capacitance change : Dissipation factor : Insulation resistance : 1	No abnormality Within ±7.5% Initial value Initial value petween terminals) : No	o abnormality		
			Class 1		Class 2		
	Preconditioning	None		Thermal treatment (at 150°C for 1 hr) Note 2			
Test	1 cycle	Step	Step Temperature		Time (min.)		
Methods and		1	Minimum operatin	g temperature	30±3		
Remarks		2	Normal tem		2 to 3		
		3	Maximum operating		30±3		
		4	Normal tem	perature	2 to 3		
	Number of cycles		5	times			
	Recovery	6 to 24 hrs(Star	ndard condition)Note 5	24±2 hrs(S	Standard condition)Note 5		

15. Humidity(Steady State)					
	Temperature Compensating(Class)	Standard	Capacitance change Q	No abnormality Within $\pm 5\%$ or $\pm 0.5 pF$, whichever is larger. $C < 10 pF : Q \ge 200 + 10C$ $10 \le C < 30 pF : Q \ge 275 + 2.5C$ $C \ge 30 pF: Q \ge 350 (C: Nominal capacitance)$ 1000 M Ω min.		
Specified Value		High Frequency Type	Capacitance change	: No abnormality : Within $\pm 0.5 \text{pF}$, : 1000 M Ω min.		
	High Permittivity(Class2) Note 1		Capacitance change Dissipation factor	: No abnormality : Within $\pm 12.5\%$: 5.0% max. : 50 M $\Omega\mu$ F or 1000 M Ω whichever is smaller.		
		Cla	ass 1	Class 2		
		Standard	High Frequency Type	All items		
Test	Preconditioning	N	one	Thermal treatment(at 150°C for 1 hr) Note 2		
Methods and	Temperature	40±2°C	60±2°C	40±2°C		
Remarks	Humidity	90 to 95%RH		90 to 95%RH		
	Duration	500+2	4∕−0 hrs	500+24/-0 hrs		
	Recovery	6 to 24 hrs (Standa	ard condition)Note 5	24±2 hrs(Standard condition)Note 5		

16. Humidity Lo	pading					
Specified Value	Temperature Compensating(Class1)	Standard	Appearance Capacitance change Q Insulation resistance	: No abnormality : Within $\pm 7.5\%$ or ± 0.75 pF, whichever is larger. : C < 30pF: Q \ge 100 + 10C/3 C \ge 30pF: Q \ge 200 (C:Nominal capacitance) : 500 M Ω min.		
		High Frequency Type	Appearance: No abnormality Capacitance changeequency Type: C≦2pF:Within ±0.4 pF C>2pF:Within ±0.75 pF (C:Nominal capacitance)Insulation resistance: 500 M Ω min.			
	High Permittivity(Class2) Note 1		Appearance Capacitance change Dissipation factor Insulation resistance	: No abnormality : Within \pm 12.5% : 5.0% max. : 25 M $\Omega\mu$ F or 500 M Ω whichever is smaller.		
		C	lass 1	Class 2		
		Standard	High Frequency Ty	rpe All items		
	Preconditioning	None		Voltage treatment (Rated voltage are applied for 1 hour at 40°C) Note 3		
Test	Temperature	40±2°C	60±2°C	40±2°C		
Methods and	Humidity	90 to 95%RH		90 to 95%RH		
Remarks	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±2 hrs(Standard condition) Note 5		

mperature mpensating(Class1)	Standard High Frequency Type	Appearance Capacitance change Q Insulation resistance Appearance Capacitance change Insulation resistance Appearance	: C < 10pF: Q ≧ 10≦C < 30pF: Q ≧ : 1000 MΩmin. : No abnormality : Within ±3% or	±0.3pF, whichever is 200+10C Q≧275+2.5C 350(C:Nominal capa	0	
	High Frequency Type	Capacitance change Insulation resistance	: Within $\pm 3\%$ or			
		Appearance	ce change : Within $\pm 3\%$ or ± 0.3 pF, whichever is larger.			
High Permittivity(Class2) Note 1		Appearance Capacitance change Dissipation factor Insulation resistance	: No abnormality : Within \pm 12.5% : 5.0% max. : 50 M Ω //F or 1000 M Ω whichever is smaller.		smaller.	
	Class 1		Class 2			
	Standard H	ligh Frequency Type	BJ, LD(🔆)	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			
[emperature	Maximum operating temperature		Maximum operating temperature			
Duration	1000+48/-0 hrs		1000+48/-0 hrs			
	Rated voltage × 2 Note 4		Rated voltage × 2 Note 4			
Applied voltage	50mA max.		50mA max.			
Applied voltage Charge/discharge current		6 to 24hr(Standard condition)Note 5		24 ± 2 hrs (Standard condition) Note 5		
)ura	ition ied voltage rge/discharge	ttion 1000+48, ied voltage Rated voltage rge/discharge 50mA	1000+48/-0 hrs ied voltage Rated voltage × 2 Note 4 rge/discharge 50mA max.	Ition 1000+48/-0 hrs ied voltage Rated voltage × 2 Note 4 rge/discharge 50mA max.	Ition 1000+48/-0 hrs 1000+48/-0 hrs ied voltage Rated voltage × 2 Note 4 Rated voltage × 2 Note 9 rge/discharge 50mA max. 50mA max.	

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 $150+0/-10^{\circ}$ 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±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°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±2°C, Relative humidity: 60 to 70 % RH, Air pressure: 86 to 106kPa Unless otherwise specified, all the tests are conducted under the "standard condition".