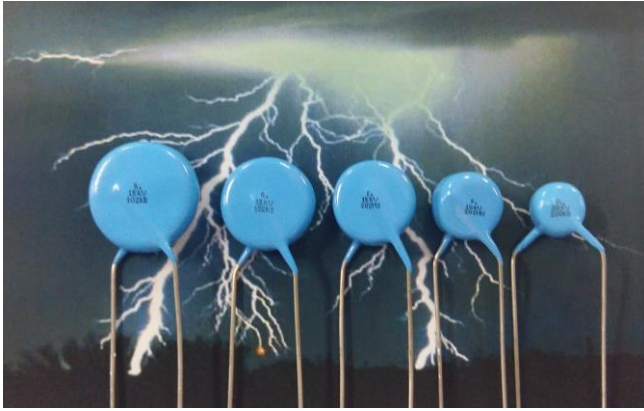


# Ultra High Voltage (UHV) Ceramic Capacitor



## Introduction

SAMWHA UHV (Ultra High Voltage) Ceramic Capacitor series uses the line up ceramic technology for long life and high reliability in application such as SMPS (X-ray equipment, TV and monitors, DC pulse high voltage) for power electronics.

Various disc types cover a wide range of capacitances and voltages as shown in the following table. Specific properties depend on the dielectric material used. Please consult with SAMWHA for special requirements

## Features

- Wide rated voltage range, wide nominal capacitance range
- Flame-retardant insulating coating applied

## Applications

- Filter circuit of high voltage power
- High voltage circuit of TV set and monitor
- High voltage circuit of various electronic equipment's
- X-Ray equipment, Medical, Display, Industry etc.
- DC Pulse High Voltage

## How to Order (Product Identification)

**EK**    **B**    **4C**    **102**    **K**    **17**    **D**    **S**    **2**  
 |        |        |        |        |        |        |        |  
**1**    **2**    **3**    **4**    **5**    **6**    **7**    **8**    **9**

### 1 Type & Class

EK : High Dielectric Type (Class II)

EC : Temperature Compensating Type (Class I)

### 2 Temperature Characteristics

Temp. Char.	Operating Temp.	Temp. Range (TCC)	Change Rate ( $\Delta C$ )
B (Y5P)	-25°C ~ +85°C	-25°C ~ +85°C	-10% ~ +10%
E (Y5U)	-25°C ~ +85°C	-25°C ~ +85°C	-56% ~ +22%
F (Y5V)	-25°C ~ +85°C	-25°C ~ +85°C	-82% ~ +22%
R (Y5R)	-25°C ~ +85°C	-25°C ~ +85°C	-15% ~ +15%
O (SL)	-25°C ~ +85°C	+20°C ~ +85°C	-1000 ~ +350ppm
N (N4700)	-25°C ~ +85°C	+20°C ~ +85°C	-4700 $\pm$ 1000ppm

### 3 Rating Voltage

Code	Rating Voltage (R.V)	Testing Voltage (In Silicon Oil)
4A	10 kV	R.V x 150%
4C	15 kV	R.V x 150%
4D	20 kV	R.V x 130%
4E	30 kV	R.V x 130%

### 4 Capacitance

In Pico farads. The first two digits indicate significant digits. The 3<sup>rd</sup> digits indicate the number of zero following. For example :220 = 22pF, 221 = 220pF, 222 = 2200pF

# Ultra High Voltage (UHV) Ceramic Capacitor



## 5 Tolerance

Mark	K	M	Z
Cap Tolerance	±10%	±20%	-20% ~ +80%

## 6 Disc Diameter

Code	10	11	12	13	14	15	16	17	18	19	20	22	23
Max Dia. (Ømm)	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	22.5	23.5

## 7 Packing Style & Lead Variation

Packing Style		Lead Variation	
B	Bulk	S	Straight Long Type
		W	Kink Short Type
		N	Straight Short Type

Packing Style		Lead Variation	
D	Double Kink	S	Straight Long Type

## 8 Lead Spacing & Pitch of Components

Bulk Type	
Code	Lead Spacing (mm)
1	10.0
2	12.5
3	15.0

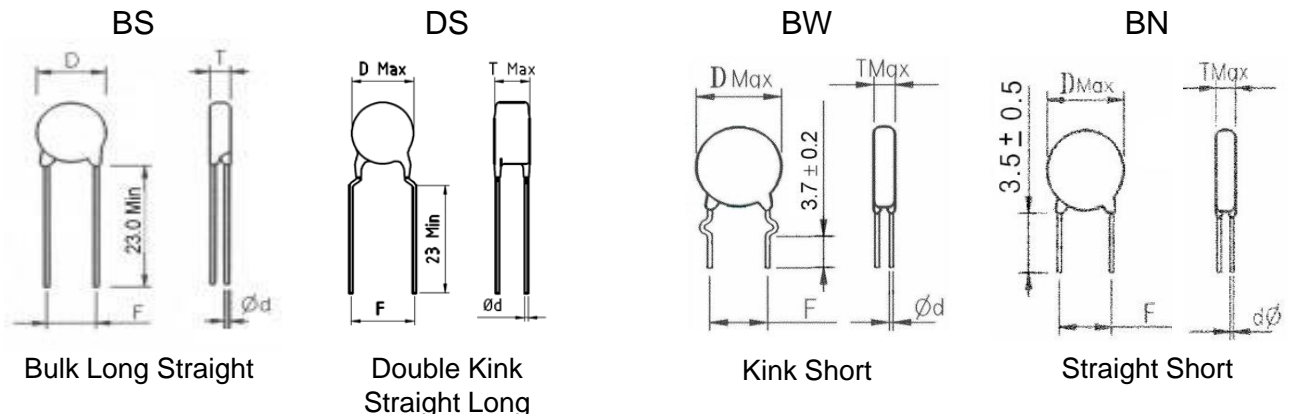
## Typical Performance Characteristics

Char.	B (Y5P)	E (Y5U)	F (Y5V)	R (Y5R)	O (SL)	N (4700)
Temp. Range (TCC)	-25°C~ +85°C	-25°C~ +85°C	-25°C~ +85°C	-25°C~ +85°C	+20°C ~ +85°C	+20°C ~ +85°C
Temperature Coefficient	-10% ~ +10%	-56% ~ +22%	-82% ~ +22%	-15% ~ +15%	-1000 ~ +350ppm	-4700 ± 1000ppm
Dissipation Factor	tg δ ≤ 2.5%	tg δ ≤ 3.5%	tg δ ≤ 3.5%	tg δ ≤ 0.2%	C<30pF, Q≥400+20C C≥30pF, Q≥1000	tg δ ≤ 1.0%
Insulation Resistance	Charge at 500VDC for 60 seconds, R≥10000 MΩ					
Rated Voltage (RV)	10 ~ 15kVdc	10 ~ 30kVdc	10 ~ 15kVdc	10 ~ 15kVdc	10 ~ 20kVdc	10 ~ 20kVdc

## PACKING STYLE

Long Type

Short Type



# Ultra High Voltage (UHV) Ceramic Capacitor



10kVDC

TCC	Cap.	TOL.	D	T	F	WIRE SIZE ORDERING	Size code
	(pF)	(%)	Dmax (mm)	Tmax (mm)	mm	mm	
B(Y5P) -25~85°C ±10%	100	±10%	10.5	8.5	10±2.0	0.80±0.05	10
	150	±10%	10.5	8.5	10±2.0	0.80±0.05	10
	220	±10%	10.5	8.5	10±2.0	0.80±0.05	10
	270	±10%	11.5	8.5	10±2.0	0.80±0.05	11
	330	±10%	12.5	8.5	10±2.0	0.80±0.05	12
	470	±10%	14.5	8.5	10±2.0	0.80±0.05	14
	560	±10%	14.5	8.5	10±2.0	0.80±0.05	14
	680	±10%	14.5	8.5	10±2.0	0.80±0.05	14
	1000	±10%	16.5	8.5	10±2.0	0.80±0.05	16
	2000	±20%	18.5	8.5	10±2.0	0.80±0.05	18
	2200	±20%	18.5	8.5	10±2.0	0.80±0.05	18
E(Y5U) -25~85°C +22~-56%	1000	±20%	11.5	9.0	10±2.0	0.80±0.05	11
	2000	±20%	14.5	9.0	10±2.0	0.80±0.05	14
	2200	±20%	15.5	9.0	10±2.0	0.80±0.05	15
	3300	±20%	20.5	9.0	10±2.0	0.80±0.05	20
	4700	±20%	22.5	9.0	10±2.0	0.80±0.05	22
F(Y5V) -25~85°C +22~-82%	1000	±20%	10.5	9.0	10±2.0	0.80±0.05	10
	2000	±20%	12.5	9.0	10±2.0	0.80±0.05	12
	2200	±20%	13.5	9.0	10±2.0	0.80±0.05	13
	3300	±20%	15.5	9.0	10±2.0	0.80±0.05	15
	4700	±20%	18.5	9.0	10±2.0	0.80±0.05	18
	1000	+80~-20%	10.5	9.0	10±2.0	0.80±0.05	10
	2000	+80~-20%	12.5	9.0	10±2.0	0.80±0.05	12
	2200	+80~-20%	13.5	9.0	10±2.0	0.80±0.05	13
	3300	+80~-20%	15.5	9.0	10±2.0	0.80±0.05	15
	4700	+80~-20%	18.5	9.0	10±2.0	0.80±0.05	18
SL +20~85°C +350~-1000ppm	10	±10%	9.5	8.5	10±2.0	0.80±0.05	9
	15	±10%	9.5	8.5	10±2.0	0.80±0.05	9
	20	±10%	9.5	8.5	10±2.0	0.80±0.05	9
	22	±10%	10.5	8.5	10±2.0	0.80±0.05	10
	27	±10%	10.5	8.5	10±2.0	0.80±0.05	10
	33	±10%	11.5	8.5	10±2.0	0.80±0.05	11
	47	±10%	12.5	8.5	10±2.0	0.80±0.05	12
	56	±10%	13.5	8.5	10±2.0	0.80±0.05	13
	68	±10%	14.5	8.5	10±2.0	0.80±0.05	14
	82	±10%	16.5	8.5	10±2.0	0.80±0.05	16
	100	±10%	18.5	8.5	10±2.0	0.80±0.05	18
R(Y5R) -25~85°C ±15%	100	±10%	9.5	8.5	10±2.0	0.80±0.05	9
	150	±10%	9.5	8.5	10±2.0	0.80±0.05	9
	220	±10%	10.5	8.5	10±2.0	0.80±0.05	10
	330	±10%	12.5	8.5	10±2.0	0.80±0.05	12
	470	±10%	14.5	8.5	10±2.0	0.80±0.05	14
	680	±10%	14.5	8.5	10±2.0	0.80±0.05	14
	1000	±10%	17.5	8.5	10±2.0	0.80±0.05	17
N (N4700) +20~85°C 4700±1000	100	±10%	8.5	7.0	10±2.0	0.80±0.05	8
	150	±10%	8.5	7.0	10±2.0	0.80±0.05	8
	220	±10%	9.5	7.0	10±2.0	0.80±0.05	9
	330	±10%	10.5	7.0	10±2.0	0.80±0.05	10
	470	±10%	12.5	7.0	10±2.0	0.80±0.05	12
	680	±10%	13.5	7.0	10±2.0	0.80±0.05	13
	1000	±10%	16.5	7.0	10±2.0	0.80±0.05	16

# Ultra High Voltage (UHV) Ceramic Capacitor



15kVDC

TCC	Cap.	TOL.	D	T	F	WIRE SIZE ORDERING	Size code
	(pF)	(%)	Dmax (mm)	Tmax (mm)	mm	mm	
B(Y5P) -25~85°C ±10%	100	±10%	10.5	10.0	12.5±2.0	0.80±0.05	10
	150	±10%	10.5	10.0	12.5±2.0	0.80±0.05	10
	220	±10%	11.5	10.0	12.5±2.0	0.80±0.05	11
	270	±10%	11.5	10.0	12.5±2.0	0.80±0.05	11
	330	±10%	12.5	10.0	12.5±2.0	0.80±0.05	12
	470	±10%	14.5	10.0	12.5±2.0	0.80±0.05	14
	560	±10%	14.5	10.0	12.5±2.0	0.80±0.05	14
	680	±10%	17.5	10.0	12.5±2.0	0.80±0.05	17
	1000	±10%	18.5	10.0	12.5±2.0	0.80±0.05	18
E(Y5U) -25~85°C +22~-56%	1000	±20%	11.5/15.5	10.0	12.5±2.0	0.80±0.05	11/15
	2000	±20%	15.5	10.0	12.5±2.0	0.80±0.05	15
	2200	±20%	16.5	10.0	12.5±2.0	0.80±0.05	16
	2400	±20%	17.5	10.0	12.5±2.0	0.80±0.05	17
	3300	±20%	20.5	10.0	12.5±2.0	0.80±0.05	20
	4700	±20%	23.5	10.0	12.5±2.0	0.80±0.05	23
Y5V -25~85°C +22~-82%	1000	±20%	11.5	10.0	12.5±2.0	0.80±0.05	11
	2000	±20%	14.5	10.0	12.5±2.0	0.80±0.05	14
	2200	±20%	16.5	10.0	12.5±2.0	0.80±0.05	16
	3300	±20%	17.5	10.0	12.5±2.0	0.80±0.05	17
	4700	±20%	20.5	10.0	12.5±2.0	0.80±0.05	20
	1000	+80~-20%	11.5	10.0	12.5±2.0	0.80±0.05	11
	2000	+80~-20%	14.5	10.0	12.5±2.0	0.80±0.05	14
	2200	+80~-20%	16.5	10.0	12.5±2.0	0.80±0.05	16
	3300	+80~-20%	17.5	10.0	12.5±2.0	0.80±0.05	17
	4700	+80~-20%	20.5	10.0	12.5±2.0	0.80±0.05	20
SL +20~85°C +350~-1000ppm	12	±10%	10.5	9.0	12.5±2.0	0.80±0.05	10
	15	±10%	10.5	9.0	12.5±2.0	0.80±0.05	10
	20	±10%	10.5	9.0	12.5±2.0	0.80±0.05	10
	22	±10%	10.5	9.0	12.5±2.0	0.80±0.05	10
	27	±10%	11.5	9.0	12.5±2.0	0.80±0.05	11
	33	±10%	12.5	9.0	12.5±2.0	0.80±0.05	12
	47	±10%	13.5	9.0	12.5±2.0	0.80±0.05	13
	56	±10%	14.5	9.0	12.5±2.0	0.80±0.05	14
	68	±10%	16.5	9.0	12.5±2.0	0.80±0.05	16
	82	±10%	17.5	9.0	12.5±2.0	0.80±0.05	17
R(Y5R) -25~85°C ±15%	100	±10%	10.5	9.0	12.5±2.0	0.80±0.05	10
	150	±10%	10.5	9.0	12.5±2.0	0.80±0.05	10
	220	±10%	11.5	9.0	12.5±2.0	0.80±0.05	11
	330	±10%	14.5	9.0	12.5±2.0	0.80±0.05	14
	470	±10%	14.5	9.0	12.5±2.0	0.80±0.05	14
	680	±10%	17.5	9.0	12.5±2.0	0.80±0.05	17
	1000	±20%	20.5 / 24.5	9.0	12.5±2.0	0.80±0.05	20 / 24
N (N4700) +20~85°C 4700±1000	82	±10%	8.5	9.0	10.0±2.0	0.80±0.05	8
	100	±10%	8.5	9.0	10.0±2.0	0.80±0.05	8
	150	±10%	9.5	9.0	10.0±2.0	0.80±0.05	9
	220	±10%	12.5	9.0	10.0±2.0	0.80±0.05	12
	330	±10%	14.5	9.0	10.0±2.0	0.80±0.05	14
	470	±10%	15.5	9.0	10.0±2.0	0.80±0.05	15
	680	±10%	15.5	9.0	10.0±2.0	0.80±0.05	15
	1000	±10%	18.5/21.5	10.0	12.5±2.0	0.80±0.05	18/21
	2200	±10%	22.5	10.0	12.5±2.0	0.80±0.05	22

# Ultra High Voltage (UHV) Ceramic Capacitor



## 20kVDC

TCC	Cap.	TOL.	D	T	F	WIRE SIZE ORDERING	Size Code
	(pF)	(%)	Dmax (mm)	Tmax (mm)	mm	mm	
E(Y5U) -25~85°C +22~-56%	2200	±20%	19.5	10.0	15±2.0	0.80±0.05	19
SL +20~85°C +350~-1000ppm	15	±10%	12.5	10.0	15±2.0	0.80±0.05	12
	20	±10%	12.5	10.0	15±2.0	0.80±0.05	12
	22	±10%	12.5	10.0	15±2.0	0.80±0.05	12
	27	±10%	12.5	10.0	15±2.0	0.80±0.05	12
	33	±10%	13.5	10.0	15±2.0	0.80±0.05	13
	47	±10%	13.5	10.0	15±2.0	0.80±0.05	13
	56	±10%	15.5	10.0	15±2.0	0.80±0.05	15
	68	±10%	17.5	10.0	15±2.0	0.80±0.05	17
N (N4700) +20~85°C 4700±1000	330	±10%	14.5	10.0	15±2.0	0.80±0.05	14
	1000	±10%	21.5	10.0	15±2.0	0.80±0.05	21

## 30kVDC

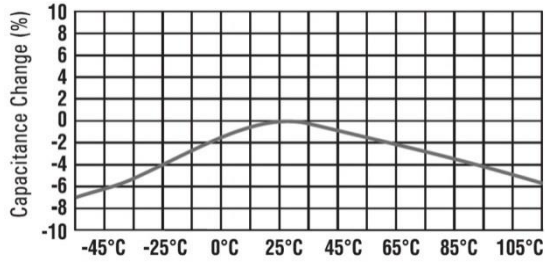
TCC	Cap.	TOL.	D	T	F	WIRE SIZE ORDERING	Size Code
	(pF)	(%)	Dmax (mm)	Tmax (mm)	mm	mm	
E(Y5U) -25~85°C +22~-56%	2000	±10%	20.5	12.0	15±2.0	0.80±0.05	20
	2200	±10%	20.5	12.0	15±2.0	0.80±0.05	20

# Ultra High Voltage (UHV) Ceramic Capacitor

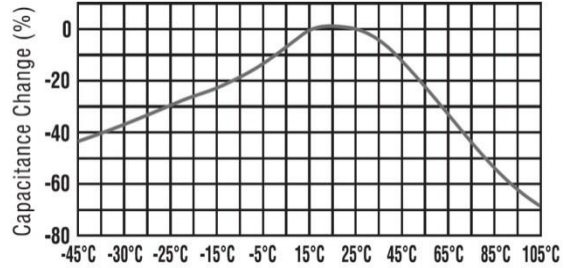


## TYPICAL CHARACTERISTICS GRAPH

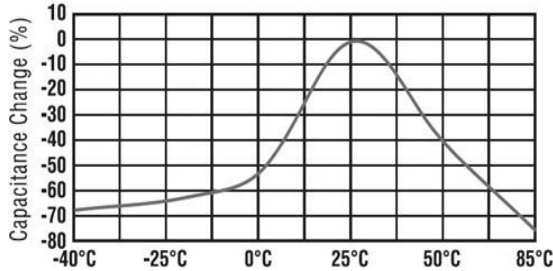
Temperature Characteristics Curve – B(Y5P)



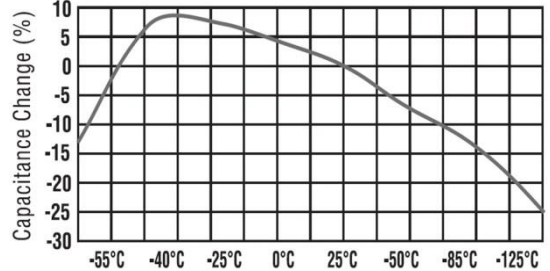
Temperature Characteristics Curve – E(Y5U)



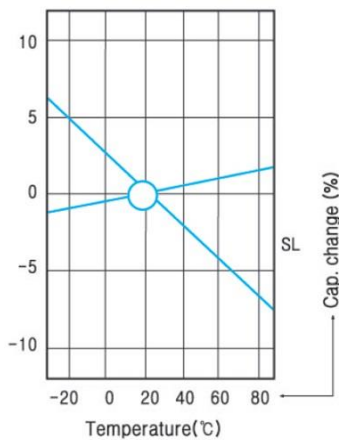
Temperature Characteristics Curve – F(Y5V)



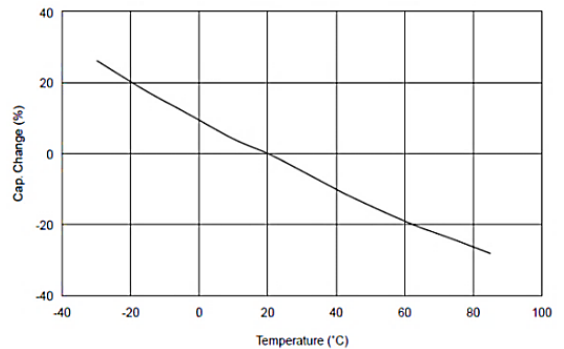
Temperature Characteristics Curve – R(Y5R)



Temperature Characteristics Curve – O(SL)



Temperature Characteristics Curve – N(N4700)



# Ultra High Voltage (UHV) Ceramic Capacitor



## ⚠ Caution / Notice

### ⚠ Caution (Rating)

#### 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the  $V_{p-p}$  value of the applied voltage or the  $V_{o-p}$  which contains DC bias within the rated voltage range. When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

Voltage	DC Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage (1)	Pulse Voltage (2)
Positional Measurement					

#### 2. Operating Temperature and Self-generated Heat

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high frequency current, pulse current or similar current, it may self-generate heat due to dielectric loss. The applied voltage load should be such that the capacitor's self-generated heat is within  $10^{\circ}\text{C}$  at an atmosphere temperature of  $25^{\circ}\text{C}$ . When measuring, use a thermocouple of small thermal capacity-K of  $\varnothing 0.1\text{mm}$  in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

# Ultra High Voltage (UHV) Ceramic Capacitor



## Caution / Notice

### Caution (Storage and Operation Condition)

#### Operating and Storage Environment

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture.

The capacitor is designed to be used in insulating media, such as epoxy resin, silicone oil, etc.

There must be 3mm or more of insulating media for each direction of the capacitor.

Before cleaning, bonding, or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed -10 to 40 degrees centigrade and 15 to 85%. Use capacitors within 6 months after delivered.

**FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.**

### Caution (Soldering and Mounting)

#### 1. Vibration and Impact

Do not expose a capacitor or its leads to excessive shock or vibration during use.

#### 2. Soldering

When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specification of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.

When soldering capacitor with a soldering iron, it should be performed in following conditions.

Temperature of iron-tip: 400 degrees C. max.

Soldering iron wattage : 50W max.

Soldering time : 3.5 sec. max.

**FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.**

### Caution (Handling)

#### Vibration and Impact

Do not expose a capacitor or its leads to excessive shock or vibration during use.

**FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.**

### Notice (Soldering and Mounting)

#### Cleaning (ultrasonic cleaning)

To perform ultrasonic cleaning conditions.

Rinse bath capacity: Output of less.

Rinsing time: 5 min. maximum.

Do not vibrate the PCB/PWB directly.

Excessive ultrasonic cleaning may destruction of the lead wires.

### Notice (Rating)

#### Capacitance Change of Capacitor

##### 1. Class 1 Capacitors

Capacitance might change a little depending on the surrounding temperature or an applied voltage.

Please contact us if you intend to use this product in a strict time constant circuit.

##### 2. Class 2 Capacitors

Class 2 capacitors with temperature characteristics B, E and F have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time.

Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage.

So, it is not likely to be suitable for use in a time constant circuit.