

# Metal Oxide Varistor : TVB Series

## Plastic Encapsulated Type Varistor for Surge Protection

### ■ Features

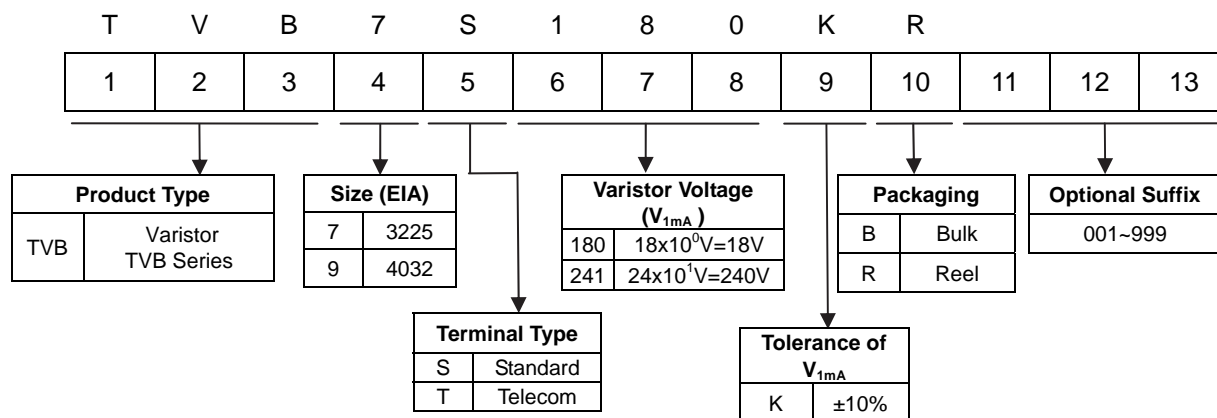
1. RoHS compliant
2. Available for SMT flow/reflow soldering
3. Low profile and space saving
4. Large capability to withstand high surge current
5. Low inductance construction with excellent response
6. Encapsulation material according to UL94-V0
7. Operating temperature range: -40°C ~ +85°C  
Storage temperature range: -40°C ~ +125°C
8. Agency recognition: UL/cUL
9. UL 1449 3<sup>rd</sup> SPD Type Application: for SPD "Other" Applications



### ■ Recommended Applications

1. Power supply
2. Home appliance
3. Industrial equipment
4. Telecommunication or telephone system

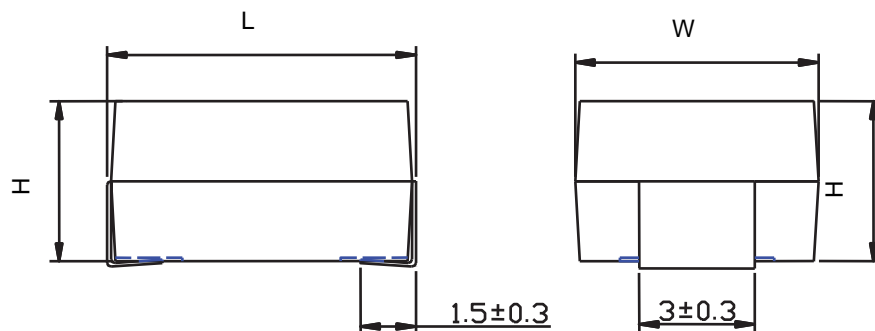
### ■ Part Number Code



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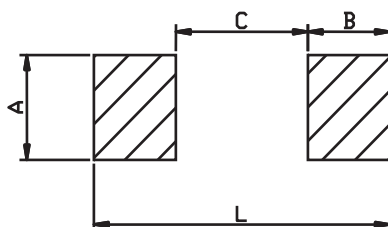
### ■ Structures and Dimensions



(Unit: mm)

Size (EIA)	Varistor Voltage Range (V)	L	W	H
3225	$V_{1mA}=180 \sim 271$	$8.0 \pm 0.3$	$6.3 \pm 0.3$	$3.2 \pm 0.3$
	$V_{1mA}=361 \sim 561$			$4.5 \pm 0.3$
4032	$V_{1mA}=180 \sim 271$	$10.2 \pm 0.3$	$8.0 \pm 0.3$	$3.2 \pm 0.3$
	$V_{1mA}=301 \sim 751$			$4.5 \pm 0.3$

### ● Soldering Pads



(Unit: mm)

Item	A	B	C	L
Size (EIA) 3225	3.5	2.8	4.5	10.1
4032	3.5	2.8	6.5	12.1

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### ■ Electrical Characteristics

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20µs)		Max. Surge Current (8/20µs)	Max. Energy (10/1000µs)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
		V <sub>AC(rms)</sub> (V)	V <sub>DC</sub> (V)	V <sub>P</sub> (V)	I <sub>P</sub> (A)					UL	cUL
	V <sub>1mA</sub> (V)	V <sub>AC(rms)</sub> (V)	V <sub>DC</sub> (V)	V <sub>P</sub> (V)	I <sub>P</sub> (A)	I <sub>max</sub> (A)	W <sub>max</sub> (J)	P (W)	C <sub>p</sub> (pF)	UL 1449 <sup>3rd.</sup> E314979	
TVB7S180	18 (16~20)	11	14	36	1.0	150	0.6	0.01	1750	√	√
TVB7S220	22 (20~24)	14	18	43	1.0	150	0.7	0.01	1450	√	√
TVB7S270	27 (24~30)	17	22	53	1.0	150	0.9	0.01	1200	√	√
TVB7S330	33 (30~36)	20	26	65	1.0	150	1.1	0.01	980	√	√
TVB7S390	39 (35~43)	25	31	77	1.0	150	1.2	0.01	850	√	√
TVB7S470	47 (42~52)	30	38	93	1.0	150	1.5	0.01	720	√	√
TVB7S560	56 (50~62)	35	45	110	1.0	150	1.8	0.01	620	√	√
TVB7S680	68 (61~75)	40	56	135	1.0	150	2.2	0.01	520	√	√
TVB7S820	82 (74~90)	50	65	135	5.0	400	2.5	0.1	300	√	√
TVB7S101	100 (90~110)	60	85	165	5.0	400	3.0	0.1	250	√	√
TVB7S121	120 (108~132)	75	100	200	5.0	400	4.0	0.1	210	√	√
TVB7S151	150 (135~165)	95	125	250	5.0	400	6.0	0.1	135	√	√
TVB7S181	180 (162~198)	115	150	300	5.0	400	6.5	0.1	110	√	√
TVB7S201	200 (180~220)	130	170	340	5.0	400	7.0	0.1	100	√	√
TVB7S221	220 (198~242)	140	180	360	5.0	400	7.5	0.1	95	√	√
TVB7S241	240 (216~264)	150	200	395	5.0	400	9.0	0.1	90	√	√
TVB7S271	270 (243~297)	175	225	455	5.0	400	9.5	0.1	75	√	√
TVB7S361	360 (324~396)	230	300	595	5.0	400	10.0	0.1	60	√	√
TVB7S391	390 (351~429)	250	320	650	5.0	400	11.0	0.1	55	√	√
TVB7S431	430 (387~473)	275	350	710	5.0	400	13.0	0.1	50	√	√
TVB7S471	470 (423~517)	300	385	775	5.0	400	15.0	0.1	45	√	√
TVB7S511	510 (459~561)	320	410	845	5.0	400	16.5	0.1	40	√	√
TVB7S561	560 (504~616)	350	450	930	5.0	400	18.0	0.1	35	√	√

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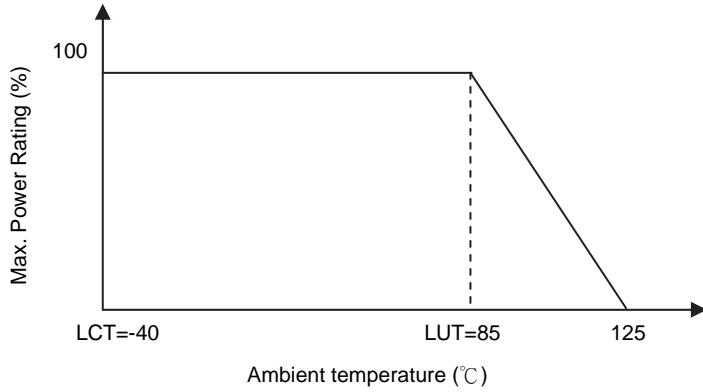
## Plastic Encapsulated Type Varistor for Surge Protection

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20µs)		Max. Surge Current (8/20µs)	Max. Energy (10/1000µs)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
		$V_{AC(rms)}$ (V)	$V_{DC}$ (V)	$V_P$ (V)	$I_P$ (A)					UL	cUL
TVB9S180	18 (16~20)	11	14	36	2.5	300	1.1	0.02	2750	√	√
TVB9S220	22 (20~24)	14	18	43	2.5	300	1.3	0.02	2300	√	√
TVB9S270	27 (24~30)	17	22	53	2.5	300	1.6	0.02	1900	√	√
TVB9S330	33 (30~36)	20	26	65	2.5	300	2.0	0.02	1600	√	√
TVB9S390	39 (35~43)	25	31	77	2.5	300	2.4	0.02	1400	√	√
TVB9S470	47 (42~52)	30	38	93	2.5	300	2.8	0.02	1200	√	√
TVB9S560	56 (50~62)	35	45	110	2.5	300	3.4	0.02	1050	√	√
TVB9S680	68 (61~75)	40	56	135	2.5	300	4.1	0.02	900	√	√
TVB9S820	82 (74~90)	50	65	135	10	1200	6.5	0.25	530	√	√
TVB9S101	100 (90~110)	60	85	165	10	1200	7.0	0.25	480	√	√
TVB9S121	120 (108~132)	75	100	200	10	1200	9.0	0.25	430	√	√
TVB9S151	150 (135~165)	95	125	250	10	1200	11.0	0.25	260	√	√
TVB9S181	180 (162~198)	115	150	300	10	1200	13.0	0.25	220	√	√
TVB9S201	200 (180~220)	130	170	340	10	1200	15.0	0.25	200	√	√
TVB9S221	220 (198~242)	140	180	360	10	1200	18.0	0.25	180	√	√
TVB9S241	240 (216~264)	150	200	395	10	1200	18.5	0.25	170	√	√
TVB9S271	270 (243~297)	175	225	455	10	1200	21.0	0.25	150	√	√
TVB9S301	300 (270~330)	195	250	500	10	1200	21.5	0.25	140	√	√
TVB9S331	330 (297~363)	215	275	550	10	1200	22.0	0.25	120	√	√
TVB9S361	360 (324~396)	230	300	595	10	1200	23.0	0.25	115	√	√
TVB9S391	390 (351~429)	250	320	650	10	1200	25.0	0.25	105	√	√
TVB9S431	430 (387~473)	275	350	710	10	1200	29.0	0.25	95	√	√
TVB9S471	470 (423~517)	300	385	775	10	1200	30.0	0.25	90	√	√
TVB9S511	510 (459~561)	320	410	845	10	1200	33.0	0.25	85	√	√
TVB9S561	560 (504~616)	350	450	930	10	1200	33.0	0.25	80	√	√
TVB9S621	620 (558~682)	395	510	1020	10	1200	35.0	0.25	60	√	√
TVB9S681	680 (612~748)	420	560	1120	10	1200	35.0	0.25	55	√	√
TVB9S751	750 (675~825)	460	615	1235	10	1200	50.5	0.25	55	√	√

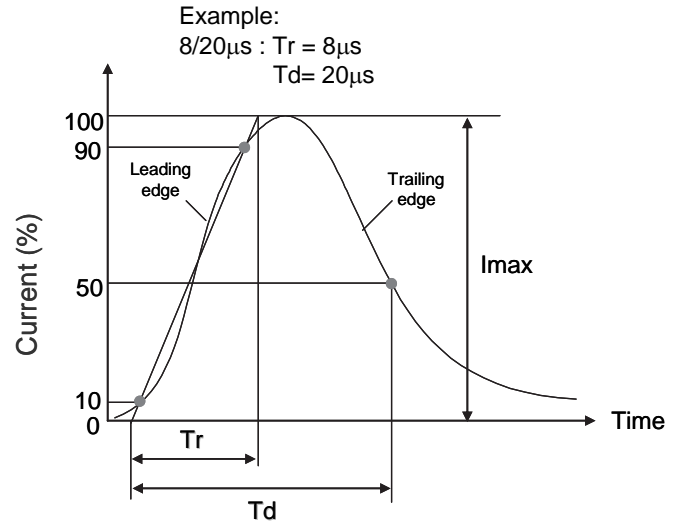
# Metal Oxide Varistor : TVB Series

## Plastic Encapsulated Type Varistor for Surge Protection

### Power Derating Curve

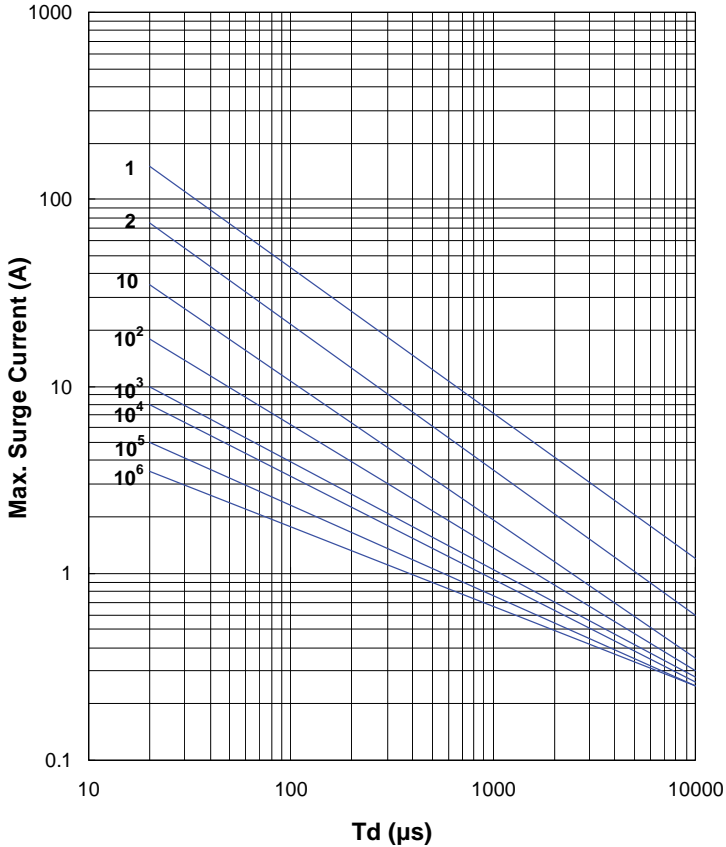


### Surge Current Standard Waveform

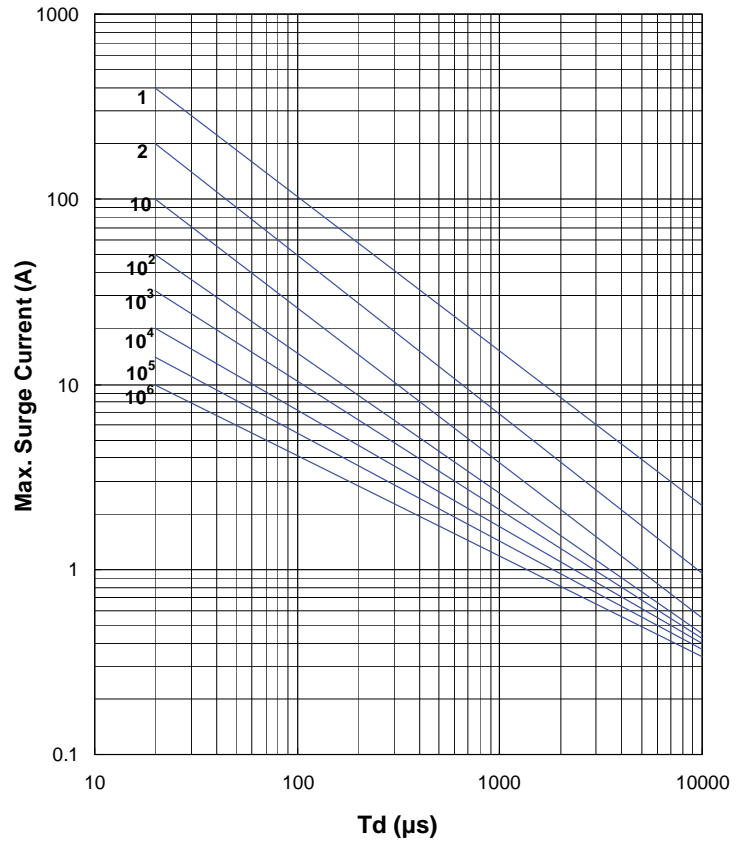


### Max. Surge Current Derating Curves

TVB7S180 to TVB7S680



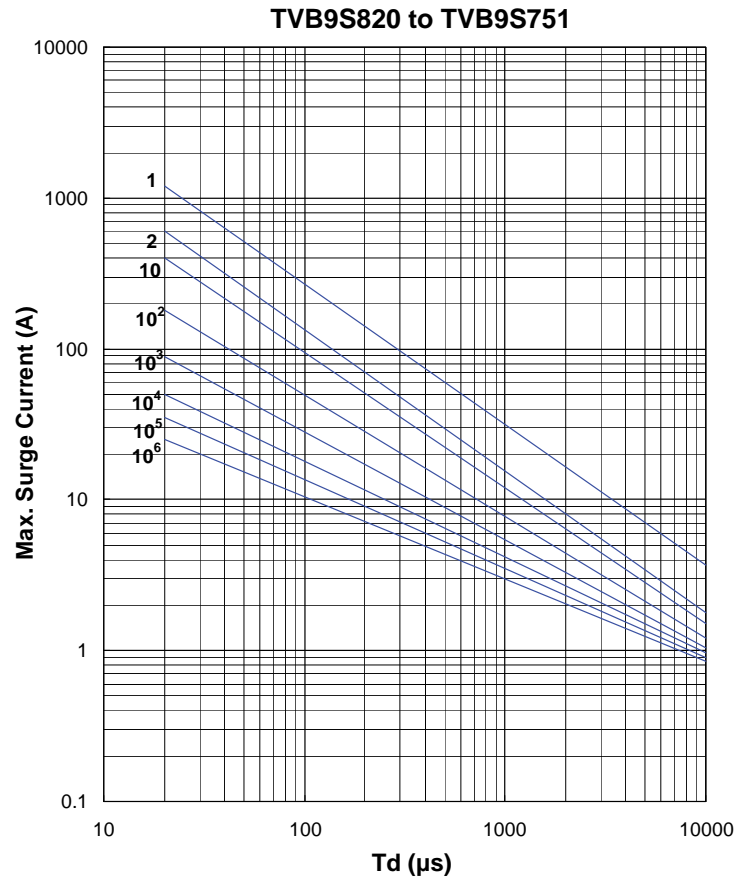
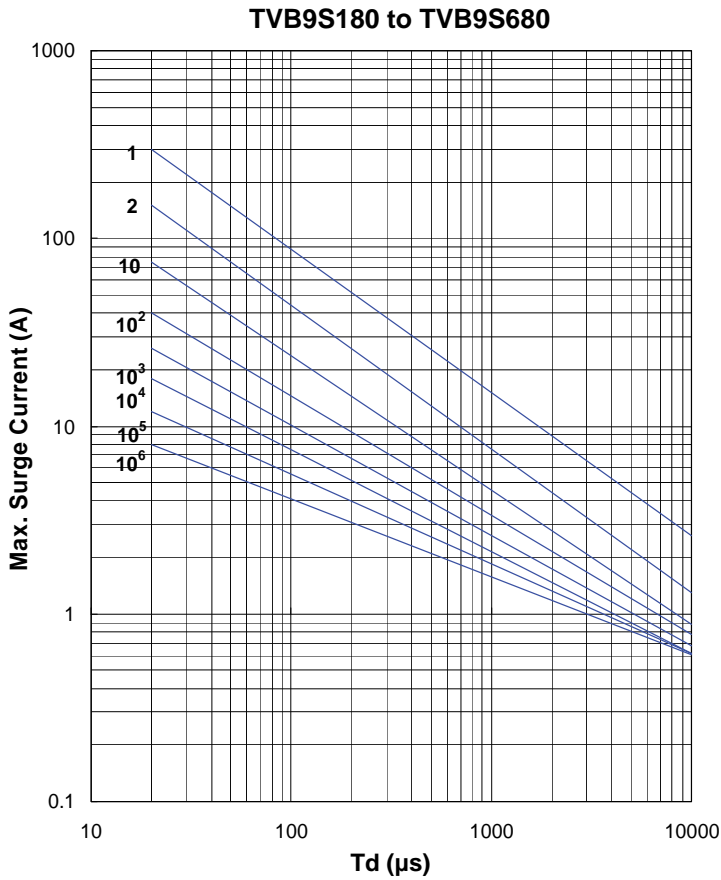
TVB7S820 to TVB7S561



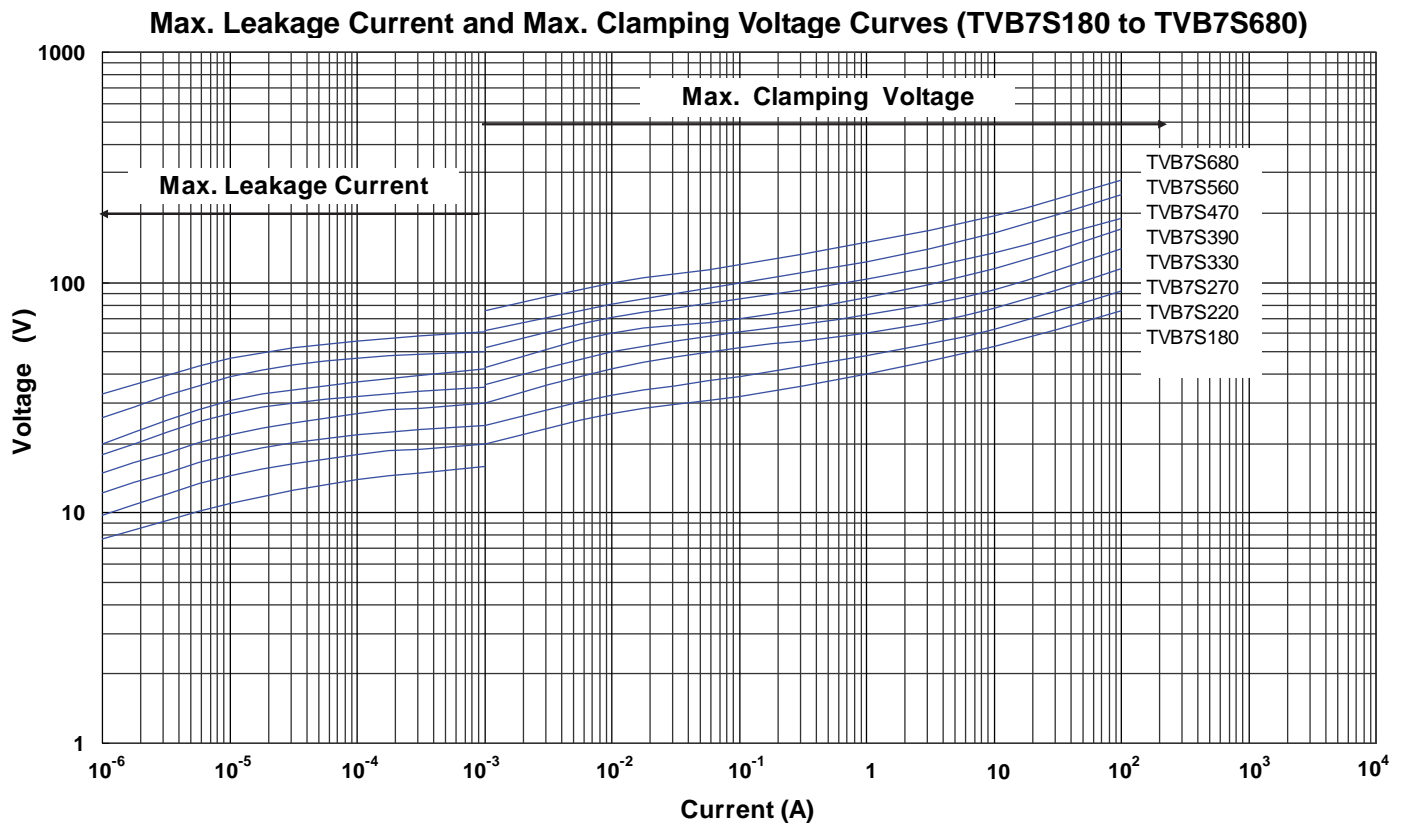
# Metal Oxide Varistor : TVB Series

## Plastic Encapsulated Type Varistor for Surge Protection

### Max. Surge Current Derating Curves



### Max. Leakage Current and Max. Clamping Voltage Curves

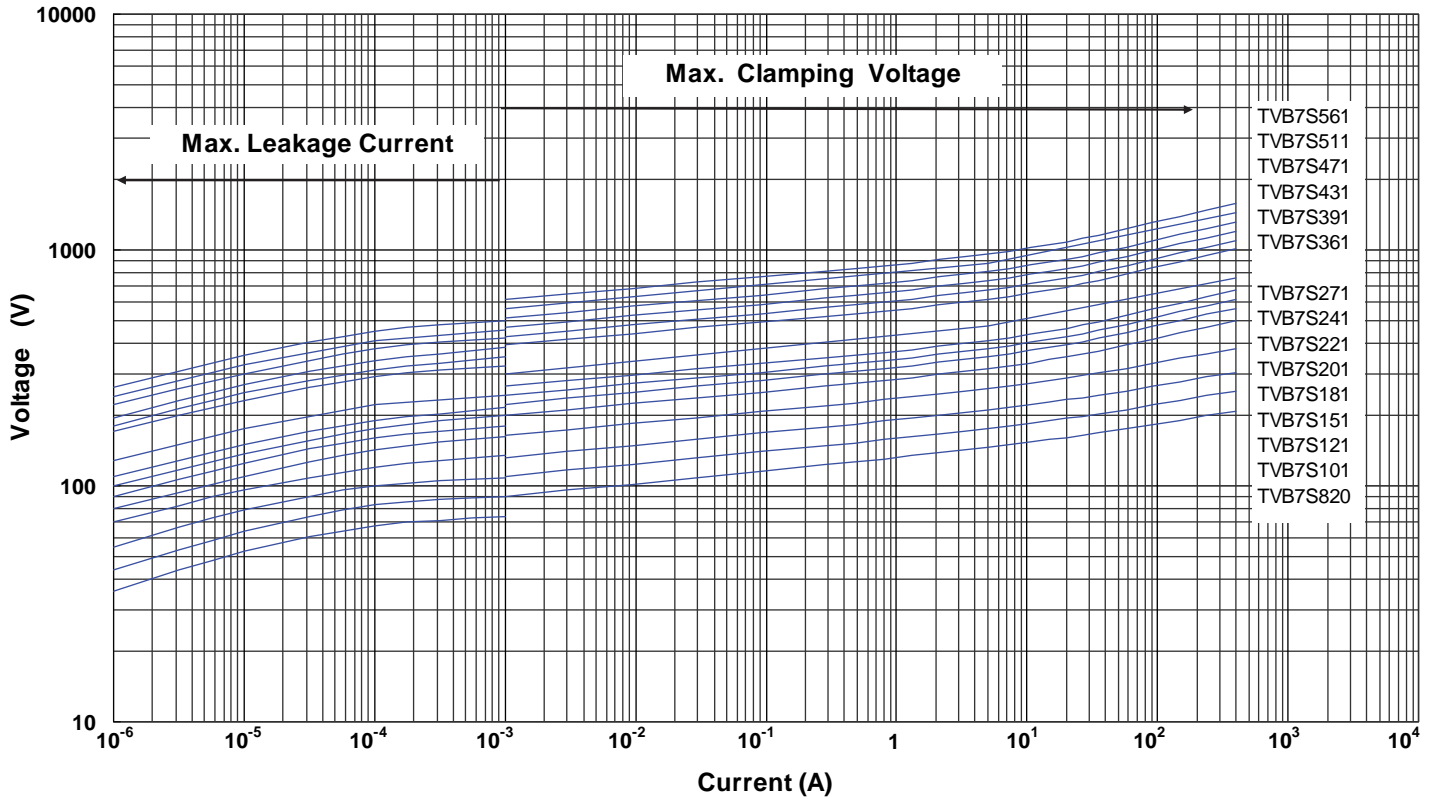


# Metal Oxide Varistor : TVB Series

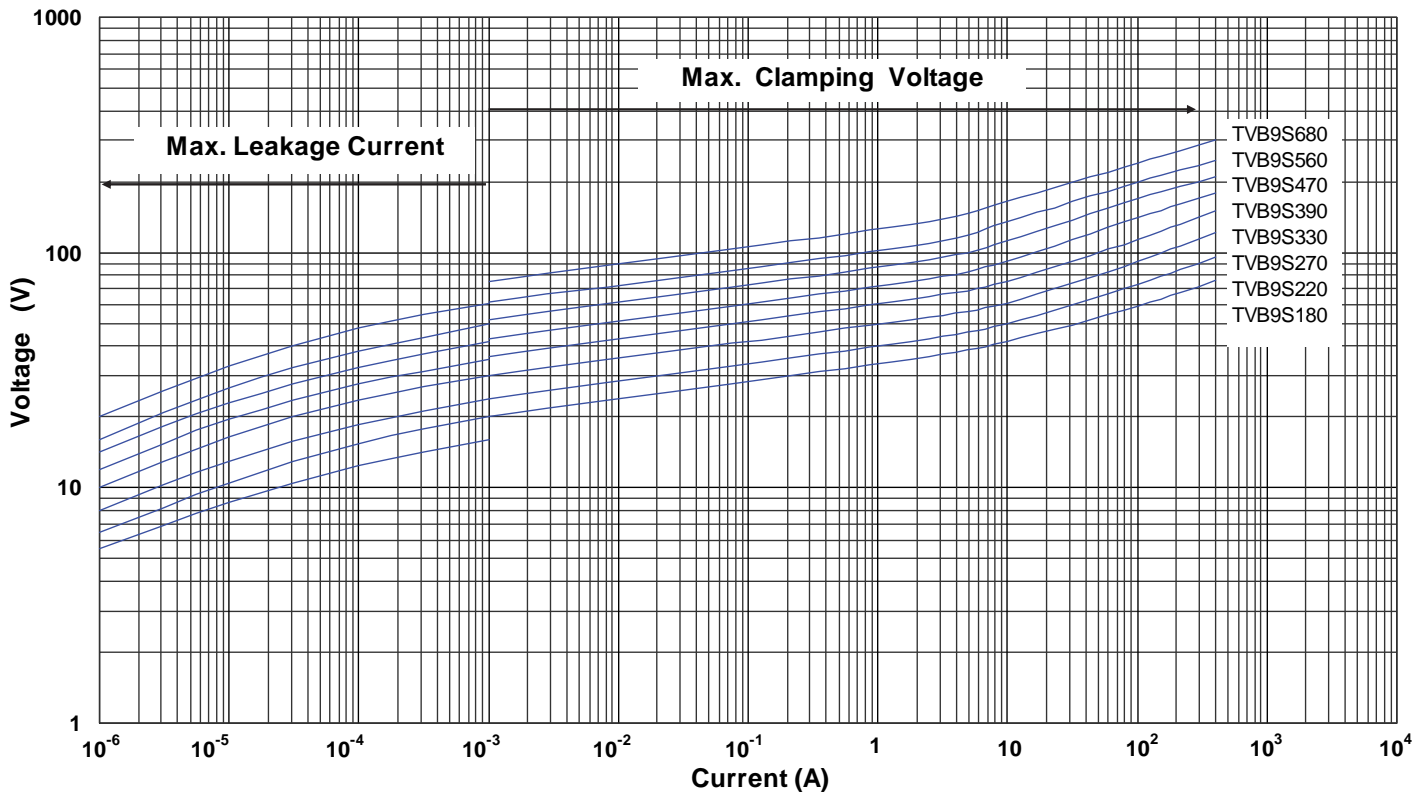
## Plastic Encapsulated Type Varistor for Surge Protection

### ■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVB7S820 to TVB7S561)



Max. Leakage Current and Max. Clamping Voltage Curves (TVB9S180 to TVB9S680)

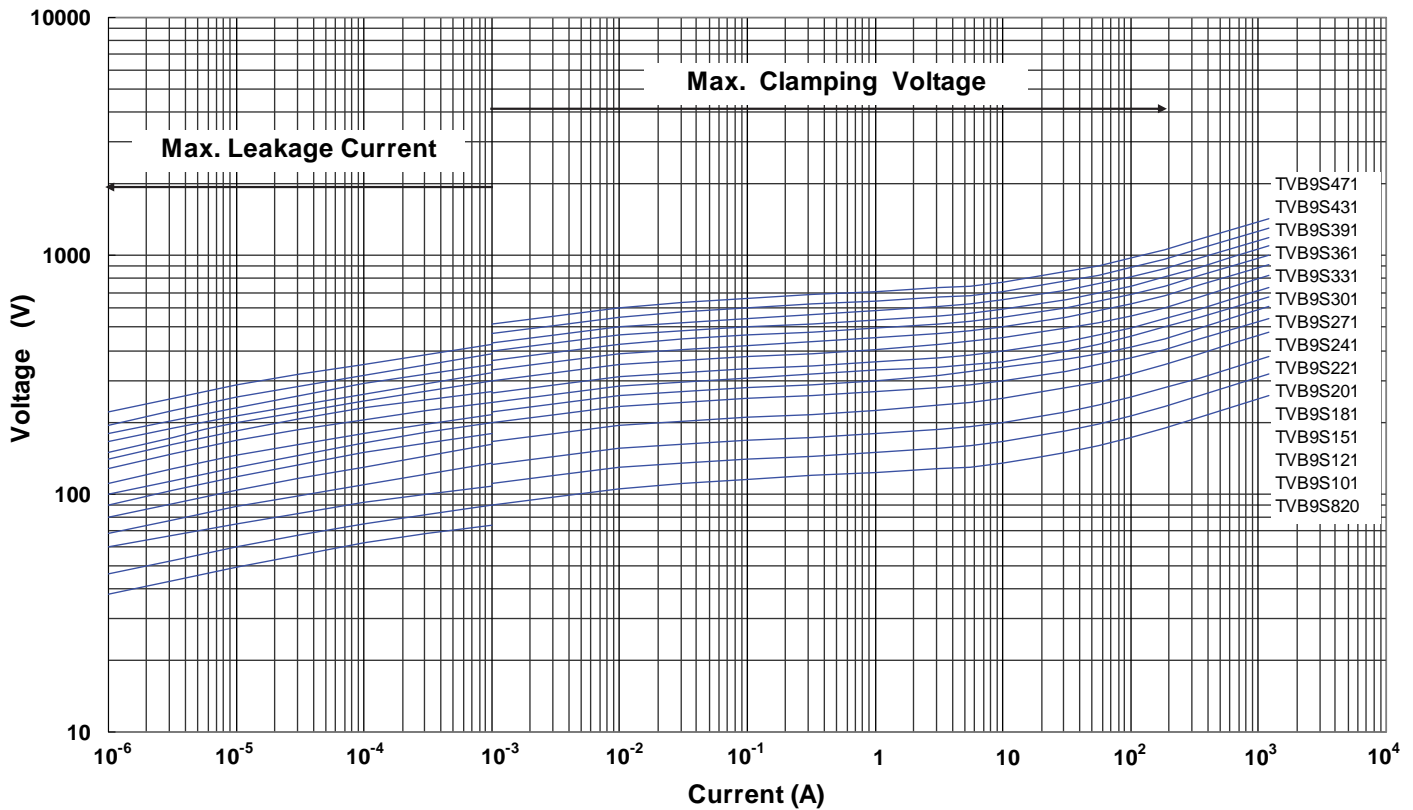


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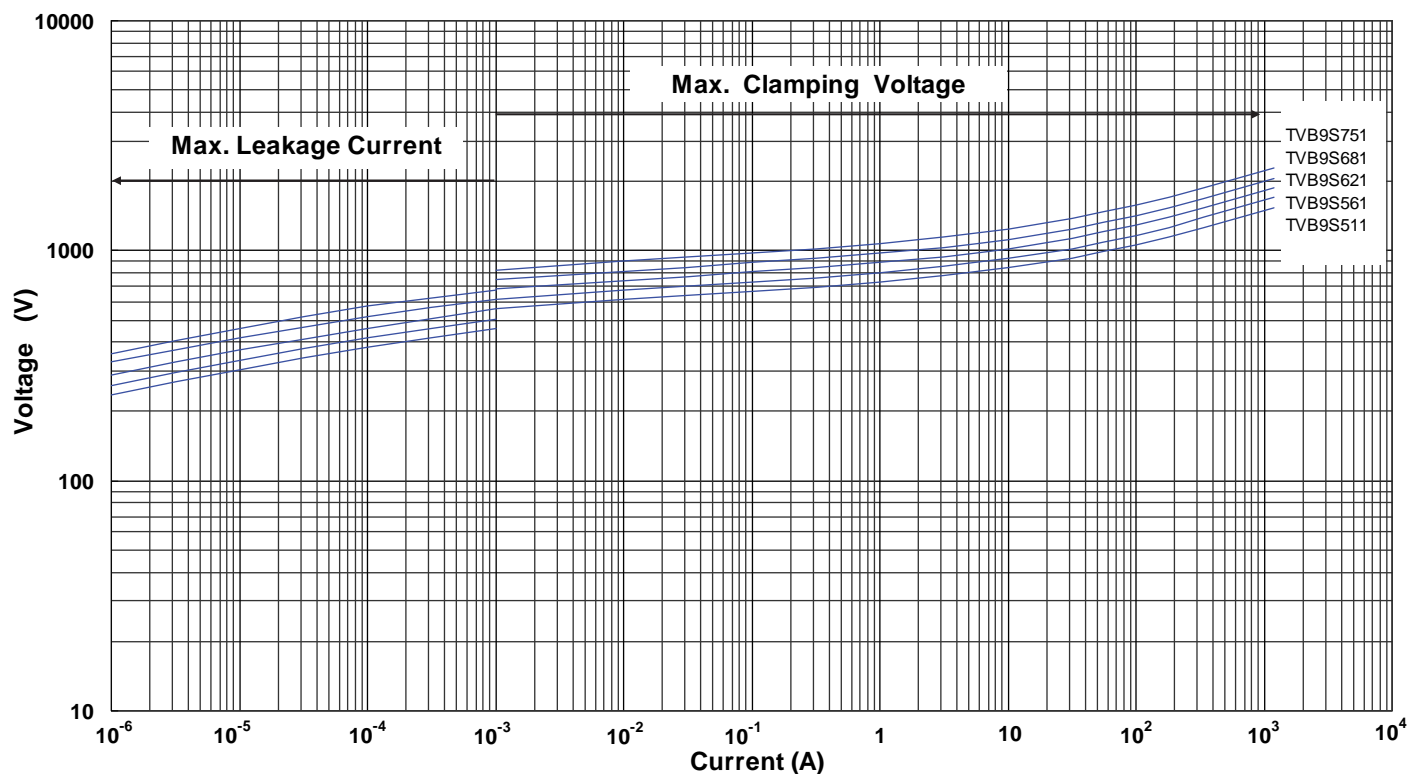
## Plastic Encapsulated Type Varistor for Surge Protection

### ■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVB9S820 to TVB9S471)



Max. Leakage Current and Max. Clamping Voltage Curves (TVB9S511 to TVB9S751)



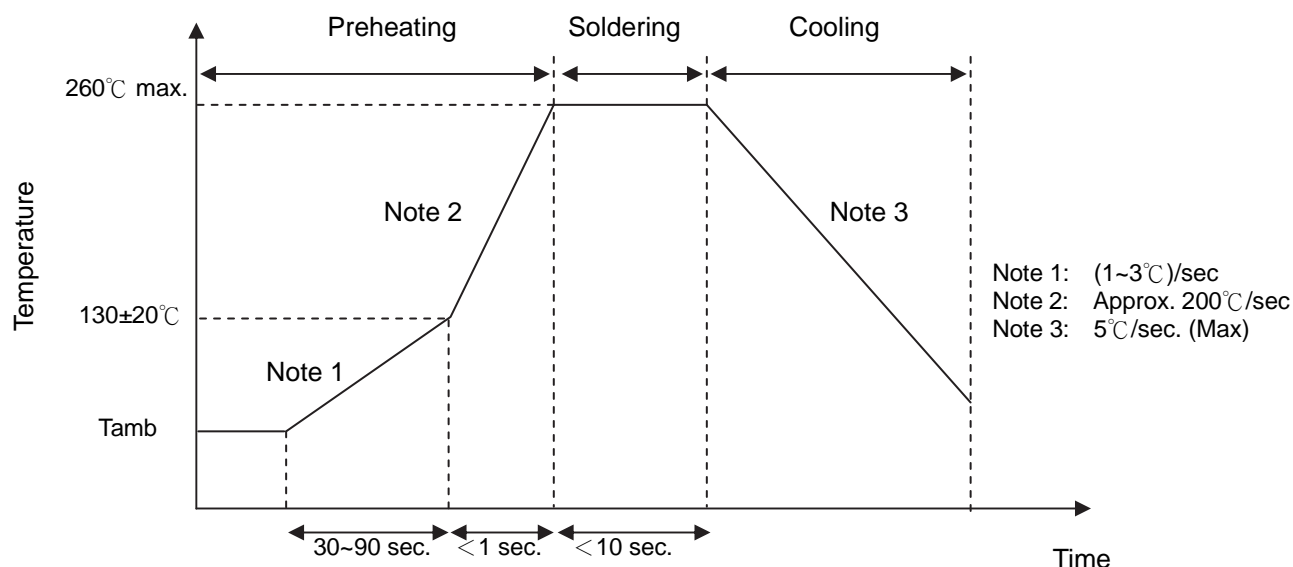


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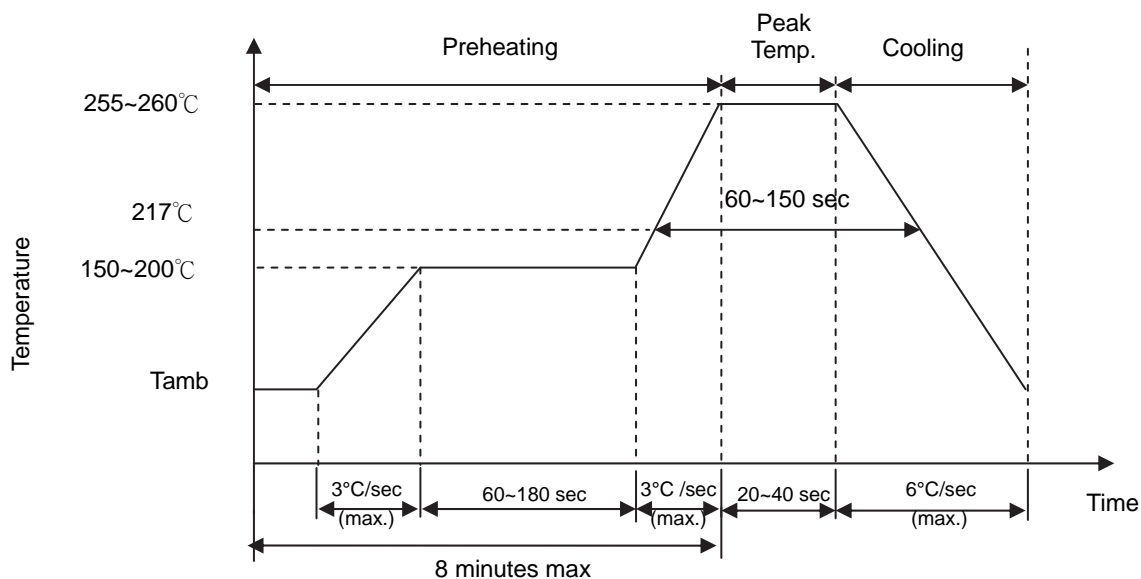
## Plastic Encapsulated Type Varistor for Surge Protection

### ■ Soldering Recommendation

#### ● Wave Soldering Profile



#### ● IR-reflow Soldering Profile



#### ● Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	$350^\circ\text{C (max.)}$
Soldering Time	$3 \text{ sec (max.)}$
Diameter of Soldering Iron-tip	$\Phi 3 \text{ mm (max.)}$

# Metal Oxide Varistor : TVB Series

## Plastic Encapsulated Type Varistor for Surge Protection

### ■ Reliability

Item	Standard	Test conditions / Methods	Specifications		
Vibration	IEC 60068-2-6	Frequency range: 10~55Hz Amplitude: 0.75mm or 98m/s <sup>2</sup> Direction: 3 mutually perpendicular directions, 2 hrs each.	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage		
Solderability	IEC 60068-2-20	245±3°C, 3±0.3 sec	At least 95% of terminal electrode is covered by new solder		
Resistance to Soldering Heat	IEC 60068-2-20	260±3°C, 5±1 sec for TVB7S Series 10±1 sec for TVB9S Series	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage		
High Temperature Storage	IEC 60068-2-2	125±5°C x 1000 ±24 hrs	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage		
Damp Heat, Steady State	IEC60068-2-78	a. 40±2°C, 90 ~ 95 % RH, 1344 hrs. b. 40±2°C, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage Insulation Resistance ≥ 100MΩ		
Rapid Change of Temperature	IEC 60068-2-14	The conditions shown below shall be repeated 5 cycles		$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage	
		Step	Temperature (°C)		Period (minutes)
		1	-40±3		30±3
		2	Room temperature		5±3
		3	85±2		30±3
4	Room temperature	5±3			
High Temp. Load	MIL-STD-202 Method 108	85±2°C, 1000±24 hrs at V <sub>DC</sub> or V <sub>rms</sub> (Max. Continuous Voltage)	$ \Delta V_{1mA} / V_{1mA}  \leq 10\%$ No visible damage		
8/20µs Surge Life	IEC 61051-1	8/20µs waveform, 10 surge currents, unipolar, interval 30 sec, amplitude corresponding to max. surge current derating curves for 20µs.	$ \Delta V_{1mA} / V_{1mA}  \leq 10\%$ No visible damage		
10/1000µs Surge Life	IEC 61051-1	10/1000µs waveform, 10 surge currents, unipolar, interval 2 mins, amplitude corresponding to max. surge current derating curves for 1000µs.	$ \Delta V_{1mA} / V_{1mA}  \leq 10\%$ No visible damage		
Voltage Proof	IEC 61051-1	Metal balls method, 2500 V <sub>ac</sub> 1 min	No visible damage		
Varistor VoltageTemp. Coefficient	Specification Standard	$\frac{V_{1mA@85^\circ C} - V_{1mA@25^\circ C}}{V_{1mA@25^\circ C}} \times \frac{1}{60} \times 100\% (\% / ^\circ C)$ , $\frac{V_{1mA@-40^\circ C} - V_{1mA@25^\circ C}}{V_{1mA@25^\circ C}} \times \frac{1}{65} \times 100\% (\% / ^\circ C)$	-0.05 ≤ TC ≤ 0.05 (%/°C)		

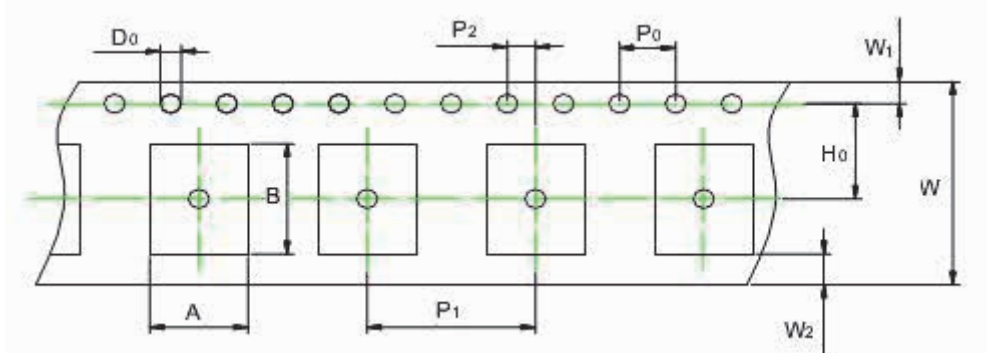
# Metal Oxide Varistor : TVB Series

## Plastic Encapsulated Type Varistor for Surge Protection

### ■ Packaging

#### ● Taping Specification

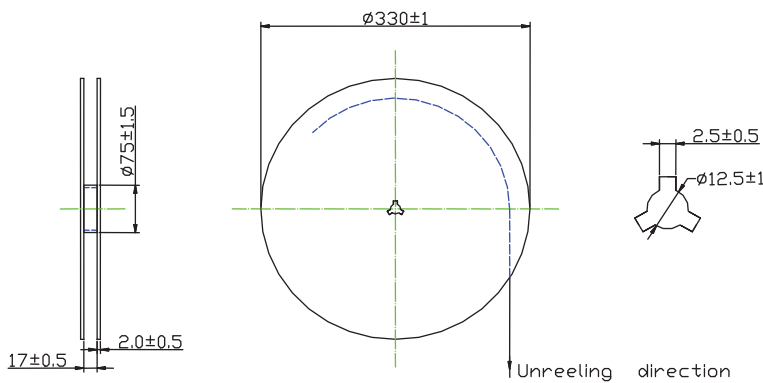
16mm plastic embossed



(Unit: mm)

Item	A*B	$P_0$	$P_1$	$P_2$	$H_0$	W	$W_1$	$W_2$	$D_0$	
Size	3225	7.0*8.7	4.0	12.0	2.0	7.5	16	1.75	0.75	1.5
	4032	8.6*10.6								
Tolerance	+/- 0.2	+/- 0.1	+/- 0.1	+/- 0.05	+/- 0.05	+/- 0.3	+/- 0.1	Min.	+0.1/-0	

#### ● Quantity



(Unit: mm)

Size	Quantity (pcs/reel)
3225	1,000
4032	1,000

### ■ Warehouse Storage Conditions of Products

#### ● Storage Conditions:

1. Storage Temperature:  $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
2. Relative Humidity:  $\leq 75\% \text{RH}$
3. Keep away from corrosive atmosphere and sunlight.

#### ● Period of Storage: 1 year