

CERAMATE	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	1/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Structure			REV.	C01	

1. STRUCTURE

NO.	ITEM	DESCRIPTION		
1.1	Main Material	Zinc Oxide		
1.2	End termination	Ag/Ni/Sn		
1.3	Packaging	Reel		
1.4	Complies with Standard	IEC61000-4-2 level 4		
1.5	Complies with RoHS Standard	Yes		
1.6	Lead content	< 1000ppm		
1.7	Reflow solder profile temperature (Recommend)	250 °C		
1.8	Dimensions	(Unit : mm)	L	1.00 ± 0.10
			W	0.50 ± 0.10
			T(max.)	0.60
			a	0.25 ± 0.1

CERAMATE	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	2/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Electrical Characteristics			REV.	C01	

2. ELECTRICAL CHARACTERISTICS

N0.	ITEM	PERFORMANCE	TEST METHODS
2.0	Standard Conditions		Unless otherwise specified, all tests are made under environmental conditions as given below: Temperature: 5~35°C Relative humidity: 45~85 % RH
2.1	Maximum Allowable Voltage	AC : *(1) V _{rms} DC : *(1) V	Maximum continuous sine wave(RMS) or DC voltage which may be applied.
2.2	Varistor Voltage	V _{0.1mA} : *(1) V	Voltage across the varistor measured at C _{mA} DC.
2.3	Varistor Voltage Temperature Coefficient	0 ~ -0.05 %/°C	$\frac{V_{cma@85^{\circ}C} - V_{cma@25^{\circ}C}}{V_{cma@25^{\circ}C}} \times \frac{1}{60} \times 100$
2.4	Max. Clamping Voltage	*(1) V at 1 A	Peak voltage across the varistor with a specified peak impulse current of 8x20μs waveform.
2.5	ESD Trigger Voltage (V _T)	< *(1) V	
2.6	Response time	T _{rise} < 1 nS	
2.7	Leakage current	I _{LDC} < *(1) μA	at V _{1mA} ×80%
		I _{LDCA} < *(1) μA	at V _{1mA} ×80% (After ESD Test)
2.8	Capacitance	*(1) pF.	Capacitance shall be measured at 1 MHz, 1 Vrms max. 0V bias and 20±2°C

***(1) See table 2.1 Electrical Characteristics**

	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	3/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Electrical Characteristics			REV.	C01	

Table 2.1 Electrical Characteristics

Part Number	Maximum Allowable Voltage		Varistor Voltage	Max. Clamping Voltage	ESD Trigger Voltage (V _T)	Leakage Current (μA)		Typical Capacitance	
	AC	DC				I _{LDC}	I _{LDCA}	PF(MHz)	Tolerance (%)
0402E0503R0PRR	---	5	48~73	<135	---	0.1	2	2.5	+80/-20
0402E050050PRR	3.3	5	28~38	<72	---	0.1	2	4~9	+80/-20
0402E050100NRR	3.3	5	28~38	<72	---	0.1	2	7~13	+30/-30
0402E050200NRR	3.3	5	18~28	<52	---	0.1	2	14~26	+30/-30
0402E050220NRR	3.3	5	18~28	<52	---	0.1	2	15.4~28.6	+30/-30
0402E050330NRR	3.3	5	18~28	<52	---	0.1	2	23.1~42.9	+30/-30
0402E050470NRR	3.3	5	18~28	<52	---	0.1	2	32.9~61.1	+30/-30
0402E050560NRR	3.3	5	18~28	<52	---	0.1	2	39.2~72.8	+30/-30
0402E050820NRR	3.3	5	18~28	<52	---	0.1	2	57.4~106.6	+30/-30
0402E050101NRR	3.3	5	18~28	<52	---	0.1	2	70~130	+30/-30
0402E120050PRR	8	12	28~38	<72	---	0.1	2	4~9	+80/-20
0402E120100NRR	8	12	28~38	<72	---	0.1	2	10	+30/-30
0402E120220NRR	8	12	20~30	<55	---	0.1	2	22	+30/-30
0402E120330NRR	8	12	20~30	<55	---	0.1	2	33	+30/-30
0402E120560NRR	8	12	20~30	<55	---	0.1	2	56	+30/-30
0402E120820NRR	8	12	20~30	<55	---	1	2	82	+30/-30
0402E120101NRR	8	12	20~30	<55	---	0.1	2	100	+30/-30
0402E1400R2PRR	---	14	---	<35	250	0.05	10	0.25	+200/-50
0402E140101NRR	10	14	27~42	<68	---	0.1	2	100	+30/-30
0402E1802R05PR	---	18	48~72	<145	---	0.1	2	2	+50/-50
0402E1803R0PRR	---	18	48~72	<200	---	0.1	2	3	+80/-20
0402E180100NRR	12	18	27~42	<60	---	0.1	2	10	+30/-30
0402E180220NRR	12	18	21~27	<60	---	0.1	2	22	+30/-30
0402E180101NRR	12	18	21~28	<68	---	0.1	2	100	+30/-30
0402E2400R8PRR	---	24	100~150	<200	---	0.1	2	0.8~1.5	+80/-20
0402E2402R5PRR	18	24	100~150	<200	---	0.1	2	2~4.5	+80/-20
0402E2403R0NRR	---	24	48~72	<200	---	0.1	2	3	+80/-20

* 0603E2400R2PRR : Minimum ESD pulse withstand 2000 times

	TYPE	SMV0402E □□□□□□□□ RR	MODEL		PAGE	4/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Reliability			REV.	C01	

3. ENVIRONMENTAL CHARACTERISTICS

No.	Characteristic	Test method and description			
3.1	High Temperature Storage	The specimen shall be subjected to $150 \pm 2^{\circ}\text{C}$ for 1000 ± 12 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. The change of varistor voltage shall be within 10% .			
3.2	Temperature Cycle	The temperature cycle of specified temperature shall be repeated five times and then stored at room temperature and humidity for one or two hours. The change of varistor voltage shall be within 10% and mechanical damage shall be	Step	Temperature	Period
			1	$-40 \pm 3^{\circ}\text{C}$	30Min $\pm$ 3
			2	Room Temperature	1~2 hours
			3	$125 \pm 2^{\circ}\text{C}$	30Min $\pm$ 3
3.3	High Temperature Load	After being continuously applied the maximum allowable voltage at $85 \pm 2^{\circ}\text{C}$ For 1000 ± 2 hours, the specimen shall be stored at room temperature and humidity for one or two hours, the change of varistor voltage shall be within 10% .	4	Room Temperature	1~2 hours
3.4	Damp Heat Load/ Humidity Load	The specimen should be subjected to $40 \pm 2^{\circ}\text{C}$, 90 to 95%RH environment, and the maximum allowable voltage applied for 1000 hours, then stored at room temperature and humidity for one or two hours. The change of varistor voltage shall be within 10%.			
3.5	Low Temperature Storage	The specimen should be subjected to $-40 \pm 2^{\circ}\text{C}$, without load for 500 hours and then stored at room temperature for one or two hours. The change of varistor voltage shall be within 10%			

4. TECHNICAL TERM

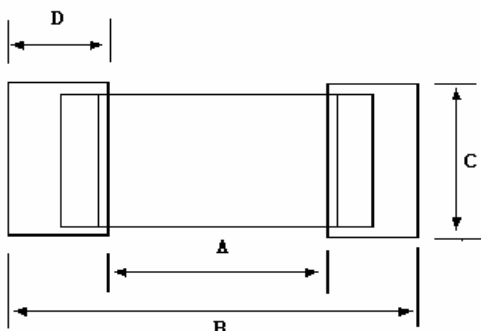
No.	Item	Specifications	Description
4.1	Operating Temperature Range	-40°C to $+85^{\circ}\text{C}$	Operating temperature range without derating.
4.2	Storage Temperature Range	-40°C to $+125^{\circ}\text{C}$	Storage temperature range without voltage applied.
4.3	Transient Response Time	< 50 ns	Time lag between application of surge and varistor's "turn-on" conduction action.

CERAMATE	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	5/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Soldering			REV.	C01	

5. SOLDERING RECOMMENDATIONS

5.1 Recommended solder pad layout

A	B	C	D
0.4~0.6	1.4~1.8	0.5~0.6	0.6~1.2
(Unit : mm)			



The diagram illustrates a rectangular layout with four dimensions labeled A, B, C, and D. Dimension A is the horizontal distance between the inner vertical lines of two rectangular pads. Dimension B is the total horizontal width of the layout, including the pads and the space between them. Dimension C is the vertical height of the pads. Dimension D is the horizontal width of each individual pad. The pads are represented by two vertical rectangles, one on the left and one on the right, with dimension lines indicating the specified measurements.

5.2 The SIR test of the solder paste shall be done (Based on JIS-Z-3284)

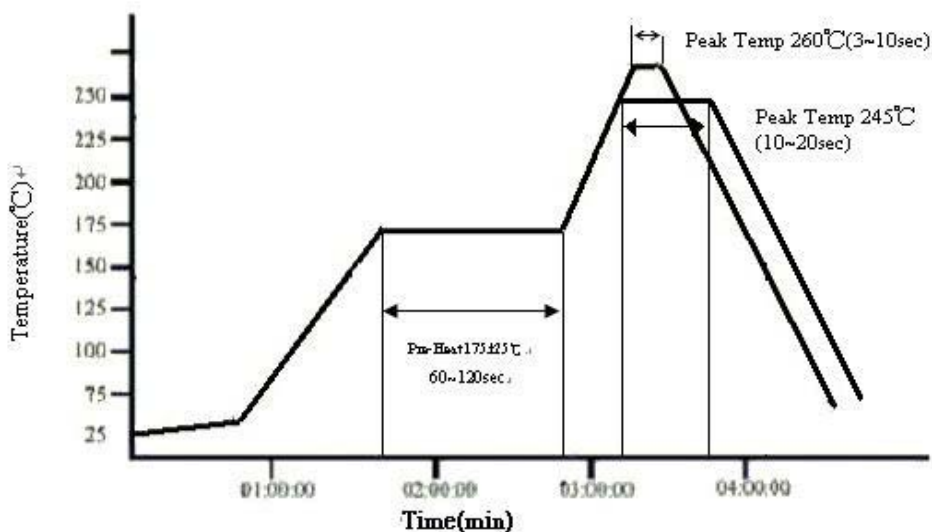
5.3 Steel plate and foot distance printing

Foot distance printing (mm)	Steel Plate thickness (mm)
> 0.65mm	0.18mm
0.65mm~0.5mm	0.15mm
0.50mm~0.40mm	0.12mm
<=0.40 mm	0.10mm

5.4 IR Soldering

Rapid heating, partial heating or rapid cooling will easily cause defect of the component. So preheating and gradual cooling process is suggested. IR soldering has the highest yields due to controlled heating rates and solder liquids times. Make sure that the element is not subjected to a thermal gradient steeper than 4 degrees per second. 2 degrees per second is the ideal gradient. During the soldering process, pre- heating to within 100 degrees of the solders peak temperature is essential to minimize thermal shock.

CERAMATE	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	6/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Soldering			REV.	C01	



☆ IR reflow Pb Free Process suggestion profile

- (1) The solder recommend is Sn96.5/Ag 3.5 of 120 to 150μm
- (2) Ramp-up rate (217°C to Peak) + 3°C/second max
- (3) Temp. maintain at 175 +/-25°C 180 seconds max
- (4) Temp. maintain above 217 °C 60-150 seconds
- (5) Peak temperature range 245°C +20°C/-10 °C time within 5 °C of actually peak temperature (tp) 10~20 seconds
- (6) Ramp down rate +6 °C/second max.

※Perform adequate test in advance as the reflow temperature profile will vary according to the conditions of the manufacturing process, and the specification of the reflow furnace.

5.5 Resistance to soldering heat-High Temperature Resistance:260°C,10sec-3times.

5.6 Hand Soldering

In hand soldering of the Varistors. Large temperature gradient between preheated the Varistors and the tip of soldering iron may cause electrical failures and mechanical damages such as crackings or breakings of the devices. The soldering shall be carefully controlled and carried out so that the temperature gradient is kept minimum with following recommended conditions for hand soldering.

5.6.1 Recommended Soldering Condition 1

- (1) Solder :
0.12~0.18mm Thread solder (Sn96.5:Ag3.5) with soldering flux in the core. Rosin-based and non-activated flux is recommended.
- (2) Preheating
The Varistors shall be preheated so that Temperature Gradient between the devices and the tip of soldering iron is 150°C or below.

	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	7/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Soldering			REV.	C01	

(3) Soldering Iron

Rated Power of 20w max with 3mm soldering tip in diameter.

Temperature of soldering iron tip 380℃ max,3-5sec (The required amount of solder shall be melted in advance on the soldering tip.)

(4) Cooling

After soldering. The Varistors shall be cooled gradually at room ambient temperature.

5.6.2 Recommended Soldering Condition 2 (Without preheating)

(1) Solder iron tip shall not directly touch to ceramic dielectrics.

(2) Solder iron tip shall be fully preheated before soldering while soldering iron tip to the external electrode of Varistors.

5.7 Post Soldering Cleaning

5.7.1 Residues of corrosive soldering fluxes on the PC board after cleaning may greatly have influences on the electrical characteristic and the reliability (such as humidity resistance)of the Varistors which have been mounted on the board. It shall be confirmed that the characteristic and the reliability of the devices are not affected by the applied cleaning conditions.

5.7.2. When an ultrasonic cleaning is applied to the mounted Varistors on PC Boards. Following conditions are recommended for preventing failures or damages of the devices due to the large vibration energy and the resonance caused by the ultrasonic waves.

(1) Frequency 29MHz max

(2) Radiated Power 20w/lithr max

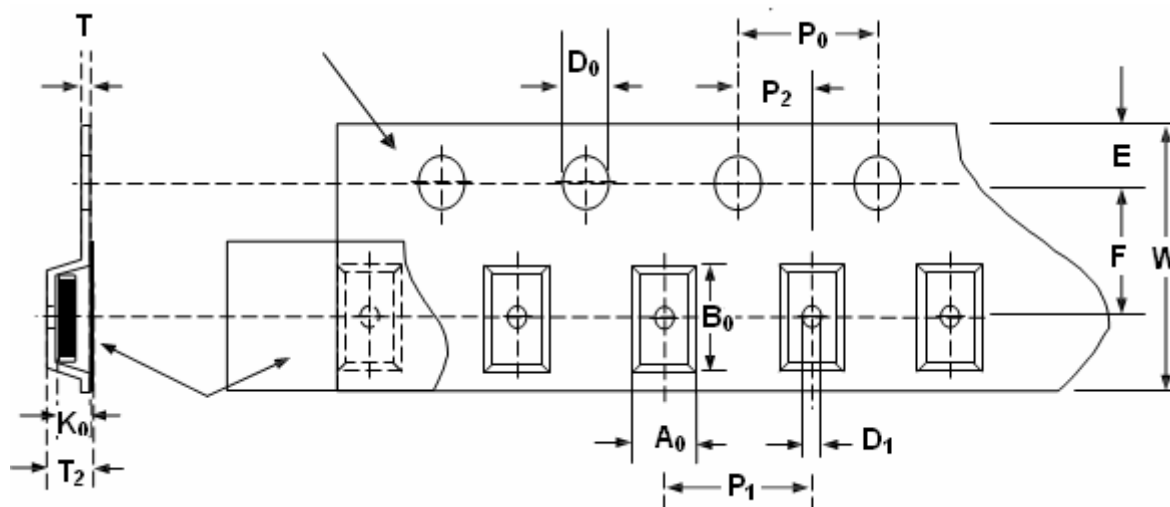
(3) Period 5minuets max

6. PACKAGING SPECIFICATION

6.1 Carrier tape and transparent cover tape should be heat-sealed to carry the products, and the reel should be used to reel the carrier tape.

6.2 The adhesion of the heat-sealed cover tape shall be 40 +20/ -15grams.

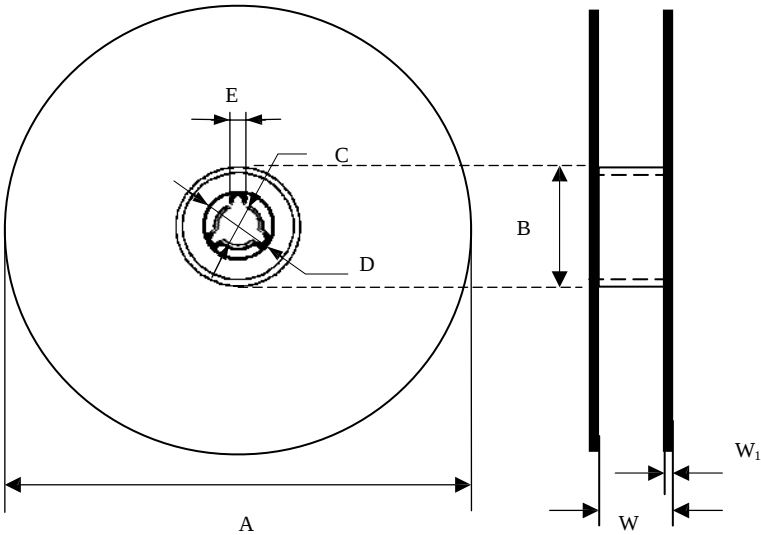
6.3 Both the head and the end portion of the taping shall be empty for reel package and SMT auto-pickup machine. And a normal paper tape shall be connected in the head of taping for the operator to handle



Symbol	A0 ±0.05	B0 ±0.05	K0 ±0.05	T ±0.05	T2 ±0.05	D0 +0.10 -0.05	D1 ±0.05	P1 ±0.10	P2 ±0.10	P0 ±0.10	W ±0.10	E ±0.10	F ±0.05
mm	1.10	1.90	0.95	0.22	1.26	1.56	1.00	4.00	2.00	4.00	8.00	1.75	3.50

CERAMATE	TYPE	SMV0402E□□□□□□□RR	MODEL		PAGE	9/9
CITATION				DATE	Feb. 13, 2009	
SUBJECT	Reel Dimension			REV.	C01	

7. REEL DIMENSION



Symbol	A	B	C	D	E	W	W ₁
Unit(mm)	178±1	60±0.5	13±0.2	21±0.2	2.0±0.5	9±0.5	1.5±0.15

Standard packaging : 1000 pcs/Reel.