SPECIFICATION

SAMWHA CAPACITOR CO.,LTD
PT SAMCON

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To. TME **No. SWC-20251016-04**

SPECIFICATION

ITEM : DISC CERAMIC CAPACITOR
(Capacitor SL SERIES)

PT. SAMCON		
Written	Checked	Approved
		
Irman Sudirman	Apang Djafar S.	Kim Jae Min
TME		

2025.10.16

SAMWHA CAPACITOR Co., Ltd
(Manufacturer : PT. SAMCON)

Record of Revision

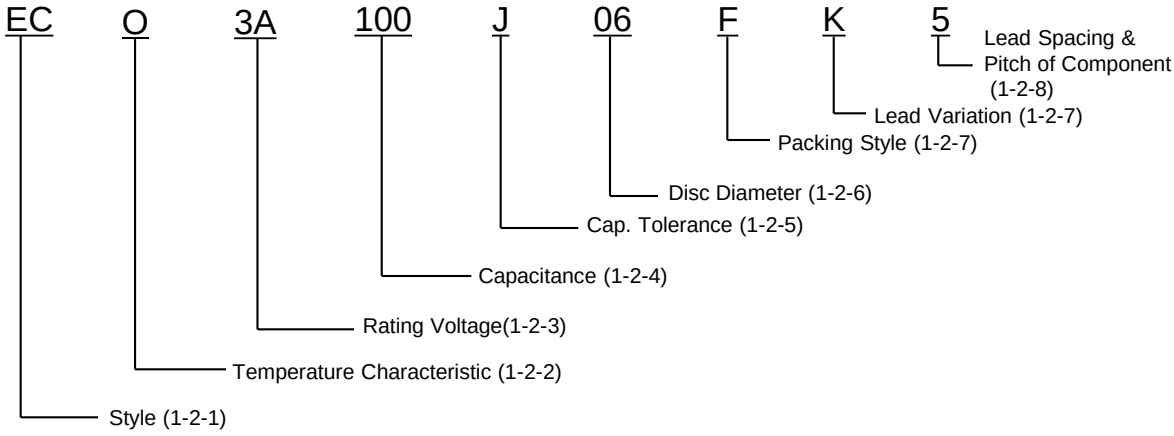
P/N	SAMWHA SPEC	P/N	SAMWHA SPEC
-	ECO3A100J06FK5	-	ECO3D470J06FK5
-	ECO3A101J08FK5	-	ECO3D471J15FF8
-	ECO3A220J06FK5	-	ECO3D820J08FK5
-	ECO3A221J10FK5	-	ECO3F150J08FF7
-	ECO3A470K06FK5	-	ECO3F220J08FF7
-	ECO3A680K08FK5	-	ECO3F470J08FF7
-	ECO3D100J06FK5	-	ECO3J150J08FF1
-	ECO3D101J08FK5	-	ECO3J220J08FF7
-	ECO3D220J06FK5	-	ECO3J470J08FF7
-	ECO3D221J10FK5		

No	Reason	Contents	Date of approval	Checked	Remark
1	RoHS Free	1) P.6/15 4. Solder Heat Resistance 2) P.7/15 8. The regulation of environmental pollution materials	05.11.10		
2	Material Change	Material wire from Cu wire (Sn-Cu) to Cp wire (Sn-Cu-Fe)	08.01.01		
3	Add Soldering Profile	Flow Soldering & Iron Soldering	10.11.15		
4	Drawing & Dimension of Taping Style	Hold Down Tape Width (Wo)	12.05.01		
5	Electrical Performance	Dielectric Strength & Body Insulation Condition. P. 5/15	12.06.07		

1. Scope.

This specification relates low loss ceramic capacitor for use in high frequency and high power circuit.

1-1. Type Designation



1-2. Specification

1-2-1. Style

EC : Epoxy coated Temperature compensating fixed ceramic capacitor (Class I).

1-2-2. Temperature Characteristic

Operating temperature : -25˚C ~ +85˚C

* Operating temperature range guaranteed up to 125 degrees

• Test Condition

Step	Temp
1	20 ± 2°C
2	Min Operating Temp
3	20 ± 2°C
4	Max Operating Temp
5	20 ± 2°C

• Judgment

T.C	Temp. Range	Charge Rate
SL Type	+20℃ ~ +85℃	-1000 ~ +350 ppm/℃

1-2-3. Rating Voltage

3A : 1 kV, 3D : 2 kV, 3F : 3.15 kV, 3J : 6.3 kV.

1-2-4. Nominal Capacitance

The nominal capacitance value in pF is expressed by three digit number.

The first, two digits represent significant figures and the last digit is the number of zero to follow.

Ex) 100 : 10pF

1-2-5. Capacitance Tolerance.

D : ± 0.5pF, G : ± 2%, J : ± 5% , K : ± 10% , M : ± 20% , Z : -20/+80%

1-2-6.Disc Diameter (Unit : mm max)

Code	06	07	08	09	10	11	12	13	14	15	16	17	18	20
Dia (mm)	6.3	7	8	9	10	11	12.5	13.5	14.5	15	16	17	18	20

1-2-7. Packing Style and Lead Variation

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

1-2-8. Lead Spacing & Pitch of Component : [mm] (see pages 9/15 ~ 13/15)

5 : F=5.0 , P=12.5 (Bulk or Taping) 9 : F=7.5, P=25.4 (Taping)

7 : F=7.5 , P=15.0 (Bulk or Taping) 1 : F=10.0 , P=25.4 (Bulk or Taping)

8 : F=7.5 , P=30.0 (Taping) 2 : F=10.0 , P=30.0 (Taping)

2. Electrical Performance

2-1. Capacitance

Capacitance shall be within the specified tolerance when measured at temperature of 20℃±2℃, 1±0.2MHz with 1Vrms

*) Note: Pre-treatment : max operating temp ± 2°C heating and maintain 1hr, and release 24±2hr at room condition, using LCR meter.

2-2. Quality Factor (Q)

Measured at 1±0.2MHz, 1Vrms and 20℃±2℃

T.C	SL Type
Q	30pF and over ≥ 1000 less then 30pF ≥ 400+20C

*) Note: Pre-treatment : max operating temp ± 2°C heating and maintain 1hr, and release 24±2hr at room condition, using LCR meter.

2-3. Body Insulation

The Capacitors shall not be damaged when 1.3 KV DC Voltage applied for 1 to 50sec. both connected leads and body.

*Special Note.

we produced a special FS7 (Lead Spacing 7.5mm), ambient temperature, relative humidity measured in the high-voltage lead terminal and the terminals arc occurs when factors(Spark phenomena), in this case Insulation oil ceramic capacitor using the BDV.(Brake Down Voltage) is measured.

2-4. Others

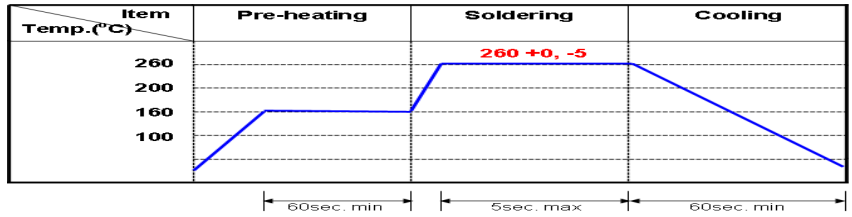
No	Item	Requirement			Test Conditions
1	Insulation Resistance	10000MΩ Min			Applied voltage 500 VDC. Charging time 1 minute.
2	Dielectric Strength	No Defect or Abnormalities			The capacitor should be following table below on 1 ~ 5 sec : Rating Voltage (R.V) | 50V DC | 500V DC | 1~2kV DC | 3kV DC | 6kV DC Testing Voltage (T.V) | R.V x 3 | R.V x 2.5 | R.V x 2 | R.V x 1.75 | R.V x 1.5 The discharge current, however was 50mA or less. (*3J: Lead spacing(FS7):AC4.5kv/10mA)
3	High Temperature Load	Appearance		No. visible damage	- Temperature : 85±3℃ - Applied Voltage : 1.5 times rated voltage - Period of test : 1000 +48, -0 hours *Note Test sample is must it, Lead spacing min 10.0mm< Post-treatment : Capacitor should be stored for 1 to 2 hrs. at room condition
		Cap. Change	SL	± 3% max	
		Q	SL	30pF & over ≥ 350 less then 30pF ≥ 275+5/2C	
		I . R		1000MΩ min	
		Dielectric Strength		No. Failure	
4	Humidity (Under Steady State)	Appearance		No. visible damage	Set the capacitor for 500 +24/-0 hrs. at 40±2°C in 90 to 95% relative humidity. Post-treatment : Capacitor should be stored for 1 to 2 hrs. at room condition
		Cap. Change	SL	± 5% max	
		Q	SL	30pF & over ≥ 350 less then 30pF ≥ 275+5/2C	
		I . R		1000MΩ min	
		Dielectric Strength		No. Failure	
5	Humidity Load	Appearance		No. visible damage	Apply the rated voltage for 500 +24/-0 hrs. at 40±2°C in 90 tp 95% relative humidity. (Charge/Discharge ≦ 50mA) Post-treatment : Capacitor should be stored for 1 to 2 hrs. at room condition *Note Test sample is must it, Lead spacing min 10.0mm<
		Cap. Change	SL	± 5% max	
		Q	SL	30pF & over ≥ 350 less then 30pF ≥ 275+5/2C	
		I . R		1000MΩ min	
		Dielectric Strength		No. Failure	

3. Mechanical Test and Environmental Substance

<table>
<tr><th>No</th><th>Item</th><th>Requirement</th><th>Test Conditions</th></tr>
<tr><td>1</td><td>Lead Pull Test</td><td>Capacitors shall not be damaged, when tested as follows :
<table><tr><td>Lead Dia.</td><td>Load</td></tr><tr><td>0.50 ~ 0.8 mm</td><td>1.0 kg</td></tr></table></td><td>– The load in table shall be applied gradually to the terminal in its draw-out direction and held thus for 1 to 10 sec</td></tr>
<tr><td>2</td><td>Lead Terminal Bending Test</td><td>Capacitors shall not be damaged or broken, when tested as follows :
<table><tr><td>Lead Dia.</td><td>Load</td></tr><tr><td>0.50 ~ 0.8 mm</td><td>0.5 kg</td></tr></table></td><td>– The Capacitor shall be held so that draw-out axis of the lead is kept vertical and load in left table shall be bent 90°and returned its original position in 5 sec.
– Then the body shall be bent 90° to opposite direction and returned to its original position in the same speed.</td></tr>
<tr><td>3.</td><td>Solder ability</td><td>The lead wire shall be soldered with uniformly coated on the axial direction over 75% of the circumferential direction.</td><td>– Flux : Solution of rosin in 25%
– Solder temp : 230 ± 5℃
– Immersion time : 2 ± 0.5 sec.
– Immersion depth : up to 3 ~ 4 ㎜ from the root of terminals</td></tr>
<tr><td>4.</td><td>Solder Heat Resistance</td><td><table><tr><td colspan="2">Appearance</td><td>No. visible damage</td></tr><tr><td>Cap. Change</td><td>SL</td><td>± 2.5% max</td></tr><tr><td>Q</td><td>SL</td><td>30pF & over ≥ 1000
less then 30pF
≥ 400+20C</td></tr><tr><td>I.R</td><td>SL</td><td>Initial test must be min 10000MΩ and after test must be min 1000MΩ</td></tr><tr><td colspan="2">Dielectric Strength</td><td>No. Failure</td></tr></table></td><td>– Solder temp. : 260 ± 5℃
– Immersion time : 10 ± 0.5 sec</td></tr>
<tr><td>5</td><td>Vibration Resistance</td><td><table><tr><td colspan="2">Appearance</td><td>No. visible damage</td></tr><tr><td>Cap. Change</td><td>SL</td><td>± 5.0% max</td></tr><tr><td>Q</td><td>SL</td><td>30pF & over ≥ 1000
less then 30pF
≥ 400+20C</td></tr><tr><td>I.R</td><td>SL</td><td>Initial test must be min 10000MΩ and after test must be min 1000MΩ</td></tr><tr><td colspan="2">Dielectric Strength</td><td>No. Failure</td></tr></table></td><td>The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6hrs., 2hrs. Each in mutually perpendicular directions</td></tr>
<tr><td>6</td><td>Temperature Cycling Test</td><td><table><tr><td colspan="2">Appearance</td><td>No. visible damage</td></tr><tr><td>Cap. Change</td><td>SL</td><td>± 5.0% max</td></tr><tr><td>Q</td><td>SL</td><td>30pF & over ≥ 350
less then 30pF
≥ 275+5/2C</td></tr><tr><td>I.R</td><td>SL</td><td>1000MΩ min</td></tr><tr><td colspan="2">Dielectric Strength</td><td>No. Failure</td></tr></table></td><td>Temperature cycle should be measured in the
following test.
Cycle time : 5 cycle (-25 ~ +85℃)

Post treatment : Capacitor should be stored for 24±2hrs at room.
<table><tr><td>STEP</td><td>TEMP (°C)</td><td>Time (Min)</td></tr><tr><td>1</td><td>Min Operating Temp</td><td>30</td></tr><tr><td>2</td><td>Room Temp</td><td>5</td></tr><tr><td>3</td><td>Max Operating Temp</td><td>30</td></tr><tr><td>4</td><td>Room Temperature</td><td>5</td></tr></table></td></tr>
</table>

3. Mechanical Test and Environmental Substance

No	Item	Requirement	Test Condition
7	Soldering Profile	Flow Soldering	 When soldering this product to a Pcb / Pwb, do not exceed the solder heat resistance specification of 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.
		Iron Soldering	When soldering capacitor with a soldering capacitor iron, it should be performed in following conditions. Temperature of iron-tip : 350°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.
8	The Regulation of Environmental Pollution Materials.		*Never use materials mentioned below based on International RoHS Standard. *Pb, Hg, Cr^{+6}, PBB, PBDE, Cd, Phthalate (DEHP, DBP, BBP & DIBP)
9	Preservation (keeping)	When solderablility is considered, capacitors are recommended to be used in 12 months	(1) Temperature : 30°C ± 10°C (2) Relative Humidity : 55% ± 25

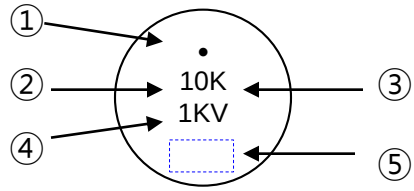
4. Standard Test Condition

– Temperature : 20 ± 2℃

– Humidity : 65 ± 5% R.H

5. Marking

SL TYPE



No.	EXAM.	ITEM	REMARK
1	Omitted	Temp. characteristic	>Φ10 SL : Omitted Φ6 ~ 9 : •
2	10	Capacitance	
3	K	Cap. tolerance	04~05Φ: Omitted
4	1KV	Rated voltage	
5	SWC	Manufacturer ' s code	<10Φ: Omitted, 10~20Φ : SWC

6. Enclosure

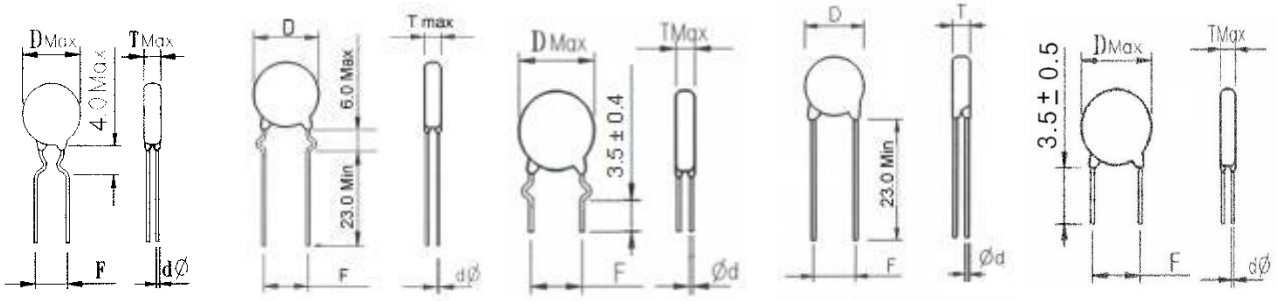
Capacitors are coated by non-flammable Epoxy Powder resin. (Conform UL94V-0)

7. Dimensions and Constructions

1) Bulk (Size)

In-kink Type | OUT-kink Type | Straight Type

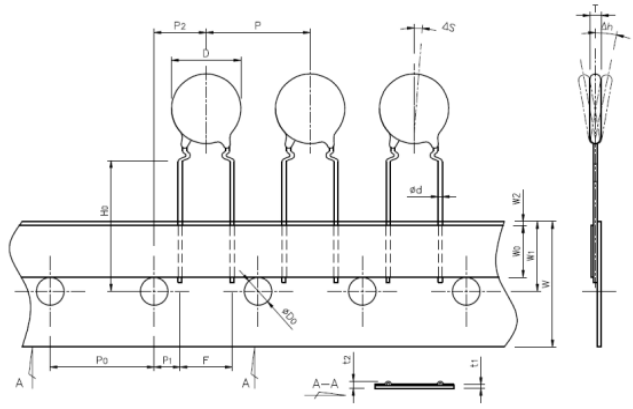
BK Type (Kink Long Type) | BK Type (King Long Type) | BW Type (Short Out-kink) | BS Type (Long Straight) | BN Type (Short Straight)



Rating voltage	Capacitance (pF)	Dimensions (mm)			
	SL	D max	T max	F ± 1.0	d(φ)±0.05
1 KV	10,12,15,18,20,22,24,27,30,33,39,43,47,51	6.3	5.0	5.0	0.50
	56,62,68,75,82,91,100	8.0	5.0	5.0	0.50
	110,120,150	9.0	5.0	5.0/7.5	0.50/0.60
	180,200, 220	10.0	5.0	5.0/7.5	0.50/0.60
	240,270,300,330	12.5	5.0	7.5/10.0	0.60
	390,430,470	13.5	5.0	7.5/10.0	0.60
	560	15.0	5.0	10.0	0.60
2 KV	10,15,18,20,22,24,27,30,33,36,39,43,47	6.3	5.0	5.0/7.5	0.50/0.60
	51,56,62,68,75, 100	8.0	5.0	5.0/7.5/10.0	0.50/0.60
	120,150	10.0	5.0	5.0/7.5/10.0	0.50/0.60
	180,200	11.0	5.0	5.0/7.5/10.0	0.50/0.60
	220,240,270,330	12.5	5.0	7.5/10.0	0.60
	360	13.5	5.0	7.5/10.0	0.60
	390,430	14.5	5.0	7.5/10.0	0.60
	470	15.0	5.0	7.5/10.0	0.60
3KV	3,5,6,10,12,15,22,27,33,47	8.0	6.0	5.0/7.5	0.50/0.60
	82,100	10.0	6.0	7.5/10.0	0.60
6.3 KV	3,5,6, 10,12,15,22,27,33,39,47	8.0	6.0	7.5/10.0	0.60
	54, 68	9.5	6.0	7.5/10.0	0.60
	100	13.0	6.0	10.0	0.60
	120	14.0	6.0	10.0	0.60
	150	15.0	6.0	10.0	0.60

2). Taping – FK5

FK5

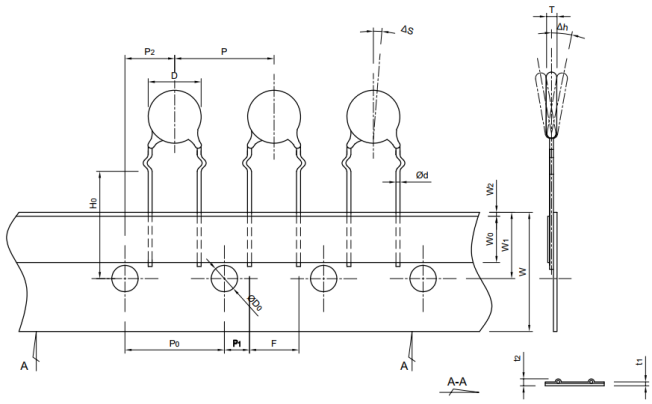


[Unit : mm]

ITEM	SYMBOL	TAPING SPECIFICATION	NOTE
		FK5	
Body Diameter	D	10.0 Max	
Body Thickness	T	5.0 Max	
Lead Diameter	Φ d	0.50 ± 0.05	
Pitch of Sprocket Hole	Po	12.7 ± 0.3	Accumulative.pitch error : ± 1mm/20pitch
Pitch of Component	P	12.7 ± 1.0	
Lead Length from Hole Center to Lead	P1	3.85 ± 0.7	
Lead Length from Hole Center to Component Center	P2	6.35 ± 1.3	
Lead Spacing	F	5.0 + 0.8 - 0.2	
Deviation Along Tape	△S	0 ± 1.0	
Deviation Across Tape	△h	0 ± 2.0	
Carrier Tape Width	W	18.0 + 1.0 - 0.5	
Hold Down Tape Width	Wo	6.0 Min	
Position of Sprocket Hole	W1	9.0 ± 0.5	
Hold Down Tape Position	W2	3.0 Max	
Diameter of Sprocket Hole	Φ Do	4.0 ± 0.2	
Lead-Wire Clinch Height	Ho	16.0 ± 0.5	
Total Tape Thickness	t_1	0.7 ± 0.2	
Total Thickness, Tape and Lead Wire	t_2	1.5 Max	

2). Taping – FF7

FF7

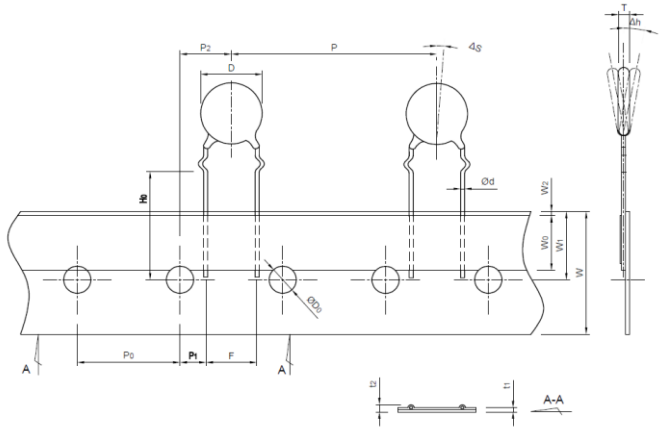


[Unit : mm]

ITEM	SYMBOL	TAPING SPECIFICATION	NOTE
		FF7	
Body Diameter	D	8.0 Max	
Body Thickness	T	6.0 Max	
Lead Diameter	Φd	0.60 ± 0.05	
Pitch of Sprocket Hole	Po	15.0 ± 0.3	
Pitch of Component	P	15.0 ± 1.0	
Lead Length from Hole Center to Lead	P1	3.75 ± 1.0	
Lead Length from Hole Center to Component Center	P2	7.5 ± 1.5	
Lead Spacing	F	7.5 ± 1.0	
Deviation Along Tape.Left or Right	△S	0 ± 1.0	
Deviation Across Tape	△h	0 ± 2.0	
Carrier Tape Width	W	18.0 + 1.0 - 0.5	
Hold Down Tape Width/Masking Tape Width	Wo	8.0 min	
Position of Sprocket Hole	W1	9.0 ± 0.5	
Hold Down Tape Position	W2	3.0 Max	
Lead-Wire Clinch Height	Ho	16.0 ± 0.5	
Height of Component Hole	H	20.0 + 1.5 - 1.0	
Diameter of Sprocket Hole	ΦDo	4.0 ± 0.2	
Total Tape Thickness	t_1	0.7 ± 0.2	
Total Thickness, Tape and Lead Wire	t_2	1.7 Max	

2). Taping – FF8

FF8

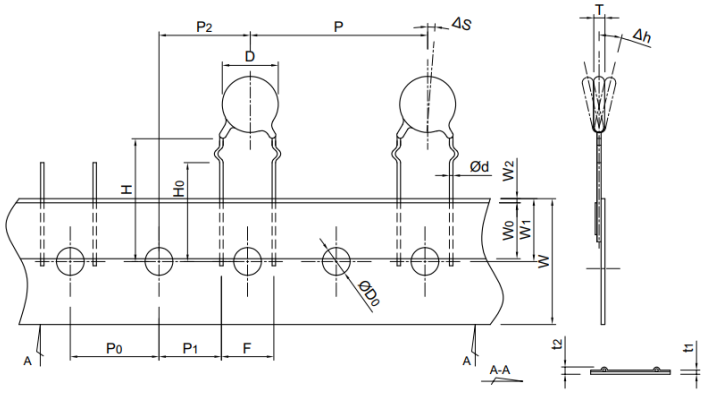


[Unit : mm]

ITEM	SYMBOL	TAPING SPECIFICATION	NOTE
		FF8	
Body Diameter	D	15.0 Max	
Body Thickness	T	5.0 Max	
Lead Diameter	Φd	0.60 ± 0.05	
Pitch of Sprocket Hole	Po	15.0 ± 0.3	
Pitch of Component	P	30.0 ± 1.0	
Lead Length from Hole Center to Lead	P1	3.75 ± 1.0	
Lead Length from Hole Center to Component Center	P2	7.5 ± 1.5	
Lead Spacing	F	7.5 ± 1.0	
Deviation Along Tape.Left or Right	△S	0 ± 1.0	
Deviation Across Tape	△h	0 ± 2.0	
Carrier Tape Width	W	18.0 + 1.0 - 0.5	
Hold Down Tape Width/Masking Tape Width	Wo	8.0 Min	
Position of Sprocket Hole	W1	9.0 ± 0.5	
Hold Down Tape Position	W2	3.0 Max	
Lead-Wire Clinch Height	Ho	16.0 ± 0.5	
Height of Component Hole	H	20.0 + 1.5 - 1.0	
Diameter of Sprocket Hole	ΦDo	4.0 ± 0.2	
Total Tape Thickness	t_1	0.7 ± 0.2	
Total Thickness, Tape and Lead Wire	t_2	1.7 Max	

2). Taping – FF1

FF1



[Unit : mm]

ITEM	SYMBOL	TAPING SPECIFICATION	NOTE
		FF1	
Body Diameter	D	8.0 Max	
Body Thickness	T	6.0 Max	
Lead Diameter	dΦ	0.60 ± 0.05	
Pitch of Sprocket Hole	Po	12.7 ± 0.3	
Pitch of Component	P	25.4 ± 1.0	
Lead Length from Hole Center to Lead	P1	7.7 ± 1.0	
Lead Length from Hole Center to Component Center	P2	12.7 ±1.5	
Lead Spacing	F	10.0 ± 1.0	
Deviation Along Tape, Left or Right	△S	0 ± 1.0	
Deviation Across Tape	△h	0 ± 2.0	
Carrier Tape Width	W	18.0 + 1.0 - 0.5	
Hold Down Tape Width/Masking Tape Width	Wo	8.0 Min	
Position of Sprocket Hole	W1	9.0 ± 0.5	
Hold Down Tape Position	W2	3.0 Max	
Lead-Wire Clinch Height	Ho	16.0 ± 0.5	
Height of Component from Hole Center	H	20.0 + 1.5 - 1.0	
Diameter of Sprocket Hole	ΦDo	4.0 ± 0.2	
Total Tape Thickness	t_1	0.7 ± 0.2	
Total Thickness, Tape and Lead Wire	t_2	1.7 Max	

▣ PACKING SPECIFICATION

1) BULK

TYPE		PACKING QUANTITY [pcs]					
DIVISION	L/W DIVISION [mm]	DIAMETER [Φ]	INNER BOX			OUT BOX	
			VINIL PAPERBAG		IBB 140	OBB 150	OBB 300
1 ~ 2 KV	Long	~ 8	F: 5.0	1,000 + 3, - 0	10,000	-	40,000
			F: 7.5, 10.0	500 + 2, - 0	4,000	-	16,000
		9 ~ 10	F: 5.0	500 + 2, - 0	5,000	-	20,000
			F: 7.5, 10.0	500 + 2, - 0	4,000	-	16,000
		11 ~ 12	500 + 2, - 0		4,000	-	16,000
		13 ~ 16	500 + 2, - 0		2,500	-	10,000
		17 ~ 20	400 + 1, - 0		2,000	-	8,000
	Short	~ 8	1,000 + 3, - 0		10,000	20,000	-
		9 ~ 10	F: 5.0	1,000 + 3, - 0	10,000	20,000	-
			F: 7.5, 10.0	500 + 2, - 0	10,000	20,000	-
		11 ~ 16	500 + 2, - 0		5,000	10,000	-
		17 ~ 20	500 + 2, - 0		4,000	8,000	-
3 KV ~	Long	~ 7	500 + 2, - 0		5,000	-	20,000
		8 ~ 11			4,000	-	16,000
		12 ~ 14			3,000	6,000	-
		15 ~ 16			2,500	5,000	-
		17 ~ 20	200 + 1, - 0		2,000	4,000	-
	Short	~ 9	500 + 2, - 0		10,000	20,000	-
		10 ~ 11	500 + 2, - 0		7,500	15,000	-
		12 ~ 14	500 + 2, - 0		5,000	10,000	-
		15 ~ 16	500 + 2, - 0		4,000	8,000	-
		17 ~ 20	200 + 1, - 0		2,000	4,000	-

▣ PACKING SPECIFICATION

2) TAPING

DIVISION	F [mm]	TYPE	PITCH	DIAMETER [Φ]		VOLTAGE [V]	BOX H [mm]	PACKING QUANTITY [pcs]	
								IBR	OBR
~2 KV	5.0	FK5, FF5,	12.7	8.0 ↓		500V ↓	52	2,000 + 5, - 0	10,000
				10.0 ~ 12.0			52	2,000 + 5, - 0	10,000
				ALL		KV	52	2,000 + 5, - 0	10,000
	7.5	FF7	15.0	14.0↓	~10	KV	52	1,500 + 5, - 0	7,500
					12~			1,300 + 5, - 0	6,500
		FF8	30.0	15.0↑				700 + 5, - 0	3,500
		FF9	25.4	ALL				700 + 5, - 0	3,500
	10.0	FF1,FF2		ALL		-	52	700 + 5, - 0	3,500
3 KV~	7.5	FF7 FS7	15.0	14.0↓		KV	52	1,000 + 5, - 0	5,000
		FF8	30.0	15.0↑				600 + 5, - 0	3,000
		FF9	25.4	ALL				600 + 5, - 0	3,000
	10.0	FF1 FS1	25.4	ALL				600 + 5, - 0	3,000
		FF2	30.0					500 + 5, - 0	2,500

3) PACKING BOX DIMENSIONS

PACKING STYLE		CATEGORY	L × W × H [mm]
BULK	IBB (Inner Box Bulk)	IBB 140	250 × 233 × 130
	OBB (Out Box Bulk)	OBB 150 (IBB 140 × 2)	485 × 265 × 145
TAPING	INNER BOX	IBR 52	325 × 280 × 55
	OUT BOX	OBR 52 (IBR 52 × 5)	340 × 305 × 300

4) STACKING BOX (Maximum)

PACKING STYLE	INBOX	OUTBOX
BULK	6	6
TAPING	10	6

▣ MATERIAL LIST

NO	Material Name	Substance	Hazardous Substance Existences						Remarks
			Pb	Hg	Cr	Cr^{+6}	PBB	PBDE	
1	Dielectric Powder	$SrTiO_3$	X	X	X	X	X	X	
2	Ag Paste	Ag	X	X	X	X	X	X	
3	Solder	Sn, Ag, Cu	X	X	X	X	X	X	
4	Epoxy resin	Epoxy	X	X	X	X	X	X	
5	Lead wire	Cu, Sn, Fe	X	X	X	X	X	X	Plating thickness: min 3μm. (material : tin)

■ Notice (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, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture. 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 12 months after delivery.

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 (Capacitance change of capacitors)

For some of the capacitors, capacitance value may change considerably in the temperature range, or by applied DC voltage. and capacitor has aging characteristics (capacitance decreases by keeping as it is)

▣ Label Type

▣ Bulk Style

BULK TYPE		
PLASTIC	INBOX	OUTBOX
		

▣ Taping Style

TAPING TYPE		
PLASTIC	INBOX	OUTBOX
		

■ Notices :

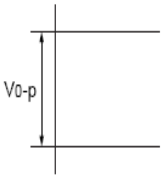
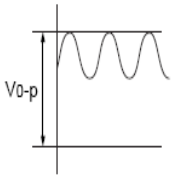
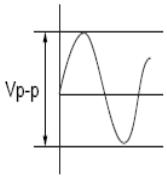
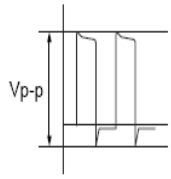
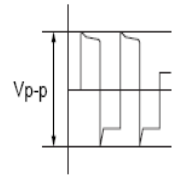
▶ Caution (Rating)

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 ECO series (SL Char.) series in a high-frequency and high-voltage circuit, be sure to read the instructions in item 4.

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 frequency of the applied sine wave voltage should be less than 300kHz. The applied voltage load should be such that the capacitor's self-generated heat is within 5°C at an atmosphere temperature of 25°C. When measuring, use a thermocouple of small thermal capacity-k of ø0.1mm 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.

4. Load Reduction and Self-generated Heat During Application of High-frequency and High-voltage

Due to the low self-heating characteristics of low dissipation capacitors, the allowable electric power of these capacitors is generally much higher than that of B characteristic capacitors. However, in case the self heating temperature is 5°C under a high-frequency voltage whose peak-to-peak value equals the capacitor's rated voltage, the capacitor's power consumption may exceed it's allowable electric power. Therefore, when using the Low loss series in a high-frequency and high-voltage circuit with a frequency of 1kHz or higher, make sure that the V_{p-p} values including the DC bias, do not exceed the applied voltage value specified in Table 1. Also make sure that the self-heating temperature (the difference between the capacitor's surface temperature and the capacitor's ambient temperature) at an ambient temperature of 25°C does not exceed the value specified in Table 1. As shown in Fig. 2, the self-heating temperature depends on the ambient temperature. Therefore, if you are not able to set the ambient temperature to approximately 25°C, please contact our sales representatives or product engineers.

[Table 1] Allowable conditions at high frequency

Series	DC rated Voltage	Allowable conditions at High frequency *2		Capacitor's ambient temp.
		Applied voltage (MAX)	Self-heating temp. (25℃ ambient temp.)*1	
SL series	1KV	1000Vp-p	5℃ Max	-25 ~ 85℃
	2KV	2000Vp-p	5℃ Max	
	3.15KV	3150Vp-p	5℃ Max	

*1 Fig. 1 shows the relationship between the applied voltage and the allowable self-heating temperature regarding 1 to 3.15KV rated voltage of the ECO(SL) series characteristic./ Fig 2. shows self heating temperature for the ECO(SL) series characteristic

*2 Fig. 3 shows reference data on the allowable voltage-frequency characteristic for a sine wave voltage.

Failure to follow the above cautions (items 1 to 4) may result, worst case, in a short circuit and cause fuming or partial dispersion when the product is used.

Fig 1 : Relationship Between Applied Voltage and Self-heating Temperature (SL series)
(Allowable Self-heating Temp. at 25 ℃ Ambient Temp.)

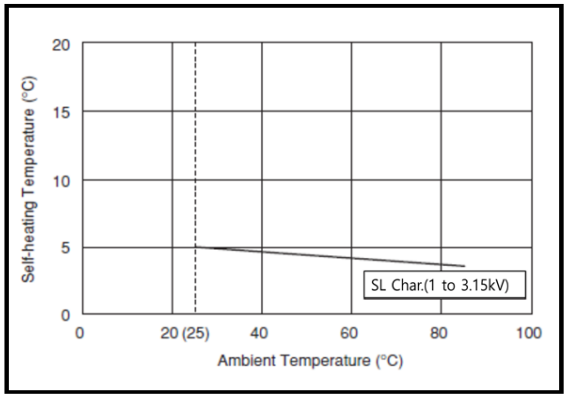
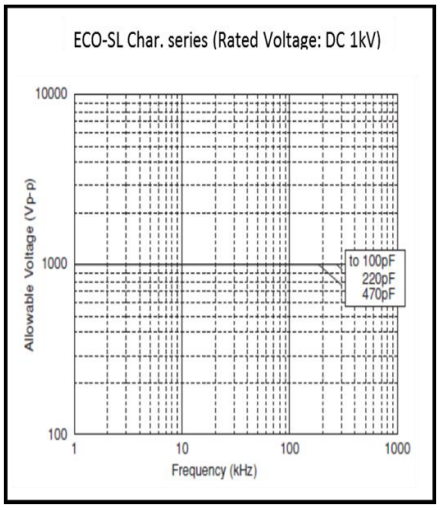
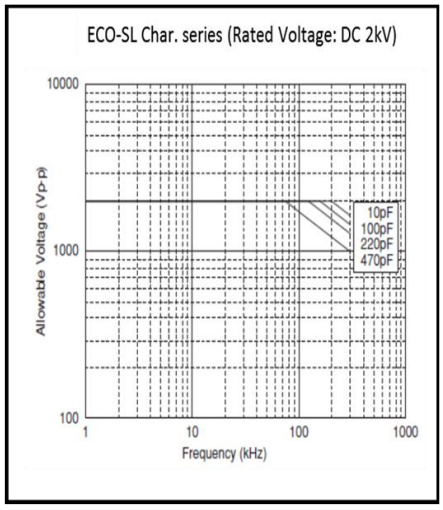
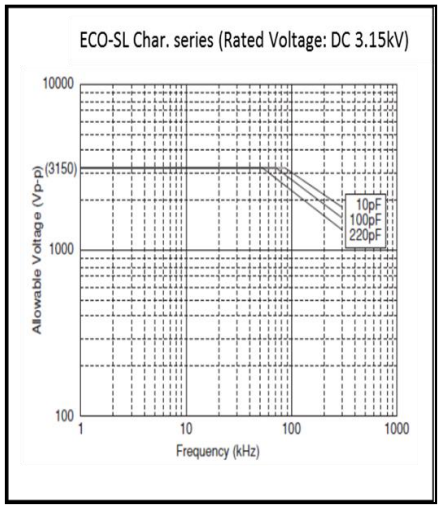


Fig 2 : Allowable Voltage (Sine Wave Voltage) – Frequency Characteristics (At Ambient Temperature of 85 or less)







Because of the influence of harmonics, when the applied voltage is a rectangular wave or pulse wave voltage (instead of a sine wave voltage), the heat generated by the capacitor is higher than the value obtained by application of the sine wave with the same fundamental frequency.

Roughly calculated for reference, the allowable voltage for a rectangular wave or pulse wave corresponds approximately to the allowable voltage for a sine wave whose fundamental frequency is twice as large as that of the rectangular wave or pulse wave.

This allowable voltage, however, varies depending on the voltage and current waveforms.

Therefore, you are requested to make sure that the self heating temperature is not higher than the value specified in Table 1.