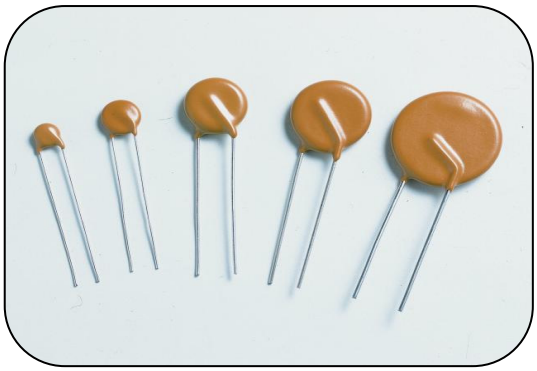
Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge protection

■ Features

1. RoHS Compliant
2. Body size Φ5~ Φ 20mm
3. Wide operating voltage range：11Vac ~ 680Vac
4. Large withstanding surge current capability：100A ~ 6500A (@8/20)
5. Radial lead resin coated
6. Excellent clamping ratio
7. Low leakage current
8. Bidirectional and symmetrical V/I characteristics
9. Cost effective
10. Operating temperature range：-40 ~ +85°C
11. Agency Recognition: UL /cUL/VDE /CSA/CQC



■ Recommended Applications

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

■ Part No. Code

Φ 5mm~ Φ 20mm

T	V	R	0	5	1	8	0	K	I	A	R				Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Code	
TVR	Thinking Varistor TVR Type

Disc Size	
05	Φ5mm
07	Φ 7mm
10	Φ10mm
14	Φ14mm
20	Φ20mm

Varistor Voltage(V_{1mA})	
180	$18x10^0$V=18V
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

Classification	
Blank	Standard
Y	ROHS Control

Appearance	
S	Straight Lead, Epoxy Coating
F	Y Kink Lead, Epoxy Coating
I	Inner Kink Lead, Epoxy Coating

Packaging	
A	Tapping (Hole Pitch:12.7mm)
E	Tapping (Hole Pitch:15.0mm)
B	Tape + Ammo Box Packing
R	Tape + Reel Packing
C	Bulk + Cut Lead (Followed by 2 lead length's codes)
Blank	Bulk

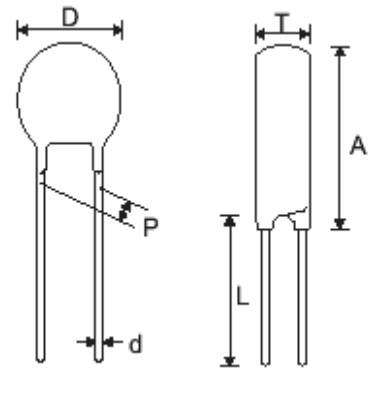
Note: Code 11~16 will shift forward when previous codes are not used.

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge protection

■ Dimensions

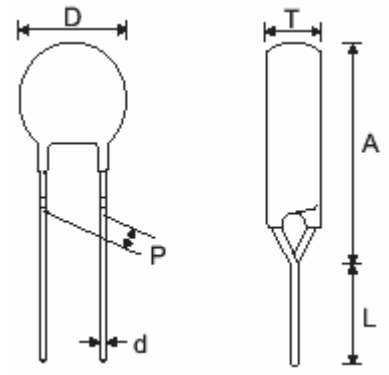
● S Type (Straight Lead)



(Unit :mm)

Disc Size	D max.	L min.	d nor.	P nor.	A max.	T max.
05	7.5	30	0.6±0.02	5±1	10	Show on the characteristics
07	9.5	30	0.6±0.02	5±1	12	
10	12.5	30	0.8±0.02	7.5±1	15.5	
14	17	30	0.8±0.02	7.5±1	20	
20	23.5	26	1.0±0.02	10±1	26.5	

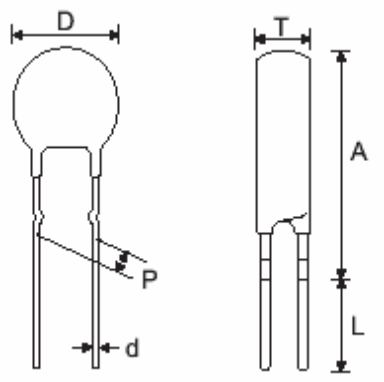
● F Type (Y Kink Lead)



(Unit :mm)

Disc Size	D max.	L min.	d nor.	P nor.	A max.	T max.
05	7.5	28	0.6±0.02	5±1	12.5	Show on the characteristics
07	9.5	28	0.6±0.02	5±1	14.5	
10	12.5	26	0.8±0.02	7.5±1	19	
14	17	26	0.8±0.02	7.5±1	22.5	
20	23.5	24	1.0±0.02	10±1	29.5	

● I Type (Inner Kink Lead)



(Unit :mm)

Disc Size	D max.	L min.	d nor.	P nor.	A max.	T max.
05	7.5	25	0.6±0.02	5±1	12.5	Show on the characteristics
07	9.5	25	0.6±0.02	5±1	14.5	
10	12.5	25	0.8±0.02	7.5±1	20	
14	17	25	0.8±0.02	7.5±1	22.5	
20	23.5	25	1.0±0.02	10±1	29.5	

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge protection

Part No.	Normal Varistor Voltage	Max. Allowable Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Max. Energy (10/1000μs)	Rated Power	Reference Capacitance @1KHz	Thickness
	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 (PF)	T_{max} (mm)
TVR 05101	100	60	85	175	5	400	3	0.1	230	4.2
TVR 07101	100	60	85	165	10	1200	6.5	0.25	420	4.2
TVR 10101	100	60	85	165	25	2500	15	0.4	920	4.6
TVR 14101	100	60	85	165	50	4500	28	0.6	1900	4.6
TVR 20101	100	60	85	165	100	6500	51	1	3900	5.0
TVR 05121	120	75	100	210	5	400	4	0.1	210	4.4
TVR 07121	120	75	100	200	10	1200	7.8	0.25	380	4.4
TVR 10121	120	75	100	200	25	2500	18	0.4	830	4.8
TVR 14121	120	75	100	200	50	4500	32	0.6	1700	4.8
TVR 20121	120	75	100	200	100	6500	55	1	3300	5.2
TVR 05151	150	95	125	260	5	400	4.8	0.1	190	4.7
TVR 07151	150	95	125	250	10	1200	9.7	0.25	350	4.7
TVR 10151	150	95	125	250	25	2500	22	0.4	760	5.1
TVR 14151	150	95	125	250	50	4500	40	0.6	940	5.1
TVR 20151	150	95	125	250	100	6500	70	1	1950	5.5
TVR 05181	180	115	150	315	5	400	5.9	0.1	70	4.2
TVR 07181	180	115	150	300	10	1200	11.7	0.25	155	4.2
TVR 10181	180	115	150	300	25	2500	27	0.4	310	4.6
TVR 14181	180	115	150	300	50	4500	52	0.6	800	4.6
TVR 20181	180	115	150	300	100	6500	84	1	1620	5.0
TVR 05201	200	130	170	355	5	400	6.5	0.1	65	4.3
TVR 07201	200	130	170	340	10	1200	13	0.25	140	4.3
TVR 10201	200	130	170	340	25	2500	30	0.4	290	4.7
TVR 14201	200	130	170	340	50	4500	57	0.6	700	4.7
TVR 20201	200	130	170	340	100	6500	95	1	1460	5.1
TVR 05221	220	140	180	380	5	400	7	0.1	60	4.4
TVR 07221	220	140	180	360	10	1200	14	0.25	130	4.4
TVR 10221	220	140	180	360	25	2500	32	0.4	270	4.8
TVR 14221	220	140	180	360	50	4500	60	0.6	640	4.8
TVR 20221	220	140	180	360	100	6500	100	1	1320	5.2
TVR 05241	240	150	200	415	5	400	8	0.1	55	4.5
TVR 07241	240	150	200	395	10	1200	15	0.25	120	4.5
TVR 10241	240	150	200	395	25	2500	35	0.4	240	4.9
TVR 14241	240	150	200	395	50	4500	63	0.6	580	4.9
TVR 20241	240	150	200	395	100	6500	108	1	1200	5.3
TVR 05271	270	175	225	475	5	400	8.5	0.1	50	4.7
TVR 07271	270	175	225	455	10	1200	18	0.25	110	4.7
TVR 10271	270	175	225	455	25	2500	40	0.4	230	5.1
TVR 14271	270	175	225	455	50	4500	70	0.6	520	5.1
TVR 20271	270	175	225	455	100	6500	127	1	1100	5.5

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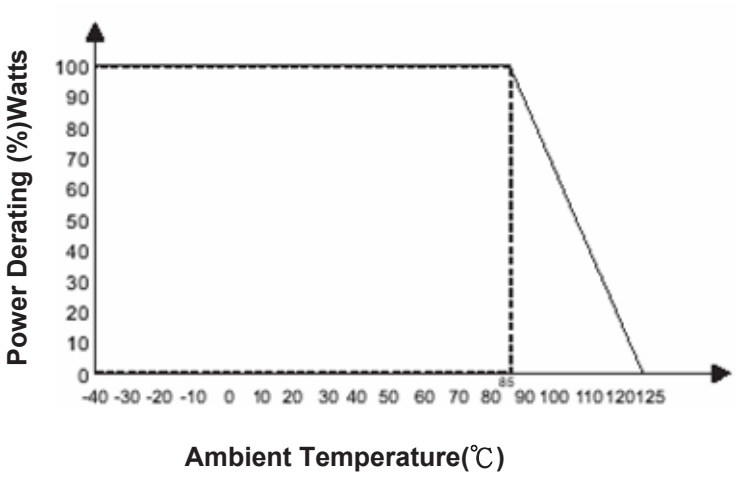
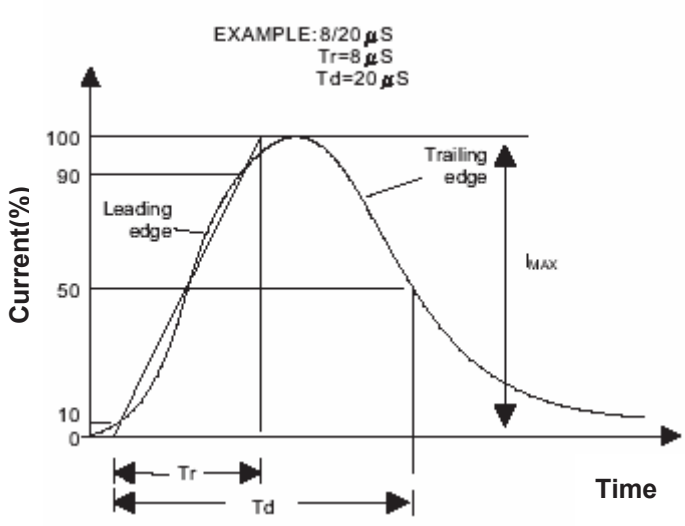
■ Operating Temperature vs. Power Derating Curve

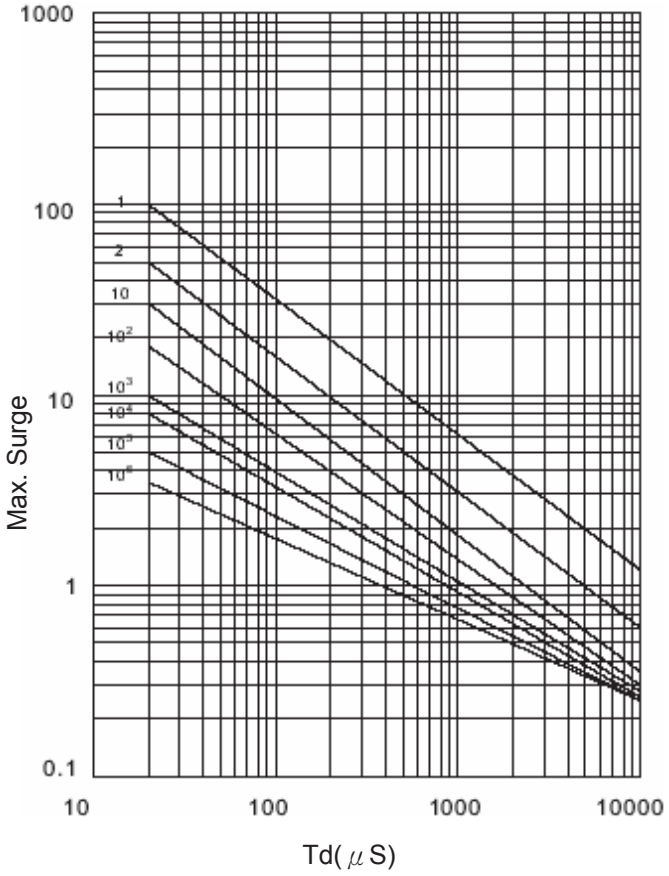


■ Surge Current Standard Waveform

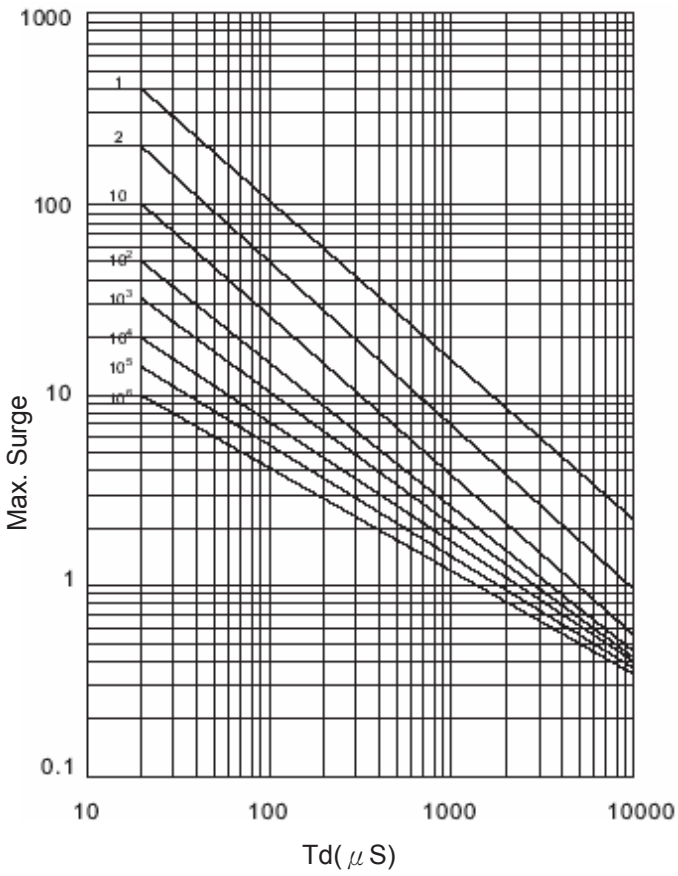


■ Max. Surge Current Derating Curves

TVR05180~TVR05680

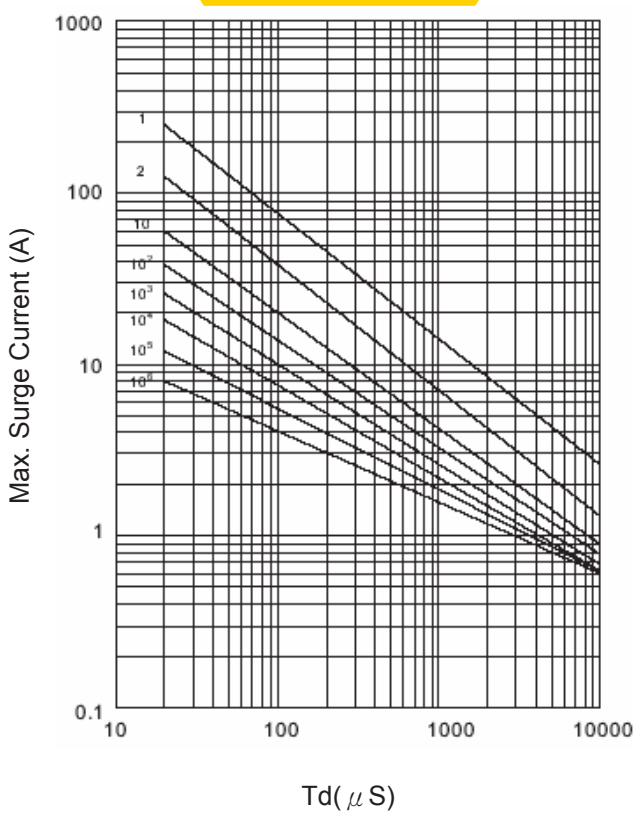


TVR05820~TVR05751

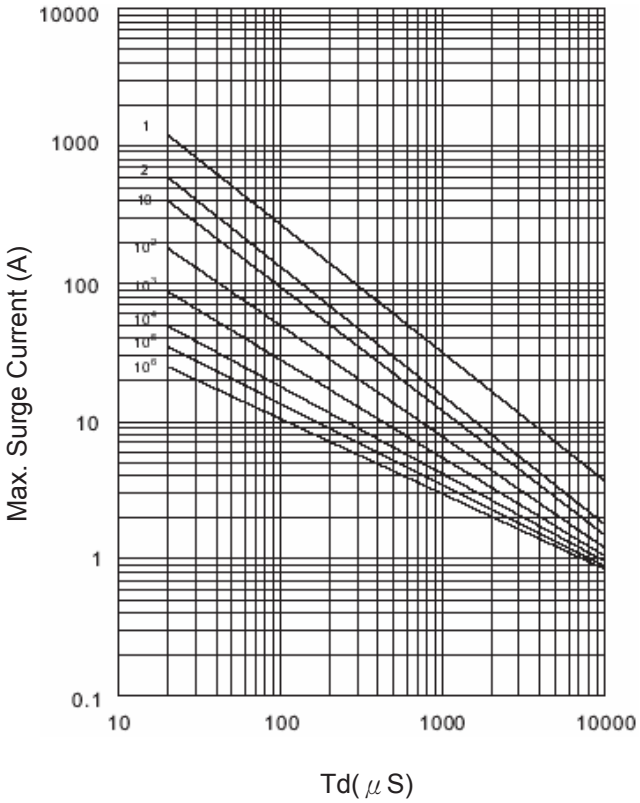


Max. Surge Current Derating Curves

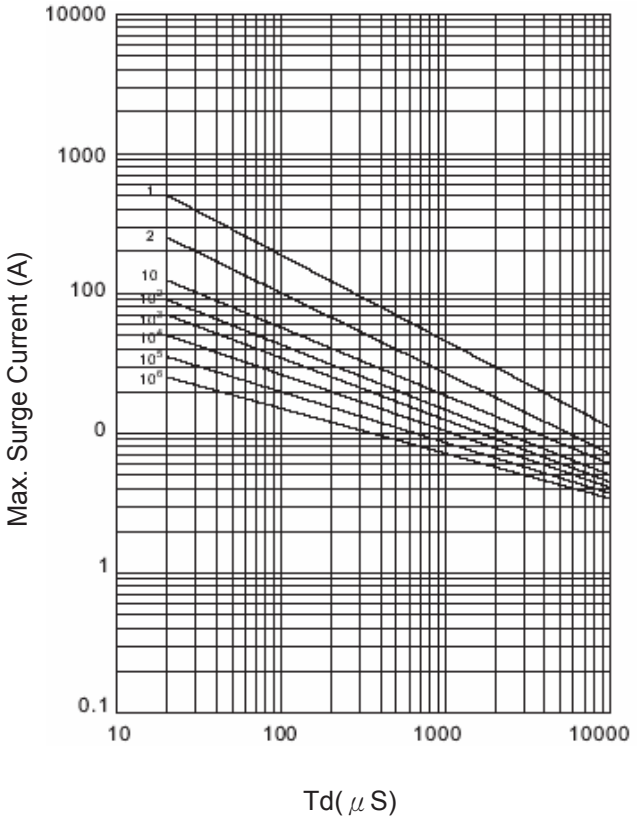
TVR07180~TVR07680



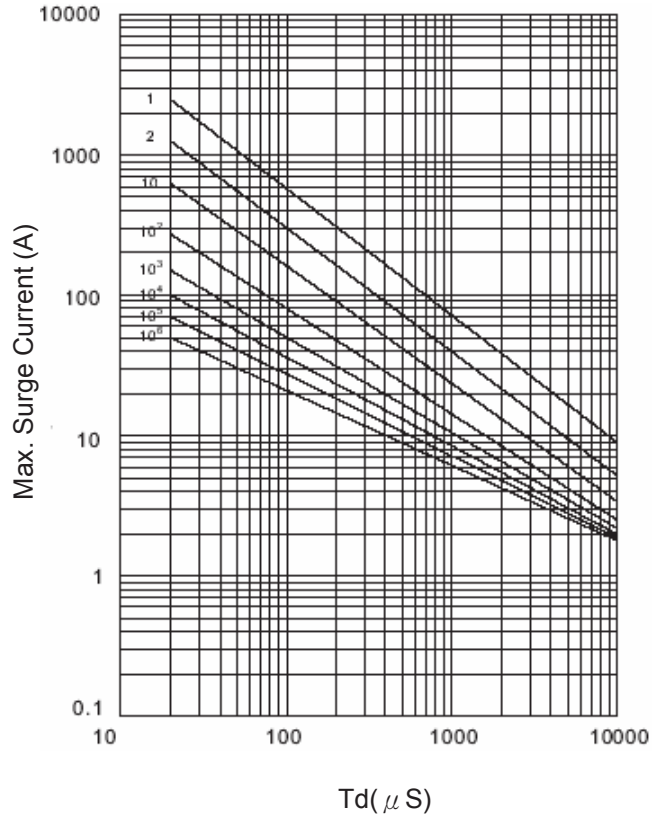
TVR07820~TVR07821



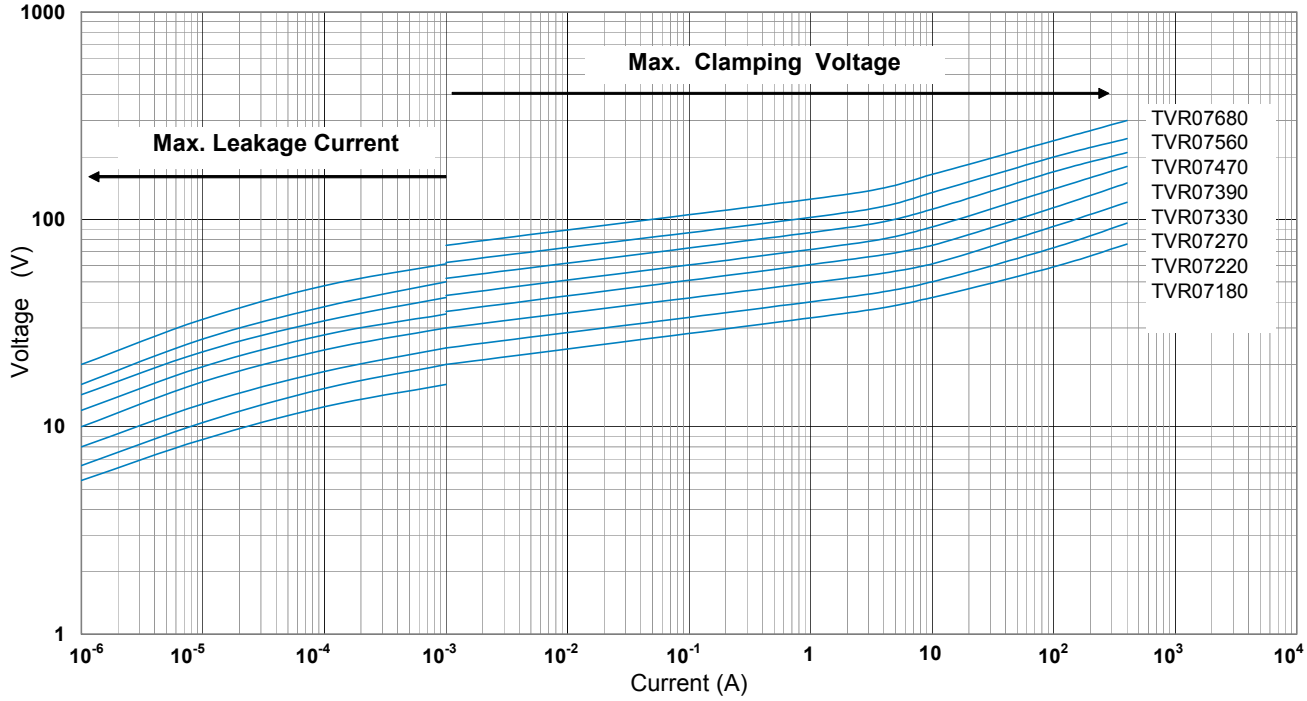
TVR10180~TVR10680



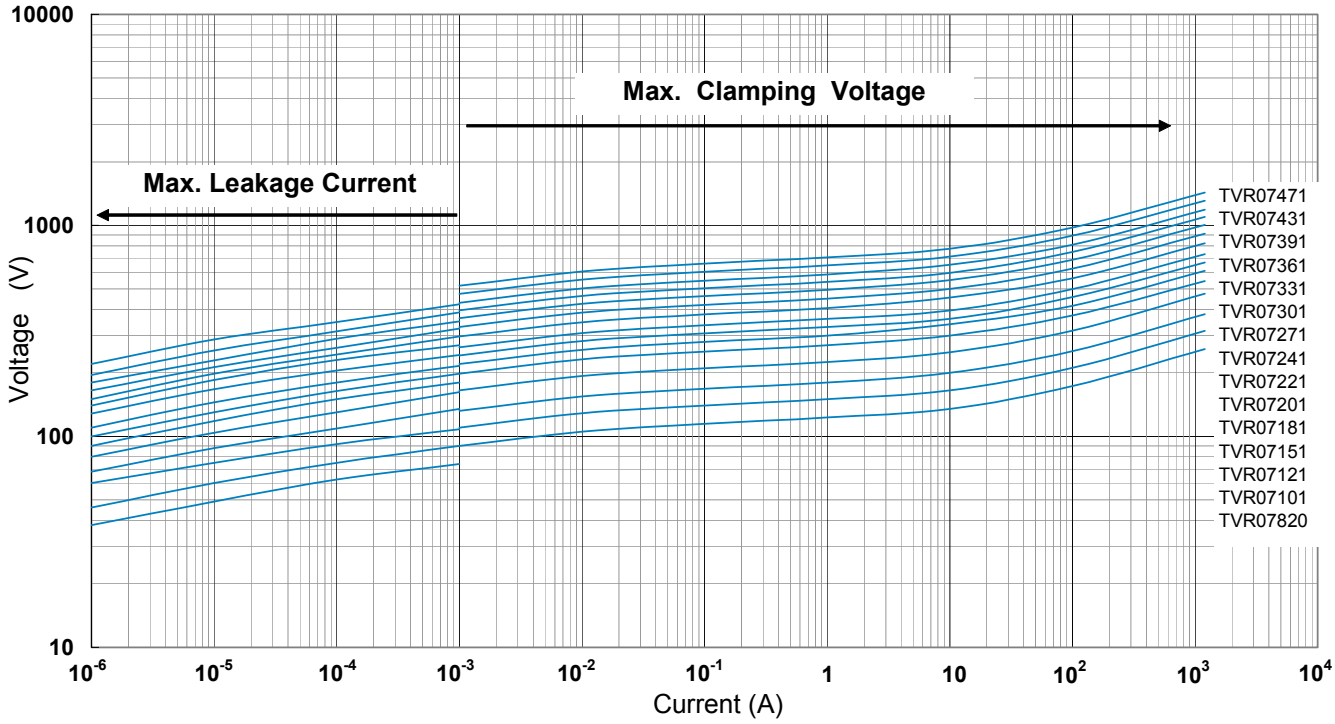
TVR10820~TVR10182



Max. Leakage Current and Max. Clamping Voltage Curves (TVR07 180 to TVR 07 680)

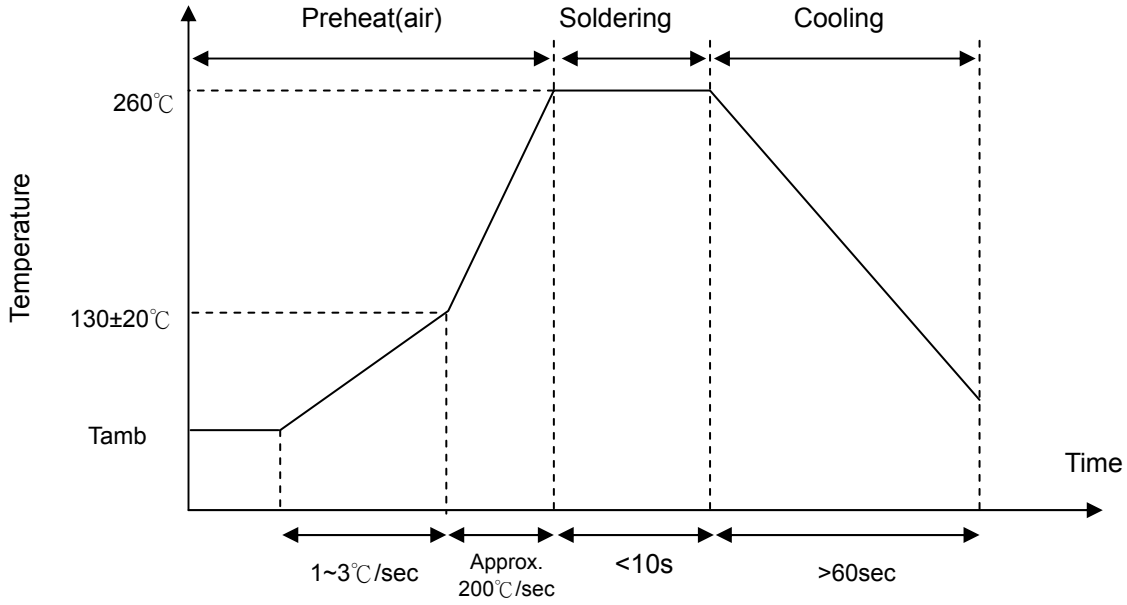


Max. Leakage Current and Max. Clamping Voltage Curves (TVR 07 820 to TVR 07 471)



■ Soldering Recommendation

● Wave Flow Soldering Profile



● Recommended Reworking Conditions With Soldering Iron

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

■ Reliability Test

<table>
<tr><th>Item</th><th>Standard</th><th>Test Conditions / Methods</th><th>Specifications</th></tr>
<tr><td>Tensile Strength of Terminations</td><td>IEC60068-2-21</td><td>Gradually applying the force specified below to each terminal and keeping 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</td><td>No visible damage</td></tr>
<tr><td>Bending Strength of Terminations</td><td>IEC 60068-2-21</td><td>Hanging the force specified below to each terminal and gradually bending each terminal by 90° in one direction, then 90° in the opposite direction, and again back to the origin.

Terminal diameter (mm) / Force (Kg)
0.5<d≦0.8 : 0.5
0.8<d≦1.25 : 1.0
1.25<d : 2.0</td><td>No visible damage</td></tr>
<tr><td>Vibration</td><td>IEC 1051-14.16</td><td>Frequency range: 10 ~ 55 Hz
Amplitude: 0.75mm or 98 m/s^2
Duration: 6 HRS (3 x 2 HRS)</td><td>No visible damage</td></tr>
<tr><td>Solderability</td><td>IEC 60068-2-20</td><td>235±5℃ , 2±0.5 sec</td><td>At least 95% of terminal electrode is covered by new solder</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>IEC 60068-2-20</td><td>260±5℃ , 10±1 sec</td><td>$|\triangle V/V_{1mA}| \leqq 5\%$
No visible damage</td></tr>
<tr><td>High Temperature Storage</td><td>IEC 60068-2-2</td><td>125±5℃ x 1000± 24 hrs</td><td>$|\triangle V/V_{1mA}| \leqq 5\%$</td></tr>
<tr><td>Damp Heat Load</td><td>IEC 60068-2-3</td><td>40±2℃ , 90 ~ 95 % RH
1000 ±24 HRS at V_{DC}</td><td>$|\triangle V/V_{1mA}| \leqq 5\%$</td></tr>
<tr><td>Thermal Shock</td><td>IEC 60068-2-14</td><td>The thermal shock 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</td><td>$|\triangle V/V_{1mA}| \leqq 5\%$
No visible damage</td></tr>
<tr><td>High Temperature Load</td><td>CECC42000</td><td>85±2℃, 1000±24 HRS at V_{DC} or V_{rms} (Max. Allowable Voltage)</td><td>$|\triangle V/V_{1mA}| \leqq 10\%$</td></tr>
<tr><td>Low Temperature Storage (Optional)</td><td>CECC42000</td><td>–40±5℃, 1000±24 HRS at V_{DC} or V_{rms} (Max. Allowable Voltage)</td><td>$|\triangle V/V_{1mA}| \leqq 5\%$</td></tr>
<tr><td>8/20μs Surge Life</td><td>CECC42000</td><td>8/20 μs waveform, 10000 surge currents, unipolar, interval 10 secs amplitude corr. to max. Surge current derating curves for 20 μs</td><td>$|\triangle V/V_{1mA}| \leqq 10\%$
No visible damage</td></tr>
<tr><td>Varistor Voltage Temp. Coefficient</td><td>Specification Standard</td><td>$\frac{V_{1mA} \text{ at } 85℃ - V_{1mA} \text{ at } 25℃}{V_{1mA} \text{ at } 25℃} \times \frac{1}{60} \times 100\ (\%/℃)$</td><td>$-0.05 \leqq T_C \leqq 0\ (\%/℃)$</td></tr>
<tr><td>Voltage Proof</td><td>CECC42000</td><td>Metal balls method, 2500 V_{ac} 1 min</td><td>No visible damage</td></tr>
</table>

■ Packaging

● Taping Specification

S Type (Straight Lead)

Figure A

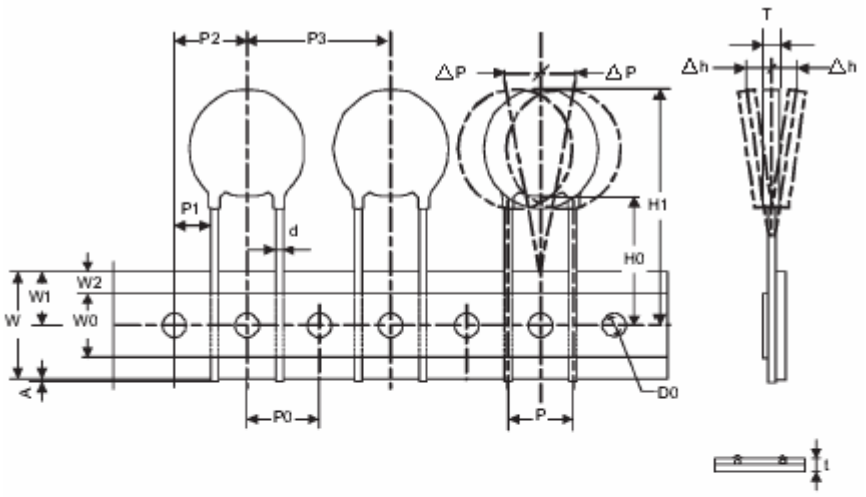
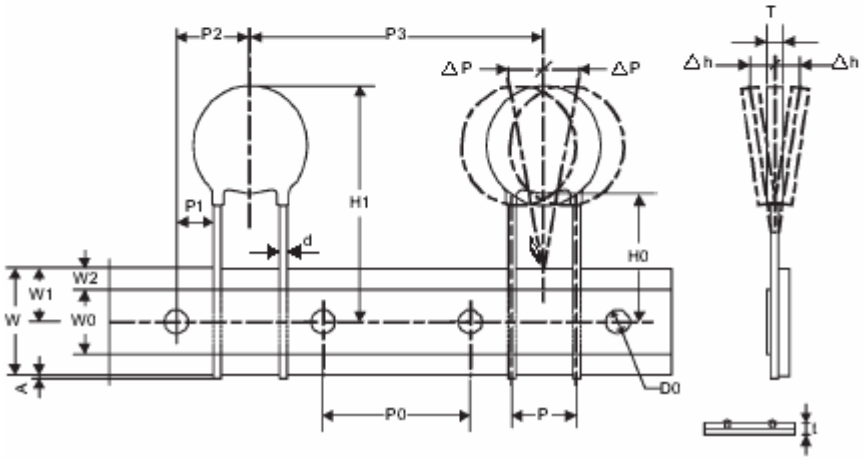


Figure B



(Unit: mm)

Taping Code	Disc Size	P_0 ±0.3	P ±1	P_1 ±1	P_2 ±1.3	P_3 ±1	H_0 ±1	H_1 Max.	d ±0.02	W_0 ±1	W_1 ±1	W_2 Max.	W ±1	△P Max.	△h Max.	A Max.	D_0 ±0.2	t ±0.2	Figure
A (P_0=12.7)	05	12.7	5	3.55	6.35	12.7	20	28	0.6	12	9	3	18	1	2	0.5	4	0.6	B
	07	12.7	5	3.55	6.35	12.7	20	30	0.6	12	9	3	18	1	2	0.5	4	0.6	B
	10	12.7	7.5	8.55	12.7	12.7	20	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	A
	14	12.7	7.5	8.55	12.7	25.4	20	38	0.8	12	9	3	18	1	2	0.5	4	0.6	A
	20	12.7	7.5	8.55	12.7	25.4	16	40.5	1.0	12	9	3	18	1	2	0.5	4	0.6	A
E (P_0=15.0)	05	15	5	4.7	7.5	15	20	28	0.6	12	9	3	18	1	2	0.5	4	0.6	B
	07	15	5	4.7	7.5	15	20	30	0.6	12	9	3	18	1	2	0.5	4	0.6	B
	10	15	7.5	3.35	7.5	15	20	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	14	15	7.5	3.35	7.5	30	20	38	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	20	15	7.5	3.35	7.5	30	16	40.5	1.0	12	9	3	18	1	2	0.5	4	0.6	B

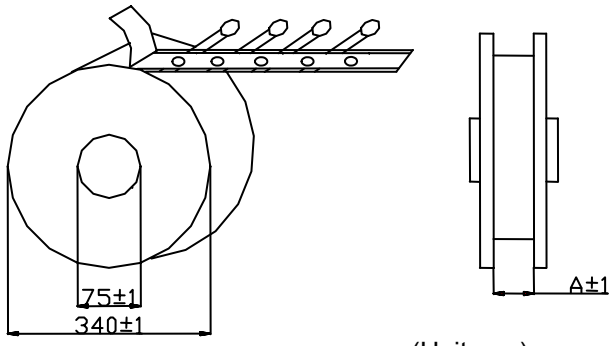
■ Quantity

● Bulk Packing

Disc Size/mm	Quantity PCS/ Bag
ϕ05	200
ϕ07	200
ϕ10	200
ϕ14	100
ϕ20	50

● Reel Packing

Disc Size/mm	Quantity PCS/Reel
ϕ05(180～391)	1500
ϕ05(431～751)	1000
ϕ07(180～391)	1500
ϕ07(431～821)	1000
ϕ10(180～911)	1000
ϕ10(102～112)	750
ϕ14(180～470)	1000
ϕ14(560～391)	750
ϕ14(431～112)	500
ϕ20(301～561)	500
ϕ20(621～112)	300



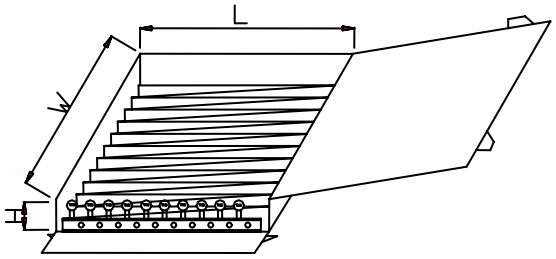
(Unit:mm)

A	46	55
Disc Size	ϕ05～ϕ14	ϕ20

Note: The standard package for TVRXX122 to TVRXX182 is bulk. For any other demand, please contact sales.

● Ammo packing

Disc Size/mm	Quantity PCS/ Box
ϕ05(180～391)	1000
ϕ05(431～751)	1200
ϕ07(180～821)	1000
ϕ10(180～361)	750
ϕ10(391～621)	500
ϕ10(681～112)	400
ϕ14(180～271)	500
ϕ14(301～112)	250
ϕ20(180～112)	250



Disc Size	W±5	L±5	H±5
φ07~φ14	348	275	50
	348	185	50
φ20	348	275	60
	348	185	60

Note: The standard package for TVRXX122 to TVRXX182 is bulk. For any other demand, please contact sales.

■ Storage condition

- Storage Conditions :
  1. Storage Temperature : -10℃~+40℃
  2. Relative humidity : ≦75%RH
  3. Varistor must be kept away from sunlight and stored in a non-corrosive atmosphere.
- Period of Storage : 1 year . If stored beyond 1 year, please check the solder ability before use.