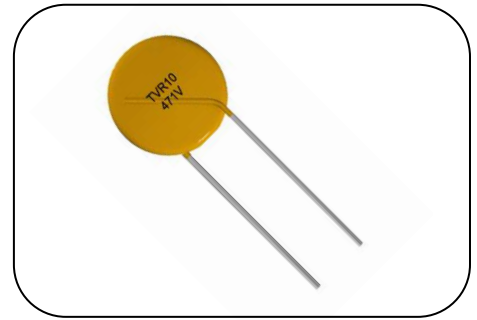


# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Features

1. RoHS compliant
2. Halogen-free series are available
3. Body size:  $\Phi 10$  and  $\Phi 14$  mm
4. Wide operating voltage range: 130Vac ~ 680Vac
5. Operating temperature range:  $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$   
Storage temperature range :  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
6. Agency recognition: UL 1449 3<sup>rd</sup>/cUL/VDE/CQC
7. Meet IEC 60950-1:2013 Annex Q requirement

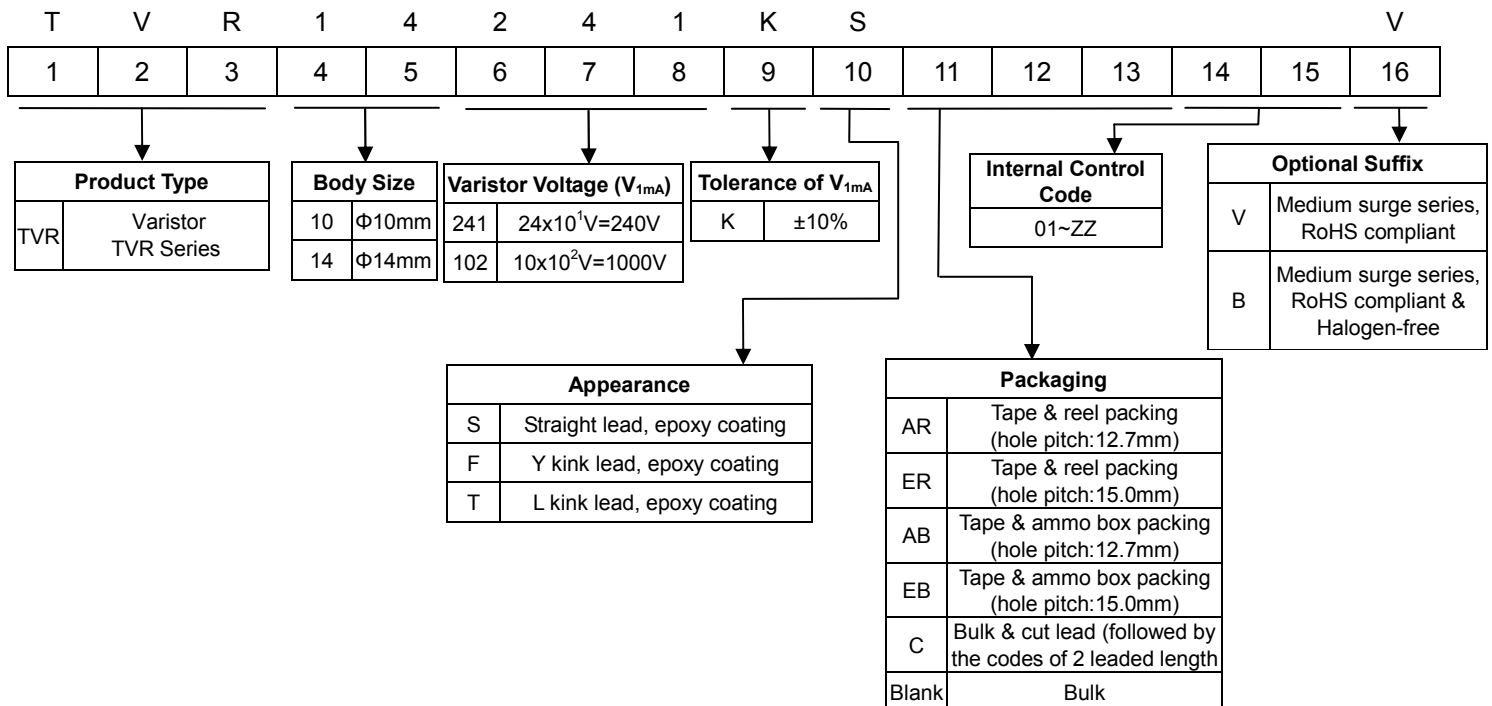


Note: V of the marking stands for TVR-V series

### ■ Recommended Applications

1. Power supply
2. Home appliance
3. Industrial equipment
4. Telecommunication or telephone system
5. Smart meter
6. PLC (Power line communication)
7. Lighting products
8. Photovoltaic industry

### ■ Part Number Code



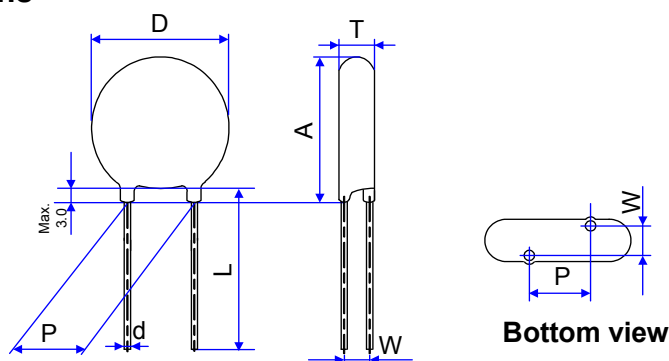
Note: Optional suffix will be the 11<sup>th</sup> digit if packaging and internal control codes are not coded.

# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Structure and Dimensions

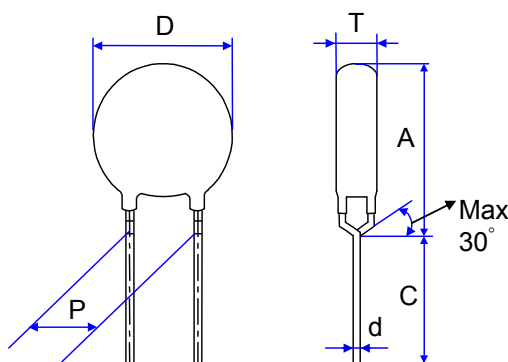
#### ● S Type (Straight lead)



(Unit: mm)

Series	D	Lmin.	d	P	Amax.	Tmax.	W
TVR10-V	9.5~12.5	26.5	0.8±0.02	7.5±1	15.0	Please refer to Electrical Characteristics Table	
TVR14-V	13.5~16.0	26.5	0.8±0.02	7.5±1	18.5 (for TVR14201-511-V) 19.0 (for TVR14561-112-V)		

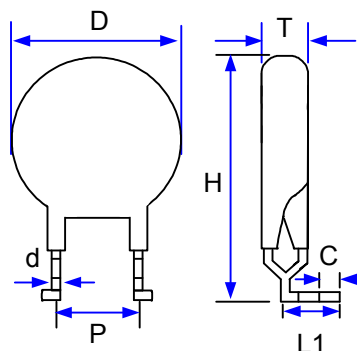
#### ● F Type (Y kink lead)



(Unit: mm)

Series	D	Cmin.	d	P	Amax.	Tmax.
TVR10-V	9.5~12.5	20	0.8±0.02	7.5±1	16.0	Please refer to Electrical Characteristics Table
TVR14-V	13.5 ~16.0	20	0.8±0.02	7.5±1	19.0	

#### ● T Type (L kink lead)



(Unit: mm)

Series	D	Cmin.	d	P	Hmax.	L1	Tmax.
TVR10-V	9.5~12.5	3.8±0.8	0.8±0.02	7.5±1	20.0	7.0±1	Please refer to Electrical Characteristics Table
TVR14-V	13.5 ~16.0			7.5±1	23.5	7.0±1	

# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Electrical Characteristics

#### 10-V Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20µs)		Max. Surge Current (8/20µs)	Rated Power	Max. Energy (10/1000µs)	Reference Capacitance @1KHz	Dimension			UL 1449 3 <sup>rd</sup> SPD Application
	V <sub>1mA</sub>	V <sub>AC(rms)</sub>	V <sub>DC</sub>	V <sub>P</sub>	I <sub>P</sub>	I <sub>max</sub>	P	W <sub>max</sub>	C <sub>p</sub>	T <sub>min</sub>	T <sub>max</sub>	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR10201-V	200 (180~220)	130	170	340	25	3500	0.4	35	570	2.9	4.4	1.7	For SPD Type 3 Application
TVR10221-V	220 (198~242)	140	180	360	25	3500	0.4	39	520	3.0	4.5	1.7	
TVR10241-V	240 (216~264)	150	200	395	25	3500	0.4	42	480	3.1	4.6	1.8	
TVR10271-V	270 (243~297)	175	225	455	25	3500	0.4	49	425	3.3	5.0	1.9	
TVR10301-V	300 (270~330)	195	250	500	25	3500	0.4	53	380	3.5	5.3	2.1	
TVR10331-V	330 (297~363)	215	275	550	25	3500	0.4	58	350	3.8	5.7	2.2	
TVR10361-V	360 (324~396)	230	300	595	25	3500	0.4	65	320	4.0	6.0	2.3	
TVR10391-V	390 (351~429)	250	320	650	25	3500	0.4	70	295	4.2	6.2	2.5	
TVR10431-V	430 (387~473)	275	350	710	25	3500	0.4	80	260	4.3	6.5	2.5	
TVR10471-V	470 (423~517)	300	385	775	25	3500	0.4	85	240	4.4	6.6	2.6	
TVR10511-V	510 (459~561)	320	410	845	25	3500	0.4	92	220	4.6	6.8	2.8	
TVR10561-V	560 (504~616)	350	450	930	25	3500	0.4	92	200	4.7	7.1	3.0	
TVR10621-V	620 (558~682)	395	510	1020	25	3500	0.4	95	180	4.8	7.2	3.2	
TVR10681-V	680 (612~748)	420	560	1120	25	3500	0.4	98	175	4.9	7.4	3.4	
TVR10751-V	750 (675~825)	465	615	1235	25	3500	0.4	100	160	5.1	7.6	3.7	
TVR10821-V	820 (738~902)	510	670	1355	25	3500	0.4	110	150	5.2	7.8	3.4	
TVR10911-V	910 (819~1001)	550	745	1500	25	3500	0.4	130	130	5.3	8.0	3.7	
TVR10102-V	1000 (900~1100)	625	825	1650	25	3500	0.4	140	120	5.3	8.3	4.0	
TVR10112-V	1100 (990~1210)	680	895	1815	25	3500	0.4	155	110	5.7	8.6	4.3	

# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### 14-V Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20µs)		Max. Surge Current (8/20µs)	Nominal Discharge Current* <sup>1</sup> (8/20µs)	Rated Power	Max. Energy (10/1000µs)	Reference Capacitance @1KHz	Dimension			UL 1449 3 <sup>rd</sup> SPD Type <sup>2</sup>
	V <sub>1mA</sub>	V <sub>AC(rms)</sub>	V <sub>DC</sub>	V <sub>P</sub>	I <sub>P</sub>	I <sub>max</sub>	I <sub>n</sub>	P	W <sub>max</sub>	C <sub>p</sub>	T <sub>min</sub>	T <sub>max</sub>	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR14201-V	200 (180~220)	130	170	340	50	6000	3000	0.6	84	970	2.9	4.4	1.7	Type 5
TVR14221-V	220 (198~242)	140	180	360	50	6000	3000	0.6	91	880	3.0	4.5	1.7	
TVR14241-V	240 (216~264)	150	200	395	50	6000	3000	0.6	98	820	3.1	4.7	1.8	
TVR14271-V	270 (243~297)	175	225	455	50	6000	3000	0.6	112	720	3.3	4.9	1.9	
TVR14301-V	300 (270~330)	195	250	500	50	6000	3000	0.6	123	650	3.4	5.1	2.1	
TVR14331-V	330 (297~363)	215	275	550	50	6000	3000	0.6	133	600	3.5	5.3	2.2	
TVR14361-V	360 (324~396)	230	300	595	50	6000	3000	0.6	147	550	3.6	5.5	2.3	
TVR14391-V	390 (351~429)	250	320	650	50	6000	3000	0.6	161	500	3.7	5.6	2.5	
TVR14431-V	430 (387~473)	275	350	710	50	6000	3000	0.6	182	440	3.8	5.7	2.5	
TVR14471-V	470 (423~517)	300	385	775	50	6000	3000	0.6	196	400	3.9	5.9	2.6	
TVR14511-V	510 (459~561)	320	420	845	50	6000	3000	0.6	210	370	4.1	6.1	2.8	
TVR14561-V	560 (504~616)	350	460	930	50	6000	3000	0.6	231	340	4.2	6.4	3.0	
TVR14621-V	620 (558~682)	395	510	1020	50	6000	3000	0.6	252	300	4.5	6.7	3.2	
TVR14681-V	680 (612~748)	420	560	1120	50	6000	3000	0.6	266	290	4.7	7.1	3.4	
TVR14751-V	750 (675~825)	465	615	1235	50	6000	3000	0.6	280	270	5.0	7.5	3.7	
TVR14821-V	820 (738~902)	510	670	1355	50	6000	3000	0.6	280	250	5.2	7.9	3.4	
TVR14911-V	910 (819~1001)	550	745	1500	50	6000	3000	0.6	308	220	5.6	8.4	3.7	
TVR14102-V	1000 (900~1100)	625	825	1650	50	6000	3000	0.6	336	200	5.9	8.9	4.0	
TVR14112-V	1100 (990~1210)	680	895	1815	50	6000	3000	0.6	364	180	6.3	9.5	4.3	

Note:




\*1: Nominal discharge current is the specification defined in UL 1449 3<sup>rd</sup> and use 8/20µs current waveform to test the varistor.

\*2: SPD Type 5 also can be applied for SPD Type 2 application based on selecting suitable "Nominal Discharge Current" rating.

# Metal Oxide Varistor : TVR-V Series




## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Safety Approvals

Certified Model No.	Agency				
					
	UL1449 3 <sup>rd</sup> & cUL: E314979	5944	IEC60950-1:2013 Annex Q	GB/T10193-1997 GB/T10194-1997 CQC10001041748 CQC10001041749	GB8898-2011 GB4943.1-2011 CQC10001041748 CQC10001041749
TVR10201-V	√	√	√	√	√
TVR10221-V	√	√	√	√	√
TVR10241-V	√	√	√	√	√
TVR10271-V	√	√	√	√	√
TVR10301-V	√	√	√	√	√
TVR10331-V	√	√	√	√	√
TVR10361-V	√	√	√	√	√
TVR10391-V	√	√	√	√	√
TVR10431-V	√	√	√	√	√
TVR10471-V	√	√	√	√	√
TVR10511-V	√	√	√	√	√
TVR10561-V	√	√	√	√	√
TVR10621-V	√	√	√	√	√
TVR10681-V	√	√	√	√	√
TVR10751-V	√	√	√	√	√
TVR10821-V	√	√	√	√	√
TVR10911-V	√	√	√	√	√
TVR10102-V	√	√	√	√	√
TVR10112-V	√	√	√	√	√

# Metal Oxide Varistor : TVR-V Series

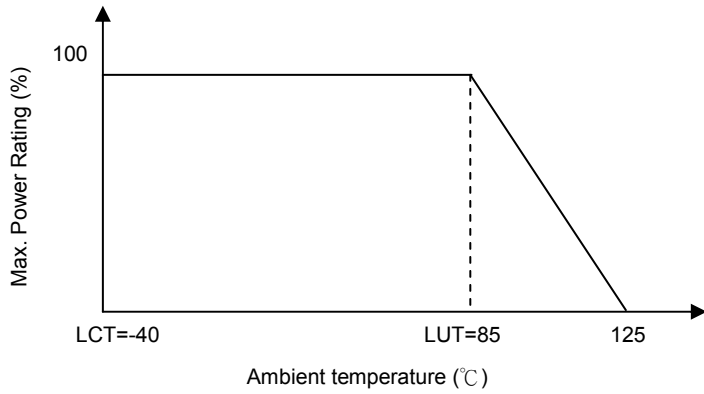
## Disc Type Varistor for Surge Protection (Medium Surge Series)

Certified Model No.	Agency				
					
	UL1449 3 <sup>rd</sup> & cUL: E314979	5944	IEC60950-1:2013 Annex Q	GB/T10193-1997 GB/T10194-1997 CQC10001041748 CQC10001041749	GB8898-2011 GB4943.1-2011 CQC13001089857 CQC10001041859
TVR14201-V	√	√	√	√	
TVR14221-V	√	√	√	√	
TVR14241-V	√	√	√	√	
TVR14271-V	√	√	√	√	
TVR14301-V	√	√	√	√	
TVR14331-V	√	√	√	√	
TVR14361-V	√	√	√	√	
TVR14391-V	√	√	√	√	
TVR14431-V	√	√	√	√	√
TVR14471-V	√	√	√	√	√
TVR14511-V	√	√	√	√	√
TVR14561-V	√	√	√	√	√
TVR14621-V	√	√	√	√	√
TVR14681-V	√	√	√	√	√
TVR14751-V	√	√	√	√	√
TVR14821-V	√	√	√	√	√
TVR14911-V	√	√	√	√	√
TVR14102-V	√	√	√	√	√
TVR14112-V	√	√	√	√	√

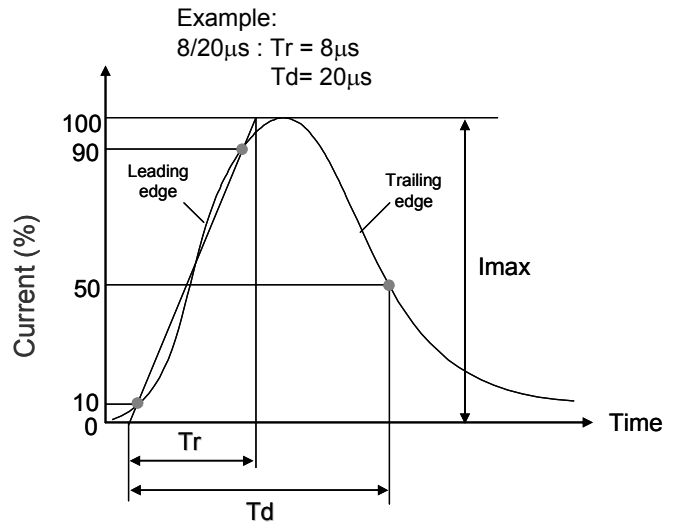
# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

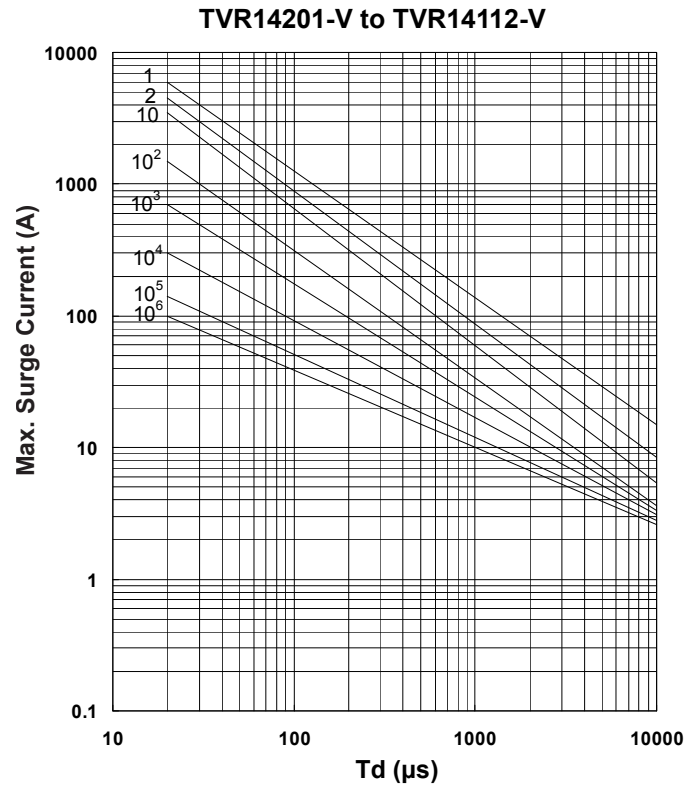
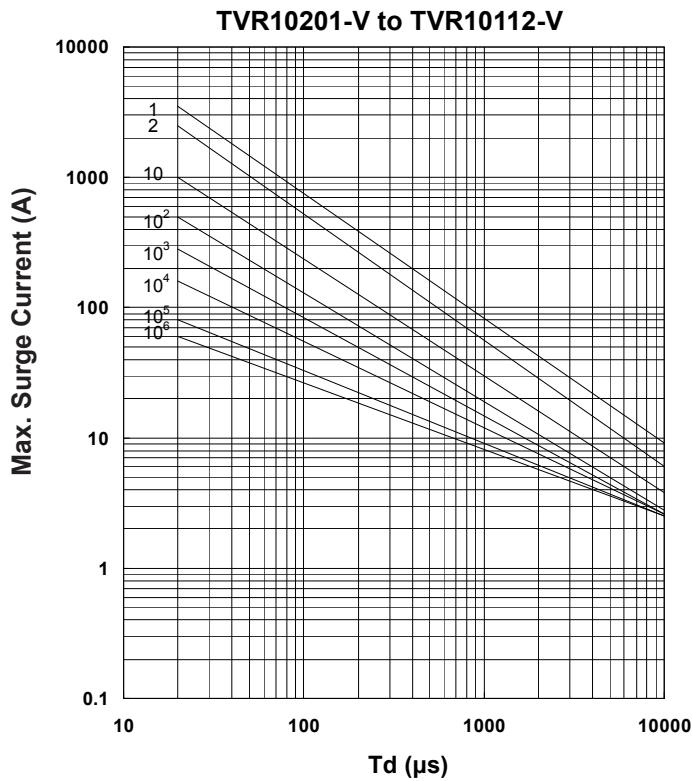
### Power Derating Curve



### Surge Current Standard Waveform



### Max. Surge Current Derating Curves

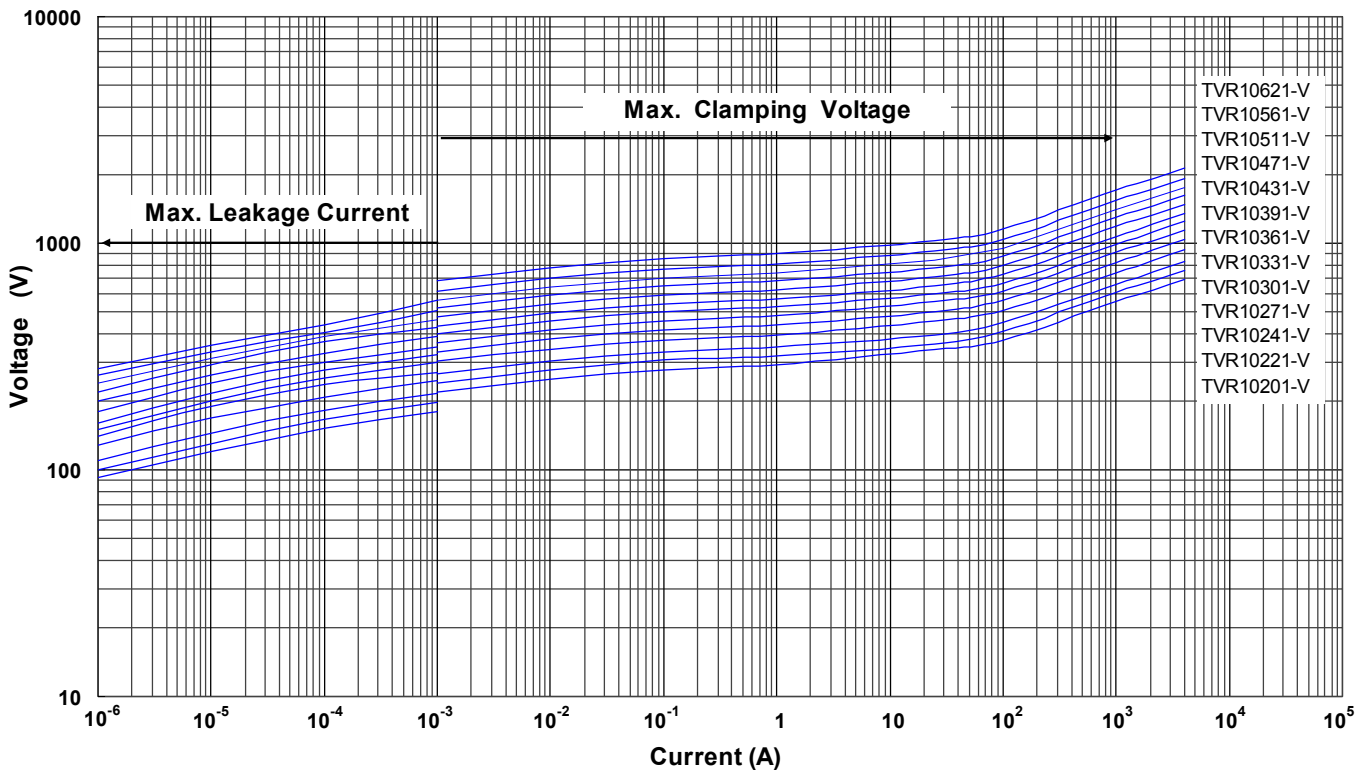


# Metal Oxide Varistor : TVR-V Series

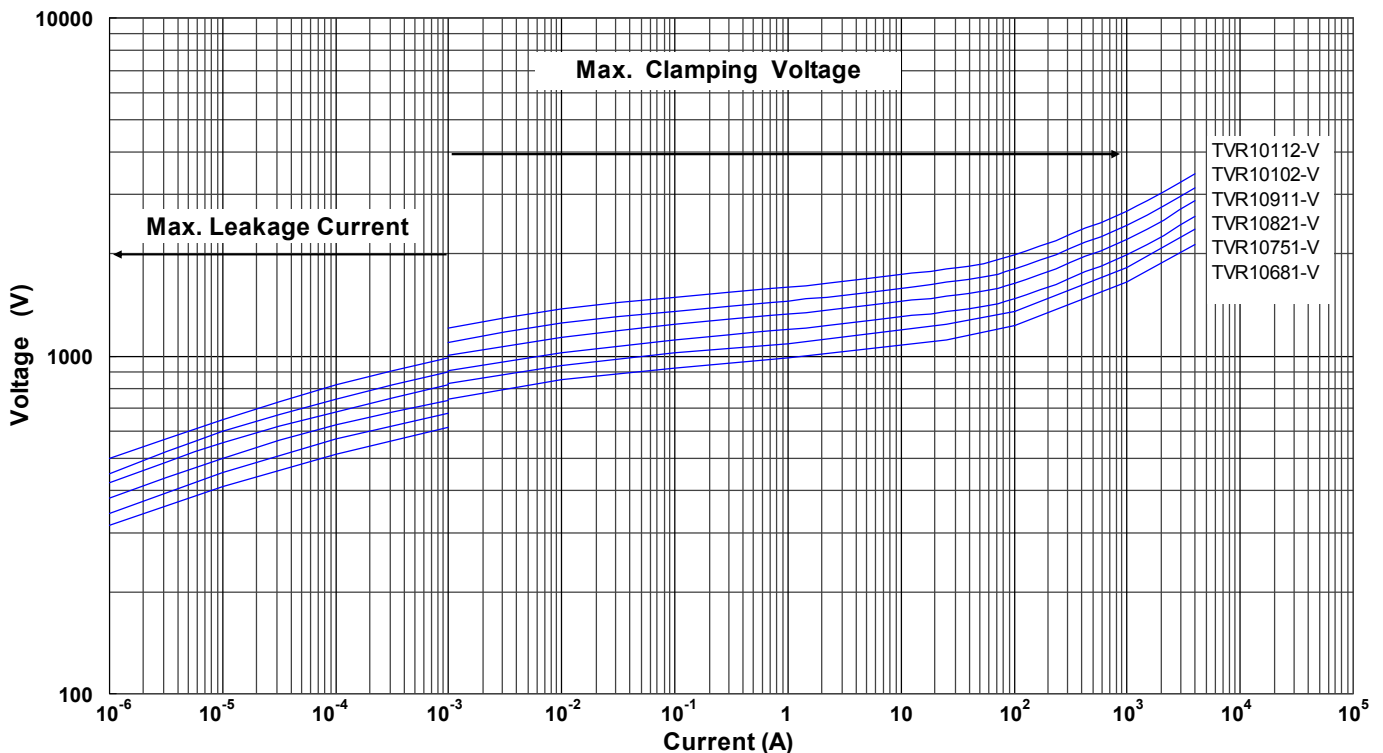
## Disc Type Varistor for Surge Protection (Medium Surge Series)

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

Max. Leakage Current and Max. Clamping Voltage Curves (TVR10201-V to TVR10621-V)



Max. Leakage Current and Max. Clamping Voltage Curves (TVR10681-V to TVR10112-V)



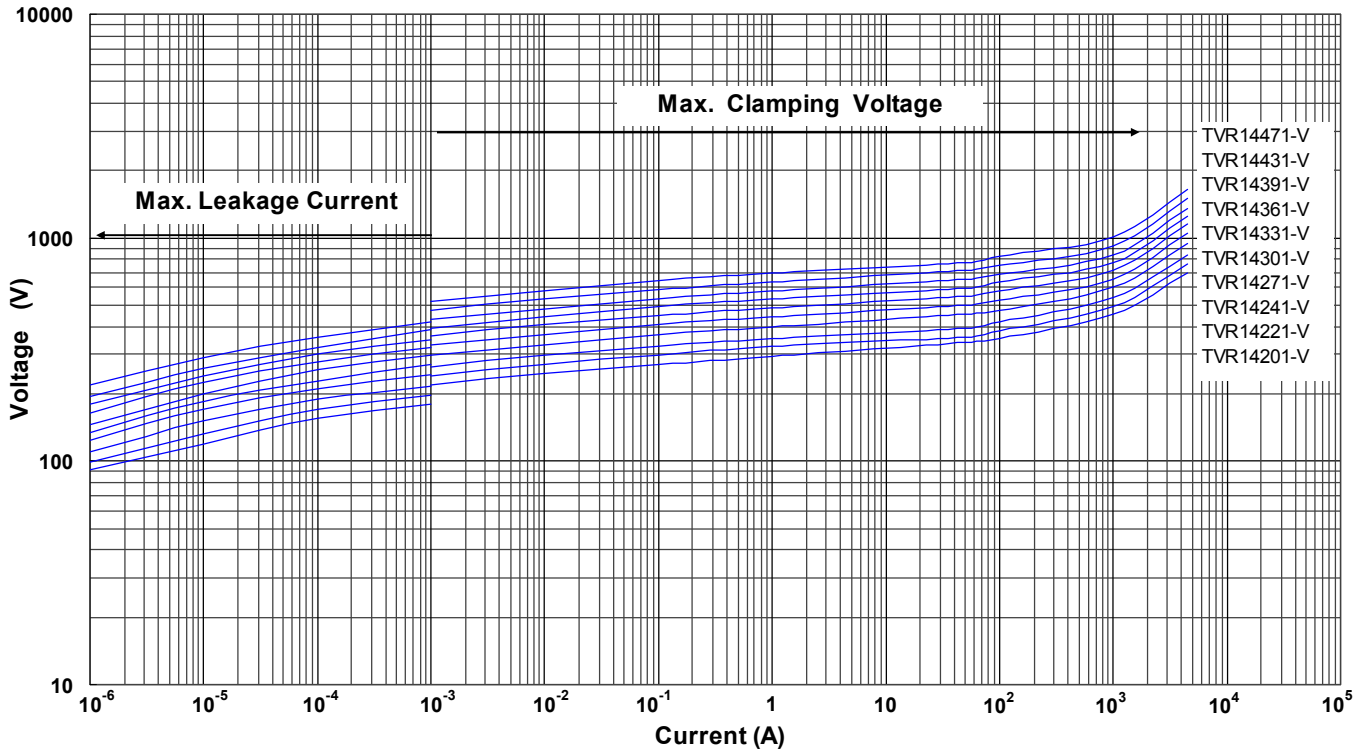


# Metal Oxide Varistor : TVR-V Series

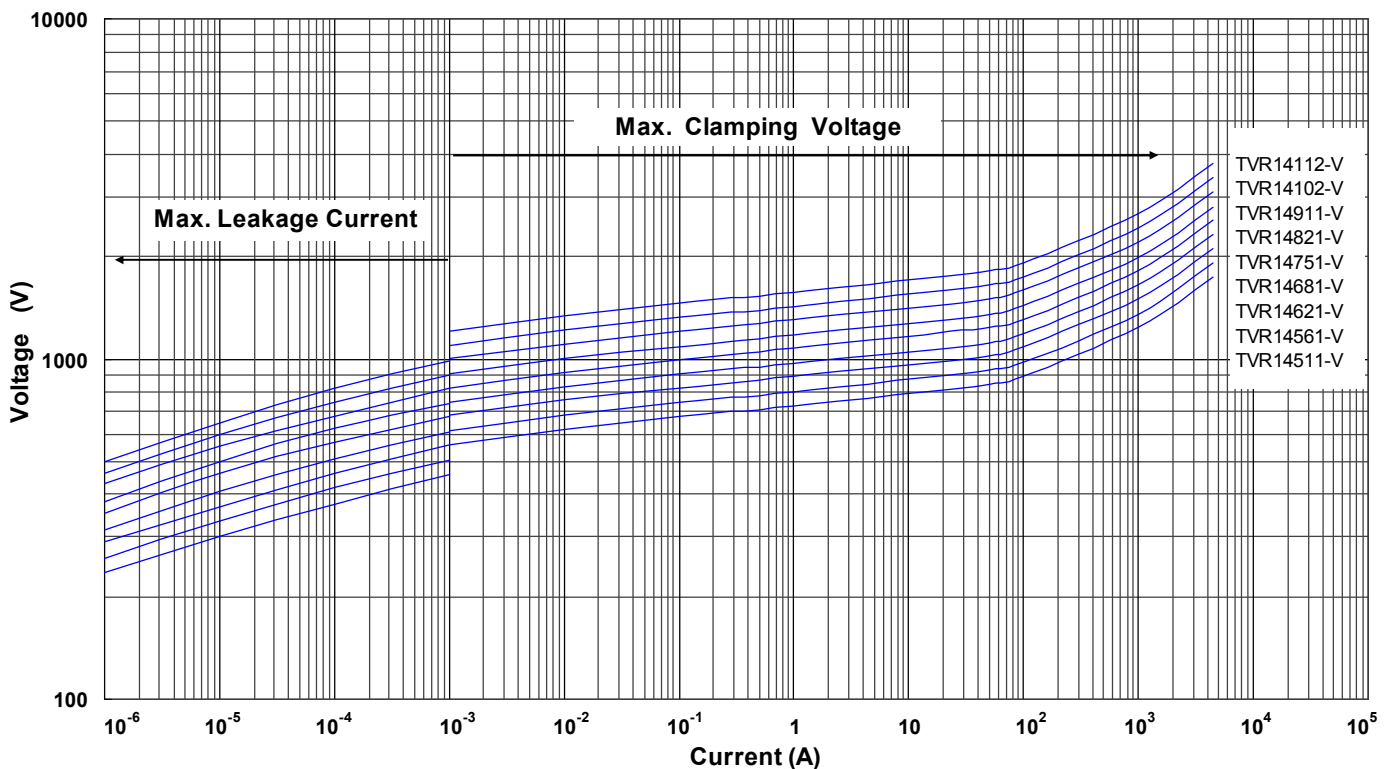
## Disc Type Varistor for Surge Protection (Medium Surge Series)

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

Max. Leakage Current and Max. Clamping Voltage Curves (TVR14201-V to TVR14471-V)



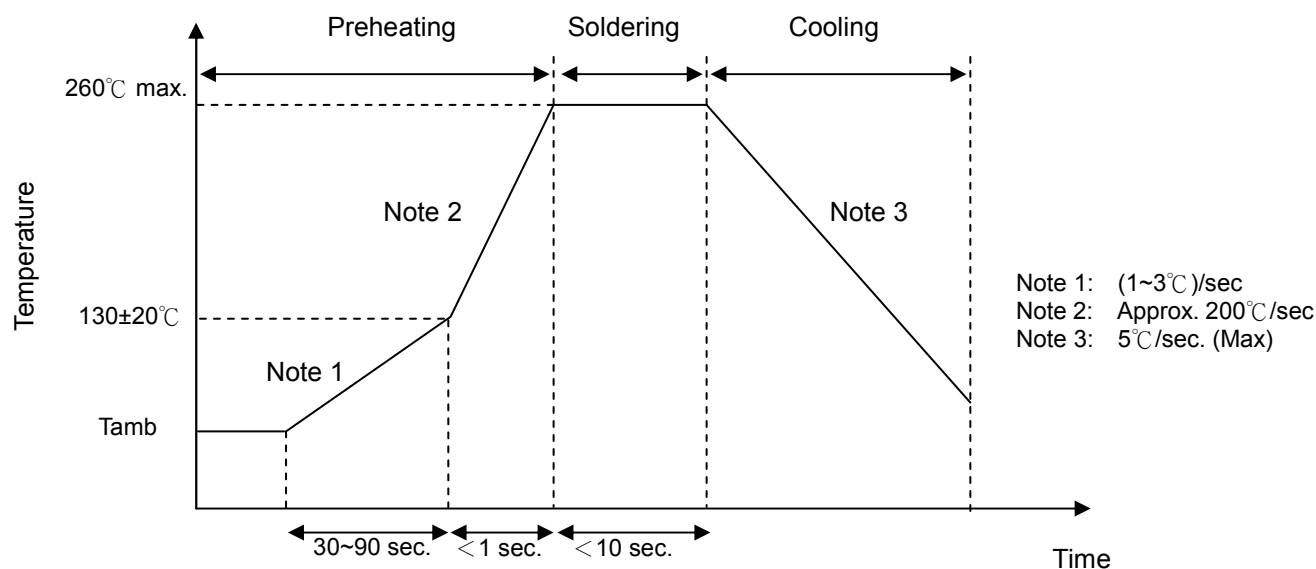
Max. Leakage Current and Max. Clamping Voltage Curves (TVR14511-V to TVR14112-V)



## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Soldering Recommendation

#### ● Wave Soldering Profile



#### ● Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Distance from Varistor	2 mm (min.)

# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Reliability

Item	Standard	Test conditions / Methods	Specifications															
Tensile Strength of Terminals	IEC 60068-2-21	Gradually apply the specified force and keep the unit fixed for 10±1 sec.  <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%;">Terminal diameter (mm)</td> <td style="text-align: center; width: 50%;">Force (Kg)</td> </tr> <tr> <td style="text-align: center;">0.5&lt;d≤0.8</td> <td style="text-align: center;">1.0</td> </tr> <tr> <td style="text-align: center;">0.8&lt;d≤1.25</td> <td style="text-align: center;">2.0</td> </tr> </table>	Terminal diameter (mm)	Force (Kg)	0.5<d≤0.8	1.0	0.8<d≤1.25	2.0	$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ No visible damage									
Terminal diameter (mm)	Force (Kg)																	
0.5<d≤0.8	1.0																	
0.8<d≤1.25	2.0																	
Bending Strength of Terminals	IEC 60068-2-21	Hold specimen and apply the force specified below to each lead. Bend the specimen to 90°, then return to the original position. Repeat the procedure in the opposite direction.  <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%;">Terminal diameter (mm)</td> <td style="text-align: center; width: 50%;">Force (Kg)</td> </tr> <tr> <td style="text-align: center;">0.5&lt;d≤0.8</td> <td style="text-align: center;">0.5</td> </tr> <tr> <td style="text-align: center;">0.8&lt;d≤1.25</td> <td style="text-align: center;">1.0</td> </tr> </table>	Terminal diameter (mm)	Force (Kg)	0.5<d≤0.8	0.5	0.8<d≤1.25	1.0	$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ No visible damage									
Terminal diameter (mm)	Force (Kg)																	
0.5<d≤0.8	0.5																	
0.8<d≤1.25	1.0																	
Vibration	IEC 60068-2-6	Frequency range: 10 ~ 55 Hz Amplitude: 0.75mm or 98 m/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, 10 ± 1 sec	$ \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	IEC 60068-2-78	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="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">-40±3</td> <td style="text-align: center;">30±3</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Room temperature</td> <td style="text-align: center;">5±3</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">85±2</td> <td style="text-align: center;">30±3</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">Room temperature</td> <td style="text-align: center;">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 <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															
Operating Duty Cycle Test	UL 1449 3 <sup>rd</sup>	6KV/3KA 1.2/50µs +8/20µs combination waveform with Vac(@ Deg 90) for 15 times. Interval time between tests is 60 sec. (For TVR10-V series test only)	$ \Delta V_p / V_p  \leq 10\%$ No visible damage															
Nominal Discharge Current Test	UL 1449 3 <sup>rd</sup>	Refer to UL 1449 3 <sup>rd</sup> item 37A, the test condition is 3KA 8/20µs surge current waveform for 15 times. (For TVR14-V (SPD Type 5) series test only)	$ \Delta V_{1mA}/V_{1mA}  \leq 10\%$ No visible damage															
Voltage Proof	IEC 61051-1	Metal balls method, 2500 Vac 1 min	No visible damage															
Varistor Voltage Temp. 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 : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### ■ Packaging

#### ● Taping Specification

#### S Type (Straight lead)

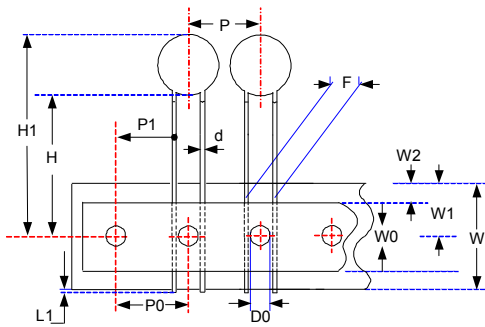


Figure A

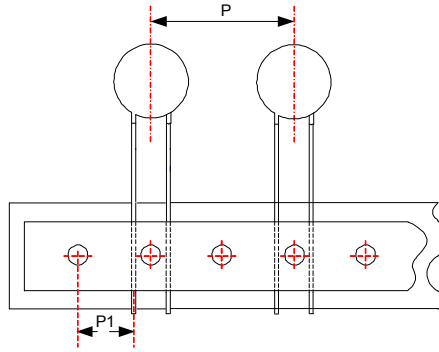


Figure B

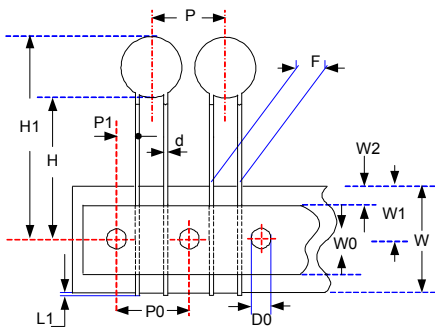
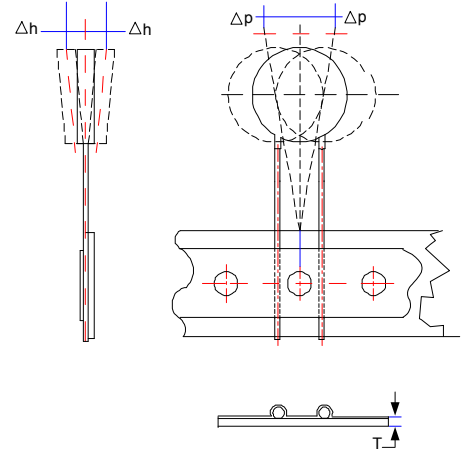


Figure C

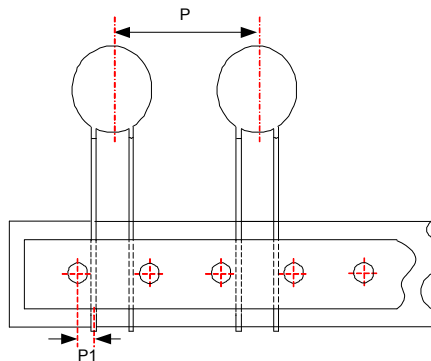


Figure D

(Unit: mm)

Taping Code	Series	P <sub>0</sub>	F	P	P <sub>1</sub>	H	H <sub>1</sub>	d	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	W	ΔP	Δh	L <sub>1</sub>	D <sub>0</sub>	T	Figure
		±0.3	±1	±1	±0.7	+2/-0	Max.	±0.02	±1	+0.75/-0.5	Max	+1/-0.5	Max.	Max.	Max.	±0.2	±0.2	
A (P <sub>0</sub> :12.7)	10-V	12.7	7.5	12.7	8.95	18	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	A
	14-V	12.7	7.5	25.4	8.95	18	38.0	0.8	12	9	3	18	1	2	0.5	4	0.6	B
E (P <sub>0</sub> :15.0)	10-V	15	7.5	15.0	3.75	18	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	C
	14-V	15	7.5	30.0	3.75	18	38.0	0.8	12	9	3	18	1	2	0.5	4	0.6	D

# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

### F Type (Y kink lead)

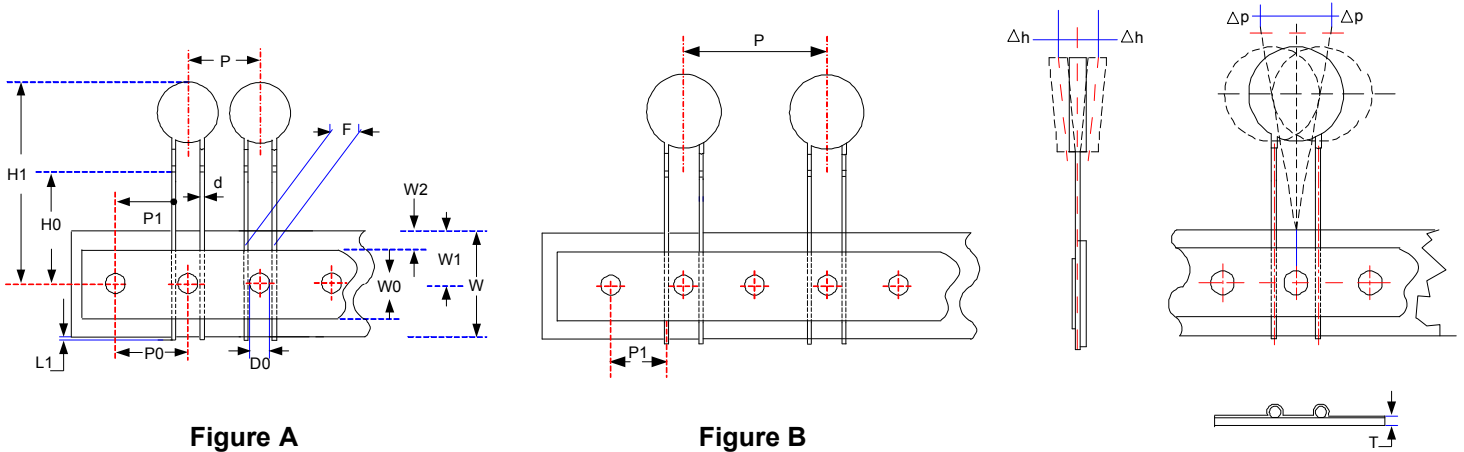


Figure A

Figure B

Figure C

Figure D

(Unit: mm)

Taping Code	Series	P <sub>0</sub>	F	P	P <sub>1</sub>	H <sub>0</sub>	H <sub>1</sub>	d	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	W	ΔP	Δh	L <sub>1</sub>	D <sub>0</sub>	T	Figure
		±0.3	±1	±1	±0.7	±0.5	Max.	±0.02	±1	+0.75/ -0.5	Max	+1/ -0.5	Max.	Max.	Max.	±0.2	±0.2	
A (P <sub>0</sub> :12.7)	10-V	12.7	7.5	12.7	8.95	16	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	A
	14-V	12.7	7.5	25.4	8.95	16	38.0	0.8	12	9	3	18	1	2	0.5	4	0.6	B
E (P <sub>0</sub> :15.0)	10-V	15.0	7.5	15.0	3.75	16	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	C
	14-V	15.0	7.5	30.0	3.75	16	38.0	0.8	12	9	3	18	1	2	0.5	4	0.6	D

# Metal Oxide Varistor : TVR-V Series

## Disc Type Varistor for Surge Protection (Medium Surge Series)

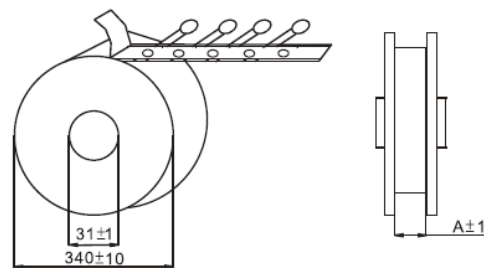
### ■ Quantity

#### ● Bulk Packing

Series	Quantity (pcs/bag)
TVR10-V	200
TVR14-V	100

#### ● Reel Packing

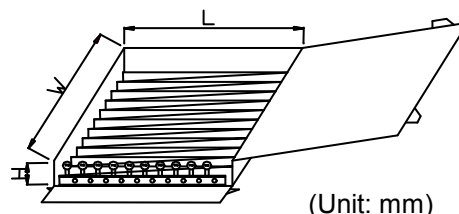
Series	A (mm)	Quantity (pcs/reel)
TVR10(201~471)-V	46	750
TVR10(511~112)-V		500
TVR14(201~391)-V		750
TVR14(431~112)-V		500



(Unit: mm)

#### ● Ammo Packing

Series	Quantity (pcs/box)
TVR10(201~361)-V	750
TVR10(391~621)-V	500
TVR10(681~112)-V	400
TVR14(201~271)-V	500
TVR14(301~112)-V	250



(Unit: mm)

Series	W±5	L±5	H±5
TVR10-V	348	275	60
TVR14-V	348	185	60

### ■ 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