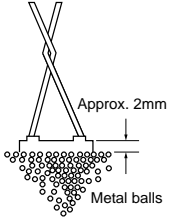


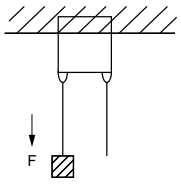
RDE Series (Only for Commercial) Specifications and Test Methods


No.	Item	Specifications		Test Method																
		Temperature Compensating Type	High Dielectric Constant Type																	
1	Operating Temperature Range	-55 to +125°C	Char. X7R, X7S: -55 to +125°C Char. F: -25 to +85°C Char. Y5V: -30 to +85°C	-																
2	Appearance	No defects or abnormalities		Visual inspection																
3	Dimension and Marking	See previous pages		Visual inspection, Vernier Caliper																
4	Dielectric Strength	Between Terminals	No defects or abnormalities	<p>The capacitors should not be damaged when test voltages of Table are applied between the terminals for 1 to 5 sec. (Charge/Discharge current \leq 50mA)</p> <table border="1"> <thead> <tr> <th colspan="2">Temperature Compensating Type</th> </tr> <tr> <th>Rated Voltage</th> <th>Test Voltage</th> </tr> </thead> <tbody> <tr> <td>DC50V, DC100V</td> <td>300% of the rated voltage</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">High Dielectric Constant Type</th> </tr> <tr> <th>Rated Voltage</th> <th>Test Voltage</th> </tr> </thead> <tbody> <tr> <td>DC25V, DC50V</td> <td>250% of the rated voltage</td> </tr> <tr> <td>DC100V, DC250V</td> <td>200% of the rated voltage</td> </tr> <tr> <td>DC630V</td> <td>150% of the rated voltage</td> </tr> </tbody> </table>	Temperature Compensating Type		Rated Voltage	Test Voltage	DC50V, DC100V	300% of the rated voltage	High Dielectric Constant Type		Rated Voltage	Test Voltage	DC25V, DC50V	250% of the rated voltage	DC100V, DC250V	200% of the rated voltage	DC630V	150% of the rated voltage
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DC630V	150% of the rated voltage																			
Body Insulation	No defects or abnormalities	<p>The capacitor is placed in a container with metal balls of 1mm diameter so that each terminal, short-circuited, is kept approximately 2mm from the balls as shown in the figure, and 250% of the rated voltage (200% of the rated voltage in case of rated voltage: DC100V, DC250V, DC630V) is impressed for 1 to 5 sec. between capacitor terminals and metal balls. (Charge/Discharge current \leq 50mA)</p> 																		
5	Insulation Resistance	Between Terminals	Rated Voltage: DC25V, DC50V, DC100V 10,000M Ω min. or 500M Ω • μ F min. whichever is smaller Rated Voltage: DC250V, DC630V 10,000M Ω min. or 100M Ω • μ F min. whichever is smaller	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage (DC500 \pm 50V in case of rated voltage: DC630V) at normal temperature and humidity and within 2 min. of charging. (Charge/Discharge current \leq 50mA)																
6	Capacitance	Within the specified tolerance		The capacitance, Q/D.F. should be measured at 25°C at the frequency and voltage shown in the table.																
7	Q/Dissipation Factor (D.F.)	30pF min.: $Q \geq 1,000$ 30pF max.: $Q \geq 400+20C$ C: Nominal capacitance (pF)	Char. X7R: 0.025 max. Char. F, Y5V: 0.05 max. Char. X7S: 0.125 max.	<table border="1"> <thead> <tr> <th colspan="3">Temperature Compensating Type</th> </tr> <tr> <th>Capacitance</th> <th>C \leq 1000pF</th> <th>C > 1000pF</th> </tr> </thead> <tbody> <tr> <td>Item</td> <td></td> <td></td> </tr> <tr> <td>Frequency</td> <td>1\pm0.1MHz</td> <td>1\pm0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>AC0.5 to 5V (r.m.s.)</td> <td>AC1\pm0.2V (r.m.s.)</td> </tr> </tbody> </table>	Temperature Compensating Type			Capacitance	C \leq 1000pF	C > 1000pF	Item			Frequency	1 \pm 0.1MHz	1 \pm 0.1kHz	Voltage	AC0.5 to 5V (r.m.s.)	AC1 \pm 0.2V (r.m.s.)	
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No.	Item		Specifications		Test Method												
			Temperature Compensating Type	High Dielectric Constant Type													
8	Capacitance Temperature Characteristics	Capacitance Change	Within the specified tolerance (Table A on last column)	Within the specified tolerance (Table B on last column)	<p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <p>(1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5 (-55 to +125°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as shown in Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in step 1, 3 and 5 by the cap. value in step 3.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>(2) High Dielectric Constant Type The ranges of capacitance change compared with the 25°C (Char. F: 20°C) value over the temperature ranges as shown in Table B should be within the specified ranges.</p> <ul style="list-style-type: none"> Pretreatment (for high dielectric constant type) Perform a heat treatment at 150+0/-10°C for 1 hr., and then let sit at room temperature for 24±2 hrs. 	Step	Temperature (°C)	1	25±2	2	-55±3	3	25±2	4	125±3	5	25±2
		Step	Temperature (°C)														
		1	25±2														
2	-55±3																
3	25±2																
4	125±3																
5	25±2																
Temperature Coefficient	Within the specified tolerance (Table A on last column)																
Capacitance Drift	Within ±0.2% or ±0.05pF (whichever is larger)																
9	Terminal Strength	Tensile Strength	Termination not to be broken or loosened		<p>As in the figure, fix the capacitor body, apply the force gradually to each lead in the radial direction of the capacitor until reaching 10N and then keep the force applied for 10±1 sec.</p> 												
		Bending Strength	Termination not to be broken or loosened														
10	Vibration Resistance	Appearance	No defects or abnormalities		<p>The capacitor is soldered securely to a supporting terminal and a 10 to 55Hz vibration of 1.5mm peak-peak amplitude is applied for 6 hrs. total, 2 hrs. in each mutually perpendicular direction. Allow 1 min. to cycle the frequency from 10Hz to 55Hz and the converse.</p>												
		Capacitance	Within the specified tolerance														
		Q/D.F.	30pF min.: Q _≥ 1,000 30pF max.: Q _≥ 400+20C C: Nominal capacitance (pF)	Char. X7R: 0.025 max. Char. F, Y5V: 0.05 max. Char. X7S: 0.125 max.													
11	Solderability of Leads	Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.		<p>The terminal of a capacitor is dipped into a 25% ethanol (JIS-K-8101) solution of rosin (JIS-K-5902) and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5mm to 2mm from the terminal body.</p> <p>Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder</p>													
12	Resistance to Soldering Heat	Appearance	No defects or abnormalities		<p>The lead wire is immersed in the melted solder 1.5mm to 2mm from the main body at 350±10°C for 3.5±0.5 sec.</p> <p>The specified items are measured after 24±2 hrs.</p> <ul style="list-style-type: none"> Pretreatment (for high dielectric constant type) Perform a heat treatment at 150+0/-10°C for 1 hr., and then let sit at room temperature for 24±2 hrs. 												
		Capacitance Change	Within ±2.5% or ±0.25pF (whichever is larger)	Char. X7R, X7S: Within ±10% Char. F, Y5V: Within ±20%													
		Dielectric Strength (Between Terminals)	No defects														

Continued on the following page. 

RDE Series (Only for Commercial) Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications		Test Method																
		Temperature Compensating Type	High Dielectric Constant Type																	
13	Temperature Cycle	Appearance	No defects or abnormalities		<p>The capacitor should be subjected to 5 temperature cycles.</p> <p>Remove and set for 24±2 hrs. at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. Operating Temp. ±3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>3 max.</td> </tr> <tr> <td>3</td> <td>Max. Operating Temp. ±3</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room Temp.</td> <td>3 max.</td> </tr> </tbody> </table> <p>• Pretreatment (for high dielectric constant type) Perform a heat treatment at 150+0/-10°C for 1 hr., and then let sit at room temperature for 24±2 hrs.</p>	Step	Temperature (°C)	Time (min)	1	Min. Operating Temp. ±3	30±3	2	Room Temp.	3 max.	3	Max. Operating Temp. ±3	30±3	4	Room Temp.	3 max.
		Step	Temperature (°C)	Time (min)																
		1	Min. Operating Temp. ±3	30±3																
		2	Room Temp.	3 max.																
		3	Max. Operating Temp. ±3	30±3																
4	Room Temp.	3 max.																		
Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	Char. X7R, X7S: Within ±12.5% Char. F, Y5V: Within ±30%																		
Q/D.F.	30pF min.: Q≥350 10pF to 30pF: Q≥275+5C/2 10pF max.: Q≥200+10C C: Nominal capacitance (pF)	Char. X7R: 0.05 max. Char. F, Y5V: 0.075 max. Char. X7S: 0.2 max.																		
Insulation Resistance	Rated Voltage: DC25V, DC50V, DC100V 1,000MΩ, 50MΩ • μF min. (whichever is smaller) Rated Voltage: DC250V, DC630V 1,000MΩ, 10MΩ • μF min. (whichever is smaller)																			
Dielectric Strength (Between Terminals)	No defects or abnormalities																			
14	Humidity (Steady State)	Appearance	No defects or abnormalities		<p>Set the capacitor at 40±2°C and relative humidity of 90 to 95% for 500±24 hrs.</p> <p>Remove and set for 24±2 hrs. at room temperature, then measure.</p> <p>• Pretreatment (for high dielectric constant type) Perform a heat treatment at 150+0/-10°C for 1 hr., and then let sit at room temperature for 24±2 hrs.</p>															
		Capacitance Change	Within ±5% or ±0.5pF (whichever is larger)	Char. X7R, X7S: Within ±15% Char. F, Y5V: Within ±30%																
		Q/D.F.	30pF min.: Q≥350 10pF to 30pF: Q≥275+5C/2 10pF max.: Q≥200+10C C: Nominal capacitance (pF)	Char. X7R: 0.05 max. Char. F, Y5V: 0.075 max. Char. X7S: 0.2 max.																
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15	Humidity Load	Appearance	No defects or abnormalities		<p>Apply the rated voltage for 500±24 hrs. at 40±2°C and in 90 to 95% humidity.</p> <p>Remove and set for 24±2 hrs. at room temperature, then measure.</p> <p>(Charge/Discharge current ≤50mA)</p> <p>• Pretreatment (for high dielectric constant type) Perform a heat treatment at 150+0/-10°C for 1 hr., and then let sit at room temperature for 24±2 hrs.</p>															
		Capacitance Change	Within ±7.5% or ±0.75pF (whichever is larger)	Char. X7R, X7S: Within ±15% Char. F, Y5V: Within ±30%																
		Q/D.F.	30pF min.: Q≥200 30pF max.: Q≥100+10C/3 C: Nominal capacitance (pF)	Char. X7R: 0.05 max. Char. F, Y5V: 0.075 max. Char. X7S: 0.2 max.																
		Insulation Resistance	Rated Voltage: DC25V, DC50V, DC100V 500MΩ or 25MΩ • μF min. (whichever is smaller) Rated Voltage: DC250V, DC630V 1,000MΩ or 10MΩ • μF min. (whichever is smaller)																	
16	High Temperature Load	Appearance	No defects or abnormalities		<p>Apply voltage in Table for 1000±48 hrs. at the maximum operating temperature±3°C.</p> <p>Remove and set for 24±2 hrs. at room temperature, then measure. (Charge/Discharge current ≤50mA)</p> <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>Test Voltage</th> </tr> </thead> <tbody> <tr> <td>DC25V, DC50V</td> <td>150% of the rated voltage</td> </tr> <tr> <td>DC100V, DC250V</td> <td rowspan="2">120% of the rated voltage</td> </tr> <tr> <td>DC630V</td> </tr> </tbody> </table> <p>• Pretreatment (for high dielectric constant type) Apply test voltage for 1 hr., at test temperature. Remove and see for 24±2 hrs. at room temperature.</p>	Rated Voltage	Test Voltage	DC25V, DC50V	150% of the rated voltage	DC100V, DC250V	120% of the rated voltage	DC630V								
		Rated Voltage	Test Voltage																	
		DC25V, DC50V	150% of the rated voltage																	
		DC100V, DC250V	120% of the rated voltage																	
DC630V																				
Capacitance Change	Within ±3% or ±0.3pF (whichever is larger)	Char. X7R, X7S: Within ±15% Char. F, Y5V: Within ±30%																		
Q/D.F.	30pF min.: Q≥350 10pF to 30pF: Q≥275+5C/2 10pF max.: Q≥200+10C C: Nominal capacitance (pF)	Char. X7R: 0.05 max. Char. F, Y5V: 0.075 max. Char. X7S: 0.2 max.																		
Insulation Resistance	Rated Voltage: DC25V, DC50V, DC100V 1,000MΩ, 50MΩ • μF min. (whichever is smaller) Rated Voltage: DC250V, DC630V 1,000MΩ, 10MΩ • μF min. (whichever is smaller)																			
17	Solvent Resistance	Appearance	No defects or abnormalities		<p>The capacitor should be fully immersed, unagitated, in reagent at 20 to 25°C for 30±5 sec. and then remove gently. Marking on the surface of the capacitor should immediately be visually examined.</p> <p>Reagent: • Isopropyl alcohol</p>															
		Marking	Legible																	

Table A

Char.	Nominal Values (ppm/°C) *1	Capacitance Change from 25°C (%)					
		-55°C		-30°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

*1: Nominal values denote the temperature coefficient within a range of 25 to 125°C

Table B

Char.	Temp. Range	Reference Temp.	Cap. Change Rate
X7R	-55 to +125°C	25°C	Within ±15%
X7S			Within ±22%
Y5V	-30 to + 85°C		Within ±22%
F	-25 to + 85°C	20°C	Within ±22%