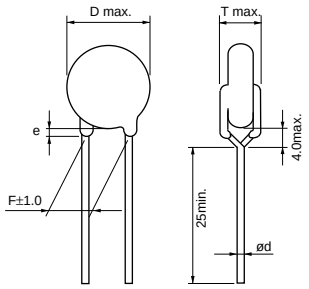
Safety Recognized Ceramic Capacitors

Type KX (Reinforced insulation)-IEC60384-14 Class X1, Y1-

■ Features

1. Operating temperature range guaranteed up to 125 degree(UL/CSA:85deg.).
2. Dielectric strength:AC4000V(r.m.s.)
3. Class X1/Y1 capacitors of UL1414 6th edition and IEC60384-14 2nd edition.
4. The type KX is recognized by UL/CSA/BSI/SEMKO/SEV/ VDE/FIMKO/NEMKO/DEMKO/IMQ.
5. Possible to use with a component in appliance req- uiring reinforced insulation and double insulation based on UL1492, IEC60065 and IEC60950.
6. Coated with flame-retardant epoxy resin (conforming to UL94V-0 standards).
7. Automatic insertion can be, and save costs.

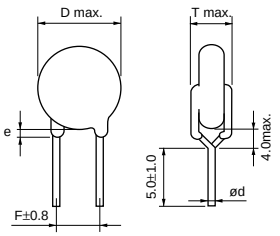
[Bulk]
Vertical Crimp Long (A5)



(in mm)

Lead Code	Coating Extension e	ø d
A5	Up to the end of crimp	$0.6^{+0.1}_{-0.05}$

[Bulk]
Vertical Crimp Short (B5)



(in mm)

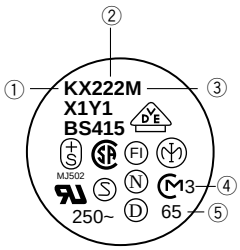
Lead Code	Coating Extension e	ø d
B5	Up to the end of crimp	$0.6^{+0.1}_{-0.05}$

■ Standard Recognition

	Standard No.	Recognized No.		Rated Voltage
		Japan	Taiwan	
UL	UL1414	E37921		AC250V (r.m.s.)
CSA	C22.2 No.1	LR36214	LR44559	
BSI	EN60065 (8.8, 14.2) EN132400	227859		
SEMKO	EN132400	9735046/01-02		
SEV		99, 5 50753		
VDE		89763, 89767	89764, 89768	
FIMKO		196766		
NEMKO		P97102026		
DEMKO		123125/DK 97-02986		
IMQ		V4069		

- The recognition number might change by the revision of the application standard and the change within the range of acquisition.
- Capacitance values less than 100pF are also recognized. Please contact us for details.
- CCEE (Chinese Safety Standard) Safety Standard is also available as special specification. Please contact us for details.

■ Marking

Example	Item	
	① Type Designation	KX
	② Nominal Capacitance (Marked with 3 figures)	
	③ Capacitance Tolerance	
	④ Manufacturer's Identification	*
	⑤ Manufactured Date Code	
	UL Approval Mark	
	CSA Approval Mark	
	BSI Approval Mark	BS415
	SEMKO Approval Mark	
	SEV Approval Mark	
	VDE Approval Mark	
	IMQ Approval Mark	
	FIMKO Approval Mark	
	NEMKO Approval Mark	
	DEMKO Approval Mark	
	Class Code (Except for CSA)	X1Y1
	Rated Voltage Mark	250~

*M3 : Made in Japan. M8 : Made in Taiwan.

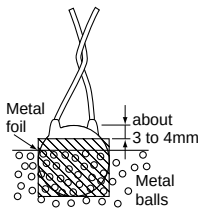
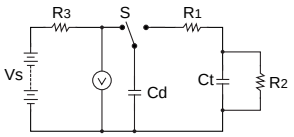
Part Number	AC Rated Voltage (Vac)	Temp. Char.	Capacitance (pF)	Body Dia. D (mm)	Lead Spacing F (mm)	Body Thickness T (mm)	Lead Package Long Bulk	Lead Package Short Bulk	Lead Package Taping (1)
DE1B3KX101K□□□	250	B	100 +10,-10%	9 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1B3KX151K□□□	250	B	150 +10,-10%	9 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1B3KX221K□□□	250	B	220 +10,-10%	9 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1B3KX331K□□□	250	B	330 +10,-10%	9 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1B3KX471K□□□	250	B	470 +10,-10%	9 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1B3KX681K□□□	250	B	680 +10,-10%	10 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1E3KX102M□□□A01	250	E	1000 +20,-20%	8 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1E3KX152M□□□A01	250	E	1500 +20,-20%	9 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1E3KX222M□□□A01	250	E	2200 +20,-20%	10 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1E3KX332M□□□A01	250	E	3300 +20,-20%	12 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1E3KX392M□□□A01	250	E	3900 +20,-20%	13 max.	10.0	8.0 max.	A5B	B5B	N5A
DE1E3KX472M□□□A01	250	E	4700 +20,-20%	15 max.	10.0	8.0 max.	A5B	B5B	N5A

Three blank columns are filled with the lead and packaging codes. Please refer to each code which is shown in the right end.
Murata part numbers might be changed depending on lead code or any other changes.Therefore, please specify only the type name(KX) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

Type KY/KH/KX Specifications and Test Methods

■ Apply to Type KY/KH/KX

Operating Temperature Range : -25 to +125°C (-25 to +85°C in case of the standard of UL / CSA)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specification</th><th>Testing Method</th></tr>
<tr><td>1</td><td colspan="2">Appearance and Dimensions</td><td>No marked defect on appearance form and dimensions are within specified range.</td><td>The capacitor shall be inspected by naked eyes for visible evidence of defect.
Dimensions shall be measured with slide calipers.</td></tr>
<tr><td>2</td><td colspan="2">Marking</td><td>To be easily legible</td><td>The capacitor shall be inspected by naked eyes.</td></tr>
<tr><td>3</td><td colspan="2">Capacitance</td><td>Within specified tolerance.</td><td rowspan="2">The capacitance, dissipation factor and Q shall be measured at 20˚C with 1±0.1kHz(char. SL : 1±0.1MHz) and AC5V (r.m.s.) max.</td></tr>
<tr><td>4</td><td colspan="2">Dissipation Factor (D.F.)
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>B, E</td><td>D.F.≦2.5%</td></tr><tr><td>F</td><td>D.F.≦5.0%</td></tr><tr><td>SL</td><td>Q≧400+20C*1(C＜30pF)
Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>5</td><td colspan="2">Insulation Resistance (I.R.)</td><td>10000MΩ min.</td><td>The insulation resistance shall be measured with DC500±50V within 60±5 s of charging.
The voltage shall be applied to the capacitor through a resistor of 1MΩ.</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Dielectric Strength</td><td>Between Lead Wires</td><td>No failure.</td><td>The capacitor shall not be damage when Test voltage of Table 1 are applied between the lead wires for 60 s.
<Table.1><table><tr><th>Type</th><th>Test voltage</th></tr><tr><td>KY</td><td>In case of lead spacing F=5mm AC2000V (r.m.s.)
In case of lead spacing F=7.5mm AC2600V (r.m.s.)</td></tr><tr><td>KH</td><td>AC2600V (r.m.s.)</td></tr><tr><td>KX</td><td>AC4000V (r.m.s.)</td></tr></table></td></tr>
<tr><td>Body Insulation</td><td>No failure.</td><td>First, the terminals of the capacitor shall be connected together. Then, as shown in Figure right, a metal foil shall be closely wrapped around the body of the capacitor to the distance of about 3 to 4mm from each terminal.
Then,the capacitor shall be inserted into a container filled with metal balls of about 1mm diameter. Finally, AC voltage of Table 2 is applied for 60 s between the capacitor lead wires and metal balls.
 
<Table.2><table><tr><th>Type</th><th>Test voltage</th></tr><tr><td>KY</td><td>AC2600V (r.m.s.)</td></tr><tr><td>KH</td><td>AC2600V (r.m.s.)</td></tr><tr><td>KX</td><td>AC4000V (r.m.s.)</td></tr></table></td></tr>
<tr><td>7</td><td colspan="2">Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within $^{+20}_{-55}$%</td></tr><tr><td>F</td><td>Within $^{+30}_{-80}$%</td></tr></table>Temperature characteristic guarantee is -25 to +85°C
<table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to -1000ppm/°C</td></tr></table>Temperature characteristic guarantee is +20 to +85°C</td><td>The capacitance measurement shall be made at each step specified in Table 3.
<Table.3><table><tr><th>Step</th><th>Temperature (ºC)</th></tr><tr><td>1</td><td>+20±2</td></tr><tr><td>2</td><td>-25±2</td></tr><tr><td>3</td><td>+20±2</td></tr><tr><td>4</td><td>+85±2</td></tr><tr><td>5</td><td>+20±2</td></tr></table></td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Discharge Test (Ⅰ)</td><td>Appearance</td><td>No marked defect.</td><td rowspan="3">As in Figure 1, discharge is made 50 times at 5 s intervals from the capacitor (Cd) charged at DC voltage of specified.
 
Fig.1
Ct: Capacitor under test
Cd: 0.001μF
S: High-voltage switch
R1: 1000Ω
R2: 100MΩ
R3: Surge resistance
Vs: DC10kV</td></tr>
<tr><td>I.R.</td><td>1000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6.</td></tr>
</table>

*1 "C" expresses nominal capacitance value (pF).

Continued on the following page.

Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

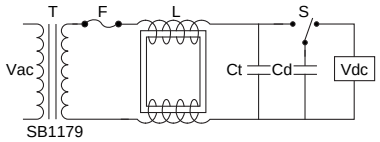
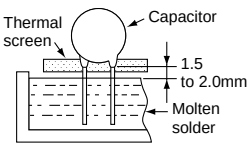
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specification</th><th>Testing Method</th></tr>
<tr><td>9</td><td colspan="2">Discharge Test (II)
[Not apply to Type KY]</td><td>The cheese-cloth around capacitors shall not glow or flame.</td><td>A single layer of cheese-cloth is to be placed around the body of the test capacitor. Each sample is to be subjected to four discharges from a dump capacitor charged to a voltage that, when discharged, placed DC 5kV across the capacitor under test. The interval between successive discharges is to be 5 s. AC240V (r.m.s.), 60Hz potential is to be applied across the capacitor under test and is to be maintained for 30 s after the fourth discharge, unless the circuit is opened in a shorter time by breakdown of the test capacitor.
The direct current supply is to be adjusted to provide a potential in accordance with the following.
$Vdc = \frac{5000\ (Cd+Ct)}{Cd}$ (V)
 

Fig.2
Vdc : Variable direct-current voltage source
S : High-voltage switch
L : Choke coil of approximately 3mH and 0.03Ω
F : Plug fuse rated 30A and 250V
Vac : Supply source rated 240V, 60Hz and 30A
Ct : Capacitor under test
Cd : Dump Capacitor
Capacitance value and D.F. are as follows.
<table><tr><td>Cap. value of Ct</td><td>0 to 0.005μF</td><td>0.0051 to 0.05μF</td></tr><tr><td>Cap. value of Cd</td><td>0.005μF</td><td>0.05μF</td></tr><tr><td>D.F.of Cd</td><td>0.5% max.</td><td>0.5% max.</td></tr></table></td></tr>
<tr><td>10</td><td colspan="2">Solderability of Leads</td><td>Lead wire shall be soldered with uniformly coated on the axial direction over 3/4 of the circumferential direction.</td><td>The lead wire of a capacitor shall be dipped into molten solder of 235±5°C for 2±0.5 s.
The depth of immersion is up to about 1.5 to 2.0mm from the root of lead wires.</td></tr>
<tr><td rowspan="4">11</td><td rowspan="4">Soldering Effect</td><td>Appearance</td><td>No marked defect.</td><td rowspan="4">As in figure,the lead wires shall be immersed solder of 350 ±10°C or 260±5°C up to 1.5 to 2.0mm from the root of terminal for 3.5±0.5 s (10±1 s for 260 ±5°C).
 

Pre-treatment:
Capacitor shall be stored at 85±2°C for 1 h, then placed at *1room condition for 24±2 h before initial measurements.
Post-treatment:
Capacitor shall be stored for 1 to 2 h at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within±10%</td></tr>
<tr><td>I.R.</td><td>1000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6.</td></tr>
<tr><td rowspan="3">12</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No marked defect.</td><td rowspan="3">The capacitor shall firmly be soldered to the supporting lead wire and vibration which is 10 to 55Hz in the vibration frequency range, 1.5mm in total amplitude, and about 1min in the rate of vibration change from 10Hz to 55Hz and back to10Hz is applied for a total of 6 h; 2 h each in 3 mutually perpendicular directions.</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance.</td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>B, E</td><td>D.F.≦2.5%</td></tr><tr><td>F</td><td>D.F.≦5.0%</td></tr><tr><td>SL</td><td>Q≧400+20C*2(C＜30pF)
Q≧1000 (C≧30pF)</td></tr></table></td></tr>
</table>

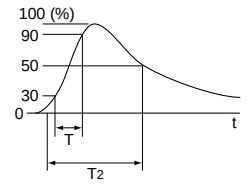
∗1 "room condition" temperature : 15 to 35°C, relative humidity : 45 to 75%, atmospheric pressure : 86 to 106kPa

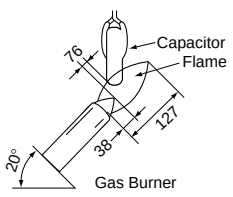
∗2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specification</th><th>Testing Method</th></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Humidity (Under Steady State)</td><td>Appearance</td><td>No marked defect.</td><td rowspan="5">Set the capacitor for 500±12 h at 40±2°C in 90 to 95% relative humidity.
Post-treatment :
Capacitor shall be stored for 1 to 2 h at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within±10%</td></tr><tr><td>E, F</td><td>Within±15%</td></tr><tr><td>SL</td><td>Within± 5%</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>B, E</td><td>D.F.≦5.0%</td></tr><tr><td>F</td><td>D.F.≦7.5%</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2(C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6.</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Humidity Loading</td><td>Appearance</td><td>No marked defect.</td><td rowspan="5">Apply the rated voltage for 500±12 h at 40±2°C, in 90 to 95% relative humidity.
Post-treatment:
Capacitor shall be stored for 1 to 2 h at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within±10%</td></tr><tr><td>E, F</td><td>Within±15%</td></tr><tr><td>SL</td><td>Within± 5%</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>B, E</td><td>D.F.≦5.0%</td></tr><tr><td>F</td><td>D.F.≦7.5%</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2(C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6.</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Life</td><td>Appearance</td><td>No marked defect.</td><td rowspan="5">Impulse Voltage
Each individual capacitor shall be subjected to a 5kV (Type KX: 8kV) impulses for three times. After the capacitors are applied to life test.
 

T1=1.2µs=1.67T
T2=50µs
Apply a voltage of table 4 for 1000 h at 125+2/-0°C, and relative humidity of 50% max..
<Table.4>
<table><tr><th>Applied voltage</th></tr><tr><td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1 s.</td></tr></table>
Post-treatment:
Capacitor shall be stored for 1 to 2 h at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within±20%</td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6.</td></tr>
<tr><td>Discharge Test (II) [Not apply to Type KY]</td><td>Per Item 9.</td></tr>
<tr><td>16</td><td colspan="2">Flame Test</td><td>The capacitor flame discontinue as follows.
<table><tr><th>Cycle</th><th>Time</th></tr><tr><td>1 to 4</td><td>30 s max.</td></tr><tr><td>5</td><td>60 s max.</td></tr></table></td><td>The capacitor shall be subjected to applied flame for 15 s and then removed for 15 s until 5 cycle.
 

(in mm)</td></tr>
</table>

*1 "room condition" temperature : 15 to 35°C, relative humidity : 45 to 75%, atmospheric pressure : 86 to 106kPa

*2 "C" expresses nominal capacitance value (pF).

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Type KY/KH/KX Specifications and Test Methods

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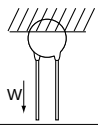
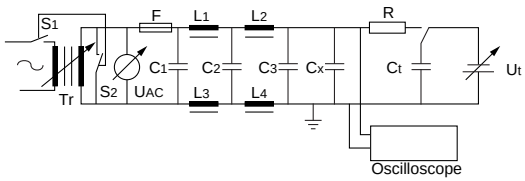
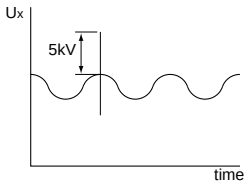
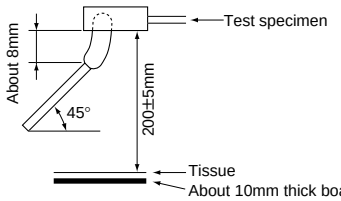
No.	Item		Specification	Testing Method
17	Robustness of terminations	Tensile	Lead wire shall not cut off. Capacitor shall not be broken.	As a figure, fix the body of capacitor, apply a tensile weight gradually to each lead wire in the radial direction of capacitor up to 10N and keep it for 10±1 s. 
		Bending		Each lead wire shall be subjected to 5N weight and then a 90° bend, at the point of egress, in one direction, return to original position, and then a 90° bend in the opposite direction at the rate of one bend in 2 to 3 s.
18	Active Flammability		The cheese-cloth shall not be on fire.	The capacitor shall be individually wrapped in at least one but more than two complete layers of cheese-cloth.The capacitor shall be subjected to 20 discharges. The interval between successive discharges shall be 5 s. The U_{AC} shall be maintained for 2 min after the last discharge.  $C_{1,2}$: 1µF±10% C_3 : 0.033µF±5% 10kV C_t : 3µF±5% 10kV C_x : Capacitor under test F : Fuse, Rated 10A $L_{1\ to\ 4}$: 1.5mH±20% 16A Rod core choke R : 100Ω±2% U_{AC} : U_R±5% U_R : Rated Voltage U_t : Voltage applied to C_t 
19	Passive Flammability		The burning time shall not be exceeded the time 30 s. The tissue paper shall not ignite.	The capacitor under test shall be held in the flame in the position which best promotes burning. Each specimen shall only be exposed once to the flame. Time of exposure to flame: 30 s. Length of flame : 12±1mm Gas burner : Length 35mm min. Inside Dia. : 0.5±0.1mm Outside Dia. : 0.9mm max. Gas : Butane gas Purity 95% min. 

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Type KY/KH/KX Specifications and Test Methods

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<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specification</th><th>Testing Method</th></tr>
<tr><td rowspan="5">20</td><td rowspan="5">Temperature and Immersion Cycle</td><td>Appearance</td><td>No marked defect.</td><td rowspan="5">The capacitor shall be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.

<Temperature cycle>
<table><tr><th>Step</th><th>Temperature (ºC)</th><th>Time</th></tr><tr><td>1</td><td>-25+0/-3</td><td>30 min</td></tr><tr><td>2</td><td>Room temp.</td><td>3 min</td></tr><tr><td>3</td><td>+125+3/-0</td><td>30 min</td></tr><tr><td>4</td><td>Room temp.</td><td>3 min</td></tr></table>Cycle time : 5 cycle

<Immersion cycle>
<table><tr><th>Step</th><th>Temperature (ºC)</th><th>Time</th><th>Immersion water</th></tr><tr><td>1</td><td>+65+5/-0</td><td>15 min</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15 min</td><td>Salt water</td></tr></table>Cycle time : 2 cycle
Pre-treatment :
Capacitor shall be stored at 85±2˚C for 1 h, then placed at *1room condition for 24±2 h.
Post-treatment :
Capacitor shall be stored for 24±2 h at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within±10%</td></tr><tr><td>E, F</td><td>Within±20%</td></tr><tr><td>SL</td><td>Within± 5%</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>B, E</td><td>D.F.≦5.0%</td></tr><tr><td>F</td><td>D.F.≦7.5%</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2(C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>3000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>Per Item 6.</td></tr>
</table>

∗1 "room condition" temperature : 15 to 35°C, relative humidity : 45 to 75%, atmospheric pressure : 86 to 106kPa

∗2 "C" expresses nominal capacitance value (pF).