

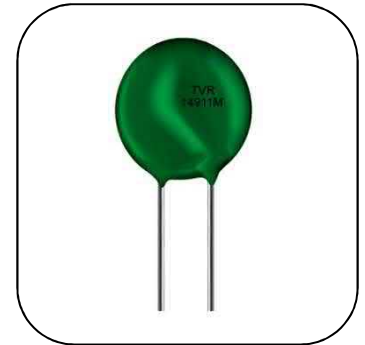
Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Feature

1. Designed for 48Vdc architecture of vehicles' electrical systems
2. Superior resistance to cyclic temperature
3. High operating temperature range up to 125 °C
4. Agency approval: UL, VDE, TUV, CQC
5. AEC-Q 200 qualified
6. First UL 1449A approval part in the world



■ Recommended Applications

1. 48Vdc automotive devices
2. Telecom Infrastructure devices
3. Industrial Power and devices

■ Part Number Code

T	V	R	1	0	1	5	1	K	L			Q	0	0	M
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Type		Body Size		Varistor Voltage (V _{1mA})		Tolerance of V _{1mA}		Appearance		Packaging		Optional Suffix	
TVR	THINKING Varistor TVR Series	10	Φ10mm	820	82x10 ⁰ V=82V	K	±10%	L	Straight lead, silicon coating	AR	Tape & reel packing (hole pitch:12.7mm)	M	Varistor for Automotive applications (When internal control code is used)
		14	Φ14mm	151	15x10 ¹ V=150V	L	±15%	W	Outer kink lead, silicon coating	ER	Tape & reel packing (hole pitch:15.0mm)		
		20	Φ20mm			M	±20%			AB	Tape & ammo box packing (hole pitch:12.7mm)		
										EB	Tape & ammo box packing (hole pitch:15.0mm)		
										C	Bulk & cut lead (followed by the codes of 2 leaded length)		
										Blank	Bulk		

Internal Control Code	
Q00~QZZ	

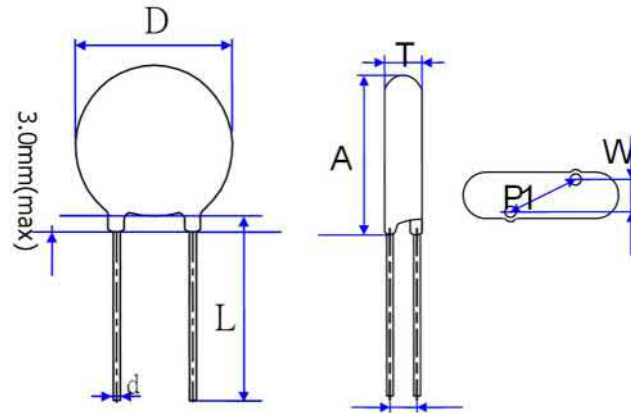
Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Structure & Dimensions

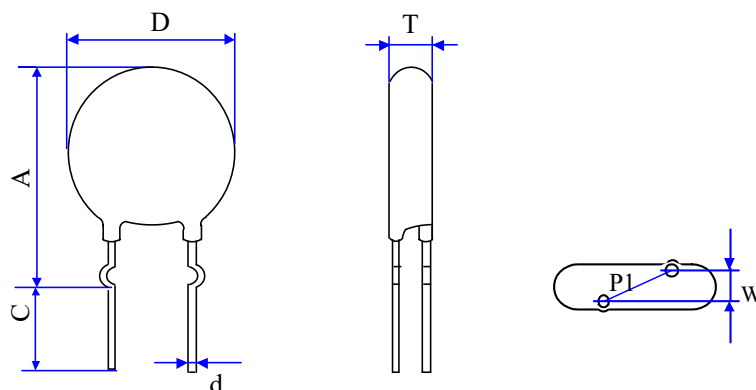
● L Type (Straight Lead)



(Unit: mm)

Series	Dmax.	Amin.	Lmin	$\Phi d \pm 0.02$	$P1 \pm 1.0$	T & W
TVR10-M	14.4	15.0	26.5	0.8	7.5	Please refer to Electrical Characteristics Table
TVR14-M	18.0	18.5	26.5	0.8	7.5	
TVR20-M	24.0	25.5	22.5	1.0	10.0	

● W Type (Outer Kink Lead)



(Unit: mm)

Series	Dmax.	Amin.	Cmin	$\Phi d \pm 0.02$	$P1 \pm 1.0$	T & W
TVR10-M	14.4	20.0	20	0.8	7.5	Please refer to Electrical Characteristics Table
TVR14-M	18.0	22.5	20	0.8	7.5	

Note: Size of C is customized, and tolerance of cut lead product is ± 0.5 (Please refer to minimal size in the chart above if customers do not request). Popular minimal size of cut lead products is 3.5 ± 0.5 mm.

Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Electrical Characteristics

For 48Vdc Architecture of Vehicle's Electrical Systems




Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20 μ s)		Max. Surge Current (8/20 μ s)	Rated Power	Max. Energy (10/1000 μ s)	Dimension		
	V _{1mA}	V _{ac}	V _{dc}	V _P	I _p	I _{max}	P	W _{max}	T _{min}	T _{max}	W \pm 1
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(mm)		
TVR10820-M	82 \pm 10%	50	65	135	25	3500	0.4	14	2.56	5.34	1.6
TVR10101-M	100 \pm 10%	60	85	165	25	3500	0.4	17	2.58	5.35	1.7
TVR10121-M	120 \pm 10%	75	100	200	25	3500	0.4	20	2.6	5.36	1.8
TVR10151-M	150 \pm 10%	95	125	250	25	3500	0.4	25	2.63	5.37	1.9
TVR10181-M	180 \pm 10%	115	150	300	25	3500	0.4	31	2.8	4.8	1.6
TVR14820-M	82 \pm 10%	50	65	135	50	6000	0.6	28	2.96	5.34	1.6
TVR14101-M	100 \pm 10%	60	85	165	50	6000	0.6	35	2.98	5.35	1.7
TVR14121-M	120 \pm 10%	75	100	200	50	6000	0.6	42	3.0	5.36	1.8
TVR14151-M	150 \pm 10%	95	125	250	50	6000	0.6	53	3.03	5.37	1.9
TVR14181-M	180 \pm 10%	115	150	300	50	6000	0.6	67	2.8	4.8	1.6
TVR20820-M	82 \pm 10%	50	65	135	100	10000	1.0	56	3.36	5.74	1.8
TVR20101-M	100 \pm 10%	60	85	165	100	10000	1.0	70	3.38	5.75	1.9
TVR20121-M	120 \pm 10%	75	100	200	100	10000	1.0	85	3.4	5.76	2.0
TVR20151-M	150 \pm 10%	95	125	250	100	10000	1.0	106	3.43	5.77	2.1
TVR20181-M	180 \pm 10%	115	150	300	100	10000	1.0	127	3.2	5.2	1.8

Varistor: TVR-M Series

Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems



Agency Approval

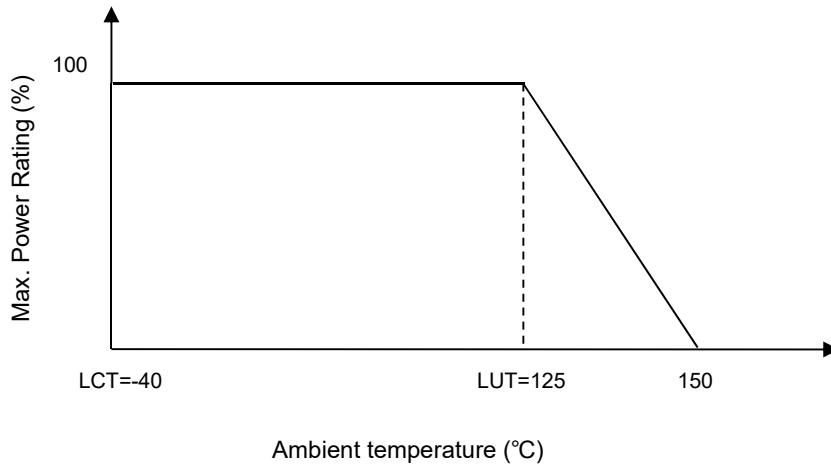
Certified Model No.	Agency				
					
	UL 1449A	UL1449 5 th & cUL	EN/IEC 61051-1, IEC 61051-2, IEC 61051-2-2	IEC 60950-1 Annex Q IEC 62368-1 Annex G.8.1 IEC 62368-1 Annex G.8.2	GB/T10193-1997 GB/T10194-1997
	E510434	E314979	J 50259116 J 50405420		TVR10-M CQC13001090356 CQC13001090357 TVR14-M CQC15001128796 CQC15001128834 TVR20-M CQC15001128792 CQC15001128793
TVR10820-M	√	√			√
TVR10101-M	√	√			√
TVR10121-M	√	√			√
TVR10151-M	√	√			√
TVR10181-M		√			√
TVR14820-M	√	√			√
TVR14101-M	√	√			√
TVR14121-M	√	√			√
TVR14151-M	√	√			√
TVR14181-M		√	√		√
TVR20820-M	√	√			√
TVR20101-M	√	√			√
TVR20121-M	√	√			√
TVR20151-M	√	√			√
TVR20181-M		√		√	√

Varistor: TVR-M Series

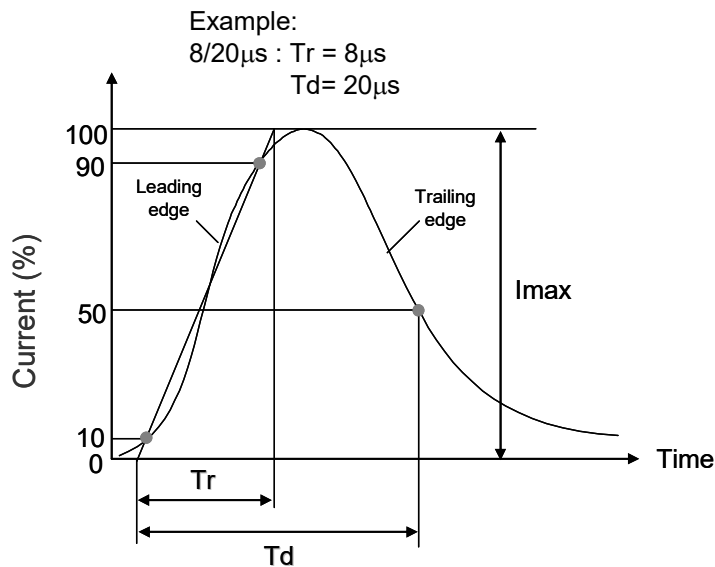


Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Power Derating Curve



■ Surge Current Standard Waveform



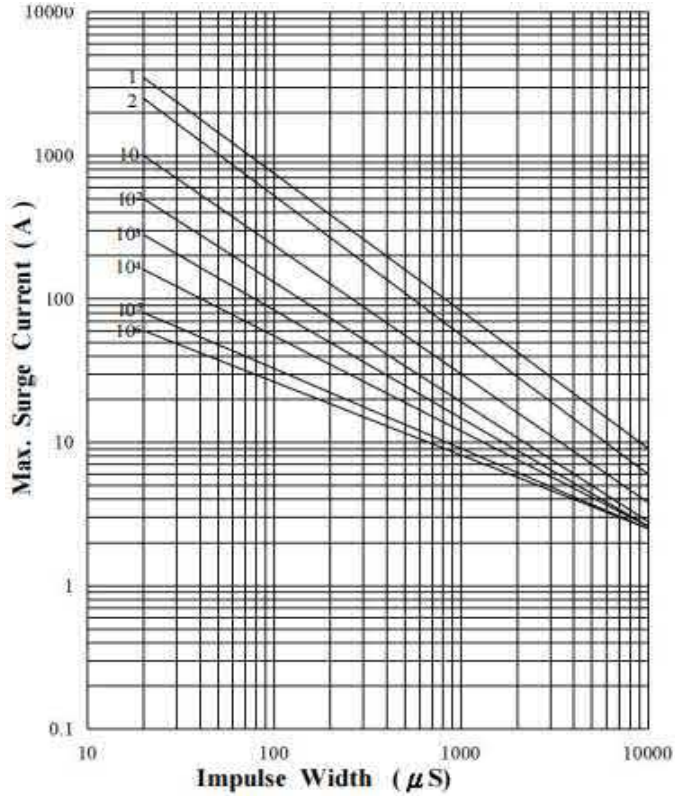
Varistor: TVR-M Series



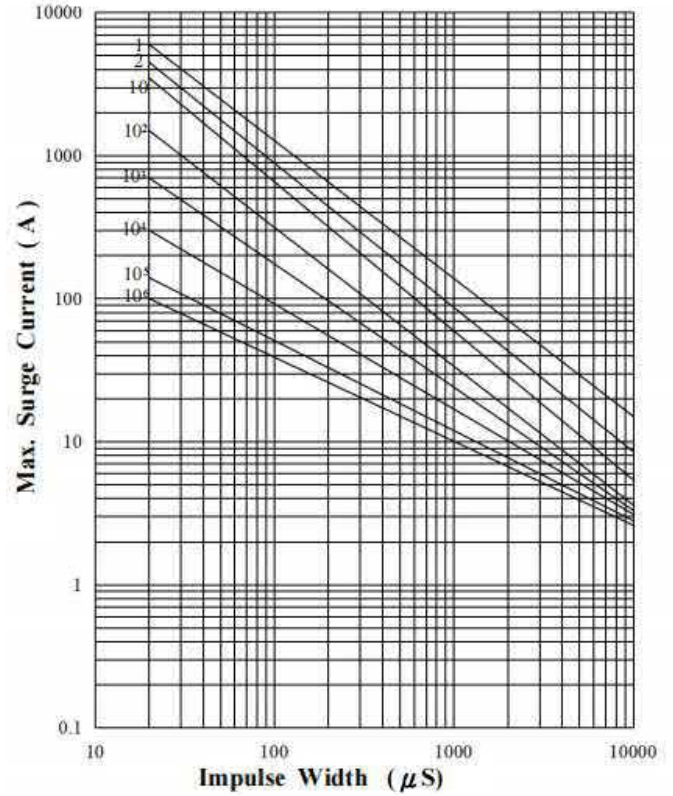
Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Max. Surge Current Derating Curves

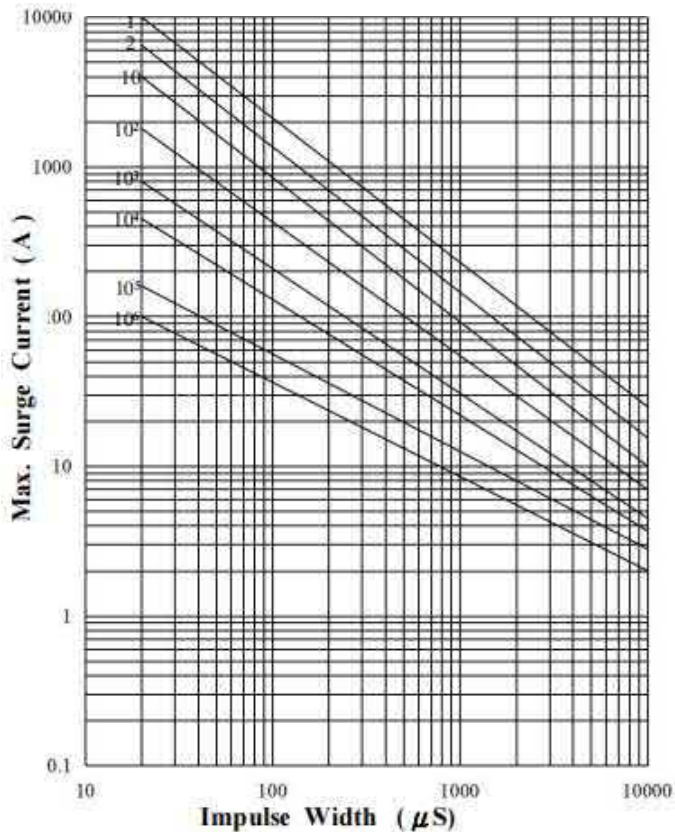
TVR10820-M to TVR10181-M



TVR14820-M to TVR14181-M



TVR20820-M to TVR20181-M



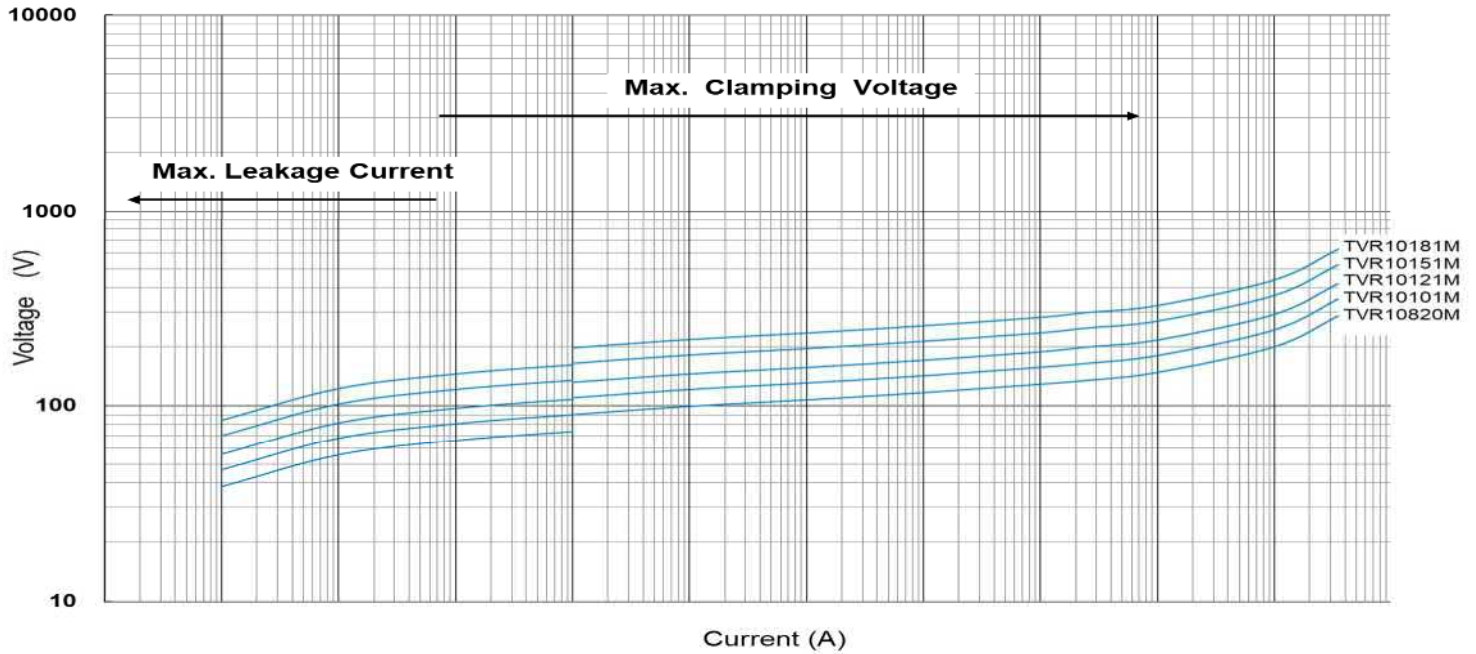
Varistor: TVR-M Series



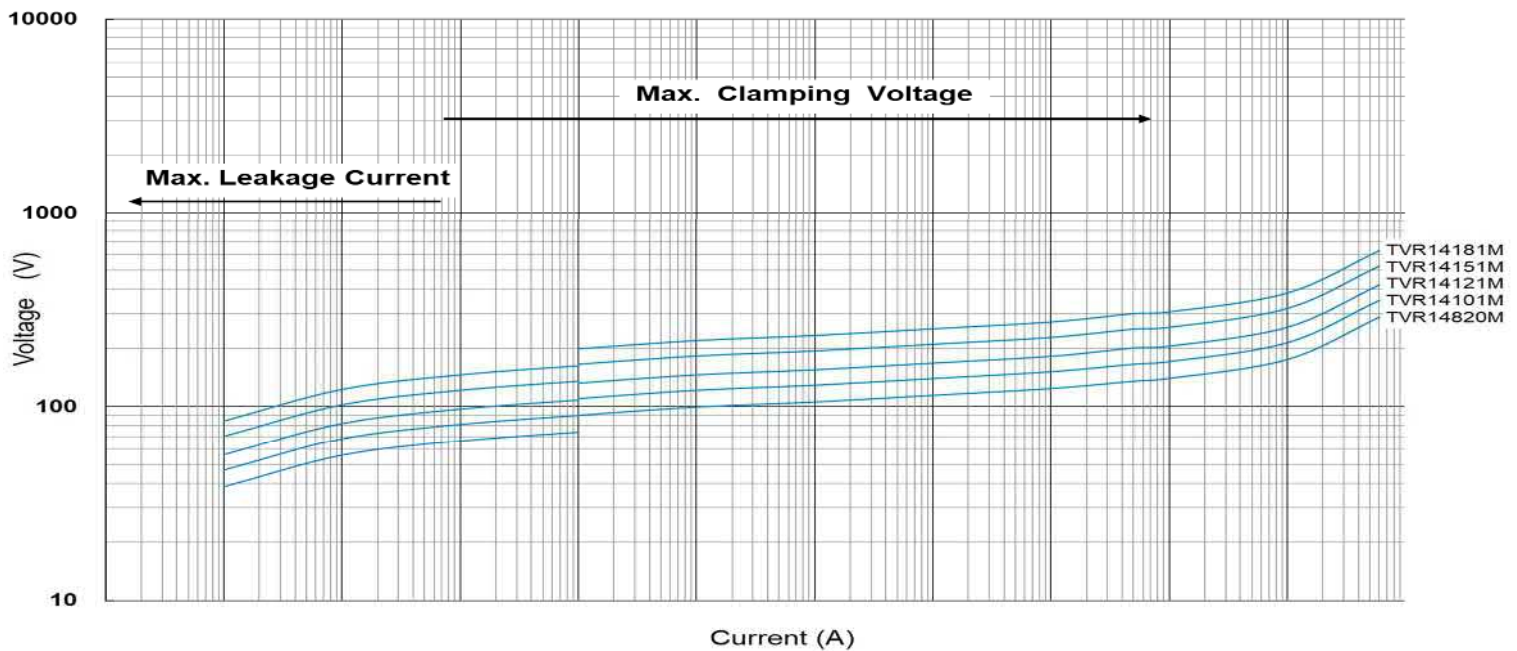
Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR10820M to TVR10181M)



Max. Leakage Current and Max. Clamping Voltage Curves (TVR14820M to TVR14181M)



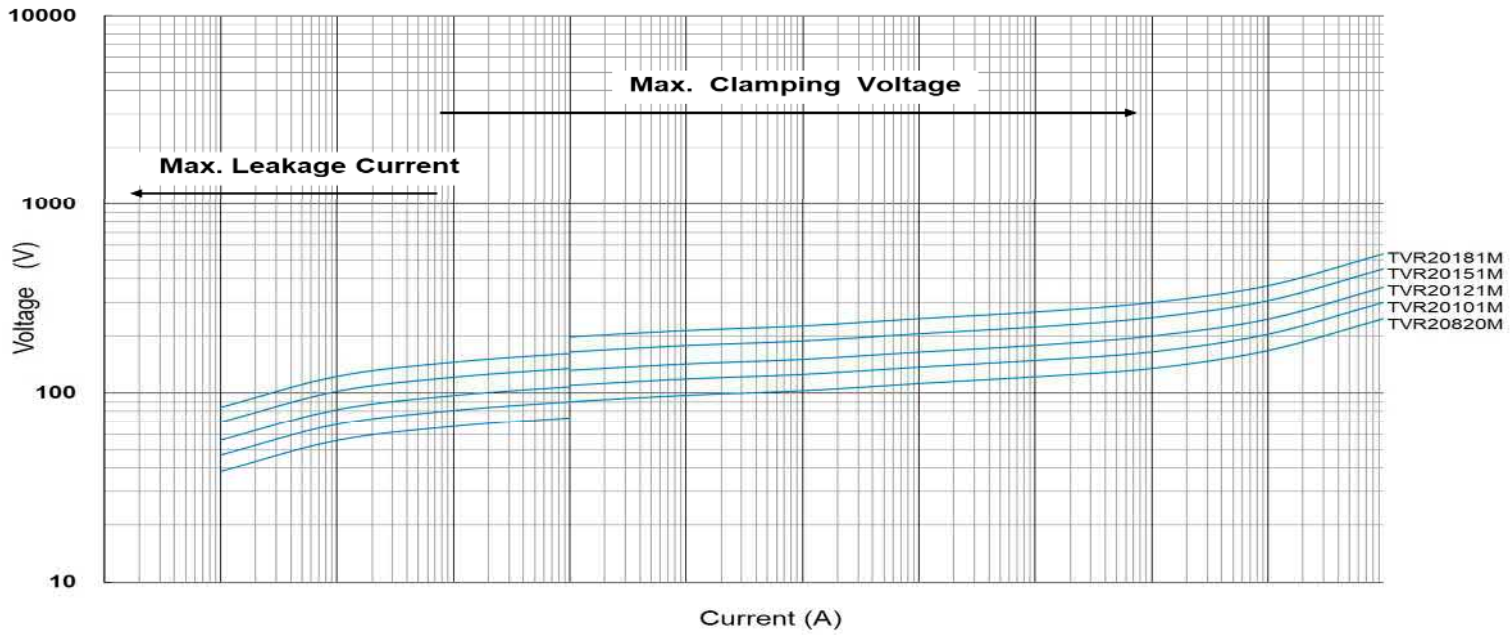
Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR20820M to TVR20181M)



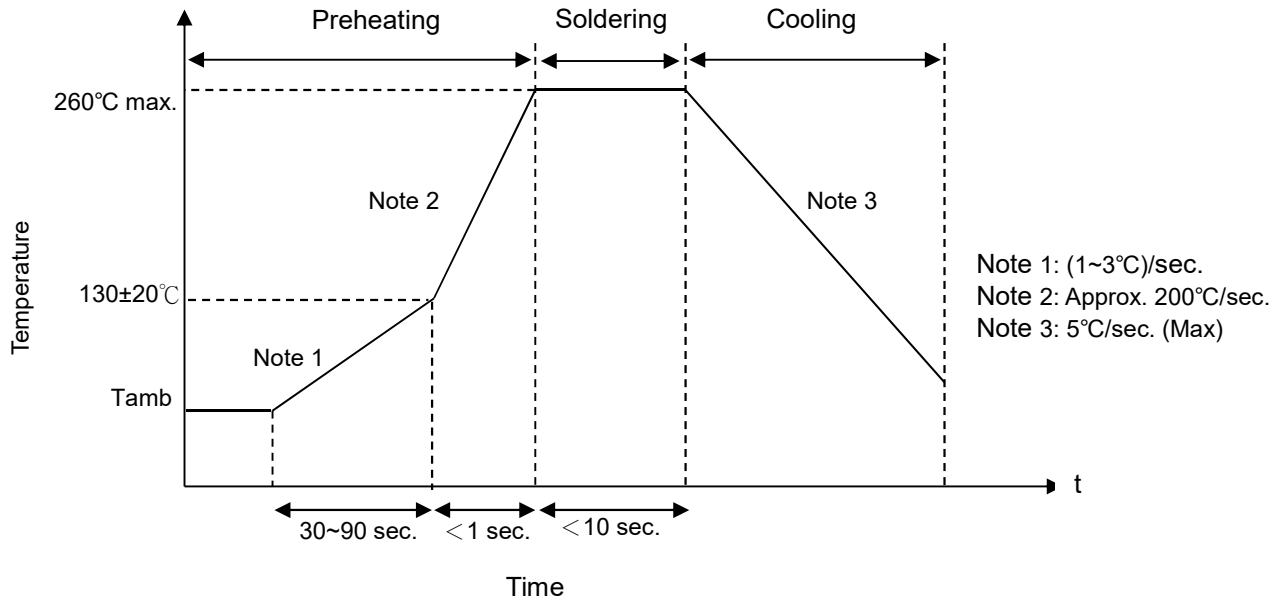
Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Soldering Recommendation

● IR-reflow Soldering Profile



● Recommended Reworking Conditions with Soldering Iron

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

Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Reliability (based on AEC-Q200 Rev-D)

Item	Standard	Test conditions / Methods	Specifications
Varistor voltage	Specification Standard	The voltage between two terminals with the specified measuring current applied is called V_v	To meet the specified value
Clamping voltage	Specification Standard	The maximum voltage between two terminals with the specified standard impulse current (8/20 μ s) applied	To meet the specified value
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	Test temp.: 150 +3/-0°C Duration: 1000 h Unpowered Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Resistance to Soldering Heat	MIL-STD-202 Method 210	No pre-heat of samples. Temperature 260 ±5°C, Time 10 ±1 s Immersion and emersion rate 25mm/s ±6 mm/s Number of heat cycles 1	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Vibration	MIL-STD-202 Method 204	Acceleration 5 g's Sweep time: 20 min Frequency range: 10 to 2000 Hz 3×12 cycles	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Solderability	J-STD-002	Steam aging 8hr@93±3°C, 245±5°C 5 +0/-0.5sec	At least 95% of terminal electrode is covered by new solder
Terminal Strength	MIL-STD-202 Method 211	1. Pull test (2.27 kg) 2. Wire-lead bend test (227 g) Duration of the applied forces: 10 ±1sec	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Biased Humidity	MIL-STD-202 Method 103	Test temp.: 125°C Rel. humidity of air: 85% Duration: 1000 h Test Power Bias at 85%(+5%/-0%) of rated varistor voltage=230Vdc Measurement at 24±2 hours after test conclusion	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Operational Life	MIL-STD-202 Method 108	Test temp.: 125 +3/-0°C Duration: 1000 h Test Power: Bias at 85%(+5%/-0%) of rated Varistor voltage	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Temperature Cycling	JESD22 Method JA-104	Lower test temp. : -40 +0/-10°C Upper test temp. : 125 +15/-0°C Soak time at lower or upper temp. : 15 min Transfer time: 5 mins Cycle time: 2 Cycles/hr Number of cycles: 1000 Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Mechanical Shock	MIL-STD-202, Method 213	Peak value 100g's Half sine Waveform Normal duration (D): 6ms In 3 directions perpendicularly intersecting each other (total 18 times)	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
Resistance to Solvents	MIL-STD-202 Method 215	Add aqueous wash chemical- OKEM Clean or equivalent. Do not use banned solvents	No visible damage
Thermal Shock	Specification Standard	Lower test temp. : -55 +0/-3°C Upper test temp. : 125 +3/-0°C Maximum transfer time: 20 seconds. Dwell time: 15 minutes. Air-Air. Number of cycles: 300	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10% $\Delta V_{clamp}/V_{clamp}$ ≤ 10%
8/20 μ s Surge Current Derating	IEC 61051-1	8/20 μ s waveform, 10 surge currents, unipolar, interval 30 secs	$\Delta V_{1mA}/V_{1mA}$ ≤ 10% No visible damage

Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

Package

Taping Specification

L Type (Straight Lead)

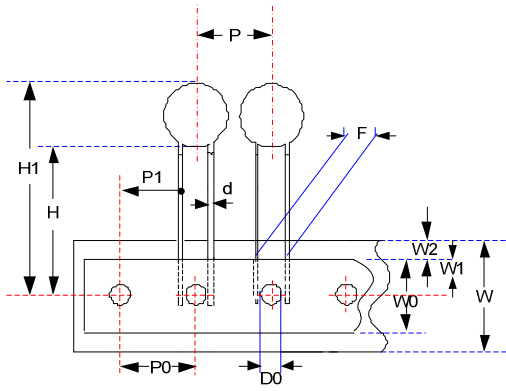


Figure A

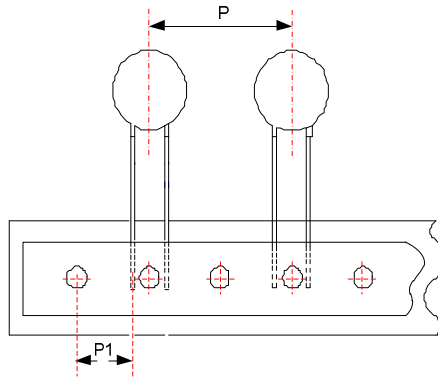


Figure B

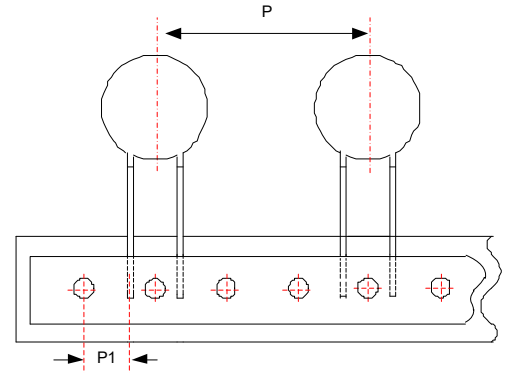


Figure C

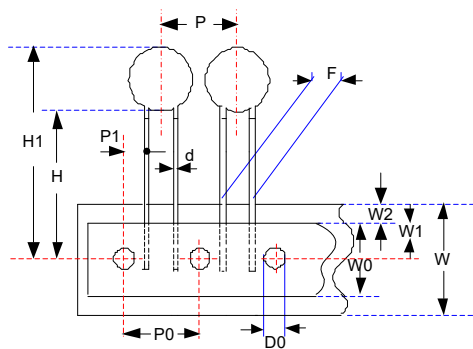


Figure D

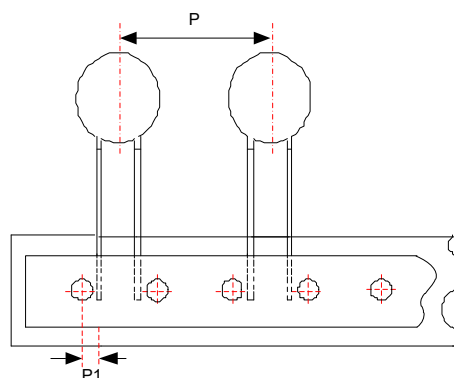
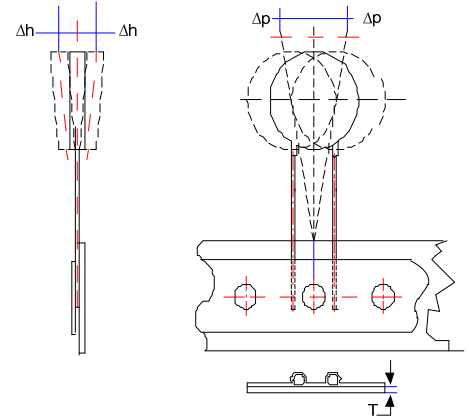


Figure E



(Unit: mm)

Taping Code	Body Size	P ₀	F	P	P ₁	H	H ₁	d	W ₀	W ₁	W ₂	W	Δ P	Δ h	D ₀	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 ₀ :12.7)	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	38.1	7.20	18	40.5	1.0	12	9	3	18	1	2	4	0.6	C
E (P ₀ :15.0)	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

Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Quantity

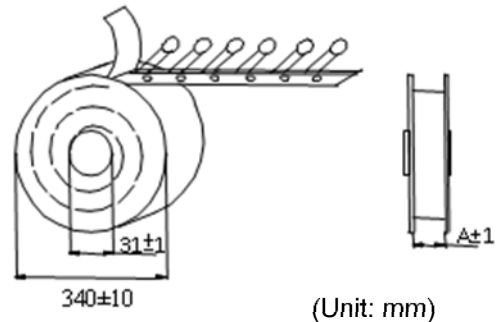
● Bulk Packing

Series	Quantity of Straight Lead Type (pcs/bag)	Quantity of Cut Lead Type (pcs/bag)	Quantity of Kink Lead Type (pcs/bag)
TVR10(820-181)-M	200	200	200
TVR14(820-181)-M	100	100	100
TVR20(820-181)-M	Box Packing: 640	50	50

● Reel Packing

First Reel Packing

Series	A (mm)	Quantity (pcs/reel)
TVR10(820~181)-M	55	750
TVR14(820~181)-M		750
TVR20(820~181)-M		500

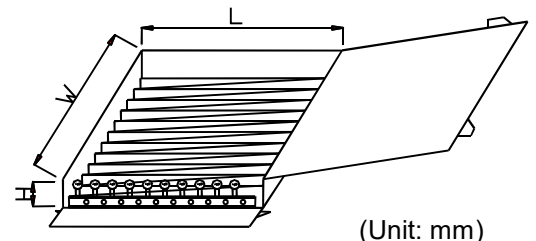


Second Reel Packing

Series	A (mm)	Quantity (pcs/reel) P0=12.7mm	Quantity (pcs/reel) P0=15mm
TVR10(820~181)-M	46	1,000	1,000
TVR14(820~181)-M	46	750	750
TVR20(820~181)-M	55	500	500

● Ammo Packing

Series	Quantity (pcs/box) P0=12.7mm	Quantity (pcs/box) P0=15.0mm
TVR10(820~181)-M	900	800
TVR14(820~181)-M	500	450
TVR20(820~181)-M	350	300



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

Varistor: TVR-M Series



Dip Type Varistor for 48Vdc Architecture of Vehicle's Electrical Systems

■ Warehouse Storage Conditions of Products

- Storage Conditions:
 1. Storage Temperature: $-10^{\circ}\text{C}\sim+40^{\circ}\text{C}$
 2. Relative Humidity: $\leq 75\%RH$
 3. Thermistors must be kept away from sunlight and stored in a non-corrosive atmosphere.
- Period of Storage: 1 year