

# Ceramic Type

## Introduction

SAMWHA disc ceramic capacitors are designed and produced to offer the user capacitors with high reliability and small size.

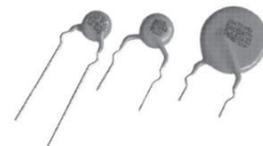
With wide selection of temperature characteristics and voltage ratings, the user can make use for in various circuit application.

※ Special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representative

## How to Order

**EK R 3A 101 K 09 F K 5**

1 2 3 4 5 6 7 8 9



### 1 Style & Class

Mark	Product Name	Mark	Product Name
EC	Temperature Compensating Type	SD	AC250/400V(Testing Voltage : AC4000V)
EK	High Dielectric Type	SC	AC250(Testing Voltage : AC2500V)

### 2 Temp. Char.

EC Type (PPM/°C)		EK, SC, SD	
C	NPO (0± 60)	B	Y5P (+10%~-10%)
O	SL (+350 ~ -1000)	R	Y5R (+15%~-15%)
N	N4700 (-4700± 1000)	E	Y5U (+22%~-56%)
		F	Y5V (+22%~-82%)

### 3 Rating Voltage

DC Class				AC Class	
Code	Rating Voltage	Code	Rating Voltage	Code	Rating Voltage
3A	1kV	4A	10kV	2E	250V
3D	2kV	4B	12kV	2G	400V
3F	3.15kV	4C	15kV		
3J	6.3kV	4D	20kV		

## 4 Capacitance

(in picofarads) The first two digits indicate significant digits. The 3rd digit indicate the number of zero following. R denotes decimal.

Ex.) 100 =  $10 \times 10^0 = 10\text{pF}$

102 =  $10 \times 10^2 = 1000\text{pF}$

## 5 Cap. Tolerance

Mark	Cap. Tolerance	Mark	Cap. Tolerance
J	±5%	M	±20%
K	±10%	Z	-20%~+80%

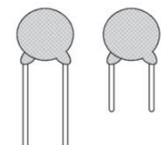
## 6 Disc Diameter

Code	Dia(Ømm)								
06	6.3	09	9.0	12	12.5	15	15.0	18	18.0
07	7.0	10	10.0	13	13.0	16	16.0	19	19.0
08	8.0	11	11.0	14	14.0	17	17.0	20	20.0

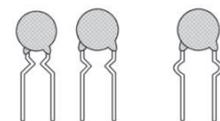
## 7 Packing Style

## 8 Lead Variation

	Packing Style	Lead Variation
F	Taping Type Flat Pack	F Out-Kink type
		K In-Kink type
		S Straight type
		R / A Parallel type
B	Bulk	W / L Out-Kink Short type
		K Out-Kink Long type
		N Straight Short type
		S Straight Long type
		J Parallel Short type
		R Parallel Long Type



Straight Type



In-kink Out-kink

Forming(Kink) Type

## 9 Lead Spacing & Pitch of Component

Taping Type			Bulk Type	
Code	Lead Spacing(mm)	Pitch of Component(mm)	Code	Lead Spacing(mm)
5	5.0	12.7	5	5.0
7	7.5	15.0	7	7.5
8	7.5	30.0	1	10.0
9	7.5	25.4		
1	10.0	25.4/15.0		
2/3	10.0	30.0		

# CLASS || High Dielectric Constant Ceramic Capacitors

## Specification

Temp. Range : -25 ~ +85°C (Y class)

Capacitance : Measured at 1kHz, 1 Vrms and 20°C ± 2°C

### Testing Voltage

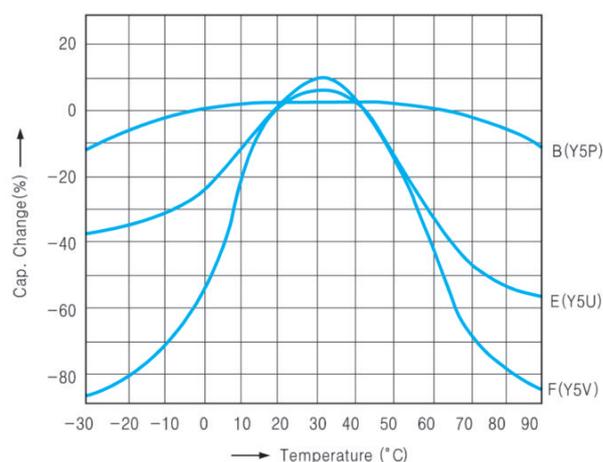
R.V	1 ~ 2kV DC	3kV DC	4 ~ kV DC
T.V	R.V x 2	R.V x 1.75	R.V x 1.5

Insulation Resistance : Min 10,000MΩ at 500 V DC for 1minute

### Dissipation Factor(tanδ)

T.C	B	E	F
tanδ	2.5%	2.5%	5.0%

## Temp. Char.



## DC High Voltage Ceramic Capacitors

### High Voltage Ceramic Capacitor (Epoxy Coated Ceramic Capacitor)

T.C R.V	Capacitance(μF)			Dimensions(mm)				Part No. (How to order)	Marking
	Y5P(B)	Y5U(E)	Y5V(F)	Dmax	Tmax	F ± 1.0	Ød ± 0.05		
1KV DC	100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680	1000	1000, 2200	6.3	5.0	5.0	0.50	EKΔ3AΔΔΔΔ06ΔΔΔ	B 101K 1KV 6.3≤D≤9.0
	820, 1000, 1200, 1500		4700	8.0	5.0	5.0	0.50	EKΔ3AΔΔΔΔ08ΔΔΔ	
	1800, 2200	2200	10000	10.0	5.0	5.0(7.5)	0.50(0.60)	EKΔ3AΔΔΔΔ10ΔΔΔ	B 222K 1KV SWC D≥10.0
	2700, 3300	4700		12.5	5.0	5.0(7.5)	0.50(0.60)	EKΔ3AΔΔΔΔ12ΔΔΔ	
			22000	13.0	5.0	7.5(10.0)	0.60	EKΔ3AΔΔΔΔ13ΔΔΔ	
	3900, 4700	10000		14.0	5.0	7.5(10.0)	0.60	EKΔ3AΔΔΔΔ14ΔΔΔ	
5600, 6800			16.0	5.0	7.5(10.0)	0.60	EKΔ3AΔΔΔΔ16ΔΔΔ		
2KV DC	100, 120, 150, 180, 220, 270, 330, 390, 470, 560		1000, 2200	6.3	5.0	5.0	0.50	EKΔ3DΔΔΔΔ06ΔΔΔ	B 101K 2KV 6.3≤D≤9.0
	680, 820, 1000	1000, 2200		8.0	5.0	7.5	0.60	EKΔ3DΔΔΔΔ08ΔΔΔ	
	1200, 1500	4700	4700	10.0	5.0	5.0(7.5)	0.50(0.60)	EKΔ3DΔΔΔΔ10ΔΔΔ	B 222K 2KV SWC D≥10.0
	1800, 2200, 2700		6800, 10000	12.5	5.0	7.5(10.0)	0.60	EKΔ3DΔΔΔΔ12ΔΔΔ	
	3300, 3900			14.0	5.0	7.5(10.0)	0.60	EKΔ3DΔΔΔΔ14ΔΔΔ	
	4700	10000		16.0	5.0	7.5(10.0)	0.60	EKΔ3DΔΔΔΔ16ΔΔΔ	
	5600			18.0	5.0	7.5(10.0)	0.60	EKΔ3DΔΔΔΔ18ΔΔΔ	
	6800			20.0	5.0	7.5(10.0)	0.60	EKΔ3DΔΔΔΔ20ΔΔΔ	

## DC High Voltage Ceramic Capacitors

### High Voltage Ceramic Capacitors(Epoxy Coated Ceramic Capacitors)

T.C R.V	Capacitance( $\mu$ F)			Dimensions(mm)				Part No. (How to order)	Marking	
	Y5P(B)	Y5U(E)	Y5V(F)	Dmax	Tmax	F $\pm$ 1.0	$\varnothing$ d $\pm$ 0.05			
3.15KV DC	100, 120, 150, 180, 220, 270, 330, 390, 470, 560	1000		8.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 08 $\Delta\Delta\Delta$	 6.3 $\leq$ D $\leq$ 9.0	
	680	1500		10.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 10 $\Delta\Delta\Delta$		
				11.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 11 $\Delta\Delta\Delta$		
	820, 1000	2200	4700	12.5	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 12 $\Delta\Delta\Delta$		
			6800	13.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 13 $\Delta\Delta\Delta$		
	1200, 1500	3300, 4700	10000	14.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 14 $\Delta\Delta\Delta$		 D $\geq$ 10.0
	1800, 2200			15.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 15 $\Delta\Delta\Delta$		
	2700			16.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 16 $\Delta\Delta\Delta$		
3300			16.0	6.0	7.5(10.0)	0.60	EK $\Delta$ 3F $\Delta\Delta\Delta\Delta$ 18 $\Delta\Delta\Delta$			
6.3KV DC	100, 120, 150, 180, 220, 330, 470	1000	1000	8.0	7.0	10.0	0.60	EK $\Delta$ 3J $\Delta\Delta\Delta\Delta$ 08 $\Delta\Delta\Delta$	 6.3 $\leq$ D $\leq$ 9.0	
		1500		9.0	7.0	10.0	0.60	EK $\Delta$ 3J $\Delta\Delta\Delta\Delta$ 09 $\Delta\Delta\Delta$		
	1000	2200	2200, 4700	12.5	7.0	10.0	0.60	EK $\Delta$ 3J $\Delta\Delta\Delta\Delta$ 12 $\Delta\Delta\Delta$		
		3300		14.0	7.0	10.0	0.60	EK $\Delta$ 3J $\Delta\Delta\Delta\Delta$ 14 $\Delta\Delta\Delta$		 D $\geq$ 10.0
		3300, 3900		15.5	7.0	10.0	0.60	EK $\Delta$ 3J $\Delta\Delta\Delta\Delta$ 15 $\Delta\Delta\Delta$		
			10000	20.0	7.0	10.0	0.60	EK $\Delta$ 3J $\Delta\Delta\Delta\Delta$ 20 $\Delta\Delta\Delta$		

# Low Loss Ceramic Capacitors (SL & R Series)

## Specification

Temp. Range: -25 ~ +85°C

Operating Temperature Range : -25 ~ +125°C

Capacitance : Measured at 1MHz, 1 Vrms and 20°C ± 2°C(SL type)

Measured at 1kHz(R type), 1 Vrms and 20°C ± 2°C(R type)

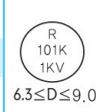
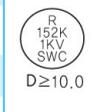
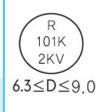
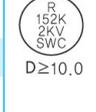
## Testing Voltage

Rating Voltage (R.V)	1~2kV DC	3.15kV DC	6.3kV DC
Testing Voltage (T.V)	R.V x 2	R.V x 1.75	R.V x 1.5

Insulation Resistance : Min 10,000MΩ at 500 V DC for 1minute

## Temperature Characteristics & Dissipation Factor(tand) / Q

T.C	SL	R(Y5R)
Change Rate	(20 ~ +85°C) +350 ~ -1000ppm/°C	(-25 ~ +85°C) ± 15% (-25 ~ +125°C) +15 ~ - 30%
Q / D.F	30pF and over : 1000min Less than 30pF : 400+(20xC) min.	0.2%max

Item	Capacitance(μF)		Dimensions(mm)				Part No. (How to order)	Marking
	SL	R(Y5R)	D	T	F	Ød		
1KV DC	10, 11, 12, 15, 18, 20, 22, 24 27, 30, 33, 39, 43, 47, 51	220, 270 330, 390	6.3	5.0	5.0	0.50	E△△3A△△△△06△△△△	 
		470	7.0	5.0	5.0	0.50	E△△3A△△△△07△△△△	
	56, 62, 68, 75, 82, 91, 100	560, 680	8.0	5.0	5.0	0.50	E△△3A△△△△08△△△△	
		820, 1000	9.0	5.0	5.0/7.5	0.50/0.60	E△△3A△△△△09△△△△	
	110, 120, 150	1200	10.0	5.0	5.0/7.5	0.50/0.60	E△△3A△△△△10△△△△	
		1500	11.0	5.0	5.0/7.5	0.50/0.60	E△△3A△△△△11△△△△	
	180, 200, 220, 240, 270		12.5	5.0	5.0/7.5	0.50/0.60	E△△3A△△△△12△△△△	
	300, 330, 360	1800, 2200, 2700	14.0	5.0	10.0	0.60	E△△3A△△△△14△△△△	
		3300	15.0	5.0	10.0	0.60	E△△3A△△△△15△△△△	
	390, 430, 470		16.0	5.0	10.0	0.60	E△△3A△△△△16△△△△	
	3900	17.0	5.0	10.0	0.60	E△△3A△△△△17△△△△		
	4700	18.0	5.0	10.0	0.60	E△△3A△△△△18△△△△		
2KV DC	10, 18, 20, 22, 24, 27, 30, 33 36, 39, 43, 47	120	6.3	5.0	5.0	0.50	E△△3D△△△△06△△△△	 
		220, 270	7.0	5.0	5.0	0.50	E△△3D△△△△07△△△△	
	51, 56, 62, 68, 75, 82, 91	330, 390	8.0	5.0	10.0	0.60	E△△3D△△△△08△△△△	
	100	470, 560, 680	10.0	5.0	10.0	0.60	E△△3D△△△△10△△△△	
		820, 1000	11.0	5.0	10.0	0.60	E△△3D△△△△11△△△△	

## Low Loss Ceramic Capacitors (SL & R Series)

Item R.V	Capacitance(pF)		Dimensions(mm)				Part No. (How to order)	Marking
	SL	R(Y5R)	D	T	F	Ød		
2KV DC	120, 150, 180, 200, 220		12.5	5.0	10.0	0.60	E△△3D△△△△12△△△	 6.3≤D≤9.0
	240	1200, 1500	14.0	5.0	10.0	0.60	E△△3D△△△△14△△△	
		1800, 2200	15.0	5.0	10.0	0.60	E△△3D△△△△15△△△	
	270, 300, 330, 360		16.0	5.0	10.0	0.60	E△△3D△△△△16△△△	 D≥10.0
		2700	17.0	5.0	10.0	0.60	E△△3D△△△△17△△△	
	390, 430, 470	3300	18.0	5.0	10.0	0.60	E△△3D△△△△18△△△	
3.15KV DC		150, 180, 220, 270	7.0	6.0	5.0	0.50	E△△3F△△△△07△△△	 6.3≤D≤9.0
	10, 15, 16, 18, 20, 22, 27, 30, 33, 36, 39, 43, 47, 51, 56	330, 390	8.0	6.0	5.0	0.50	E△△3F△△△△08△△△	
	62, 68, 75, 82	470, 560, 680	10.0	6.0	10.0	0.60	E△△3F△△△△10△△△	 D≥10.0
	91, 100, 110, 120, 150	820, 1000	12.5	6.0	10.0	0.60	E△△3F△△△△12△△△	
	180, 200	1200, 1500	14.0	6.0	10.0	0.60	E△△3F△△△△14△△△	
	220, 240	1800	16.0	6.0	10.0	0.60	E△△3F△△△△16△△△	
	270, 300, 330, 360	2200, 2700	18.0	6.0	10.0	0.60	E△△3F△△△△18△△△	
6.3KV DC	22, 24, 27, 30, 33, 36		8.0	7.0	10.0	0.60	E△△3J△△△△08△△△	 6.3≤D≤9.0
	43, 47	220, 270, 330	10.0	7.0	10.0	0.60	E△△3J△△△△10△△△	
	51, 56, 62, 68, 75	390, 470	12.5	7.0	10.0	0.60	E△△3J△△△△12△△△	 D≥10.0
	120	560, 680	16.0	7.0	10.0	0.60	E△△3J△△△△16△△△	

Note : All spec size can change based on customer requirement

## Notices:

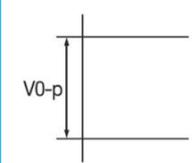
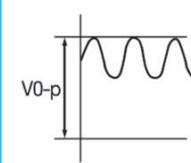
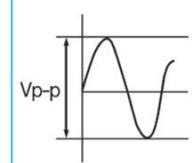
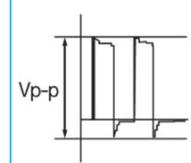
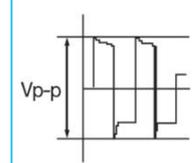
### Caution(Rating)

#### 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  $V_{0-p}$  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.

When using the series in a high-frequency and high-voltage circuit, be sure to read the instructions in item 4.

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

#### 2. Operating Temperature And Self-Generated Heat(Apply to B/E/F/SL/R char.)

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 20°C (5°C for SL Series) at an atmosphere temperature of 25°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.)

#### 3. Fail-Safe

When capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure would follow an electric shock, fire or fume.

Note : details information refer to approval sheet or contact engineer.

## Safety Standard Recognized Ceramic Capacitors

### Specification

Temp. Range : -25 ~ +85°C (Y class)

Operating Temperature Range : -25 ~ +125°C

Capacitance : Measured at 1kHz, 1 Vrms and 20°C ± 2°C (B, E, F type)

Measured at 1MHz, 1 Vrms and 20°C ± 2°C (O(=SL) type)

### Testing Voltage

<b>Rating Voltage (R.V)</b>	250 Vac	400Vac
<b>Testing Voltage (T.V)</b>	2500 Vac	4000Vac

Insulation Resistance: Min 10,000MΩ at 500V DC for 1 minute.

### Dissipation Factor(tanδ)

T.C	O(=SL)	B	E	Fz
tanδ/Q	30pF and over : 1000min Less than 30pF : 400+(20xC) min.	2.5% Max.	2.5% Max.	5.0% Max.

### How to Order(Product Identification)

**SC B 2E 101 K 08 FF 7**



- 1 Type
- 2 Temperature Characteristic
- 3 Voltage
- 4 Capacitance
- 5 Capacitance Tolerance
- 6 Disc Size
- 7 Packing and Lead Style
- 8 Lead Spacing & Pitch of Component

### Specification

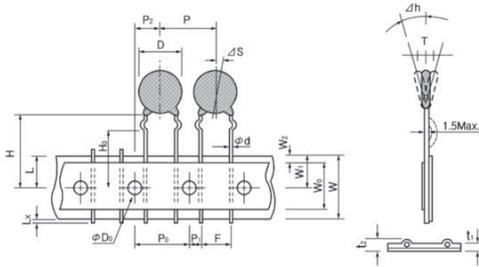
Type	Temp char.	Capacitance	Size			Marking	
		(pF)	Dmax	Tmax	F (±1.0)		∅d(±0.05)
SC	B	100, 150, 220, 330, 390, 470, 560	8.0	6.0	7.5 10.0	0.60	<b>SC101KA</b>  
		680	9.0				
		820, 1000	10.0				
	E	1000	7.0				
		1500	9.0				
		1800, 2200	10.0				
		3300	12.5				
		3900	13.0				
	F	4700	14.0				
		3300	9.0				
		4700	10.0				
		6800	11.0				
	O(=SL)	10000	14.0				
		10,22, 33, 47	9.0				
56		10.0					
68		11.0					

Type	Temp char.	Capacitance	Size			Marking	
		(pF)	Dmax	Tmax	F ( $\pm 1.0$ )		$\varnothing d(\pm 0.05)$
SD	B	100, 150, 220, 330, 390, 470, 560, 680	10.0	7.0	10.0	0.60	<b>SD101K A</b>  X1Y1 10 400~   SWC
	E	1000	8.0				
		1500	9.0				
		2200	12.5				
		3300	14.0				
		3900, 4700	15.0				
	O(=SL)	10, 22, 33, 47	9.5	6.0	10.0	0.60	<b>SD560K A</b>  X1Y1 10 400~   SWC
		56	10.5				
		68	11.5				

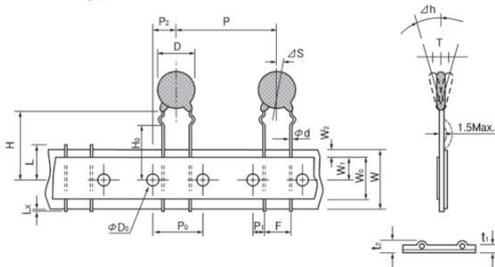
## Safety Standard Recognized Ceramic Capacitors

### FF7 Type

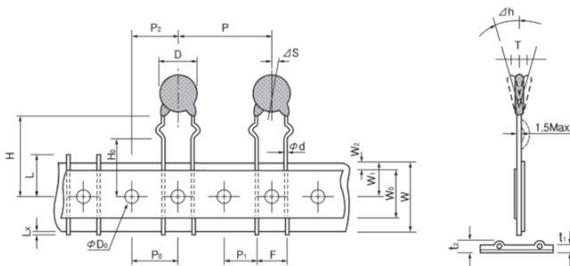
Unit : mm



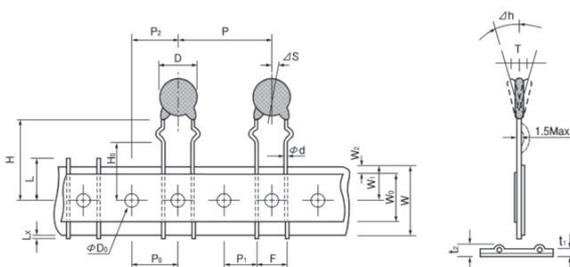
### FF8 Type



### FF1 Type



### FF2 Type



Item	Code	Taping Specification			
		FF7	FF8	FF1	FF2
Body Diameter	D	6.3~14.0	15.0~20.0	6.3~20.0	6.3~20.0
Body Thickness	T	6.0 max	6.0 max	7.0 max	7.0 max
Lead Diameter	∅d	0.6±0.05	0.6±0.05	0.6±0.05	0.6±0.05
Pitch of sprocket Hole	P0	15.0±0.3	15.0±0.3	12.7±0.3	15.0±0.3
Pitch of Component	P	15.0±1.0	30.0±1.0	25.4±1.0	30.0±1.0
Lead Length from Hole Center Lead	P1	3.75±1.0	3.75±1.0	7.7±1.0	10.0±1.0
Lead Length from Hole Center to Component Center	P2	7.5±1.5	7.5±1.5	12.7±1.5	15.0±1.5
Lead Spacing	F	7.5±1.0	7.5±1.0	10.0±1.0	10.0±1.0
Deviation Along Tape Left or Right	ΔS	0±1.0	0±1.0	0±1.0	0±1.0
Deviation Across Tape	ΔH	0±2.0	0±2.0	0±2.0	0±2.0
Carrier Tape Width	W	18.0 <sup>+1.0</sup> <sub>-0.5</sub>	18.0 <sup>+1.0</sup> <sub>-0.5</sub>	18.0 <sup>+1.0</sup> <sub>-0.5</sub>	18.0 <sup>+1.0</sup> <sub>-0.5</sub>
Hold Down Tape Width	W0	8.0 min	8.0 min	8.0 min	8.0 min
Position of Sprocket Hole	W1	9.0±0.5	9.0±0.5	9.0±0.5	9.0±0.5
Hole Down Tape Position	W2	3.0 max	3.0 max	3.0 max	3.0 max
Height of Component From Hole Center	H	20.0 <sup>+1.5</sup> <sub>-1.0</sub>	20.0 <sup>+1.5</sup> <sub>-1.0</sub>	20.0 <sup>+1.5</sup> <sub>-1.0</sub>	20.0 <sup>+1.5</sup> <sub>-1.0</sub>
Lead-Wire Clinch Height	H0	16.0±0.5	16.0±0.5	16.0±0.5	16.0±0.5
Diameter of Sprocket Hole	∅D0	4.0±0.2	4.0±0.2	4.0±0.2	4.0±0.2
Total Taps Thickness	t1	0.7±0.2	0.7±0.2	0.7±0.2	0.7±0.2
Total Thickness. Tape and Lead Wire	t2	1.7 max	1.7 max	1.7 max	1.7 max
Lead Wire Protrusion	Lx	1.0 max	1.0 max	1.0 max	1.0 max

### SC Type : Rating Voltage AC 250V, X1 and Y2 Testing Voltage AC 2500V

UL	File No. E97754
VDE	File No. 40015805
CSA	File No. 2476563
CQC	File No. 10001054594
KTL	File No. SU03004-16001 / SU03004-16003
ENEC	File No. ENEC FI 2016053

### SD Type : Rating Voltage AC 250/440V, X1 and Y1 Testing Voltage AC 4000V

UL	File No. E97754
VDE	File No. 40015804
CSA	File No. 2476564
CQC	File No. 10001054593
KTL	File No. SU03004-16002 / SU03004-16004
ENEC	File No. ENEC FI 2016053

# Notices:

## 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  $V_{0-p}$  that 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	DV Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage(1)	Pulse Voltage(2)
Positional Measurement					

### 2. Operating Temperature And Self-Generated Heat (Apply to B/E/F/SL char.)

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 have self-generated heat due to dielectric loss. Applied voltage load should be such that self-generated heat is within 20°C (5°C for SL) under the condition where the capacitor is subjected to an atmospheric temperature of 25°C. When measuring, use a thermocouple of small thermal capacity- K of  $\varnothing 0.1\text{mm}$  under conditions where the capacitor is not affected by radiant heat from other components or wind from surroundings. 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.)

### 3. Fail-Safe

#### 1) Test Equipment

Test equipment for AC withstanding voltage should be used with the performance of the wave similar to 50/60Hz sine wave.

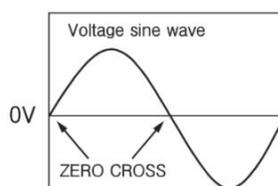
If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

#### 2) Voltage Apply Method

When the withstanding voltage is applied, the capacitor's lead or terminal should be firmly connected to the output of the withstanding voltage test equipment, and then the voltage should be raised from near zero to the test voltage. If the test voltage without the raise from near zero voltage would be applied directly to capacitor, test voltage should be applied with the zero cross. At the end of the test time, the test voltage should be reduced to near zero, and then capacitor's lead or terminal should be taken off the output of the withstanding voltage test equipment.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, the surge voltage may rise, and therefore, a defect may be caused.

\*ZERO CROSS is the point where voltage sine wave passes 0V. See the figure at below.



#### 4. Fail-Safe

When the capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure could result in an electric shock, fire or fuming.

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(Storage and Operating 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, sulphide gas, acid, alkali, salt or the like present. Also avoid exposure to moisture. Before cleaning, bonding or moulding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or moulded 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 capacitor within 6 months after delivery, check the solderability after 6 months or more.

### Caution(Soldering and Mounting)

#### 1. Vibration and Impact.

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

Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board. Please take measures to hold a capacitor on the circuit boards by adhesive, moulding resin or another coating.

#### 2. Soldering.

When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specifications 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.

Soldering the capacitor with a soldering iron should be performed in the following conditions.

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

Soldering iron wattage: 50W max.

Soldering time: 3.5 sec. max.

### 3. Bonding, Resin Molding and Coating.

For bonding, molding or coating this product, verify that these processes do not affect the quality of the capacitor by testing the performance of the bonded, molded or coated product in the intended equipment.

When the amount of applications, dryness/hardening conditions of adhesives and molding resins containing organic solvents (ethyl acetate, methyl ethyl ketone, toluene, etc). are unsuitable, the outer coating resin of a capacitor is damaged by the organic solvents and it may result, worst case, in a short circuit. The variation in thickness of adhesive, molding resin or coating may cause outer coating resin cracking and/or ceramic element cracking of a capacitor in a temperature cycling.

### 4. Treatment after Bonding, Resin Molding and Coating

When the outer coating is hot (over 100 degrees C.) after soldering, it becomes soft and fragile. Therefore, please be careful not to give it mechanical stress.

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 Impact

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

Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board. Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.

Please confirm there is no influence of holding measures on the product with the intended equipment.

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, observe the following conditions.

Rinse bath capacity : output of 20 watts per litre or less.

Rinsing time : 5 min. maximum

Do not vibrate the PCB/PWB directly

Excessive ultrasonic cleaning may lead to fatigue destruction the lead wires.

## Notice(Rating)

### 1. For SL char.

Capacitance might change a little depending on a surrounding temperature or an applied voltage.  
Please contact us if you use a strict constant time circuit.

### 2. Capacitance Change of Capacitor (for B/E/F char.).

Capacitor have an aging characteristics, 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.

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

### 3. Performance Check by Equipment.

Before using capacitor, check that there is no problem in the equipment's performance and the specification.

Generally speaking, ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance, so the capacitance value may change depending on the operating condition in the equipment. Therefore, be sure to confirm the apparatus performance of receiving influence in the capacitance value change of capacitor, such as leakage current and noise suppression characteristics.

Moreover, check the surge-proof ability of a capacitor in the equipment, if needed, because the surge voltage may exceed specific value by the inductance of the circuit.