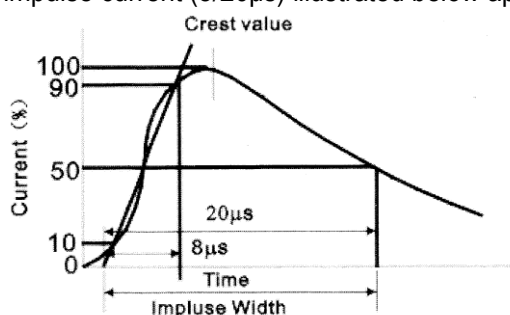


### 名詞定義與試規範 Performance Characteristic

#### (一). Electrical 電氣性能

Characteristics		Test Methods/Description	Specifications
Standard Test condition		Environmental conditions under which every measuring is done without doubt on the measuring results. Unless specially specified. Temperature relative humidity are 5 to 35°C. 45 to 85% RH.	-
Maximum Allowable Voltage		The maximum sinusoidal RMS voltage or maximum DC voltage that can be applied continuously in the specified environmental	To meet the specified value
Varistor Voltage		The voltage between two terminals with the specified measuring current Cm A DC applied is called Vc or VcmA, the measurement shall be made as fast as possible to avoid heat affection.	
Clamping Voltage		The maximum voltage between two terminals with the specified standard impulse current (8/20µs) illustrated below applied. 	
Maximum Peak Current (withstanding Surge Current)	2 times	The maximum current within the varistor voltage change of ±10% with the standard impulse current(8/20µs) applied two times with an interval of 5 minutes.	
	1 time	The maximum current within the varistor voltage change of ±10% with the standard impulse current(8/20µs) applied one time.	
Maximum Energy		The maximum energy within the varistor voltage change of ±10% when one impulse of 2 ms or 10/1000µs is applied.	
Rated Power		The power that can be applied in the specified ambient temperature.	
Capacitance		Capacitance shall be measured at 1 KHz ±10%, 1 Vrms max. (1 MHz below 100pf). OV bias and 20±2°C.	
Dissipation Factor		Dissipation factor shall be measured at 1 KHz±10%, 1 Vrms max. (1 MHz±10% below 100pf). OV bias and 20±2°C.	
Temperature Coefficient of varistor voltage		$\frac{V_c \text{ at } 85^\circ\text{C} - V_c \text{ at } 25^\circ\text{C}}{V_c \text{ at } 25^\circ\text{C}} \times \frac{1}{60} \times 100(\% / ^\circ\text{C})$	

Note: Varistor voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

### 續表

Characteristic	Test Methods/ Description	Specifications																																
Withstanding Voltage (Body Insulation)	<p>The specified voltage shall be applied both terminals of the specimen connected together and metal foil closely wrapped round it's body for 1 minute. Electrical breakdown shall be examined.</p> <table border="1"> <thead> <tr> <th>Classification (Nominal varistor voltage)</th> <th>Test Voltage (AC)</th> </tr> </thead> <tbody> <tr> <td>V0.1mA.V1mA ≤ 330V</td> <td>1000 Vrms</td> </tr> <tr> <td>V0.1mA.V1mA &gt; 330V</td> <td>1500 Vrms</td> </tr> </tbody> </table>	Classification (Nominal varistor voltage)	Test Voltage (AC)	V0.1mA.V1mA ≤ 330V	1000 Vrms	V0.1mA.V1mA > 330V	1500 Vrms	No breakdown																										
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V0.1mA.V1mA > 330V	1500 Vrms																																	
Impulse Life (I)	<p>The change of Vc shall be measured after the impulse listed below is applied 10,000 times continuously with the interval of 10 seconds at room temperature.</p> <table border="1"> <thead> <tr> <th>Series</th> <th>Resistance Range</th> <th>Current (8/20μs)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">05D Series</td> <td>180L to 680K</td> <td>8A (8/20μs)</td> </tr> <tr> <td>820K to 561K</td> <td>40A ((8/20μs)</td> </tr> <tr> <td rowspan="2">07D Series</td> <td>180L to 680K</td> <td>25A (8/20μs)</td> </tr> <tr> <td>820K to 681K</td> <td>100A ((8/20μs)</td> </tr> <tr> <td rowspan="2">10D Series</td> <td>180L to 680K</td> <td>50A (8/20μs)</td> </tr> <tr> <td>820K to 112K</td> <td>150A ((8/20μs)</td> </tr> <tr> <td rowspan="3">14D Series</td> <td>180L to 680K</td> <td>90A (8/20μs)</td> </tr> <tr> <td>820K to 122K</td> <td>300A ((8/20μs)</td> </tr> <tr> <td>182K</td> <td>150A ((8/20μs)</td> </tr> <tr> <td rowspan="3">20D Series</td> <td>180L to 680K</td> <td>130A ((8/20μs)</td> </tr> <tr> <td>820K to 122K</td> <td>250A (8/20μs)</td> </tr> <tr> <td>182K</td> <td>200A ((8/20μs)</td> </tr> </tbody> </table>	Series	Resistance Range	Current (8/20μs)	05D Series	180L to 680K	8A (8/20μs)	820K to 561K	40A ((8/20μs)	07D Series	180L to 680K	25A (8/20μs)	820K to 681K	100A ((8/20μs)	10D Series	180L to 680K	50A (8/20μs)	820K to 112K	150A ((8/20μs)	14D Series	180L to 680K	90A (8/20μs)	820K to 122K	300A ((8/20μs)	182K	150A ((8/20μs)	20D Series	180L to 680K	130A ((8/20μs)	820K to 122K	250A (8/20μs)	182K	200A ((8/20μs)	$\Delta V_{cmA} / V_{cmA} \leq \pm 10\%$
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Impulse Life (II)	<p>The change of Vc shall be measured after the impulse listed below is applied 100,000 times continuously with the interval of 10 seconds at room temperature.</p> <table border="1"> <thead> <tr> <th>Series</th> <th>Resistance Range</th> <th>Current (8/20μs)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">05D Series</td> <td>180L to 680K</td> <td>5A (8/20μs)</td> </tr> <tr> <td>820K to 561K</td> <td>25A ((8/20μs)</td> </tr> <tr> <td rowspan="2">07D Series</td> <td>180L to 680K</td> <td>15A (8/20μs)</td> </tr> <tr> <td>820K to 681K</td> <td>60A ((8/20μs)</td> </tr> <tr> <td rowspan="2">10D Series</td> <td>180L to 680K</td> <td>35A (8/20μs)</td> </tr> <tr> <td>820K to 112K</td> <td>85A ((8/20μs)</td> </tr> <tr> <td rowspan="3">14D Series</td> <td>180L to 680K</td> <td>50A (8/20μs)</td> </tr> <tr> <td>820K to 122K</td> <td>110A ((8/20μs)</td> </tr> <tr> <td>182K</td> <td>80A ((8/20μs)</td> </tr> <tr> <td rowspan="3">20D Series</td> <td>180L to 680K</td> <td>65A (8/20μs)</td> </tr> <tr> <td>820K to 122K</td> <td>120A ((8/20μs)</td> </tr> <tr> <td>182K</td> <td>90A ((8/20μs)</td> </tr> </tbody> </table>	Series	Resistance Range	Current (8/20μs)	05D Series	180L to 680K	5A (8/20μs)	820K to 561K	25A ((8/20μs)	07D Series	180L to 680K	15A (8/20μs)	820K to 681K	60A ((8/20μs)	10D Series	180L to 680K	35A (8/20μs)	820K to 112K	85A ((8/20μs)	14D Series	180L to 680K	50A (8/20μs)	820K to 122K	110A ((8/20μs)	182K	80A ((8/20μs)	20D Series	180L to 680K	65A (8/20μs)	820K to 122K	120A ((8/20μs)	182K	90A ((8/20μs)	$\Delta V_{cmA} / V_{cmA} \leq \pm 10\%$
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Impulse Response Time	Time lag between application of surge and varistor's "turn-on" conduction action.	< 50 nanoseconds																																
Non Linear Exponent (α)	<p>The varistor voltage - current characteristic is defined by the equation <math>I=KV^{\alpha}</math>, where K where K is a constant dependent on geometry, and α is the non linear exponent. We usually take two points (V<sub>1</sub>, I<sub>1</sub>), (V<sub>2</sub>, I<sub>2</sub>) to estimate the value of α.</p> $a = \frac{\log I_1 / I_2}{\log V_1 / V_2}$ <p>In which I<sub>1</sub> and I<sub>2</sub> are the current value corresponding to the voltage value V<sub>1</sub> and V<sub>2</sub>.</p>	<p>03D-25D Voltage α min</p> <table border="1"> <tbody> <tr> <td>180L to 330K</td> <td>18</td> </tr> <tr> <td>390K to 680K</td> <td>20</td> </tr> <tr> <td>820K to 151K</td> <td>30</td> </tr> <tr> <td>181K to 112K</td> <td>40</td> </tr> </tbody> </table>	180L to 330K	18	390K to 680K	20	820K to 151K	30	181K to 112K	40																								
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DC Leakage Current	Maximum current with rated DC voltage applied (Test by 80% of breakdown voltage)	200μA max																																
Current / Energy Derating	Derating of maximum values when operated above 85°C	-2.5% / °C																																

Note: Varistor voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

### Mechanical 機械性能

Characteristics	Test Methods / Description	Specifications								
Robustness of terminations (Tensile)	After gradually applying the force specified below and keeping the unit fixed for ten seconds. The terminal shall be visually examined for any damage. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Terminal diameter</th> <th>Force</th> </tr> </thead> <tbody> <tr> <td>Φ0.6mm</td> <td>9.8N(1.0kgf)</td> </tr> <tr> <td>Φ0.8mm</td> <td>9.8N(1.0kgf)</td> </tr> <tr> <td>Φ1.0mm</td> <td>19.6N(2.0kgf)</td> </tr> </tbody> </table>	Terminal diameter	Force	Φ0.6mm	9.8N(1.0kgf)	Φ0.8mm	9.8N(1.0kgf)	Φ1.0mm	19.6N(2.0kgf)	No outstanding damage.
Terminal diameter	Force									
Φ0.6mm	9.8N(1.0kgf)									
Φ0.8mm	9.8N(1.0kgf)									
Φ1.0mm	19.6N(2.0kgf)									
Robustness of terminations (Bending)	The unit shall be secured with its terminal kept vertical and the force specified below be applied in the axial direction. The terminal shall gradually be bent by 90° in one direction. Then 90° in the opposite direction, and again back to the. The damage of the terminal shall be visually examined. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Terminal diameter</th> <th>Force</th> </tr> </thead> <tbody> <tr> <td>Φ0.6mm</td> <td>4.9N(0.5kgf)</td> </tr> <tr> <td>Φ0.8mm</td> <td>4.9N(0.5kgf)</td> </tr> <tr> <td>Φ1.0mm</td> <td>9.8N(1.0kgf)</td> </tr> </tbody> </table>	Terminal diameter	Force	Φ0.6mm	4.9N(0.5kgf)	Φ0.8mm	4.9N(0.5kgf)	Φ1.0mm	9.8N(1.0kgf)	
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Φ0.8mm	4.9N(0.5kgf)									
Φ1.0mm	9.8N(1.0kgf)									
Vibration	After repeatedly applying a single harmonic vibration (amplitude:0.75mm) double amplitude: 1.5mm with 1 minute vibration frequency cycles (10Hz to 55Hz to 10Hz) to each of three perpendicular directions for 2 hours. Thereafter the unit shall be visually examined.									
Solderability	After dipping the terminals to a depth of approximately 3 mm from the body in a soldering bath of 230±10°C for 2±10 seconds, the terminal shall be visually examined.	Approximately 95% of the terminals shall be covered with solder uniformly.								
Resistance to soldering heat	After each lead shall be dipped into a solder bath having a temperature 260±5°C to a point 2.0 to 2.5mm from the body of the unit and then be held there for specified time (5 series: 5±1s and others: 10±1s) and then be stored at room temperature and humidity for 1 to 2 hours. The change of VC and mechanical damages are examined.	$\Delta V_{cmA} / V_{cmA} \leq \pm 5\%$ No outstanding damage								

### Environmental 耐候性能

Characteristics	Test Methods / Description	Specifications														
High temperature storage / Dry heat	The specimen shall be subjected to 125±2°C for 1,000 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter the change of Vc shall be measured.	$\Delta V_{cmA} / V_{cmA} \leq \pm 5\%$														
Damp heat / Humidity (Steady state)	The specimen shall be subjected to 40±2°C 90 to 95% RH for 1,000 hours without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter the change of Vc shall be measured.															
Temperature cycle	The temperature cycle shown below shall be repeated five times and then stored at room temperature and humidity for 1 to 2 hours. Thereafter the change of Vc and mechanical damage shall be examined. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Setp.</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40±3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>15±3</td> </tr> <tr> <td>3</td> <td>125±2</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>15±3</td> </tr> </tbody> </table>		Setp.	Temperature (°C)	Period (minutes)	1	-40±3	30±3	2	Room temperature	15±3	3	125±2	30±3	4	Room temperature
Setp.	Temperature (°C)	Period (minutes)														
1	-40±3	30±3														
2	Room temperature	15±3														
3	125±2	30±3														
4	Room temperature	15±3														
High temperature load / Dry heat load	After being continuously applied the maximum allowable voltage at 85±2°C for 1,000 hours. The specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter the change of Vc shall be measured.	$\Delta V_{cmA} / V_{cmA} \leq \pm 10\%$														
Damp heat load / Humidity load	The specimen shall be subjected to 40±2°C 90 to 95% RH and the maximum allowable voltage for 1,000 hours and then stored at room temperature and humidity for 1 to 2 hours. Thereafter the change of Vc shall be measured.	$\Delta V_{cmA} / V_{cmA} \leq \pm 10\%$														
Low temperature storage / Cold	The specimen shall be subjected to -40±2°C without load for 1,000 hours and then stored at room temperature for 1 to 2 hours. Thereafter the change of Vc shall be measured.	$\Delta V_{cmA} / V_{cmA} \leq \pm 5\%$														

### 用途 Applications

MODEL NUMBER Φ5mm	MODEL NUMBER Φ7mm	MODEL NUMBER Φ10mm	MODEL NUMBER Φ14mm	MODEL NUMBER Φ20mm	主要用途 Recommended Applications
VCR-05D180L	VCR-07D180L	VCR-10D180L	VCR-14D180L	VCR-20D180L	* Protection of various kinds of semiconductors
VCR-05D220K	VCR-07D220K	VCR-10D220K	VCR-14D220K	VCR-20D220K	* Protection of automobile equipment
VCR-05D270K	VCR-07D270K	VCR-10D270K	VCR-14D270K	VCR-20D270K	* Absorption of switching surge from various kinds of relays and electro-magnetic valves (DC below 48V)
VCR-05D330K	VCR-07D330K	VCR-10D330K	VCR-14D330K	VCR-20D330K	* Protection of electronic equipment from electrostatic discharge
VCR-05D390K	VCR-07D390K	VCR-10D390K	VCR-14D390K	VCR-20D390K	* Cellular phone
VCR-05D470K	VCR-07D470K	VCR-10D470K	VCR-14D470K	VCR-20D470K	* Telephone. Communication line (DC 48V)
VCR-05D560K	VCR-07D560K	VCR-10D560K	VCR-14D560K	VCR-20D560K	
VCR-05D680K	VCR-07D680K	VCR-10D680K	VCR-14D680K	VCR-20D680K	
VCR-05D820K	VCR-07D820K	VCR-10D820K	VCR-14D820K	VCR-20D820K	* AC 100V Line-Line Applications (Japan)
VCR-05D101K	VCR-07D101K	VCR-10D101K	VCR-14D101K	VCR-20D101K	
VCR-05D121K	VCR-07D121K	VCR-10D121K	VCR-14D121K	VCR-20D121K	
VCR-05D151K	VCR-07D151K	VCR-10D151K	VCR-14D151K	VCR-20D151K	
VCR-05D181K	VCR-07D181K	VCR-10D181K	VCR-14D181K	VCR-20D181K	* AC 100V to 120V, Line-Line Applications (Japan., U.S., Canada)
VCR-05D201K	VCR-07D201K	VCR-10D201K	VCR-14D201K	VCR-20D201K	
VCR-05D221K	VCR-07D221K	VCR-10D221K	VCR-14D221K	VCR-20D221K	
VCR-05D241K	VCR-07D241K	VCR-10D241K	VCR-14D241K	VCR-20D241K	* Telephone line application (250V insulation resistance test applicable)
VCR-05D271K	VCR-07D271K	VCR-10D271K	VCR-14D271K	VCR-20D271K	
VCR-05D301K	VCR-07D301K	VCR-10D301K	VCR-14D301K	VCR-20D301K	
VCR-05D331K	VCR-07D331K	VCR-10D331K	VCR-14D331K	VCR-20D331K	* AC200/220V Line-Line Applications
VCR-05D361K	VCR-07D361K	VCR-10D361K	VCR-14D361K	VCR-20D361K	* AC100V to 220V, Line-Ground Applications
VCR-05D391K	VCR-07D391K	VCR-10D391K	VCR-14D391K	VCR-20D391K	* AC 240V Line-Line Applications (U.K., Australia, Middle East Countries)
VCR-05D431K	VCR-07D431K	VCR-10D431K	VCR-14D431K	VCR-20D431K	
VCR-05D471K	VCR-07D471K	VCR-10D471K	VCR-14D471K	VCR-20D471K	
VCR-05D561K	VCR-07D561K	VCR-10D561K	VCR-14D561K	VCR-20D561K	
	VCR-07D621K	VCR-10D621K	VCR-14D621K	VCR-20D621K	
	VCR-07D681K	VCR-10D681K	VCR-14D681K	VCR-20D681K	
		VCR-10D751K	VCR-14D751K	VCR-20D751K	* AC 380V, Line-Line and Line-Ground Applications
		VCR-10D781K	VCR-14D781K	VCR-20D781K	
		VCR-10D821K	VCR-14D821K	VCR-20D821K	
		VCR-10D911K	VCR-14D911K	VCR-20D911K	* AC 415V, Line-Line and Line-Ground Applications
		VCR-10D102K	VCR-14D102K	VCR-20D102K	* AC 480V, Line-Line and Line-Ground Applications
		VCR-10D112K	VCR-14D112K	VCR-20D112K	
			VCR-14D182K	VCR-20D182K	* Line-Ground Applications ( For AC 1200V withstanding test)

### 保險絲配用建議

#### Select of fuse in conformity to VCR Varistor

When conform with Diameter:

P/N	05D Series	07D Series	10D Series	14D Series	20D Series
Fuse rating	1 to 2A	2 to 3A	3 to 5A	3 to 10A	5 to 15A

When conform with Max. Peak current:

Max. Peak Current 8/20μs 1 time(A)	Up to 500	501 to 2000	2001 to 6000
Fuse Rating	3A	5A	10A