

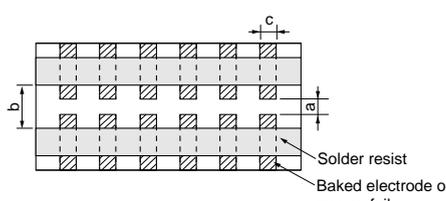
GRM Series Specifications and Test Methods (1)

No.	Item	Specifications		Test Method																				
		Temperature Compensating Type	High Dielectric Type																					
1	Operating Temperature Range	-55 to +125°C	B1, B3, F1: -25 to +85°C R1, R7: -55 to +125°C R6: -55 to +85°C C8: -55 to +105°C E4: +10 to +85°C F5: -30 to +85°C	Reference temperature: 25°C (2Δ, 3Δ, 4Δ, B1, B3, F1, R1: 20°C)																				
2	Rated Voltage	See the previous pages.		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, should be maintained within the rated voltage range.																				
3	Appearance	No defects or abnormalities		Visual inspection																				
4	Dimensions	Within the specified dimensions		Using calipers (GRM02 size is based on Microscope)																				
5	Dielectric Strength	No defects or abnormalities		No failure should be observed when 300%* of the rated voltage (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V																				
6	Insulation Resistance	$C \leq 0.047\mu\text{F}$: More than 10,000MΩ $C > 0.047\mu\text{F}$: More than $500\Omega \cdot \text{F}$ C: Nominal Capacitance		The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20/25°C and 75%RH max. and within 2 minutes of charging, provided the charge/discharge current is less than 50mA.																				
7	Capacitance	Within the specified tolerance		The capacitance/Q/D.F. should be measured at 20/25°C at the frequency and voltage shown in the table. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Char.</th> <th>ΔC to 7U, 1X (1000pF and below)</th> <th>ΔC to 7U, 1X (more than 1000pF)</th> <th>R6, R7, F5 ($C > 10\mu\text{F}$)</th> <th>E4</th> </tr> </thead> <tbody> <tr> <td>Item</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Frequency</td> <td>1±0.1MHz</td> <td>1±0.1kHz</td> <td>120±24kHz</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> <td>1±0.2Vrms</td> <td>0.5±0.1Vrms</td> <td>0.5±0.05Vrms</td> </tr> </tbody> </table>	Char.	ΔC to 7U, 1X (1000pF and below)	ΔC to 7U, 1X (more than 1000pF)	R6, R7, F5 ($C > 10\mu\text{F}$)	E4	Item					Frequency	1±0.1MHz	1±0.1kHz	120±24kHz	1±0.1kHz	Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.1Vrms	0.5±0.05Vrms
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Frequency	1±0.1MHz	1±0.1kHz	120±24kHz	1±0.1kHz																				
Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.1Vrms	0.5±0.05Vrms																				
8	Q/ Dissipation Factor (D.F.)	30pF and over: $Q \geq 1000$ 30pF and below: $Q \geq 400 + 20C$ C: Nominal Capacitance (pF)	[R6, R7, C8] W.V.: 100V : 0.025 max. ($C < 0.068\mu\text{F}$) : 0.05 max. ($C \geq 0.068\mu\text{F}$) W.V.: 50/25V: : 0.025 max. ($C < 10\mu\text{F}$) : 0.035 max. ($C \geq 10\mu\text{F}$) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. ($C < 3.3\mu\text{F}$) : 0.1 max. ($C \geq 3.3\mu\text{F}$) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. ($C < 0.1\mu\text{F}$) : 0.09 max. ($C \geq 0.1\mu\text{F}$) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.																					

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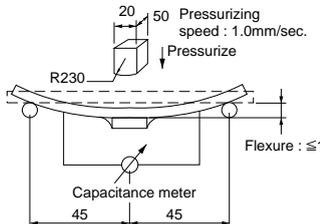
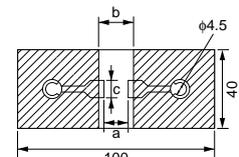
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		Temperature Compensating Type	High Dielectric Type																																							
9	Capacitance Temperature Characteristics	No bias	B1, B3: Within $\pm 10\%$ (–25 to +85°C) R1, R7: Within $\pm 15\%$ (–55 to +125°C) R6: Within $\pm 15\%$ (–55 to +85°C) E4: Within $\pm 22/-56\%$ (+10 to +85°C) F1: Within $\pm 30/-80\%$ (–25 to +85°C) F5: Within $\pm 22/-82\%$ (–30 to +85°C) C8: Within $\pm 22\%$ (–55 to +105°C)	The capacitance change should be measured after 5 min. at each specified temp. stage. (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 (5C: +25 to +125°C/ Δ C: +20 to +125°C: other temp. coeffs.: +25 to +85°C/+20 to +85°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.																																						
		50% of the Rated Voltage	B1: Within +10/–30% R1: Within +15/–40% F1: Within +30/–95%																																							
		Capacitance Drift	*Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/–10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement. *Do not apply to 1X/25V																																							
10	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.		Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *1N (GRM02), 2N (GRM03), 5N (GRM15, GRM18)																																						
		 <p>Fig. 1a</p>			(in mm) <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM02</td> <td>0.2</td> <td>0.56</td> <td>0.23</td> </tr> <tr> <td>GRM03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GRM15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table>	Type	a	b	c	GRM02	0.2	0.56	0.23	GRM03	0.3	0.9	0.3	GRM15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55
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		Temperature Compensating Type	High Dielectric Type																																							
11	Vibration Resistance	Appearance	No defects or abnormalities		Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).																																					
		Capacitance	Within the specified tolerance																																							
	Q/D.F.	30pF and over: $Q \geq 1000$ 30pF and below: $Q \geq 400+20C$ C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. ($C < 0.068\mu\text{F}$) : 0.05 max. ($C \geq 0.068\mu\text{F}$) W.V.: 50/25V: : 0.025 max. ($C < 10\mu\text{F}$) : 0.035 max. ($C \geq 10\mu\text{F}$) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. ($C < 3.3\mu\text{F}$) : 0.1 max. ($C \geq 3.3\mu\text{F}$) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. ($C < 0.1\mu\text{F}$) : 0.09 max. ($C \geq 0.1\mu\text{F}$) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.																																							
12	Deflection	No crack or marked defect should occur.		Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5 ± 1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.																																						
		 <p>Fig. 3a</p>			 <p>Fig. 2a t: 1.6mm (GRM02/03/15: t: 0.8mm)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM02</td> <td>0.2</td> <td>0.56</td> <td>0.23</td> </tr> <tr> <td>GRM03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GRM15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM02	0.2	0.56	0.23	GRM03	0.3	0.9	0.3	GRM15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55
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13	Solderability of Termination	75% of the terminations are to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion) . Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2 ± 0.5 seconds at $230 \pm 5^\circ\text{C}$ or Sn-3.0Ag-0.5Cu solder solution for 2 ± 0.5 seconds at $245 \pm 5^\circ\text{C}$.																																						

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No.	Item	Specifications		Test Method															
		Temperature Compensating Type	High Dielectric Type																
14		The measured and observed characteristics should satisfy the specifications in the following table.		<p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure.</p> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.</p> <p>•Preheating for GRM32/43/55</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table>	Step	Temperature	Time	1	100 to 120°C	1 min.	2	170 to 200°C	1 min.						
	Step	Temperature	Time																
	1	100 to 120°C	1 min.																
	2	170 to 200°C	1 min.																
	Appearance	No defects or abnormalities																	
	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4: Within ±20%																
Q/D.F.	30pF and over: $Q \geq 1000$ 30pF and below: $Q \geq 400+20C$ C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≥0.068μF) W.V.: 50/25V: : 0.025 max. (C<10μF) : 0.035 max. (C≥10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.																	
I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)																		
Dielectric Strength	No defects																		
15		The measured and observed characteristics should satisfy the specifications in the following table.		<p>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table. Set for 24±2 hours at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. +0/−3</td> <td>Room Temp.</td> <td>Max. Operating Temp. +3/−0</td> <td>Room Temp.</td> </tr> <tr> <td>Time (min.)</td> <td>30±3</td> <td>2 to 3</td> <td>30±3</td> <td>2 to 3</td> </tr> </tbody> </table> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
	Step	1	2		3	4													
	Temp. (°C)	Min. Operating Temp. +0/−3	Room Temp.		Max. Operating Temp. +3/−0	Room Temp.													
	Time (min.)	30±3	2 to 3		30±3	2 to 3													
	Appearance	No defects or abnormalities																	
	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4: Within ±20%																
Q/D.F.	30pF and over: $Q \geq 1000$ 30pF and below: $Q \geq 400+20C$ C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≥0.068μF) W.V.: 50/25V: : 0.025 max. (C<10μF) : 0.035 max. (C≥10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.																	
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No.	Item	Specifications		Test Method
		Temperature Compensating Type	High Dielectric Type	
16		The measured and observed characteristics should satisfy the specifications in the following table.		Set the capacitor at 40±2°C and in 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure.
	Appearance	No defects or abnormalities		
	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4: Within ±30%	
	Q/D.F.	30pF and over: Q≥350 10pF and over 30pF and below: Q≥275+2.5C 10pF and below: Q≥200+10C C: Nominal Capacitance (pF)	[R6, R7, C8] W.V.: 100V : 0.05 max. (C<0.068μF) : 0.075 max. (C≥0.068μF) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. (C<3.3μF) : 0.125 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.075 max. (C<0.1μF) : 0.125 max. (C≥0.1μF) W.V.: 16/10V: 0.15 max. W.V.: 6.3V: 0.2 max.	
	I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)		
17		The measured and observed characteristics should satisfy the specifications in the following table.		Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for F1, F5/10V max. Apply the rated DC voltage for 1 hour at 40±2°C. Remove and set for 24±2 hours at room temperature. Perform initial measurement.
	Appearance	No defects or abnormalities		
	Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4: Within ±30% [W.V.: 10V max.] F1, F5: Within +30/-40%	
	Q/D.F.	30pF and over: Q≥200 30pF and below: Q≥100+10C/3 C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.05 max. (C<0.068μF) : 0.075 max. (C≥0.068μF) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. (C<3.3μF) : 0.125 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.075 max. (C<0.1μF) : 0.125 max. (C≥0.1μF) W.V.: 16/10V: 0.15 max. W.V.: 6.3V: 0.2 max.	
	I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)		

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No.	Item	Specifications		Test Method
		Temperature Compensating Type	High Dielectric Type	
18	High Temperature Load	The measured and observed characteristics should satisfy the specifications in the following table.		Apply 200% (GRM21BR71H105, GRM21BR72A474, GRM31CR71H475: 150% of the rated voltage) of the rated voltage at the maximum operating temperature $\pm 3^{\circ}\text{C}$ for 1000 ± 12 hours. Set for 24 ± 2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage at the maximum operating temperature $\pm 3^{\circ}\text{C}$ for one hour. Remove and set for 24 ± 2 hours at room temperature. Perform initial measurement.
		Appearance	No defects or abnormalities	
		Capacitance Change	Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger) B1, B3, R1, R6, R7, C8 : Within $\pm 12.5\%$ F1, F5, E4: Within $\pm 30\%$ [Except 10V max. and. $C \geq 1.0\mu\text{F}$] F1, F5: Within $+30/-40\%$ [10V max. and $C \geq 1.0\mu\text{F}$]	
		Q/D.F.	30pF and over: $Q \geq 350$ 10pF and over 30pF and below: $Q \geq 275 + 2.5C$ 10pF and below: $Q \geq 200 + 10C$ C: Nominal Capacitance (pF) [B1, B3, R6, R7, C8] W.V.: 100V : 0.05 max. ($C < 0.068\mu\text{F}$) : 0.075 max. ($C \geq 0.068\mu\text{F}$) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. ($C < 3.3\mu\text{F}$) : 0.125 max. ($C \geq 3.3\mu\text{F}$) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.075 max. ($C < 0.1\mu\text{F}$) : 0.125 max. ($C \geq 0.1\mu\text{F}$) W.V.: 16/10V: 0.15 max. W.V.: 6.3V: 0.2 max.	
I.R.	More than $1,000\text{M}\Omega$ or $50\Omega \cdot \text{F}$ (Whichever is smaller)			

Table A-1
(1)

Char.	Nominal Values (ppm/ $^{\circ}\text{C}$)*1	Capacitance Change from 25°C (%)					
		-55		-30		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0 ± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
6C	0 ± 60	0.87	-0.48	0.59	-0.33	0.38	-0.21
6P	-150 ± 60	2.33	0.72	1.61	0.50	1.02	0.32
6R	-220 ± 60	3.02	1.28	2.08	0.88	1.32	0.56
6S	-330 ± 60	4.09	2.16	2.81	1.49	1.79	0.95
6T	-470 ± 60	5.46	3.28	3.75	2.26	2.39	1.44
7U	-750 ± 120	8.78	5.04	6.04	3.47	3.84	2.21
1X	+350 to -1000	-	-	-	-	-	-

*1: Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for ΔC)/ 85°C (for other TC).

(2)

Char.	Nominal Values (ppm/ $^{\circ}\text{C}$)*2	Capacitance Change from 20°C (%)					
		-55		-25		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
2C	0 ± 60	0.82	-0.45	0.49	-0.27	0.33	-0.18
3C	0 ± 120	1.37	-0.90	0.82	-0.54	0.55	-0.36
4C	0 ± 250	2.56	-1.88	1.54	-1.13	1.02	-0.75
2P	-150 ± 60	-	-	1.32	0.41	0.88	0.27
3P	-150 ± 120	-	-	1.65	0.14	1.10	0.09
4P	-150 ± 250	-	-	2.36	-0.45	1.57	-0.30
2R	-220 ± 60	-	-	1.70	0.72	1.13	0.48
3R	-220 ± 120	-	-	2.03	0.45	1.35	0.30
4R	-220 ± 250	-	-	2.74	-0.14	1.83	-0.09
2S	-330 ± 60	-	-	2.30	1.22	1.54	0.81
3S	-330 ± 120	-	-	2.63	0.95	1.76	0.63
4S	-330 ± 250	-	-	3.35	0.36	2.23	0.24
2T	-470 ± 60	-	-	3.07	1.85	2.05	1.23
3T	-470 ± 120	-	-	3.40	1.58	2.27	1.05
4T	-470 ± 250	-	-	4.12	0.99	2.74	0.66
3U	-750 ± 120	-	-	4.94	2.84	3.29	1.89
4U	-750 ± 250	-	-	5.65	2.25	3.77	1.50

*2: Nominal values denote the temperature coefficient within a range of 20°C to 125°C (for ΔC)/ 85°C (for other TC).