

Metal Oxide Varistor : TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

■ Features

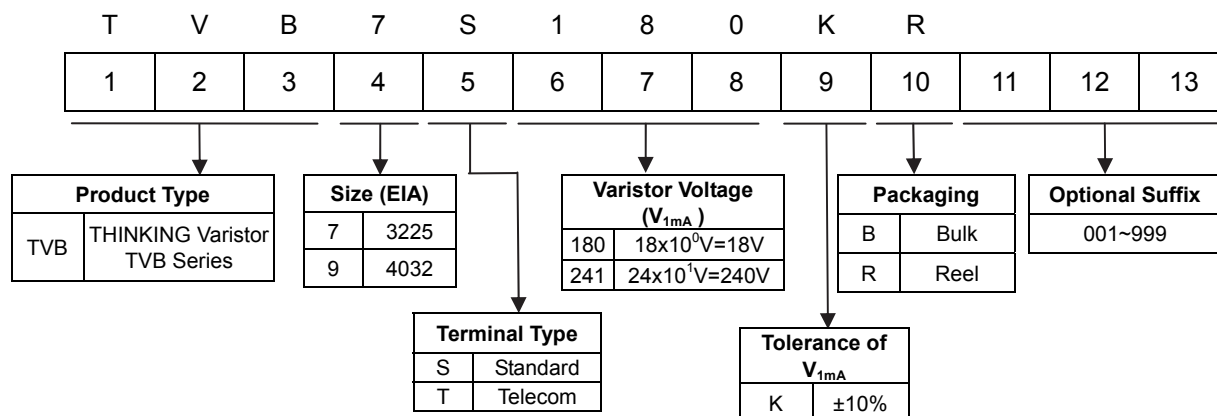
1. RoHS compliant
2. Available for SMT flow/reflow soldering
3. Low profile and space saving
4. Large capability to withstand high surge current
5. Low inductance construction with excellent response
6. Encapsulation material according to UL94-V0
7. Operating temperature range: $-40^{\circ}\text{C} \sim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



■ Recommended Applications

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

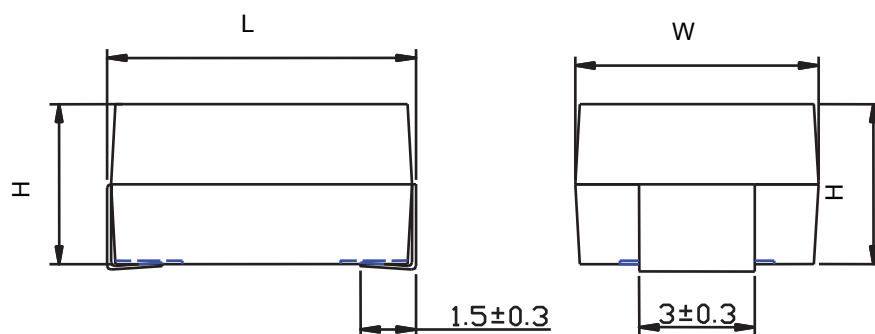
■ Part Number Code



Metal Oxide Varistor : TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

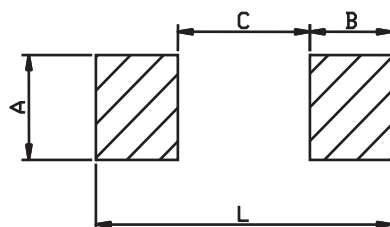
■ Structures and Dimensions



(Unit: mm)

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

Metal Oxide Varistor : TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

■ 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 _{AC(rms)} (V)	V _{DC} (V)	V _P (V)	I _P (A)					UL	cUL
	V _{1mA} (V)	V _{AC(rms)} (V)	V _{DC} (V)	V _P (V)	I _P (A)	I _{max} (A)	W _{max} (J)	P (W)	C _p (pF)	UL 1449 ^{3rd.} 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	√	√

Metal Oxide Varistor : TVB Series

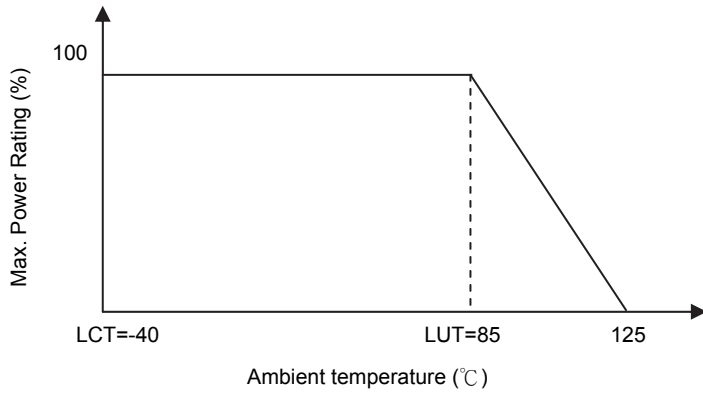
Plastic Encapsulated Type Varistor for Surge Protection

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
	V _{1mA} (V)					I _{max} (A)	W _{max} (J)	P (W)	C _p (pF)	UL 1449 ^{3rd.} E314979	
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	√	√

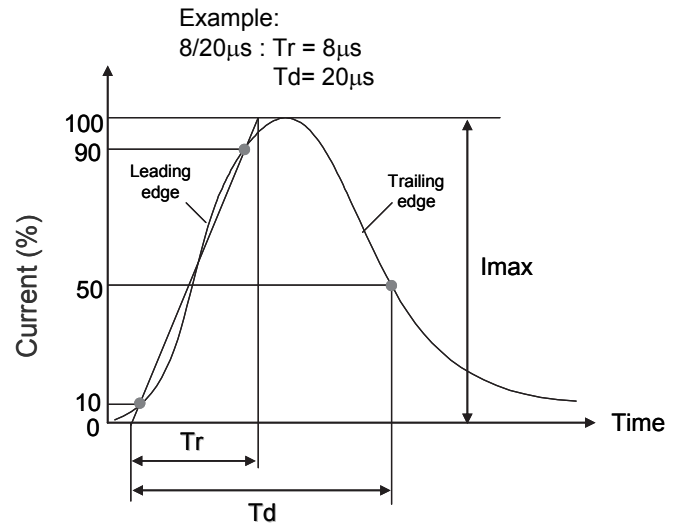
Metal Oxide Varistor : TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

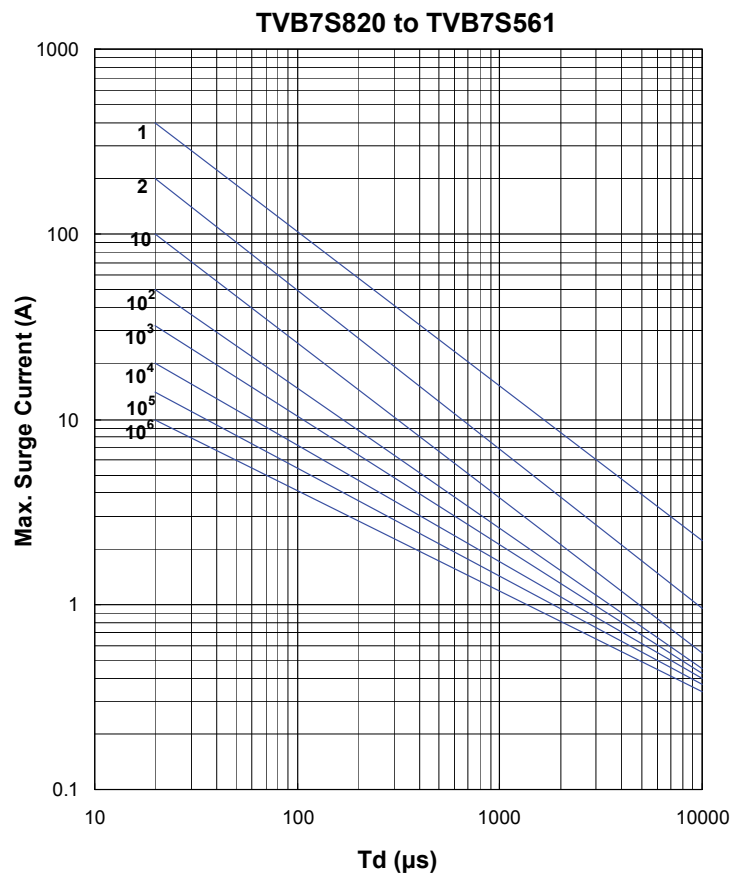
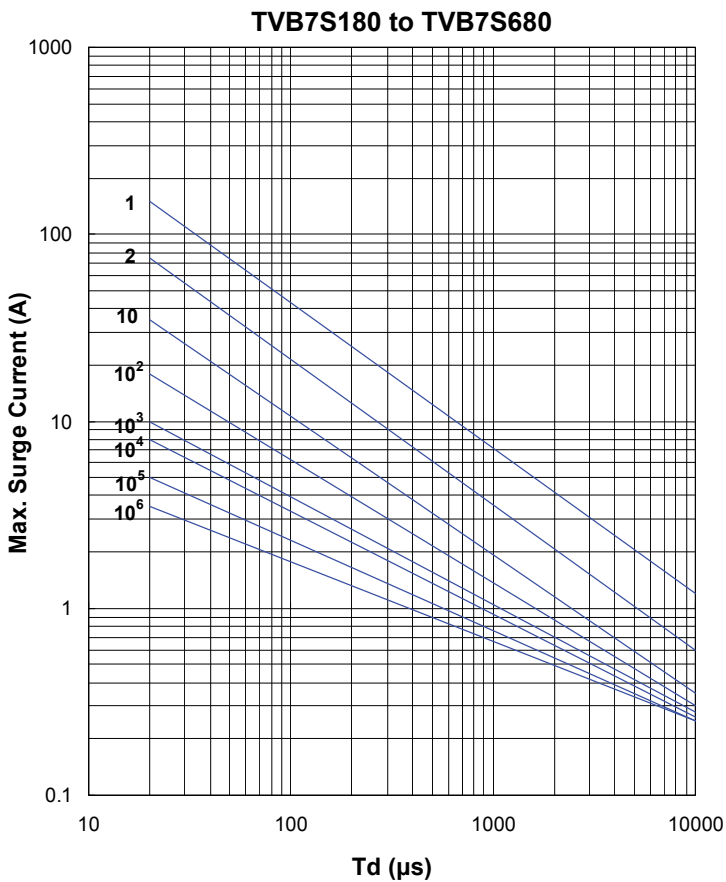
Power Derating Curve



Surge Current Standard Waveform



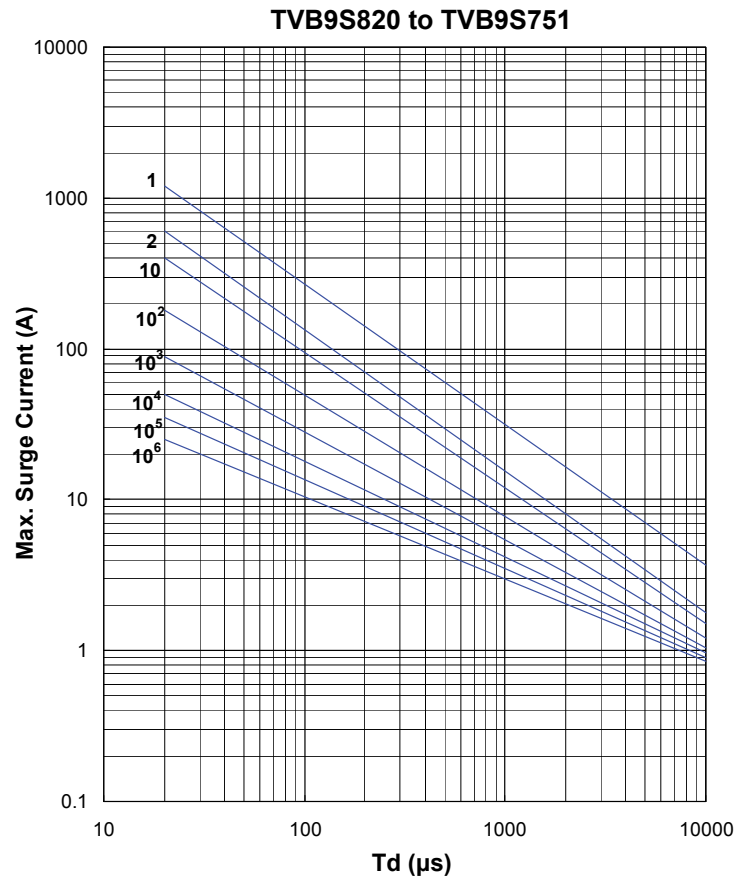
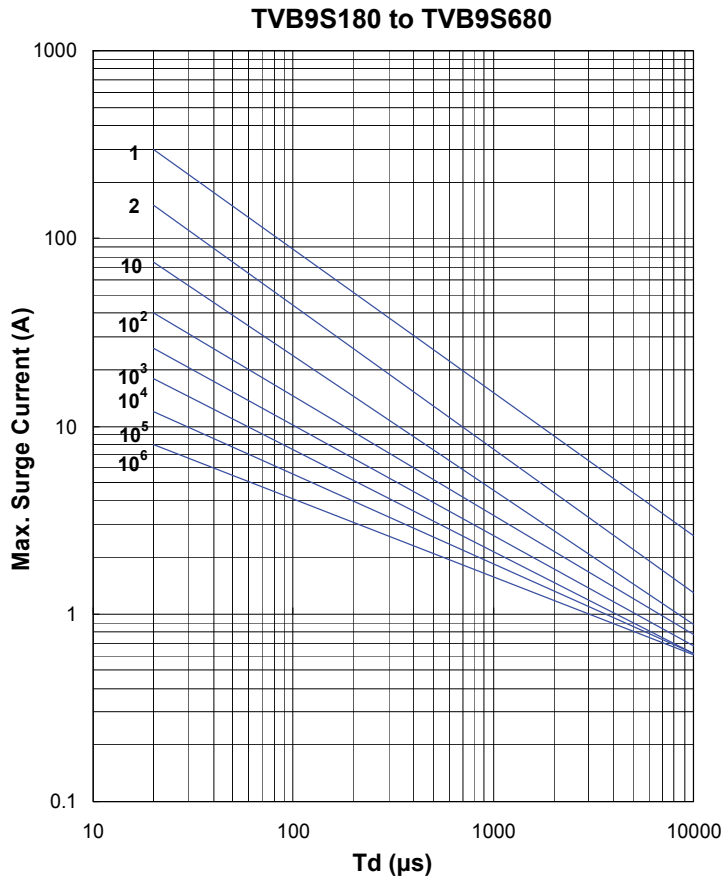
Max. Surge Current Derating Curves



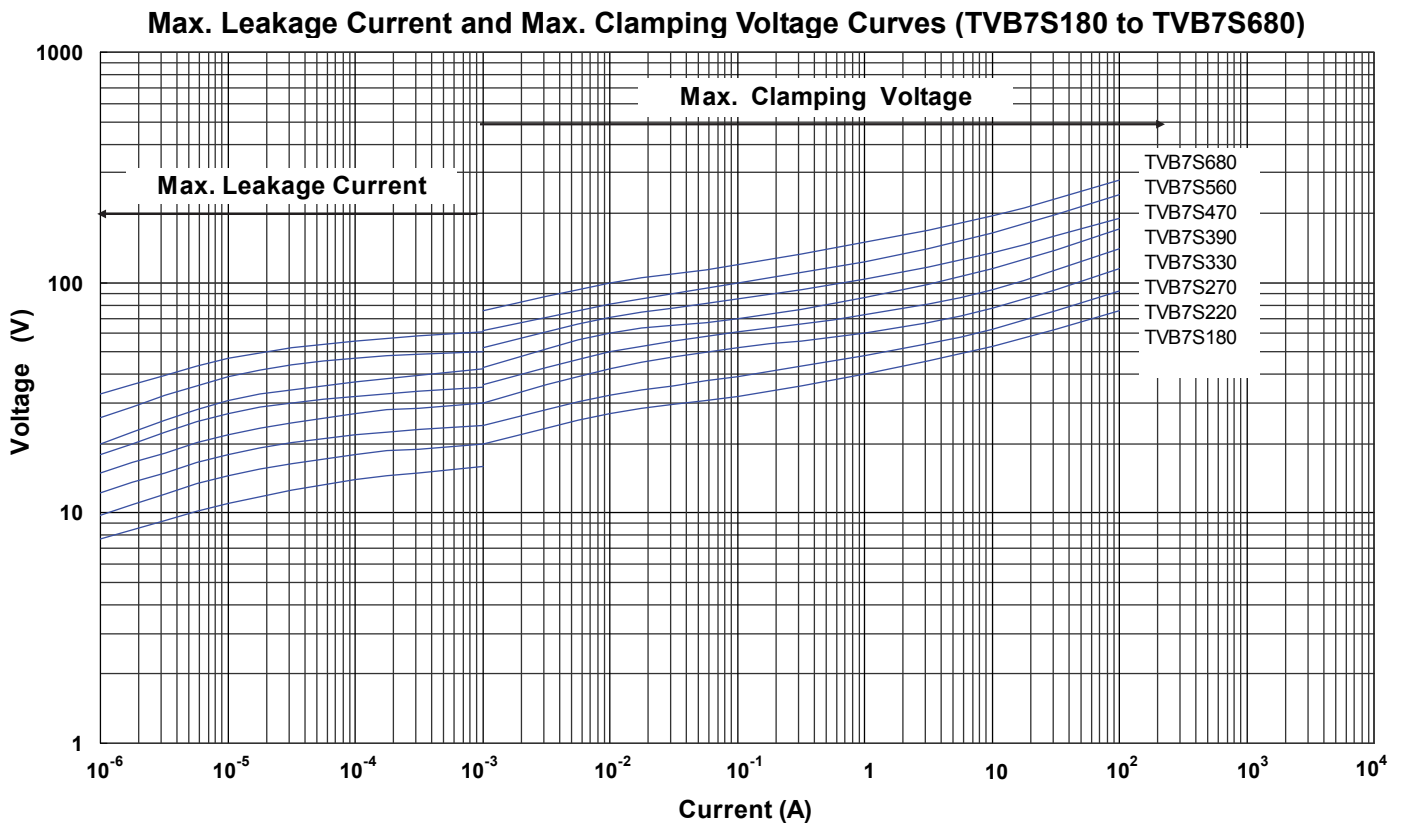
Metal Oxide Varistor : TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

■ Max. Surge Current Derating Curves



■ Max. Leakage Current and Max. Clamping Voltage Curves

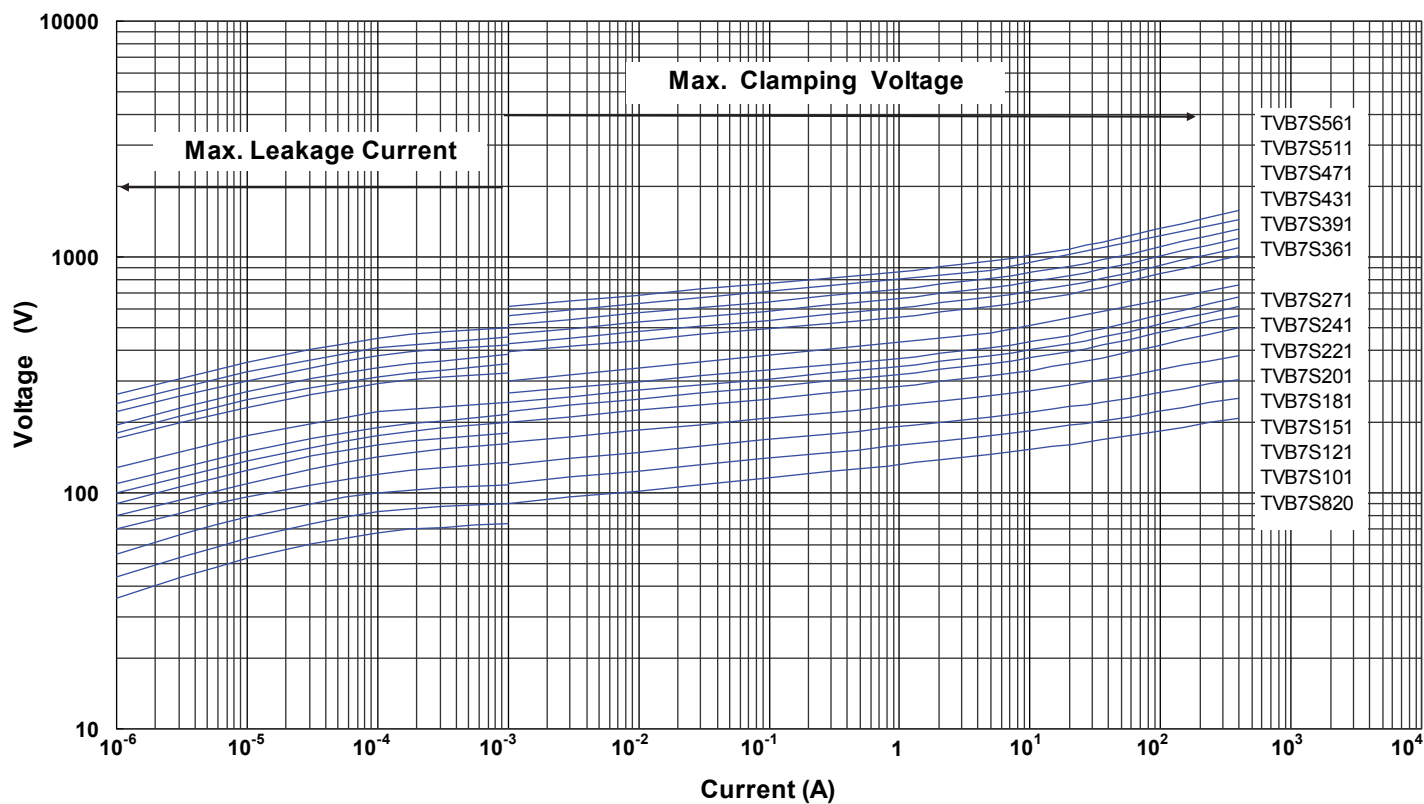


Metal Oxide Varistor : TVB Series

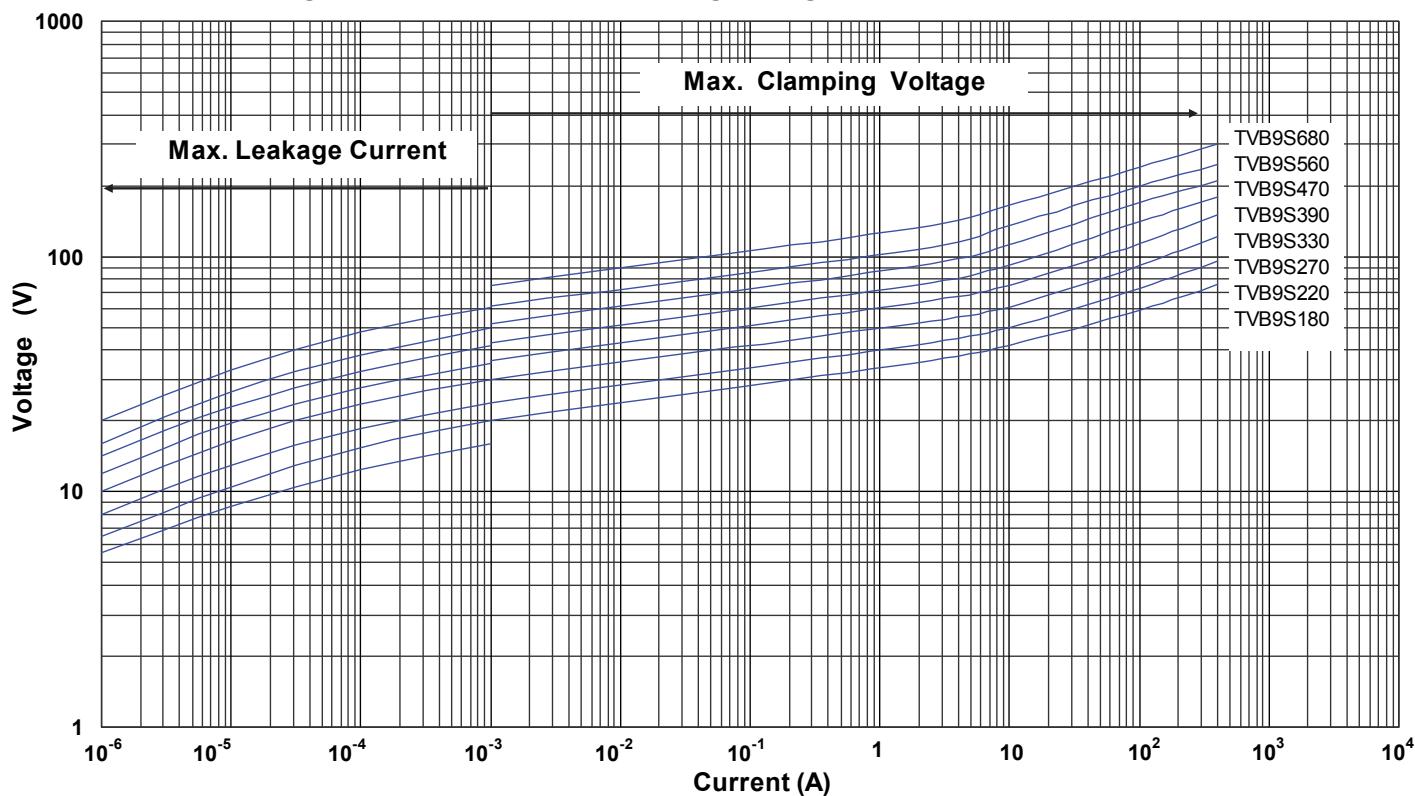
Plastic Encapsulated Type Varistor for Surge Protection

■ 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)

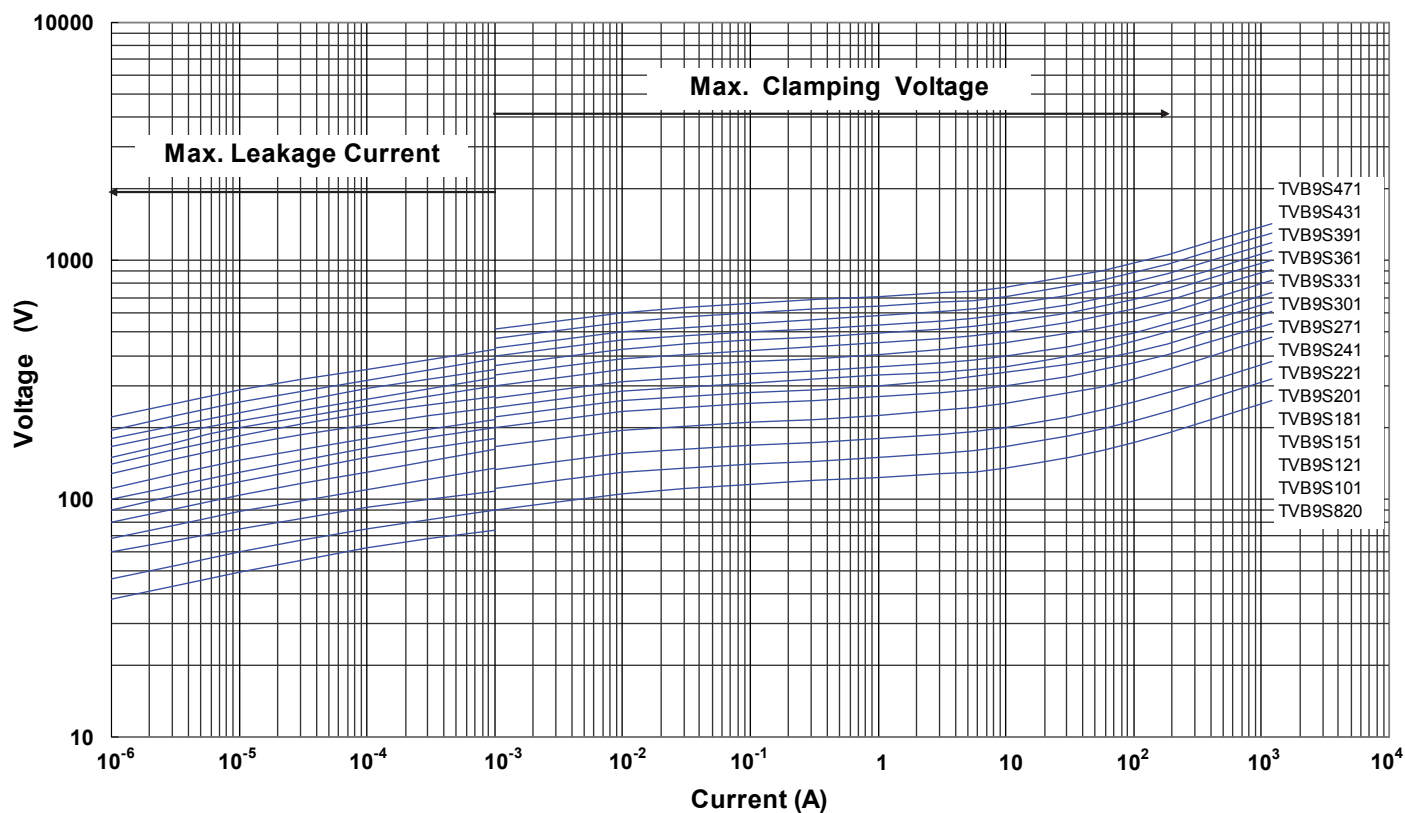


Metal Oxide Varistor : TVB Series

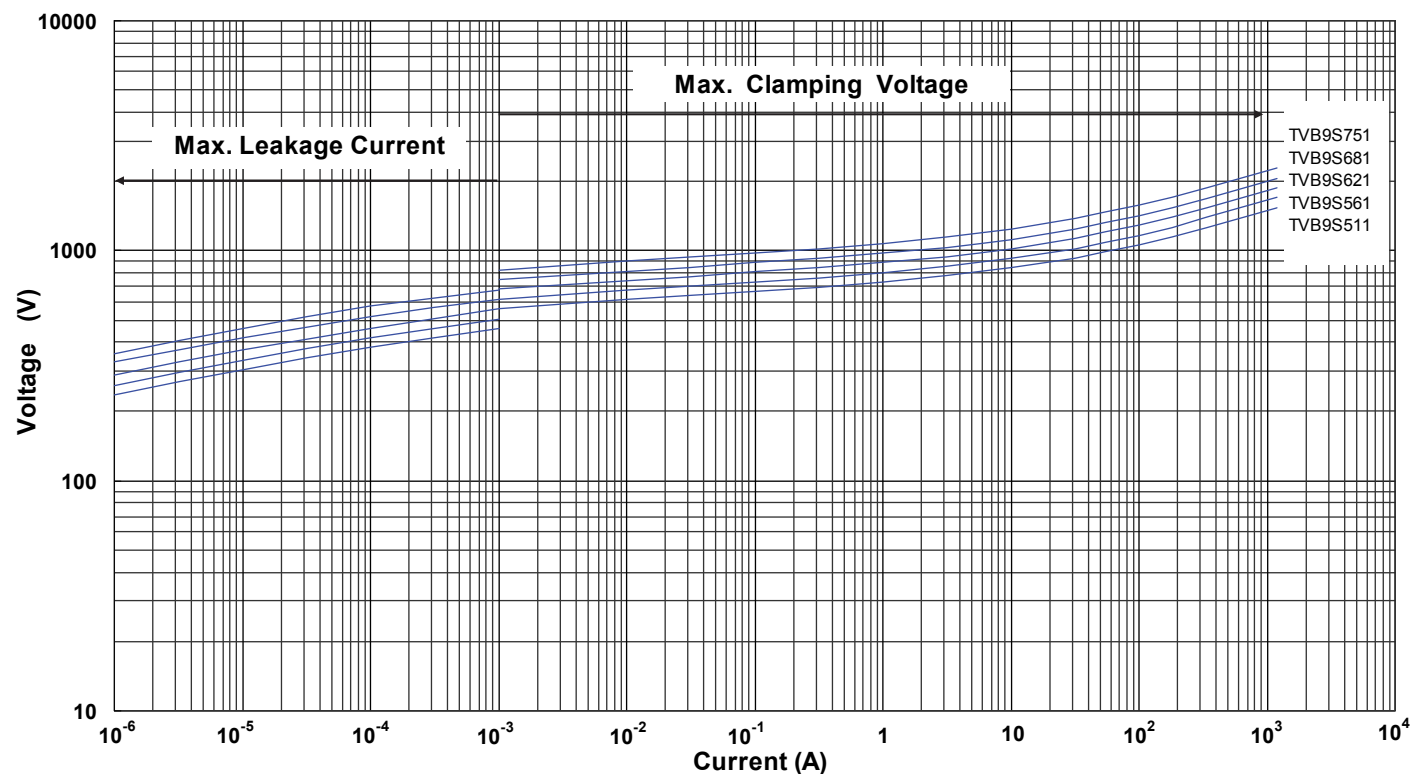
Plastic Encapsulated Type Varistor for Surge Protection

■ Max. Leakage Current and Max. Clamping Voltage Curves

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



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

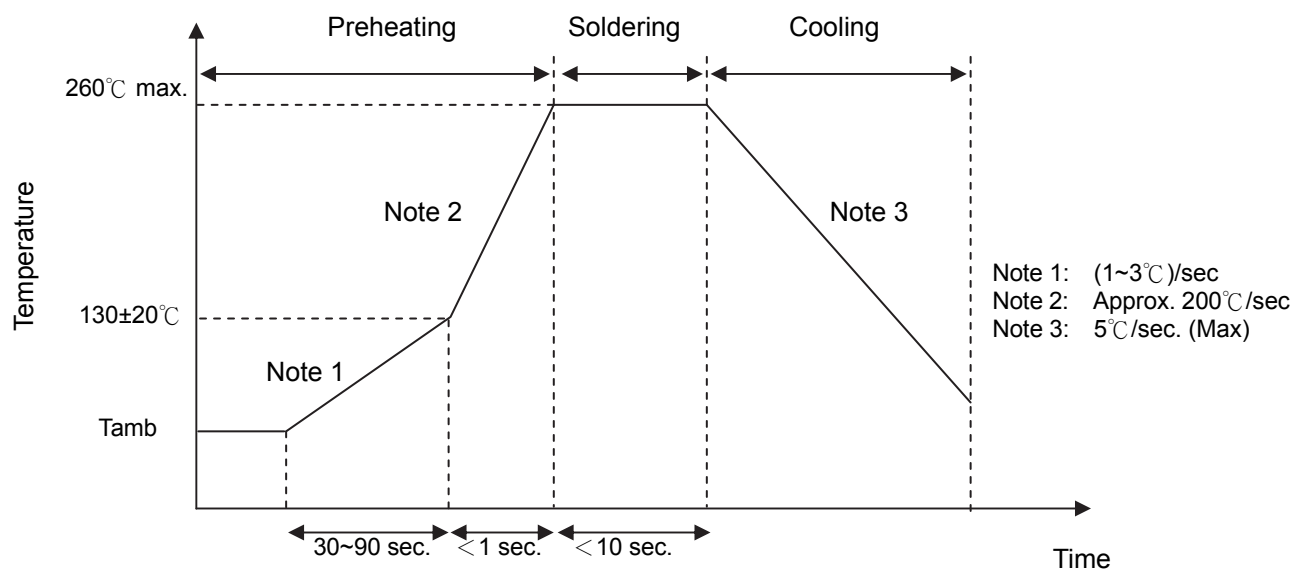


Metal Oxide Varistor : TVB Series

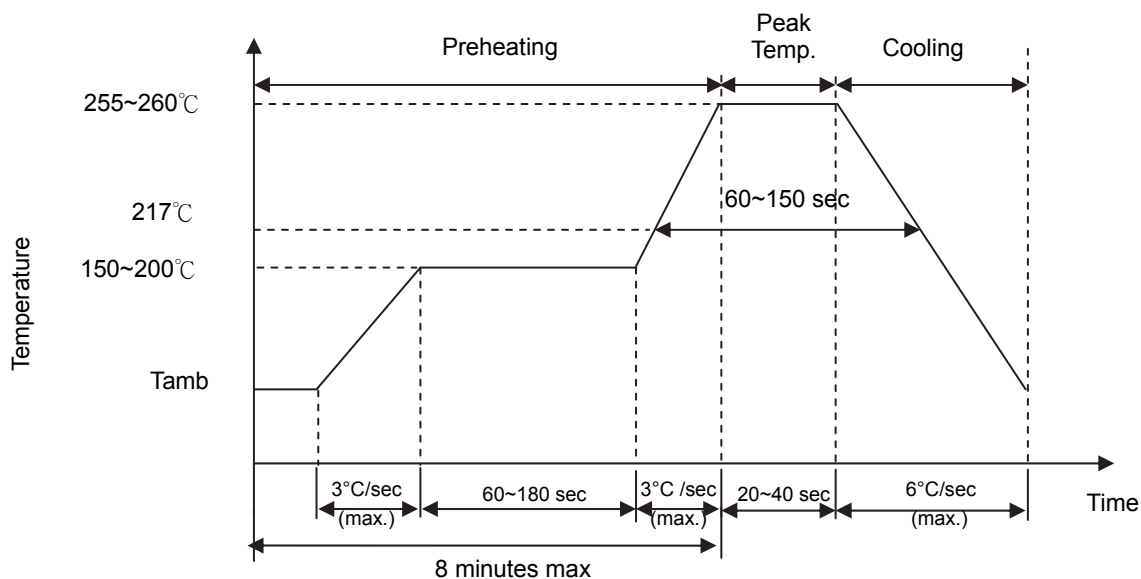
Plastic Encapsulated Type Varistor for Surge Protection

■ Soldering Recommendation

● Wave Soldering Profile



● IR-reflow Soldering Profile



● Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	350°C (max.)
Soldering Time	3 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 ² 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 <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40±3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>5±3</td> </tr> <tr> <td>3</td> <td>85±2</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>5±3</td> </tr> </tbody> </table>	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	$ \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 _{DC} or V _{rms} (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 _{ac} 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)															

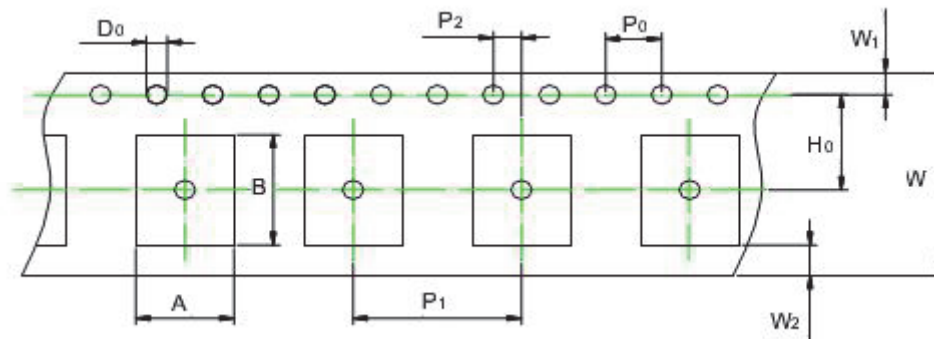
Metal Oxide Varistor : TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

■ Packaging

● Taping Specification

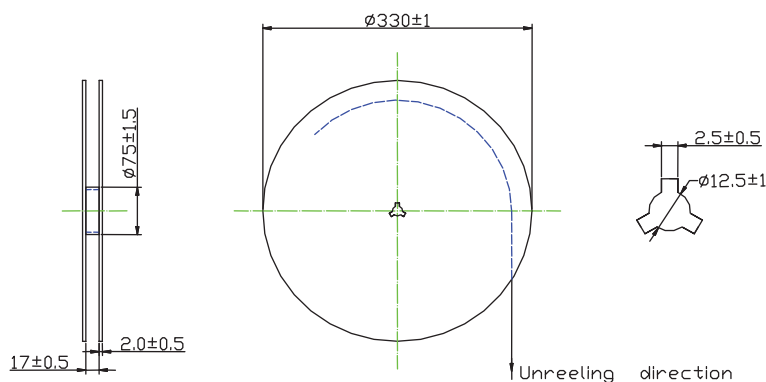
16mm plastic embossed



(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