Safety

SPECIFICATION

SAMWHA CAPACITOR CO.,LTD

PT SAMCON

JL. RAYA SUBANG CIKUMPAY

CAMPAKA-PURWAKARTA

JAWA BARAT - INDONESIA

To. AAA-LUX BV (네덜란드) **No. SWC-20230831-01**

SPECIFICATION

ITEM : VARISTOR
(CERAMIC SURGE ABSORBER)

PT. SAMCON		
Written	Checked	Approved
		
Irman Sudirman	Apang Djafar S.	Kim Jae Min
AAA-LUX BV (네덜란드)		

SAMWHA CAPACITOR Co., Ltd
(Manufacturer : PT. SAMCON)
Jln Raya Subang Cikumpay – campaka
Purwakarta – West Java Indonesia

Record of Revision

P/N	SAMWHA SPEC	P/N	SAMWHA SPEC
- -	SVC431D-20ABW1S SVC681D-20ABW1S		

No	Reason	Contents	Date of approval	Checked	Remark

1. SCOPE

This specification relates zinc oxide varistor or ceramic surge absorbers are designed to protect low voltage electronic devices such as semiconductors from the effects of surge voltage transient.

2. GENERAL DESCRIPTION

SVC Series varistors are used in application where protection from lightning and switching surges is required and are widely used in T/V set broadcasting and communication equipment and similar situation where there is danger of over voltages or lightning damage and other devices.

SVC Series are gapless ceramic surge absorbers of a new type made of metal oxide.

They have excellent non-linear characteristics and their use gives a high degree of reliability to voltage sensitive circuit components. They have excellent clamping characteristics and when subjected to high emerge transient currents their impedance rapidly changes from a high standby value to a low conducting value which keeps voltages within safe limits.

Discharge transient peak current ratings are available up to a maximum of 4000A between 50 ~1000 volts RMS AC or 65 ~1465 volts DC. They are easily installed, take up little space, and are attractively priced.

3. APPLICATION, APPLICATION EXAMPLES AND FEATURES

3-1. Applications.

- Protection of semiconductor element such as diodes, thyristors,transistors, IC and relays against transient voltages.
- Similar protection of many types of measuring instruments, control machinery and equipment, communication and broadcasting equipment against inductive lightning and switching surges.
- Protection of general purpose electrical equipment, communication equipment, T/V set, radio and similar products against lightning and switching surges.

3-2. Application Examples.

– Fire-alarming equipment of systems, signal equipment for rail and road traffic, disaster prevention shutters and pressure sensors.
– Valve controllers, semiconductor power conversion systems, motor controllers, relay control equipment.
– Centralized meter reading equipment, cable and community T/V systems and broadcast relay equipment.
– Industrial gasoline heaters, automatic vending machines, air conditioning equipment, boilers, refrigerators.
– Medical equipment's, air-operated break switches, ELCB's, clutches and magnetic breaks.
– Temperature relays, proximity switches measuring instrument protection and noise filers.
– T/V set, VTR, Telephone, PBX, car, microwave oven, washing machine and others.

3-3. Features.

– Excellent clamping characteristics.
– High discharge current capability-up to 4000 Amps.
– Fast response time-under 50 nanoseconds.
– Wide operating temperature range.
– Eliminate follow-on current .
– Improve product safety.
– Remarkably symmetrical V-I characteristics.
– Protect circuit insulation and improve system reliability.
– Low installation cost.

4. SPECIFICATION.

- See Specification Table (page 14/14)

5. CHARACTERISTIC

5-1. V-I Characteristics.

The most distinguishing feature of zinc oxide varistor is their highly exponential variation of current over a narrow range of applied voltage.

Within the useful varistor voltage range, the voltage current relationship is empirically approximated by the expression :

$I = K V^{\alpha}$ Where, I = Current in amperes.

V = Voltage.

K = a material constant.

α= an exponent defining the degree of non-linearity.

it is convenient to use a log-log plot of the above equation where is the slope of the V-I curve.

$$\alpha = \frac{\log (i'/I)}{\log (v'/V)}$$

where, I = 1㎃

i‘ = 10㎂

V = V1㎃ = Voltage at 1㎃

v'= V10㎂ = Voltage at 10㎂

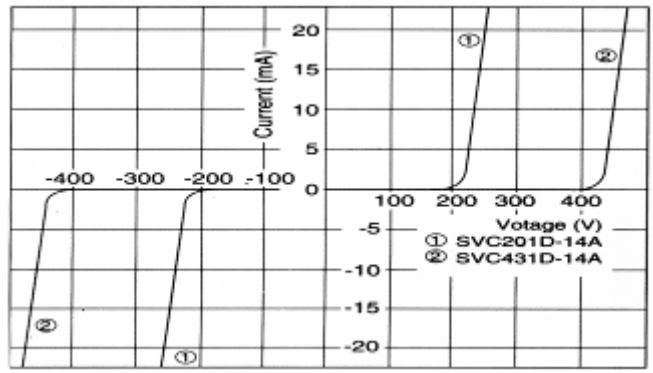


Fig 5-1) Small-current region of V-I curve

Typically, the varistor voltage range may be defined qualitively as that portion of V-I curve Which falls between two regions of transition resistivity :

(1) at lower voltage-a linear/non-linear transition from a high resistance ohmic mode (10^8 ~10^9 ohms), and

(2) at higher voltage a non-linear transition back to an ohmic with resistance of only a few ohms.

Note : Since the V-I curve is symmetrical SVC are capable of absorbing surge having both positive negative polarities with a similar suppression performance.

5-2. Maximum Allowable Voltage (Withstanding Voltage)

The maximum sinusoidal RMS voltage or maximum DC Voltage that can be applied continuously in the specified environmental temperature range for 60 second.

For example: Spec SVC681D-14A

- Vac (RMS 50/60Hz) = 420 volt
- Vdc = 560 volt

5-3. Varistor Nominal Voltage (V_{1mA}) & Tolerance (±10 %)

The voltage across the varistor measured at specified current Ic (1㎃) of specified duration (when applied voltage ex. 681D-14, Vdc 560 V)

For Varistor Nominal Voltage tolerance :

Example : SVC681D-14A; 681D= ± 10%; Max = 748 volt; min = 612 volt

(Refer to Specification table; page 13/14)

5-4. L/C Characteristics

The voltage across the varistor measured at specified current Ic (1mA) of specified duration (when applied voltage ex. 681D-14, Vdc 560 V)

For Varistor Nominal Voltage tolerance :

Example : SVC681D-14A; 681D= ± 10%; Max = 748 volt; min = 612 volt

Leakage Current (L/C) characteristics of varistor finish goods must be not over than 200μA.

For example: Spec SVC681D-14A

Check L/C Applied Voltage (Vdc) = 560V

Applied voltage : 560 Vdc (Refer to Specification table; page 13/14)

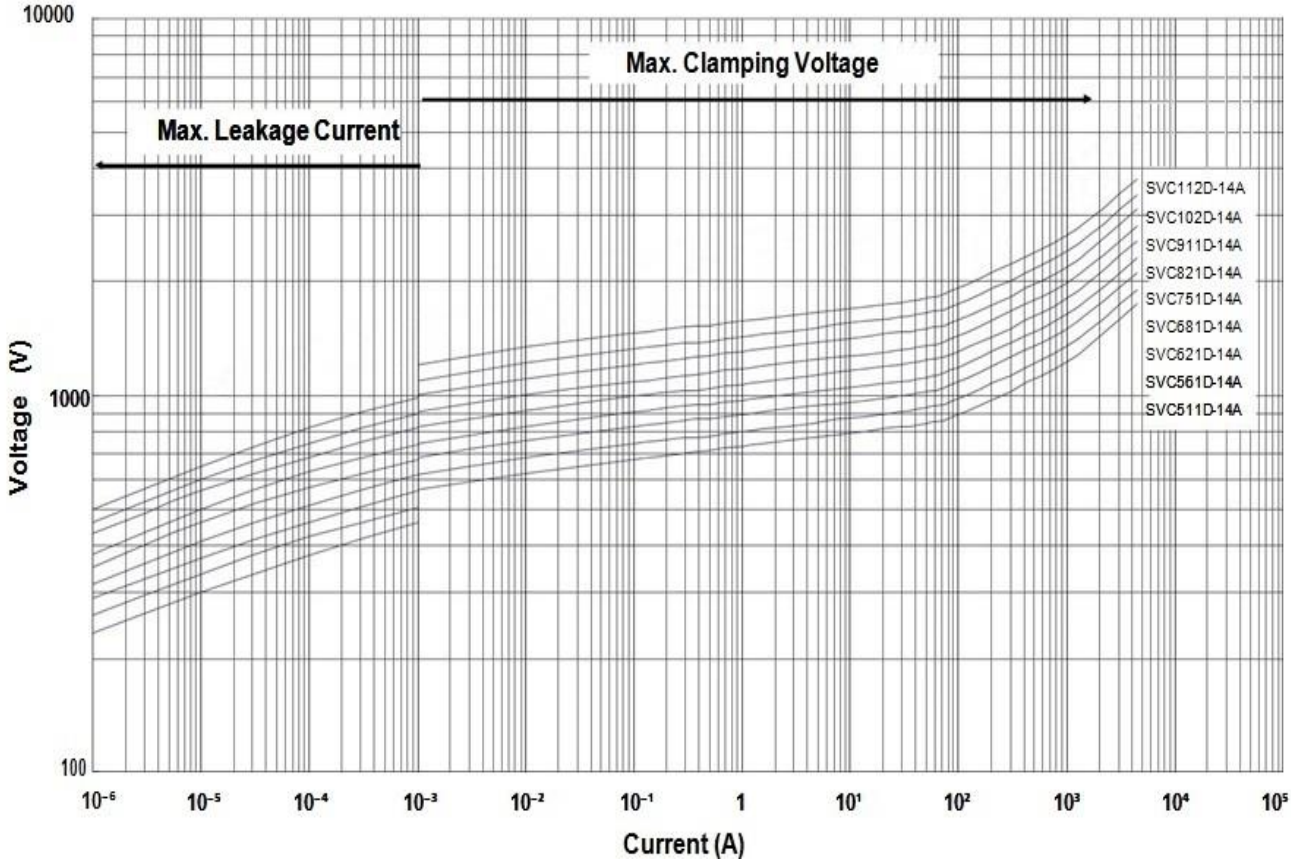


Fig 5-2) Example of transient V-I characteristic curves ∅10.

SVC Series characteristic curves.

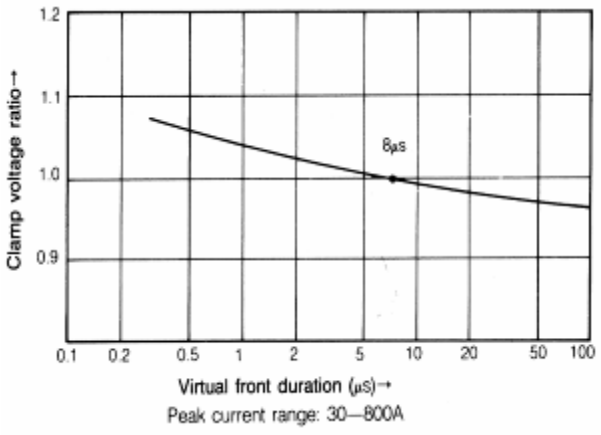


Fig 5-3) Front duration vs. clamp voltage (Typical)

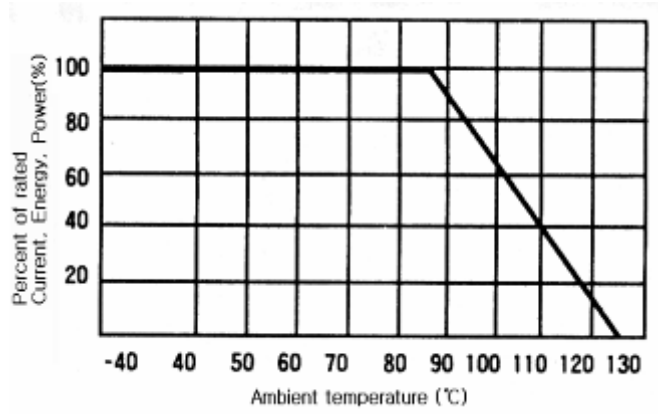


Fig 5-4) Current, Power and energy rating vs.temperature

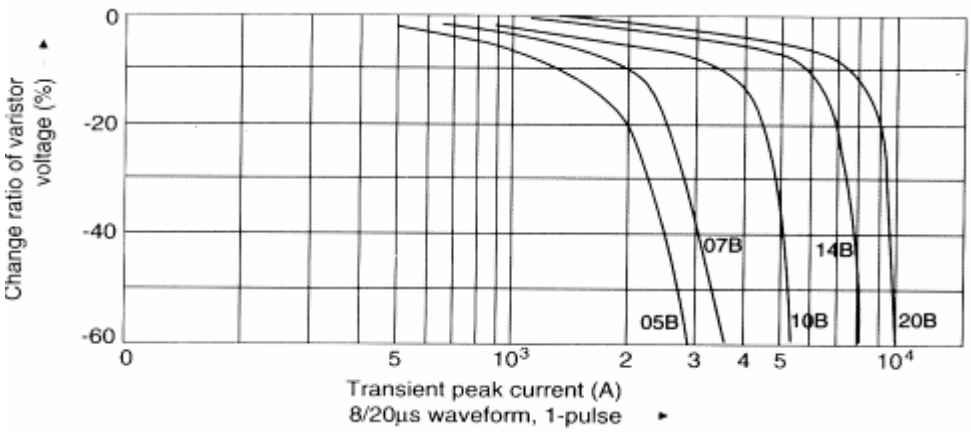


Fig 5-5) Withstand discharge impulse current characteristics - B Series.

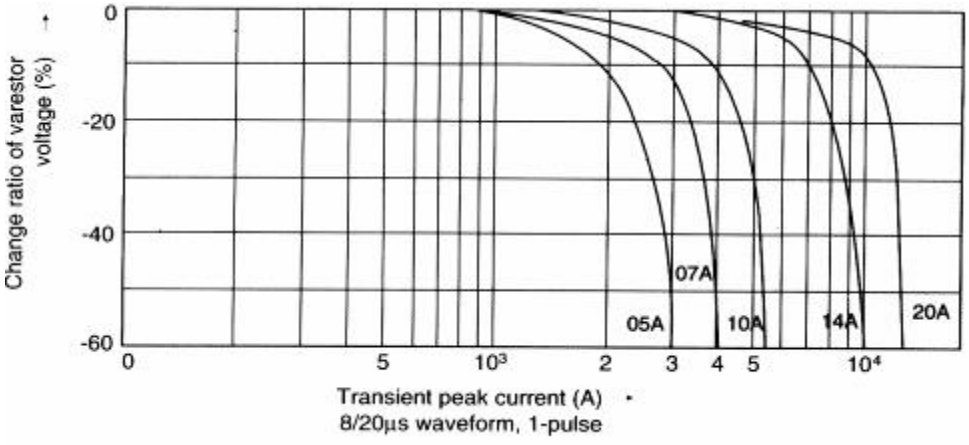


Fig 5-6) Withstand discharge impulse current characteristics - A Series.

▣ Test current waveform.

Characteristics tests for SAMWHA SVC are carried out by using 8 × 20 ㎲ test impulses. Data such as the maximum clamping voltage (Vc) and the transient peak current (Itm) are obtained by using this impulse current.

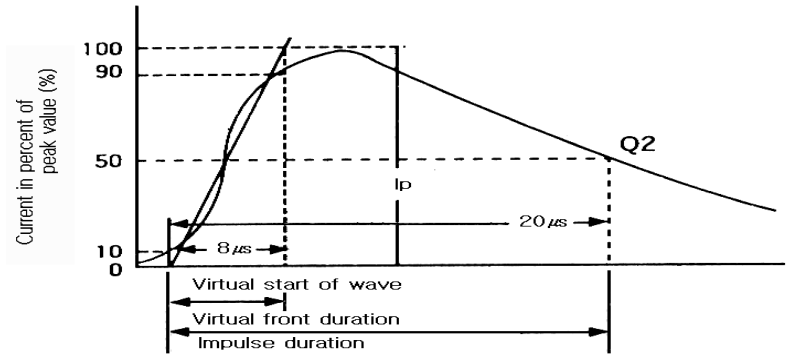


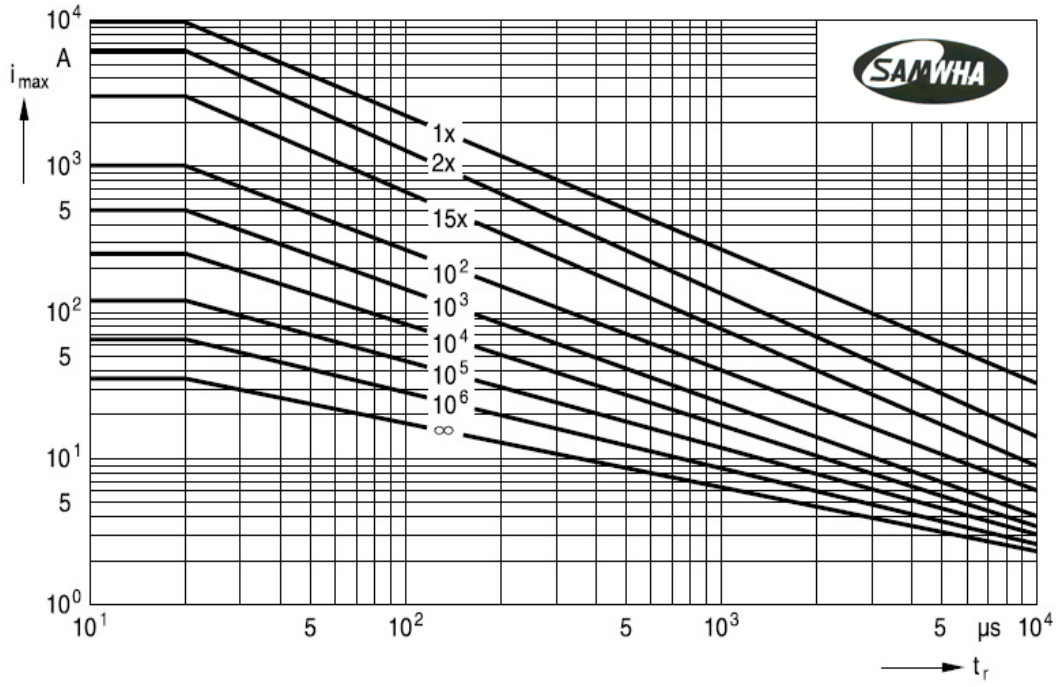
Fig 5-7) Test current waveform 8 × 20㎲ Current wave.

▣ Pulse lifetime ratings

Notes : 2 pulse : 5 minute interval

Up to 10^6 pulse : 10 second interval

● 20A (SVC***D-20A***S)



5-5. Varistor voltage temperature coefficient.

Standard :

$$\frac{V_{1mA} \text{ at } 85℃ - V_{1mA} \text{ at } 25℃}{V_{1mA} \text{ at } 25℃} \times \frac{1}{60} \times 100 \ (\%/℃) \qquad \frac{V_{1mA} \text{ at } -40℃ - V_{1mA} \text{ at } 25℃}{V_{1mA} \text{ at } 25℃} \times \frac{1}{65} \times 100 \ (\%/℃)$$

Specification : $-0.05 \leqq TC \leqq 0.05 (\%/^{O}C)$

6. ELECTRICAL AND MECHANICAL REQUIREMENTS

6-1. Terminal Pull Strength.

After gradually applying the load specified below and keeping the unit fixed for 10±1 seconds, the terminal shall be visually examined for any damage.

Terminal Dia.(㎜)	Load (㎏f)	Remarks
0.5<d≦0.8	1.0	
0.8<d≦1.25	2.0	
1.25<d	4.0	

Specification : a. No visible damage

b. $|\Delta V/V1mA| \leq 5\%$

6-2. Terminal Bending Strength.

The unit shall be secured with its terminal kept vertical the weight specified below be applied in the axial direction. The terminal shall gradually be bent by 90°in one direction, then 90°in opposite direction, than 90°in the opposite direction, and again back to the original position. The damage of the terminal shall be visually examined.

Terminal Dia.(㎜)	Load (㎏f)	Remarks
0.5<d≦0.8	0.5	
0.8<d≦1.25	1.0	
1.25<d	2.0	

Specification : a. No visible damage

b. $|\Delta V/V1mA| \leq 5\%$

6-3. Resistance to Solder Heat

After dipping the terminal to a depth of approximately 3mm from the body in a soldering bath of 260℃(-0,+5) for 10 seconds (Preheat 120°C, 60s), the terminal shall be visually examined.

Requirement = $\frac{\Delta V1mA}{V1mA} \times 100(\%) \leq \pm 10\%$ $V1mA$: Voltage at $V1mA$

$\Delta V1mA$: Change of $V1mA$

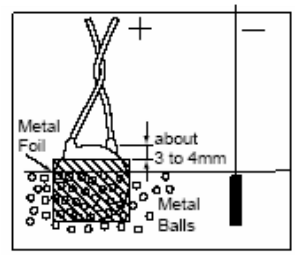
6-4. Solderability

When solderability in temp 245°C for 3 ± 0.5 sec. approximately 95% of lead wire should be covered.

6-5. Body Insulation

Metal ball method, as table below.

Classification (Nominal Voltage Varistor)	Test Voltage (AC)
$V_{0.1mA}$, $V_{1mA} \leqq 330V$	1000 Vrms
$V_{0.1mA}$, $V_{1mA} > 330V$	1500 Vrms



6-6. Humidity (Moisture Resistance)

Varistor shall be subjected to 40℃, 95% R.H for 500 hours without load and then stored at room temperature and humidity for one to two hours.

There after, the change of $V1_{mA}$ shall be measured.

$$\text{Requirement} = \frac{\Delta V1_{mA}}{V1_{mA}} \times 100(\%) \leq \pm 10\%$$

$V1_{mA}$: Voltage at 1_{mA}

$\Delta V1_{mA}$: Change of $V1_{mA}$

6-7. Temperature Cycle.

Varistor shall be subjected to the following 5 cycles : at -40℃ for 30 minutes at 125℃ for 30 minutes.

After the cycles, the varistor shall be returned to and stabilized at room ambient conditions for 1 hour.

$$\text{Requirement} = \frac{\Delta V1_{mA}}{V1_{mA}} \times 100(\%) \leq \pm 10\%$$

$V1_{mA}$: Voltage at 1_{mA}

$\Delta V1_{mA}$: Change of $V1_{mA}$

Test condition :

Step	Condition	Remarks
1	Room Temp.	Temp : ± 3 ℃
2	- 40℃ × 30 min	Time : ± 5 min
3	Room Temp. × (5 min max)	
4	+ 125℃ × 30 min	
5	Room Temp. × (5 min max)	

6-8. High Temperature Load Test

Varistors are to placed in a circulating air oven for 1000±12hours the air oven is to be maintained at a temperature of 85 ± 3℃ throughout the test, each varistor is to be subjected to a Applied voltage.

After placing in room condition for 1 to 4 hours.

$$\text{Requirement} = \frac{\Delta V1_{mA}}{V1_{mA}} \times 100(\%) \leq \pm 10\%$$

$V1_{mA}$: Voltage at 1_{mA}

$\Delta V1_{mA}$: Change of $V1_{mA}$

6-9. Surge Endurance

Methods : combination waveform

Test condition : Maximum peak current (8/20mS pulse wave to be applied once or twice, 5 minute interval)

Also the specimen shall be subjective to the Nominal Discharge Current (In) test (5kA) to fifteen (15) times with 3 group of 5 surges, each surge interval 60 seconds, after each group of 5 surges sample shall rest fo 30 minutes. After 15^{th} surge the MCOV shall be re-applied for at least 15 minutes. within the varistor voltage change of ± 10%.

Specification : a. ΔV1mA/V1mA ± 10%

b. No visible damage

6-10. Low Temperature

The specimen shall be subjected to -40 ± 2°C without load for 1000 hours and then stored at room temperature and nominal humidity for one to two hours.

Specification : a. ΔV1mA/V1mA ≦ 5%

b. No visible damage

6-11. 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).

6-12. Operating and Storage Temperature

- Operating temperature (Ambient temperature) : -40°C to +85°C
- Storage temperature : -40°C to +125°C

7. TYPE DESIGNATION. (HOW TO ORDER)

SVC 431 D - 20 A BW 1 S

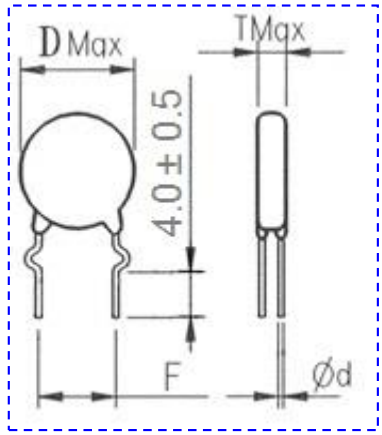
- SVC — Basic type ZnO varistor
- 431 — Varistor nominal voltage (The first two digit indicate significant digit) (The 3rd digit indicate the number of zeros following)
- D — Style: D : Disk type varistor
- 20 — Chip element size (dia): 05:5mm, 07:7mm, 10:10mm, 14:14mm, 20:20mm
- A — Classification: A:high volt, B: low volt.
- BW — Packing style & lead variation
- 1 — Suffix code
- S — Superior Type

8. MARKING

Dia.(Φ)	Marking	Remarks
20	SVC.. □□□-■■ UL CSA	□ Varistor nominal volt ■ Chip element size
	SVC431~SVC112	

9. PACKING STYLE

9-1. BULK (BS Type)



Unit : mm

TYPE	Dmax	Tmax	L (±0.5)	F (± 1.0)	Φd (±0.05)
SVC 431D-20A***S	24.0	6.0	4.0	10.0	1.00
SVC 681D-20A***S	24.0	7.5	4.0	10.0	1.00

Specification Table

Device type	Chip Element size	MAXIMUM RATINGS						CHARACTERISTICS						SAFETY APPROVAL		
		Applied voltage		Transient				Nominal varistor peak voltage (@1mA)			Max. clamping voltage @ test current (8/20/μs)		Nominal Discharge Current			
		RMS 50/60 Hz (25℃)	DC (25℃)	Energy (2mS)	Average power dissipation	Peak current (8/20μs)										
	Dia (mm)	Vacm (Volts)	Vdcm (Volts)	Wtm (Joules)	Ptam (Watts)	Itm (Amps)		Vnom (Volts)	Tolerance (± 10%)		Vc (Volts)	Ip (Amps)	In (Amps)	UL	CSA	VDE
						1 Pulse	2 Pulse		Min (Volts)	Max (Volts)						
SVC 431D-20A***S	20	275	350	140.0	1.00	10000	6000	430	387	479	710	100	5000	●	●	●
SVC 681D-20A***S	20	420	560	160.0	1.00	10000	6000	680	612	748	1120	100	5000	●	●	●

VARISTOR PACKING SPECIFICATION

1. PACKING QUANTITY

1-1. BULK

DIA [∅]	PACKING Q'TY [pcs]			
	L/W Length	VINYL	In Box	Out Box
05, 07	Long, Short	500 +2, -0	7,500	15,000
	Long : 391-07, 471-07	500 +2, -0	5,000	10,000
10, 14	Short	400 +1, -0	4,000	8,000
	Long	400 +1, -0	2,000	4,000
	911-14, 182-14	200 +1, -0	1,000	2,000
	621-14BW7	200 +1, -0	2,000	4,000
20	Long, Short	200 +1, -0	1,000	2,000
	471-20BK	200 +1, -0	1,000	2,000
	681-20S	200 +1, -0	1,000	2,000

1-2. TAPING

CATEGORY	F [㎜]	P [㎜]	DIA. [Φ]	IBR [㎜]	PACKING Q'TY [pcs]		REMARK
					Flat Box	Out Box	
Varistor	5.0	12.7	5.0 ~ 7.0	52	1000 +5,-0	5,000	
	7.5	15.0	Above 10.0		1000 +5,-0	5,000	
		30.0			500 +5,-0	2,500	
		25.4			500 +5,-0	2,500	

2. PACKING BOX DIMENSIONS

PACKING STYLE		CATEGORY	L × W × H [mm]
BULK	IBB (Inner Box Bulk)	IBB 140	250 × 235 × 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 × 310 × 290

3) STACKING BOX (Maximum)

PACKING STYLE	INBOX	OUTBOX
BULK	6	6
TAPING	10	6

▣ STUCTURE & MATERIAL LIST

No	Material Name	Substance	Hazardous Substance Existences										Remarks
			Pb	Hg	Cd	Cr^{+6}	PBB	PBDE	Halogen				
									Br	Cl	F	I	
1	Varistor Powder	ZnO	X	X	X	X	X	X	X	X	X	X	
2	Ag Paste	Ag	X	X	X	X	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	X	425	-	-	
5	Lead Wire	Cu, Sn, Fe	X	X	X	X	X	X	-	-	-	-	Plating thickness: min 3μm. (material : tin)

※ SAFETY APPROVAL FILE NO

- **UL FILE No : E332621 (Surge Protective Device)**
- **UL FILE No : E154171(Circuit Component Isolated Loop Circuit Protectors)**
- **CSA C221331 Certificate No : 1513084 (Surge Protective Device)**
- **VDE IEC 61051-2:1991/AMD1:2009 Certificate No : 116012**

▣ Varistor Label Type

▣ Varistor Label – Bulk Style

BULK TYPE		
PLASTIC	INBOX	OUTBOX
		
Varistor Bulk Plastic Style	Varistor Bulk Inbox Style	Varistor Bulk Outbox Style

▣ Varistor Label – Taping Style

TAPING TYPE		
PLASTIC	INBOX	OUTBOX
		
	Varistor Taping Inbox Style	Varistor Taping Outbox Style