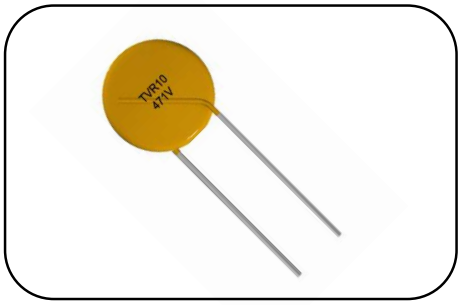
Metal Oxide Varistor：TVR-V Series

Multi-Surge Series

■ Features

1. Body size: Φ10 and Φ14 mm
2. Multi-surge capacity of combination wave 6KV/3KA.
3. Wide operating voltage range: 130Vac ~ 680Vac
4. Operating temperature range: -40℃ ~ +85℃
5. Agency recognition: UL 1449 3rd /cUL/VDE
6. RoHS compliant & Halogen-free series available



■ Recommended Applications

1. Power supply
2. Home appliance
3. Industrial equipment
4. Telecommunication or telephone system
5. PLC (power line commutation)

■ Part Number Code

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

Product Type

TVR	THINKING Varistor TVR Series

Size

10	Φ10mm
14	Φ14mm

Varistor Voltage (V_{1mA})

241	$24x10^1$V=240V
102	$10x10^2$V=1000V

Tolerance of V_{1mA}

K	±10%
A	0~+10%
B	0~-10%

Internal Control Code

01~ZZ

Optional Suffix

V	Multi-surge series

Appearance

S	Straight lead, epoxy coating
F	Y kink lead, epoxy coating

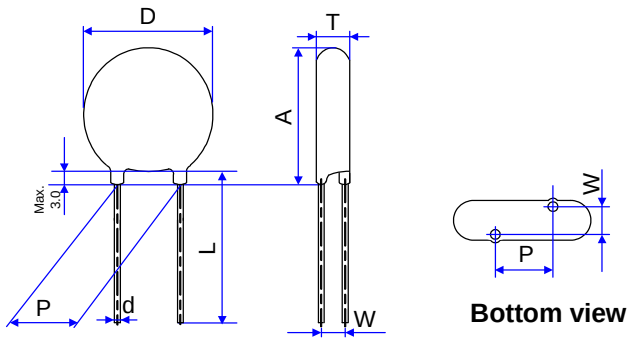
Packaging

A	Tape (hole pitch:12.7mm)
E	Tape (hole pitch:15.0mm)
B	Tape + ammo box packing
R	Tape + reel packing
C	Bulk + cut lead (followed by the codes of 2 leaded length)
Blank	Bulk

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

■ Structure and Dimensions

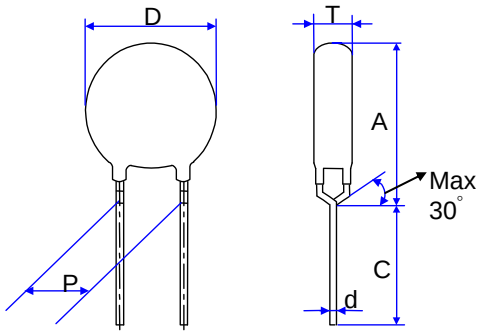
- S Type (Straight lead)



(Unit: mm)

Disc Size	D max.	L min.	d	P.	A max.	T max.	W
10-V	9.5~12.5	26.5	0.8±0.02	7.5±1	15.0	Please refer to Electrical Characteristics Table	
14-V	13.5~16.0	26.5	0.8±0.02	7.5±1	18.5 (for TVR14201-511) 19.0 (for TVR14561-112)		

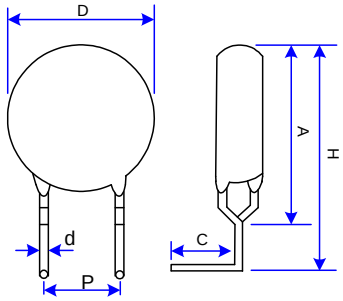
- F Type (Y kink lead)



(Unit: mm)

Disc Size	D max.	C min.	d	P.	A max.	T max.
10-V	9.5~12.5	25	0.8±0.02	7.5±1	16.0	Please refer to Electrical Characteristics Table
14-V	13.5 ~16.0	25	0.8±0.02	7.5±1	19.0	

- J Type (L kink lead)



(Unit:mm)

Disc Size	D max.	C	d	P	Amax.	H max.	T max.
10-V	12.0	4.0±1	0.8±0.02	7.5±1	16.0	20.0	Please refer to Electrical Characteristics Table
14-V	16.0				19.5	23.5	

Metal Oxide Varistor：TVR-V Series

Multi-Surge Series

■ Electrical Characteristics

Part No.	Varistor Voltage (@ 1mA DC)	Max. Operating Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Surge Capacity	Rated Power	Max. Energy (10/1000μs)	Reference Capacitance @1KHz	Dimension			UL1449 3rd SPD TYPE
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	Ip	V_P	Imax	@6KV/ 3KA	W	E	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(A)	(V)	(A)	Times	(W)	(J)	(PF)	(mm)			
TVR10201KSV	200 (180～220)	130	170	25	340	3500	25	0.4	35	570	2.9	4.4	1.7	3
TVR10221KSV	220 (198～242)	140	180	25	360	3500	25	0.4	39	520	3.0	4.5	1.7	3
TVR10241KSV	240 (216～264)	150	200	25	395	3500	25	0.4	42	480	3.1	4.6	1.8	3
TVR10271KSV	270 (243～297)	175	225	25	455	3500	25	0.4	49	425	3.3	5.0	1.9	3
TVR10301KSV	300 (270～330)	195	250	25	500	3500	25	0.4	53	380	3.5	5.3	2.1	3
TVR10331KSV	330 (297～363)	215	275	25	550	3500	25	0.4	58	350	3.8	5.7	2.2	3
TVR10361KSV	360 (324～396)	230	300	25	595	3500	25	0.4	65	320	4.0	6.0	2.3	3
TVR10391KSV	390 (351～429)	250	320	25	650	3500	25	0.4	70	295	4.2	6.2	2.5	3
TVR10431KSV	430 (387～473)	275	350	25	710	3500	25	0.4	80	260	4.3	6.5	2.5	3
TVR10471KSV	470 (423～517)	300	385	25	775	3500	25	0.4	85	240	4.4	6.6	2.6	3
TVR10511KSV	510 (459～561)	320	410	25	845	3500	25	0.4	92	220	4.6	6.8	2.8	3
TVR10561KSV	560 (504～616)	350	450	25	930	3500	25	0.4	92	200	4.7	7.1	3.0	3
TVR10621KSV	620 (558～682)	395	510	25	1020	3500	25	0.4	95	180	4.8	7.2	3.2	3
TVR10681KSV	680 (612～748)	420	560	25	1120	3500	25	0.4	98	175	4.9	7.4	3.4	3
TVR10751KSV	750 (675～825)	465	615	25	1235	3500	25	0.4	100	160	5.1	7.6	3.7	3
TVR10821KSV	820 (738～902)	510	670	25	1355	3500	25	0.4	110	150	5.2	7.8	3.4	3
TVR10911KSV	910 (819～1001)	550	745	25	1500	3500	25	0.4	130	130	5.3	8.0	3.7	3
TVR10102KSV	1000 (900～1100)	625	825	25	1650	3500	25	0.4	140	120	5.3	8.3	4.0	3
TVR10112KSV	1100 (990～1210)	680	895	25	1815	3500	25	0.4	155	110	5.7	8.6	4.3	3

Metal Oxide Varistor：TVR-V Series

Multi-Surge Series

■ Electrical Characteristics

Part No.	Varistor Voltage (@ 1mA DC)	Max. Operating Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Nominal Discharge Current (*1)	Surge capacity	Rated Power	Max. Energy (10/1000μs)	Reference Capacitance @1KHz	Dimension			UL1449 3rd SPD TYPE (*2)
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	Ip	V_P	Imax	In	@6KV/ 3KA	W	E	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(A)	(V)	(A)	(A)	Times	(W)	(J)	(PF)	(mm)			
TVR14201KSV	200 (180～220)	130	170	50	340	6000	3000	60	0.6	84	970	2.9	4.4	1.7	5
TVR14221KSV	220 (198～242)	140	180	50	360	6000	3000	60	0.6	91	880	3.0	4.5	1.7	5
TVR14241KSV	240 (216～264)	150	200	50	395	6000	3000	60	0.6	98	820	3.1	4.7	1.8	5
TVR14271KSV	270 (243～297)	175	225	50	455	6000	3000	60	0.6	112	720	3.3	4.9	1.9	5
TVR14301KSV	300 (270～330)	195	250	50	500	6000	3000	60	0.6	123	650	3.4	5.1	2.1	5
TVR14331KSV	330 (297～363)	215	275	50	550	6000	3000	60	0.6	133	600	3.5	5.3	2.2	5
TVR14361KSV	360 (324～396)	230	300	50	595	6000	3000	60	0.6	147	550	3.6	5.5	2.3	5
TVR14391KSV	390 (351～429)	250	320	50	650	6000	3000	60	0.6	161	500	3.7	5.6	2.5	5
TVR14431KSV	430 (387～473)	275	350	50	710	6000	3000	60	0.6	182	440	3.8	5.7	2.5	5
TVR14471KSV	470 (423～517)	300	385	50	775	6000	3000	60	0.6	196	400	3.9	5.9	2.6	5
TVR14511KSV	510 (459～561)	320	420	50	845	6000	3000	60	0.6	210	370	4.1	6.1	2.8	5
TVR14561KSV	560 (504～616)	350	460	50	930	6000	3000	60	0.6	231	340	4.2	6.4	3.0	5
TVR14621KSV	620 (558～682)	395	510	50	1020	6000	3000	60	0.6	252	300	4.5	6.7	3.2	5
TVR14681KSV	680 (612～748)	420	560	50	1120	6000	3000	60	0.6	266	290	4.7	7.1	3.4	5
TVR14751KSV	750 (675～825)	465	615	50	1235	6000	3000	60	0.6	280	270	5.0	7.5	3.7	5
TVR14821KSV	820 (738～902)	510	670	50	1355	6000	3000	60	0.6	280	250	5.2	7.9	3.4	5
TVR14911KSV	910 (819～1001)	550	745	50	1500	6000	3000	60	0.6	308	220	5.6	8.4	3.7	5
TVR14102KSV	1000 (900～1100)	625	825	50	1650	6000	3000	60	0.6	336	200	5.9	8.9	4.0	5
TVR14112KSV	1100 (990～1210)	680	895	50	1815	6000	3000	60	0.6	364	180	6.3	9.5	4.3	5

*1. Per UL 1449 3rd, "Nominal Discharge Current" is the peak value of the surge current applied to varistor, having the waveshape of 8/20 μs. Varistor is expected to remain functional after 15 surges.

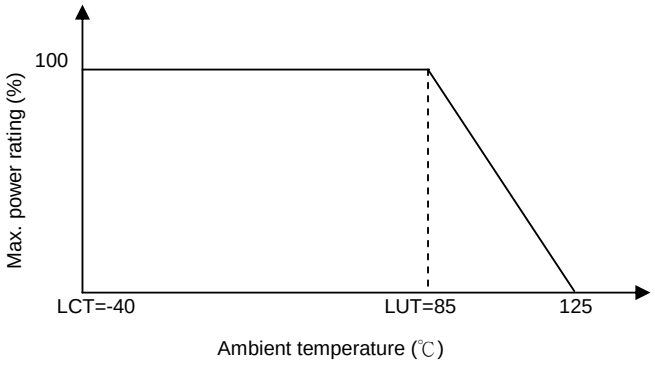
*2. SPD Type 5 also can be applied for SPD Type 2 application based on selecting suitable "Nominal Discharge Current" rating.

■ Safety Approvals

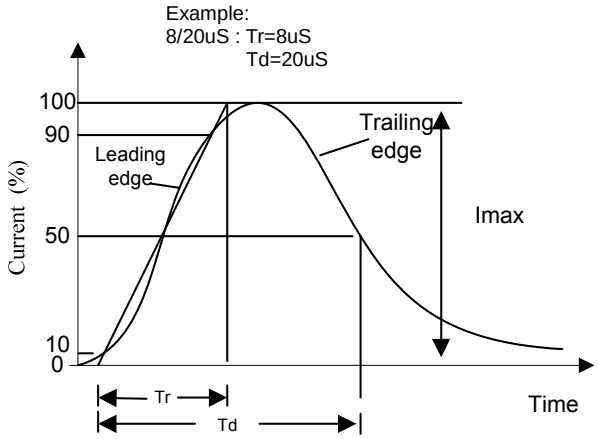
Part No.	Certified Model No.	Agency			
		c UL us	VDE		CQC
		UL1449 3rd &cUL：E314979	5944	IEC60950-1 2nd Annex Q	CQC10001041748 CQC10001041749
TVR10201KSV	TVR10201-V	√	√	√	√
TVR10221KSV	TVR10221-V	√	√	√	√
TVR10241KSV	TVR10241-V	√	√	√	√
TVR10271KSV	TVR10271-V	√	√	√	√
TVR10301KSV	TVR10301-V	√	√	√	√
TVR10331KSV	TVR10331-V	√	√	√	√
TVR10361KSV	TVR10361-V	√	√	√	√
TVR10391KSV	TVR10391-V	√	√	√	√
TVR10431KSV	TVR10431-V	√	√	√	√
TVR10471KSV	TVR10471-V	√	√	√	√
TVR10511KSV	TVR10511-V	√	√	√	√
TVR10561KSV	TVR10561-V	√	√	√	√
TVR10621KSV	TVR10621-V	√	√	√	√
TVR10681KSV	TVR10681-V	√	√	√	√
TVR10751KSV	TVR10751-V	√	√	√	√
TVR10821KSV	TVR10821-V	√	√	√	√
TVR10911KSV	TVR10911-V	√	√	√	√
TVR10102KSV	TVR10102-V	√	√	√	√
TVR10112KSV	TVR10112-V	√	√	√	√

Part No.	Certified Model No.	Agency		
		c UL us	VDE	
		UL1449 3rd &cUL：E314979	5944	IEC60950-1 2nd Annex Q
TVR14201KSV	TVR14201-V	√	√	√
TVR14221KSV	TVR14221-V	√	√	√
TVR14241KSV	TVR14241-V	√	√	√
TVR14271KSV	TVR14271-V	√	√	√
TVR14301KSV	TVR14301-V	√	√	√
TVR14331KSV	TVR14331-V	√	√	√
TVR14361KSV	TVR14361-V	√	√	√
TVR14391KSV	TVR14391-V	√	√	√
TVR14431KSV	TVR14431-V	√	√	√
TVR14471KSV	TVR14471-V	√	√	√
TVR14511KSV	TVR14511-V	√	√	√
TVR14561KSV	TVR14561-V	√	√	√
TVR14621KSV	TVR14621-V	√	√	√
TVR14681KSV	TVR14681-V	√	√	√
TVR14751KSV	TVR14751-V	√	√	√
TVR14821KSV	TVR14821-V	√	√	√
TVR14911KSV	TVR14911-V	√	√	√
TVR14102KSV	TVR14102-V	√	√	√
TVR14112KSV	TVR14112-V	√	√	√

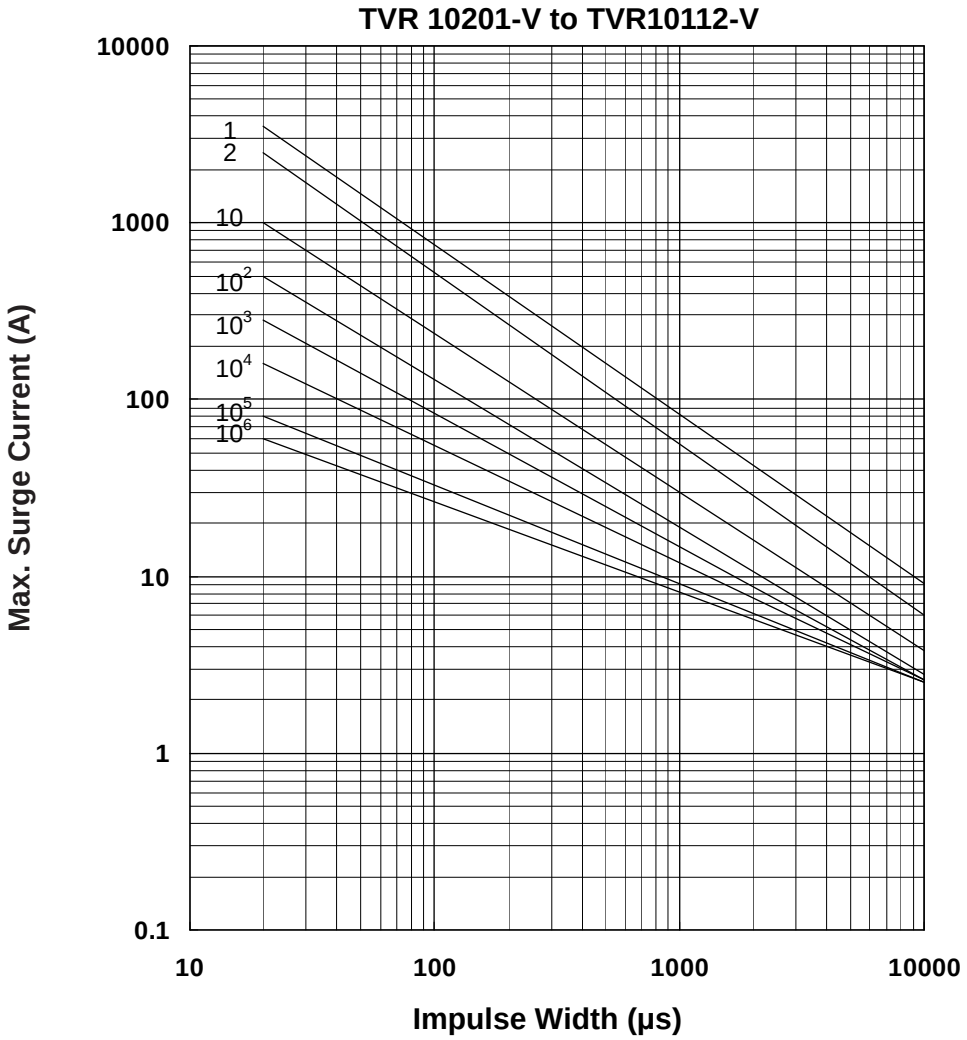
■ Power Derating Curve

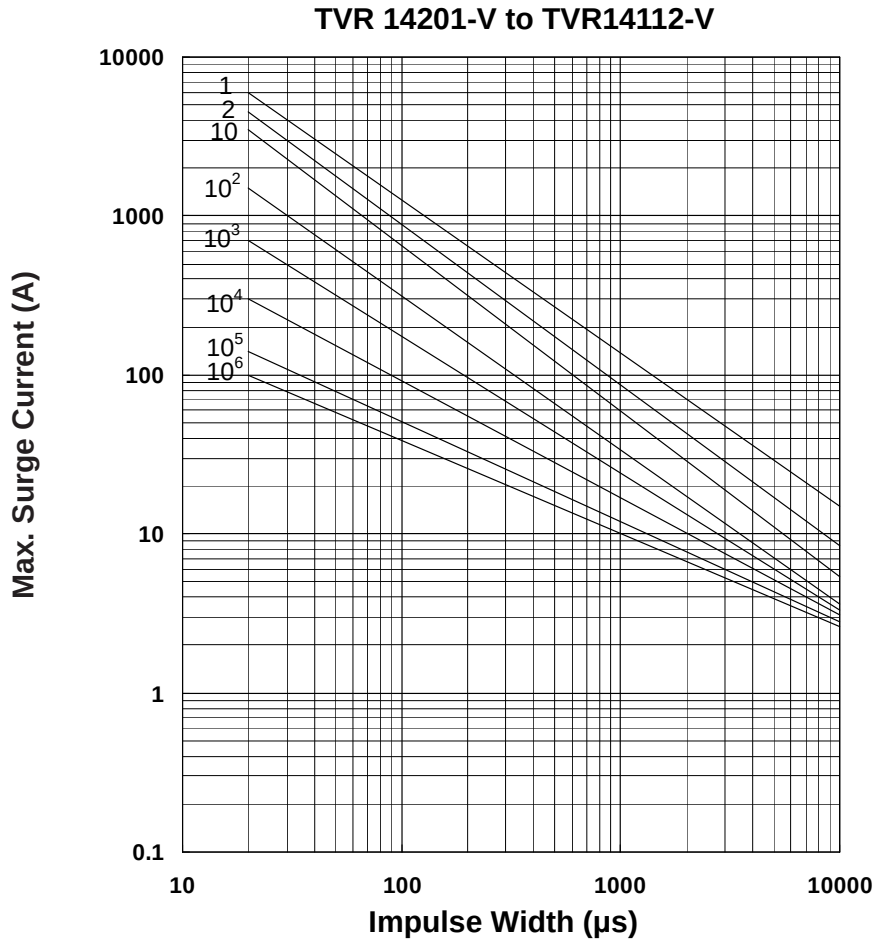


■ Surge Current Standard Waveform

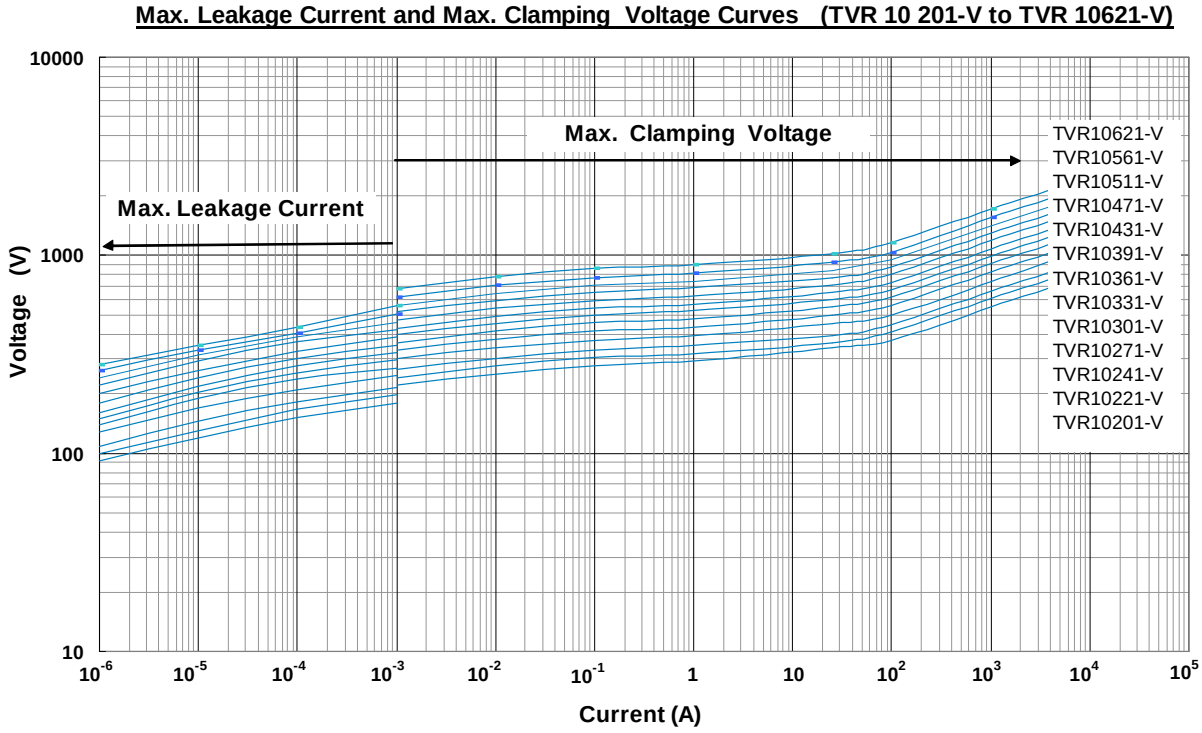


■ Max. Surge Current Derating Curves

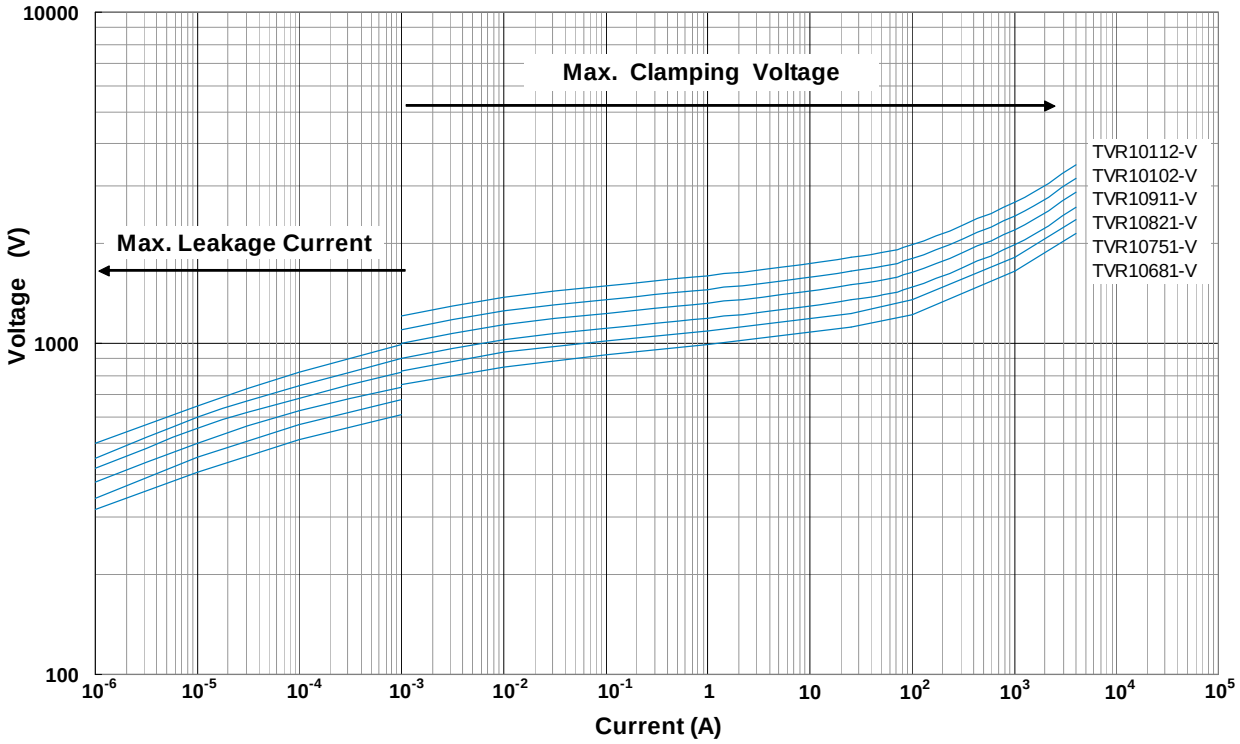




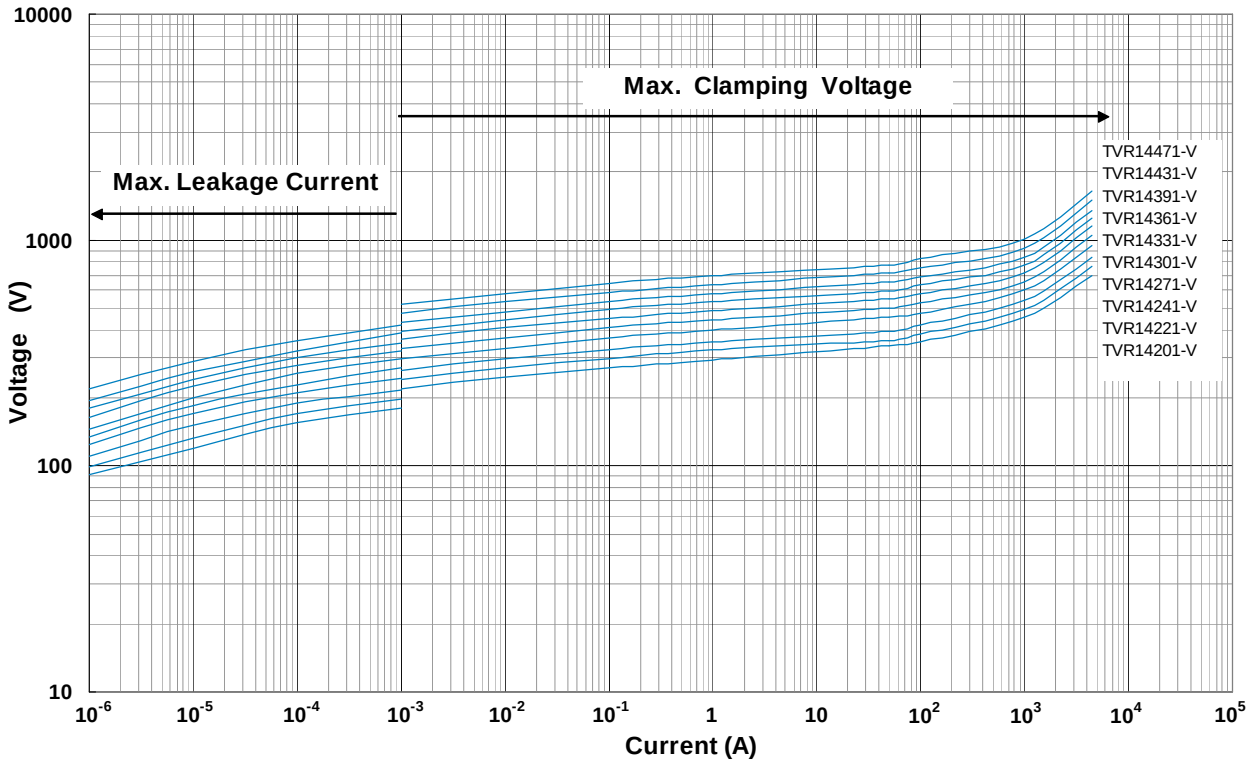
■ **Max. Leakage Current and Max. Clamping Voltage Curves**



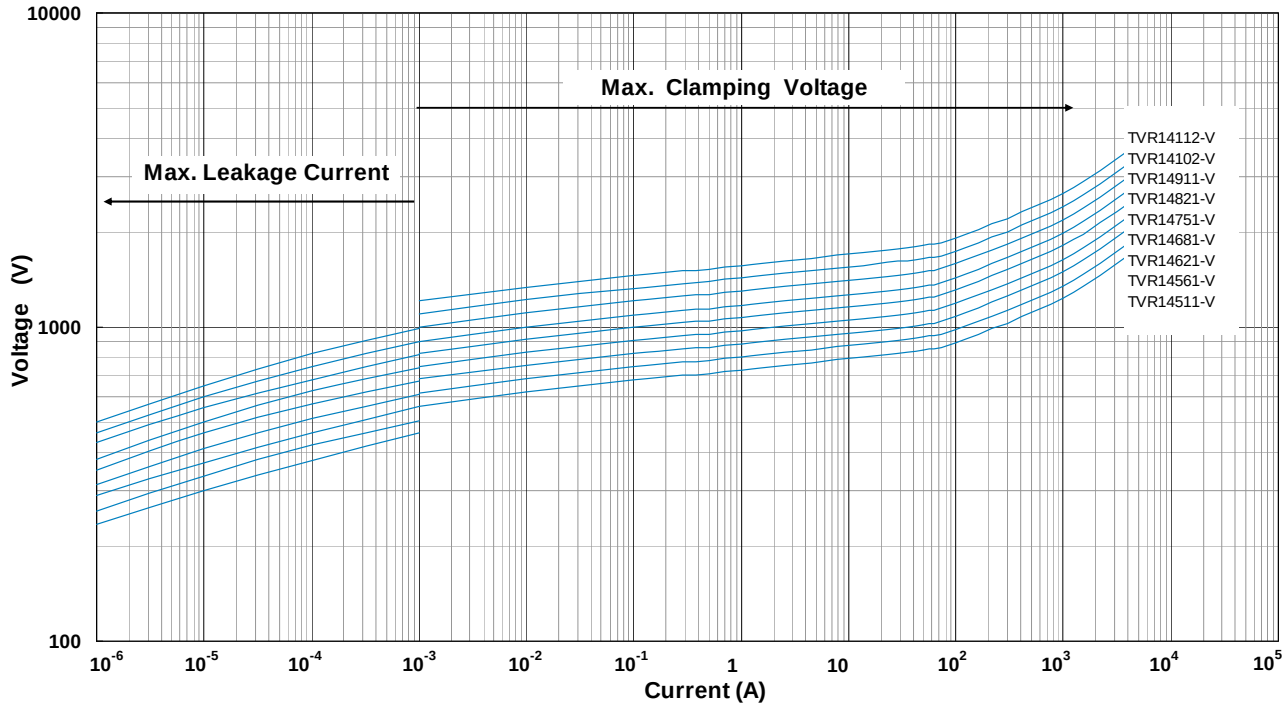
Max. Leakage Current and Max. Clamping Voltage Curves (TVR 10 681-V to TVR 10 112-V)



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

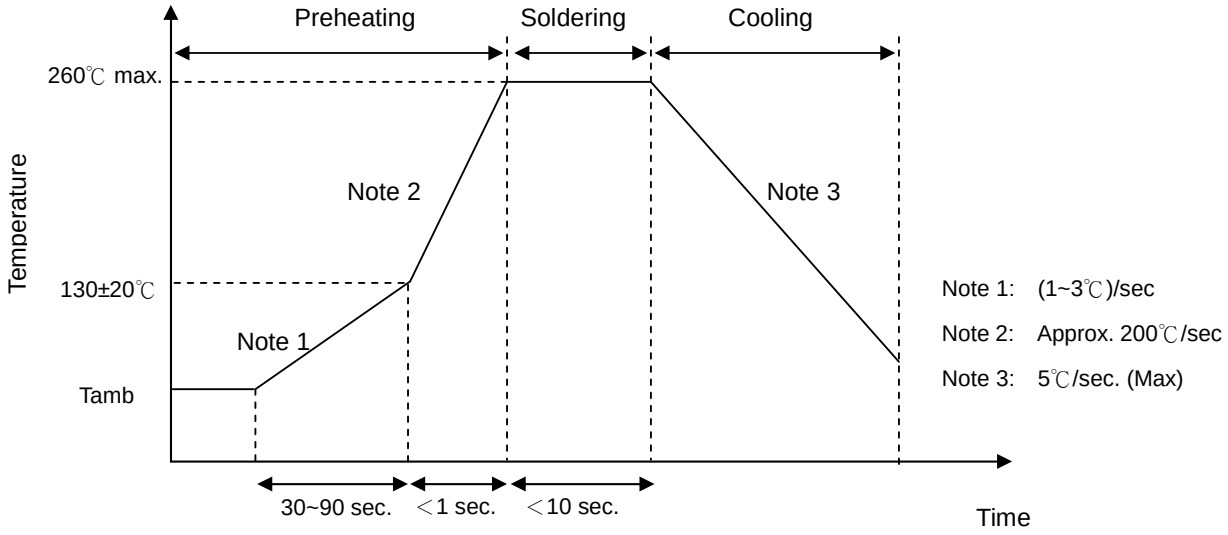


Max. Leakage Current and Max. Clamping Voltage Curves (TVR 14 511-V~ TVR 14 112-V)



■ Soldering Recommendation

● Wave Soldering Profile



● Recommended Reworking Conditions with Soldering Iron

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

■ Reliability

Item	Standard	Test conditions / Methods	Specifications
Tensile Strength of Terminals	IEC60068-2-21	Gradually apply the force specified 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 1.25<d — 4.0	No visible damage $\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$
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 positi on. 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 1.25<d — 2.0	No visible damage $\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$
Vibration	IEC 1051-1	Frequency range: 10 ~ 55 Hz Amplitude: 0.75mm or 98 m/s^2 Direction:3 mutually perpendicular directions ,2hrs each.	$\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$ No visible damage
Solderability	IEC 60068-2-20	245 ± 3 ℃, 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 ℃, 10 ± 1 sec	$\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$ No visible damage
High Temperature Storage	IEC 60068-2-2	125±5℃ x 1000± 24 hrs	$\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$ No visible damage
Damp Heat, Steady State	IEC 60068-2-3	a. 40±2℃, 90 ~ 95 % RH, 1344HRS b. 40±2℃, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs	No visible damage $\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$ Insulation Resistance ≧100MΩ
Rapid Change of Temperature	IEC 60068-2-14	The conditions shown below shall be repeated 5 cycles Step / Temperature (℃) / Period (minutes) 1 / -40±3 / 30±3 2 / Room temperature / 5±3 3 / 85±2 / 30±3 4 / Room temperature / 5±3	$\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$ No visible damage
Endurance at Upper Category Temperature	IEC61051-4.20	85 ± 2℃, 1000 ± 24 hrs, at VDC or Vrms (Max. Operating Voltage)	$\lvert \triangle V/V_{1mA} \rvert \leqq 10\%$ No visible damage
Low Temperature Storage (Optional)	CECC42000	– 40±5℃, 1000±24 hrs	$\lvert \triangle V/V_{1mA} \rvert \leqq 5\%$ No visible damage
8/20μs Surge Life	CECC42000	10,000 pulses (8/20μs), unipolar, interval 10 secs, amplitude corr. to max. Surge current derating curves for 20μs	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA}\text{ at }85℃ - V_{1mA}\text{ at }25℃}{V_{1mA}\text{ at }25℃} \times \frac{1}{60} \times 100\ (\%/℃)$ $\frac{V_{1mA}\text{ at }-40℃ - V_{1mA}\text{ at }25℃}{V_{1mA}\text{ at }25℃} \times \frac{1}{65} \times 100\ (\%/℃)$	$-0.05 \leqq TC \leqq 0.05\ (\%/℃)$

■ Reliability

Item	Standard	Test conditions / Methods	Specifications
10/1000μs Surge Life	CECC42000	10/1000μs waveform, 10 surge currents, unipolar, interval 2mins, amplitude corr. to max. surge current derating curves for 1000μS	|△V1mA/V1mA| ≦10% No visible damage
Surge Endurance	Specification Standard	6KV/3KA Combination Waveform (1.2/50+8/20us) @ Vac (90°). 25times for TVR10-V series 60times for TVR14-V series	No visible damage
Nominal Discharge Current Test	UL1449 3rd 37A	3KA 8/20us waveform @ Vac (90°) for 15 Times. (For TVR14-V series only)	|△V1mA/V1mA| ≦10% No visible damage
Voltage Proof	IEC61051-4.8	Metal balls method, 2500 Vac 1 min	No visible damage

■ Packaging

● Taping Specification
S Type (Straight lead)

Figure A

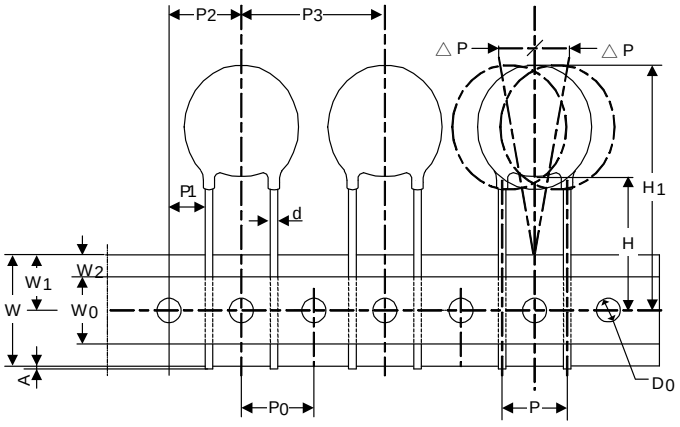
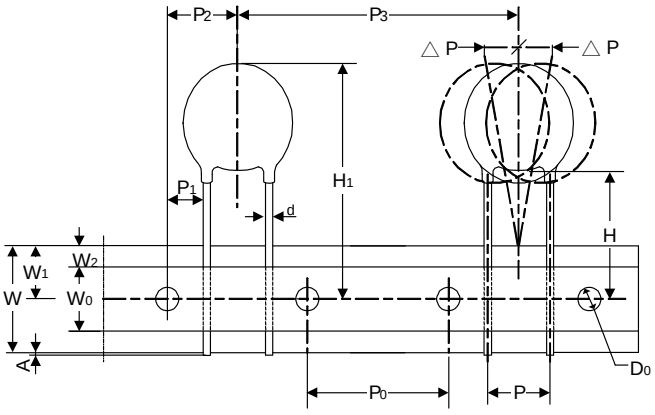


Figure B



(Unit: mm)

Taping Code	Disc Size	P_0 ±0.3	P ±1	P_1 ±1	P_2 ±1.3	P_3 ±1	H +2/-0	H_1 Max.	d ±0.02	W_0 ±1	W_1 +0.75/-0.5	W_2 Max.	W ±1	△P Max.	△h Max.	A Max.	D_0 ±0.2	t ±0.2	Figure
A (P_0=12.7)	10	12.7	7.5	3.35	12.7	12.7	18	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	A
E (P_0=15.0)	10	15	7.5	3.35	7.5	15	18	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
A (P_0=12.7)	14	12.7	7.5	8.55	12.7	25.4	18	38	0.8	12	9	3	18	1	2	0.5	4	0.6	A
E (P_0=15.0)	14	15	7.5	3.35	7.5	30	18	38	0.8	12	9	3	18	1	2	0.5	4	0.6	B

F Type (Y kink lead)

Figure A

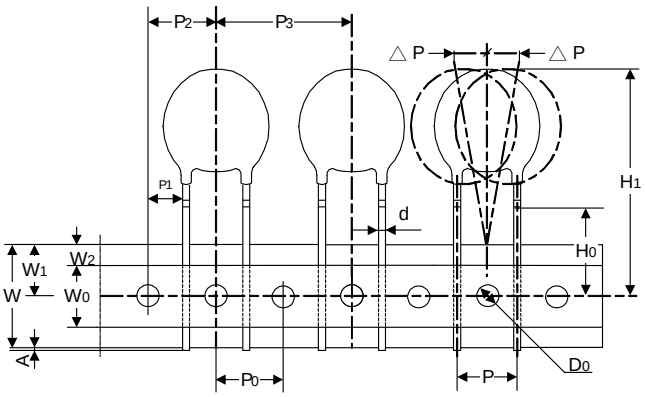
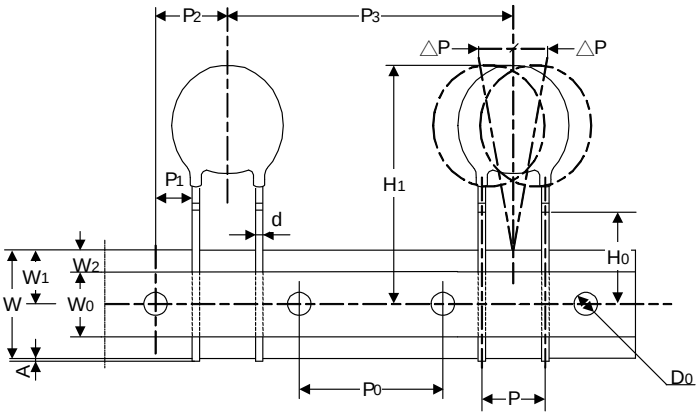


Figure B



(Unit: mm)

Taping Code	Disc Size	P_0 ±0.3	P ±1	P_1 ±1	P_2 ±1.3	P_3 ±1	H ±0.5	H_1 Max.	d ±0.02	W_0 ±1	W_1 +0.75/ -0.5	W_2 Max.	W ±1	△P Max.	△h Max.	A Max.	D_0 ±0.2	t ±0.2	Figure
A (P_0=12.7)	10	12.7	7.5	3.35	12.7	12.7	16	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	A
E (P_0=15.0)	10	15	7.5	3.35	7.5	15	16	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
A (P_0=12.7)	14	12.7	7.5	8.55	12.7	25.4	16	38	0.8	12	9	3	18	1	2	0.5	4	0.6	A
E (P_0=15.0)	14	15	7.5	3.35	7.5	30	16	38	0.8	12	9	3	18	1	2	0.5	4	0.6	B

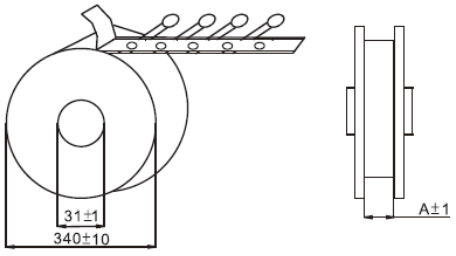
■ Quantity

● Bulk Packing

Disc Size/mm	Quantity pcs/ bag
Φ10-V	200
Φ14-V	100

● Reel Packing

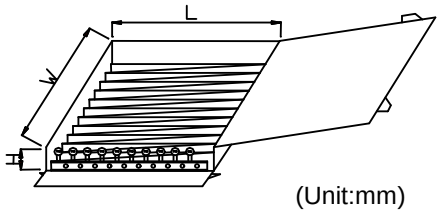
Disc Size/mm	Quantity pcs/reel
Φ10(201～911)-V	1000
Φ10(102～112)-V	750
TVR14(201~391)-V	750
TVR14(431~112)-V	500



A	46mm

- **Ammo Packing**

Disc Size/mm	Quantity pcs/ box
Φ10(201～361)-V	750
Φ10(391～621)-V	500
Φ10(681～112)-V	400
TVR14(201~271)-V	500
TVR14(301~112)-V	250



(Unit:mm)

Disc Size	W±5	L±5	H±5
Φ10-V	348	275	60
Φ14-V	348	185	60

■ Storage Conditions of Products

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