

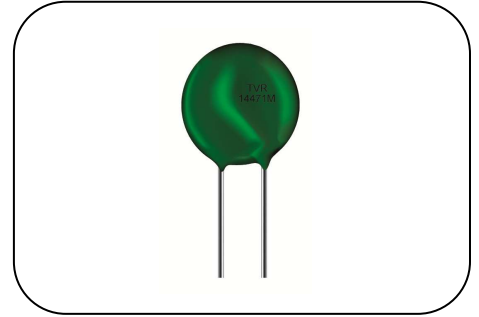
# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### ■ Features

1. RoHS and Halogen-free compliant
2. Body size:  $\Phi 5 \sim \Phi 20\text{mm}$
3. Wide continuous voltage range: 130Vac ~ 465 Vac
4. Operating temperature range:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
5. Storage temperature range:  $-40^{\circ}\text{C} \sim +150^{\circ}\text{C}$
6. UL 1449 4<sup>th</sup> SPD Type 5
7. Agency recognition: UL /cUL/VDE/CQC



### ■ Recommended Applications

1. Power supply
2. Home appliance
3. Industrial equipment
4. LED driver
5. Photovoltaic industry

### ■ Part Number Code

T	V	R	0	7	2	0	1	K	L						M
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Product Type		Body Size		Varistor Voltage( $V_{1\text{mA}}$ )		Tolerance of $V_{1\text{mA}}$		Appearance		Packaging		Optional Suffix		Internal Control Code	
TVR	THINKING Varistor TVR Series		05	$\Phi 5\text{mm}$	201	$20 \times 10^1 \text{V} = 200\text{V}$		K	$\pm 10\%$	L				M	High Temperature Series
			07	$\Phi 7\text{mm}$	471	$47 \times 10^1 \text{V} = 470\text{V}$					AR	Tape & reel packing (hole pitch: 12.7mm)			
			10	$\Phi 10\text{mm}$							ER	Tape & reel packing (hole pitch: 15.0mm)			
			14	$\Phi 14\text{mm}$							AB	Tape & ammo box packing (hole pitch: 12.7mm)			
			20	$\Phi 20\text{mm}$							EB	Tape & ammo box packing (hole pitch: 15.0mm)			
								L	Straight lead		C	Bulk & cut lead (followed by the codes of 2 leaded length)			01~ZZ
								Y	Y Kink		Blank	Bulk			

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

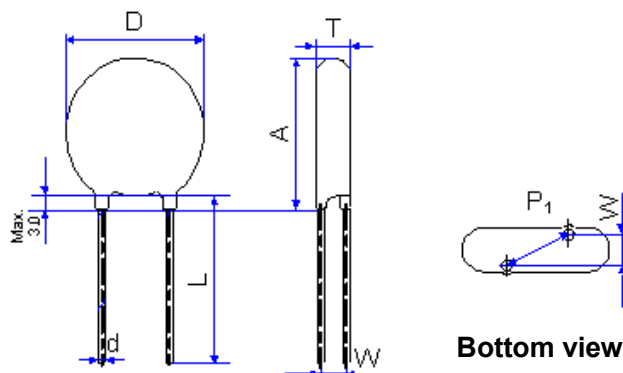
# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### Structures and Dimensions

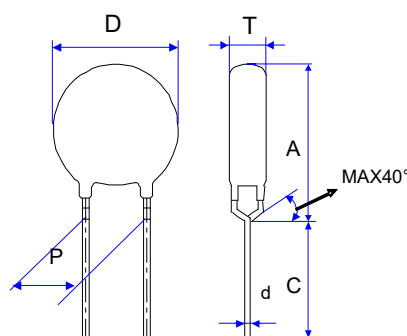
#### Straight Lead



(Unit: mm)

Series	D	L <sub>min.</sub>	d	P <sub>1</sub>	A <sub>max.</sub>	T <sub>max.</sub>	W
TVR05-M	5.6~7.5	26.5	0.6±0.02	5±1	9.0	Please refer to the Electrical Characteristics Table	
TVR07-M	7.5~9.6	26.5	0.6±0.02	5±1	11.0 (for TVR07201~621-M) 11.5 (for TVR07681~751-M)		
TVR10-M	11.0~14.4	26.5	0.8±0.02	7.5±1	15.0 (for TVR10201-751-M)		
TVR14-M	14.4~18.0	26.5	0.8±0.02	7.5±1	18.5 (for TVR14201-511-M) 19.0 (for TVR14561-751-M)		
TVR20-M	20.0~24.0	22.5	1.0±0.02	10±1	25.5 (for TVR20201-511-M) 26.0 (for TVR20561-751-M)		

#### Y kink lead



Unit: mm)

Series	D	C <sub>min.</sub>	d	P	A <sub>max.</sub>	T <sub>max.</sub>
TVR05-M	5.6~7.5	20	0.6±0.02	5±1	9.5	Please refer to the Electrical Characteristics Table
TVR07-M	7.5~9.6		0.6±0.02	5±1	11.5	
TVR10-M	11.0~14.4		0.8±0.02	7.5±1	16.0	
TVR14-M	14.4~18.0		0.8±0.02	7.5±1	19.0	
TVR20-M	20.0~24.0		1.0±0.02	10±1	26.5	

Note: If customer needs short lead (cut lead) product, the dimension C is suggested to 3.5± 0.5mm.

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### ■ Electrical Characteristics

#### 05mm 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)	Dimension		
	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>	T <sub>min</sub>	T <sub>max</sub>	W ±1.0
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(mm)		
TVR05201-M	200 (180~220)	130	170	355	5	400	0.1	6.5	3.20	4.60	1.5
TVR05221-M	220 (198~242)	140	180	380	5	400	0.1	7.0	3.36	4.80	1.5
TVR05241-M	240 (216~264)	150	200	415	5	400	0.1	8.0	3.44	4.90	1.6
TVR05271-M	270 (243~297)	175	225	475	5	400	0.1	8.5	3.52	5.00	1.7
TVR05301-M	300 (270~330)	195	250	525	5	400	0.1	8.5	3.60	5.10	1.9
TVR05331-M	330 (297~363)	215	275	585	5	400	0.1	9.2	3.76	5.30	2.0
TVR05361-M	360 (324~396)	230	300	620	5	400	0.1	10	3.92	5.50	2.1
TVR05391-M	390 (351~429)	250	320	675	5	400	0.1	12	4.00	6.00	2.3
TVR05431-M	430 (387~473)	275	350	745	5	400	0.1	13	4.16	6.19	2.3
TVR05471-M	470 (423~517)	300	385	810	5	400	0.1	15	4.24	6.36	2.4
TVR05511-M	510 (459~561)	320	410	878	5	400	0.1	16	4.40	6.56	2.6
TVR05561-M	560 (504~616)	350	450	962	5	400	0.1	18	4.56	6.80	2.8
TVR05621-M	620 (558~682)	395	510	1050	5	400	0.1	18	4.88	7.20	3.0

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### 07mm 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)	Dimension		
	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>	T <sub>min</sub>	T <sub>max</sub>	W ±1.0
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(mm)		
TVR07201-M	200 (180~220)	130	170	340	10	1750	0.25	17.5	3.20	4.60	1.5
TVR07221-M	220 (198~242)	140	180	360	10	1750	0.25	19	3.28	4.80	1.5
TVR07241-M	240 (216~264)	150	200	395	10	1750	0.25	21	3.44	4.90	1.6
TVR07271-M	270 (243~297)	175	225	455	10	1750	0.25	24	3.52	5.00	1.7
TVR07301-M	300 (270~330)	195	250	500	10	1750	0.25	26	3.60	5.10	1.9
TVR07331-M	330 (297~363)	215	275	550	10	1750	0.25	28	3.76	5.30	2.0
TVR07361-M	360 (324~396)	230	300	595	10	1750	0.25	32	3.92	5.50	2.1
TVR07391-M	390 (351~429)	250	320	650	10	1750	0.25	35	4.00	6.00	2.3
TVR07431-M	430 (387~473)	275	350	710	10	1750	0.25	40	4.16	6.19	2.3
TVR07471-M	470 (423~517)	300	385	775	10	1750	0.25	42	4.24	6.36	2.4
TVR07511-M	510 (459~561)	320	410	845	10	1750	0.25	45	4.40	6.56	2.6
TVR07561-M	560 (504~616)	350	450	930	10	1750	0.25	45.5	4.56	6.80	2.8
TVR07621-M	620 (558~682)	395	510	1020	10	1750	0.25	50	4.88	7.20	3.0
TVR07681-M	680 (612~748)	420	560	1120	10	1750	0.25	50.5	5.04	7.40	3.2
TVR07751-M	750 (675~825)	465	615	1235	10	1750	0.25	51	5.20	7.67	3.5

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### 10mm 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)	Dimension		
	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>	T <sub>min</sub>	T <sub>max</sub>	W ±1.0
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(mm)		
TVR10201-M	200 (180~220)	130	170	340	25	3500	0.4	35	3.60	5.00	1.7
TVR10221-M	220 (198~242)	140	180	360	25	3500	0.4	39	3.68	5.10	1.7
TVR10241-M	240 (216~264)	150	200	395	25	3500	0.4	42	3.84	5.30	1.8
TVR10271-M	270 (243~297)	175	225	455	25	3500	0.4	49	3.92	5.40	1.9
TVR10301-M	300 (270~330)	195	250	500	25	3500	0.4	53	4.00	5.50	2.1
TVR10331-M	330 (297~363)	215	275	550	25	3500	0.4	58	4.16	5.70	2.2
TVR10361-M	360 (324~396)	230	300	595	25	3500	0.4	65	4.24	5.90	2.3
TVR10391-M	390 (351~429)	250	320	650	25	3500	0.4	70	4.32	6.40	2.5
TVR10431-M	430 (387~473)	275	350	710	25	3500	0.4	80	4.40	6.59	2.5
TVR10471-M	470 (423~517)	300	385	775	25	3500	0.4	85	4.64	6.76	2.6
TVR10511-M	510 (459~561)	320	410	845	25	3500	0.4	92	4.88	7.00	2.8
TVR10561-M	560 (504~616)	350	450	930	25	3500	0.4	92	4.96	7.20	3.0
TVR10621-M	620 (558~682)	395	510	1020	25	3500	0.4	92	5.12	7.60	3.2
TVR10681-M	680 (612~748)	420	560	1120	25	3500	0.4	92	5.28	7.80	3.4
TVR10751-M	750 (675~825)	465	615	1235	25	3500	0.4	100	5.44	8.07	3.7

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### 14mm Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20 $\mu$ s)		Max. Surge Current (8/20 $\mu$ s)	Rated Power	Max. Energy (10/1000 $\mu$ s)	Dimension		
	$V_{1mA}$	$V_{AC(rms)}$	$V_{DC}$	$V_P$	$I_P$	$I_{max}$	P	Wmax	Tmin	Tmax	W $\pm 1.0$
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(mm)		
TVR14201-M	200 (180~220)	130	170	340	50	6000	0.6	70	3.60	5.00	1.7
TVR14221-M	220 (198~242)	140	180	360	50	6000	0.6	78	3.68	5.10	1.7
TVR14241-M	240 (216~264)	150	200	395	50	6000	0.6	84	3.84	5.30	1.8
TVR14271-M	270 (243~297)	175	225	455	50	6000	0.6	99	3.92	5.40	1.9
TVR14301-M	300 (270~330)	195	250	500	50	6000	0.6	105	4.00	5.50	2.1
TVR14331-M	330 (297~363)	215	275	550	50	6000	0.6	115	4.16	5.70	2.2
TVR14361-M	360 (324~396)	230	300	595	50	6000	0.6	130	4.24	5.90	2.3
TVR14391-M	390 (351~429)	250	320	650	50	6000	0.6	140	4.32	6.40	2.5
TVR14431-M	430 (387~473)	275	350	710	50	6000	0.6	155	4.40	6.59	2.5
TVR14471-M	470 (423~517)	300	385	775	50	6000	0.6	175	4.64	6.76	2.6
TVR14511-M	510 (459~561)	320	410	845	50	6000	0.6	190	4.88	7.00	2.8
TVR14561-M	560 (504~616)	350	450	930	50	6000	0.6	190	4.96	7.20	3.0
TVR14621-M	620 (558~682)	395	510	1020	50	6000	0.6	190	5.12	7.60	3.2
TVR14681-M	680 (612~748)	420	560	1120	50	6000	0.6	190	5.28	7.80	3.4
TVR14751-M	750 (675~825)	465	615	1235	50	6000	0.6	210	5.44	8.07	3.7

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### 20mm 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)	Dimension		
	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>	T <sub>min</sub>	T <sub>max</sub>	W ±1.0
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(mm)		
TVR20201-M	200 (180~220)	130	170	340	100	10000	1.0	140	3.84	5.40	1.9
TVR20221-M	220 (198~242)	140	180	360	100	10000	1.0	155	3.92	5.50	1.9
TVR20241-M	240 (216~264)	150	200	395	100	10000	1.0	168	4.08	5.70	2.0
TVR20271-M	270 (243~297)	175	225	455	100	10000	1.0	190	4.16	5.80	2.1
TVR20301-M	300 (270~330)	195	250	500	100	10000	1.0	210	4.24	5.90	2.3
TVR20331-M	330 (297~363)	215	275	550	100	10000	1.0	228	4.32	6.10	2.4
TVR20361-M	360 (324~396)	230	300	595	100	10000	1.0	255	4.40	6.30	2.5
TVR20391-M	390 (351~429)	250	320	650	100	10000	1.0	275	4.48	6.72	2.7
TVR20431-M	430 (387~473)	275	350	710	100	10000	1.0	303	4.56	6.84	2.7
TVR20471-M	470 (423~517)	300	385	775	100	10000	1.0	350	4.88	7.20	2.8
TVR20511-M	510 (459~561)	320	410	845	100	10000	1.0	382	5.12	7.40	3.0
TVR20561-M	560 (504~616)	350	450	930	100	10000	1.0	382	5.20	7.60	3.2
TVR20621-M	620 (558~682)	395	510	1020	100	10000	1.0	382	5.36	8.00	3.4
TVR20681-M	680 (612~748)	420	560	1120	100	10000	1.0	382	5.52	8.20	3.6
TVR20751-M	750 (675~825)	465	615	1235	100	10000	1.0	420	5.68	8.47	3.9

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### Safety Approvals

Certified Model No.	Agency		
			
	UL1449 4 <sup>th</sup> & cUL	DIN/ EN/ IEC 61051-1 DIN/ EN/ IEC 61051-2 IEC 61051-2-2	GB/T10193-1997 GB/T10194-1997
	E314979	40036061	TVR05-M CQC15001128789 CQC15001128794 TVR07-M CQC15001128790 CQC15001128788
TVR05201-M	√	√	√
TVR05221-M	√	√	√
TVR05241-M	√	√	√
TVR05271-M	√	√	√
TVR05301-M	√	√	√
TVR05331-M	√	√	√
TVR05361-M	√	√	√
TVR05391-M	√	√	√
TVR05431-M	√	√	√
TVR05471-M	√	√	√
TVR05511-M	√	√	√
TVR05561-M	√	√	√
TVR05621-M	√	√	√
TVR07201-M	√	√	√
TVR07221-M	√	√	√
TVR07241-M	√	√	√
TVR07271-M	√	√	√
TVR07301-M	√	√	√
TVR07331-M	√	√	√
TVR07361-M	√	√	√
TVR07391-M	√	√	√
TVR07431-M	√	√	√
TVR07471-M	√	√	√
TVR07511-M	√	√	√
TVR07561-M	√	√	√
TVR07621-M	√	√	√
TVR07681-M	√	√	√
TVR07751-M	√	√	√



# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection






Certified Model No.	Agency				
	UL1449 4 <sup>th</sup> & cUL	DIN/ EN/ IEC 61051-1 DIN/ EN/ IEC 61051-2 IEC 61051-2-2	IEC 62368-1 Annex G.8.1	GB/T10193-1997 GB/T10194-1997	GB8898-2011 GB4943.1-2011
	E314979	40036061		TVR10-M CQC13001090356 CQC13001090357 TVR14-M CQC15001128796 CQC15001128834	
TVR10201-M	√	√	√	√	
TVR10221-M	√	√	√	√	
TVR10241-M	√	√	√	√	
TVR10271-M	√	√	√	√	
TVR10301-M	√	√	√	√	
TVR10331-M	√	√	√	√	
TVR10361-M	√	√	√	√	
TVR10391-M	√	√	√	√	
TVR10431-M	√	√	√	√	√
TVR10471-M	√	√	√	√	√
TVR10511-M	√	√	√	√	√
TVR10561-M	√	√	√	√	√
TVR10621-M	√	√	√	√	√
TVR10681-M	√	√	√	√	√
TVR10751-M	√	√	√	√	√
TVR14201-M	√	√	√	√	
TVR14221-M	√	√	√	√	
TVR14241-M	√	√	√	√	
TVR14271-M	√	√	√	√	
TVR14301-M	√	√	√	√	
TVR14331-M	√	√	√	√	
TVR14361-M	√	√	√	√	
TVR14391-M	√	√	√	√	
TVR14431-M	√	√	√	√	√
TVR14471-M	√	√	√	√	√
TVR14511-M	√	√	√	√	√
TVR14561-M	√	√	√	√	√
TVR14621-M	√	√	√	√	√
TVR14681-M	√	√	√	√	√
TVR14751-M	√	√	√	√	√

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



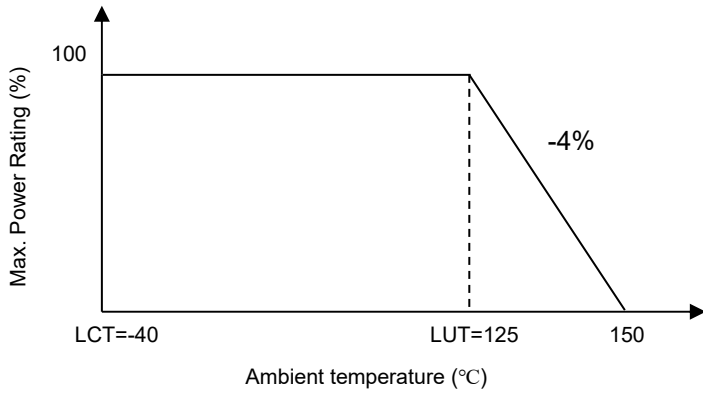
Certified Model No.	Agency				
					
	UL1449 4 <sup>th</sup> & cUL	DIN/ EN/ IEC 61051-1 DIN/ EN/ IEC 61051-2 IEC 61051-2-2	IEC 62368-1 Annex G.8.1	GB/T10193-1997 GB/T10194-1997	GB8898-2011 GB4943.1-2011
	E314979	40036061		CQC15001128792 CQC15001128793	
TVR20201-M	√	√	√	√	
TVR20221-M	√	√	√	√	
TVR20241-M	√	√	√	√	
TVR20271-M	√	√	√	√	
TVR20301-M	√	√	√	√	
TVR20331-M	√	√	√	√	
TVR20361-M	√	√	√	√	
TVR20391-M	√	√	√	√	
TVR20431-M	√	√	√	√	√
TVR20471-M	√	√	√	√	√
TVR20511-M	√	√	√	√	√
TVR20561-M	√	√	√	√	√
TVR20621-M	√	√	√	√	√
TVR20681-M	√	√	√	√	√
TVR20751-M	√	√	√	√	√

# Metal Oxide Varistor : TVR-M Series

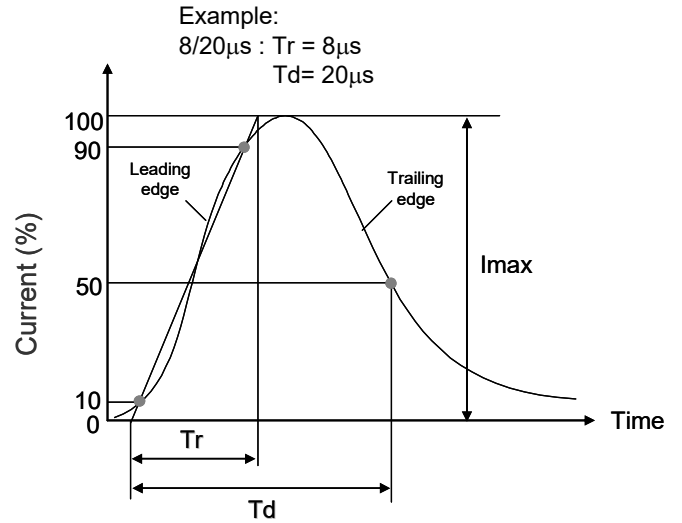
## High Temperature Varistor for Surge Protection



### Power Derating Curve

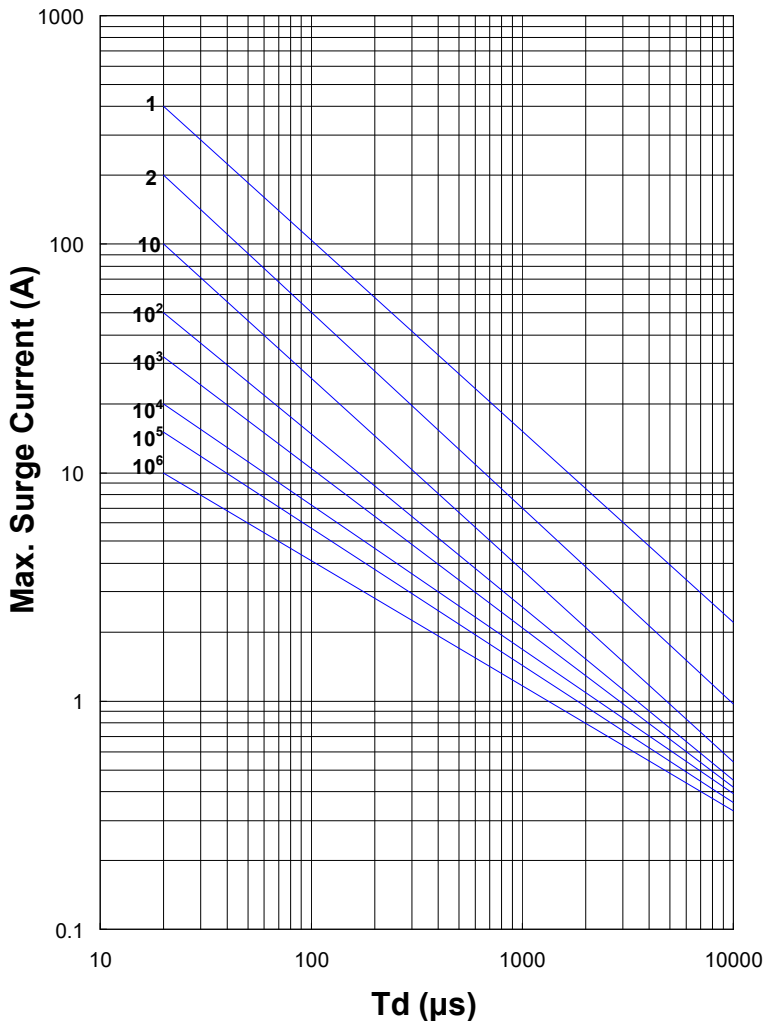


### Surge Current Standard Waveform

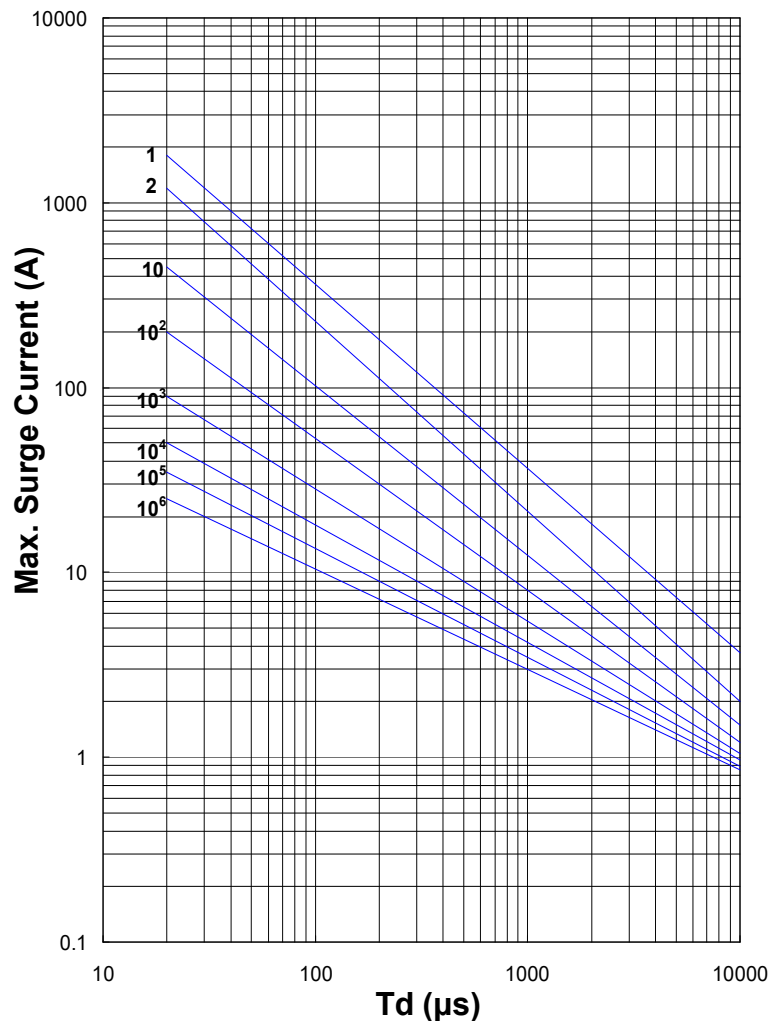


### Max. Surge Current Derating Curves

TVR05201-M ~ TVR05751-M



TVR07201-M ~ TVR07751-M

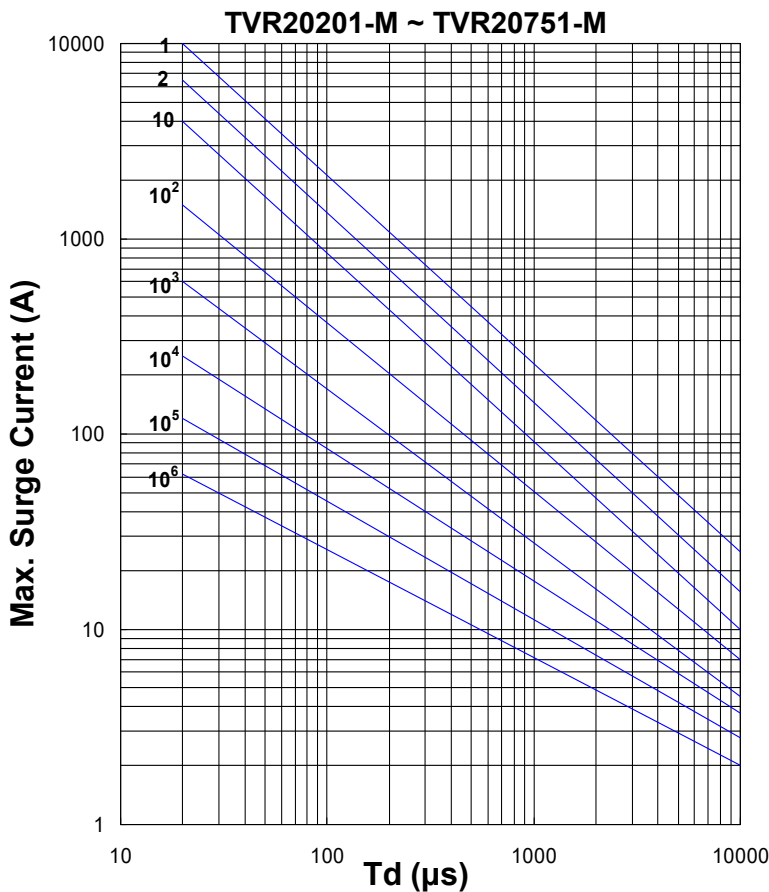
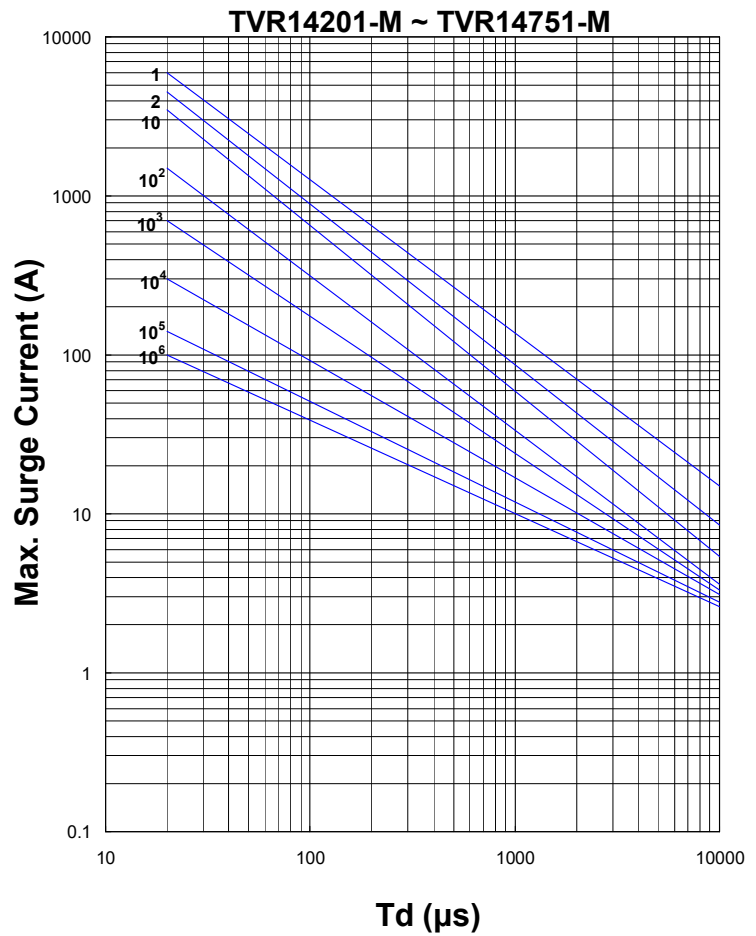
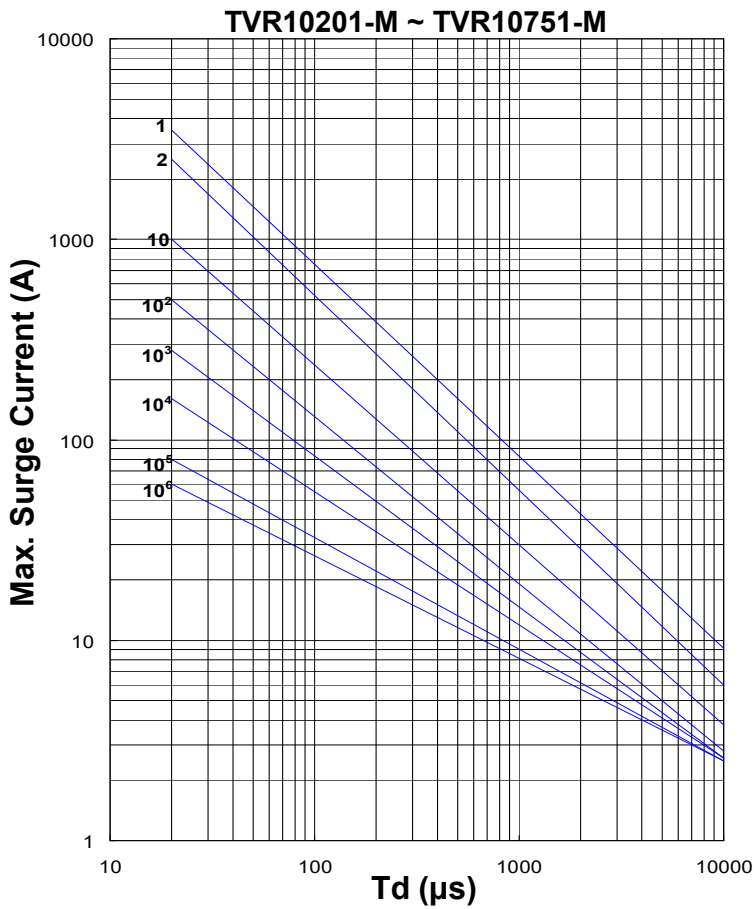


# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### Max. Surge Current Derating Curves

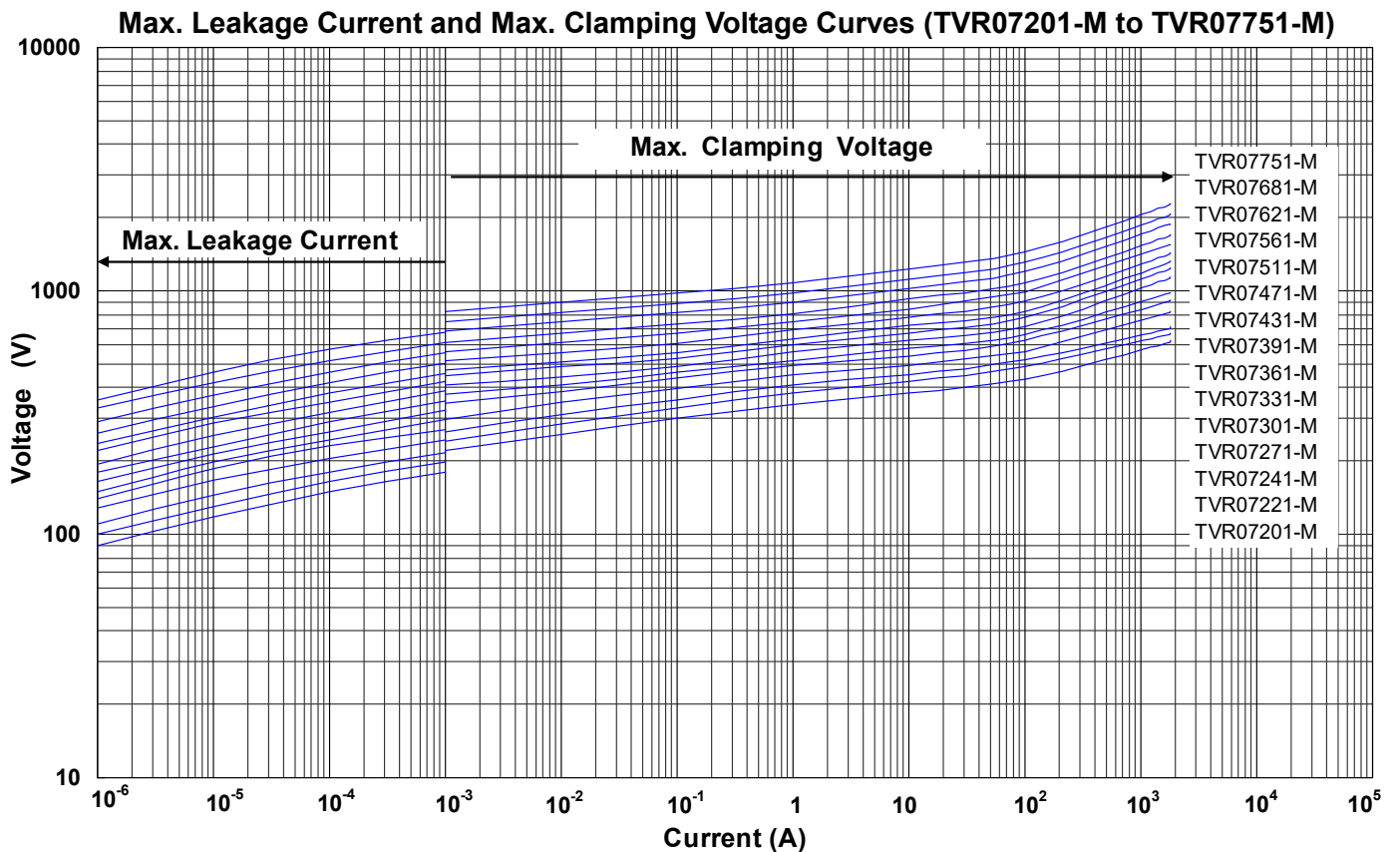
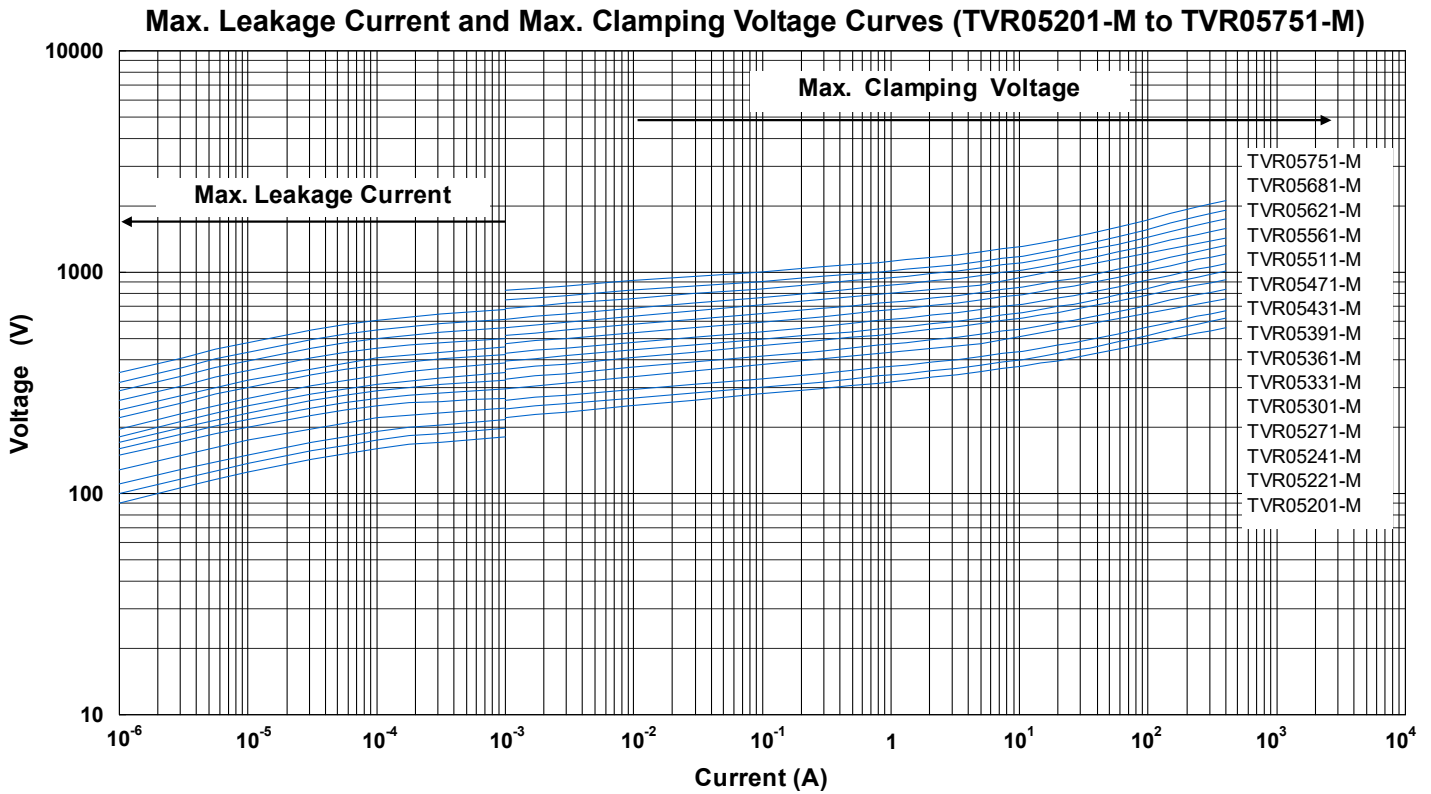


# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



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

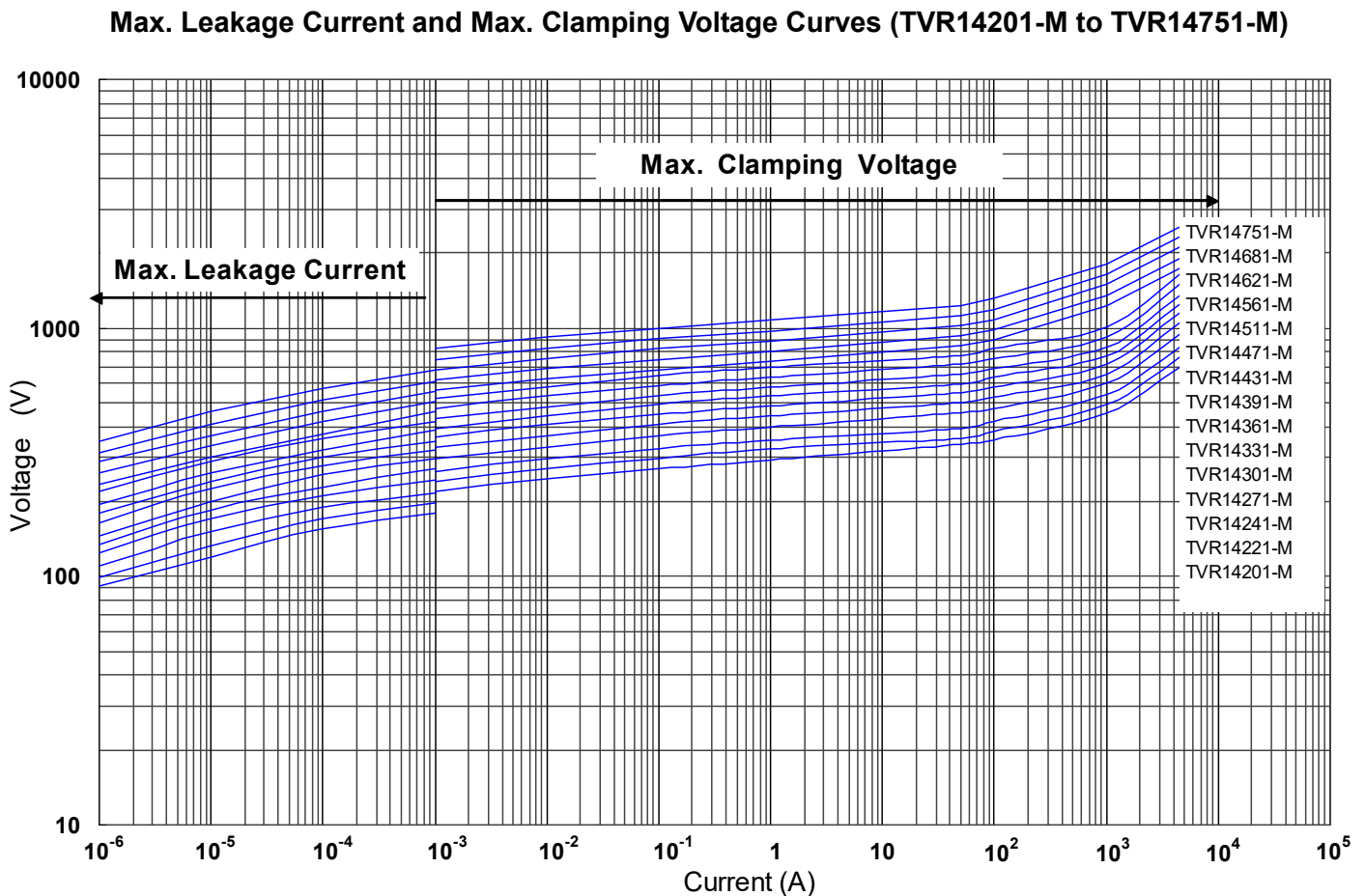
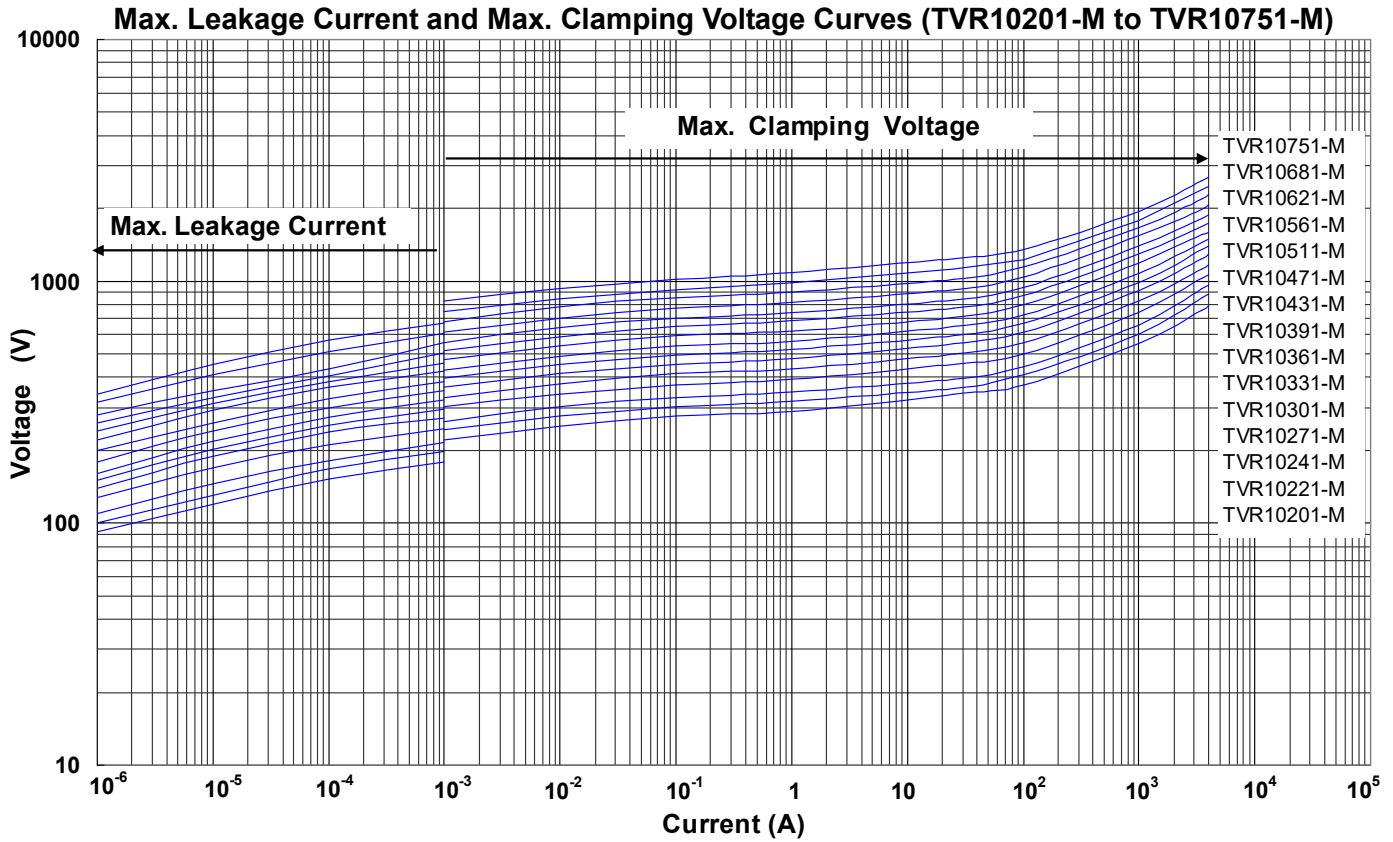


# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



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



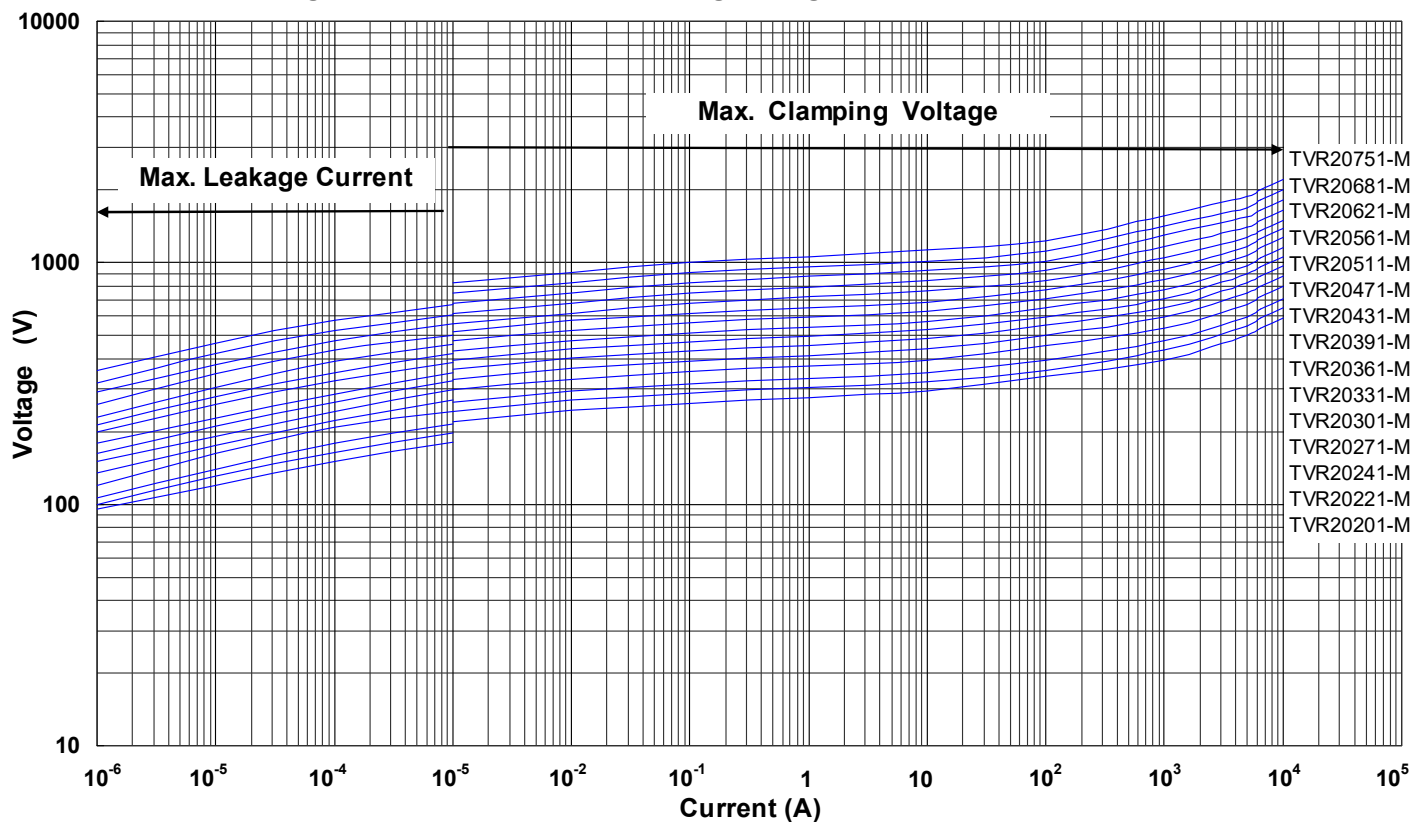
# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



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

Max. Leakage Current and Max. Clamping Voltage Curves (TVR20201-M to TVR20751-M)



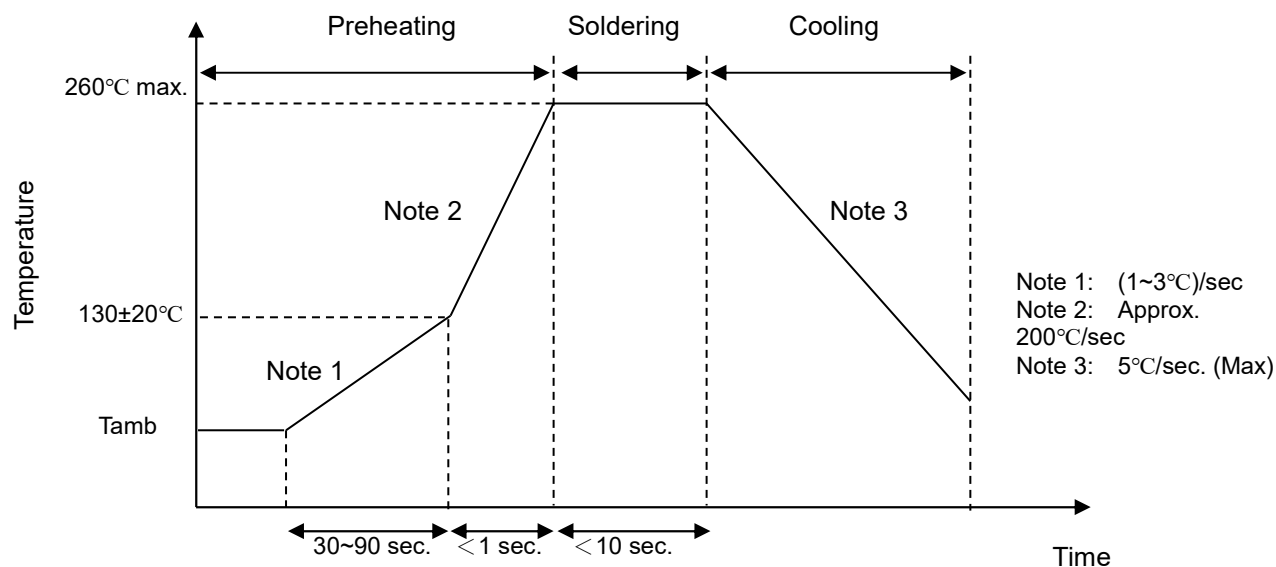
# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### ■ Soldering Recommendation

#### ● Wave Soldering Profile



#### ● Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	$360^\circ\text{C}$ (max.)
Soldering Time	3 sec (max.)
Distance from Varistor	2 mm (min.)



# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### ■ Reliability

Item	Standard	Test conditions / Methods	Specifications															
Tensile Strength of Terminals	IEC60068-2-21	Gradually apply the specified force and keep the unit fixed for 10±1 sec.  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															
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.  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															
Vibration	IEC 61051-1	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, (5±0.5 sec for TVR05)	$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ No visible damage															
High Temperature Storage	IEC 60068-2-2	150±2°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 1,000 cycles <table border="1"> <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>≤ 3</td> </tr> <tr> <td>3</td> <td>125±2</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>≤ 3</td> </tr> </tbody> </table>	Step	Temperature (°C)	Period (minutes)	1	-40±3	30±3	2	Room temperature	≤ 3	3	125±2	30±3	4	Room temperature	≤ 3	$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ No visible damage
Step	Temperature (°C)	Period (minutes)																
1	-40±3	30±3																
2	Room temperature	≤ 3																
3	125±2	30±3																
4	Room temperature	≤ 3																
Endurance at Upper Category Temperature	MIL-STD-202 Method 108	125±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 secs, 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	Max energy, 10/1000μs waveform, test one time	$ \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	$\frac{V_{1mA@125^\circ C} - V_{1mA@25^\circ C}}{V_{1mA@25^\circ C}} \times \frac{1}{100} \times 100\%(\%/^\circ C)$ , $\frac{V_{1mA@-40^\circ C} - V_{1mA@25^\circ C}}{V_{1mA@25^\circ C}} \times \frac{1}{65} \times 100\%(\%/^\circ C)$	-0.05 ≤ TC ≤ 0.05 (%/°C)															

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### ■ Packaging

#### ● Taping Specification

#### L Type (Straight Lead)

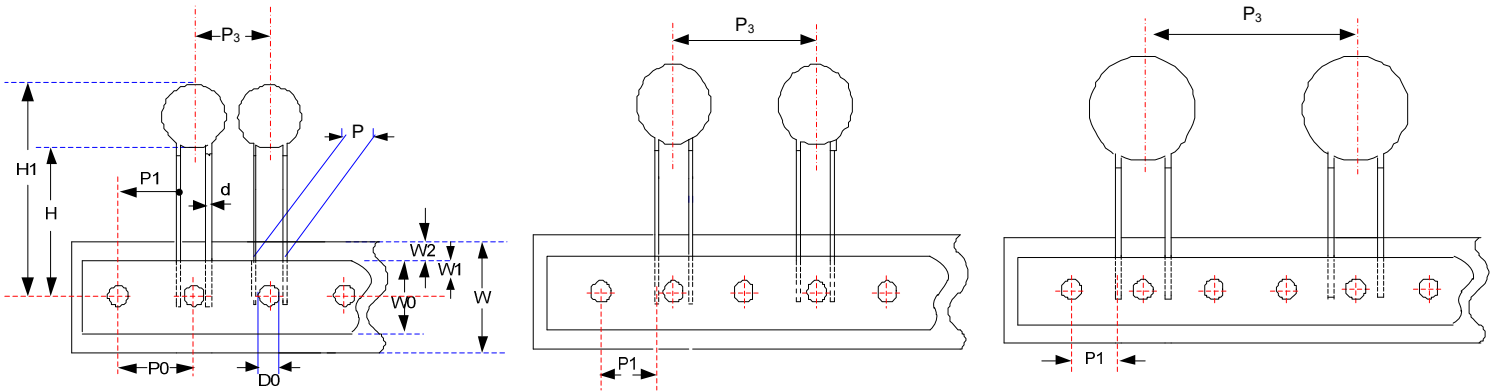


Figure A

Figure B

Figure C

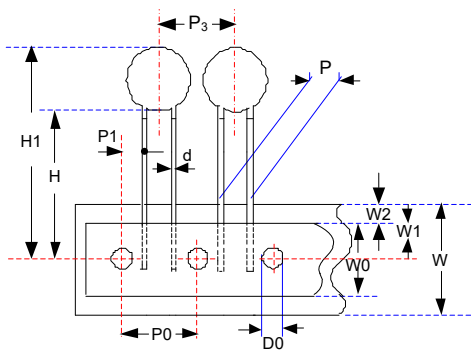


Figure D

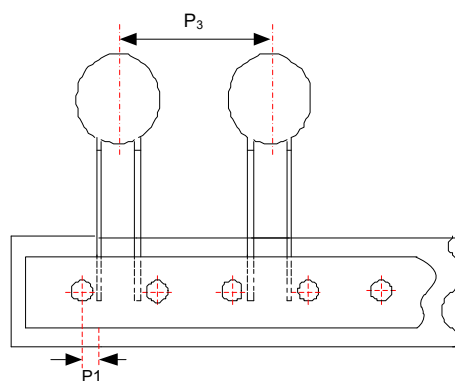
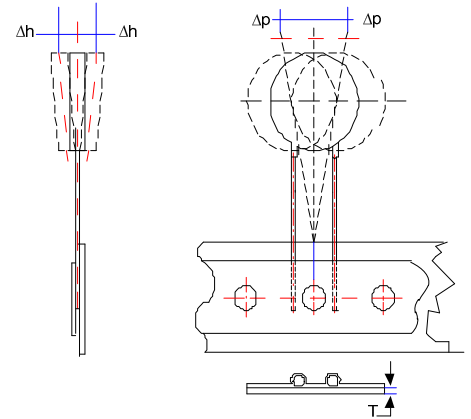


Figure E



Taping Code	Body Size	P <sub>0</sub>	P	P <sub>3</sub>	P <sub>1</sub>	H	H <sub>1</sub>	d	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	W	Δ P	Δ h	D <sub>0</sub>	T	Figure
		±0.3	±1	±1	±1	+2/-0	Max.	±0.02	±1	+0.75/-0.5	Max	+1/-0.5	Max.	Max.	±0.2	±0.2	
A (P <sub>0</sub> :12.7)	05-M	12.7	5.0	12.7	3.55	18	28	0.6	12	9	3	18	1	2	4	0.6	D
	07-M	12.7	5.0	12.7	3.55	18	31	0.6	12	9	3	18	1	2	4	0.6	D
	10-M	12.7	7.5	12.7	8.55	18	33.5	0.8	12	9	3	18	1	2	4	0.6	A
	14-M	12.7	7.5	25.4	8.55	18	38	0.8	12	9	3	18	1	2	4	0.6	B
	20-M	12.7	10.0	25.4	7.20	18	40.5	1.0	12	9	3	18	1	2	4	0.6	C
E (P <sub>0</sub> :15.0)	05-M	15	5.0	15.0	4.70	18	28	0.6	12	9	3	18	1	2	4	0.6	D
	07-M	15	5.0	15.0	4.70	18	31	0.6	12	9	3	18	1	2	4	0.6	D
	10-M	15	7.5	15.0	3.35	18	33.5	0.8	12	9	3	18	1	2	4	0.6	D
	14-M	15	7.5	30.0	3.35	18	38	0.8	12	9	3	18	1	2	4	0.6	E
	20-M	15	10.0	30.0	9.50	18	40.5	1.0	12	9	3	18	1	2	4	0.6	B

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### F Type (Y Kink Lead)

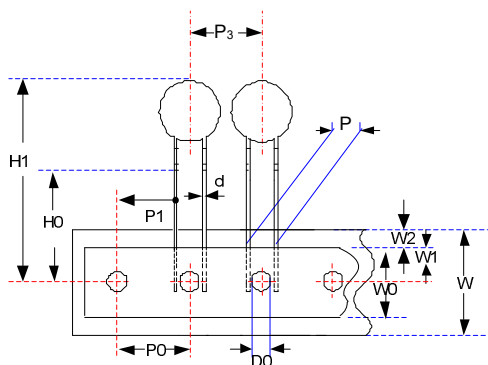


Figure A

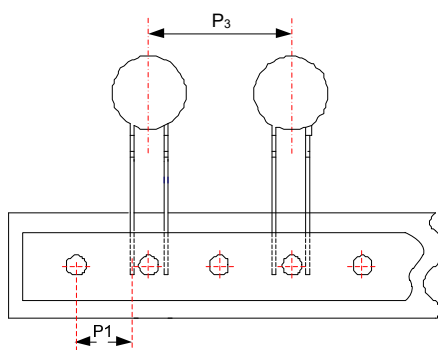


Figure B

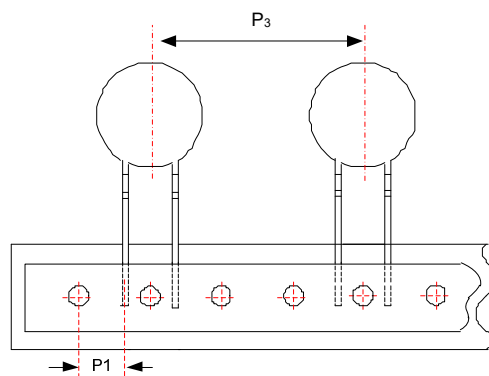


Figure C

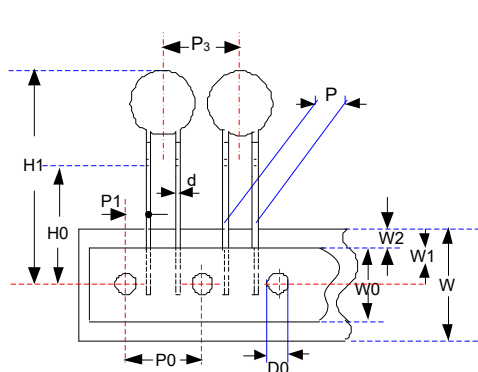


Figure D

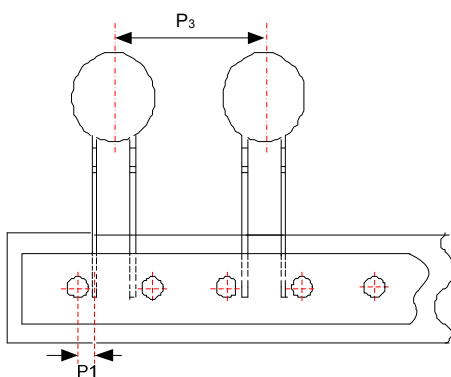
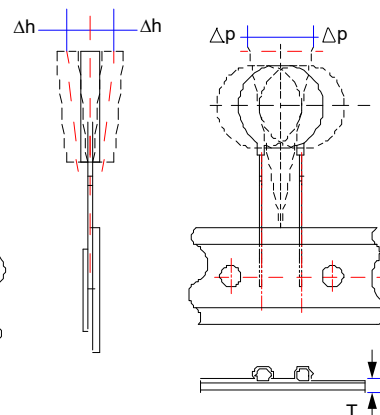


Figure E



(Unit: mm)

Taping Code	Body Size	P <sub>0</sub>	P	P <sub>3</sub>	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	D <sub>0</sub>	T	Figure
		±0.3	±1	±1	±1	±0.5	Max.	±0.02	±1	+0.75/ -0.5	Max	+1/ -0.5	Max.	Max.	±0.2	±0.2	
A (P <sub>0</sub> :12.7)	05-M	12.7	5.0	12.7	3.55	16	28	0.6	12	9	3	18	1	2	4	0.6	D
	07-M	12.7	5.0	12.7	3.55	16	31	0.6	12	9	3	18	1	2	4	0.6	D
	10-M	12.7	7.5	12.7	8.55	16	33.5	0.8	12	9	3	18	1	2	4	0.6	A
	14-M	12.7	7.5	25.4	8.55	16	38	0.8	12	9	3	18	1	2	4	0.6	B
	20-M	12.7	10.0	25.4	7.20	16	44.5	1.0	12	9	3	18	1	2	4	0.6	C
E (P <sub>0</sub> :15.0)	05-M	15	5.0	15.0	4.70	16	28	0.6	12	9	3	18	1	2	4	0.6	D
	07-M	15	5.0	15.0	4.70	16	31	0.6	12	9	3	18	1	2	4	0.6	D
	10-M	15	7.5	15.0	3.35	16	33.5	0.8	12	9	3	18	1	2	4	0.6	D
	14-M	15	7.5	30.0	3.35	16	38	0.8	12	9	3	18	1	2	4	0.6	E
	20-M	15	10.0	30.0	9.50	16	44.5	1.0	12	9	3	18	1	2	4	0.6	B

# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



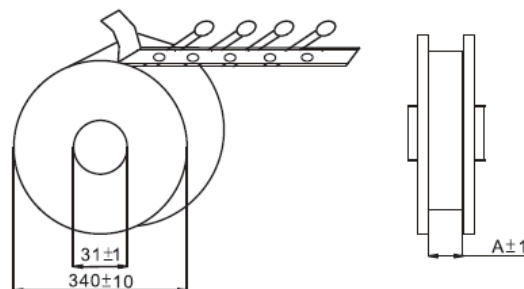
### ■ Quantity

#### ● Bulk Packing

Series	Straight Lead Type Quantity (pcs/bag)	Cut Lead Type Quantity (pcs/bag)	Kink Type Quantity (pcs/bag)
TVR05-M	250	250	--
TVR07-M	250	250	200
TVR10(180~751)-M	200	200	200
TVR10(821~182)-M	100	100	100
TVR14-M	100	100	100
TVR20-M	Box Packing: 201~471:600pcs 511 ~621:525pcs 681 ~751:450pcs	50	50

#### ● Reel Packing

Series	A (mm)	Quantity (pcs/reel)
TVR05(201~391)-M	46	1,500
TVR05(431~621)-M		1,000
TVR07(201~391)-M		1,500
TVR07(431~751)-M		1,000
TVR10(201~471)-M		1,000
TVR10(511~751)-M		750
TVR14(201~391)-M		750
TVR14(431~621)-M		500
TVR14(681~751)-M		350
TVR20(201~221)-M		52
TVR20(241~431)-M	400	
TVR20(471~681)-M	250	
TVR20751-M	200	



(Unit: mm)

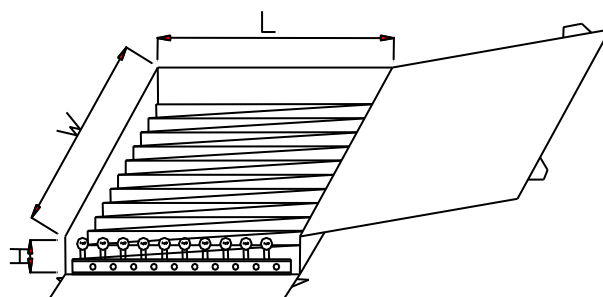
# Metal Oxide Varistor : TVR-M Series

## High Temperature Varistor for Surge Protection



### ● Ammo Packing

Series	Quantity (pcs/box) P0=12.7mm	Quantity (pcs/box) P0=15.0mm
TVR05(201~391)-M	1,200	1,200
TVR05(431~751)-M	1,000	1,000
TVR07(201~361)-M	1,200	1,100
TVR07(391~751)-M	1,000	1,000
TVR10(201~361)-M	900	800
TVR10(391~561)-M	800	700
TVR10(621~751)-M	650	500
TVR14(201~271)-M	500	450
TVR14(301~561)-M	450	350
TVR14(621~751)-M	300	300
TVR20(201~271)-M	350	300
TVR20(301~751)-M	250	250



(Unit: mm)

Series	W±5	L±5	H±5
TVR05 ~ TVR20-M	345	275	55

### ■ Warehouse Storage Conditions of Products

- Storage Conditions:
  1. Storage Temperature: -10°C~+40°C
  2. Relative Humidity: ≤75%RH
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage: 1 year