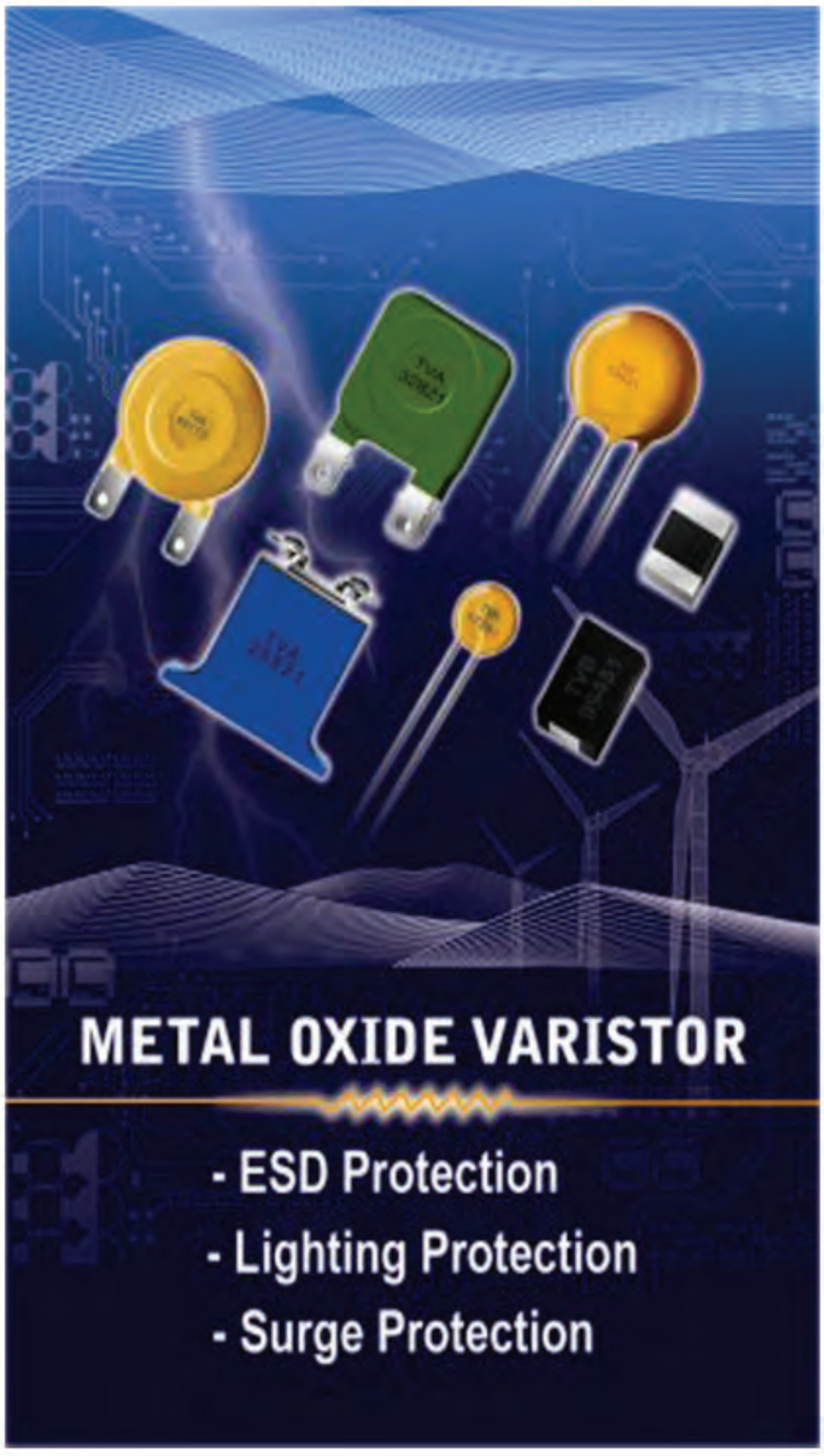
ELITALIA



TKS

TVA
TVB
TVM-B
TVM-C
TVR
TVR-D
TVR-Q
TVR-V
TVT

VARISTORS INDEX

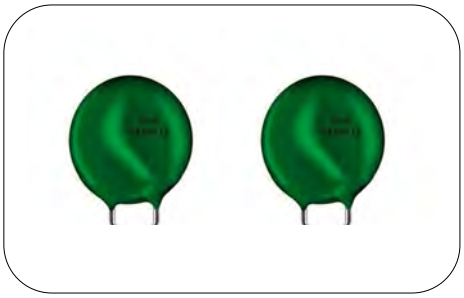
SERIE	PAG
TVA	088
TVB	123
TVM-B	134
TVM-C	001
TVR	008
TVR-D	054
TVR-Q	A01
TVR-V	040
TVT	076

Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

■ Features

1. Qualification based on AEC-Q200 Rev-C
2. Body size: Φ7~Φ20mm
3. Wide operating voltage range: 12Vdc, 24Vdc, 42Vdc
4. Operating temperature range: -40 ~ +125℃
5. Storage temperature range: -40~ +150℃
6. RoHS & Halogen-free compliant



■ Recommended Applications

1. Automotive information and entertainment system

■ Part Number Code

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

Product Type	
TVR	THINKING Varistor TVR Series

Body Size	
07	Φ7mm
10	Φ10mm
14	Φ14mm
20	Φ20mm

Varistor Voltage(V_{1mA})	
220	$22x10^0$V=22V
680	$68x10^1$V=68V

Tolerance of V_{1mA}	
K	±10%
L	±15%
M	±20%

Internal Control Code
01~ZZ

Optional Suffix	
Q	Automotive series

Appearance	
L	Straight lead
Y	Y kink lead

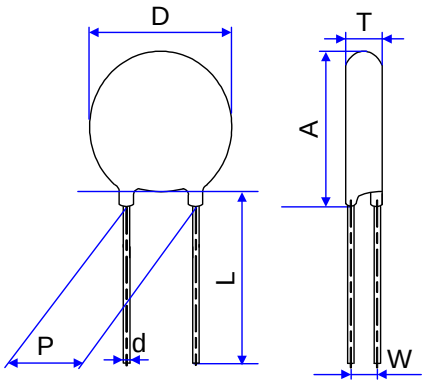
Packaging	
AR	Tape & reel packing (hole pitch:12.7mm)
ER	Tape & reel packing (hole pitch:15.0mm)
AB	Tape & ammo box packing (hole pitch:12.7mm)
EB	Tape & ammo box packing (hole pitch:15.0mm)
C	Bulk & cut lead (followed by the codes of 2 leaded length
Blank	Bulk

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

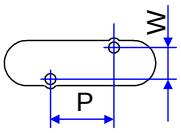
Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

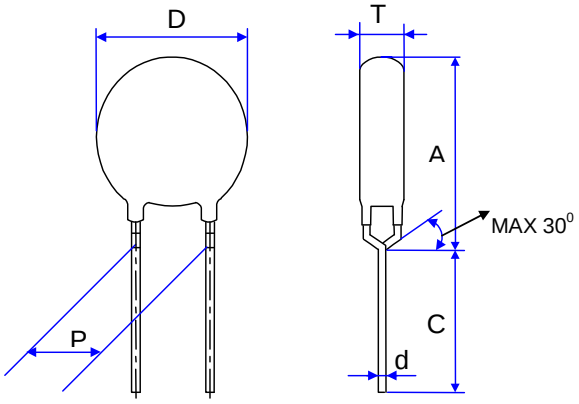
■ Structures and Dimensions



Straight Lead



Bottom View



Y Kink Lead

(Unit: mm)

Part	Dmax	Amax		P (±0.5)	W (±1.0)	Lmin	Φd (±0.05)	T	
		Straight Lead	Y Kink Lead					Min	Max
TVR07220-Q	9.0	11.0	11.5	5.0	1.4	25	0.6	2.4	4.1
TVR10220-Q	12.0	14.5	15.5	7. 5	1.4	25	0.8	2.8	4.5
TVR14220-Q	15.5	18.5	19.0	7.5	1.4	25	0.8	2.8	4.5
TVR20220-Q	21.5	25.5	26.5	10.0	1.4	25	1.0	3.2	4.9
TVR10270-Q	12.0	14.5	15.5	7.5	1.5	25	0.8	3.0	4.7
TVR14270-Q	15.5	18.5	19.0	7.5	1.5	25	0.8	3.0	4.7
TVR20270-Q	21.5	25.5	26.5	10.0	1.5	25	1.0	3.4	5.1
TVR14390-Q	15.5	18.5	19.0	7.5	1.8	25	0.8	3.2	4.9
TVR20390-Q	21.5	25.5	26.5	10.0	1.8	25	1.0	3.6	5.3
TVR14470-Q	15.5	18.5	19.0	7.5	1.8	25	0.8	3.5	5.4
TVR20470-Q	21.5	25.5	26.5	10.0	1.8	25	1.0	3.9	5.8
TVR14680-Q	15.5	18.5	19.0	7.5	2.2	25	0.8	3.3	5.0
TVR20680-Q	21.5	25.5	26.5	10.0	2.2	25	1.0	3.7	5.4

Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

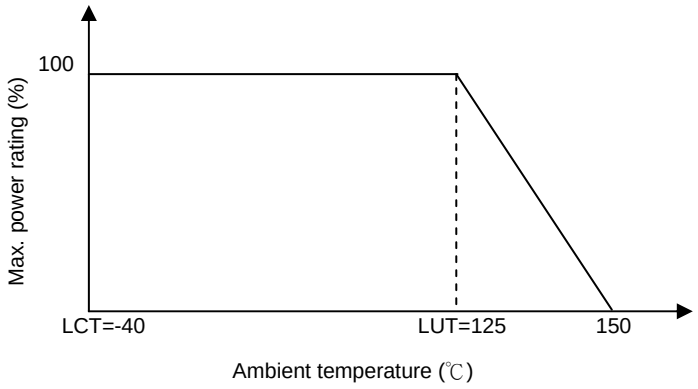
- **Electrical Characteristics**

Part no	Varistor Voltage (@ 1mA DC)	Max. Operating Voltage	Max. Clamping Voltage(8/20μs)		Max. Surge Current(8/20μs)	Vjump （5min）	Load dump Energy ISO7637 Pulse 5, 10times
	V1mA	Vdc	Vp	Ip	Imax	（V）	（J）
	(V)	(V)	(V)	(A)	(A)		
For 12Vdc system							
TVR07220-Q	22±15%	16	43	2.5	500	25	12
TVR10220-Q	22±15%	16	43	5	1000	25	25
TVR14220-Q	22±15%	16	43	10	2000	25	50
TVR20220-Q	22±15%	16	43	20	3000	25	100
TVR10270-Q	27±10%	22	53	5	1000	30	25
TVR14270-Q	27±10%	22	53	10	2000	30	50
TVR20270-Q	27±10%	22	53	20	3000	30	100
For 24Vdc system							
TVR14390-Q	39±10%	31	77	10	2000	42	50
TVR20390-Q	39±10%	31	77	20	3000	42	100
TVR14470-Q	47±10%	38	93	10	2000	50	50
TVR20470-Q	47±10%	38	93	20	3000	50	100
For 42Vdc system							
TVR10680-Q	68±10%	56	135	5	1000	65	25
TVR14680-Q	68±10%	56	135	10	2000	65	50
TVR20680-Q	68±10%	56	135	20	3000	65	100

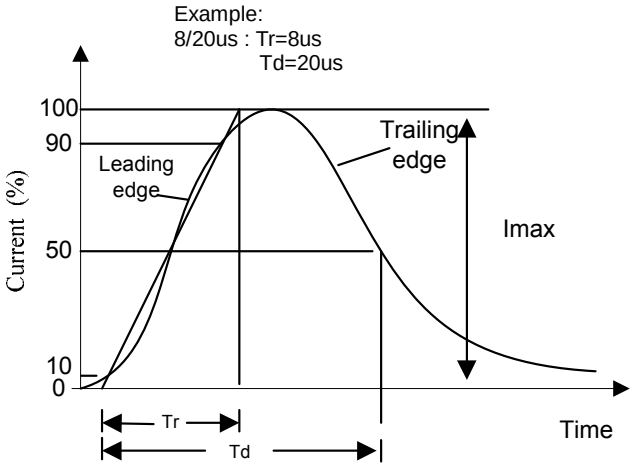
Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

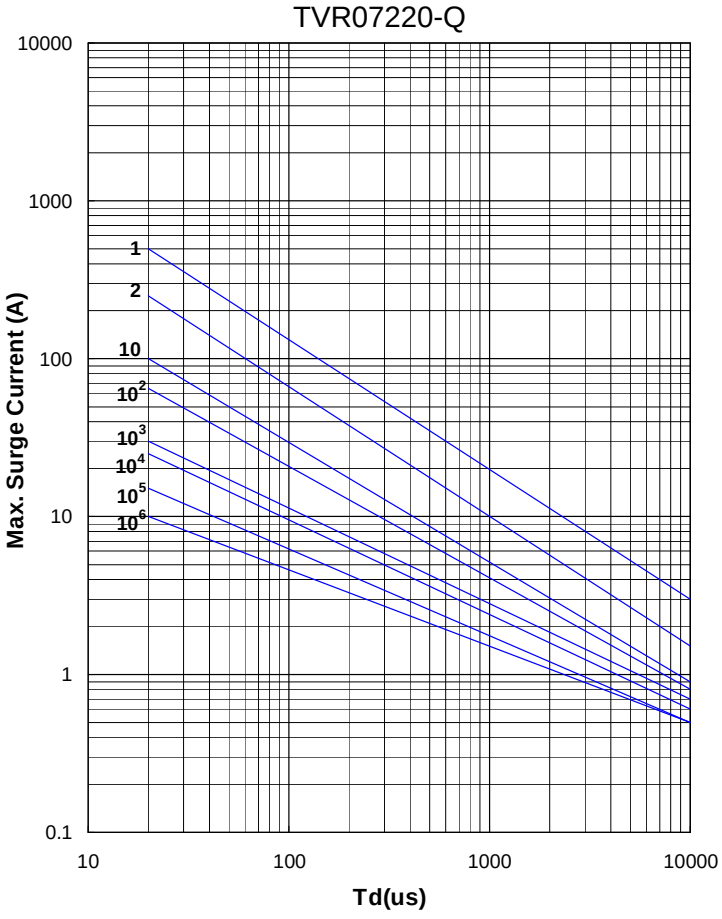
■ Power Derating Curve

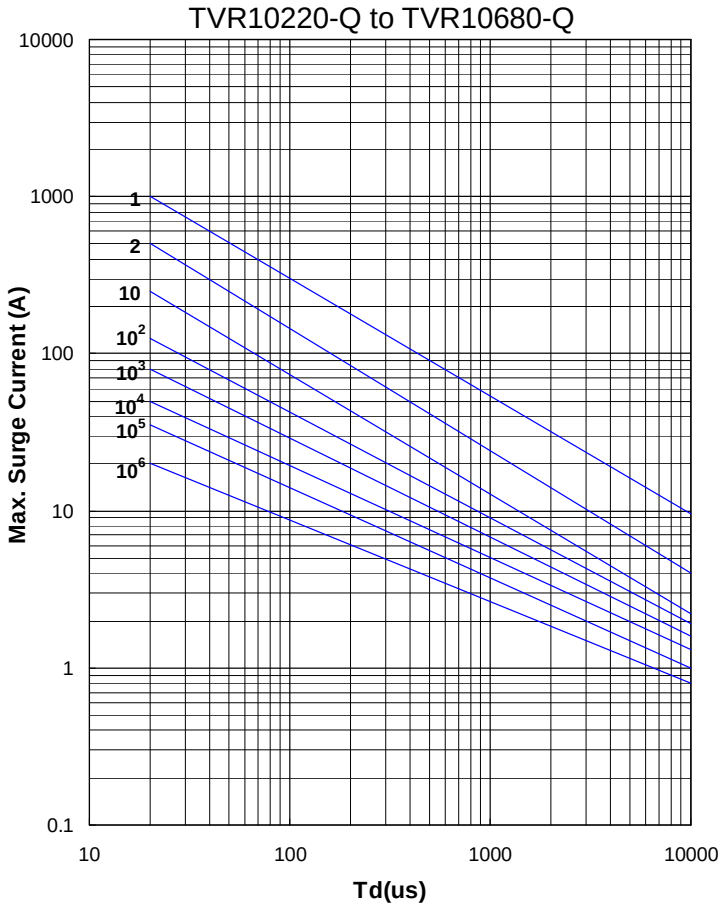


■ Surge Current Standard Waveform



■ Max. Surge Current Derating Curves

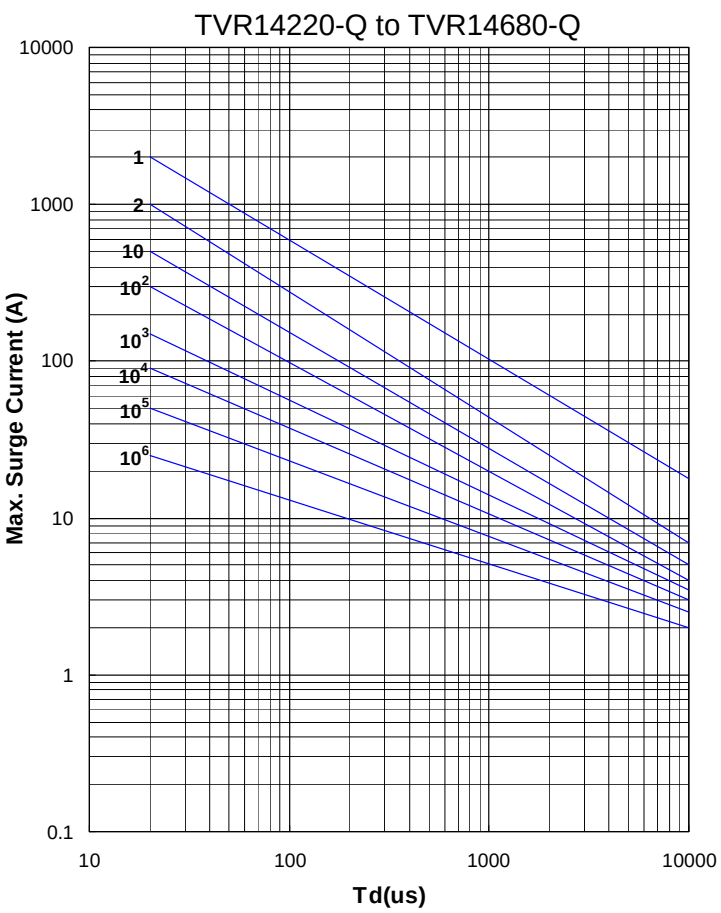


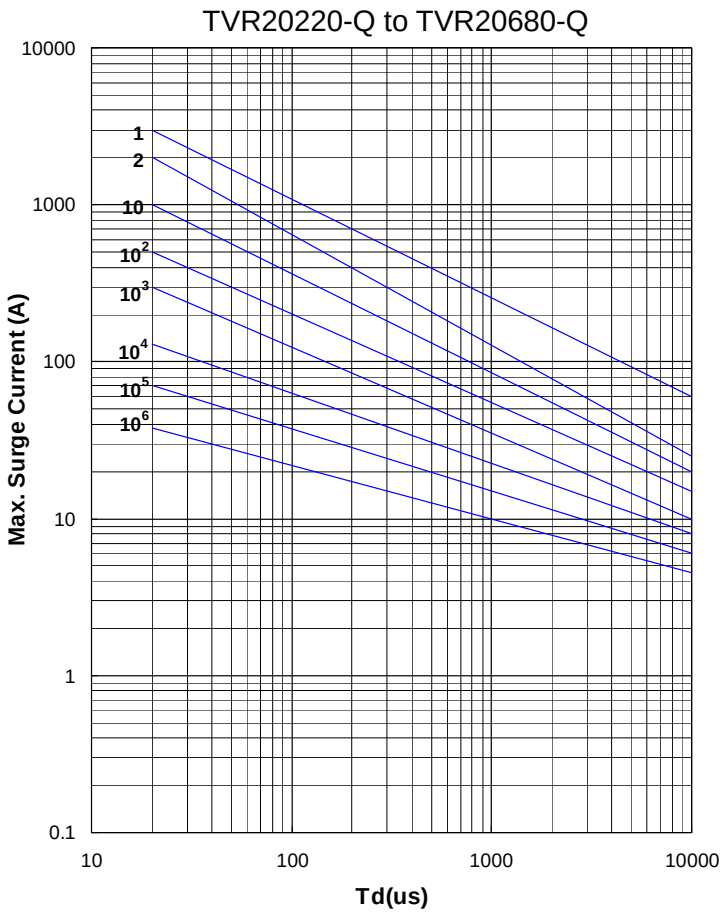


Metal Oxide Varistor：TVR-Q Series

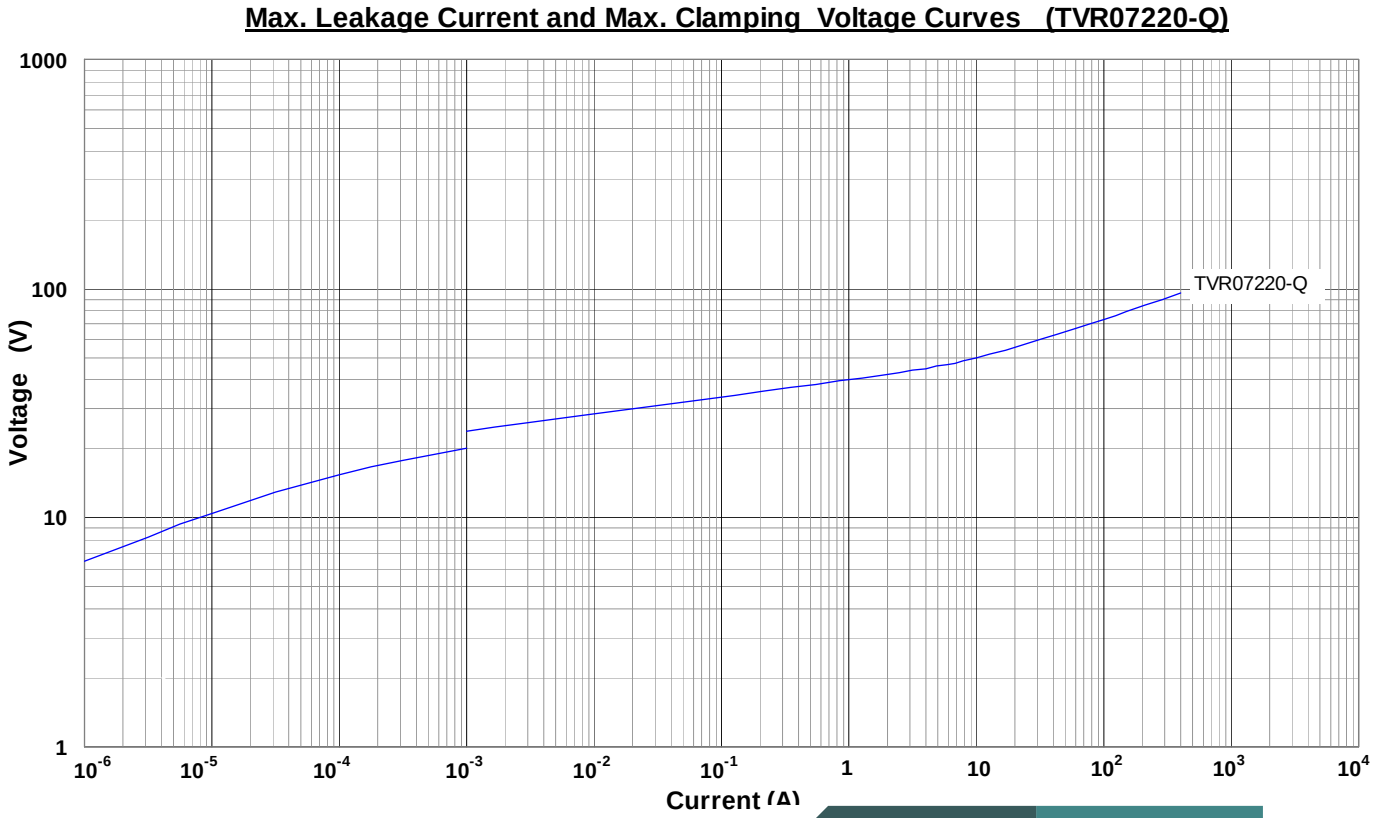
Disc Type Varistor for Automotive Applications

■ Max. Surge Current Derating Curves

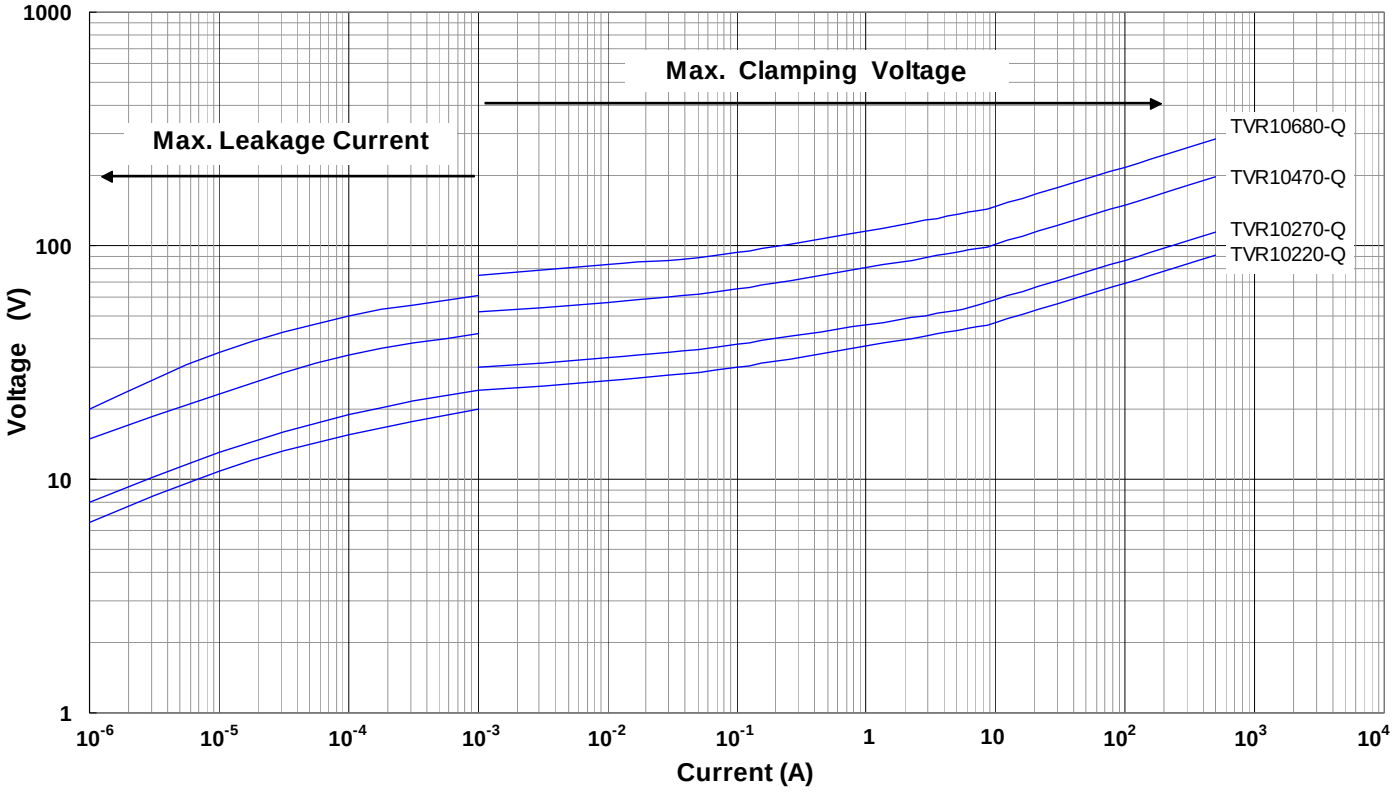




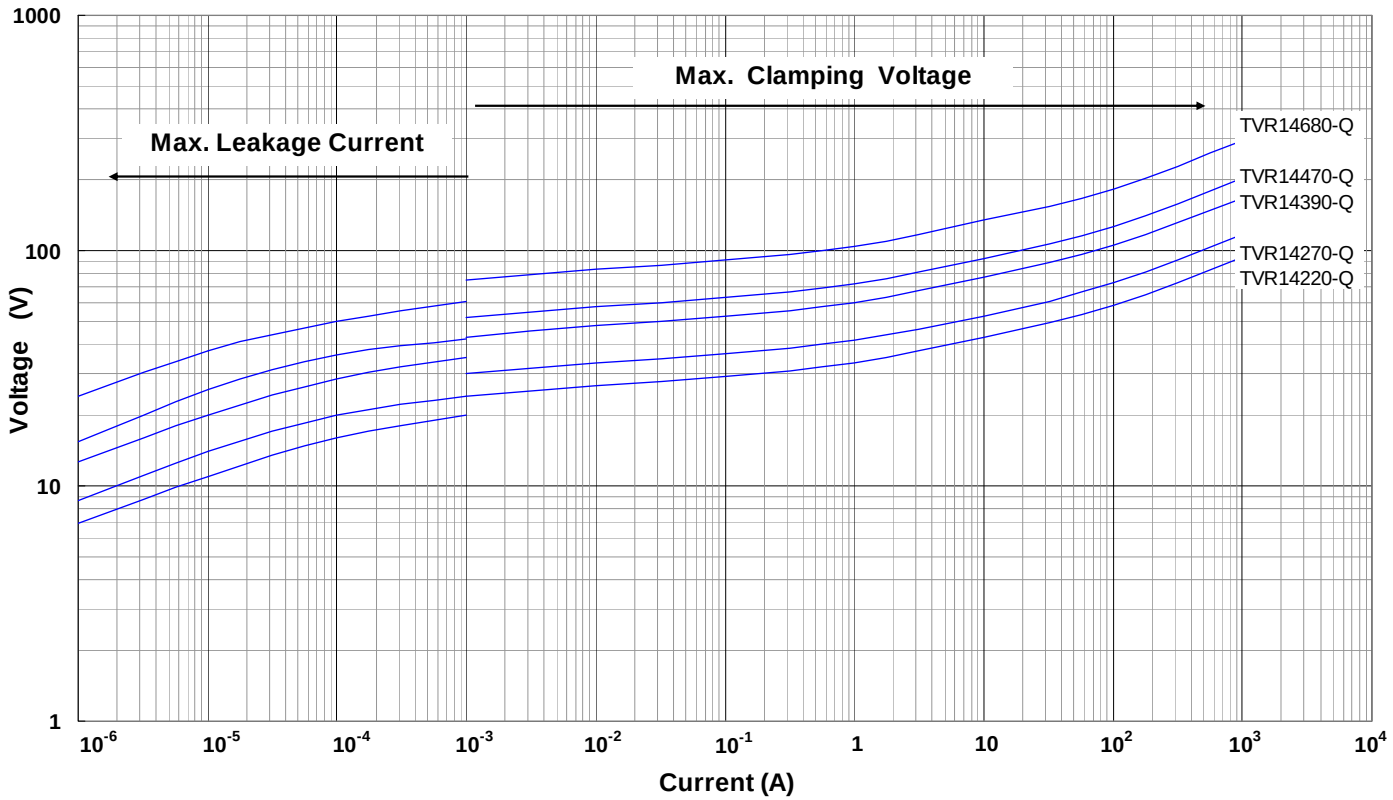
■ Max. Leakage Current and Max. Clamping Voltage Curves



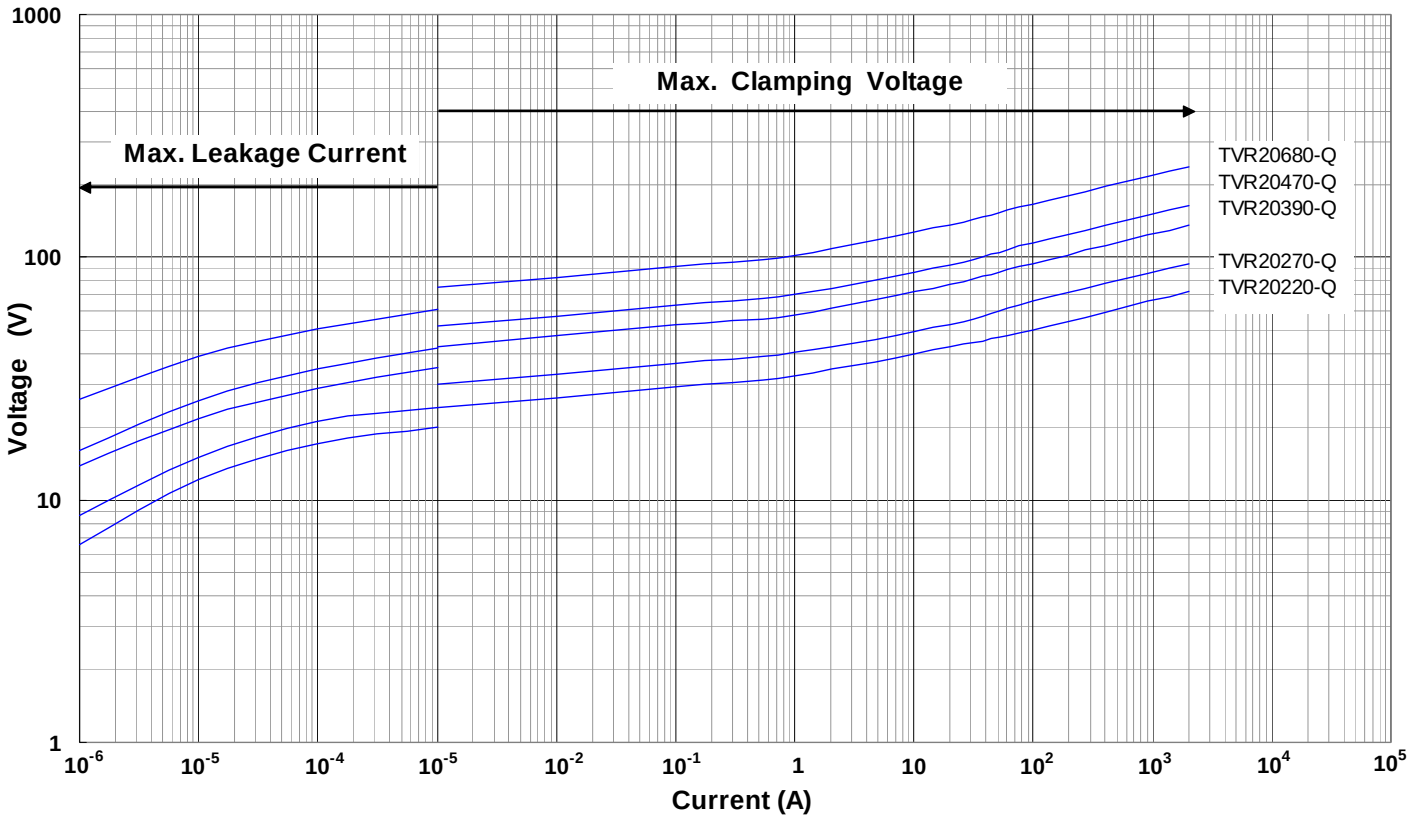
Max. Leakage Current and Max. Clamping Voltage Curves (TVR 10 220-Q to TVR 10 680-Q)



Max. Leakage Current and Max. Clamping Voltage Curves (TVR14 220-Q to TVR14 680-Q)

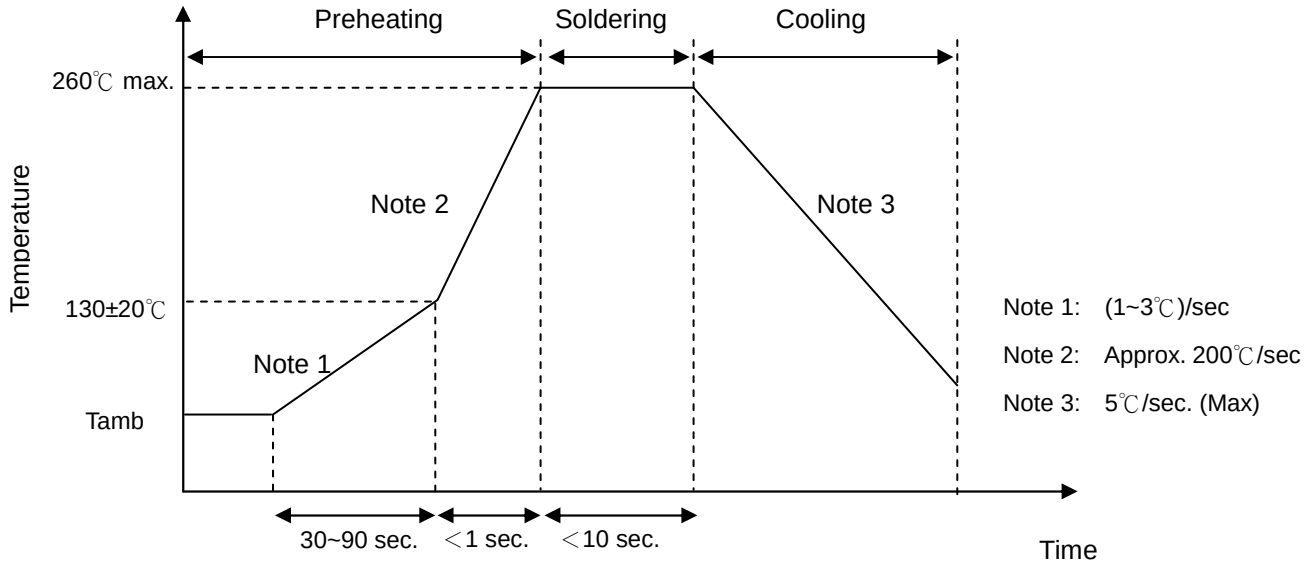


Max. Leakage Current and Max. Clamping Voltage Curves (TVR 20 220-Q to TVR 20 680-Q)



■ 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

<table>
<tr><th>Item</th><th>Standard</th><th>Test conditions / Methods</th><th>Specifications</th></tr>
<tr><td>High Temperature Exposure (Storage)</td><td>MIL-STD-202 Method 108</td><td>Test temp.: 150+3/-0℃
Duration: 1000 hrs, Unpowered
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦10%
｜△Vclamp/Vclamp｜≦10%</td></tr>
<tr><td>Temperature Cycling</td><td>JESD22 Method JA-104</td><td>Lower test temp. : -40℃ (+0/-10)
Upper test temp. : 125℃(+15/-0)
Soak Time at Lower or Upper Temp. : 15 min
Transfer time: ≤1 min
Number of cycles: 1000
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦10%
｜△Vclamp/Vclamp｜≦10%</td></tr>
<tr><td>Moisture Resistance</td><td>MIL-STD-202 Method 106</td><td>Duration of 1 cycle: 16 hrs
Number of cycles: 10, Unpowered
Measurement at 24±2 hours after test conclusion.
<table><tr><th rowspan="2">Step</th><th colspan="2">Temp.</th><th>humidity</th><th>Period</th></tr><tr><th>Start</th><th>Finish</th><th>(%)</th><th>(hr)</th></tr><tr><td>1</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr><tr><td>2</td><td>65</td><td>65</td><td>90~100</td><td>3.0</td></tr><tr><td>3</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr><tr><td>4</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr><tr><td>5</td><td>65</td><td>65</td><td>90~100</td><td>3.0</td></tr><tr><td>6</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr></table></td><td>No visible damage
｜△V1mA/V1mA｜≦10%
｜△Vclamp/Vclamp｜≦10%</td></tr>
<tr><td>Biased Humidity</td><td>MIL-STD-202 Method 103</td><td>Test temp.:85℃
Rel. humidity of air: 85%
Duration: 1000 hrs
Test Power: Bias at 85% (+5%/-0%) of rated varistor voltage
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦10%
｜△Vclamp/Vclamp｜≦10%</td></tr>
<tr><td>Operational Life</td><td>MIL-STD-202 Method 108</td><td>Test temp.: 125℃ (+3/-0)
Duration: 1000 hrs
Test Power: Bias at 85% (+5%/-0%) of rated varistor voltage
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦10%
｜△Vclamp/Vclamp｜≦10%</td></tr>
<tr><td>External Visual</td><td>MIL-STD-883 Method 2009</td><td>Inspect device construction, marking, and workmanship.</td><td>No visible damage</td></tr>
<tr><td>Physical Dimension</td><td>JESD22 Method JB-100</td><td>Verify physical dimensions to the applicable device detail specification.</td><td>Within the specified values</td></tr>
<tr><td>Terminal Strength (Leaded)</td><td>MIL-STD-202 Method 211</td><td>1. Pull test (2.27 kg),
2. Wire-lead bend test (227 g)
Duration of the applied forces: 10 ±1sec</td><td>No visible damage
｜△V1mA/V1mA｜≦10%
｜△Vclamp/Vclamp｜≦10%</td></tr>
<tr><td>Resistance to Solvents</td><td>MIL-STD-202 Method 215</td><td>Add aqueous wash chemical - OKEM Clean or equivalent.
Do not use banned solvents.</td><td>No visible damage</td></tr>
</table>

Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

Item	Standard	Test conditions / Methods	Specifications
Mechanical Shock	MIL-STD-202-213	Peak value: 100g's Half sine Waveform Normal duration (D): 6ms 3 shocks in per axis (±X, ±Y, ±Z), 3 times.	No visible damage | △V1mA/V1mA | ≦10% | △Vclamp/Vclamp | ≦10%
Vibration	MIL-STD-202 Method 204	Acceleration: 5 g's Sweep time: 20 min Frequency range: 10Hz~2KHz~10Hz 3×12 cycles	No visible damage | △V1mA/V1mA | ≦10% | △Vclamp/Vclamp | ≦10%
Resistance to Soldering Heat	MIL-STD-202 Method 210	No pre-heat of samples. Temperature: 260 ±5℃, Time: 10 ±1 s Immersion and emersion rate: 25mm/s ±6 mm/s Number of heat cycles: 1	No visible damage | △V1mA/V1mA | ≦10% | △Vclamp/Vclamp | ≦10%
Thermal Shock	MIL-STD-202 Method 107	Lower test temp.: -55 +0/-3℃ Upper test temp.: 125 +3/-0℃ Maximum transfer time: 20 seconds. Dwell time: 15 minutes. Air-Air. Number of cycles：300	No visible damage | △V1mA/V1mA | ≦10% | △Vclamp/Vclamp | ≦10%
Solderability	J-STD-002	Steam aging 8hr@93±3℃, 245±5℃, 5 +0/- 0.5sec	At least 95% of terminal electrode is covered by new solder
Electrical Characterization	Specifications	Varistor voltage and clamping voltage	Within the specified values
Flammability	UL94	V-0	UL certified coating material
Electrical Transient Conduction	ISO-7637-1	Test pulses 5	No visible damage | △V1mA/V1mA | ≦10% | △Vclamp/Vclamp | ≦10%
Jump Start	Specification Standard	Test voltage: For TVR**220-Q, Vjump = 25 Vdc For TVR**270-Q, Vjump = 30 Vdc For TVR**390-Q, Vjump = 42 Vdc For TVR**470-Q, Vjump = 50 Vdc For TVR**680-Q, Vjump = 65Vdc Duration Time: 5 minutes	$\lvert \triangle V/V_{1mA} \rvert \leqq 15\%$ No visible damage

■ Packaging

● Taping Specification
S Type (Straight lead)

Figure A

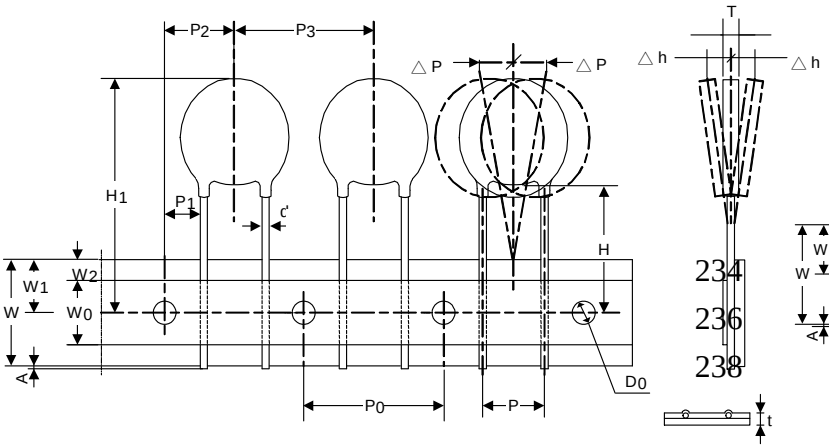


Figure C

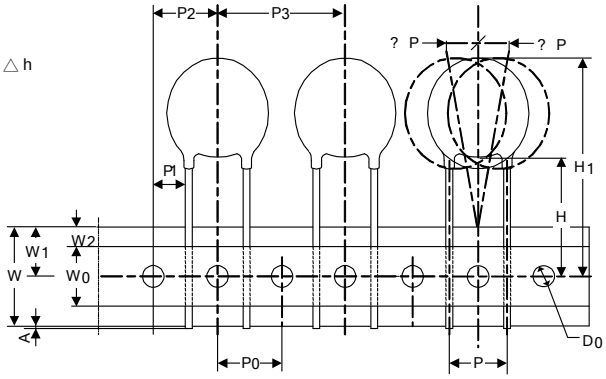


Figure B

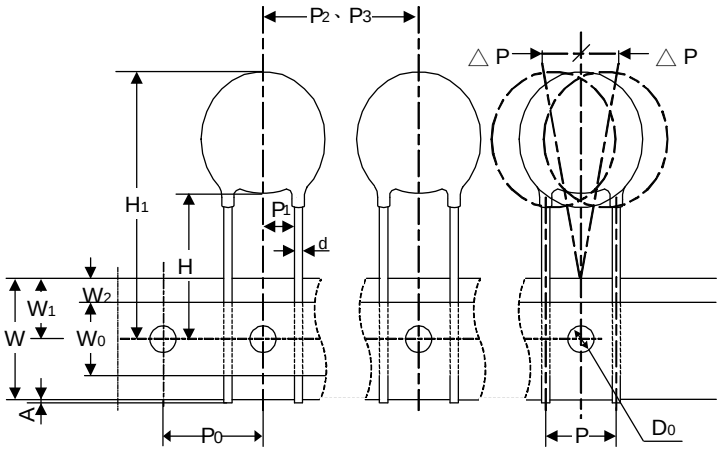
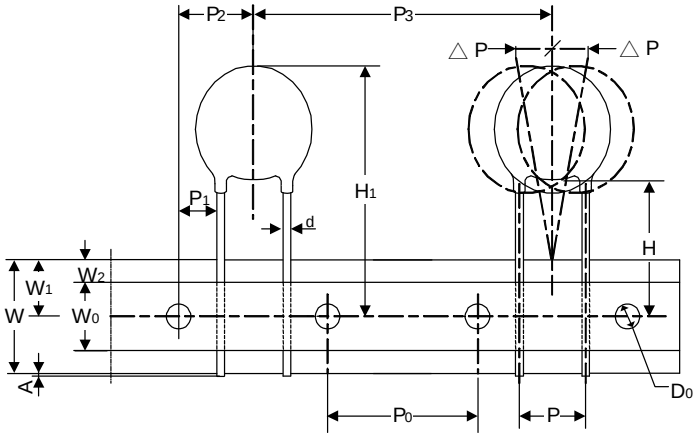


Figure D



(Unit: mm)

Taping Code	Body 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)	07	12.7	5	3.55	6.35	12.7	18	30	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	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	B
	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	C
	20	12.7	7.5	8.55	12.7	25.4	18	40.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	20	12.7	10	7.20	12.7	38.1	18	40.5	1.0	12	9	3	18	1	2	0.5	4	0.6	B
E (P_0=15.0)	07	15	5	4.7	7.5	15	18	30	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	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	A
	14	15	7.5	3.35	7.5	30	18	38	0.8	12	9	3	18	1	2	0.5	4	0.6	D
	20	15	7.5	3.35	7.5	30	18	40.5	0.8	12	9	3	18	1	2	0.5	4	0.6	D

Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

F Type (Y kink lead)

Figure A

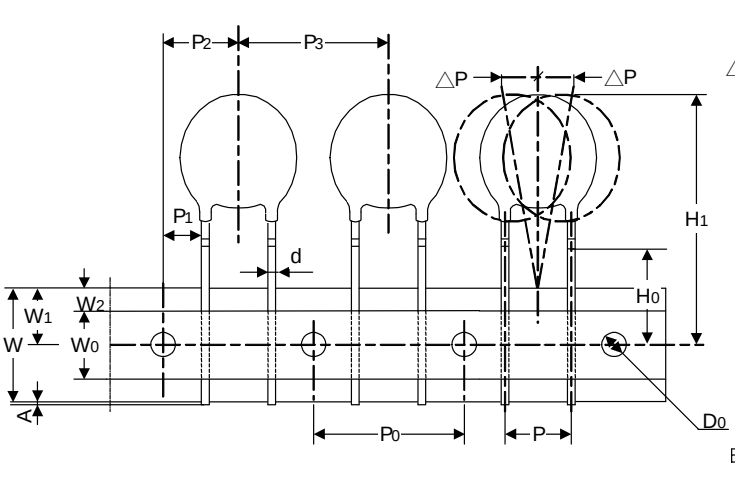


Figure C

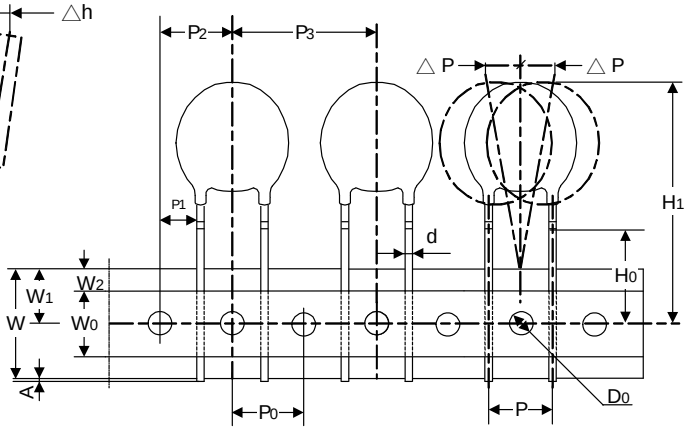


Figure B

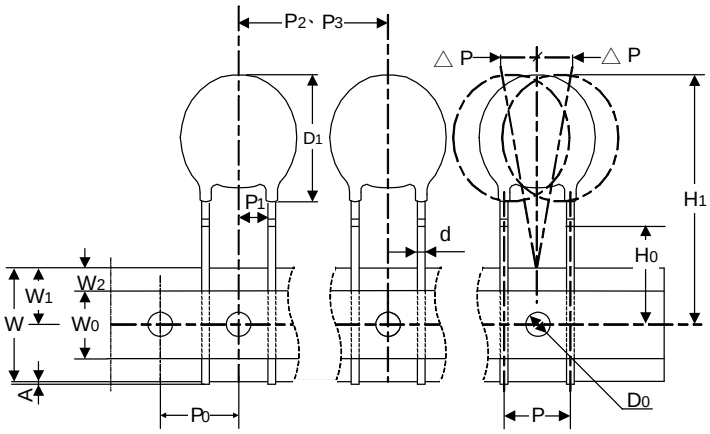
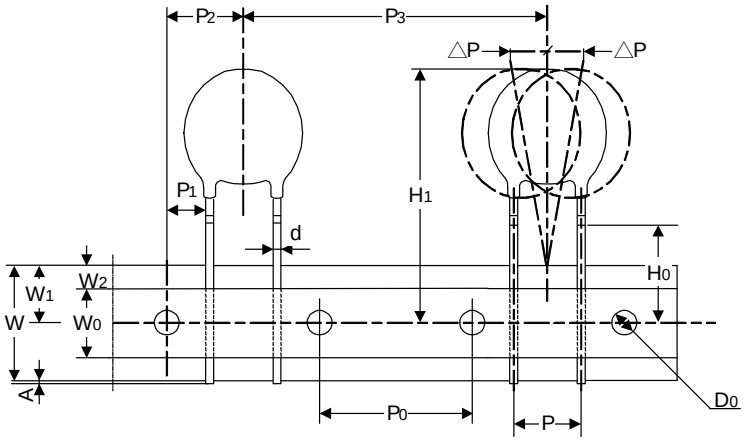


Figure D



(Unit: mm)

Taping Code	Body Size	P_0 ±0.3	P ±1	P_1 ±1	P_2 ±1.3	P_3 ±1	H_0 ±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)	07	12.7	5	3.55	6.35	12.7	16	30	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	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	B
	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	C
	20	12.7	7.5	8.55	12.7	25.4	16	44.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	20	12.7	10	7.20	12.7	38.1	16	44.5	1.0	12	9	3	18	1	2	0.5	4	0.6	B
E (P_0=15.0)	07	15	5	4.7	7.5	15	16	30	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	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	A
	14	15	7.5	3.35	7.5	30	16	38	0.8	12	9	3	18	1	2	0.5	4	0.6	D
	20	15	7.5	3.35	7.5	30	16	44.5	0.8	12	9	3	18	1	2	0.5	4	0.6	D

Metal Oxide Varistor：TVR-Q Series

Disc Type Varistor for Automotive Applications

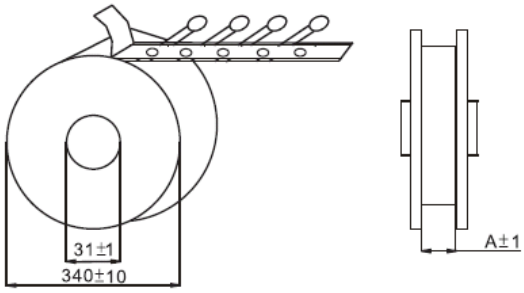
■ Quantity

● Bulk Packing

Body Size	Straight Lead Type Quantity (pcs/ bag)	Cut Lead Type Quantity (pcs/ bag)	Kink Type Quantity (pcs/ box)
TVR07	250	250	200
TVR10	200	200	200
TVR14	100	100	100
TVR20	50	50	50

● Reel Packing

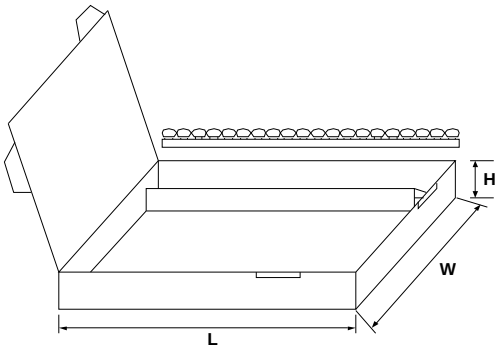
Body Size	W (mm)	Quantity (pcs/reel)
TVR07	46	1,500
TVR10		1,000
TVR14		1,000
TVR20	55	500



(Unit: mm)

● Ammo Packing

Body Size/mm	Quantity (pcs/ box)
TVR07	1,000
TVR10	750
TVR14	500
TVR20	500



(Unit: mm)

Body Size	L±5	W±5	H±5
Φ 07~ Φ 20	348	185	60
	348	275	60
	300	270	62

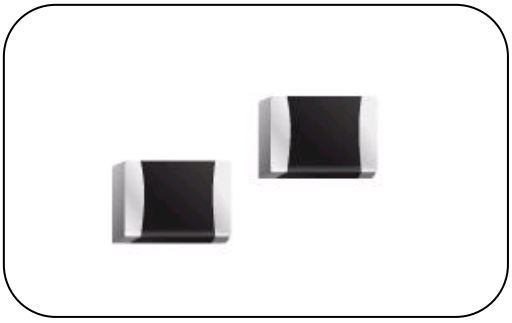
■ Storage Conditions of Products

- 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.

Metal Oxide Varistor for Automotive：TVM-C Series

SMD Type for Transient Overvoltage Protection

■ Features



1. Qualification based on AEC-Q200 Rev-C
2. High surge suppress capability for automotive application (load dump)
3. No temperature derating up to 125 ℃
4. Bidirectional and symmetrical V/I characteristics
5. Stability in high-temperature and high-humidity environment
6. RoHS compliant

■ Recommended Applications

Transient overvoltage protection in automotive applications: engine management, airbag, control units, electro hydraulic brake, ABS/ESP, sunroof

■ Part Number Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Type	
TVM	Thinking Varistor TVM type

Size(EIA)	
0	0402
1	0603
2	0805

Series	
C	Automotive series

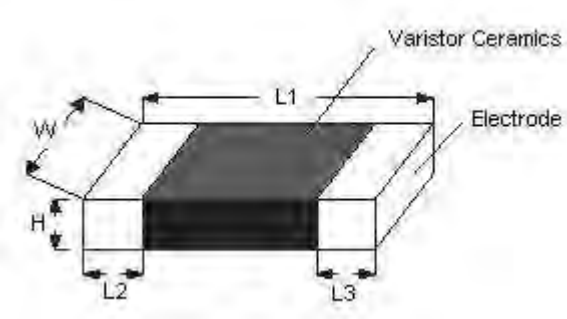
Max. Operating Voltage(V_{DC})	
5R5	5.5V
090	$9x10^0$=9V
330	$33x10^0$=33V

Typical Capacitance	
K102	$10x10^2$pF=1000pF (@1KHZ)

Packaging	
R	Reel
B	Bulk

Optional Suffix
001 ~ZZZ

■ Structure and Dimensions



(Unit: mm)

Part No.	Size (EIA)	L1	W	H max.	L2 and L3
TVM3	1206	3.20 ±0.30	1.60±0.20	1.50	0.50±0.20
TVM4	1210	3.20 ±0.30	2.50±0.25	1.50	0.50±0.20
TVM5	1812	4.50 ±0.40	3.20±0.30	1.50	0.60±0.30
TVM6	2220	5.70±0.40	5.00±0.30	2.00	0.60±0.30

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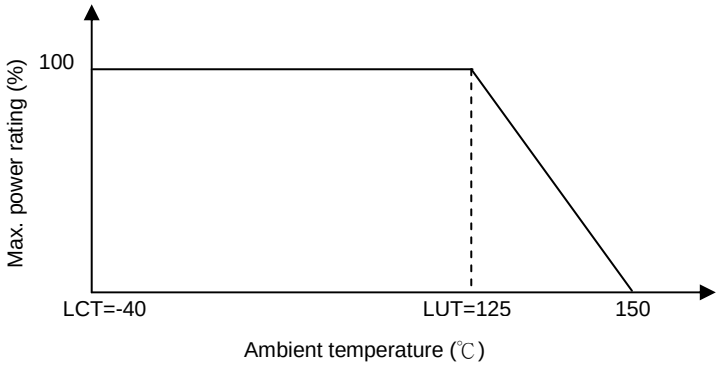
Metal Oxide Varistor for Automotive：TVM-C Series

SMD Type for Transient Overvoltage Protection

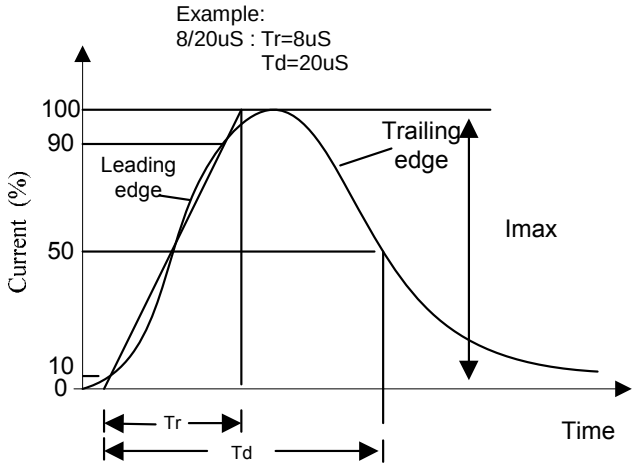
■ Electrical Characteristics

Type	Working Voltage		Vjump (5min)	Varistor Voltage	Max. clamping voltage		Imax (8/20us)	Wmax (10/1000us)	W_{LD} (10x)	Ctyp (1kHz)	Operating Temp. range
	Vrms	Vdc		Vn	Vc	Ic					
	(V)	(V)	(V)	(V)	(V)	(A)	(A)	(J)	(J)	(pF)	(℃)
TVM3C160K102	14	16	24.5	24±10%	40	1	200	0.6	1.5	1000	-55~+125
TVM4C160K242					40	2.5	400	1.6	3.0	2400	
TVM5C160K452					40	5	800	2.4	6	4500	
TVM6C160K103					40	10	1200	5.8	12	10000	
TVM6C160K203					40	20	1500	10.0	25	20000	

■ Power Derating Curve

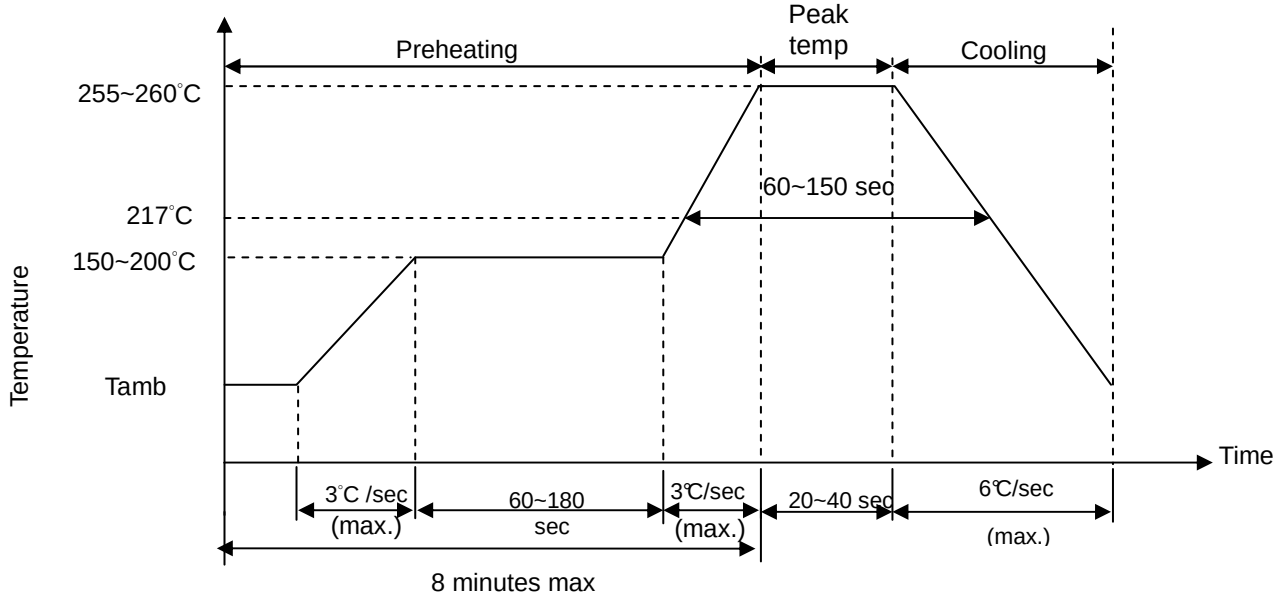


■ Surge Current Standard Waveform



■ Soldering Recommendation

● **IR-Reflow Soldering Profile**

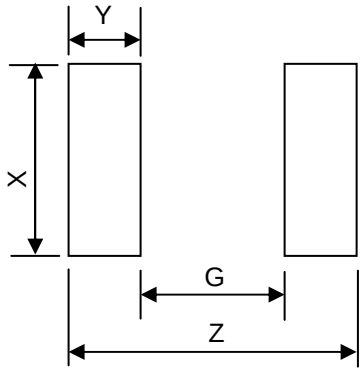


● **Reworking Conditions with Soldering Iron**

Item	Conditions
Temperature of Soldering Iron-tip	360℃ (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ 3mm (max.)

Caution: Do not touch the component surface with soldering iron directly to prevent it from damage.

■ Recommended Soldering Pad Dimensions



Size	Z (mm)	G (mm)	X (mm)	Y (mm)
1206	4.5	2.1	1.8	1.2
1210	4.5	2.1	2.8	1.2
1812	6.0	3.0	3.6	1.5
2220	7.2	4.2	5.5	1.5

■ Reliability

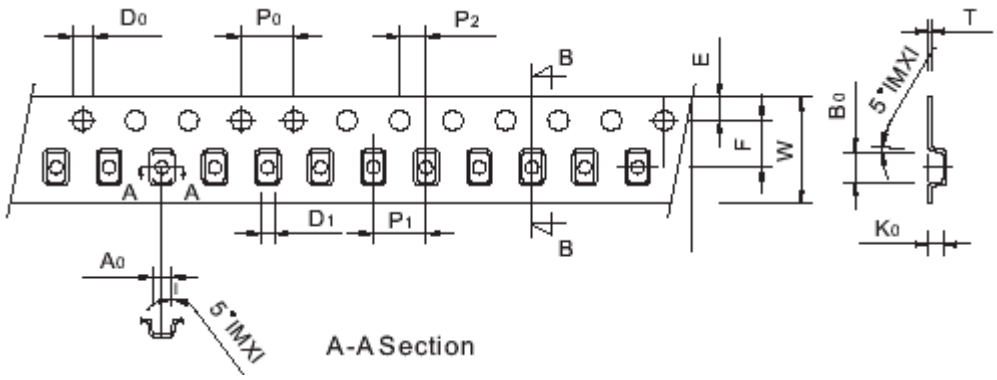
<table>
<tr><th>Item</th><th>Standard</th><th>Test conditions / Methods</th><th>Specifications</th></tr>
<tr><td>High Temperature Exposure (Storage)</td><td>MIL-STD-202 Method 108</td><td>Test temp.：150 +3/-0℃
Duration: 1000 h Unpowered
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦ 10%</td></tr>
<tr><td>Temperature Cycling</td><td>JESD22 Method JA-104</td><td>Lower test temp.：-40 +0/-3°C
Upper test temp.：125 +3/-0°C
Soak time at lower or upper temp.：1 min
Cycle time：2 Cycles/hr
Number of cycles：1000
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦ 10%</td></tr>
<tr><td>Moisture Resistance</td><td>MIL-STD-202 Method 106</td><td>Duration of 1 cycle: 24 h
Number of cycles: 10，Unpowered
Measurement at 24±2 hours after test conclusion.
<table>
<tr><th rowspan="2">Step</th><th colspan="2">Temp.</th><th>humidity</th><th>Period</th></tr>
<tr><th>Start</th><th>Finish</th><th>(%)</th><th>(hr)</th></tr>
<tr><td>1</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr>
<tr><td>2</td><td>65</td><td>65</td><td>90~100</td><td>3</td></tr>
<tr><td>3</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr>
<tr><td>4</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr>
<tr><td>5</td><td>65</td><td>65</td><td>90~100</td><td>3</td></tr>
<tr><td>6</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr>
<tr><td>7</td><td>25</td><td>25</td><td>80~100</td><td>8</td></tr>
</table></td><td>No visible damage
｜△V1mA/V1mA｜≦ 10%</td></tr>
<tr><td>Biased Humidity</td><td>MIL-STD-202 Method 103</td><td>Test temp.：85℃
Rel. humidity of air：85%
Duration: 1000 h
Bias at Working Voltage Vdc.
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
｜△V1mA/V1mA｜≦ 10%</td></tr>
</table>

Item	**Standard**	Test conditions / Methods	Specifications
Operational Life	MIL-STD-202 Method 108	Test temp.: 125 +3/-0℃ Duration: 1000 h Bias at Working Voltage Vdc. Measurement at 24±2 hours after test conclusion.	No visible damage ｜△V1mA/V1mA｜≦ 10%
External Visual	MIL-STD-883 Method 2009	Inspect device construction, marking and workmanship.	No visible damage
Physical Dimension	JESD22 Method JB-100	Verify physical dimensions to the applicable device specification.	Within the specified values
Resistance to Solvents	MIL-STD-202 Method 215	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 part (by volume) of mineral spirits.	No visible damage
Mechanical Shock	MIL-STD -202-213	Test Condition F Peak value：1500g's Half sine Waveform Normal duration (D)： 0.5ms In 3 directions perpendicularly intersecting each other (total 18 times).	No visible damage ｜△V1mA/V1mA｜≦ 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 ｜△V1mA/V1mA｜≦ 10%
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B No pre-heat of samples. Temperature：260±5℃,Time ：10±1s Immersion and emersion rate：25mm/s ±6 mm/s Number of heat cycles：1	No visible damage ｜△V1mA/V1mA｜≦ 10%
Thermal Shock	MIL-STD-202 Method 107	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 ｜△V1mA/V1mA｜≦ 10%

Item	Standard	Test conditions / Methods	Specifications
ESD	AEC-Q200 -002	Discharge capacitance：150 pF Charging voltage: 30 KV Contact discharge 1 pulse in each polarity	No visible damage ｜△V1mA/V1mA｜≦ 10%
Solderability	J-STD-002	a) 4 h @ 155℃ dry heat Dip @235±5℃ 5 +0/-0.5sec b)Steam aging 8h±15min @93±3℃ Dip @260±5℃ 7±0.5sec	95% of termination wetted
Electrical Characterization	Specifications	V1mA(-55°C)、V1mA(25°C)、V1mA(125°C)	Within the specified values
Board Flex	AEC-Q200 -005 (JIS-C-6429)	Bend the board：2mm (Min.) Duration of the applied forces ：60 (+5) Sec	No visible damage ｜△V1mA/V1mA｜≦ 10%
Terminal Strength	AEC-Q200 -006 (JIS-C-6429)	Apply force：1.8kg (17.7 N) Duration of the applied forces ： 60 (+1) Sec	No visible damage ｜△V1mA/V1mA｜≦ 10%
Electrical Transient Conduction	ISO-7637-1	Test pulses 1 to 3	No visible damage ｜△V1mA/V1mA｜≦ 10%

■ Packaging

● Taping Specification

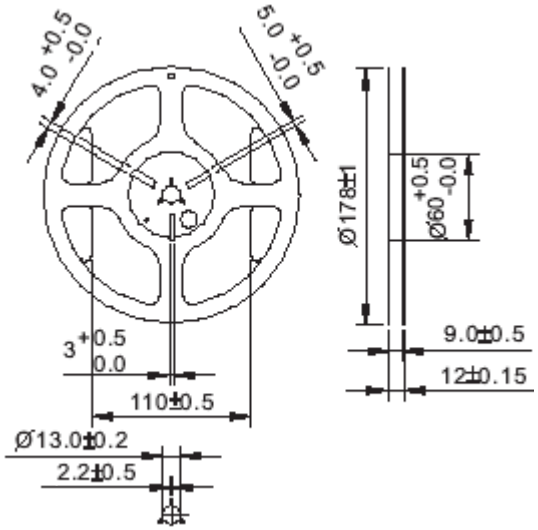


(Unit: mm)

Index / Type	A_0 ±0.2	B_0 ±0.2	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	D_1 ±0.1	T ±0.1
1206	1.85	3.45	8	1.75	3.5	4	2	4	1.55	1	0.25
1210	2.75	3.55	8	1.75	3.5	4	2	4	1.55	1	0.25

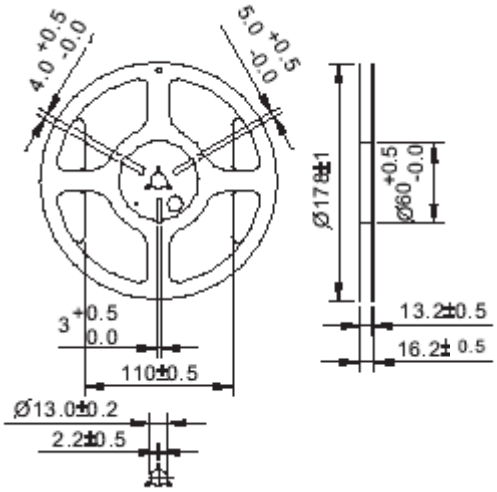
Index / Type	A_0 ±0.2	B_0 ±0.2	W ±0.3	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	D_1 ±0.1	T ±0.1
1812	3.65	4.96	12	1.75	5.5	8	2	4	1.55	1.5	0.25
2220	5.50	6.25	12	1.75	5.5	8	2	4	1.55	1.5	0.25

● Quantity



(Unit: mm)

Type	Quantity (pcs/reel)
1206	2500
1210	2500



(Unit: mm)

Type	Quantity (pcs/reel)
1812	1000
2220	1000

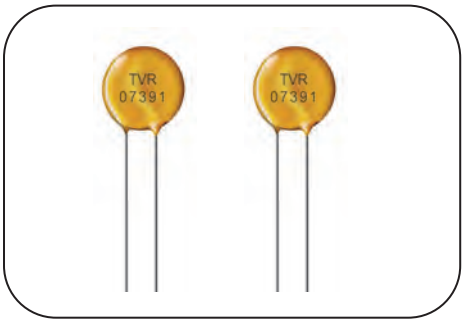
■ Storage Conditions of Products

- 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

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

■ Features



1. RoHS compliant
2. Halogen-free series are available
3. Body size: Φ5 ~ Φ20mm
4. Wide operating voltage range: 11Vac ~ 1000 Vac
5. Operating temperature range: -40°C ~ +85°C
   Storage temperature range: -40°C ~ +125°C
6. Agency recognition: UL 1449 3rd/UL 1414/cUL/VDE/CSA/CQC
7. TVR14181~14112 and TVR20181~20112 meet IEC 60950-1 Annex Q requirement
8. TVR20 series for UL 1449 3rd SPD Type 2 application is available

■ 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

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

Product Type	
TVR	THINKING Varistor TVR Series

Body Size	
05	Φ5mm
07	Φ7mm
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%

Appearance	
S	Straight lead, epoxy coating
F	Y kink lead, epoxy coating
T	L kink lead, epoxy coating

Packaging	
AR	Tape & reel packing (hole pitch:12.7mm)
ER	Tape & reel packing (hole pitch:15.0mm)
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

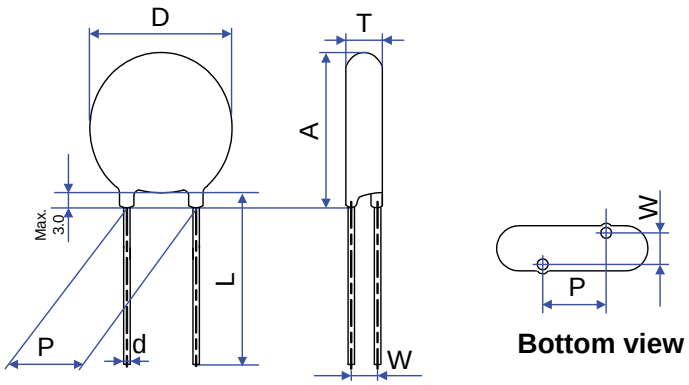
Internal Control Code
01~ZZ

Optional Suffix	
Y	RoHS Compliant
F	RoHS Compliant & Halogen-Free
R	For UL 1449 3rd SPD Type 2 Application (TVR20 only)

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

■ Structures and Dimensions

● S Type (Straight lead)



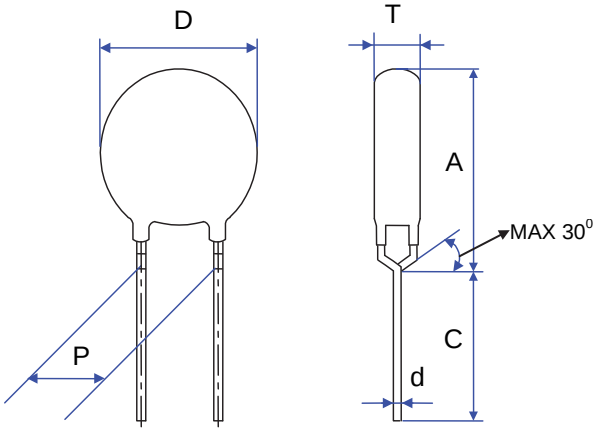
(Unit: mm)

Series	D	Lmin.	d	P	Amax.	Tmax.	W
TVR05	5.0~7.0	26.5	0.6±0.02	5±1	9.0	Please refer to the Electrical Characteristics Table	
TVR07	6.5~9.0	26.5	0.6±0.02	5±1	11.0 (for TVR07180~621) 11.5 (for TVR07681~821)		
TVR10	9.5~12.5 9.5~13.5 (for TVR10182)	26.5	0.8±0.02	7.5±1	15.0 (for TVR10180-112) 15.5 (for TVR10122-182)		
TVR14	13.5~16.0	26.5	0.8±0.02	7.5±1	18.5 (for TVR14180-511) 19.0 (for TVR14561-182)		
TVR20	19.5~22.0	22.5	1.0±0.02	10±1	25.5 (for TVR20180-511) 26.0 (for TVR20561-112) 26.5 (for TVR20122-182)		

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

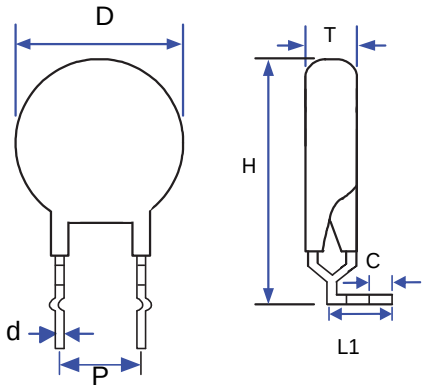
- F Type (Y kink lead)



(Unit: mm)

Series	D	Cmin.	d	P	Amax.	Tmax.
TVR05	5.0~7.0	20	0.6±0.02	5±1	9.5	Please refer to the Electrical Characteristics Table
TVR07	6.5~9.0	20	0.6±0.02	5±1	11.5	
TVR10	9.5~12.5 9.5~13.5 (for TVR10182)	20	0.8±0.02	7.5±1	16.0	
TVR14	13.5 ~16.0	20	0.8±0.02	7.5±1	19.0	
TVR20	19.5~22	20	1.0±0.02	10±1	26.5	

- T Type (L kink lead)



(Unit: mm)

Series	D	C	d	P	Hmax.	L1	Tmax.
TVR10	9.5~12.5 9.5~13.5 (for TVR10182)	3.8±0.8	0.8±0.02	7.5±1	20.0	7.0±1	Please refer to the Electrical Characteristics Table
TVR14	13.5 ~16.0		0.8±0.02	7.5±1	23.5	7.0±1	
TVR20	19.5~22		1.0±0.02	10±1	30.5	9.0±1	

■ 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)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR05180	18 (16~20)	11	14	40	1.0	100	0.01	0.4	1300	2.3	3.9	1.5	For Other Application
TVR05220	22 (20~24)	14	18	48	1.0	100	0.01	0.5	1000	2.4	4.1	1.5	
TVR05270	27 (24~30)	17	22	60	1.0	100	0.01	0.6	850	2.6	4.3	1.5	
TVR05330	33 (30~36)	20	26	73	1.0	100	0.01	0.8	700	2.9	4.5	1.5	
TVR05390	39 (35~43)	25	31	86	1.0	100	0.01	0.9	600	2.9	4.5	1.5	
TVR05470	47 (42~52)	30	38	104	1.0	100	0.01	1.1	500	2.5	4.1	1.5	
TVR05560	56 (50~62)	35	45	123	1.0	100	0.01	1.3	400	2.7	4.3	1.5	
TVR05680	68 (61~75)	40	56	150	1.0	100	0.01	1.6	330	2.9	4.6	1.5	
TVR05820	82 (74~90)	50	65	145	5.0	400	0.1	2.5	250	2.2	3.9	1.5	
TVR05101	100 (90~110)	60	85	175	5.0	400	0.1	3.0	230	2.4	4.1	1.6	
TVR05121	120 (108~132)	75	100	210	5.0	400	0.1	4.0	210	2.5	4.3	1.8	
TVR05151	150 (135~165)	95	125	260	5.0	400	0.1	4.8	190	2.0	4.6	1.6	
TVR05181	180 (162~198)	115	150	315	5.0	400	0.1	5.9	70	2.0	3.9	1.4	
TVR05201	200 (180~220)	130	170	355	5.0	400	0.1	6.5	65	2.1	4.0	1.5	
TVR05221	220 (198~242)	140	180	380	5.0	400	0.1	7.0	60	2.1	4.0	1.5	
TVR05241	240 (216~264)	150	200	415	5.0	400	0.1	8.0	55	2.3	4.2	1.6	
TVR05271	270 (243~297)	175	225	475	5.0	400	0.1	8.5	50	2.4	4.4	1.7	
TVR05301	300 (270~330)	195	250	525	5.0	400	0.1	8.5	50	2.7	4.4	1.9	
TVR05331	330 (297~363)	215	275	585	5.0	400	0.1	9.2	45	2.8	4.5	2.0	
TVR05361	360 (324~396)	230	300	620	5.0	400	0.1	10	45	2.9	4.6	2.1	
TVR05391	390 (351~429)	250	320	675	5.0	400	0.1	12	40	3.1	4.8	2.3	
TVR05431	430 (387~473)	275	350	745	5.0	400	0.1	13	35	3.0	5.1	2.3	
TVR05471	470 (423~517)	300	385	810	5.0	400	0.1	15	30	3.2	5.2	2.4	
TVR05511	510 (459~561)	320	410	878	5.0	400	0.1	16	30	3.4	5.4	2.6	
TVR05561	560 (504~616)	350	450	962	5.0	400	0.1	18	30	3.6	5.5	2.8	
TVR05621	620 (558~682)	395	510	1050	5.0	400	0.1	18	25	3.9	5.9	3.0	
TVR05681	680 (612~748)	420	560	1120	5.0	400	0.1	18	20	4.1	6.2	3.2	
TVR05751	750 (675~825)	460	615	1240	5.0	400	0.1	18	20	4.4	6.4	3.5	

Metal Oxide Varistor：TVR Series

Disc Type 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)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR07180	18 (16~20)	11	14	36	2.5	250	0.02	0.9	2400	2.3	3.9	1.3	For Other Application
TVR07220	22 (20~24)	14	18	43	2.5	250	0.02	1.1	2000	2.4	4.1	1.4	
TVR07270	27 (24~30)	17	22	53	2.5	250	0.02	1.4	1600	2.6	4.3	1.5	
TVR07330	33 (30~36)	20	26	65	2.5	250	0.02	1.7	1300	2.9	4.5	1.7	
TVR07390	39 (35~43)	25	31	77	2.5	250	0.02	2.1	1200	2.9	4.5	1.8	
TVR07470	47 (42~52)	30	38	93	2.5	250	0.02	2.5	1100	2.5	4.1	1.9	
TVR07560	56 (50~62)	35	45	110	2.5	250	0.02	3.1	1000	2.7	4.3	2.0	
TVR07680	68 (61~75)	40	56	135	2.5	250	0.02	3.6	850	2.9	4.6	2.1	
TVR07820	82 (74~90)	50	65	135	10	1200	0.25	5.5	460	2.2	3.9	1.5	
TVR07101	100 (90~110)	60	85	165	10	1200	0.25	6.5	420	2.4	4.1	1.6	
TVR07121	120 (108~132)	75	100	200	10	1200	0.25	7.8	380	2.5	4.3	1.8	
TVR07151	150 (135~165)	95	125	250	10	1200	0.25	9.7	350	2.0	4.6	1.6	
TVR07181	180 (162~198)	115	150	300	10	1200	0.25	11.7	155	2.0	3.9	1.4	
TVR07201	200 (180~220)	130	170	340	10	1200	0.25	13	140	2.1	4.0	1.5	
TVR07221	220 (198~242)	140	180	360	10	1200	0.25	14	130	2.1	4.0	1.5	
TVR07241	240 (216~264)	150	200	395	10	1200	0.25	15	120	2.3	4.2	1.6	
TVR07271	270 (243~297)	175	225	455	10	1200	0.25	18	110	2.4	4.4	1.7	
TVR07301	300 (270~330)	195	250	500	10	1200	0.25	21	105	2.7	4.4	1.9	
TVR07331	330 (297~363)	215	275	550	10	1200	0.25	23	100	2.8	4.5	2.0	
TVR07361	360 (324~396)	230	300	595	10	1200	0.25	25	95	2.9	4.6	2.1	
TVR07391	390 (351~429)	250	320	650	10	1200	0.25	25	85	3.1	4.8	2.3	
TVR07431	430 (387~473)	275	350	710	10	1200	0.25	28	80	3.0	5.1	2.3	
TVR07471	470 (423~517)	300	385	775	10	1200	0.25	30	70	3.2	5.2	2.4	
TVR07511	510 (459~561)	320	410	845	10	1200	0.25	33	65	3.4	5.4	2.6	
TVR07561	560 (504~616)	350	450	930	10	1200	0.25	33	60	3.6	5.5	2.8	
TVR07621	620 (558~682)	395	510	1020	10	1200	0.25	35	55	3.9	5.9	3.0	
TVR07681	680 (612~748)	420	560	1120	10	1200	0.25	35	50	4.1	6.2	3.2	
TVR07751	750 (675~825)	465	615	1235	10	1200	0.25	38	45	4.4	6.4	3.5	
TVR07821	820 (738~902)	510	670	1355	10	1200	0.25	42	40	4.5	6.4	3.2	

Metal Oxide Varistor：TVR Series

Disc Type 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)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR10180	18 (16~20)	11	14	36	5.0	500	0.05	2.1	4500	2.7	4.3	1.3	For Other Application
TVR10220	22 (20~24)	14	18	43	5.0	500	0.05	2.5	3500	2.8	4.5	1.4	
TVR10270	27 (24~30)	17	22	53	5.0	500	0.05	3.0	3000	3.0	4.7	1.5	
TVR10330	33 (30~36)	20	26	65	5.0	500	0.05	4.0	2500	3.3	4.9	1.7	
TVR10390	39 (35~43)	25	31	77	5.0	500	0.05	4.6	2000	3.4	5.1	1.8	
TVR10470	47 (42~52)	30	38	93	5.0	500	0.05	5.5	1500	2.9	4.5	1.8	
TVR10560	56 (50~62)	35	45	110	5.0	500	0.05	7.0	1350	3.1	4.7	1.9	
TVR10680	68 (61~75)	40	56	135	5.0	500	0.05	8.2	1250	3.3	5.0	2.2	
TVR10820	82 (74~90)	50	65	135	25	2500	0.4	12	1000	2.6	4.3	1.6	
TVR10101	100 (90~110)	60	85	165	25	2500	0.4	15	920	2.8	4.5	1.8	
TVR10121	120 (108~132)	75	100	200	25	2500	0.4	18	830	2.9	4.7	2.0	
TVR10151	150 (135~165)	95	125	250	25	2500	0.4	22	760	2.4	5.0	1.8	
TVR10181	180 (162~198)	115	150	300	25	2500	0.4	27	310	2.4	4.3	1.6	
TVR10201	200 (180~220)	130	170	340	25	2500	0.4	30	290	2.5	4.4	1.7	
TVR10221	220 (198~242)	140	180	360	25	2500	0.4	32	270	2.5	4.4	1.7	
TVR10241	240 (216~264)	150	200	395	25	2500	0.4	35	240	2.7	4.6	1.8	
TVR10271	270 (243~297)	175	225	455	25	2500	0.4	40	230	2.8	4.8	1.9	
TVR10301	300 (270~330)	195	250	500	25	2500	0.4	40	210	3.1	4.8	2.1	
TVR10331	330 (297~363)	215	275	550	25	2500	0.4	43	200	3.2	4.9	2.2	
TVR10361	360 (324~396)	230	300	595	25	2500	0.4	47	190	3.3	5.0	2.3	
TVR10391	390 (351~429)	250	320	650	25	2500	0.4	60	175	3.5	5.2	2.5	
TVR10431	430 (387~473)	275	350	710	25	2500	0.4	65	160	3.4	5.5	2.5	
TVR10471	470 (423~517)	300	385	775	25	2500	0.4	70	150	3.6	5.6	2.6	
TVR10511	510 (459~561)	320	410	845	25	2500	0.4	70	130	3.8	5.8	2.8	
TVR10561	560 (504~616)	350	450	930	25	2500	0.4	70	120	4.0	5.9	3.0	
TVR10621	620 (558~682)	395	510	1020	25	2500	0.4	70	110	4.3	6.3	3.2	
TVR10681	680 (612~748)	420	560	1120	25	2500	0.4	70	100	4.5	6.6	3.4	
TVR10751	750 (675~825)	465	615	1235	25	2500	0.4	75	90	4.8	6.8	3.7	
TVR10821	820 (738~902)	510	670	1355	25	2500	0.4	85	80	4.9	6.8	3.4	
TVR10911	910 (819~1001)	550	745	1500	25	2500	0.4	93	70	5.3	7.2	3.7	
TVR10102	1000 (900~1100)	625	825	1650	25	2500	0.4	102	65	5.5	7.5	4.0	
TVR10112	1100 (990~1210)	680	895	1815	25	2500	0.4	115	60	5.7	8.0	4.3	
TVR10122	1200 (1080~1320)	725	975	1980	25	2500	0.4	125	55	6.0	8.1	5.2	
TVR10142	1400 (1260~1540)	820	1140	2300	25	2500	0.4	145	45	6.6	8.7	6.0	
TVR10162	1600 (1440~1760)	910	1300	2630	25	2500	0.4	165	40	7.1	9.8	6.7	
TVR10182	1800 (1620~1980)	1000	1465	2950	25	2500	0.4	185	35	7.8	10.3	7.4	

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

14mm 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 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR14180	18 (16~20)	11	14	36	10	1000	0.1	4.0	10000	2.7	4.3	1.3	For Other Application
TVR14220	22 (20~24)	14	18	43	10	1000	0.1	5.0	8500	2.8	4.5	1.4	
TVR14270	27 (24~30)	17	22	53	10	1000	0.1	6.0	7000	3.0	4.7	1.5	
TVR14330	33 (30~36)	20	26	65	10	1000	0.1	7.5	6000	3.3	4.9	1.7	
TVR14390	39 (35~43)	25	31	77	10	1000	0.1	8.6	4800	3.4	5.1	1.8	
TVR14470	47 (42~52)	30	38	93	10	1000	0.1	10	3800	2.9	4.5	1.8	
TVR14560	56 (50~62)	35	45	110	10	1000	0.1	11	3300	3.1	4.7	1.9	
TVR14680	68 (61~75)	40	56	135	10	1000	0.1	14	2700	3.3	5.0	2.2	
TVR14820	82 (74~90)	50	65	135	50	4500	0.6	22	2100	2.6	4.3	1.6	For SPD Type 3 Application
TVR14101	100 (90~110)	60	85	165	50	4500	0.6	28	1900	2.8	4.5	1.8	
TVR14121	120 (108~132)	75	100	200	50	4500	0.6	32	1700	2.9	4.7	2.0	
TVR14151	150 (135~165)	95	125	250	50	4500	0.6	40	940	2.4	5.0	1.8	
TVR14181	180 (162~198)	115	150	300	50	4500	0.6	52	800	2.4	4.3	1.6	
TVR14201	200 (180~220)	130	170	340	50	4500	0.6	57	700	2.5	4.4	1.7	
TVR14221	220 (198~242)	140	180	360	50	4500	0.6	60	640	2.5	4.4	1.7	
TVR14241	240 (216~264)	150	200	395	50	4500	0.6	63	580	2.7	4.6	1.8	
TVR14271	270 (243~297)	175	225	455	50	4500	0.6	70	520	2.8	4.8	1.9	
TVR14301	300 (270~330)	195	250	500	50	4500	0.6	78	480	3.1	4.8	2.1	
TVR14331	330 (297~363)	215	275	550	50	4500	0.6	85	450	3.2	4.9	2.2	
TVR14361	360 (324~396)	230	300	595	50	4500	0.6	93	430	3.3	5.0	2.3	
TVR14391	390 (351~429)	250	320	650	50	4500	0.6	100	390	3.5	5.2	2.5	
TVR14431	430 (387~473)	275	350	710	50	4500	0.6	115	370	3.4	5.5	2.5	
TVR14471	470 (423~517)	300	385	775	50	4500	0.6	125	320	3.6	5.6	2.6	
TVR14511	510 (459~561)	320	410	845	50	4500	0.6	125	290	3.8	5.8	2.8	
TVR14561	560 (504~616)	350	450	930	50	4500	0.6	125	260	4.0	5.9	3.0	
TVR14621	620 (558~682)	395	510	1020	50	4500	0.6	125	240	4.3	6.3	3.2	
TVR14681	680 (612~748)	420	560	1120	50	4500	0.6	130	230	4.5	6.6	3.4	
TVR14751	750 (675~825)	465	615	1235	50	4500	0.6	143	220	4.8	6.8	3.7	
TVR14821	820 (738~902)	510	670	1355	50	4500	0.6	157	180	4.9	6.8	3.4	
TVR14911	910 (819~1001)	550	745	1500	50	4500	0.6	175	170	5.3	7.2	3.7	
TVR14102	1000 (900~1100)	625	825	1650	50	4500	0.6	190	150	5.5	7.5	4.0	
TVR14112	1100 (990~1210)	680	895	1815	50	4500	0.6	213	140	5.6	8.0	4.3	
TVR14122	1200 (1080~1320)	725	975	1980	50	4500	0.6	230	130	6.0	8.1	5.2	
TVR14142	1400 (1260~1540)	820	1140	2300	50	4500	0.6	250	110	6.6	8.7	6.0	
TVR14162	1600 (1440~1760)	910	1300	2630	50	4500	0.6	315	95	7.1	9.8	6.7	
TVR14182	1800 (1620~1980)	1000	1465	2950	50	4500	0.6	354	85	7.8	10.3	7.4	

Metal Oxide Varistor：TVR Series

Disc Type 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)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR20180	18 (16~20)	11	14	36	20	2000	0.2	11	19000	3.1	4.7	1.3	For Other Application
TVR20220	22 (20~24)	14	18	43	20	2000	0.2	14	16000	3.2	4.9	1.4	
TVR20270	27 (24~30)	17	22	53	20	2000	0.2	18	14500	3.4	5.1	1.5	
TVR20330	33 (30~36)	20	26	65	20	2000	0.2	23	13000	3.7	5.3	1.7	
TVR20390	39 (35~43)	25	31	77	20	2000	0.2	26	12000	3.8	5.5	1.7	
TVR20470	47 (42~52)	30	38	93	20	2000	0.2	33	11000	3.3	4.9	1.8	
TVR20560	56 (50~62)	35	45	110	20	2000	0.2	41	9000	3.5	5.1	2.0	
TVR20680	68 (61~75)	40	56	135	20	2000	0.2	46	7500	3.7	5.4	2.2	
TVR20820	82 (74~90)	50	65	135	100	6500	1.0	48	4800	3.0	4.7	1.8	For SPD Type 3 Application
TVR20101	100 (90~110)	60	85	165	100	6500	1.0	51	3900	3.2	4.9	2.0	
TVR20121	120 (108~132)	75	100	200	100	6500	1.0	55	3300	3.3	5.1	2.2	
TVR20151	150 (135~165)	95	125	250	100	6500	1.0	70	1950	2.8	5.4	2.0	
TVR20181	180 (162~198)	115	150	300	100	6500	1.0	84	1620	2.8	4.7	1.8	
TVR20201	200 (180~220)	130	170	340	100	6500	1.0	95	1460	2.9	4.8	1.9	
TVR20221	220 (198~242)	140	180	360	100	6500	1.0	100	1320	2.9	4.8	1.9	
TVR20241	240 (216~264)	150	200	395	100	6500	1.0	108	1200	3.1	5.0	2.0	
TVR20271	270 (243~297)	175	225	455	100	6500	1.0	127	1100	3.2	5.2	2.1	
TVR20301	300 (270~330)	195	250	500	100	6500	1.0	136	1000	3.5	5.2	2.3	
TVR20331	330 (297~363)	215	275	550	100	6500	1.0	150	950	3.6	5.3	2.4	
TVR20361	360 (324~396)	230	300	595	100	6500	1.0	163	900	3.7	5.4	2.5	
TVR20391	390 (351~429)	250	320	650	100	6500	1.0	180	800	3.9	5.6	2.7	
TVR20431	430 (387~473)	275	350	710	100	6500	1.0	190	700	3.8	5.9	2.7	
TVR20471	470 (423~517)	300	385	775	100	6500	1.0	220	620	4.0	6.0	2.8	
TVR20511	510 (459~561)	320	410	845	100	6500	1.0	220	530	4.2	6.2	3.0	
TVR20561	560 (504~616)	350	450	930	100	6500	1.0	220	480	4.4	6.3	3.2	
TVR20621	620 (558~682)	395	510	1020	100	6500	1.0	220	450	4.7	6.7	3.4	
TVR20681	680 (612~748)	420	560	1120	100	6500	1.0	230	440	4.9	7.0	3.6	
TVR20751	750 (675~825)	465	615	1235	100	6500	1.0	255	420	5.2	7.2	3.9	
TVR20821	820 (738~902)	510	670	1355	100	6500	1.0	282	390	5.3	7.2	3.6	
TVR20911	910 (819~1001)	550	745	1500	100	6500	1.0	310	360	5.7	7.6	3.9	
TVR20102	1000 (900~1100)	625	825	1650	100	6500	1.0	342	330	6.1	7.9	4.2	
TVR20112	1100 (990~1210)	680	895	1815	100	6500	1.0	383	310	6.2	8.4	4.5	
TVR20122	1200 (1080~1320)	725	975	1980	100	6500	1.0	415	290	6.4	8.5	5.4	
TVR20142	1400 (1260~1540)	820	1140	2300	100	6500	1.0	480	250	7.0	9.1	6.2	
TVR20162	1600 (1440~1760)	910	1300	2630	100	6500	1.0	550	220	7.5	10.2	6.9	
TVR20182	1800 (1620~1980)	1000	1465	2950	100	6500	1.0	620	195	8.5	10.7	7.6	

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

20mm Series for SPD Type 2 Application

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Nominal Discharge Current *1 (8/20μs)	Rated Power	Max. Energy (10/1000μs)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	In	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
	(V)	(V)	(V)	(V)	(A)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR20820R	82 (74~90)	50	65	135	100	6500	3000	1.0	48	4800	3.0	4.7	1.8	For SPD Type 2 Application
TVR20101R	100 (90~110)	60	85	165	100	6500	3000	1.0	51	3900	3.2	4.9	2.0	
TVR20121R	120 (108~132)	75	100	200	100	6500	3000	1.0	55	3300	3.3	5.1	2.2	
TVR20151R	150 (135~165)	95	125	250	100	6500	3000	1.0	70	1950	2.8	5.4	2.0	
TVR20181R	180 (162~198)	115	150	300	100	6500	3000	1.0	84	1620	2.8	4.7	1.8	
TVR20201R	200 (180~220)	130	170	340	100	6500	3000	1.0	95	1460	2.9	4.8	1.9	
TVR20221R	220 (198~242)	140	180	360	100	6500	3000	1.0	100	1320	2.9	4.8	1.9	
TVR20241R	240 (216~264)	150	200	395	100	6500	3000	1.0	108	1200	3.1	5.0	2.0	
TVR20271R	270 (243~297)	175	225	455	100	6500	3000	1.0	127	1100	3.2	5.2	2.1	
TVR20301R	300 (270~330)	195	250	500	100	6500	3000	1.0	136	1000	3.5	5.2	2.3	
TVR20331R	330 (297~363)	215	275	550	100	6500	3000	1.0	150	950	3.6	5.3	2.4	
TVR20361R	360 (324~396)	230	300	595	100	6500	3000	1.0	163	900	3.7	5.4	2.5	
TVR20391R	390 (351~429)	250	320	650	100	6500	3000	1.0	180	800	3.9	5.6	2.7	
TVR20431R	430 (387~473)	275	350	710	100	6500	3000	1.0	190	700	3.8	5.9	2.7	
TVR20471R	470 (423~517)	300	385	775	100	6500	3000	1.0	220	620	4.0	6.0	2.8	
TVR20511R	510 (459~561)	320	410	845	100	6500	3000	1.0	220	530	4.2	6.2	3.0	
TVR20561R	560 (504~616)	350	450	930	100	6500	3000	1.0	220	480	4.4	6.3	3.2	
TVR20621R	620 (558~682)	395	510	1020	100	6500	3000	1.0	220	450	4.7	6.7	3.4	
TVR20681R	680 (612~748)	420	560	1120	100	6500	3000	1.0	230	440	4.9	7.0	3.6	
TVR20751R	750 (675~825)	465	615	1235	100	6500	3000	1.0	255	420	5.2	7.2	3.9	
TVR20821R	820 (738~902)	510	670	1355	100	6500	3000	1.0	282	390	5.3	7.2	3.6	
TVR20911R	910 (819~1001)	550	745	1500	100	6500	3000	1.0	310	360	5.7	7.6	3.9	
TVR20102R	1000 (900~1100)	625	825	1650	100	6500	3000	1.0	342	330	6.1	7.9	4.2	
TVR20112R	1100 (990~1210)	680	895	1815	100	6500	3000	1.0	383	310	6.2	8.4	4.5	
TVR20122R	1200 (1080~1320)	725	975	1980	100	6500	3000	1.0	415	290	6.4	8.5	5.4	
TVR20142R	1400 (1260~1540)	820	1140	2300	100	6500	3000	1.0	480	250	7.0	9.1	6.2	
TVR20162R	1600 (1440~1760)	910	1300	2630	100	6500	3000	1.0	550	220	7.5	10.2	6.9	
TVR20182R	1800 (1620~1980)	1000	1465	2950	100	6500	3000	1.0	620	195	8.5	10.7	7.6	

Note:

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

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

■ Safety Approvals

Certified Model No.	Agency				
	c UL us	c UL us	CSA	VDE	CQC
	UL1449 3rd & cUL: E314979	UL1414 & cUL: E186499	97495	5944	CQC03001005165 CQC03001007654
TVR05180	√			√	√
TVR05220	√			√	√
TVR05270	√			√	√
TVR05330	√			√	√
TVR05390	√			√	√
TVR05470	√			√	√
TVR05560	√			√	√
TVR05680	√			√	√
TVR05820	√			√	√
TVR05101	√			√	√
TVR05121	√			√	√
TVR05151	√			√	√
TVR05181	√			√	√
TVR05201	√		√	√	√
TVR05221	√		√	√	√
TVR05241	√		√	√	√
TVR05271	√		√	√	√
TVR05301	√		√	√	√
TVR05331	√		√	√	√
TVR05361	√		√	√	√
TVR05391	√		√	√	√
TVR05431	√		√	√	√
TVR05471	√		√	√	√
TVR05511				√	
TVR05561				√	
TVR05621				√	
TVR05681				√	
TVR05751					

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

Certified Model No.	Agency				
	c UL us	c UL us	CSA	VDE	CQC
	UL1449 3rd & cUL: E314979	UL1414 & cUL: E186499	97495	5944	CQC03001005165 CQC03001007654
TVR07180	√			√	√
TVR07220	√			√	√
TVR07270	√			√	√
TVR07330	√			√	√
TVR07390	√			√	√
TVR07470	√			√	√
TVR07560	√			√	√
TVR07680	√			√	√
TVR07820	√			√	√
TVR07101	√			√	√
TVR07121	√			√	√
TVR07151	√			√	√
TVR07181	√			√	√
TVR07201	√	√	√	√	√
TVR07221	√	√	√	√	√
TVR07241	√	√	√	√	√
TVR07271	√	√	√	√	√
TVR07301	√	√	√	√	√
TVR07331	√	√	√	√	√
TVR07361	√	√	√	√	√
TVR07391	√	√	√	√	√
TVR07431	√	√	√	√	√
TVR07471	√	√	√	√	√
TVR07511	√	√		√	√
TVR07561	√	√		√	√
TVR07621	√	√	√	√	√
TVR07681	√	√	√	√	√
TVR07751	√		√	√	√
TVR07821	√		√	√	√

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

Certified Model No.	Agency					
	c UL us	c UL us	CSA	VDE	CQC	
	UL1449 3rd & cUL: E314979	UL1414 & cUL: E186499	97495	5944	GB/T10193-1997 GB/T10194-1997 CQC03001005165 CQC03001007654	GB8898-2011 GB4943.1-2011 CQC03001005165 CQC03001007654
TVR10180	√			√	√	
TVR10220	√			√	√	
TVR10270	√			√	√	
TVR10330	√			√	√	
TVR10390	√			√	√	
TVR10470	√			√	√	
TVR10560	√			√	√	
TVR10680	√			√	√	
TVR10820	√			√	√	
TVR10101	√			√	√	
TVR10121	√			√	√	
TVR10151	√			√	√	
TVR10181	√			√	√	
TVR10201	√	√	√	√	√	√
TVR10221	√	√	√	√	√	√
TVR10241	√	√	√	√	√	√
TVR10271	√	√	√	√	√	√
TVR10301	√	√	√	√	√	√
TVR10331	√	√	√	√	√	√
TVR10361	√	√	√	√	√	√
TVR10391	√	√	√	√	√	√
TVR10431	√	√	√	√	√	√
TVR10471	√	√	√	√	√	√
TVR10511	√	√		√	√	√
TVR10561	√	√		√	√	√
TVR10621	√	√	√	√	√	√
TVR10681	√	√	√	√	√	√
TVR10751	√	√	√	√	√	√
TVR10821	√	√	√	√	√	√
TVR10911	√	√	√	√	√	√
TVR10102	√	√	√	√	√	√
TVR10112	√	√	√	√	√	√
TVR10122	√					
TVR10142	√					
TVR10162	√					
TVR10182	√					

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

Certified Model No.	Agency						
	c UL us	c UL us	CSA	VDE		CQC	
	UL1449 3rd & cUL: E314979	UL1414 & cUL: E186499	97495	5944	IEC60950-1 2nd Annex Q	GB/T10193-1997 GB/T10194-1997 CQC03001005165 CQC03001007654	GB8898-2011 GB4943.1-2011 CQC03001005165 CQC03001007654
TVR14180	√			√		√	
TVR14220	√			√		√	
TVR14270	√			√		√	
TVR14330	√			√		√	
TVR14390	√			√		√	
TVR14470	√			√		√	
TVR14560	√			√		√	
TVR14680	√			√		√	
TVR14820	√			√		√	
TVR14101	√			√		√	
TVR14121	√			√		√	
TVR14151	√			√		√	
TVR14181	√			√	√	√	
TVR14201	√	√	√	√	√	√	√
TVR14221	√	√	√	√	√	√	√
TVR14241	√	√	√	√	√	√	√
TVR14271	√	√	√	√	√	√	√
TVR14301	√	√	√	√	√	√	√
TVR14331	√	√	√	√	√	√	√
TVR14361	√	√	√	√	√	√	√
TVR14391	√	√	√	√	√	√	√
TVR14431	√	√	√	√	√	√	√
TVR14471	√	√	√	√	√	√	√
TVR14511	√	√		√	√	√	√
TVR14561	√	√		√	√	√	√
TVR14621	√	√	√	√	√	√	√
TVR14681	√	√	√	√	√	√	√
TVR14751	√	√	√	√	√	√	√
TVR14821	√	√	√	√	√	√	√
TVR14911	√	√	√	√	√	√	√
TVR14102	√	√	√	√	√	√	√
TVR14112	√	√	√	√	√	√	√
TVR14122	√			√	√		
TVR14142	√			√	√		
TVR14162	√			√	√		
TVR14182	√			√	√		

Metal Oxide Varistor：TVR Series

Disc Type Varistor for Surge Protection

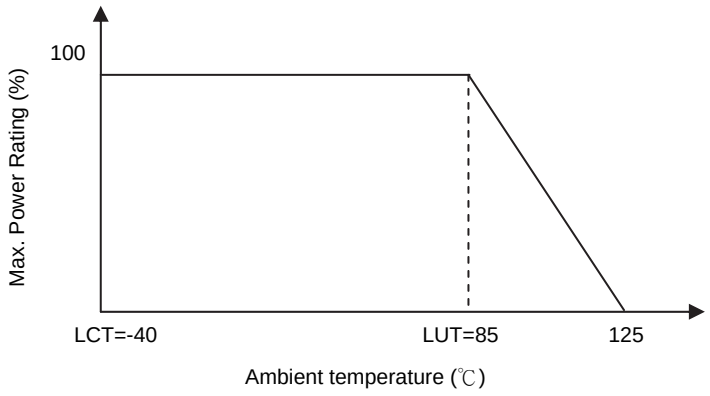
Certified Model No.	Agency						
	c UL us	c UL us	CSA	VDE		CQC	
	UL1449 3rd & cUL: E314979	UL1414 & cUL: E186499	97495	5944	IEC60950-1 2nd Annex Q	GB/T10193-1997 GB/T10194-1997 CQC03001005165 CQC03001007654	GB8898-2011 GB4943.1-2011 CQC03001005165 CQC03001007654
TVR20180	√			√		√	
TVR20220	√			√		√	
TVR20270	√			√		√	
TVR20330	√			√		√	
TVR20390	√			√		√	
TVR20470	√			√		√	
TVR20560	√			√		√	
TVR20680	√			√		√	
TVR20820	√			√		√	
TVR20101	√			√		√	
TVR20121	√			√		√	
TVR20151	√			√		√	
TVR20181	√			√	√	√	
TVR20201	√	√	√	√	√	√	√
TVR20221	√	√	√	√	√	√	√
TVR20241	√	√	√	√	√	√	√
TVR20271	√	√	√	√	√	√	√
TVR20301	√	√	√	√	√	√	√
TVR20331	√	√	√	√	√	√	√
TVR20361	√	√	√	√	√	√	√
TVR20391	√	√	√	√	√	√	√
TVR20431	√	√	√	√	√	√	√
TVR20471	√	√	√	√	√	√	√
TVR20511	√	√		√	√	√	√
TVR20561	√	√		√	√	√	√
TVR20621	√	√	√	√	√	√	√
TVR20681	√	√	√	√	√	√	√
TVR20751	√	√	√	√	√	√	√
TVR20821	√	√	√	√	√	√	√
TVR20911	√	√	√	√	√	√	√
TVR20102	√	√	√	√	√	√	√
TVR20112	√	√	√	√	√	√	√
TVR20122	√			√	√		
TVR20142	√			√	√		
TVR20162	√			√	√		
TVR20182	√			√	√		

Metal Oxide Varistor：TVR Series

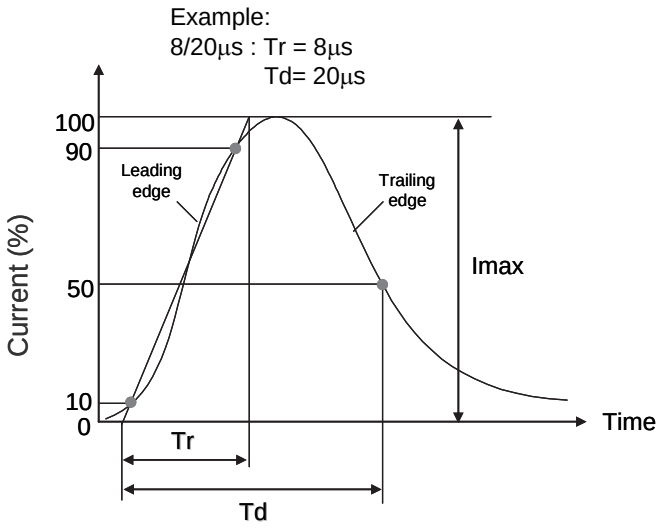
Disc Type Varistor for Surge Protection

Certified Model No.	Agency				
	c UL us	VDE		CQC	
	UL1449 3rd & cUL: E314979	5944	IEC60950-1 2nd Annex Q	GB/T10193-1997 GB/T10194-1997 CQC03001005165 CQC03001007654	GB8898-2011 GB4943.1-2011 CQC03001005165 CQC03001007654
TVR20820R	√	√		√	
TVR20101R	√	√		√	
TVR20121R	√	√		√	
TVR20151R	√	√		√	
TVR20181R	√	√	√	√	
TVR20201R	√	√	√	√	√
TVR20221R	√	√	√	√	√
TVR20241R	√	√	√	√	√
TVR20271R	√	√	√	√	√
TVR20301R	√	√	√	√	√
TVR20331R	√	√	√	√	√
TVR20361R	√	√	√	√	√
TVR20391R	√	√	√	√	√
TVR20431R	√	√	√	√	√
TVR20471R	√	√	√	√	√
TVR20511R	√	√	√	√	√
TVR20561R	√	√	√	√	√
TVR20621R	√	√	√	√	√
TVR20681R	√	√	√	√	√
TVR20751R	√	√	√	√	√
TVR20821R	√	√	√	√	√
TVR20911R	√	√	√	√	√
TVR20102R	√	√	√	√	√
TVR20112R	√	√	√	√	√
TVR20122R	√	√	√		
TVR20142R	√	√	√		
TVR20162R	√	√	√		
TVR20182R	√	√	√		

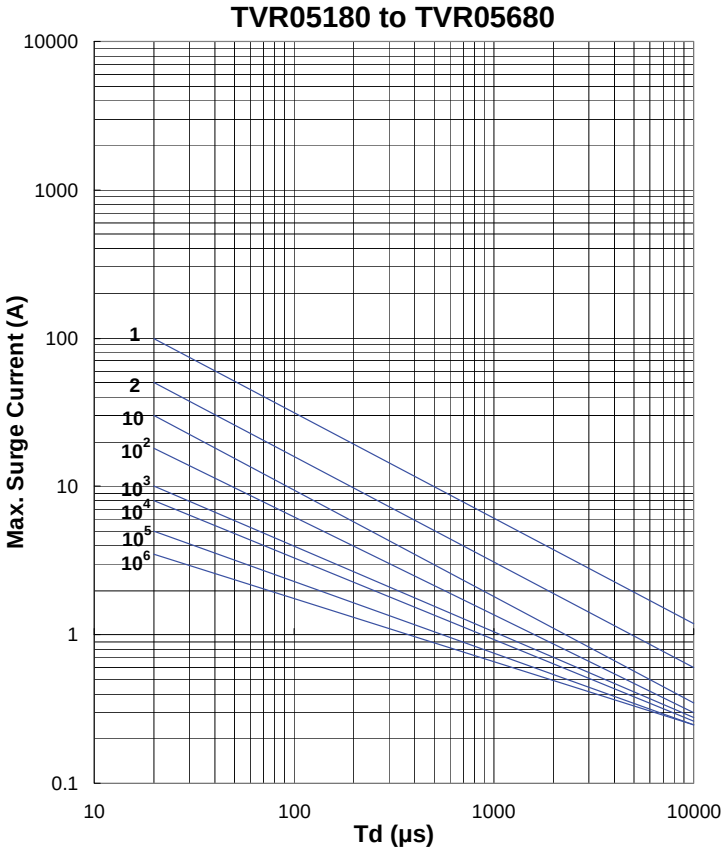
■ Power Derating Curve

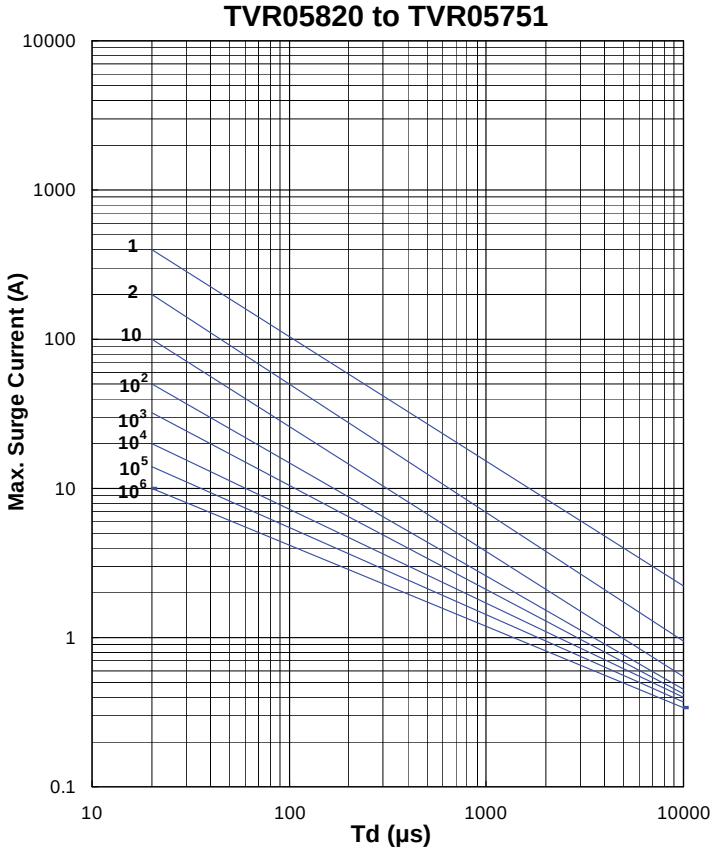


■ Surge Current Standard Waveform



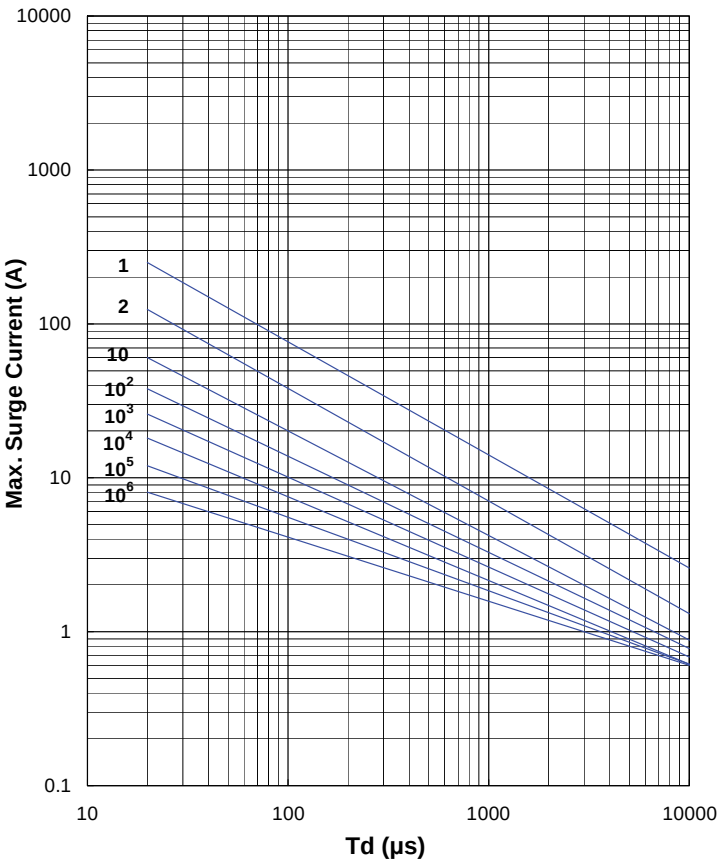
■ Max. Surge Current Derating Curves



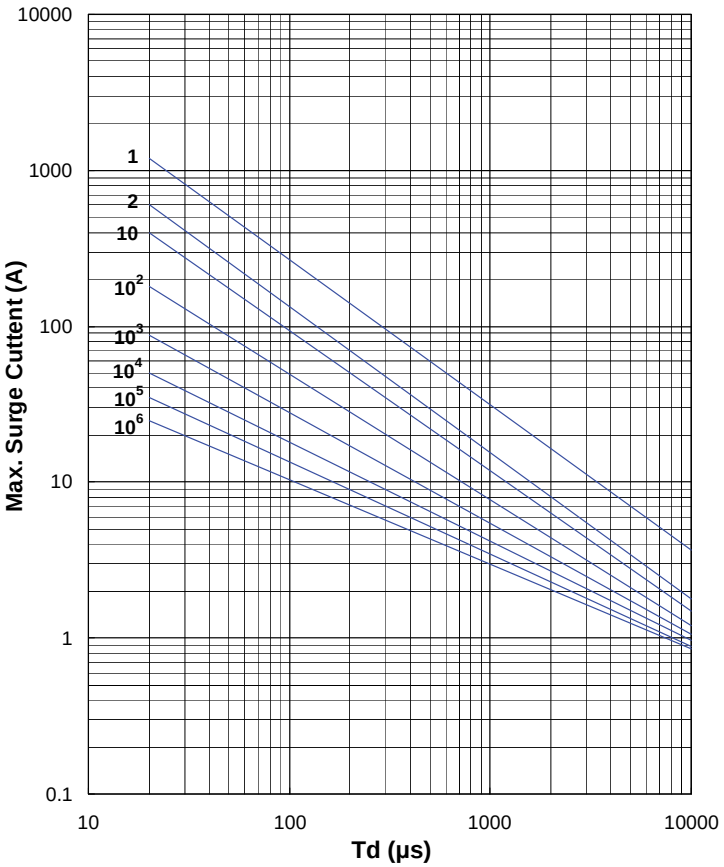


■ Max. Surge Current Derating Curves

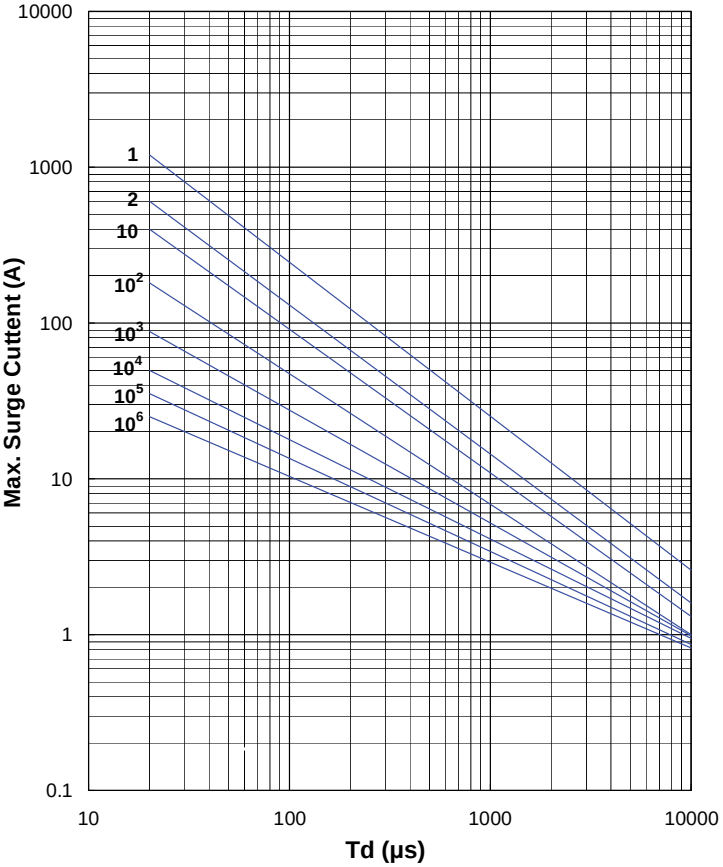
TVR07180 to TVR07680



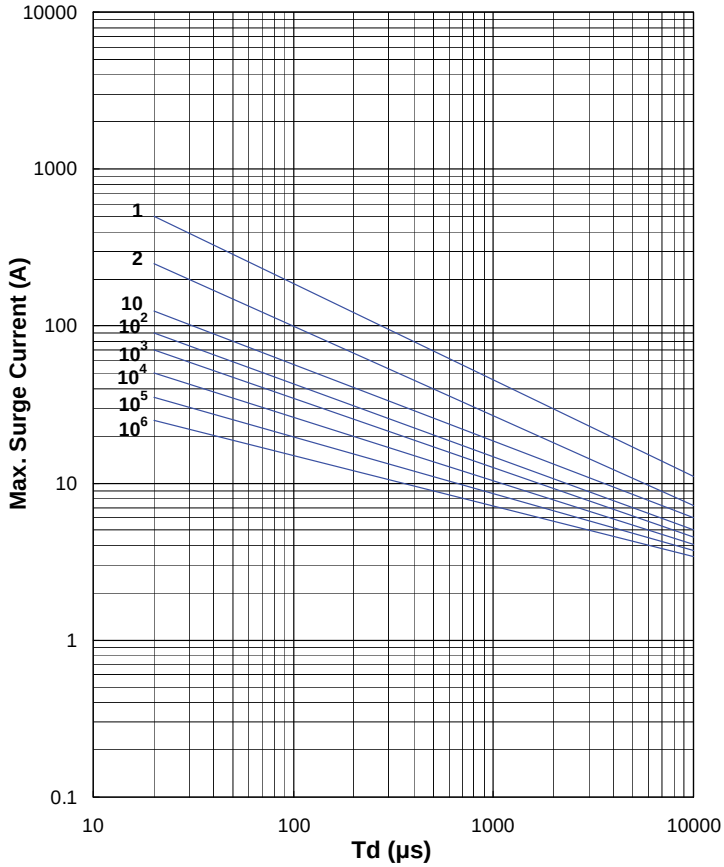
TVR07820 to TVR07471



TVR07511 to TVR07821

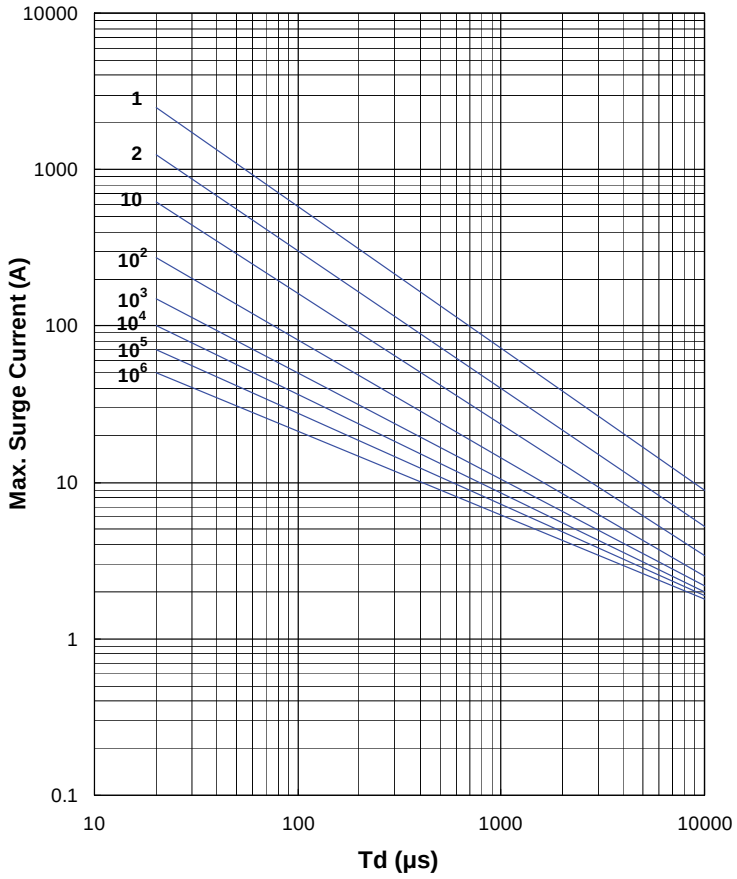


TVR10180 to TVR10680

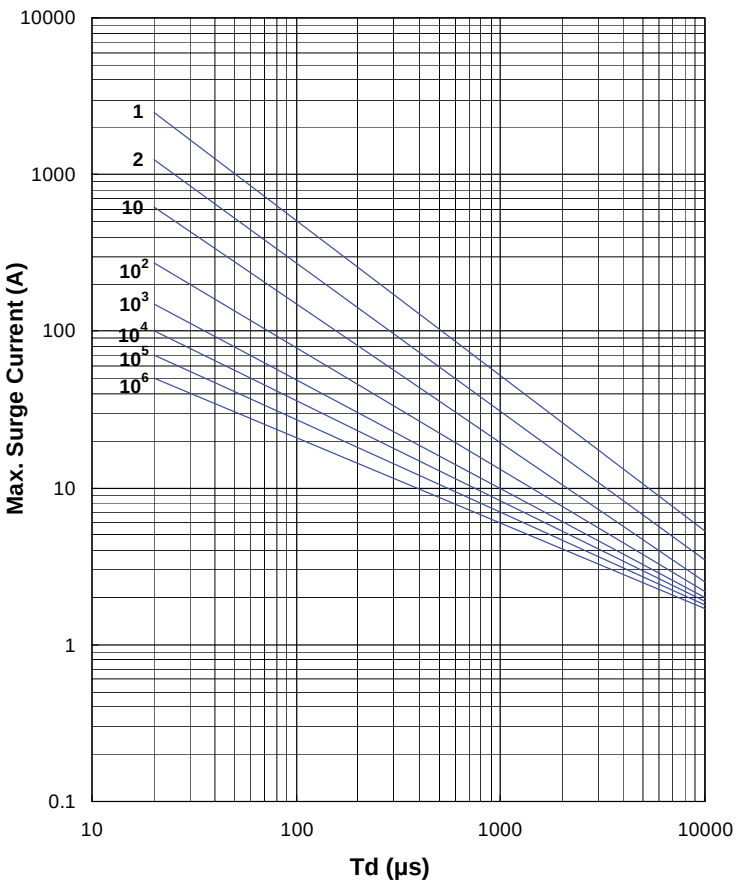


■ Max. Surge Current Derating Curves

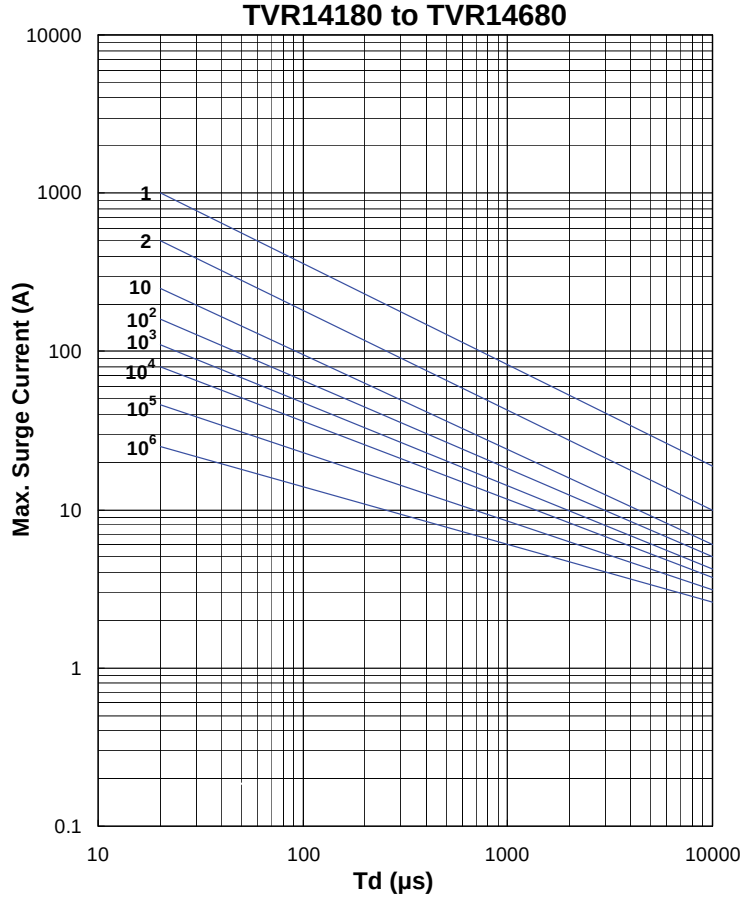
TVR10820 to TVR10751



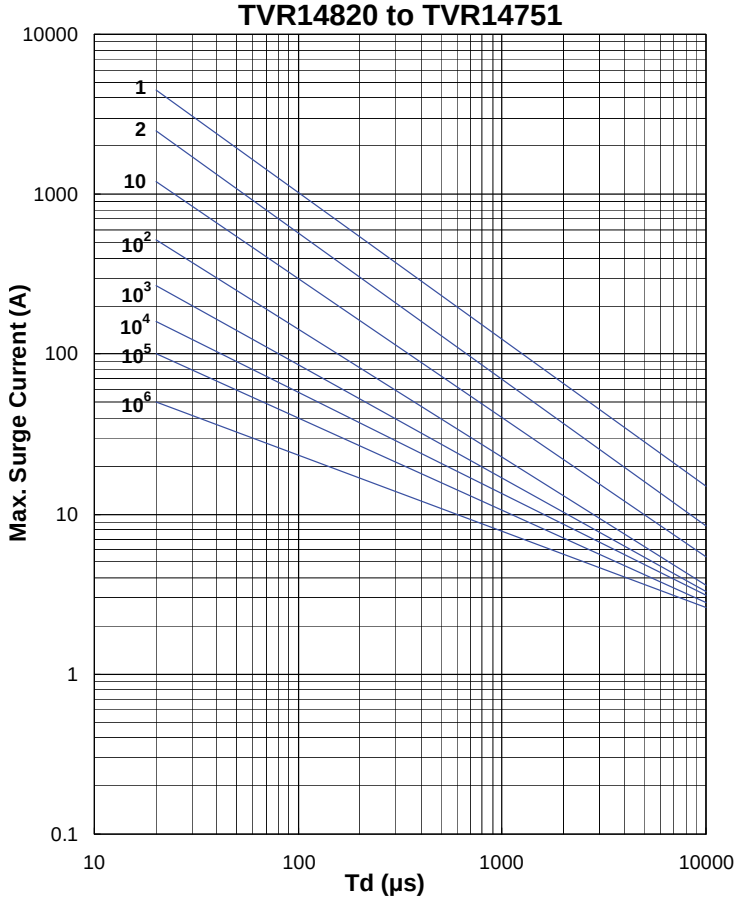
TVR10821 to TVR10182



TVR14180 to TVR14680

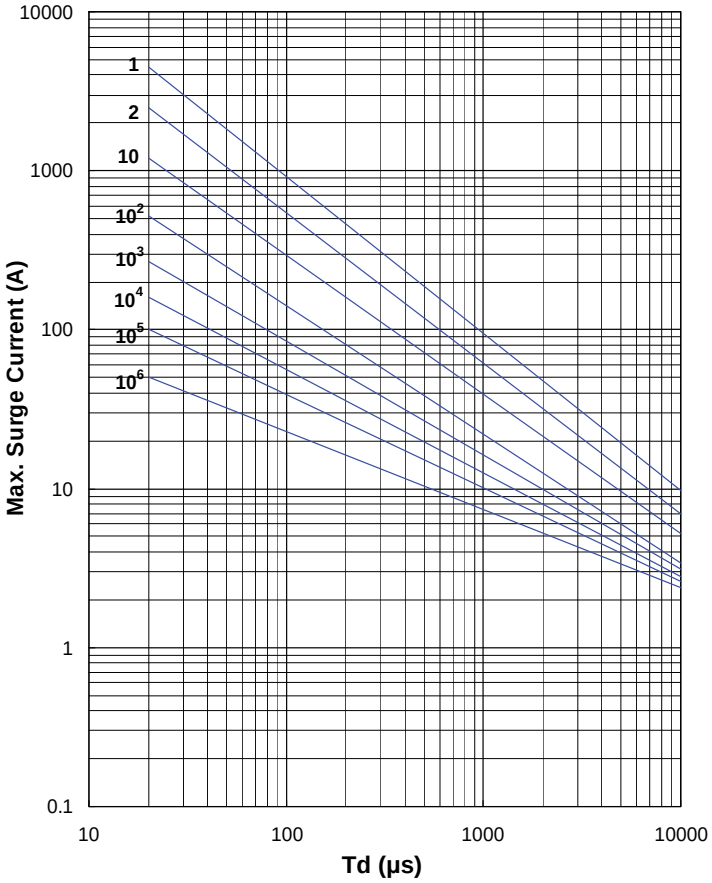


TVR14820 to TVR14751

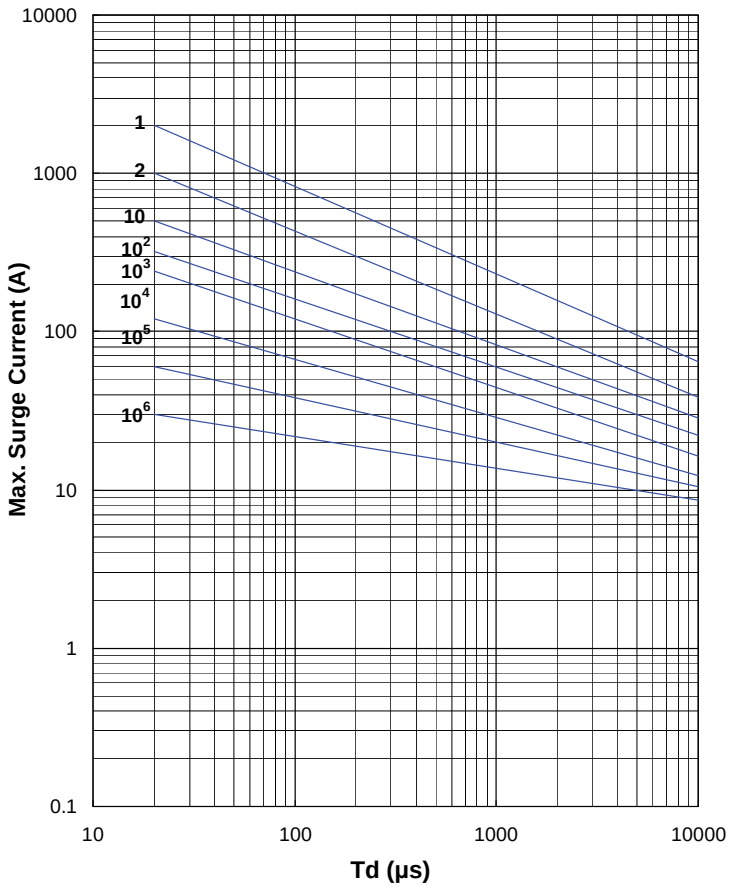


■ Max. Surge Current Derating Curves

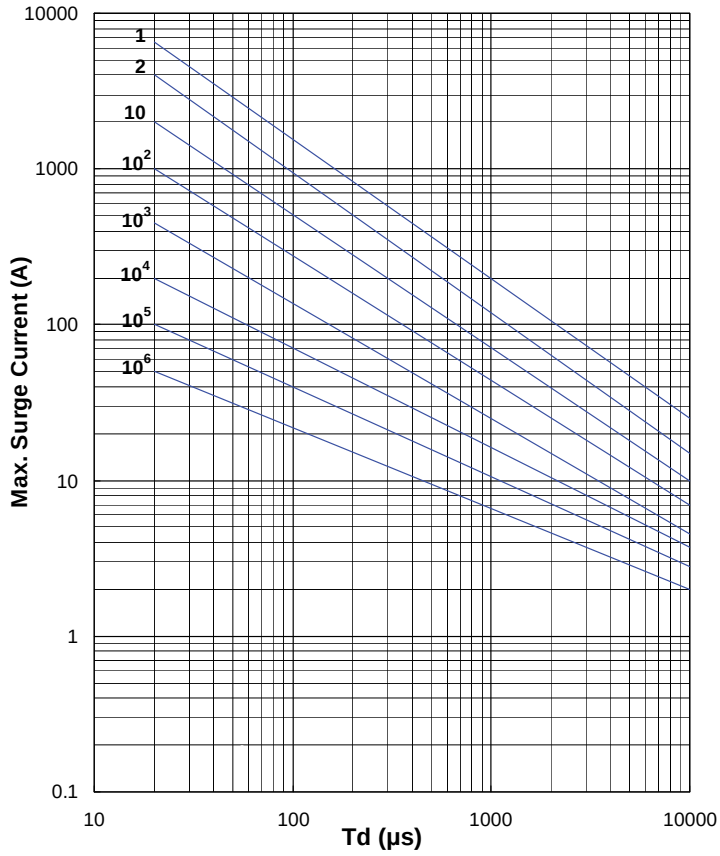
TVR14821 to TVR14182



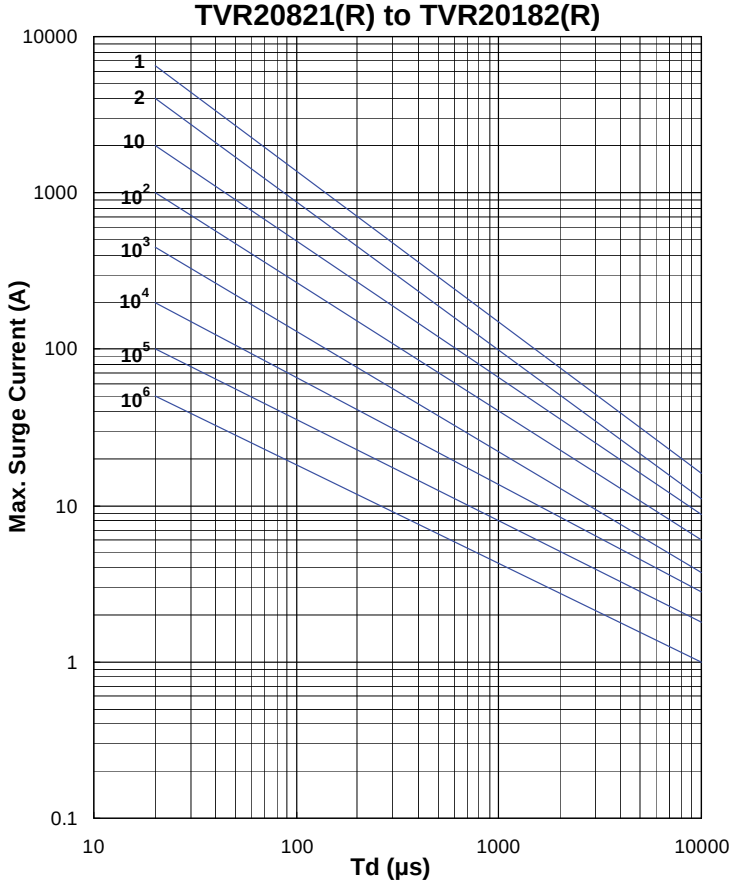
TVR20180 to TVR20680



TVR20820(R) to TVR20751(R)

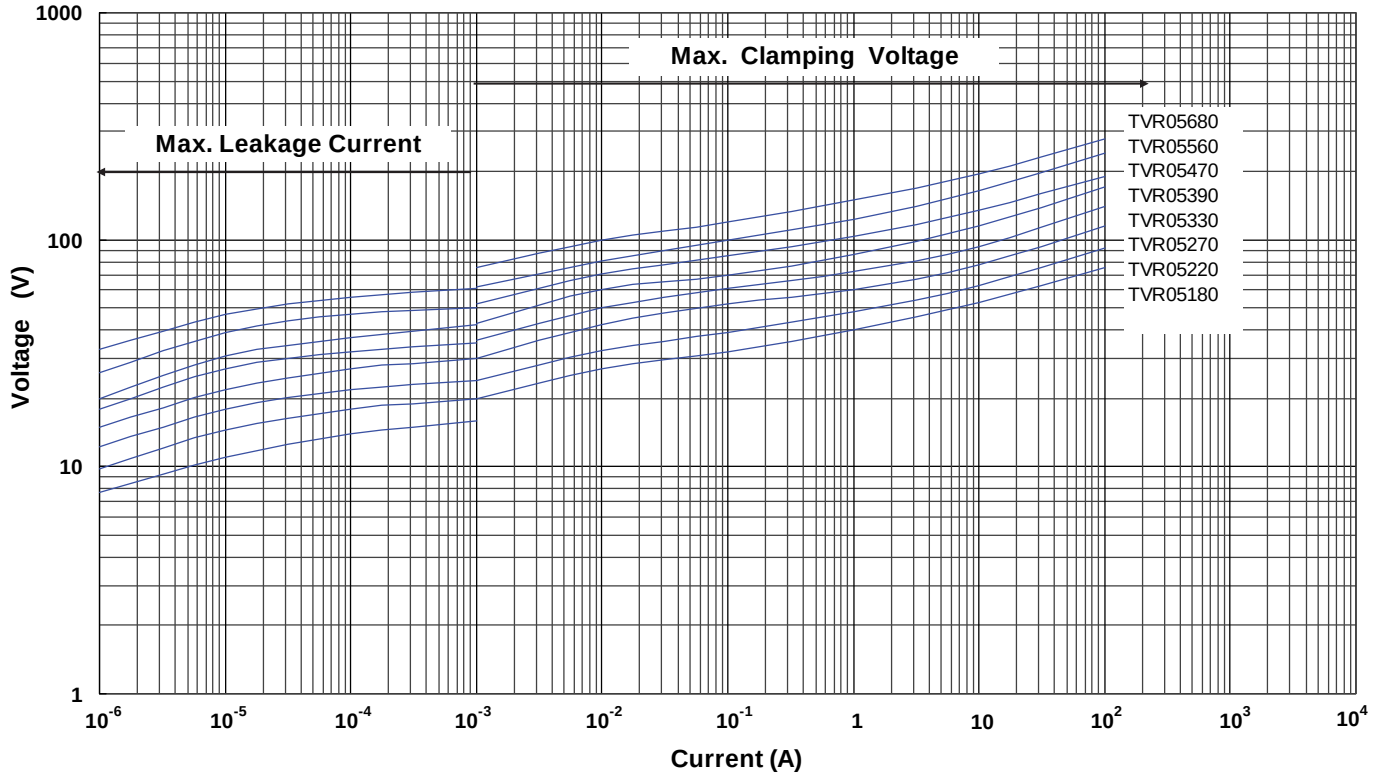


TVR20821(R) to TVR20182(R)

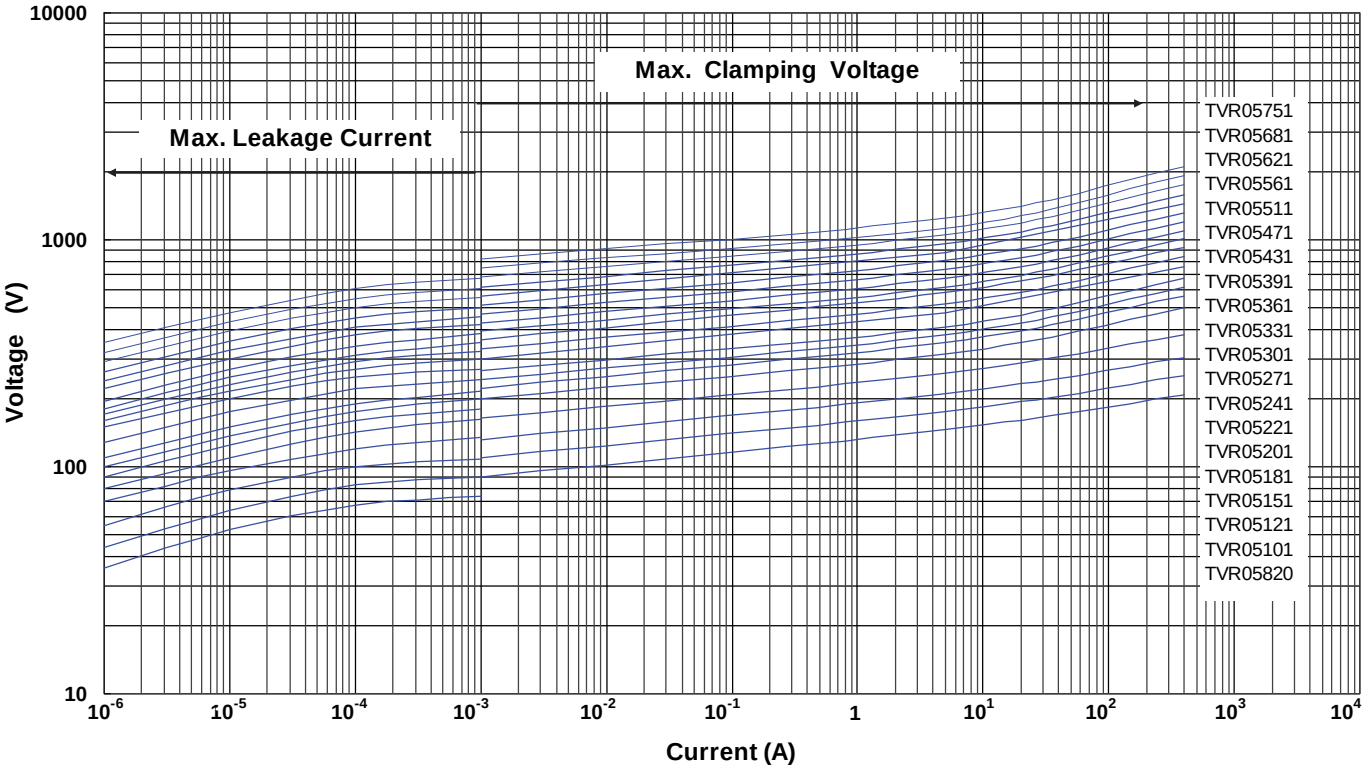


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR05180 to TVR05680)

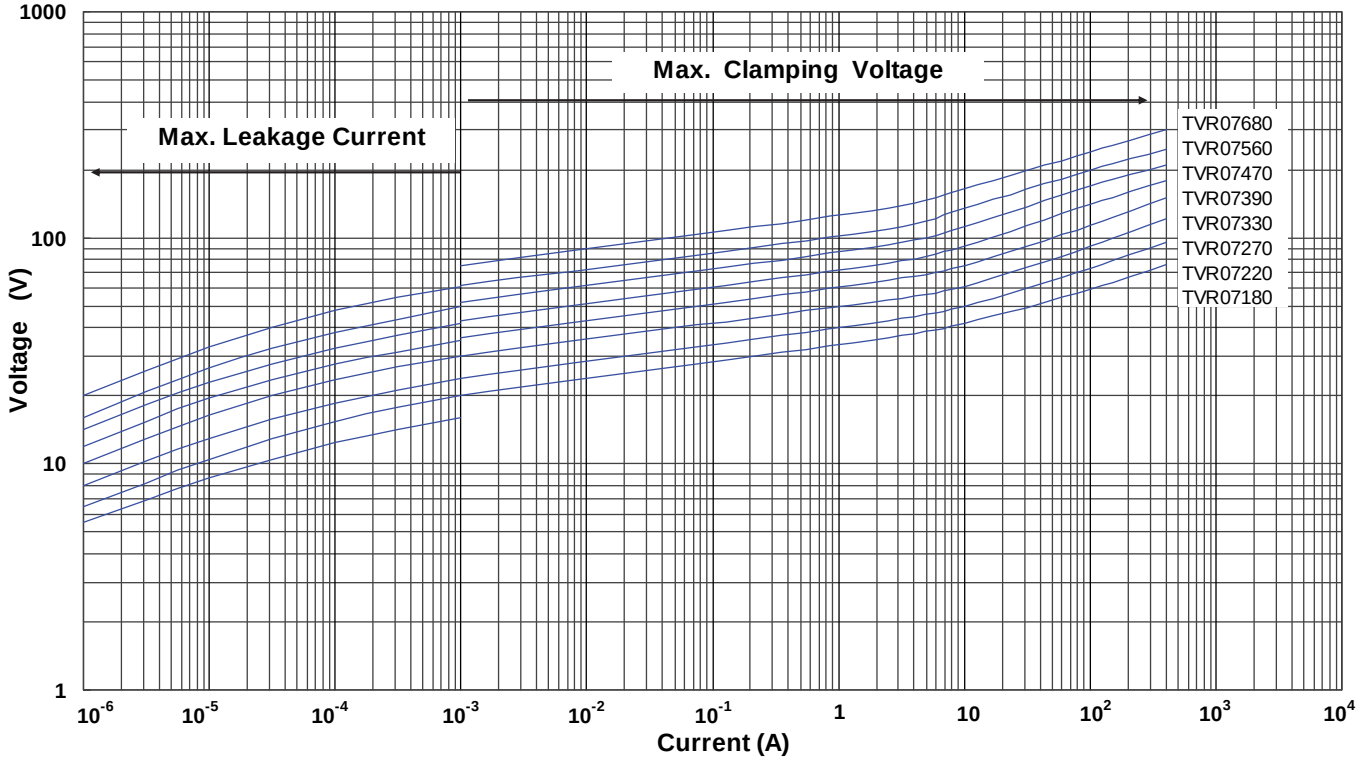


Max. Leakage Current and Max. Clamping Voltage Curves (TVR05820 to TVR05751)

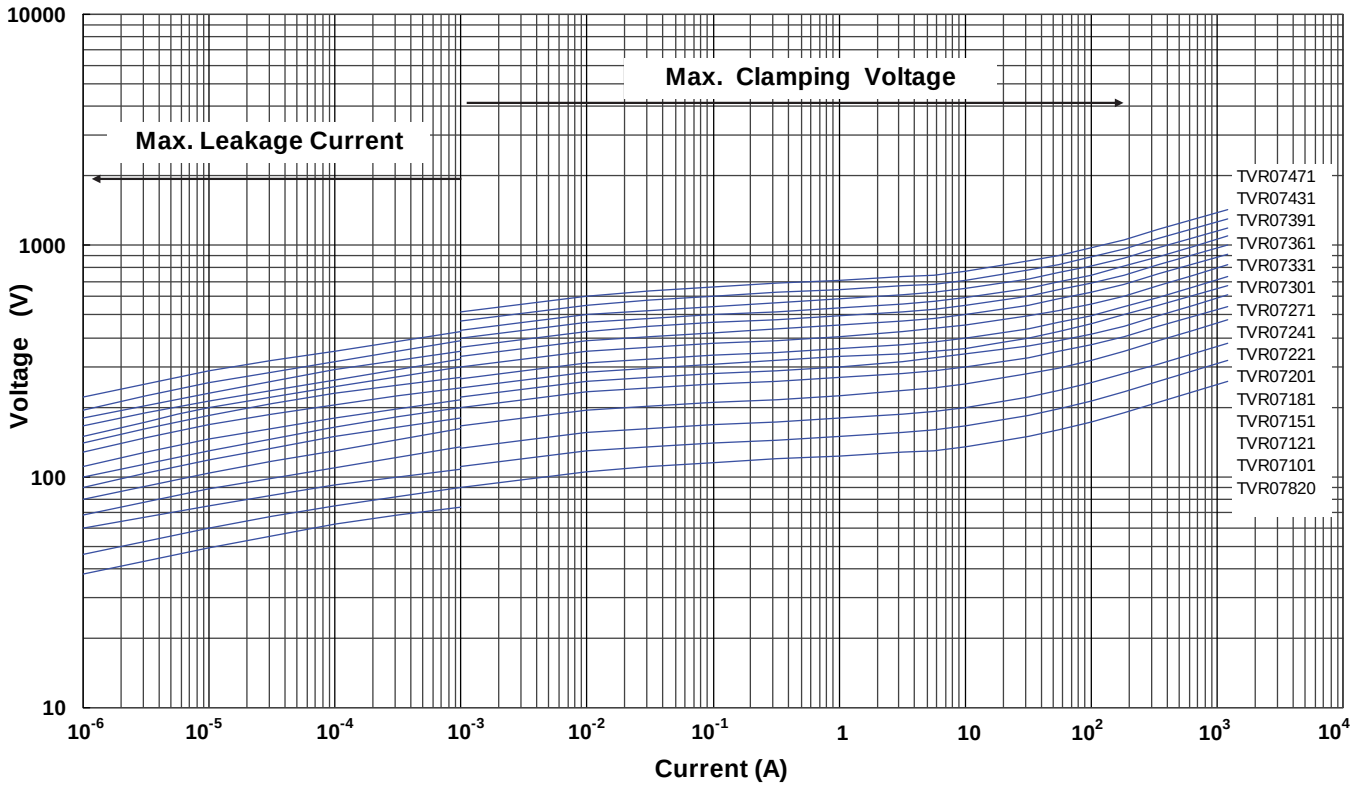


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR07180 to TVR07680)

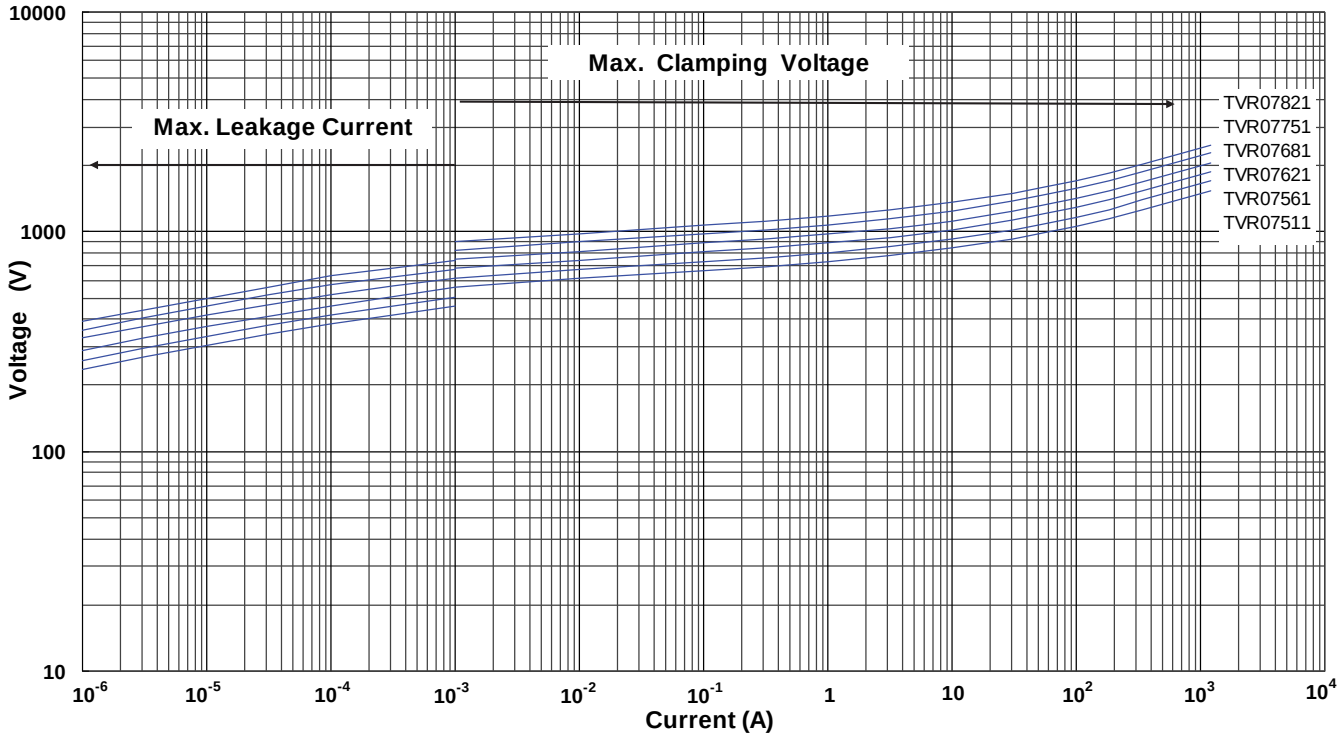


Max. Leakage Current and Max. Clamping Voltage Curves (TVR07820 to TVR07471)

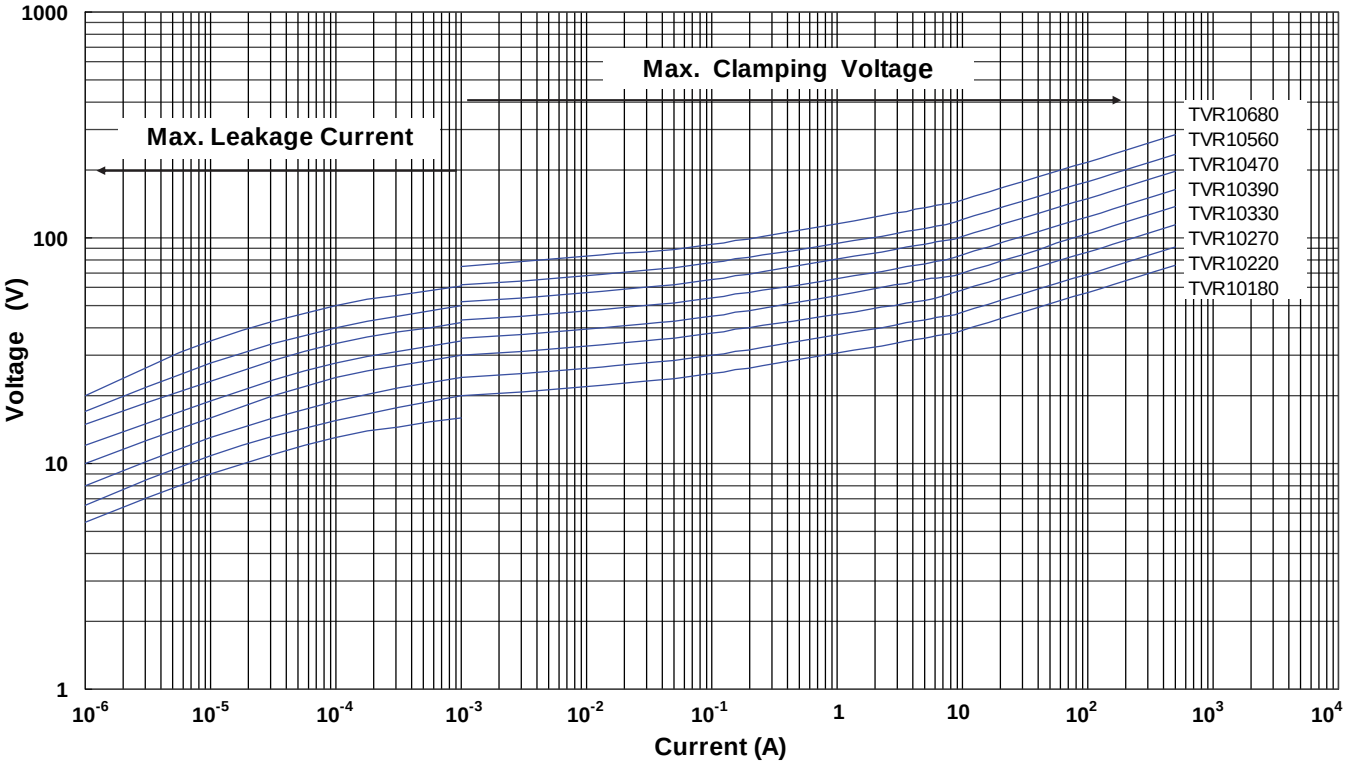


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR07511 to TVR07821)

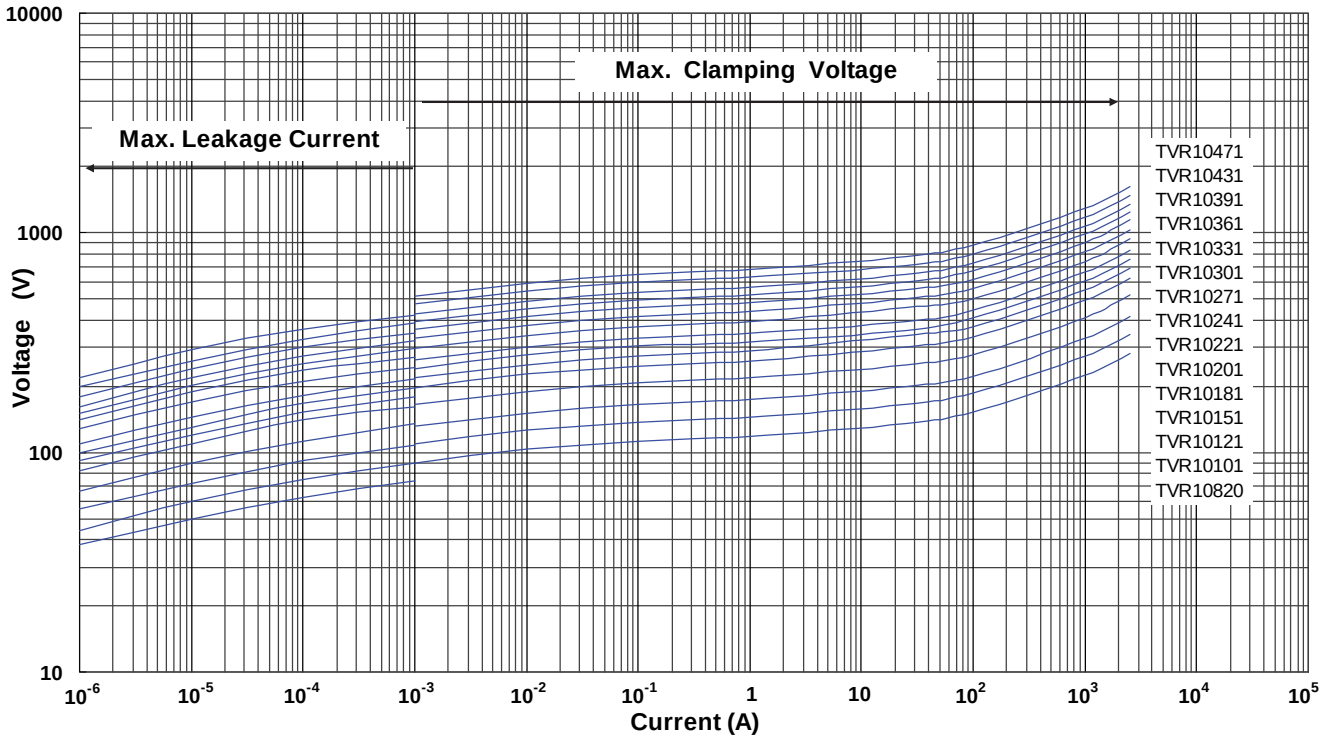


Max. Leakage Current and Max. Clamping Voltage Curves (TVR10180 to TVR10680)

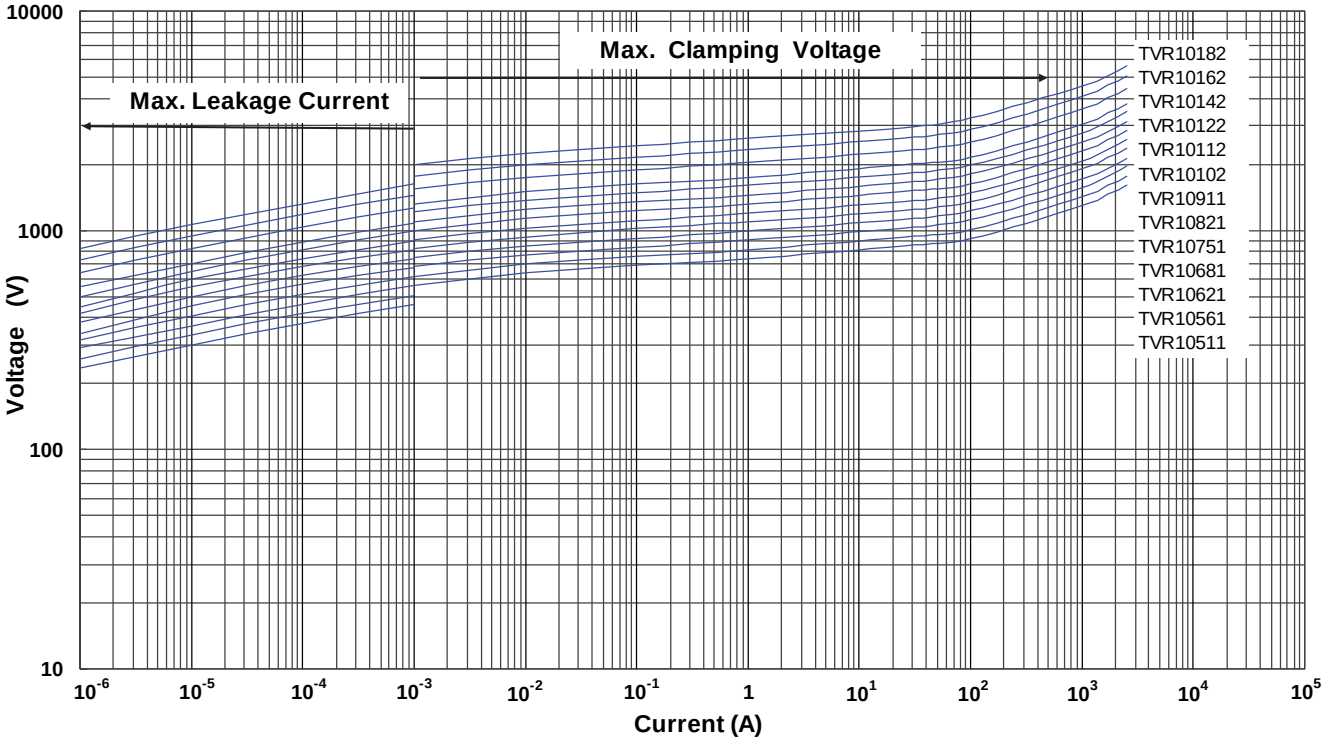


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR10820 to TVR10471)

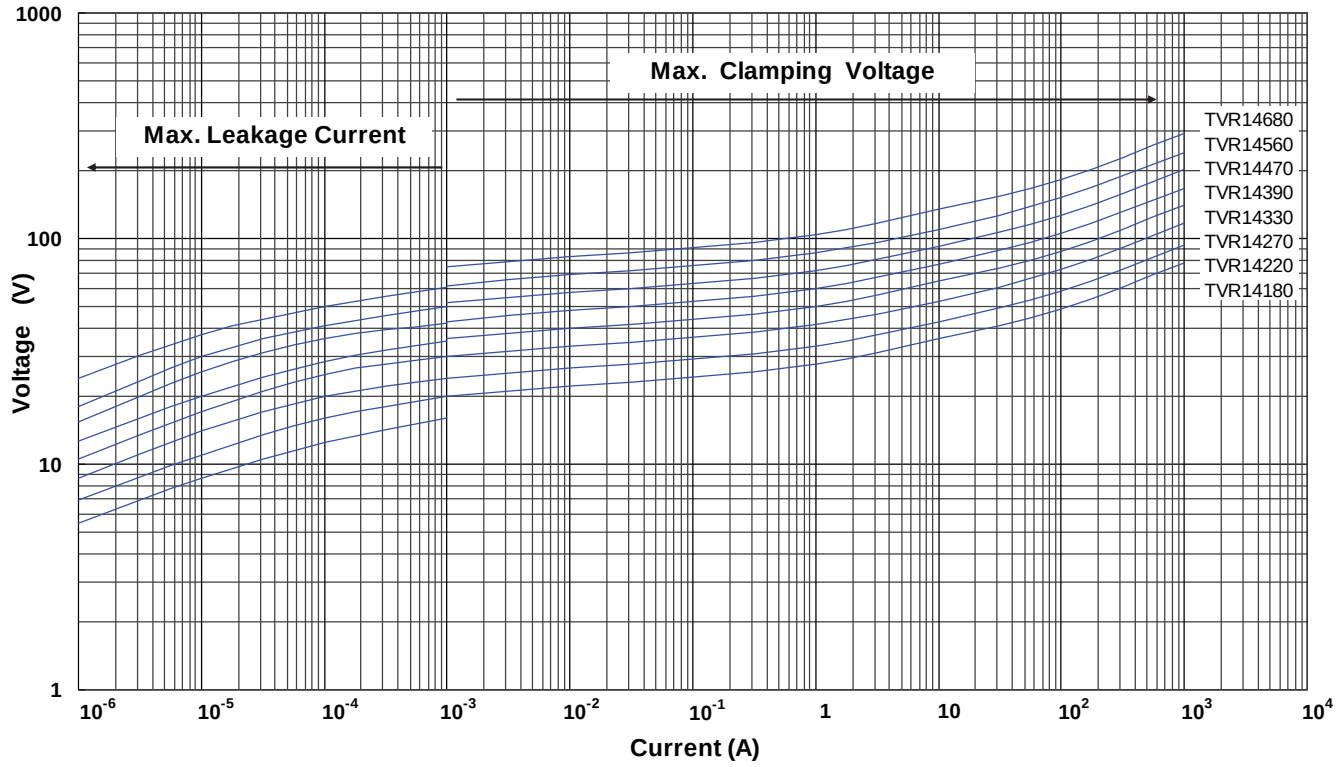


Max. Leakage Current and Max. Clamping Voltage Curves (TVR10511 to TVR10182)

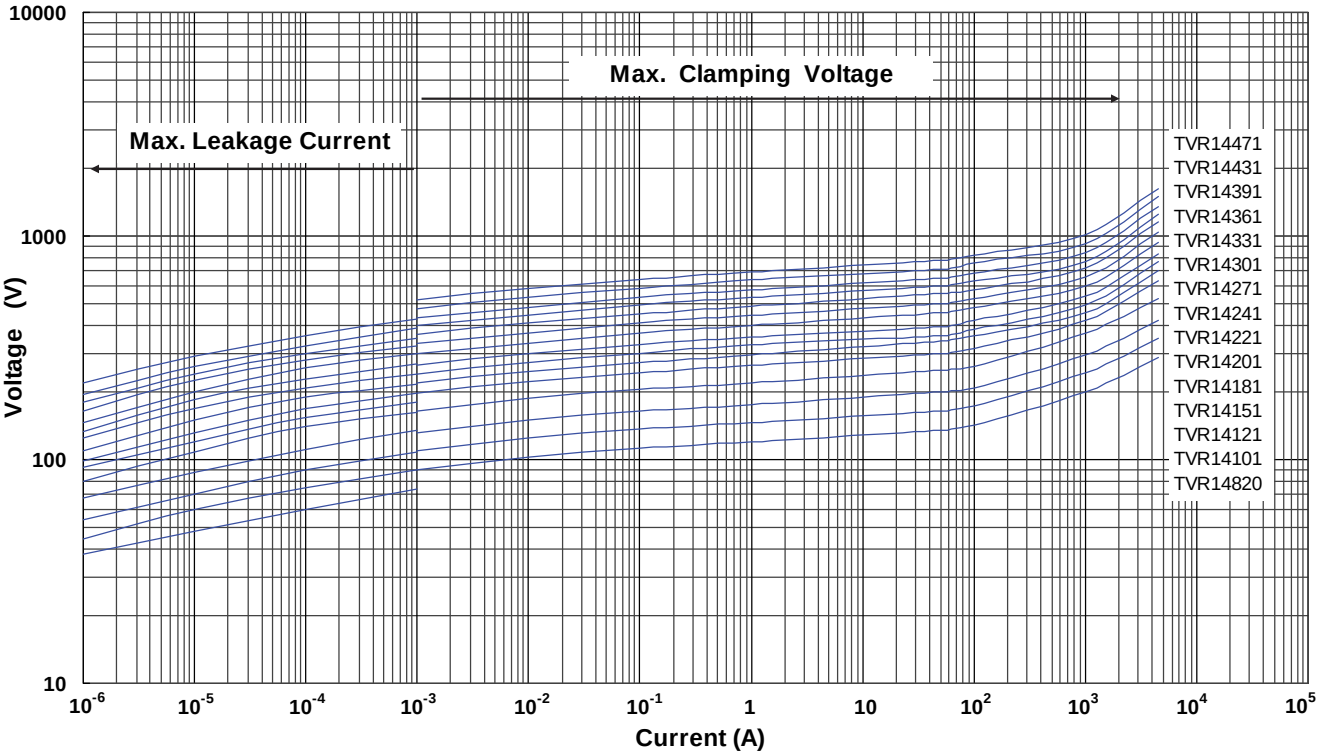


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR14180 to TVR14680)

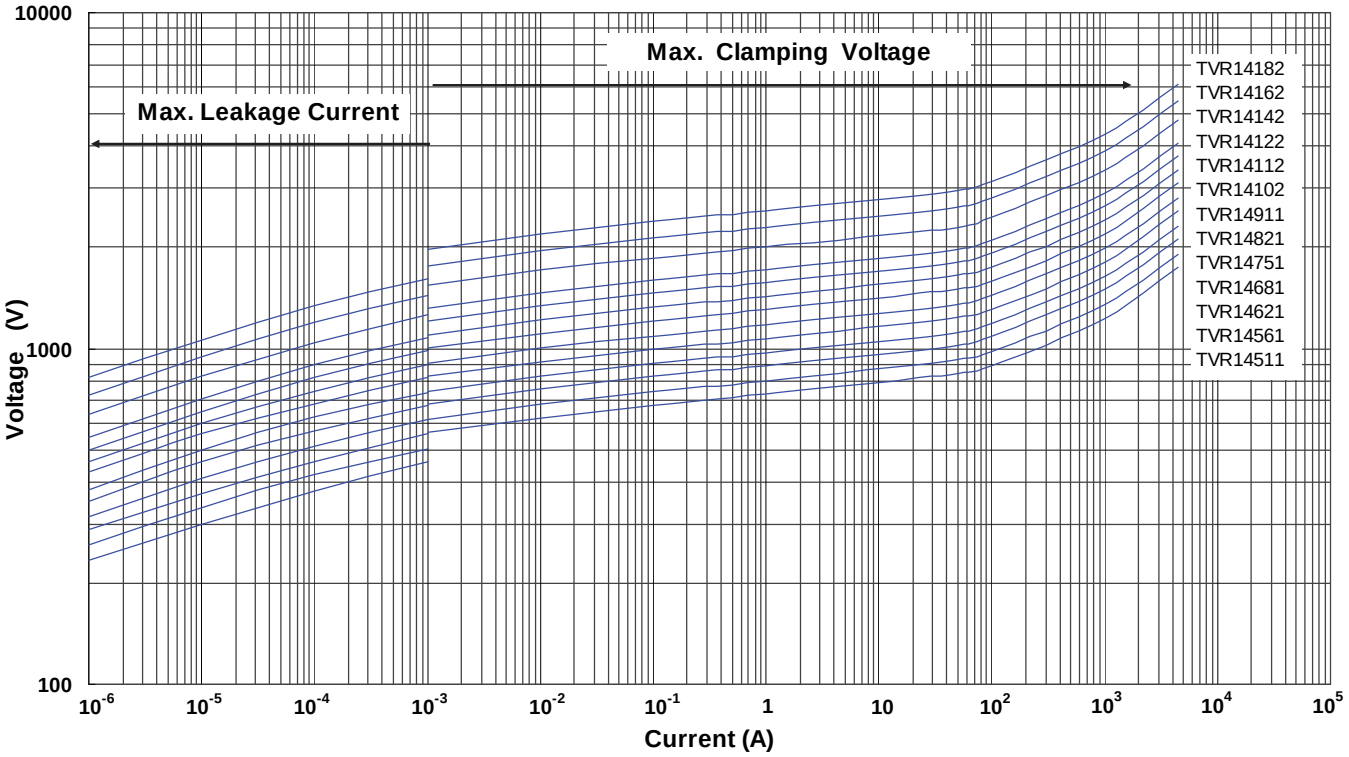


Max. Leakage Current and Max. Clamping Voltage Curves (TVR14820 to TVR14471)

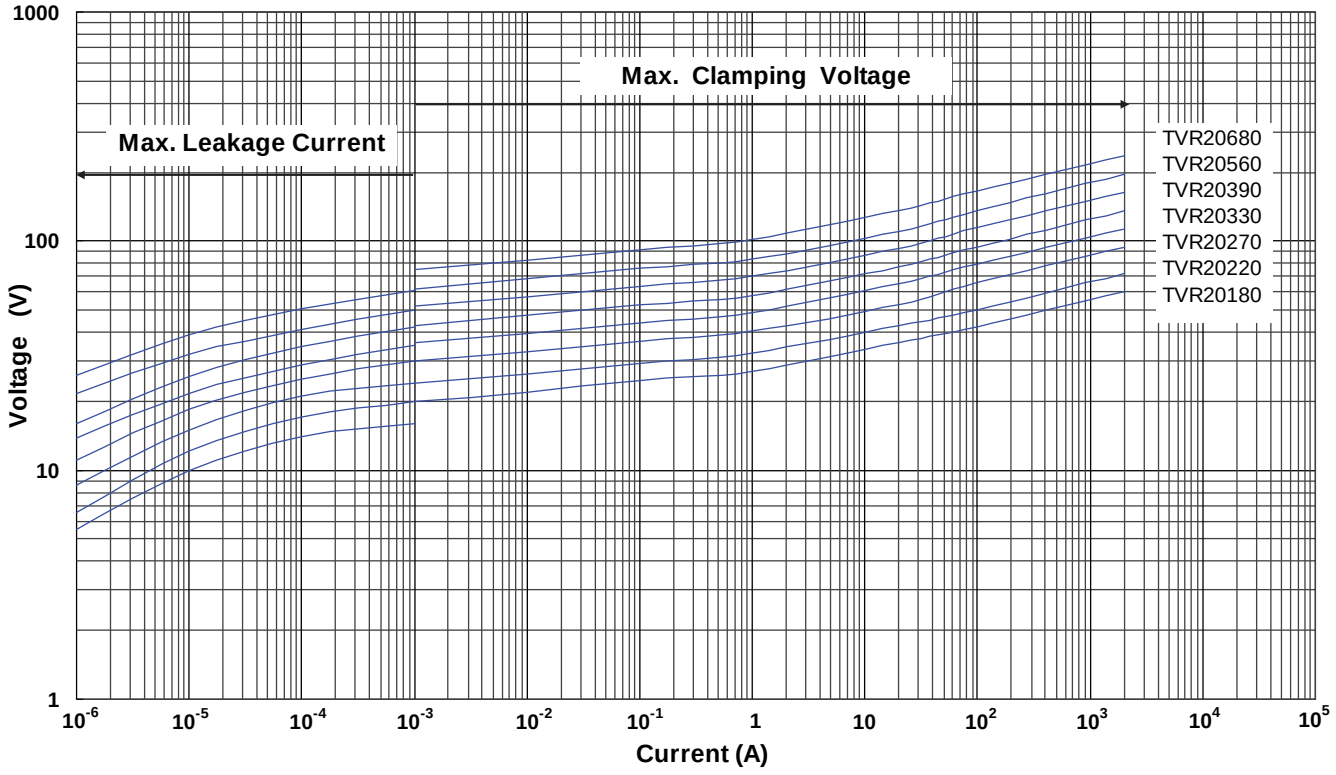


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR14511 to TVR14182)

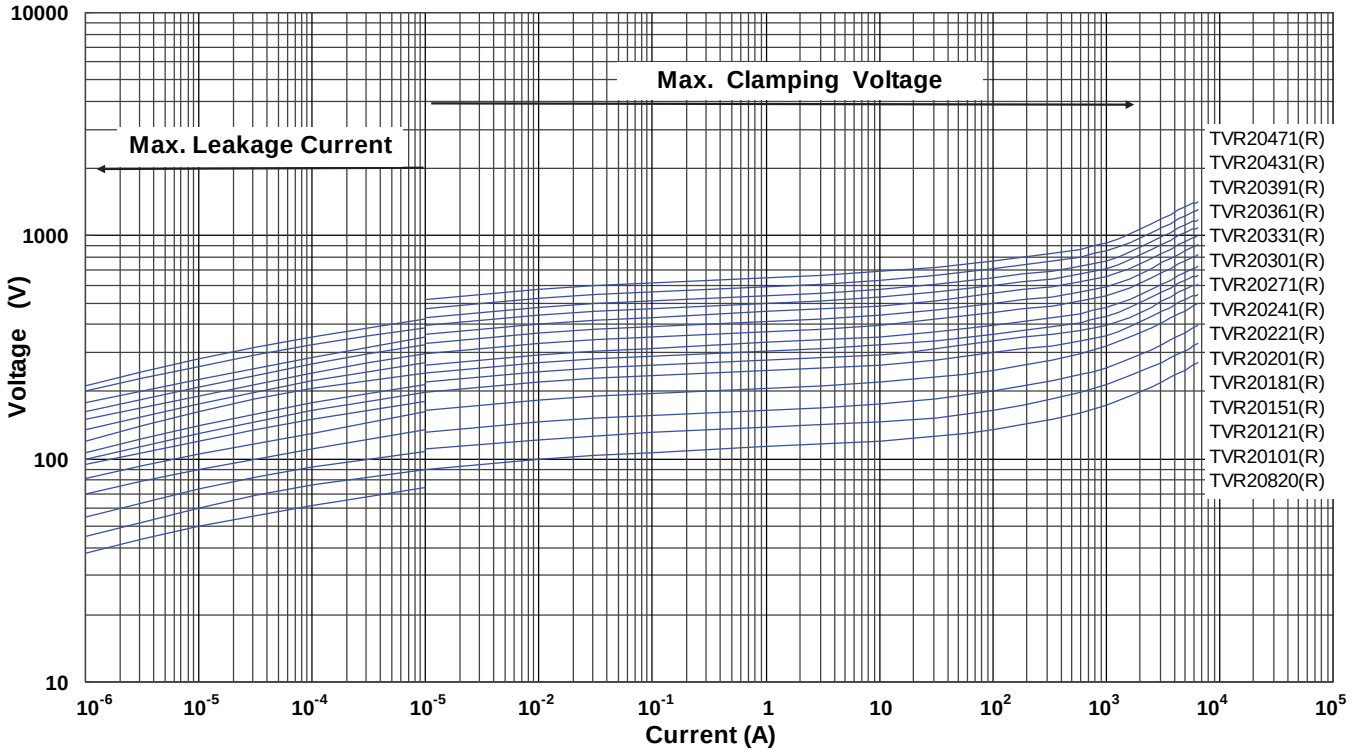


Max. Leakage Current and Max. Clamping Voltage Curves (TVR20180 to TVR20680)

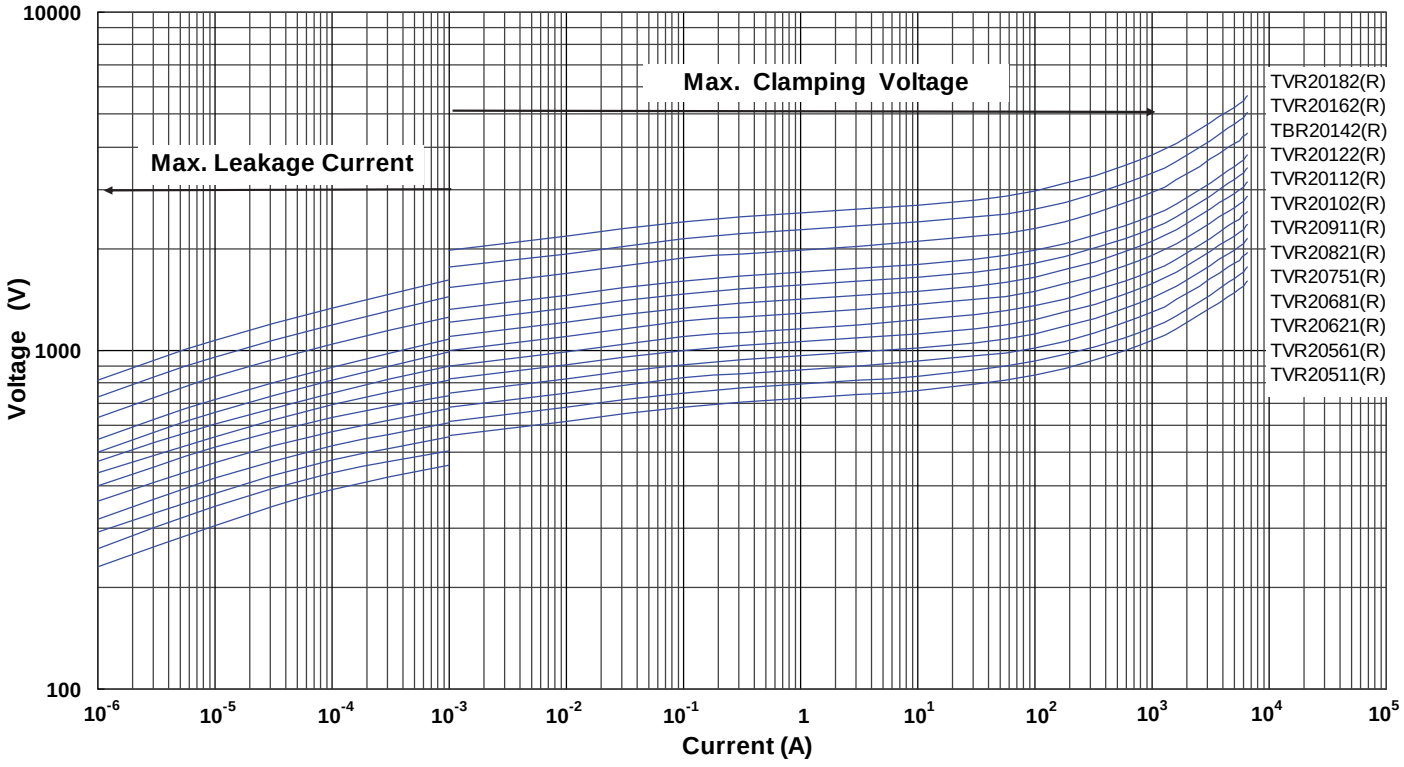


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR20820(R) to TVR20471(R))

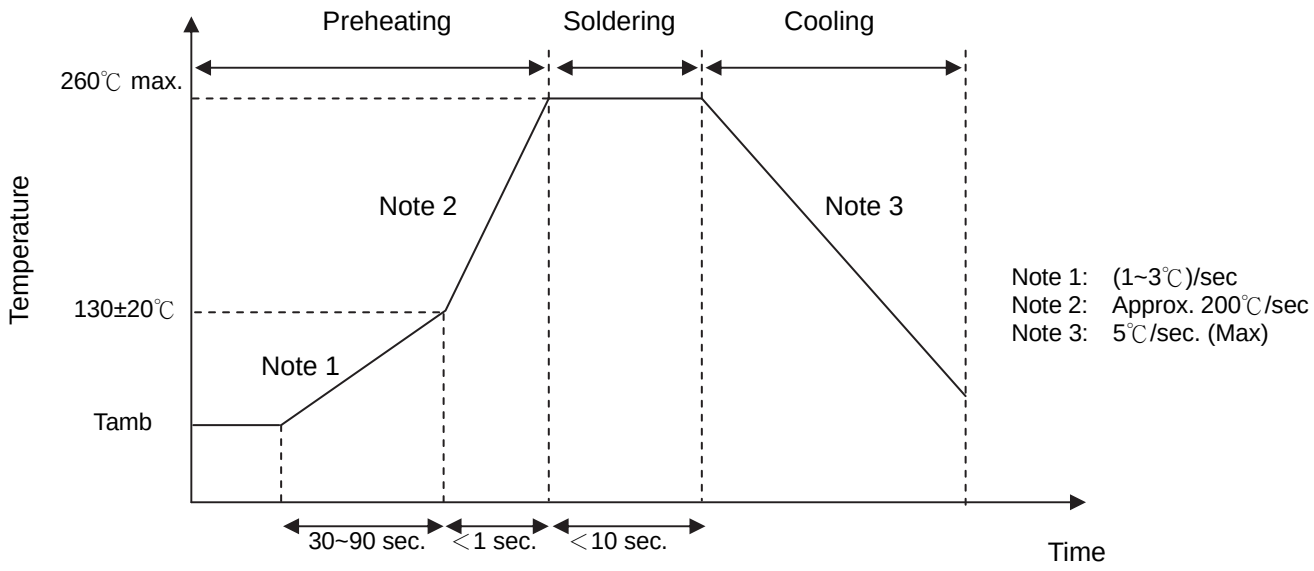


Max. Leakage Current and Max. Clamping Voltage Curves (TVR20511(R) to TVR20182(R))



■ 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 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	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ 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	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Vibration	IEC 61051-1	Frequency range: 10-55 Hz Amplitude: 0.75mm or 98 m/s^2 Direction: 3 mutually perpendicular directions, 2 hrs each	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ 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, (5±0.5 sec for TVR05)	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
High Temperature Storage	IEC 60068-2-2	125±5℃ x 1000± 24 hrs	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Damp Heat, Steady State	IEC60068-2-78	a. 40±2℃, 90 ~ 95 % RH, 1344 hrs b. 40±2℃, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage Insulation Resistance ≧100MΩ
Rapid Change of Temperature	IEC 60068-2-14	The conditions shown below shall be repeated 5 cycles Step 1: -40±3, 30±3 Step 2: Room temperature, 5±3 Step 3: 85±2, 30±3 Step 4: Room temperature, 5±3	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Endurance at Upper Category Temperature	IEC 61051-1	85±2℃, 1000±24 hrs at V_{DC} or V_{rms} (Max. Continuous Voltage)	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ 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.	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ No visible damage
10/1000μs Surge Life	IEC 61051-1	10/1000μs waveform, 10 surge currents, unipolar, interval 2mins, amplitude corresponding to max. surge current derating curves for 1000μs.	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ No visible damage
Operating Duty Cycle Test	UL 1449 3rd	6KV/3KA 1.2/50μs +8/20μs combination waveform with Vac(@ Deg 90) for 15 times. Interval time between tests is 60 secs. (For UL1449 3rd SPD Type 3 application test only)	$\lvert \triangle V_p / V_p \rvert \leqq 10\%$ No visible damage
Nominal Discharge Current Test	UL 1449 3rd	3KA 8/20μs waveform with Vac (@ Deg 90) for 15 times. Interval time between tests is 60 secs. (For TVR20R UL1449 3rd SPD Type 2 application test only)	$\lvert \triangle V_p / V_p \rvert \leqq 10\%$ No visible damage
Voltage Proof	IEC 61051-1	Metal balls method, 2500 Vac 1 min	No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA@85℃} - V_{1mA@25℃}}{V_{1mA@25℃}} \times \frac{1}{60} \times 100\%(\%/°C)$, $\frac{V_{1mA@-40℃} - V_{1mA@25℃}}{V_{1mA@25℃}} \times \frac{1}{65} \times 100\%(\%/°C)$	-0.05≦TC≦0.05 (%/℃)

■ Packaging

● Taping Specification

S Type (Straight Lead)

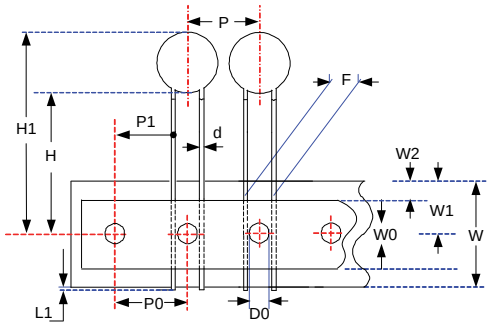


Figure A

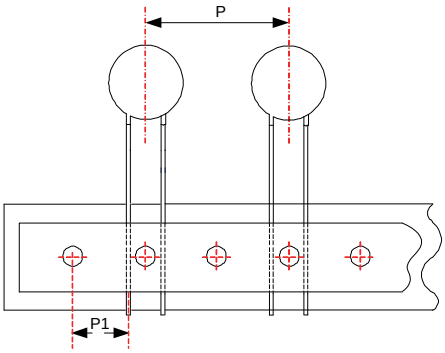


Figure B

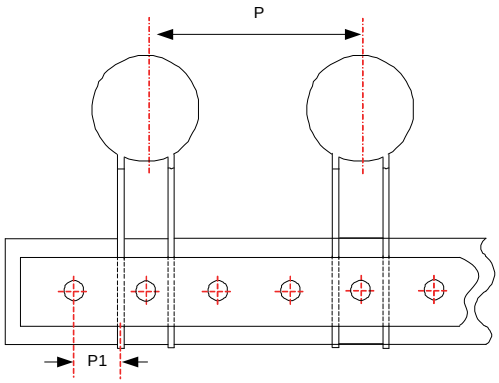


Figure C

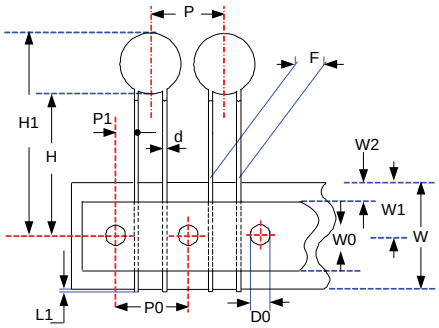


Figure D

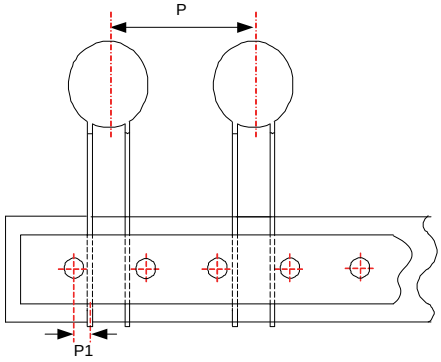
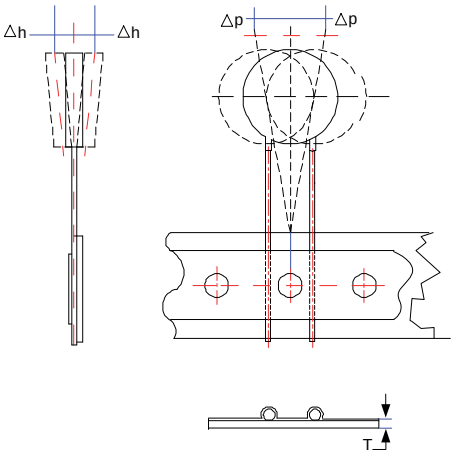


Figure E



(Unit: mm)

Taping Code	Body Size	P_0	F	P	P_1	H	H_1	d	W_0	W_1	W_2	W	△P	△h	L_1	D_0	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_0:12.7)	05	12.7	5.0	12.7	3.85	18	28.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	07	12.7	5.0	12.7	3.85	18	30.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	10	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	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
	20	12.7	7.5	25.4	8.95	18	40.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	20	12.7	10	38.1	7.70	18	40.5	1.0	12	9	3	18	1	2	0.5	4	0.6	C
E (P_0:15.0)	05	15	5.0	15.0	5.00	18	28.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	07	15	5.0	15.0	5.00	18	30.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	10	15	7.5	15.0	3.75	18	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	D
	14	15	7.5	30.0	3.75	18	38.0	0.8	12	9	3	18	1	2	0.5	4	0.6	E
	20	15	7.5	30.0	3.75	18	40.5	0.8	12	9	3	18	1	2	0.5	4	0.6	E

F Type (Y Kink Lead)

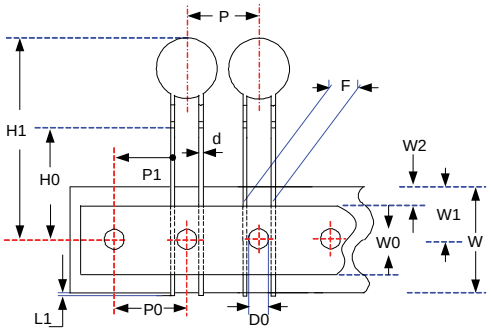


Figure A

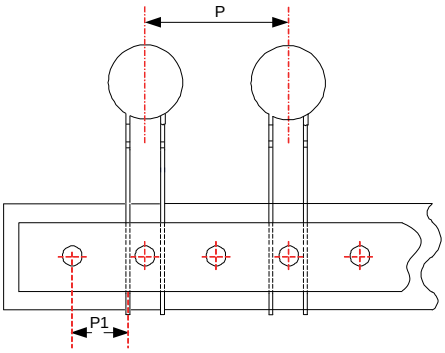


Figure B

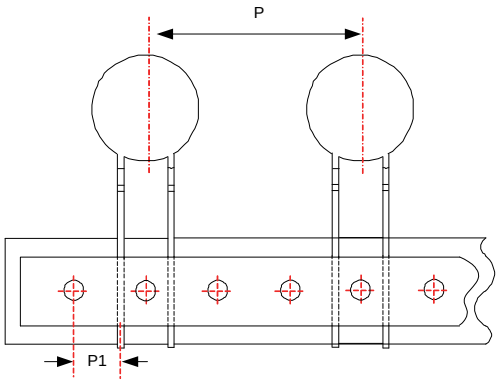


Figure C

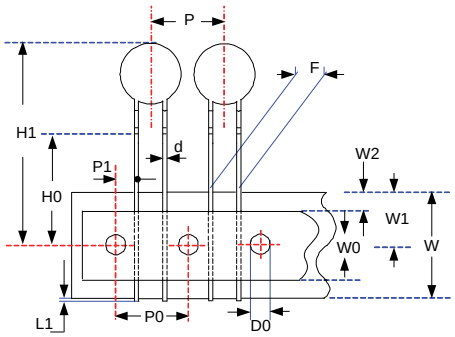


Figure D

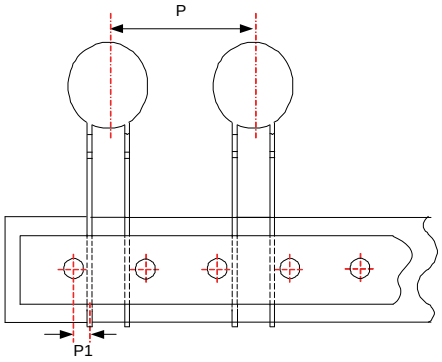
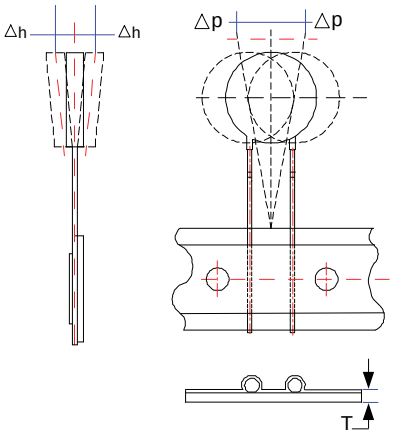


Figure E



(Unit: mm)

Taping Code	Body Size	P_0	F	P	P_1	H_0	H_1	d	W_0	W_1	W_2	W	△P	△h	L_1	D_0	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_0:12.7)	05	12.7	5.0	12.7	3.85	16	28.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	07	12.7	5.0	12.7	3.85	16	30.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	10	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	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
	20	12.7	7.5	25.4	8.95	16	40.5	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	20	12.7	10	38.1	7.70	16	40.5	1.0	12	9	3	18	1	2	0.5	4	0.6	C
E (P_0:15.0)	05	15	5.0	15.0	5.00	16	28.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	07	15	5.0	15.0	5.00	16	30.0	0.6	12	9	3	18	1	2	0.5	4	0.6	D
	10	15	7.5	15.0	3.75	16	33.5	0.8	12	9	3	18	1	2	0.5	4	0.6	D
	14	15	7.5	30.0	3.75	16	38.0	0.8	12	9	3	18	1	2	0.5	4	0.6	E
	20	15	7.5	30.0	3.75	16	40.5	0.8	12	9	3	18	1	2	0.5	4	0.6	E

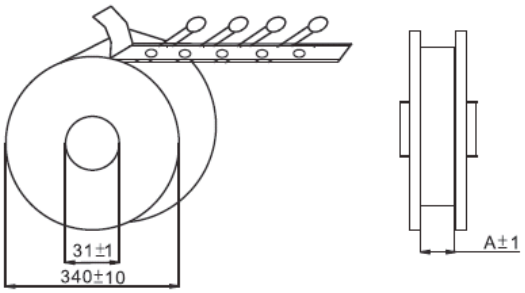
■ Quantity

● Bulk Packing

Series	Straight Lead Type Quantity (pcs/bag)	Cut Lead Type Quantity (pcs/bag)	Kink Type Quantity (pcs/bag)
TVR05	250	250	---
TVR07	250	250	200
TVR10	200	200	200
TVR14	100	100	100
TVR20	50	50	50

● Reel Packing

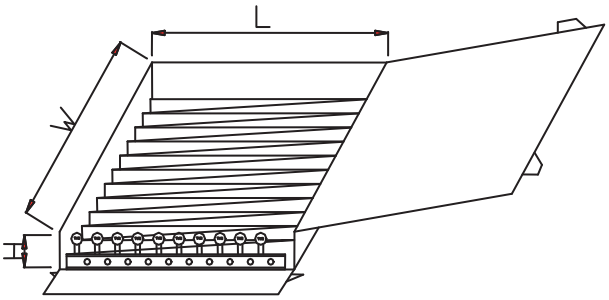
Series	A (mm)	Quantity (pcs/reel)
TVR05(180~391)	46	1,500
TVR05(431~751)		1,000
TVR07(180~391)		1,500
TVR07(431~821)		1,000
TVR10(180~911)		1,000
TVR10(102~112)		750
TVR10(122~182)		500
TVR14(180~470)		1,000
TVR14(560~391)		750
TVR14(431~182)		500
TVR20(180~681)	55	500
TVR20(751~182)		250



(Unit: mm)

- **Ammo Packing**

Series	Quantity (pcs/box)
TVR05(180~391)	1,000
TVR05(431~471)	1,200
TVR05(511~751)	1,000
TVR07(180~821)	1,000
TVR10(180~361)	750
TVR10(391~621)	500
TVR10(681~112)	400
TVR10(122~182)	200
TVR14(180~271)	500
TVR14(301~112)	250
TVR14(122~182)	200
TVR20(180~112)	250
TVR20(122~182)	200



(Unit: mm)

Series	W±5	L±5	H±5
TVR05 ~ TVR20	348	185	60
	348	275	60

■ Warehouse Storage Conditions of Products

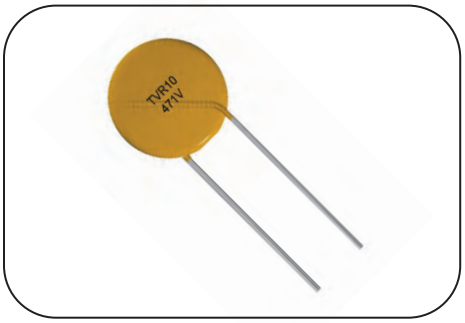
- Storage Conditions:
  1. Storage Temperature: -10℃~+40℃
  2. Relative Humidity: ≦75%RH
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage: 1 year

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: Φ10 and Φ14 mm
4. Wide operating voltage range: 130Vac ~ 680Vac
5. Operating temperature range: -40°C ~ +85°C
   Storage temperature range：-40°C ~ +125°C
6. Agency recognition: UL 1449 3rd/cUL/VDE
7. Meet IEC 60950-1 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

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

Body 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%

Internal Control Code
01~ZZ

Optional Suffix	
V	Medium surge series, RoHS compliant
B	Medium surge series, RoHS compliant & Halogen-free

Appearance	
S	Straight lead, epoxy coating
F	Y kink lead, epoxy coating
T	L kink lead, epoxy coating

Packaging	
AR	Tape & reel packing (hole pitch:12.7mm)
ER	Tape & reel packing (hole pitch:15.0mm)
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

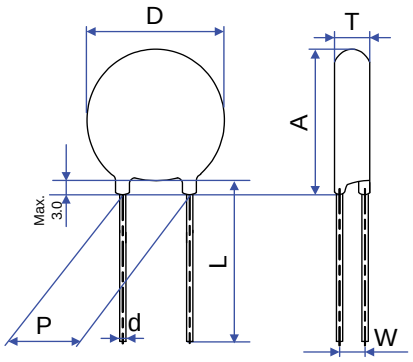
Note: Optional suffix will be the 11th digit if packaging and internal control codes are not coded.

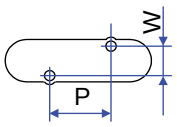
Metal Oxide Varistor：TVR-V Series

Disc Type Varistor for Surge Protection (Medium Surge Series)

■ Structure and Dimensions

● S Type (Straight lead)



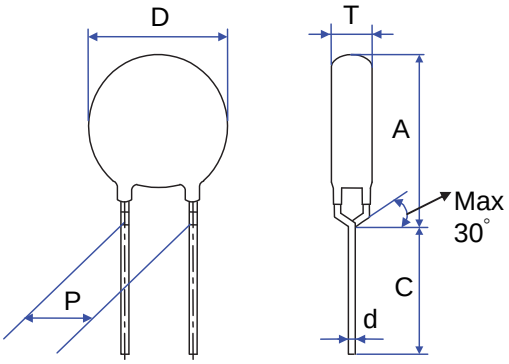


Bottom view

(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)		

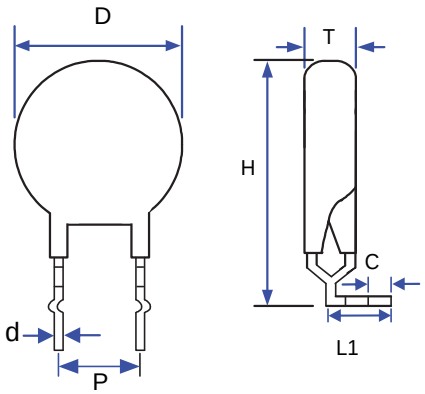
● F Type (Y kink lead)



(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 3rd SPD Application
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	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 *1 (8/20μs)	Rated Power	Max. Energy (10/1000μs)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Type *2
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	In	P	Wmax	Cp	Tmin	Tmax	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 3rd 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				
	c UL us	VDE		CQC	
	UL1449 3rd & cUL: E314979	5944	IEC60950-1 2nd 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

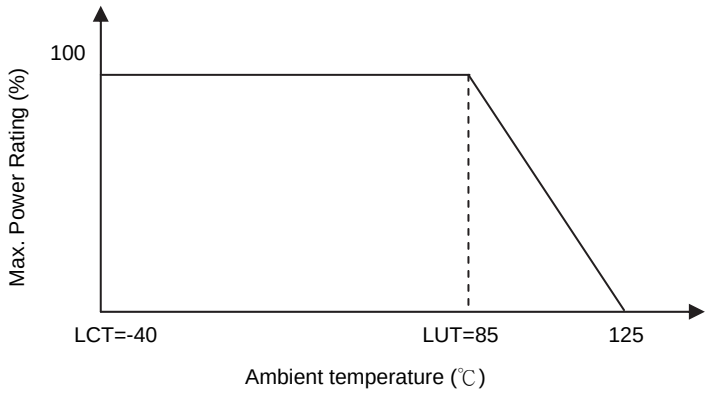
Disc Type Varistor for Surge Protection (Medium Surge Series)

Certified Model No.	Agency		
	c UL us	VDE	
	UL1449 3rd & cUL: E314979	5944	IEC60950-1 2nd Annex Q
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	√	√	√

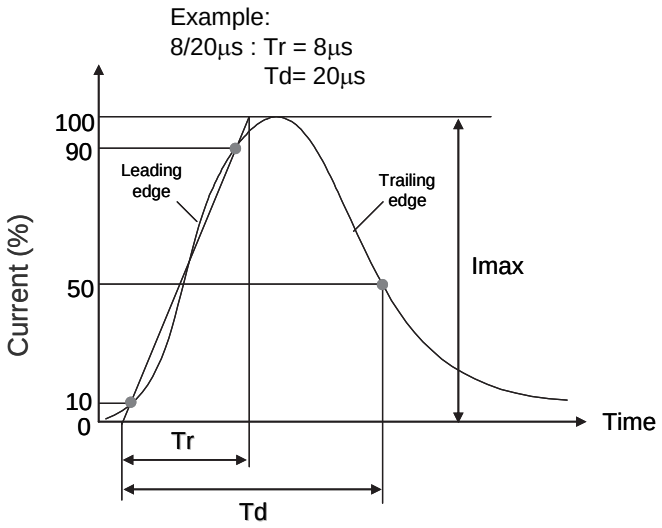
Metal Oxide Varistor：TVR-V Series

Disc Type Varistor for Surge Protection (Medium Surge Series)

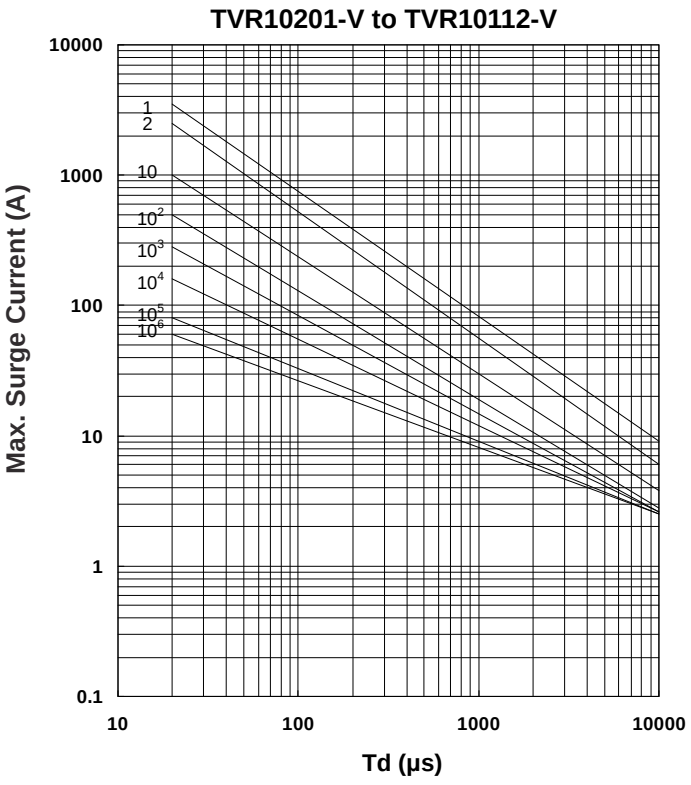
■ Power Derating Curve

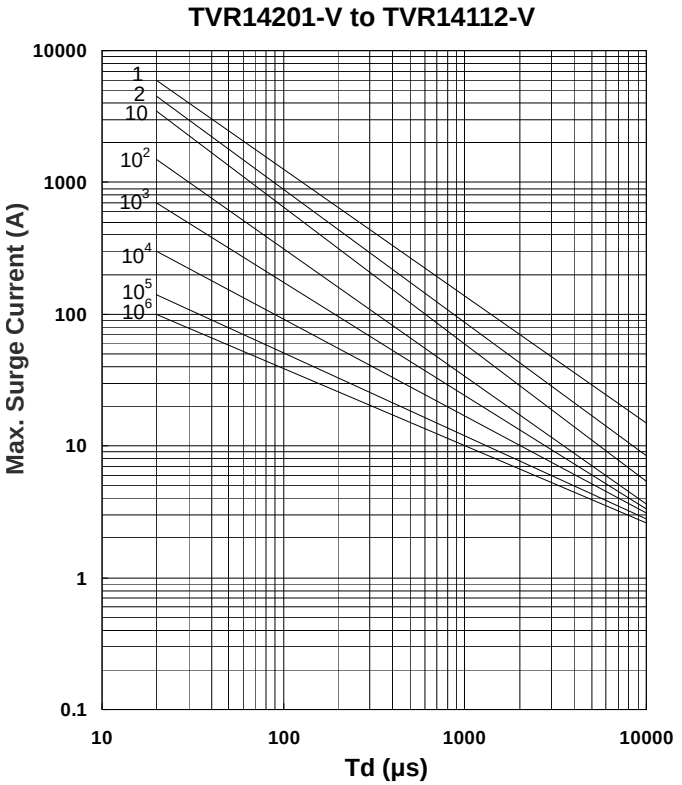


■ Surge Current Standard Waveform



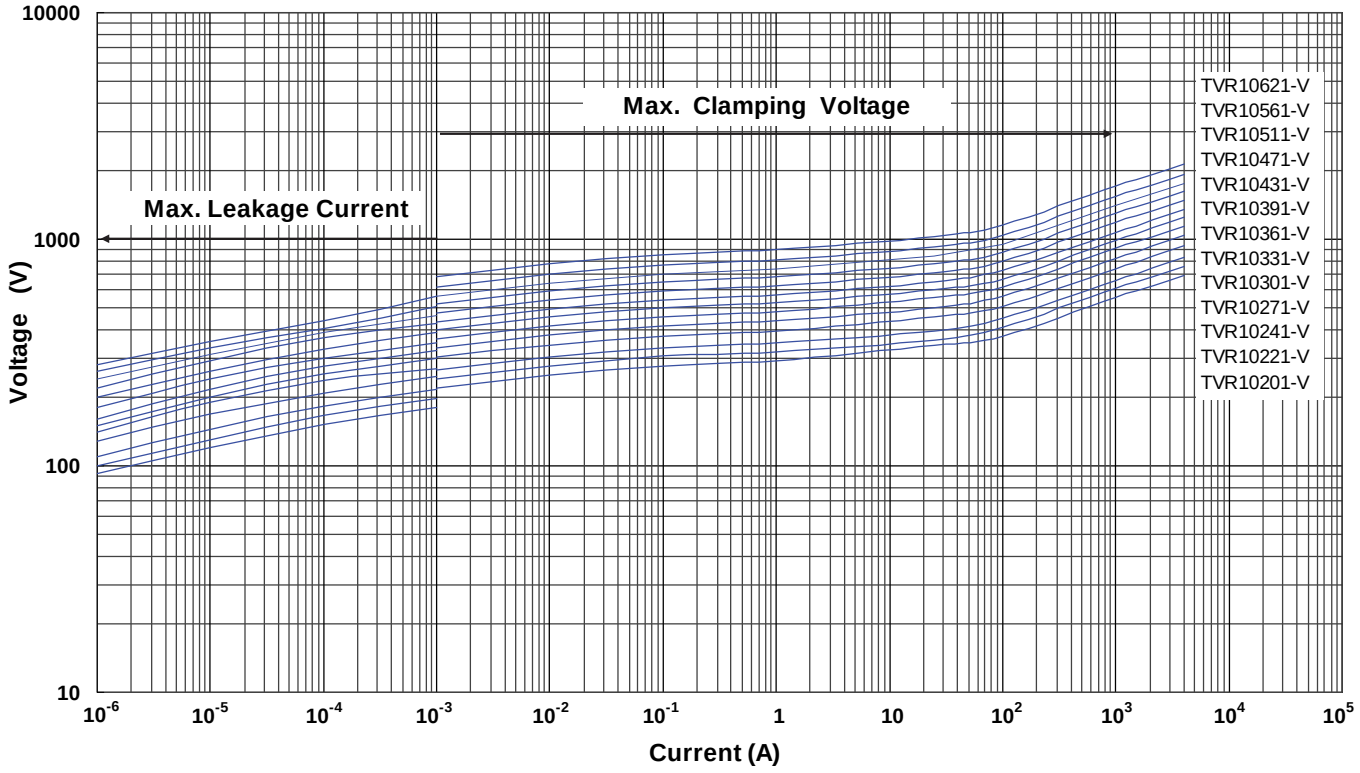
■ Max. Surge Current Derating Curves



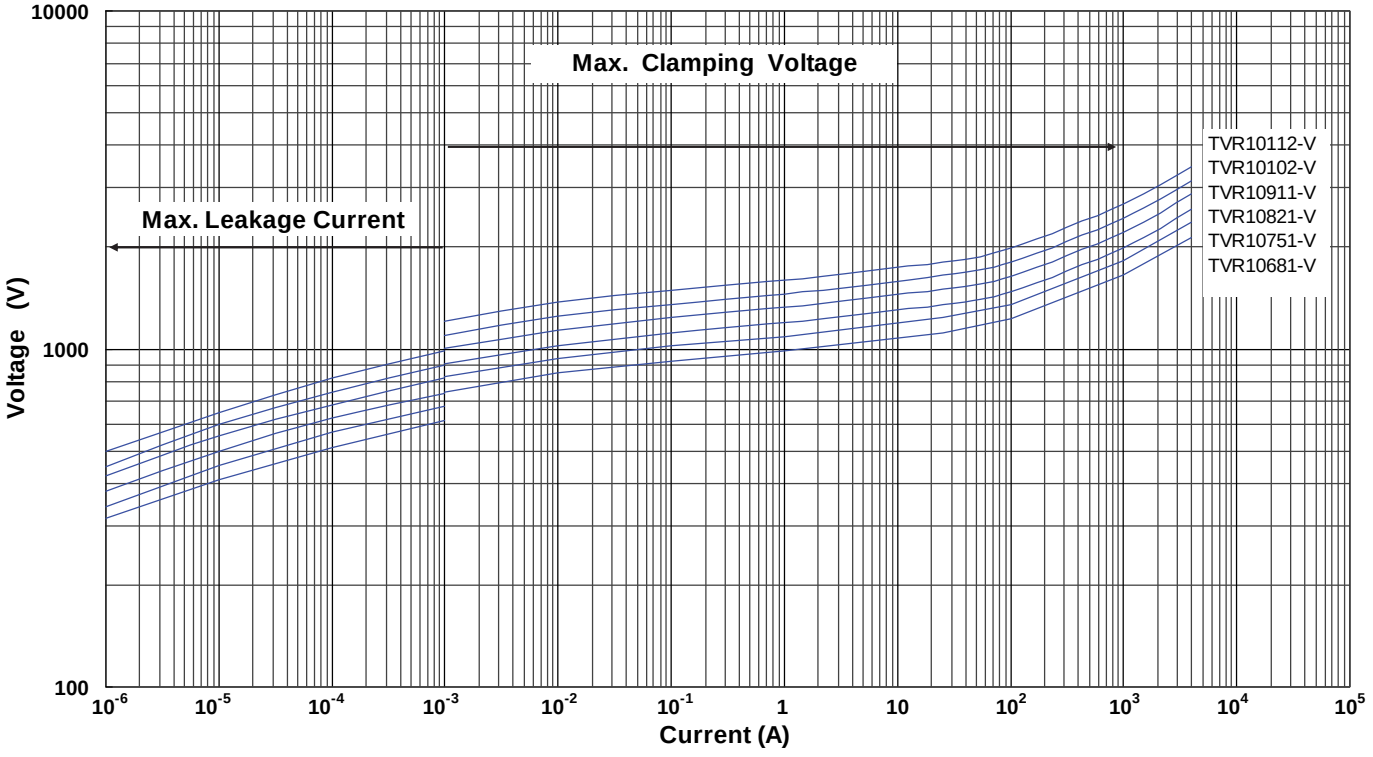


■ Max. Leakage Current and Max. Clamping Voltage Curves

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

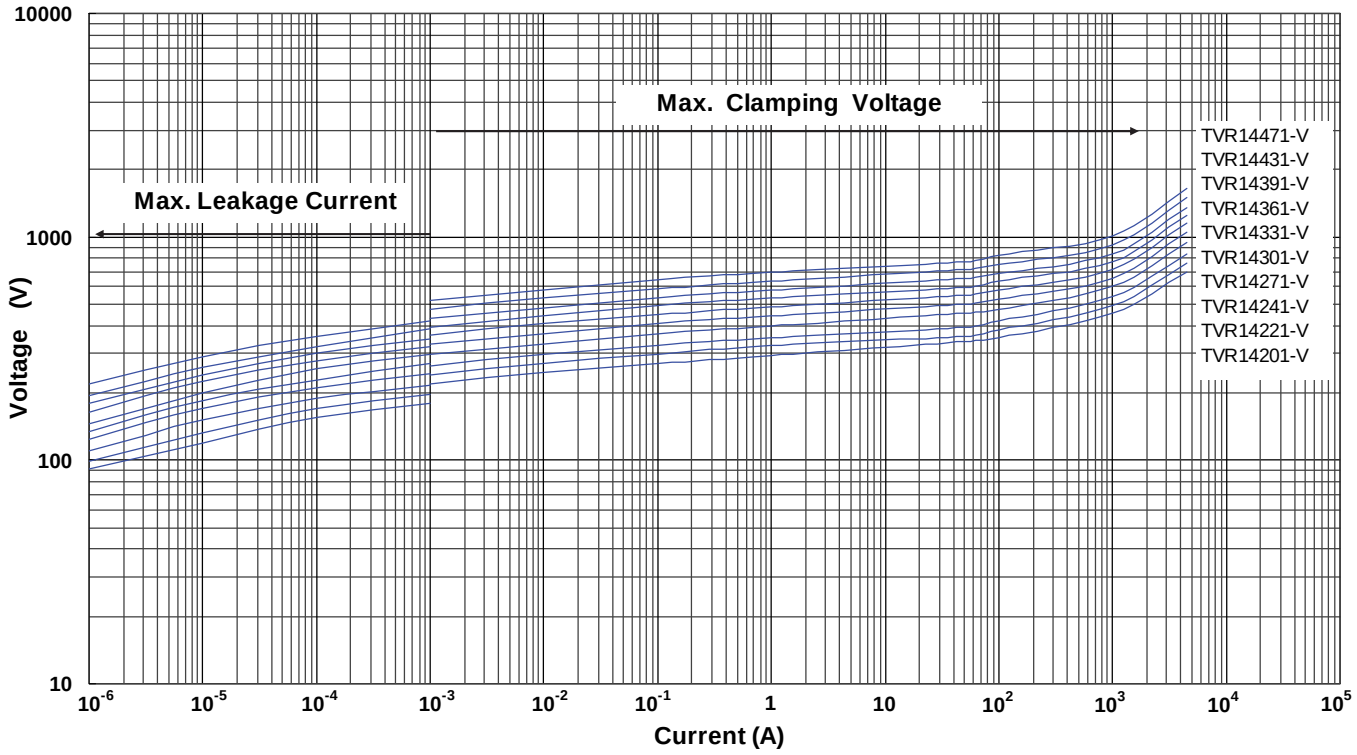


Max. Leakage Current and Max. Clamping Voltage Curves (TVR10681-V to TVR10112-V)

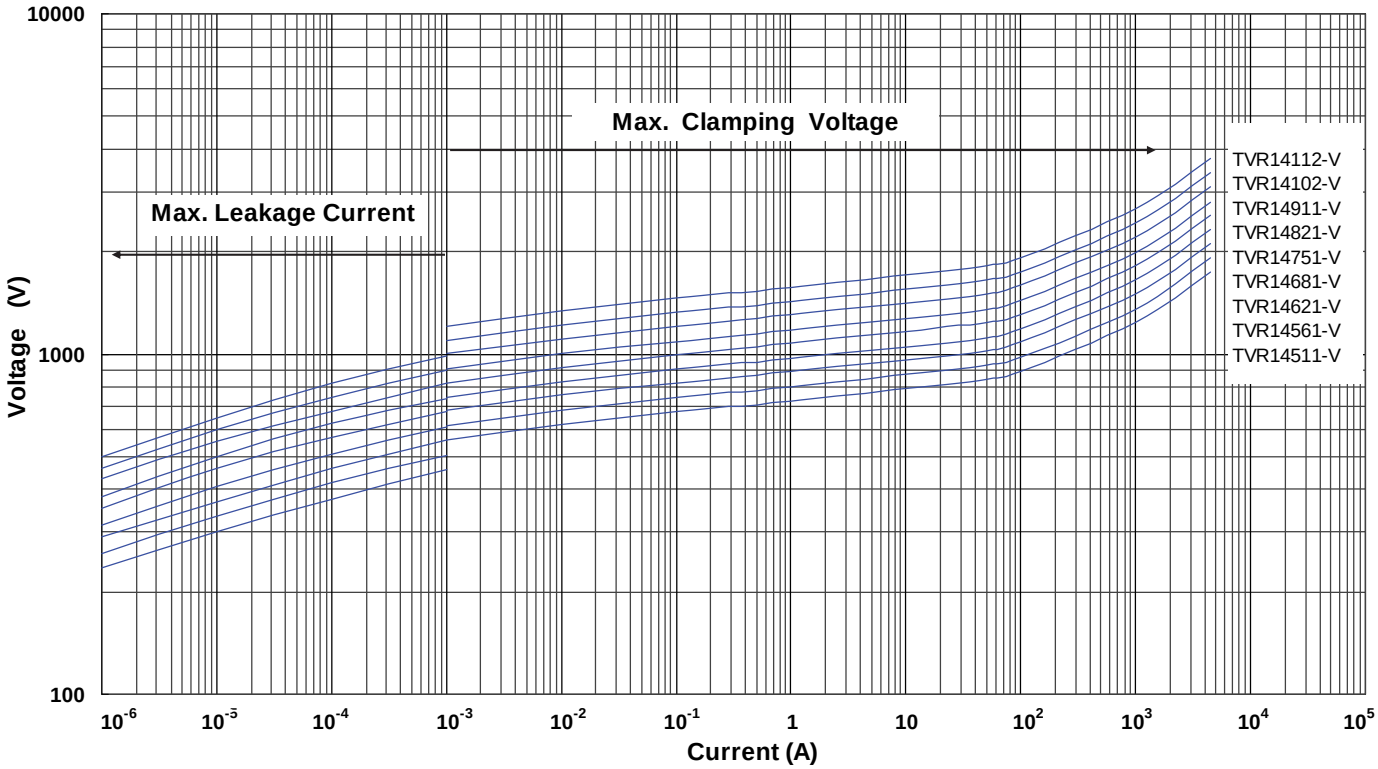


■ Max. Leakage Current and Max. Clamping Voltage Curves

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

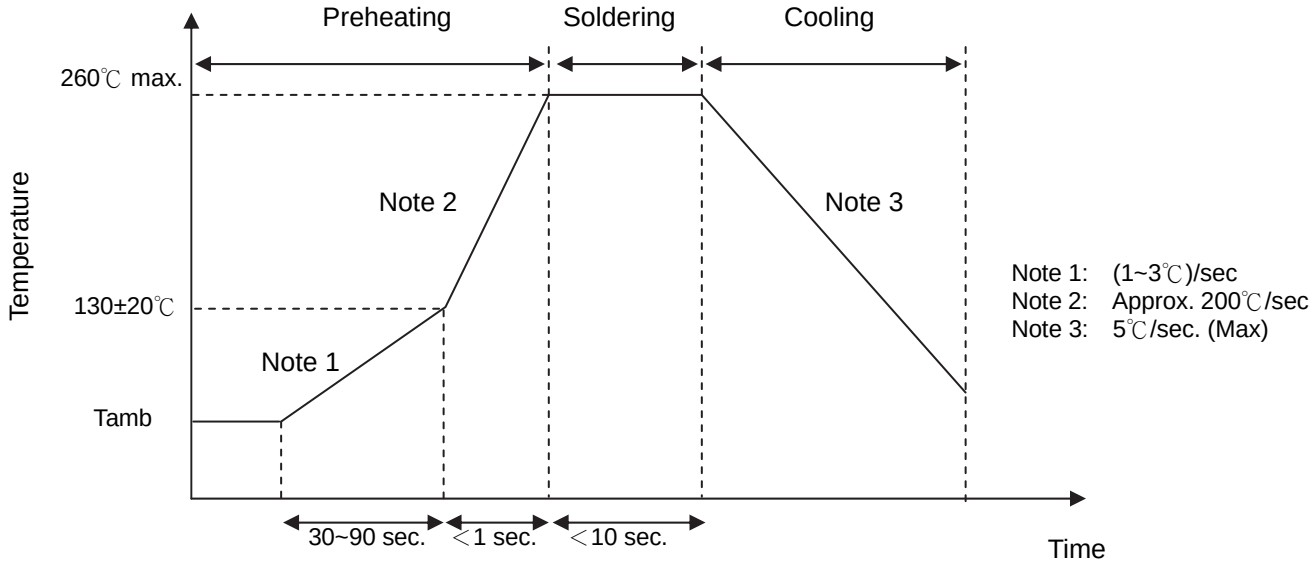


Max. Leakage Current and Max. Clamping Voltage Curves (TVR14511-V to TVR14112-V)



■ 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.)

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. Terminal diameter (mm) / Force (Kg) 0.5<d≦0.8 : 1.0 0.8<d≦1.25 : 2.0	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ 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	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
Vibration	IEC 61051-1	Frequency range: 10 ~ 55 Hz Amplitude: 0.75mm or 98 m/s^2 Direction: 3 mutually perpendicular directions, 2 hrs each.	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ 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	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
High Temperature Storage	IEC 60068-2-2	125±5℃ x 1000± 24 hrs	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
Damp Heat, Steady State	IEC 60068-2-78	a. 40±2℃, 90 ~ 95 % RH, 1344 hrs b. 40±2℃, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage 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	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
Endurance at Upper Category Temperature	IEC 61051-1	85±2℃, 1000±24 hrs at V_{DC} or V_{rms} (Max. Continuous Voltage)	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ 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.	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ 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.	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ No visible damage
Operating Duty Cycle Test	UL 1449 3rd	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)	$\lvert\triangle V_p/V_p\rvert \leqq 10\%$ No visible damage
Nominal Discharge Current Test	UL 1449 3rd	3KA 8/20μs waveform with Vac (@ Deg 90) for 15 times. Interval time between tests is 60 sec. (For TVR14-V (SPD Type 5) series test only)	$\lvert\triangle V_p/V_p\rvert \leqq 10\%$ No visible damage
Voltage Proof	IEC 61051-1	Metal balls method, 2500 Vac 1 min	No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA@85℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{60}\times100\%(\%/°C)$, $\frac{V_{1mA@-40℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{65}\times100\%(\%/°C)$	-0.05≦TC≦0.05 (%/℃)

■ Packaging

● Taping Specification

S Type (Straight lead)

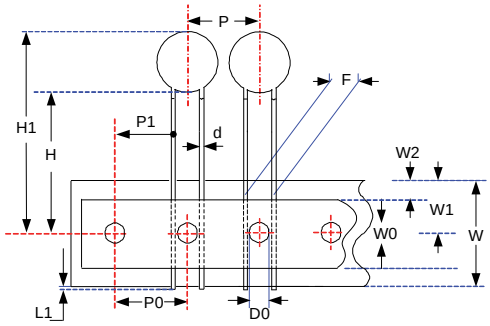


Figure A

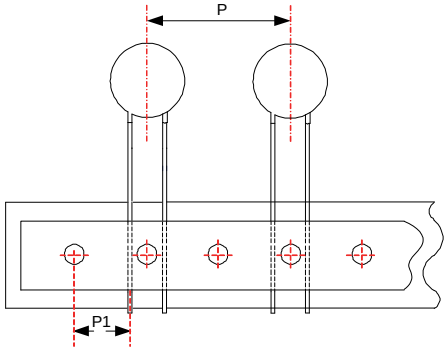
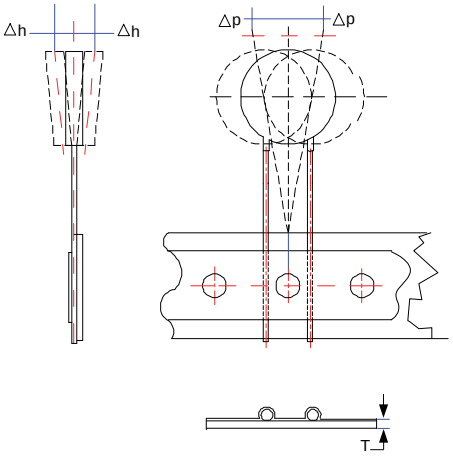


Figure B



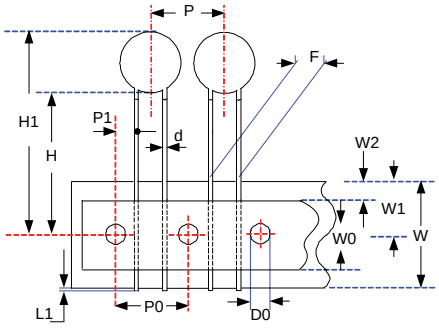


Figure C

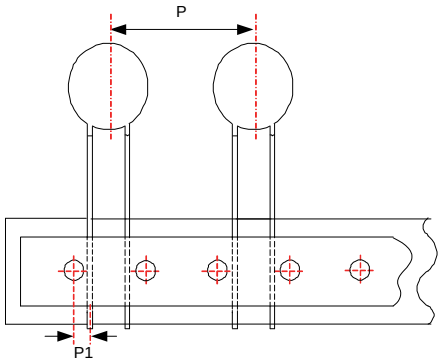


Figure D

(Unit: mm)

Taping Code	Series	P_0 ±0.3	F ±1	P ±1	P_1 ±0.7	H +2/-0	H_1 Max.	d ±0.02	W_0 ±1	W_1 +0.75/-0.5	W_2 Max	W +1/-0.5	△P Max.	△h Max.	L_1 Max.	D_0 ±0.2	T ±0.2	Figure
A (P_0:12.7)	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_0:15.0)	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

F Type (Y kink lead)

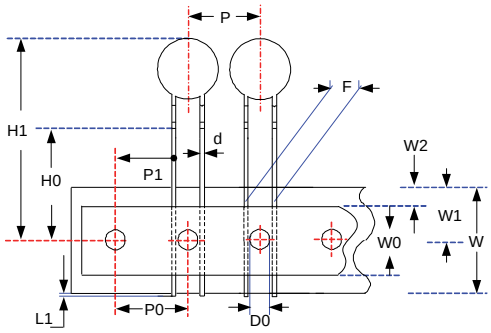
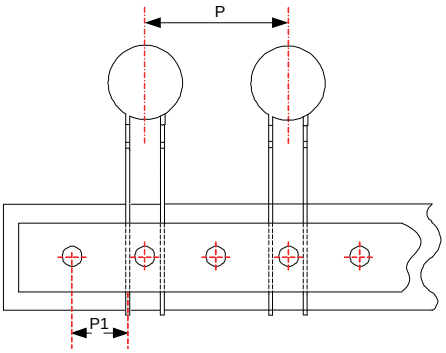
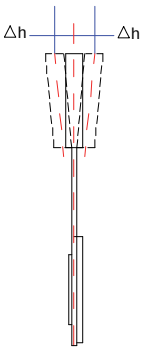


Figure A





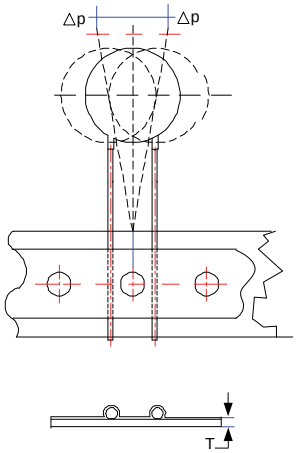


Figure B

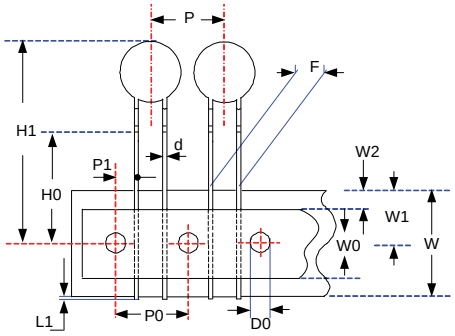


Figure C

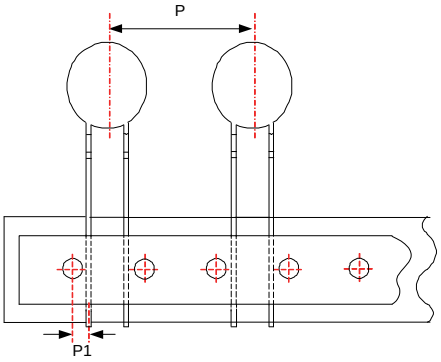


Figure D

(Unit: mm)

Taping Code	Series	P_0	F	P	P_1	H_0	H_1	d	W_0	W_1	W_2	W	△P	△h	L_1	D_0	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	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
(P_0:12.7)	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	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
(P_0:15.0)	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

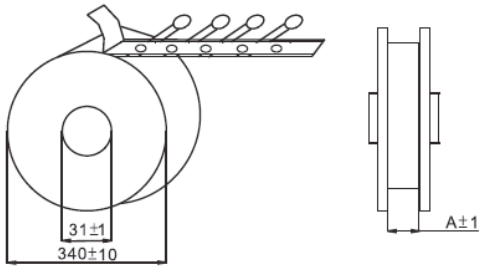
■ Quantity

● Bulk Packing

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

● Reel Packing

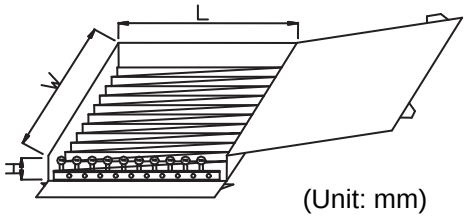
Series	A (mm)	Quantity (pcs/reel)
TVR10(201~471)-V	46	750
TVR10(511~112)-V		500
TVR14(201~391)-V		750
TVR14(431~112)-V		500



(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

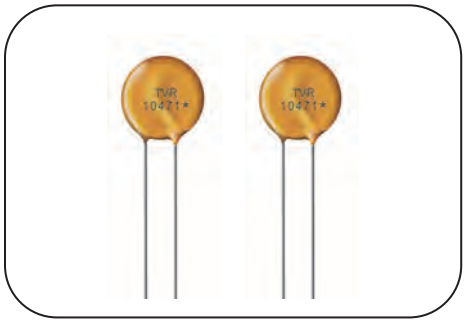
- Storage Conditions:
  1. Storage Temperature: -10℃~+40℃
  2. Relative Humidity: ≦75%RH
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage: 1 year

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

■ Features

1. RoHS compliant
2. Halogen-free series are available
3. Body size: Φ7mm ~ Φ 20mm
4. Wide operating voltage range: 115Vac ~ 680Vac
5. High surge current rating up to 13KA
6. High energy rating up to 720 Joule
7. Operating temperature range: -40°C ~ +85°C
   Storage temperature range: -40°C ~ +125°C
8. Agency recognition: UL 1449 3rd/cUL/VDE/CQC
9. TVR10-D, 14-D, and 20-D meet IEC 60950-1 Annex Q requirement
10. TVR20-D series for SPD Type 2 is available



Note: * of the marking stands for TVR-D 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

Φ 7mm~ Φ 20mm

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

Product Type	
TVR	THINKING Varistor TVR series

Body Size	
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%

Internal Control Code
01~ZZ

Optional Suffix	
D	High surge series
W	High surge series, RoHS compliant
K	High surge series, RoHS compliant & Halogen-Free
S	High surge series for UL 1449 3rd SPD Type 2 application, RoHS compliant (TVR20 only)
N	High surge series for UL 1449 3rd SPD Type 2 application, RoHS compliant & Halogen-Free (TVR20 only)

Appearance	
S	Straight lead, epoxy coating
F	Y kink lead, epoxy coating
T	L kink lead, epoxy coating

Packaging	
AR	Tape & reel packing (hole pitch:12.7mm)
ER	Tape & reel packing (hole pitch:15.0mm)
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

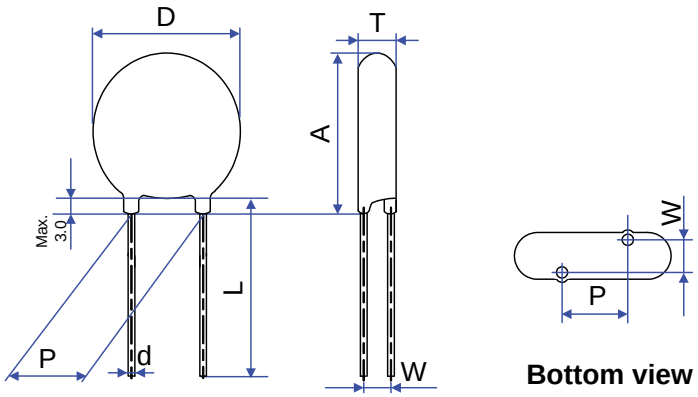
Note: Optional suffix will be the 11th digit if packaging and internal control codes are not coded.

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

■ Structures and Dimensions

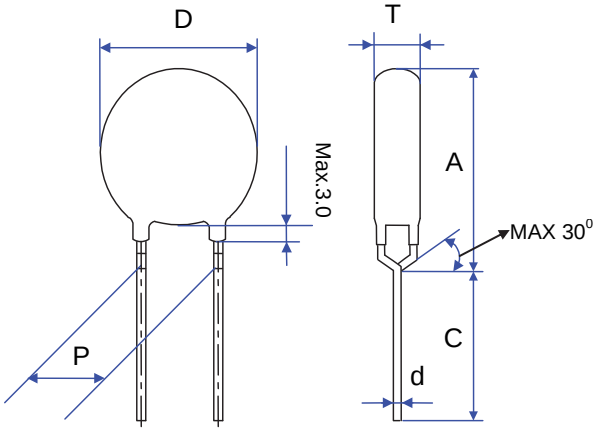
● S Type (Straight lead)



(Unit: mm)

Series	D	Lmin.	d	P	Amax.	Tmax.	W
TVR07-D	7.5~9.5	26.5	0.6±0.02	5±1	12.5	Please refer to Electrical Characteristics Table	
TVR10-D	12.0~14.0	26.5	0.8±0.02	7.5±1	17.5		
TVR14-D	16.0~18.5	26.5	0.8±0.02	7.5±1	21.5		
TVR20-D	22~24.5	22.5	1.0±0.02	10±1	28.5		

● F Type (Y kink lead)



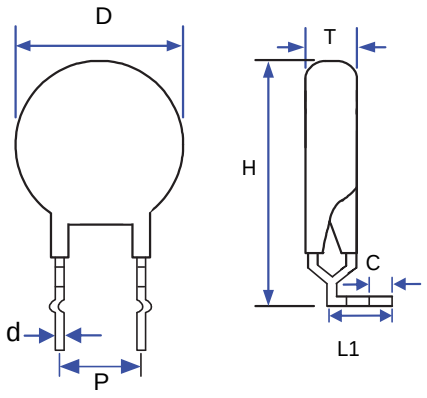
(Unit: mm)

Series	D	Cmin.	d	P	Amax.	Tmax.	W
TVR07-D	7.5~9.5	20	0.6±0.02	5±1	12.5	Please refer to Electrical Characteristics Table	
TVR10-D	12.0~14.0	20	0.8±0.02	7.5±1	18.0		
TVR14-D	16.0~18.5	20	0.8±0.02	7.5±1	22.0		
TVR20-D	22~24.5	20	1.0±0.02	10±1	29.0		

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

- T Type (L kink lead)



(Unit: mm)

Series	D	C	d	P	Amax.	Hmax.	Tmax.
TVR10-D	12.0~14.0	3.8±0.8	0.8±0.02	7.5±1	22.0	7.0±1	Please refer to Electrical Characteristics Table
TVR14-D	16.0~18.5		0.8±0.02	7.5±1	26.5	7.0±1	
TVR20-D	22.0~24.5		1.0±0.02	10±1	33.0	9.0±1	

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

■ Electrical Characteristics

07-D Series

Certified Model No.	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 3rd SPD Application
		V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
		(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR07181-D	TVR07181KSW	180 (162~198)	115	150	300	10	1800	0.25	19	255	2.0	3.9	1.4	For Other Application
TVR07201-D	TVR07201KSW	200 (180~220)	130	170	340	10	1800	0.25	21	230	2.1	4.0	1.5	
TVR07221-D	TVR07221KSW	220 (198~242)	140	180	360	10	1800	0.25	23	210	2.1	4.0	1.5	
TVR07241-D	TVR07241KSW	240(216~264)	150	200	395	10	1800	0.25	25	195	2.3	4.2	1.6	
TVR07271-D	TVR07271KSW	270 (243~297)	175	225	455	10	1800	0.25	28	175	2.4	4.4	1.7	
TVR07301-D	TVR07301KSW	300 (270~330)	195	250	500	10	1800	0.25	32	155	2.7	4.4	1.9	
TVR07331-D	TVR07331KSW	330 (297~363)	215	275	550	10	1800	0.25	34	140	2.8	4.5	2.0	
TVR07361-D	TVR07361KSW	360 (324~396)	230	300	595	10	1800	0.25	37	130	2.9	4.6	2.1	
TVR07391-D	TVR07391KSW	390 (351~429)	250	320	650	10	1800	0.25	40	120	3.1	4.8	2.3	
TVR07431-D	TVR07431KSW	430 (387~473)	275	350	710	10	1800	0.25	46	100	3.0	5.1	2.3	
TVR07471-D	TVR07471KSW	470 (423~517)	300	385	775	10	1800	0.25	49	90	3.2	5.2	2.4	
TVR07511-D	TVR07511KSW	510 (459~561)	320	410	845	10	1800	0.25	54	85	3.4	5.4	2.6	
TVR07561-D	TVR07561KSW	560 (504~616)	350	450	930	10	1800	0.25	55	80	3.6	5.5	2.8	
TVR07621-D	TVR07621KSW	620 (558~682)	395	510	1020	10	1800	0.25	59	80	3.9	5.9	3.0	
TVR07681-D	TVR07681KSW	680 (612~748)	420	560	1120	10	1800	0.25	62	75	4.1	6.2	3.2	
TVR07751-D	TVR07751KSW	750 (675~825)	465	615	1235	10	1800	0.25	66	70	4.4	6.4	3.5	
TVR07821-D	TVR07821KSW	820 (738~902)	510	670	1355	10	1800	0.25	71	65	4.5	6.4	3.2	

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

10-D Series

Certified Model No.	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 3rd SPD Application
		V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
		(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR10181-D	TVR10181KSW	180 (162~198)	115	150	300	25	4000	0.4	47	570	2.4	4.3	1.6	For Other Application
TVR10201-D	TVR10201KSW	200 (180~220)	130	170	340	25	4000	0.4	52	520	2.5	4.4	1.7	For SPD Type 3 Application
TVR10221-D	TVR10221KSW	220 (198~242)	140	180	360	25	4000	0.4	58	470	2.5	4.4	1.7	
TVR10241-D	TVR10241KSW	240 (216~264)	150	200	395	25	4000	0.4	64	420	2.7	4.6	1.8	
TVR10271-D	TVR10271KSW	270 (243~297)	175	225	455	25	4000	0.4	67	370	2.8	4.8	1.9	
TVR10301-D	TVR10301KSW	300 (270~330)	195	250	500	25	4000	0.4	70	340	3.1	4.8	2.1	
TVR10331-D	TVR10331KSW	330 (297~363)	215	275	550	25	4000	0.4	72	320	3.2	4.9	2.2	
TVR10361-D	TVR10361KSW	360 (324~396)	230	300	595	25	4000	0.4	76	300	3.3	5.0	2.3	
TVR10391-D	TVR10391KSW	390 (351~429)	250	320	650	25	4000	0.4	82	280	3.5	5.2	2.5	
TVR10431-D	TVR10431KSW	430 (387~473)	275	350	710	25	4000	0.4	93	250	3.4	5.5	2.5	
TVR10471-D	TVR10471KSW	470 (423~517)	300	385	775	25	4000	0.4	99	240	3.6	5.6	2.6	
TVR10511-D	TVR10511KSW	510 (459~561)	320	410	845	25	4000	0.4	107	220	3.8	5.8	2.8	
TVR10561-D	TVR10561KSW	560 (504~616)	350	450	930	25	4000	0.4	113	200	4.0	5.9	3.0	
TVR10621-D	TVR10621KSW	620 (558~682)	395	510	1020	25	4000	0.4	125	190	4.3	6.3	3.2	
TVR10681-D	TVR10681KSW	680 (612~748)	420	560	1120	25	4000	0.4	128	180	4.9	6.6	3.4	
TVR10751-D	TVR10751KSW	750 (675~825)	465	615	1235	25	4000	0.4	134	170	4.9	6.8	3.7	
TVR10821-D	TVR10821KSW	820 (738~902)	510	670	1355	25	4000	0.4	146	140	4.9	6.8	3.4	
TVR10911-D	TVR10911KSW	910 (819~1001)	550	745	1500	25	4000	0.4	152	130	5.3	7.2	3.7	
TVR10102-D	TVR10102KSW	1000(900~1100)	625	825	1650	25	4000	0.4	170	120	5.5	7.5	4.0	
TVR10112-D	TVR10112KSW	1100(990~1210)	680	895	1815	25	4000	0.4	180	110	5.7	8.0	4.3	

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

14-D Series

Certified Model No.	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 3rd SPD Application
		V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
		(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR14181-D	TVR14181KSW	180 (162~198)	115	150	300	50	8000	0.6	60	1000	2.4	4.3	1.6	For SPD Type 3 Application
TVR14201-D	TVR14201KSW	200 (180~220)	130	170	340	50	8000	0.6	82	900	2.5	4.4	1.7	
TVR14221-D	TVR14221KSW	220 (198~242)	140	180	360	50	8000	0.6	90	850	2.5	4.4	1.7	
TVR14241-D	TVR14241KSW	240 (216~264)	150	200	395	50	8000	0.6	98	780	2.7	4.6	1.8	
TVR14271-D	TVR14271KSW	270 (243~297)	175	225	455	50	8000	0.6	116	650	2.8	4.8	1.9	
TVR14301-D	TVR14301KSW	300 (270~330)	195	250	500	50	8000	0.6	128	610	3.1	4.8	2.1	
TVR14331-D	TVR14331KSW	330 (297~363)	215	275	550	50	8000	0.6	140	580	3.2	4.9	2.2	
TVR14361-D	TVR14361KSW	360 (324~396)	230	300	595	50	8000	0.6	158	550	3.3	5.0	2.3	
TVR14391-D	TVR14391KSW	390 (351~429)	250	320	650	50	8000	0.6	170	520	3.5	5.2	2.5	
TVR14431-D	TVR14431KSW	430 (387~473)	275	350	710	50	8000	0.6	185	480	3.4	5.5	2.5	
TVR14471-D	TVR14471KSW	470 (423~517)	300	385	775	50	8000	0.6	205	460	3.6	5.6	2.6	
TVR14511-D	TVR14511KSW	510 (459~561)	320	410	845	50	8000	0.6	220	430	3.8	5.8	2.8	
TVR14561-D	TVR14561KSW	560 (504~616)	350	450	930	50	8000	0.6	240	390	4.0	5.9	3.0	
TVR14621-D	TVR14621KSW	620 (558~682)	395	510	1020	50	8000	0.6	250	350	4.3	6.3	3.2	
TVR14681-D	TVR14681KSW	680 (612~748)	420	560	1120	50	8000	0.6	260	320	4.5	6.6	3.4	
TVR14751-D	TVR14751KSW	750 (675~825)	465	615	1235	50	8000	0.6	270	290	4.8	6.8	3.7	
TVR14821-D	TVR14821KSW	820 (738~902)	510	670	1355	50	8000	0.6	280	250	4.9	6.8	3.4	
TVR14911-D	TVR14911KSW	910 (819~1001)	550	745	1500	50	8000	0.6	295	230	5.3	7.2	3.7	
TVR14102-D	TVR14102KSW	1000(900~1100)	625	825	1650	50	8000	0.6	335	210	5.7	7.5	4.0	
TVR14112-D	TVR14112KSW	1100(990~1210)	680	895	1815	50	8000	0.6	360	190	5.8	8.0	4.3	

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

20-D Series

Certified Model No.	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 3rd SPD Application
		V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
		(V)	(V)	(V)	(V)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR20181-D	TVR20181KSW	180 (162~198)	115	150	300	100	13000	1.0	152	2200	2.8	4.7	1.8	For SPD Type 3 Application
TVR20201-D	TVR20201KSW	200 (180~220)	130	170	340	100	13000	1.0	175	1900	2.9	4.8	1.9	
TVR20221-D	TVR20221KSW	220 (198~242)	140	180	360	100	13000	1.0	185	1700	2.9	4.8	1.9	
TVR20241-D	TVR20241KSW	240 (216~264)	150	200	395	100	13000	1.0	198	1500	3.1	5.0	2.0	
TVR20271-D	TVR20271KSW	270 (243~297)	175	225	455	100	13000	1.0	220	1400	3.2	5.2	2.1	
TVR20301-D	TVR20301KSW	300 (270~330)	195	250	500	100	13000	1.0	245	1300	3.5	5.2	2.3	
TVR20331-D	TVR20331KSW	330 (297~363)	215	275	550	100	13000	1.0	268	1200	3.6	5.3	2.4	
TVR20361-D	TVR20361KSW	360 (324~396)	230	300	595	100	13000	1.0	315	1000	3.7	5.4	2.5	
TVR20391-D	TVR20391KSW	390 (351~429)	250	320	650	100	13000	1.0	350	880	3.9	5.6	2.7	
TVR20431-D	TVR20431KSW	430 (387~473)	275	350	710	100	13000	1.0	380	800	3.8	5.9	2.7	
TVR20471-D	TVR20471KSW	470 (423~517)	300	385	775	100	13000	1.0	405	700	4.0	6.0	2.8	
TVR20511-D	TVR20511KSW	510 (459~561)	320	410	845	100	13000	1.0	445	630	4.2	6.2	3.0	
TVR20561-D	TVR20561KSW	560 (504~616)	350	450	930	100	13000	1.0	475	530	4.4	6.3	3.2	
TVR20621-D	TVR20621KSW	620 (558~682)	395	510	1020	100	13000	1.0	490	490	4.7	6.7	3.4	
TVR20681-D	TVR20681KSW	680 (612~748)	420	560	1120	100	13000	1.0	500	470	4.9	7.0	3.6	
TVR20751-D	TVR20751KSW	750 (675~825)	465	615	1235	100	13000	1.0	525	450	5.2	7.2	3.9	
TVR20821-D	TVR20821KSW	820 (738~902)	510	670	1355	100	13000	1.0	545	410	5.3	7.2	3.6	
TVR20911-D	TVR20911KSW	910 (819~1001)	550	745	1500	100	13000	1.0	595	380	5.7	7.6	3.9	
TVR20102-D	TVR20102KSW	1000(900~1100)	625	825	1650	100	13000	1.0	650	360	6.1	7.9	4.2	
TVR20112-D	TVR20112KSW	1100(990~1210)	680	895	1815	100	13000	1.0	720	340	6.2	8.4	4.5	

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

20-D for SPD Type 2 Application Series

Certified Model No.	Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Nominal Discharge Current *1 (8/20us)	Rated Power	Max. Energy (10/1000μs)	Reference Capacitance @1KHz	Dimension			UL 1449 3rd SPD Application
		V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	In	P	Wmax	Cp	Tmin	Tmax	W ±1.0	
		(V)	(V)	(V)	(V)	(A)	(A)	(A)	(W)	(J)	(pF)	(mm)			
TVR20181-S	TVR20181KSS	180(162~198)	115	150	300	100	13000	5000	1.0	152	2200	2.8	4.7	1.8	For SPD Type 2 Application
TVR20201-S	TVR20201KSS	200(180~220)	130	170	340	100	13000	5000	1.0	175	1900	2.9	4.8	1.9	
TVR20221-S	TVR20221KSS	220(198~242)	140	180	360	100	13000	5000	1.0	185	1700	2.9	4.8	1.9	
TVR20241-S	TVR20241KSS	240(216~264)	150	200	395	100	13000	5000	1.0	198	1500	3.1	5.0	2.0	
TVR20271-S	TVR20271KSS	270(243~297)	175	225	455	100	13000	5000	1.0	220	1400	3.2	5.2	2.1	
TVR20301-S	TVR20301KSS	300(270~330)	195	250	500	100	13000	5000	1.0	245	1300	3.5	5.2	2.3	
TVR20331-S	TVR20331KSS	330(297~363)	215	275	550	100	13000	5000	1.0	268	1200	3.6	5.3	2.4	
TVR20361-S	TVR20361KSS	360(324~396)	230	300	595	100	13000	5000	1.0	315	1000	3.7	5.4	2.5	
TVR20391-S	TVR20391KSS	390(351~429)	250	320	650	100	13000	5000	1.0	350	880	3.9	5.6	2.7	
TVR20431-S	TVR20431KSS	430(387~473)	275	350	710	100	13000	5000	1.0	380	800	3.8	5.9	2.7	
TVR20471-S	TVR20471KSS	470(423~517)	300	385	775	100	13000	5000	1.0	405	700	4.0	6.0	2.8	
TVR20511-S	TVR20511KSS	510(459~561)	320	410	845	100	13000	5000	1.0	445	630	4.2	6.2	3.0	
TVR20561-S	TVR20561KSS	560(504~616)	350	450	930	100	13000	5000	1.0	475	530	4.4	6.3	3.2	
TVR20621-S	TVR20621KSS	620(558~682)	395	510	1020	100	13000	5000	1.0	490	490	4.7	6.7	3.4	
TVR20681-S	TVR20681KSS	680(612~748)	420	560	1120	100	13000	5000	1.0	500	470	4.9	7.0	3.6	
TVR20751-S	TVR20751KSS	750(675~825)	465	615	1235	100	13000	5000	1.0	525	450	5.2	7.2	3.9	
TVR20821-S	TVR20821KSS	820(738~902)	510	670	1355	100	13000	5000	1.0	545	410	5.3	7.2	3.6	
TVR20911-S	TVR20911KSS	910(819~1001)	550	745	1500	100	13000	5000	1.0	595	380	5.7	7.6	3.9	
TVR20102-S	TVR20102KSS	1000(900~1100)	625	825	1650	100	13000	5000	1.0	650	360	6.1	7.9	4.2	
TVR20112-S	TVR20112KSS	1100(990~1210)	680	895	1815	100	13000	5000	1.0	720	340	6.2	8.4	4.5	

Note:

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

■ Safety Approvals

Certified Model No.	Agency				
	c UL us	VDE		CQC	
	UL1449 3rd & cUL: E314979	40021243	IEC60950-1 2nd Annex Q	GB/T10193-1997 GB/T10194-1997 CQC10001041750 CQC10001041751	GB8898-2011 GB4943.1-2011 CQC10001041750 CQC10001041751
TVR07181-D	√	√		√	
TVR07201-D	√	√		√	
TVR07221-D	√	√		√	
TVR07241-D	√	√		√	
TVR07271-D	√	√		√	
TVR07301-D	√	√		√	
TVR07331-D	√	√		√	
TVR07361-D	√	√		√	
TVR07391-D	√	√		√	
TVR07431-D	√	√		√	
TVR07471-D	√	√		√	
TVR07511-D	√	√		√	
TVR07561-D	√	√		√	
TVR07621-D	√	√		√	
TVR07681-D	√	√		√	
TVR07751-D	√	√		√	
TVR07821-D	√	√		√	
TVR10181-D	√	√	√	√	
TVR10201-D	√	√	√	√	√
TVR10221-D	√	√	√	√	√
TVR10241-D	√	√	√	√	√
TVR10271-D	√	√	√	√	√
TVR10301-D	√	√	√	√	√
TVR10331-D	√	√	√	√	√
TVR10361-D	√	√	√	√	√
TVR10391-D	√	√	√	√	√
TVR10431-D	√	√	√	√	√
TVR10471-D	√	√	√	√	√
TVR10511-D	√	√	√	√	√
TVR10561-D	√	√	√	√	√
TVR10621-D	√	√	√	√	√
TVR10681-D	√	√	√	√	√
TVR10751-D	√	√	√	√	√
TVR10821-D	√	√	√	√	√
TVR10911-D	√	√	√	√	√
TVR10102-D	√	√	√	√	√
TVR10112-D	√	√	√	√	√

Metal Oxide Varistor：TVR-D Series

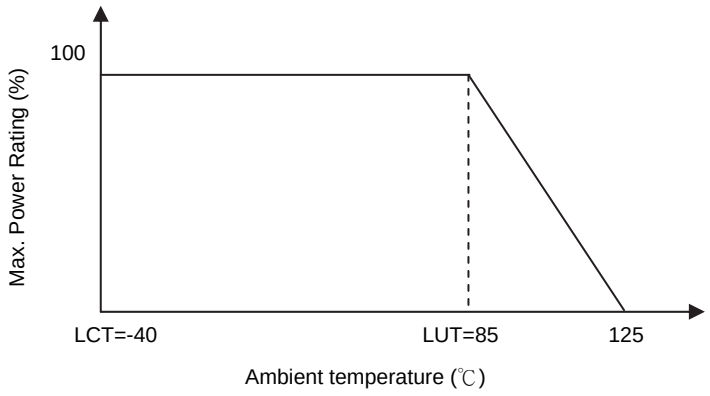
Disc Type Varistor for Surge Protection (High Surge Series)

Certified Model No.	Agency				
	c UL us	VDE		CQC	
	UL1449 3rd & cUL: E314979	40021243	IEC60950-1 2nd Annex Q	GB/T10193-1997 GB/T10194-1997 CQC10001041750 CQC10001041751	GB8898-2011 GB4943.1-2011 CQC10001041750 CQC10001041751
TVR14181-D	√	√	√	√	
TVR14201-D	√	√	√	√	√
TVR14221-D	√	√	√	√	√
TVR14241-D	√	√	√	√	√
TVR14271-D	√	√	√	√	√
TVR14301-D	√	√	√	√	√
TVR14331-D	√	√	√	√	√
TVR14361-D	√	√	√	√	√
TVR14391-D	√	√	√	√	√
TVR14431-D	√	√	√	√	√
TVR14471-D	√	√	√	√	√
TVR14511-D	√	√	√	√	√
TVR14561-D	√	√	√	√	√
TVR14621-D	√	√	√	√	√
TVR14681-D	√	√	√	√	√
TVR14751-D	√	√	√	√	√
TVR14821-D	√	√	√	√	√
TVR14911-D	√	√	√	√	√
TVR14102-D	√	√	√	√	√
TVR14112-D	√	√	√	√	√
TVR20181-D / -S	√	√	√	√	
TVR20201-D / -S	√	√	√	√	√
TVR20221-D / -S	√	√	√	√	√
TVR20241-D / -S	√	√	√	√	√
TVR20271-D / -S	√	√	√	√	√
TVR20301-D / -S	√	√	√	√	√
TVR20331-D / -S	√	√	√	√	√
TVR20361-D / -S	√	√	√	√	√
TVR20391-D / -S	√	√	√	√	√
TVR20431-D / -S	√	√	√	√	√
TVR20471-D / -S	√	√	√	√	√
TVR20511-D / -S	√	√	√	√	√
TVR20561-D / -S	√	√	√	√	√
TVR20621-D / -S	√	√	√	√	√
TVR20681-D / -S	√	√	√	√	√
TVR20751-D / -S	√	√	√	√	√
TVR20821-D / -S	√	√	√	√	√
TVR20911-D / -S	√	√	√	√	√
TVR20102-D / -S	√	√	√	√	√
TVR20112-D / -S	√	√	√	√	√

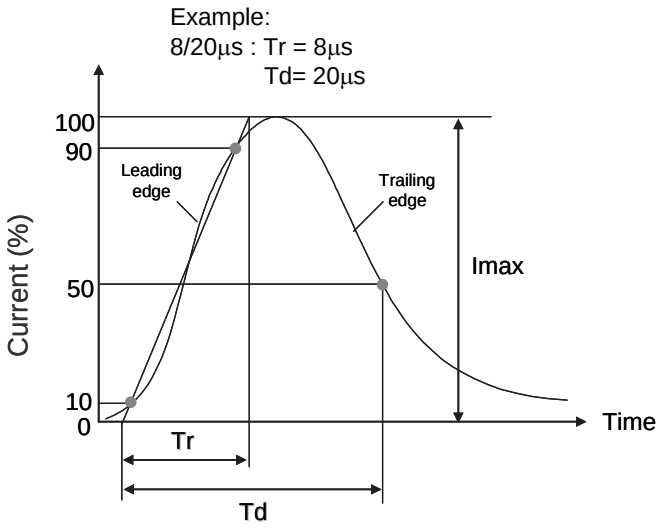
Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

■ Power Derating Curve

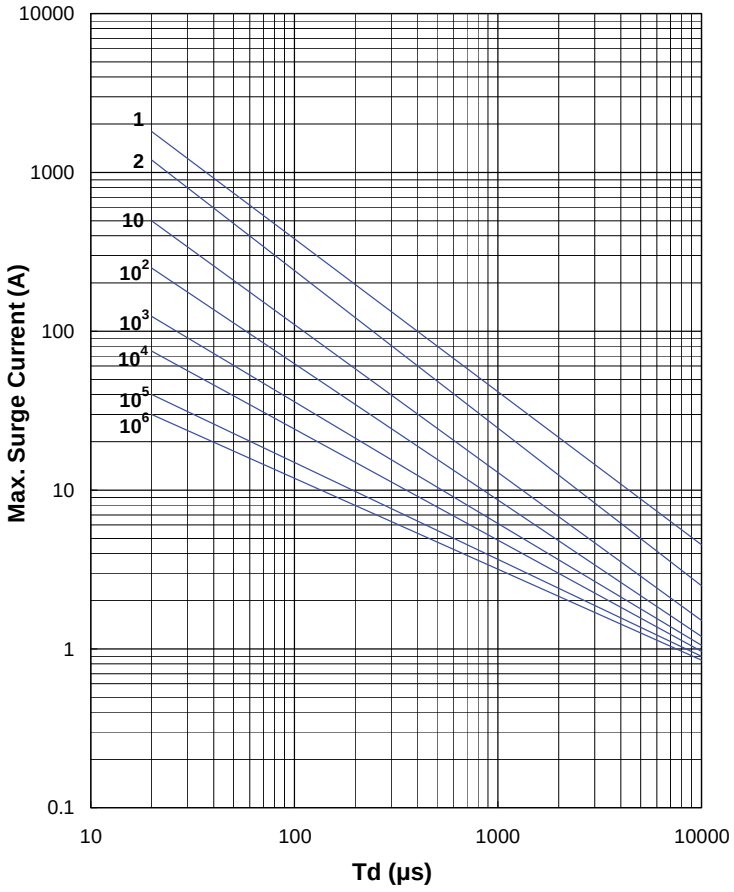


■ Surge Current Standard Waveform

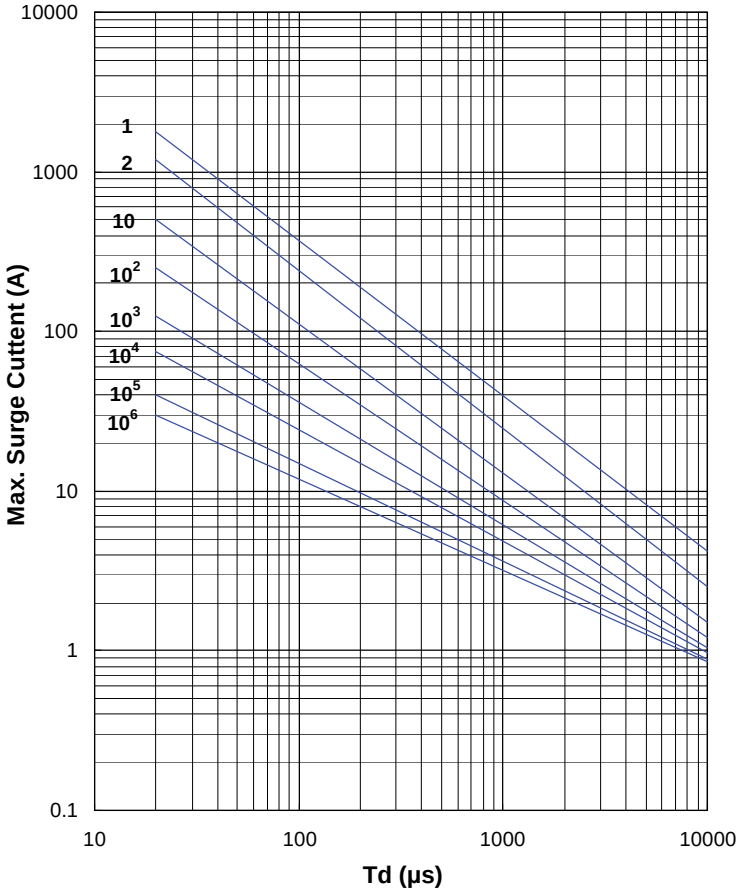


■ Max. Surge Current Derating Curves

TVR07181-D to TVR07471-D



TVR07511-D to TVR07821-D

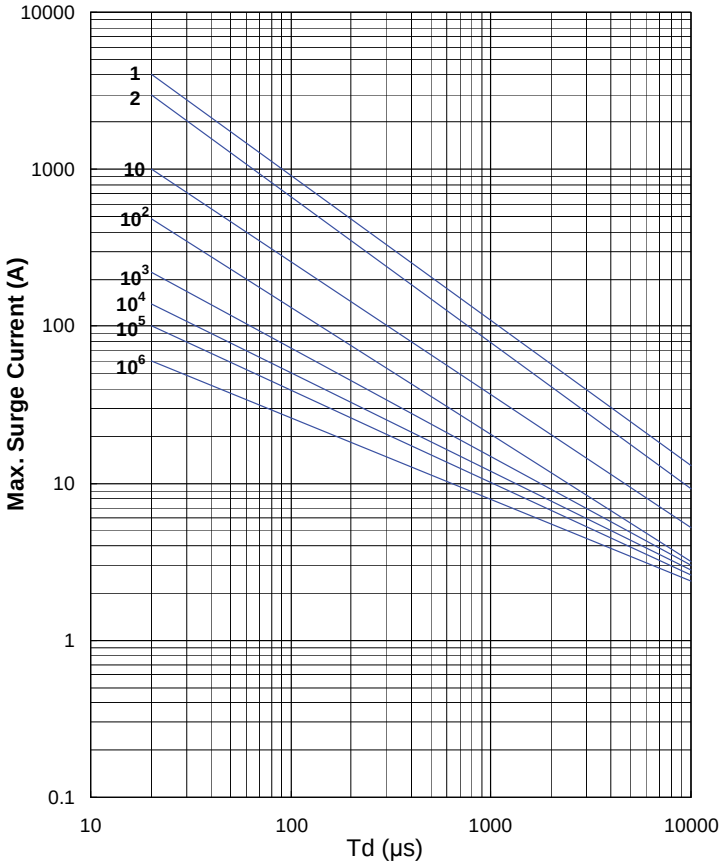


Metal Oxide Varistor：TVR-D Series

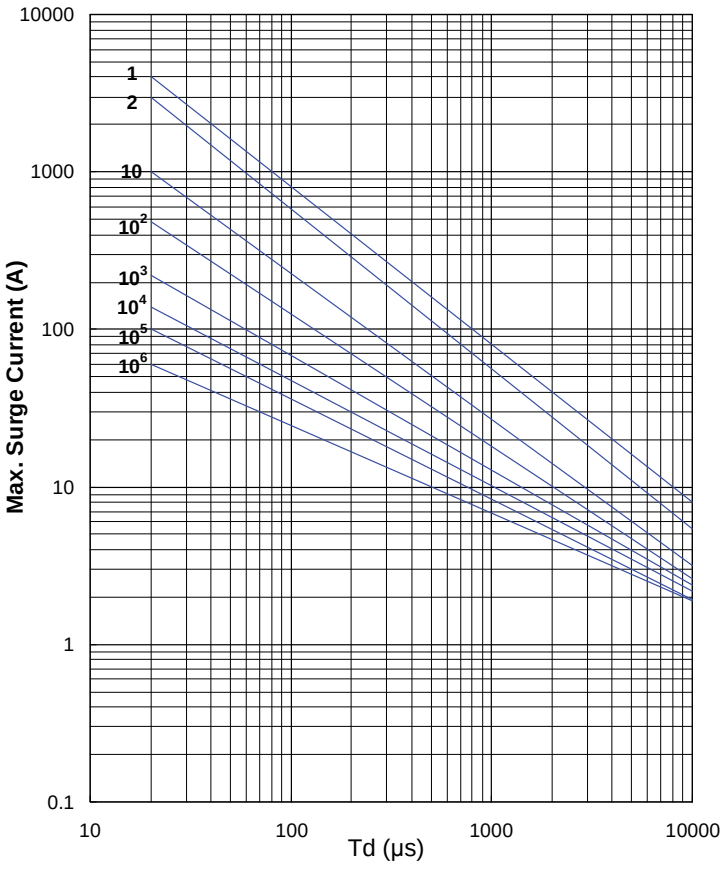
Disc Type Varistor for Surge Protection (High Surge Series)

■ Max. Surge Current Derating Curves

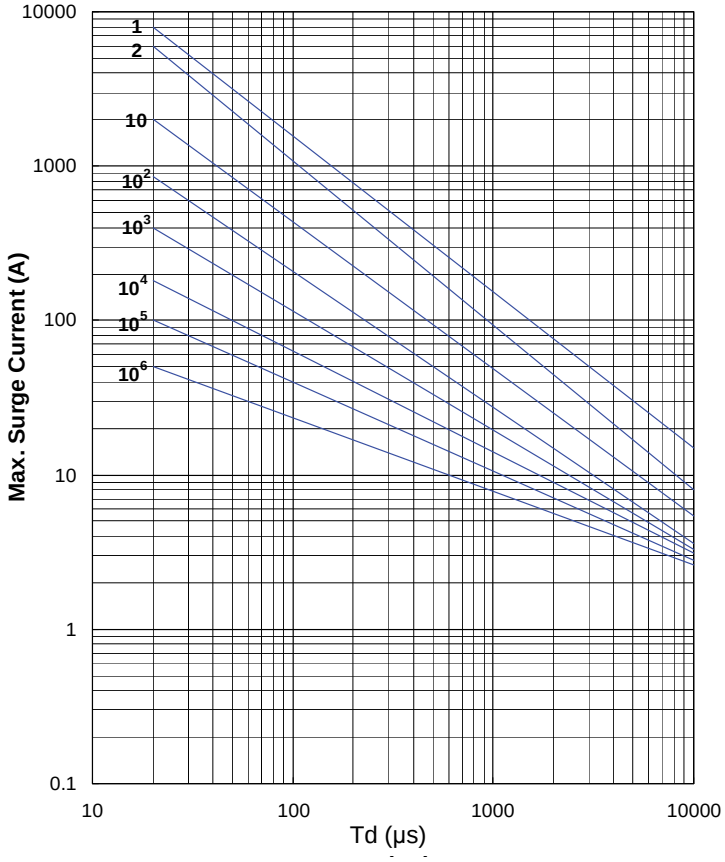
TVR10181-D to TVR10751-D



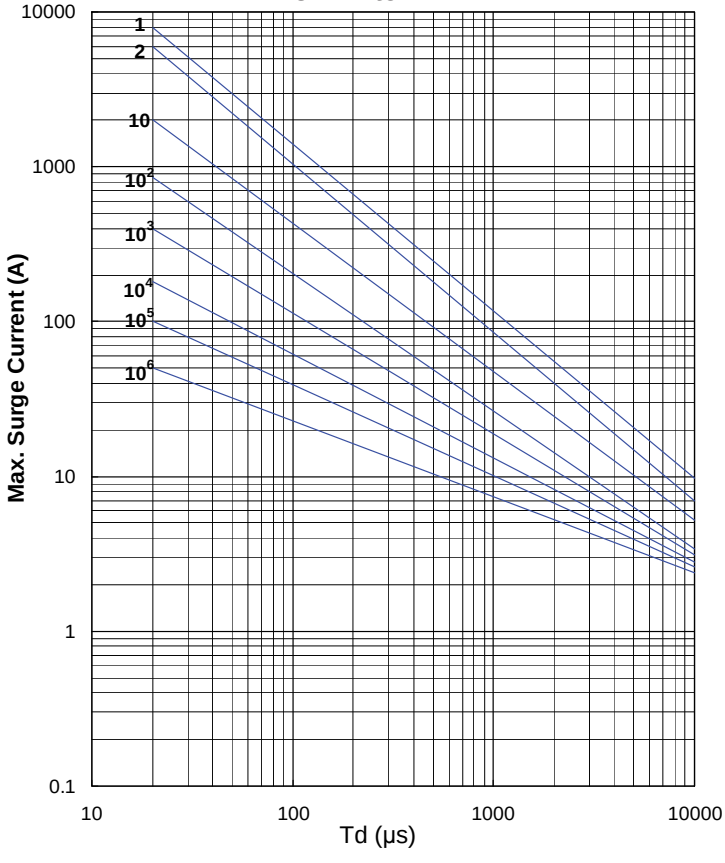
TVR10821-D to TVR10112-D



TVR14181-D to TVR14751-D



TVR14821-D to TVR14112-D

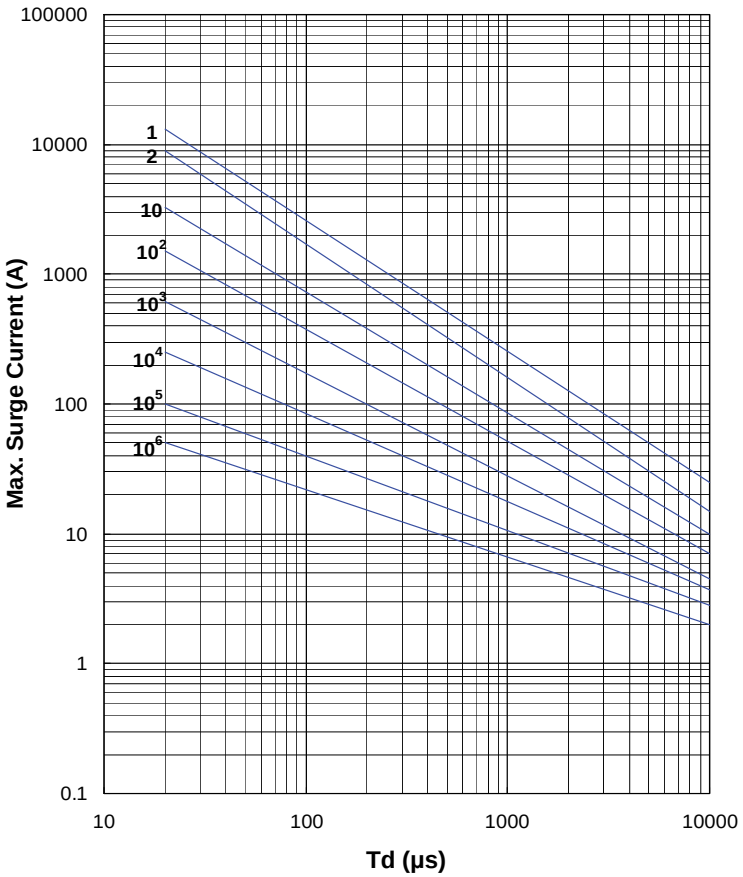


Metal Oxide Varistor：TVR-D Series

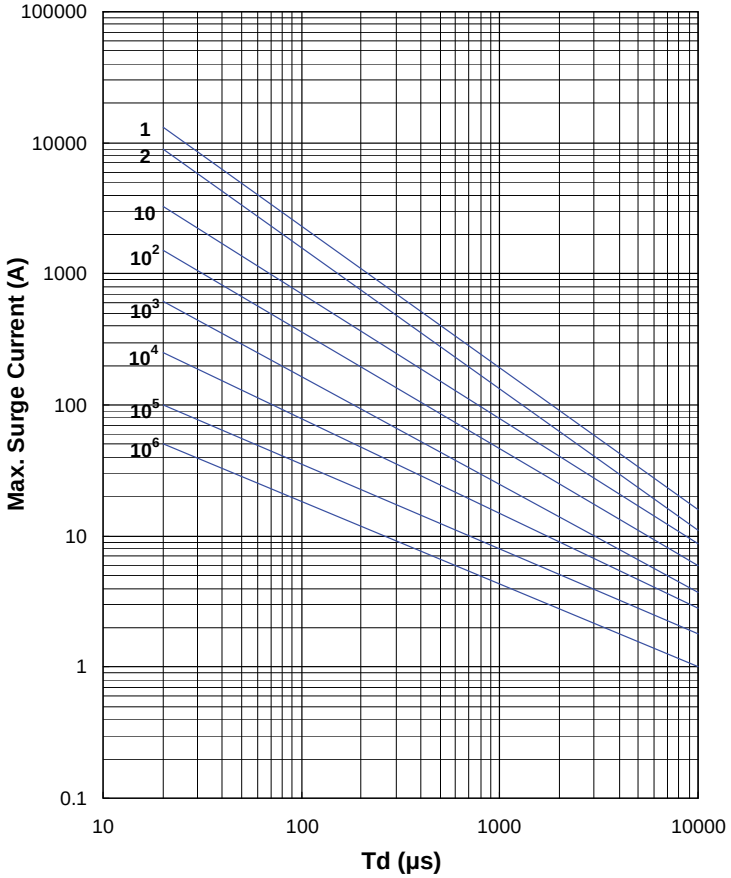
Disc Type Varistor for Surge Protection (High Surge Series)

■ Max. Surge Current Derating Curves

TVR20181-D(-S) to TVR20751-D(-S)

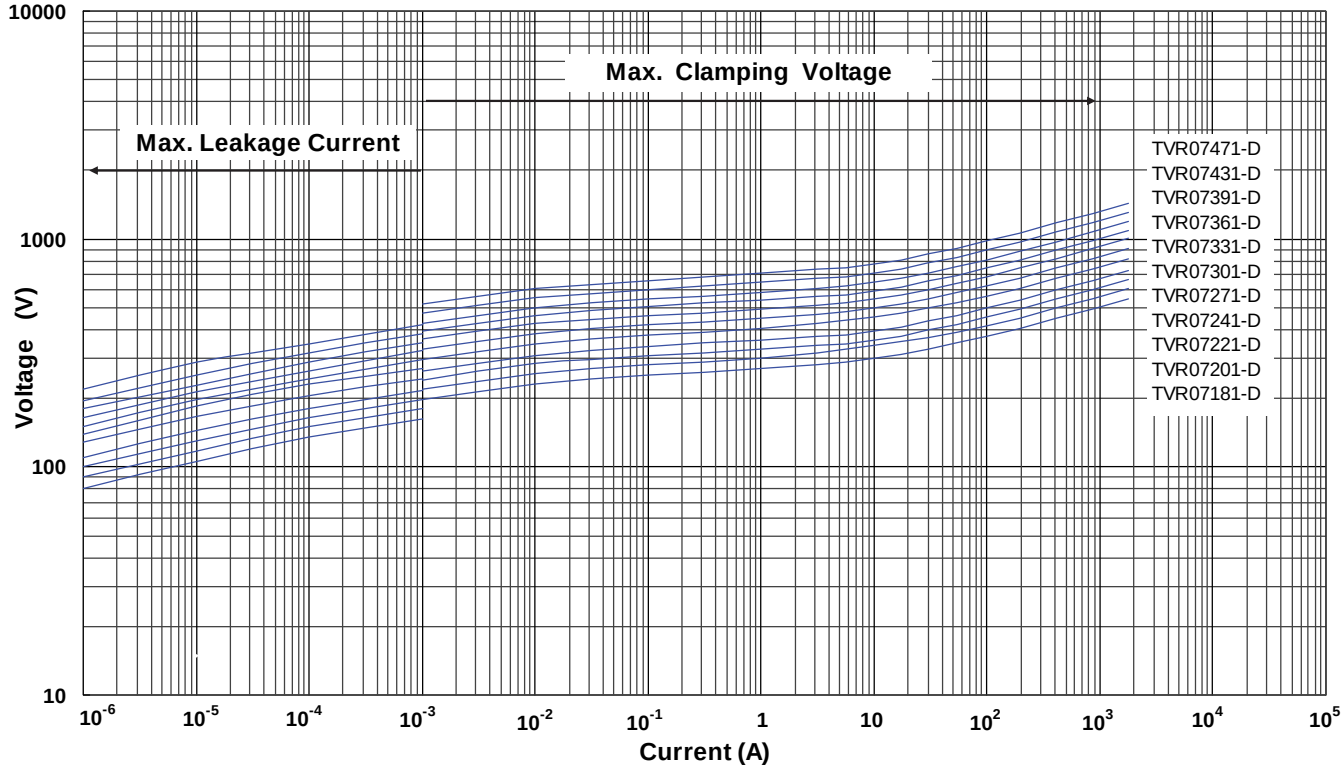


TVR20821-D(-S) to TVR20112-D(-S)



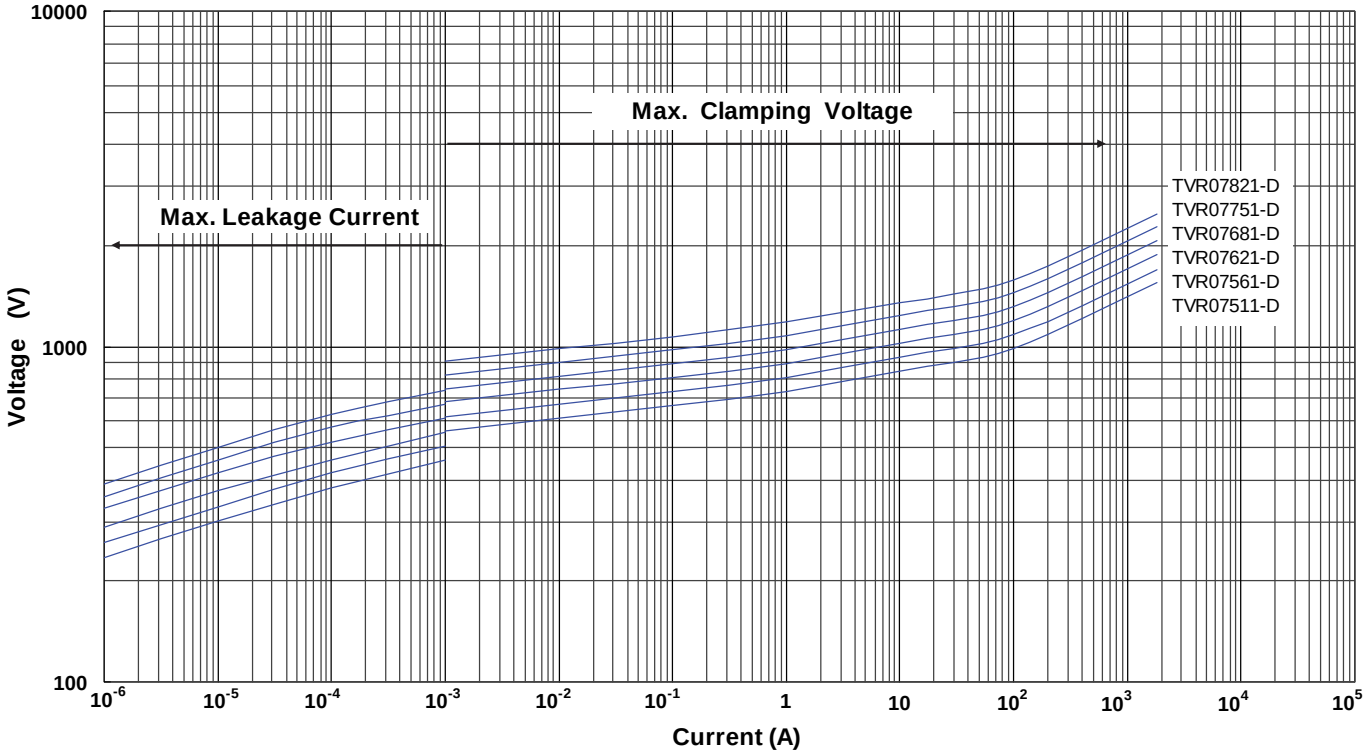
■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR07181-D to TVR07471-D)

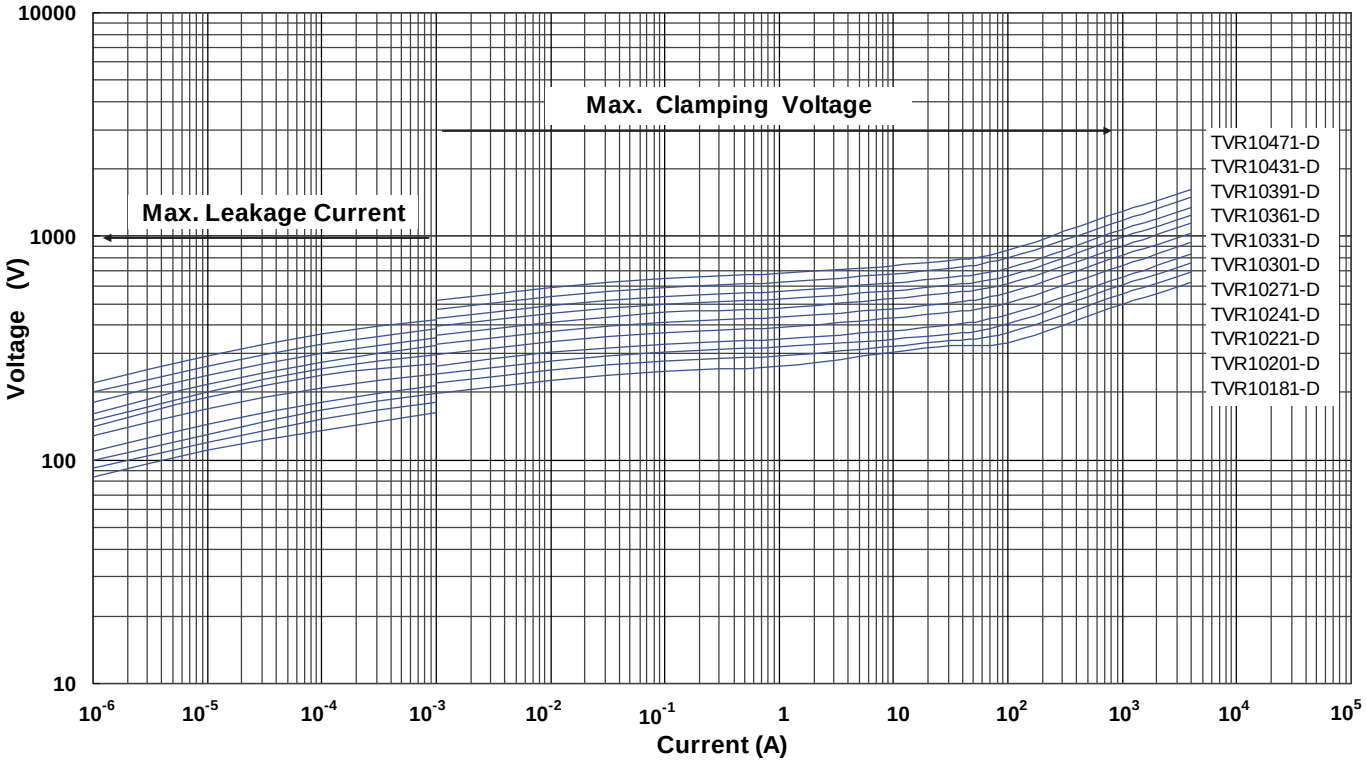


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR07511-D to TVR07821-D)

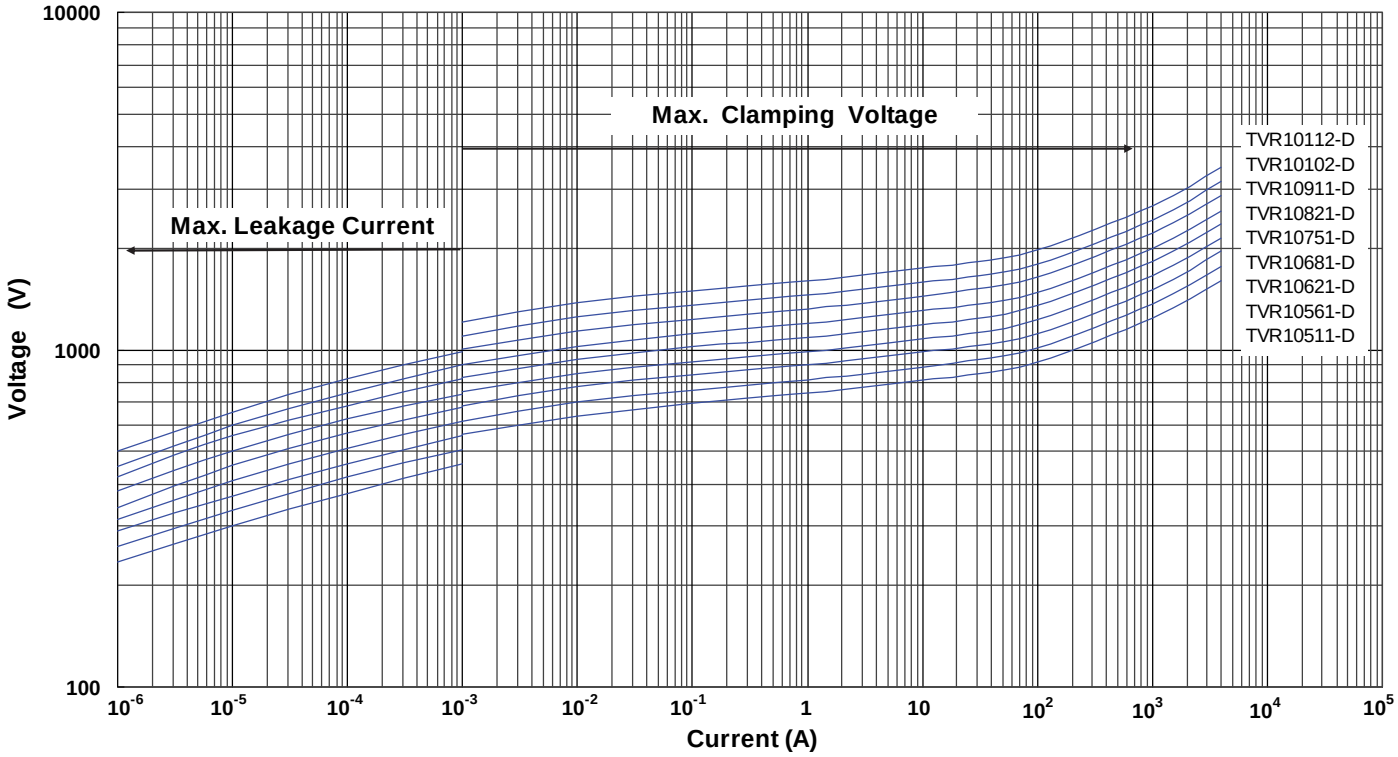


Max. Leakage Current and Max. Clamping Voltage Curves (TVR10181-D to TVR10471-D)

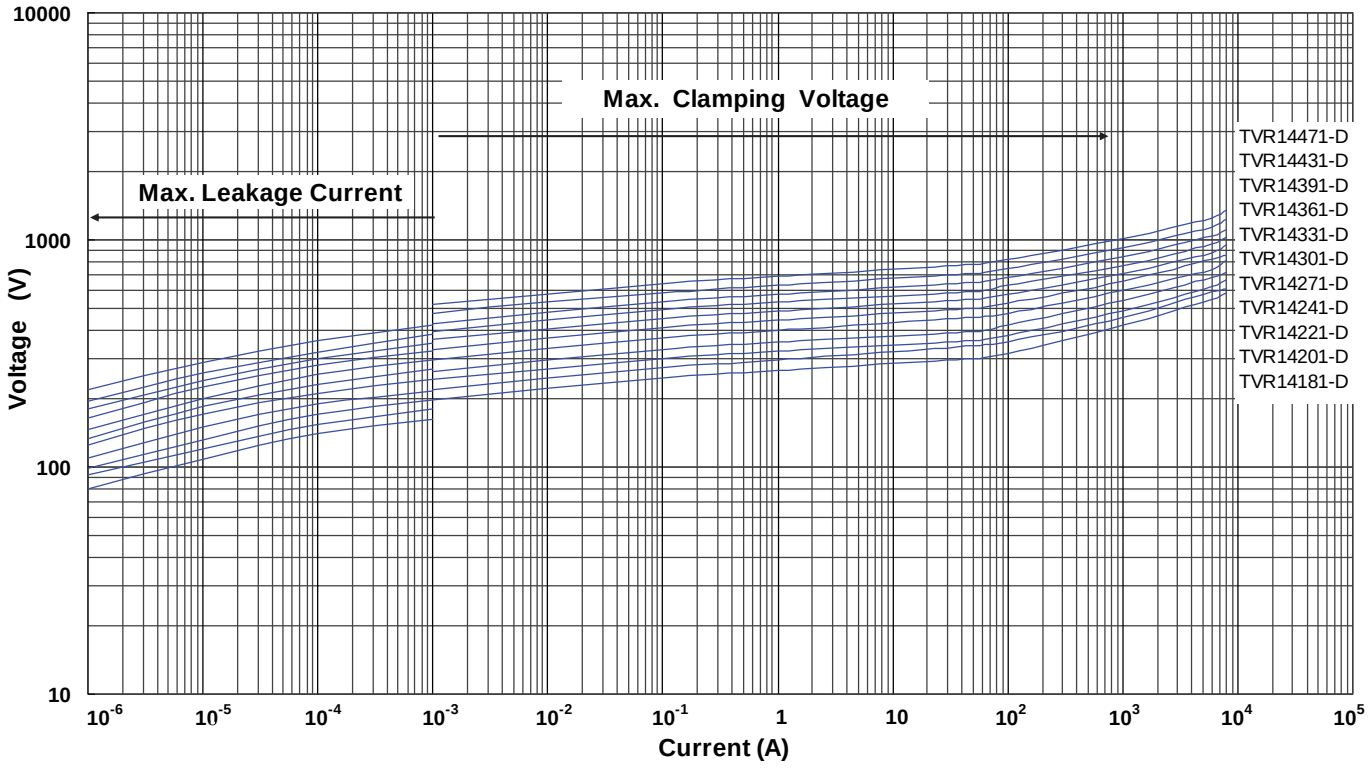


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR10511-D to TVR10112-D)

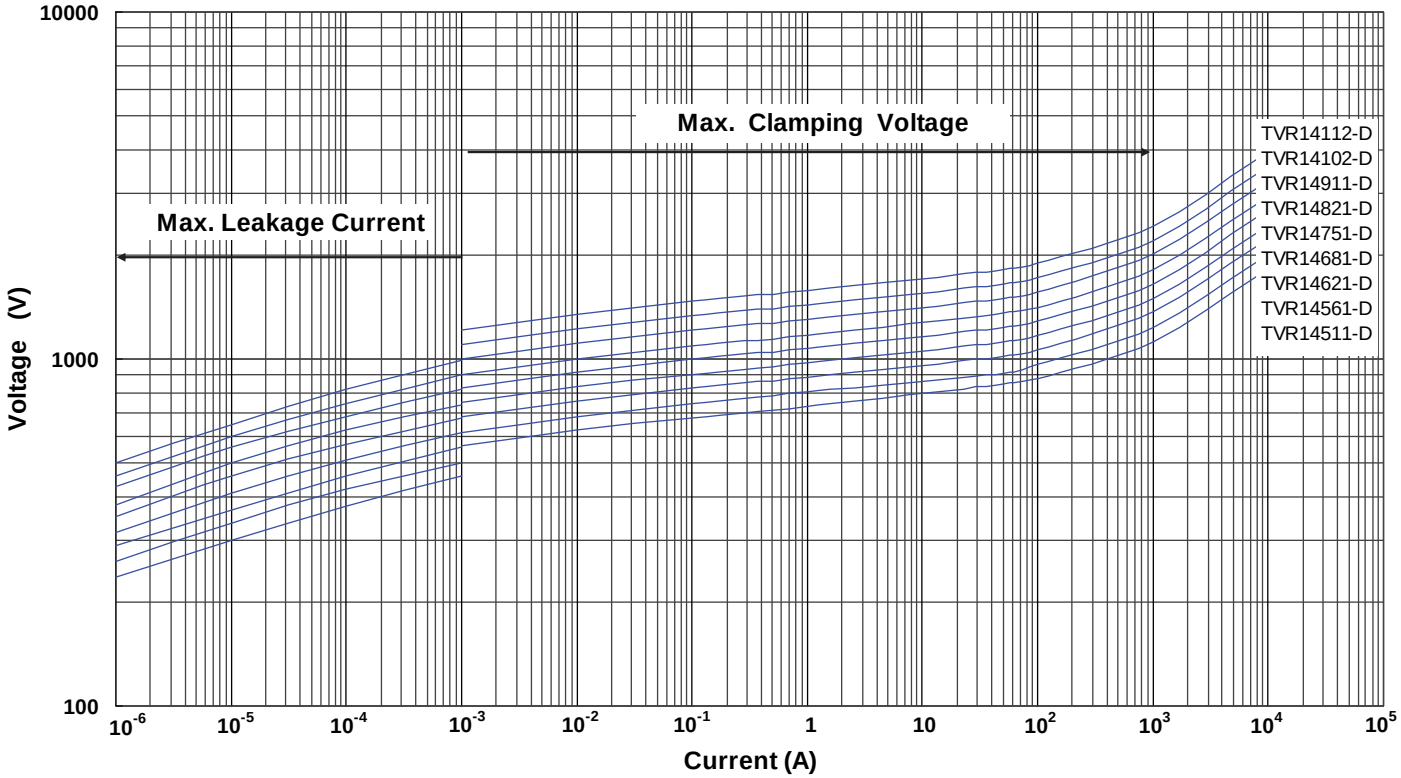


Max. Leakage Current and Max. Clamping Voltage Curves (TVR14181-D to TVR14471-D)

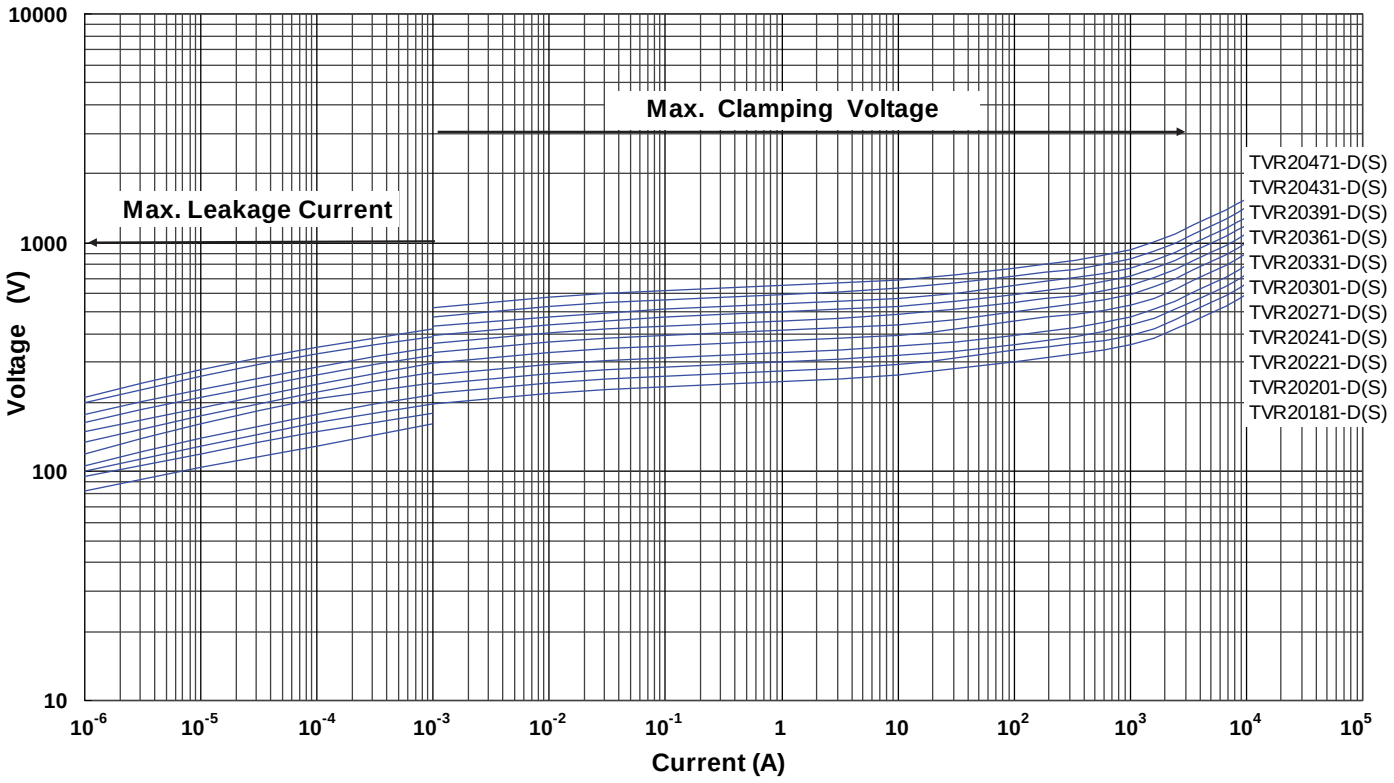


■ Max. Leakage Current and Max. Clamping Voltage Curves

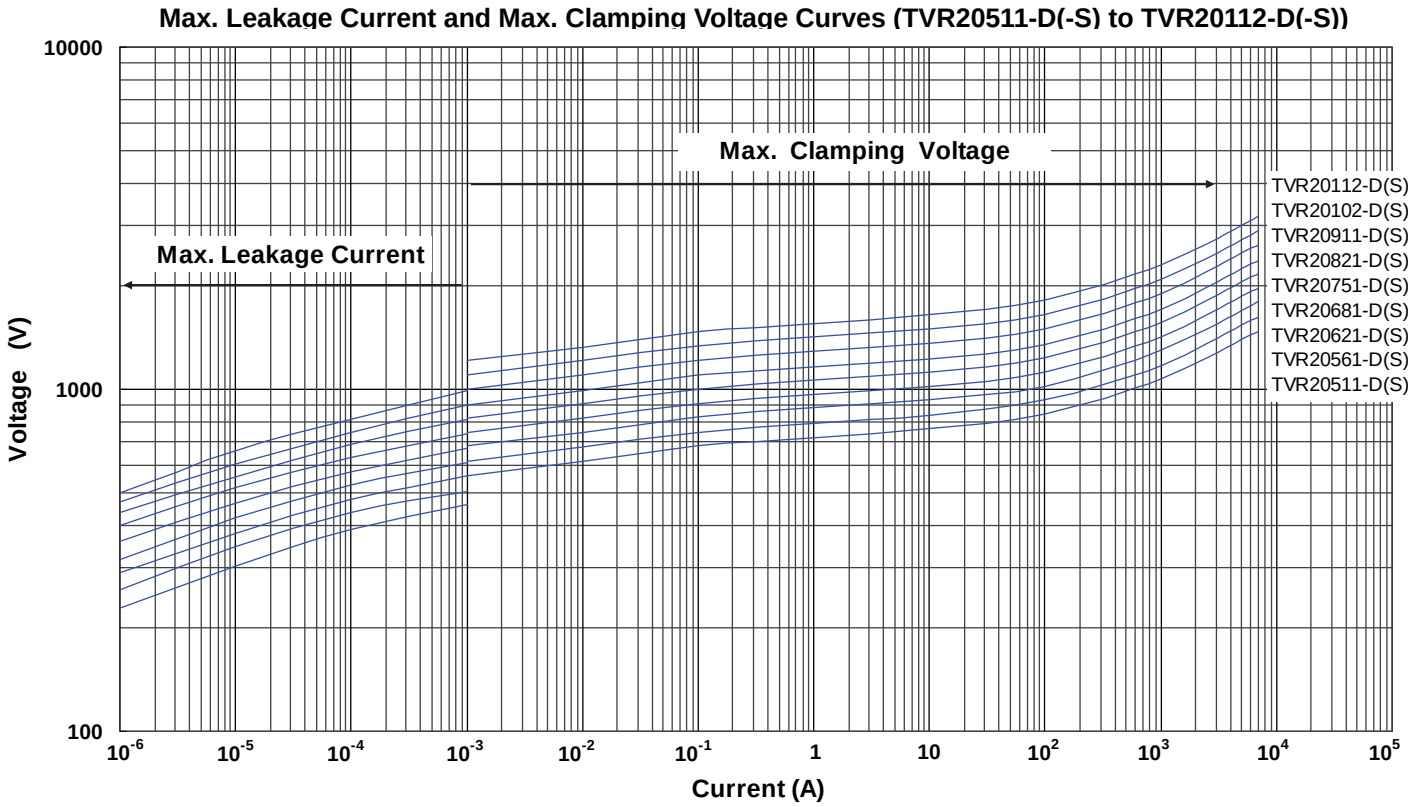
Max. Leakage Current and Max. Clamping Voltage Curves (TVR14511-D to TVR14112-D)



Max. Leakage Current and Max. Clamping Voltage Curves (TVR20181-D(-S) to TVR20471-D(-S))

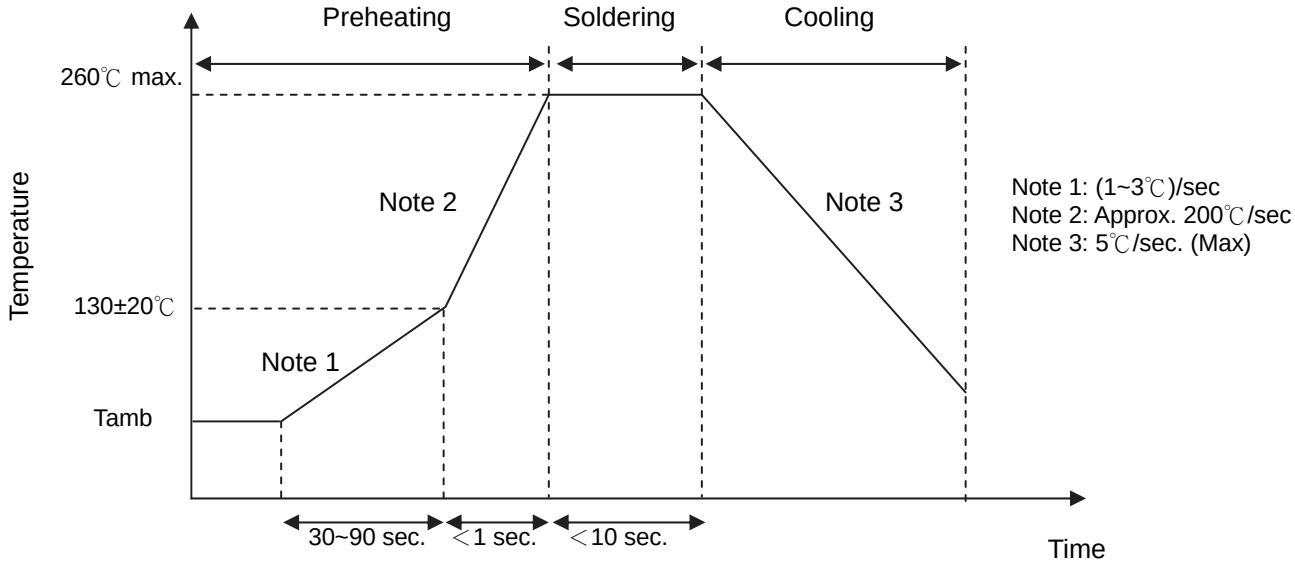


■ Max. Leakage Current and Max. Clamping Voltage Curves



■ 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.)

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

■ Reliability

Item	Standard	Test conditions / Methods	Specifications
Tensile Strength of Terminations	IEC 60068-2-21	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	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ 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	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Vibration	IEC 61051-1	Frequency range: 10~55Hz Amplitude: 0.75mm or 98m/s^2 Direction: 3 mutually perpendicular directions, 2 hrs each.	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Solderability	IEC 60068-2-20	245±5℃ , 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	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
High Temperature Storage	IEC 60068-2-2	125±5℃ x 1000 hrs ± 24hrs	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Damp Heat, Steady State	IEC 60068-2-78	a. 40±2℃, 90 ~ 95 % RH, 1344 hrs b. 40±2℃, 90~ 95 % RH , at 10% Vdc, 1344 hrs	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage Insulation Resistance ≧100MΩ
Rapid Change of Temperature	IEC 60068-2-14	The conditions shown below shall be repeated 5 cycles Step 1: -40±3 : 30±3 Step 2: Room temperature : 5±3 Step 3: 85±2 : 30±3 Step 4: Room temperature : 5±3	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 5\%$ No visible damage
Endurance at Upper Category Temperature	IEC 61051-1	85±2℃, 1000±24 hrs at V_{DC} or V_{rms} (Max. Continuous Voltage)	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ 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.	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ 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.	$\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ No visible damage
Operating Duty Cycle Test	UL1449 3rd	6KV/3KA 1.2/50μs+8/20μs combination waveform with Vac(@ Deg 90) for 15 times. Interval time between tests is 60 secs. (For UL1449 3rd SPD Type 3 application test only)	$\lvert \triangle V_p / V_p \rvert \leqq 10\%$ No visible damage
Nominal Discharge Current Test	UL1449 3rd	3KA 8/20μs waveform with Vac (@ Deg 90) for 15 times.Interval time between tests is 60 secs. (For TVR20R UL1449 3rd SPD Type 2 application test only)	$\lvert \triangle V_p / V_p \rvert \leqq 10\%$ No visible damage
Voltage Proof	IEC 61051-1	Metal balls method, 2500 V_{ac} 1 min	No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA@85℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{60}\times100\%(\%/°C)$, $\frac{V_{1mA@-40℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{65}\times100\%(\%/°C)$	-0.05≦TC≦0.05 (%/℃)

■ Packaging

● Taping Specification

S Type (Straight lead)

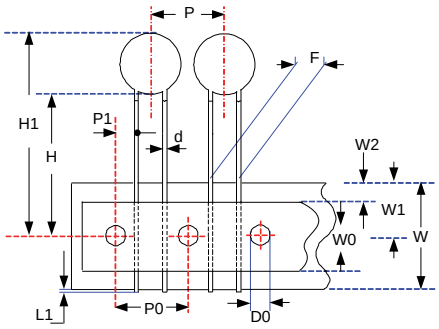


Figure A

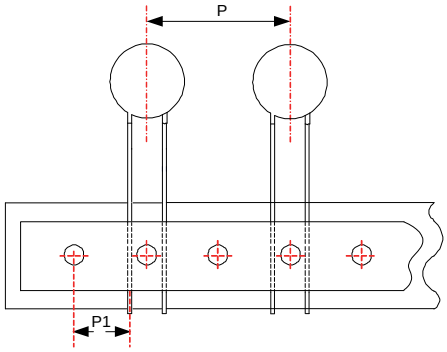


Figure B

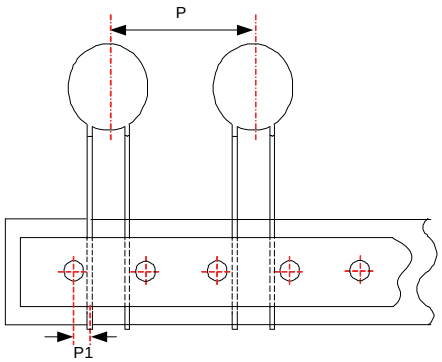
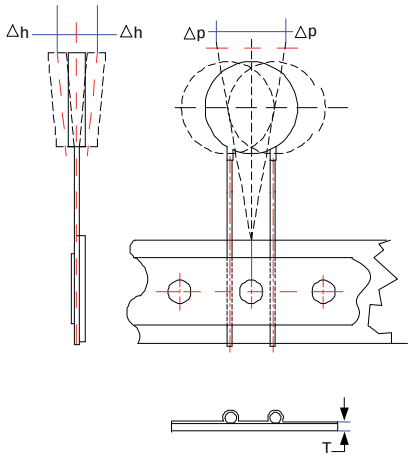


Figure C



(Unit: mm)

Taping Code	Series	P_0	F	P	P_1	H	H_1	d	W_0	W_1	W_2	W	△P	△h	L_1	D_0	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_0:12.7)	07-D	12.7	5.0	12.7	3.85	18	31	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	10-D	12.7	7.5	25.4	8.95	18	36	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	14-D	12.7	7.5	25.4	8.95	18	40	0.8	12	9	3	18	1	2	0.5	4	0.6	B
E (P_0:15.0)	07-D	15.0	5.0	15.0	5.00	18	31	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	10-D	15.0	7.5	15.0	3.75	18	36	0.8	12	9	3	18	1	2	0.5	4	0.6	A
	14-D	15.0	7.5	30.0	3.75	18	40	0.8	12	9	3	18	1	2	0.5	4	0.6	C

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

F Type (Y kink lead)

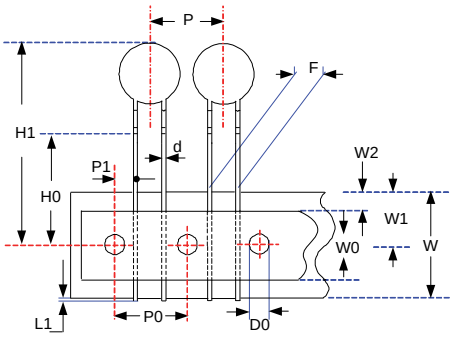


Figure A

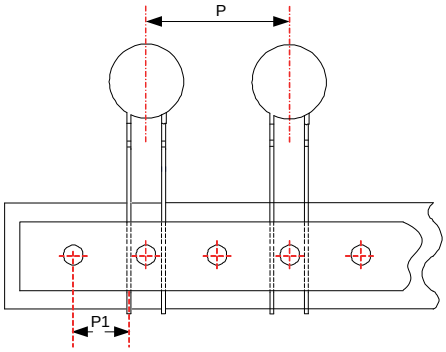


Figure B

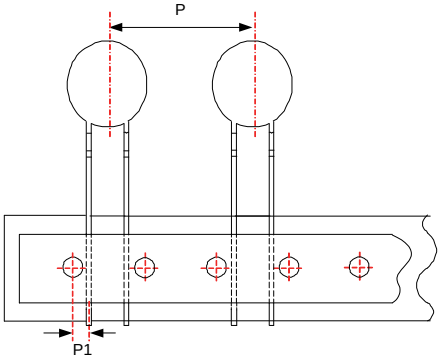
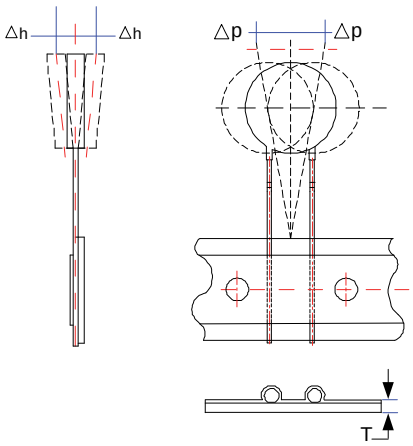


Figure C



(Unit: mm)

Taping Code	Series	P_0 ±0.3	F ±1	P ±1	P_1 ±0.7	H_0 +2/-0	H_1 Max.	d ±0.02	W_0 ±1	W_1 +0.75/ -0.5	W_2 Max	W +1/ -0.5	△P Max.	△h Max.	L_1 Max.	D_0 ±0.2	T ±0.2	Figure
A (P_0:12.7)	07-D	12.7	5.0	12.7	3.85	16	31	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	10-D	12.7	7.5	25.4	8.95	16	36	0.8	12	9	3	18	1	2	0.5	4	0.6	B
	14-D	12.7	7.5	25.4	8.95	16	40	0.8	12	9	3	18	1	2	0.5	4	0.6	B
E (P_0:15.0)	07-D	15.0	5.0	15.0	5.00	16	31	0.6	12	9	3	18	1	2	0.5	4	0.6	A
	10-D	15.0	7.5	15.0	3.75	16	36	0.8	12	9	3	18	1	2	0.5	4	0.6	A
	14-D	15.0	7.5	30.0	3.75	16	40	0.8	12	9	3	18	1	2	0.5	4	0.6	C

Metal Oxide Varistor：TVR-D Series

Disc Type Varistor for Surge Protection (High Surge Series)

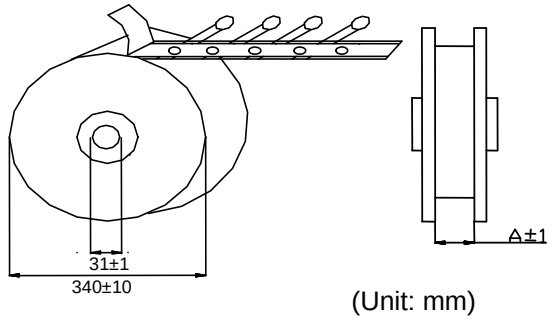
■ Quantity

● Bulk Packing

Series	Straight Lead Type Quantity (pcs/bag)	Cut Lead Type Quantity (pcs/bag)	Kink Type Quantity (pcs/bag)
TVR07-D	250	250	200
TVR10-D	200	200	200
TVR14-D	100	100	100
TVR20-D	50	50	50

● Reel Packing

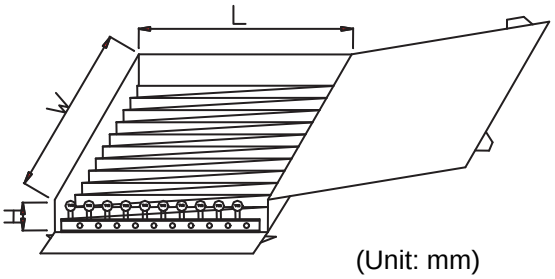
Series	A (mm)	Quantity (pcs/reel)
TVR07(181~391) -D	46	1,500
TVR07(431~821) -D		1,000
TVR10(181~391) -D		1,000
TVR10(431~911) -D		750
TVR10(102~112) -D		500
TVR14(181~331) -D	55	750
TVR14(361~112) -D		500
TVR20(181~681) -D		500
TVR20(751~112) -D		250



(Unit: mm)

● Ammo Packing

Series	Quantity (pcs/box)
TVR07(181~821) -D	1,000
TVR10(181~361) -D	750
TVR10(391~621) -D	400
TVR10(681~112) -D	300
TVR14(181~271) -D	500
TVR14(301~112) -D	250



(Unit: mm)

Series	W±5	L±5	H±5
TVR07-D~ TVR14-D	348	185	60
	348	275	60

Note: The standard package for TVR20-D is bulk. For any other demand, please contact our sales person.

■ Warehouse 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

Metal Oxide Varistor：TVT Series

Thermally Protected Varistor Series

■ Features

1. RoHS compliant
2. Halogen-free series are available
3. Two-Terminal or Three-Terminal thermally protected metal oxide varistor, Three-Terminal type is available for failure indication.
4. Body size: 14, 20 mm
5. Working voltage: 130Vac ~ 750Vac
6. Operating temperature range：-40°C ~ +85°C
   Storage temperature range：-40°C ~ +110°C
7. Patent: US 7,453,681
8. Agency approval:
   - TVT14 and TVT20 Series: UL1449 3rd & cUL/ TUV
9. UL1449 3rd SPD Type: Type 4 Assemblies
10. Meets UL 1449 3rd 39.4 limited current abnormal over- voltage test.
11. TVT14 and TVT20 Series meet IEC 60950-1 Annex Q requirement
12. Suitable for wave flow soldering

■ Recommended Applications

1. TVSS modules
2. Uninterruptible power supplies
3. Power supplies
4. Lighting products
5. Communication products
6. Smart meter
7. Photovoltaic industry

■ Part Number Code

T	V	T	1	4	2	4	1	K	A	K	G	B			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Type

TVT	THINKING Thermally Protected Varistor TVT Series

Disc Size

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%

Structure

A	Two-Terminal, Coating Structure
B	Three-Terminal, Coating Structure

Packaging

B	Bulk

Appearance

KG	Straight lead
KO	Outer kink lead
KI	Inner kink lead

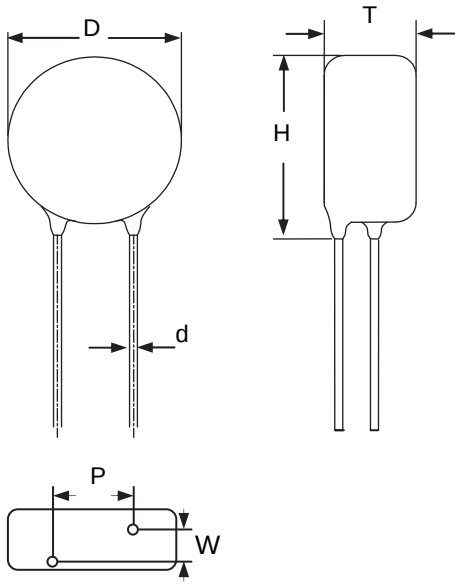
Optional Suffix

001~999

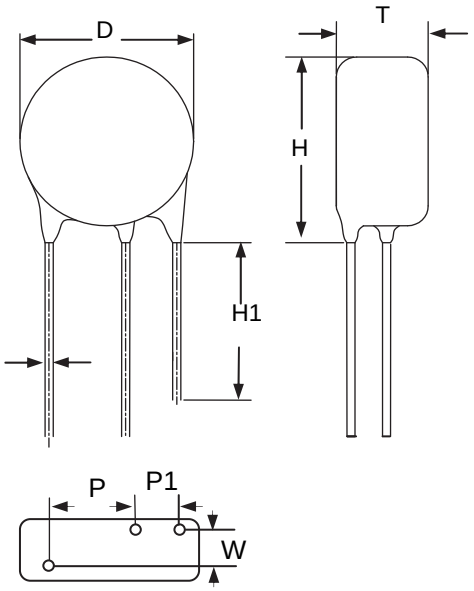
■ Structure and Dimensions

- **TVT14 ~ TVT20 Series**

Two-Terminal Type



Three-Terminal Type



(Unit: mm)

Series	Lead Type	D	P	P1	H	H1	d	W	Tmax
TVT14201~122	Two-Terminal	15.5~18.5	7.5±1	--	18.5~24	--	0.8±0.05	Please Refer to Electrical Characteristics	
TVT14201~122	Three-Terminal	15.5~18.5	7.5±1	4.0~6.0	18.5~24	7.0~18	0.8±0.05		
TVT20201~681	Two-Terminal	19.5~23.5	7.5±1	--	21.5~27	--	0.8±0.05		
TVT20751~122							1.0±0.05		
TVT20201~681	Three-Terminal	19.5~23.5	7.5±1	4.0~6.0	21.5~27	12.5~18	0.8±0.05		
TVT20751~122							1.0±0.05		

■ Electrical Characteristics

14mm 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	
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmax	W±1.0
	(V)	(V)	(V)	(V)	(A)	(KA)	(W)	(J)	(pF)	(mm)	
TVT14201	200 (180~220)	130	170	340	50	6	0.6	77	700	8.8	3.0
TVT14221	220 (198~242)	140	180	365	50	6	0.6	86	640	8.9	3.1
TVT14241	240 (216~264)	150	200	395	50	6	0.6	94	580	9.1	3.3
TVT14271	270 (243~297)	175	225	455	50	6	0.6	110	520	9.3	3.5
TVT14301	300 (270~330)	195	250	500	50	6	0.6	118	480	9.0	3.2
TVT14331	330 (297~363)	215	275	550	50	6	0.6	127	450	9.1	3.3
TVT14361	360 (324~396)	230	300	595	50	6	0.6	137	430	9.3	3.5
TVT14391	390 (351~429)	250	320	650	50	6	0.6	154	390	9.5	3.6
TVT14431	430 (387~473)	275	350	710	50	6	0.6	170	370	9.2	3.4
TVT14471	470 (423~517)	300	385	775	50	6	0.6	192	320	9.3	3.5
TVT14511	510 (459~561)	320	410	845	50	6	0.6	209	290	9.5	3.7
TVT14561	560 (504~616)	350	450	930	50	6	0.6	220	260	9.7	3.9
TVT14621	620 (558~682)	395	510	1025	50	6	0.6	231	240	10.0	4.1
TVT14681	680 (612~748)	420	560	1120	50	6	0.6	242	230	10.3	4.4
TVT14751	750 (675~825)	465	615	1240	50	6	0.6	247	220	10.6	4.7
TVT14781	780 (702~858)	485	640	1290	50	6	0.6	260	200	10.1	4.3
TVT14821	820 (738~902)	510	670	1355	50	6	0.6	270	180	10.2	4.5
TVT14911	910 (819~1001)	550	745	1500	50	6	0.6	280	170	10.6	4.8
TVT14951	950 (855~1045)	575	765	1570	50	6	0.6	290	160	10.7	4.9
TVT14102	1000 (900~1100)	625	825	1650	50	6	0.6	305	150	10.9	5.1
TVT14112	1100 (990~1210)	680	895	1815	50	6	0.6	340	140	11.2	5.4
TVT14122	1200 (1080~1320)	750	980	2000	50	6	0.6	350	130	11.6	5.8

Metal Oxide Varistor：TVT Series

Thermally Protected Varistor Series

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)	Reference Capacitance @1KHz	Dimension	
	V_{1mA}	$V_{AC(rms)}$	V_{DC}	V_P	I_P	Imax	P	Wmax	Cp	Tmax	W±1.0
	(V)	(V)	(V)	(V)	(A)	(KA)	(W)	(J)	(pF)	(mm)	
TVT20201	200 (180~220)	130	170	340	100	10	1.0	140	1460	10.2	3.0
TVT20221	220 (198~242)	140	180	365	100	10	1.0	155	1320	10.3	3.1
TVT20241	240 (216~264)	150	200	395	100	10	1.0	170	1200	10.5	3.3
TVT20271	270 (243~297)	175	225	455	100	10	1.0	190	1100	10.7	3.5
TVT20301	300 (270~330)	195	250	500	100	10	1.0	205	1000	10.4	3.2
TVT20331	330 (297~363)	215	275	550	100	10	1.0	215	950	10.5	3.3
TVT20361	360 (324~396)	230	300	595	100	10	1.0	225	900	10.7	3.5
TVT20391	390 (351~429)	250	320	650	100	10	1.0	240	800	10.9	3.6
TVT20431	430 (387~473)	275	350	710	100	10	1.0	270	700	10.6	3.4
TVT20471	470 (423~517)	300	385	775	100	10	1.0	350	620	10.7	3.5
TVT20511	510 (459~561)	320	410	845	100	10	1.0	386	530	10.9	3.7
TVT20561	560 (504~616)	350	450	930	100	10	1.0	400	480	11.1	3.9
TVT20621	620 (558~682)	395	510	1025	100	10	1.0	425	450	11.4	4.1
TVT20681	680 (612~748)	420	560	1120	100	10	1.0	455	440	11.7	4.4
TVT20751	750 (675~825)	465	615	1240	100	10	1.0	509	420	12.0	4.7
TVT20781	780 (702~858)	485	640	1290	100	10	1.0	515	400	11.5	4.3
TVT20821	820 (738~902)	510	670	1355	100	10	1.0	475	390	11.6	4.5
TVT20911	910 (819~1001)	550	745	1500	100	10	1.0	509	360	12.0	4.8
TVT20951	950 (855~1045)	575	765	1570	100	10	1.0	530	340	12.1	4.9
TVT20102	1000 (900~1100)	625	825	1650	100	10	1.0	560	330	12.3	5.1
TVT20112	1100 (990~1210)	680	895	1815	100	10	1.0	610	310	12.6	5.4
TVT20122	1200 (1080~1320)	750	980	2000	100	10	1.0	620	290	13.0	5.8

Metal Oxide Varistor：TVT Series

Thermally Protected Varistor Series

■ Safety Approvals

Part No.	Agency		
	c UL us		
	UL1449 3rd & cUL: E314979	J 50179371	IEC60950-1 2nd Annex Q
TVT14201-☐	√	√	√
TVT14221-☐	√	√	√
TVT14241-☐	√	√	√
TVT14271-☐	√	√	√
TVT14301-☐	√	√	√
TVT14331-☐	√	√	√
TVT14361-☐	√	√	√
TVT14391-☐	√	√	√
TVT14431-☐	√	√	√
TVT14471-☐	√	√	√
TVT14511-☐	√	√	√
TVT14561-☐	√	√	√
TVT14621-☐	√	√	√
TVT14681-☐	√	√	√
TVT14751-☐	√	√	√
TVT14781-☐	√	√	√
TVT14821-☐	√	√	√
TVT14911-☐	√	√	√
TVT14951-☐	√	√	√
TVT14102-☐	√	√	√
TVT14112-☐	√	√	√
TVT14122-☐		√	√

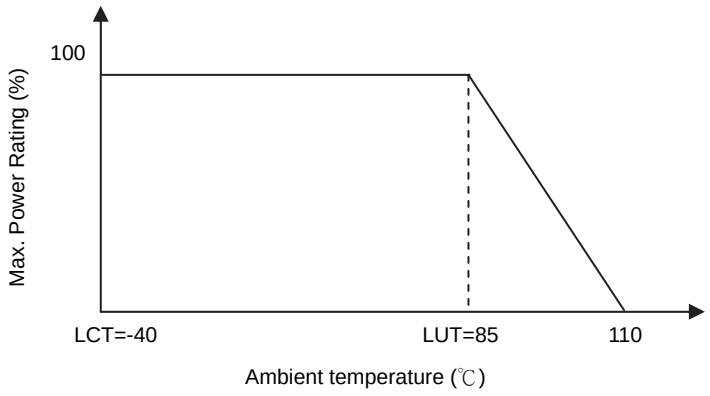
Part No.	Agency		
	c UL us		
	UL1449 3rd & cUL: E314979	J 50179389	IEC60950-1 2nd Annex Q
TVT20201-☐	√	√	√
TVT20221-☐	√	√	√
TVT20241-☐	√	√	√
TVT20271-☐	√	√	√
TVT20301-☐	√	√	√
TVT20331-☐	√	√	√
TVT20361-☐	√	√	√
TVT20391-☐	√	√	√
TVT20431-☐	√	√	√
TVT20471-☐	√	√	√
TVT20511-☐	√	√	√
TVT20561-☐	√	√	√
TVT20621-☐	√	√	√
TVT20681-☐	√	√	√
TVT20751-☐	√	√	√
TVT20781-☐	√	√	√
TVT20821-☐	√	√	√
TVT20911-☐	√	√	√
TVT20951-☐	√	√	√
TVT20102-☐	√	√	√
TVT20112-☐	√	√	√
TVT20122-☐		√	√

☐ is the code for Two -Terminal or Three -Terminal type.

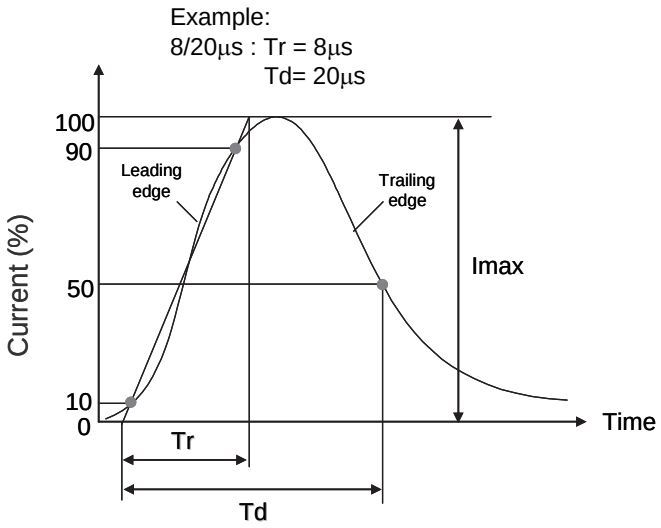
Metal Oxide Varistor：TVT Series

Thermally Protected Varistor Series

■ Power Derating Curve

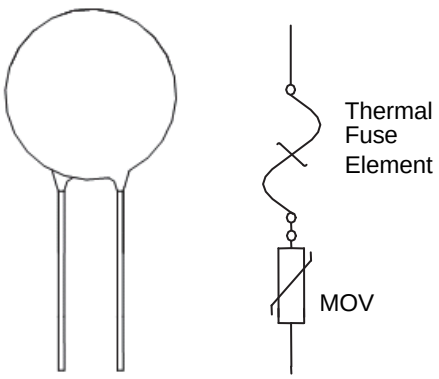


■ Surge Current Standard Waveform

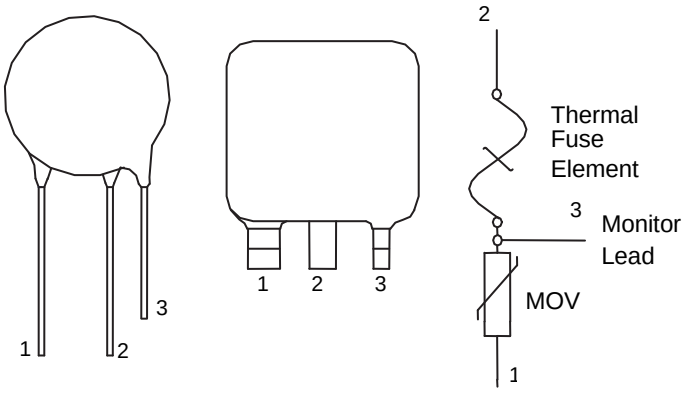


■ Lead Configuration

Two -Terminal Type

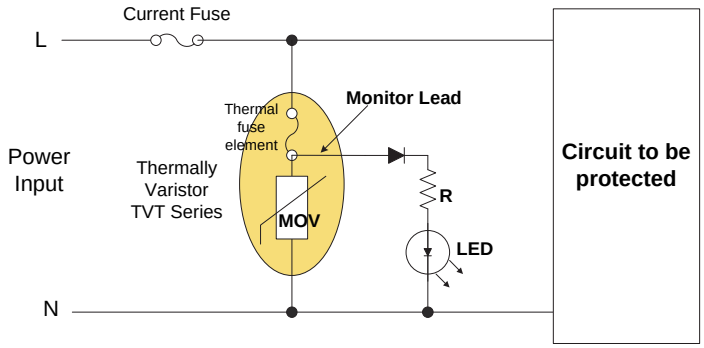


Three -Terminal Type

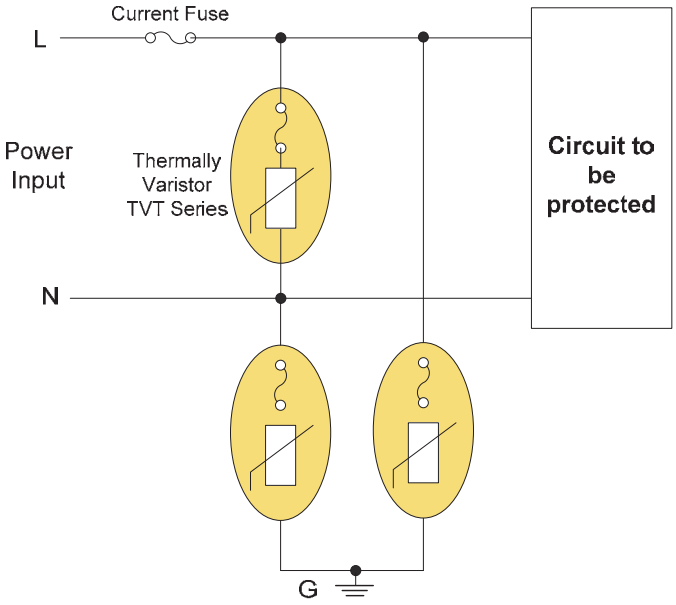


■ Typical Application Circuit

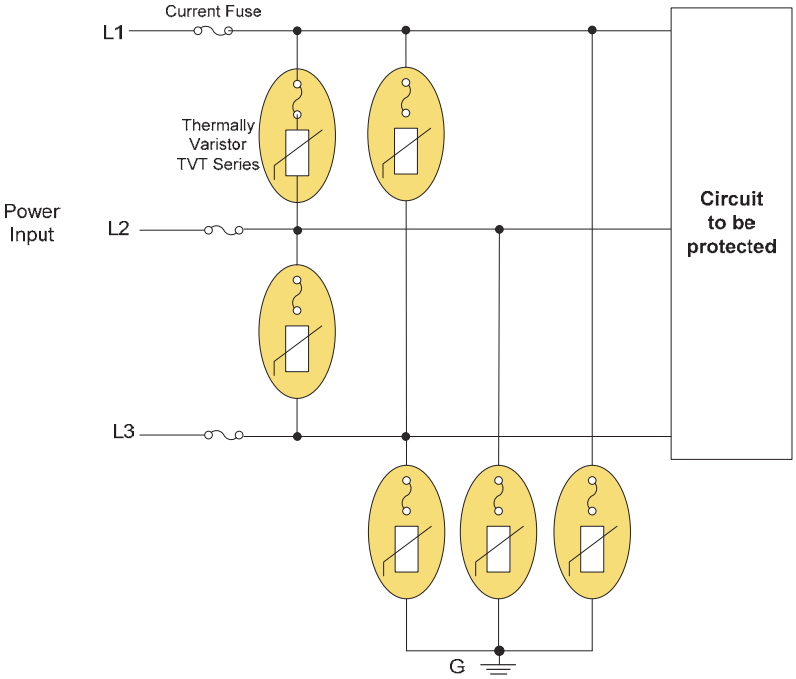
Signal Phase: Line to Line



Signal Phase: Line to Line & Line to Ground

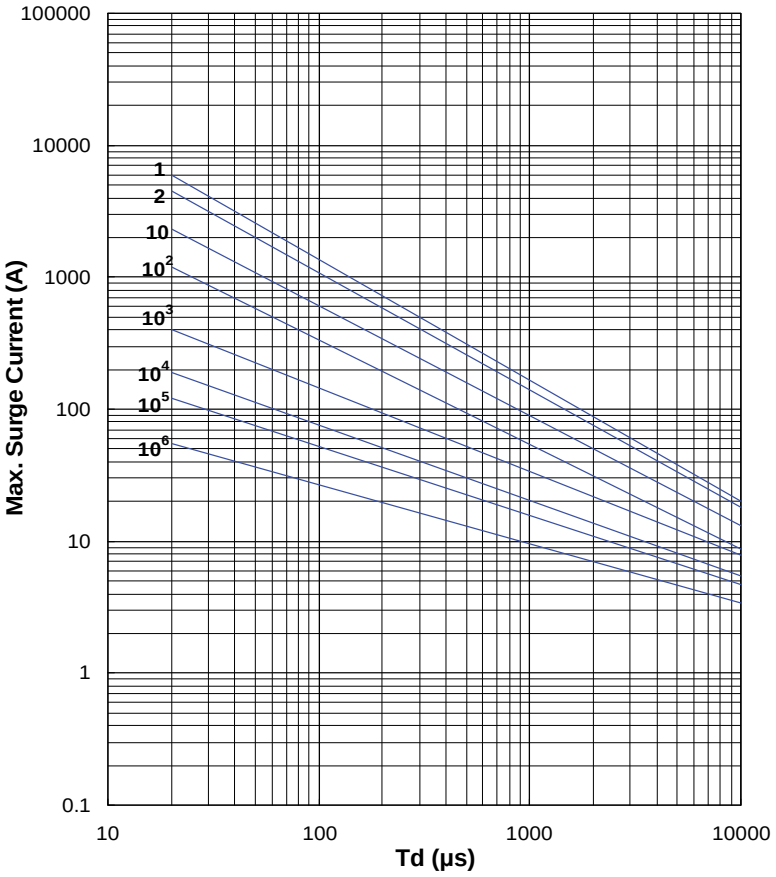


Three Phase: Line to Line & Line to Ground

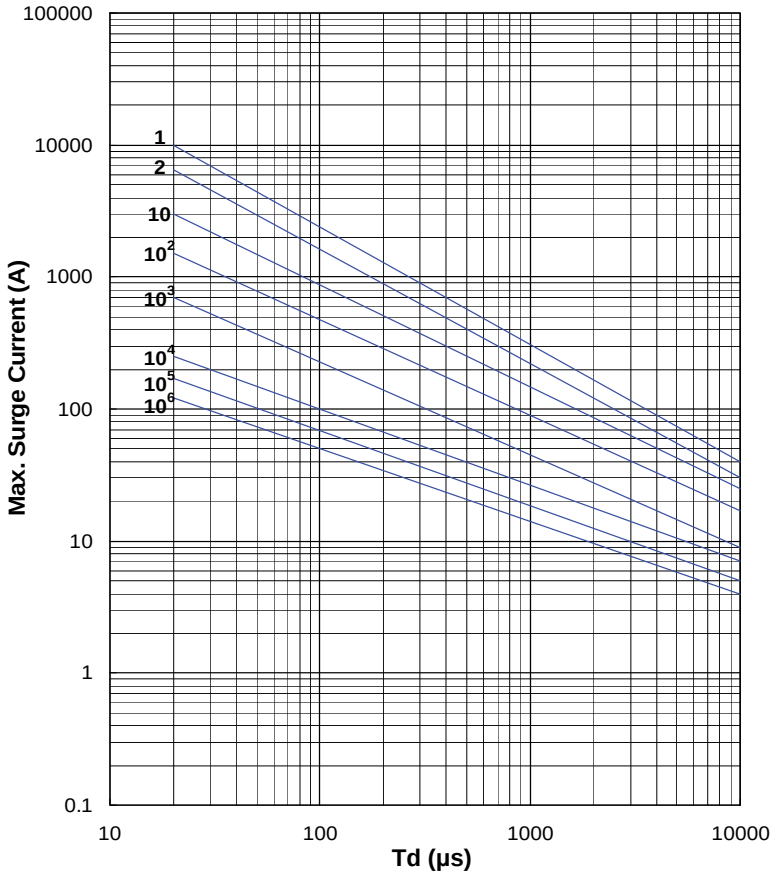


■ Max. Surge Current Derating Curves

TVT14201 ~ TVT14112

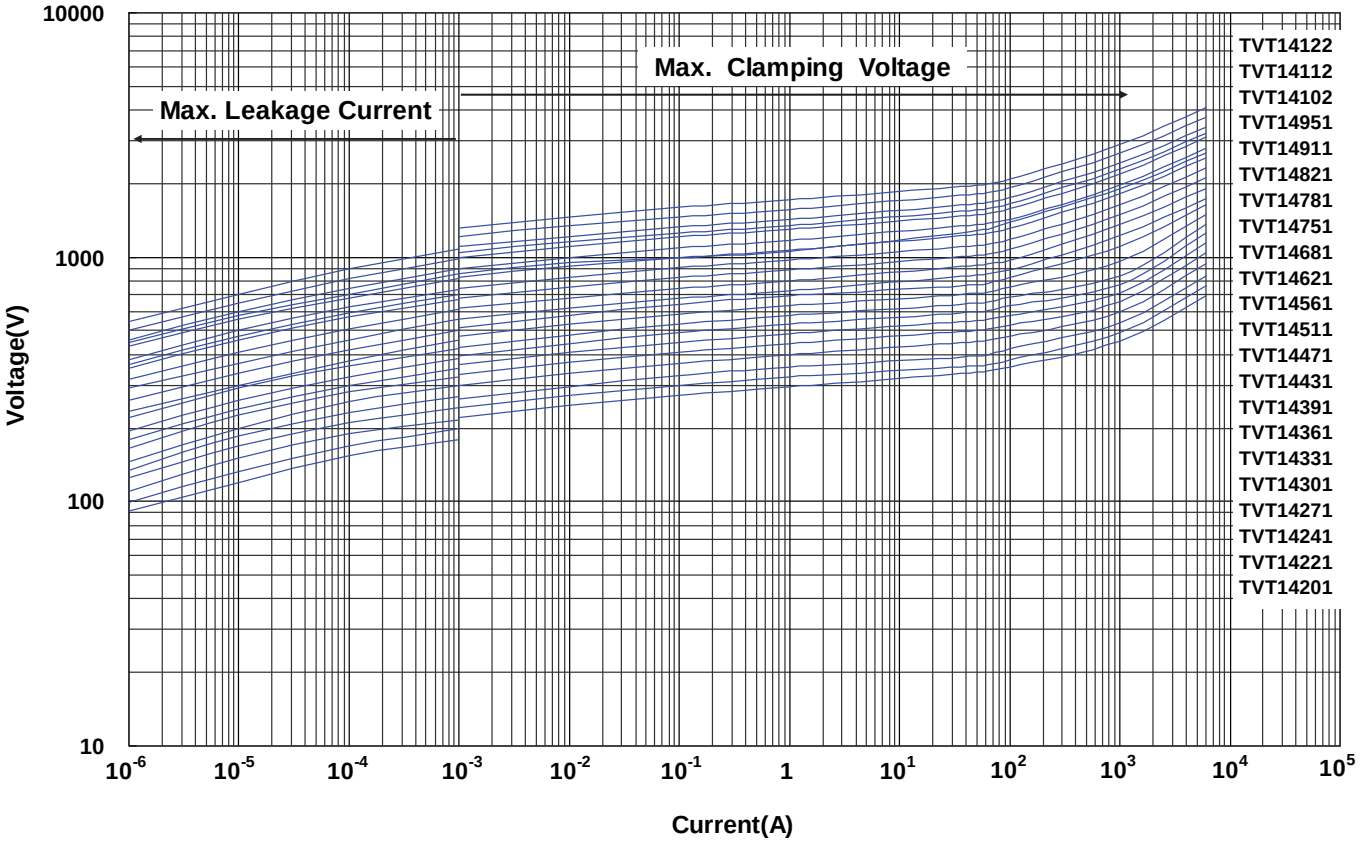


TVT20201 ~ TVT20112

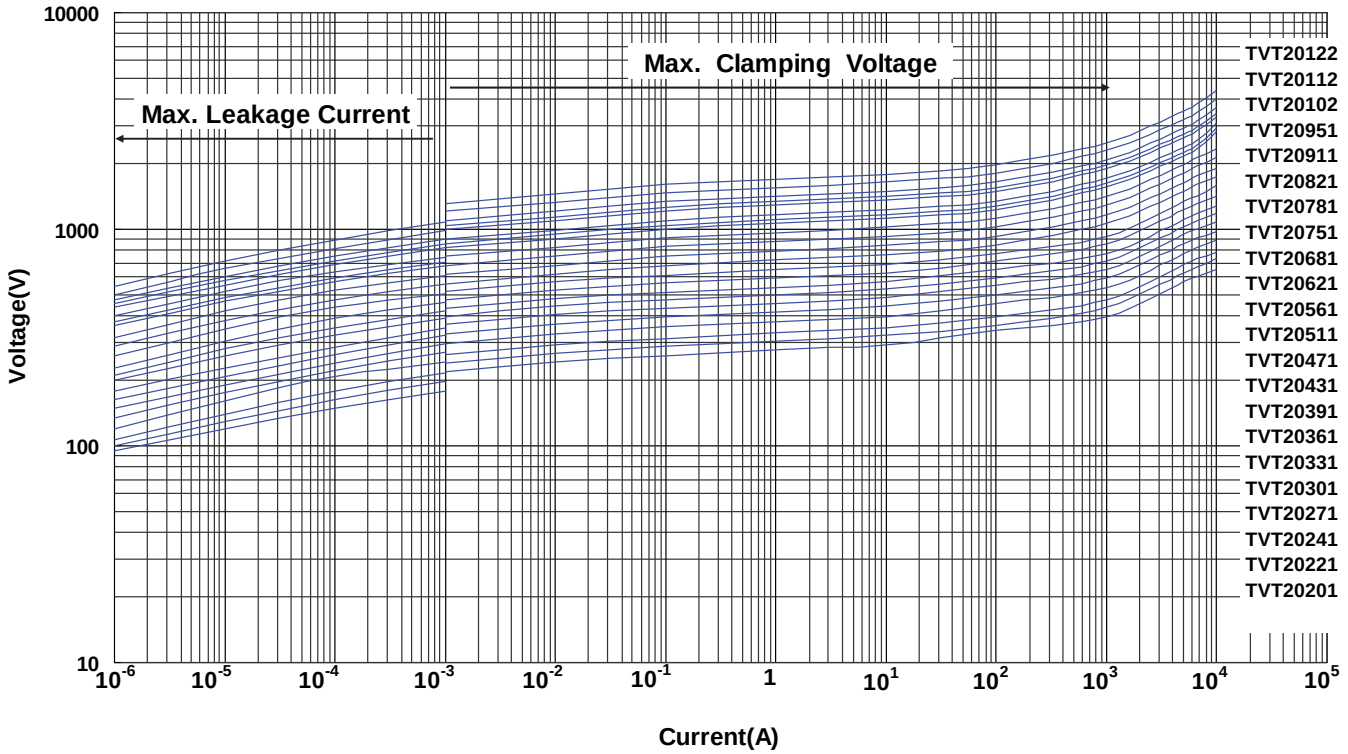


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVT14201 ~ TVT14122)

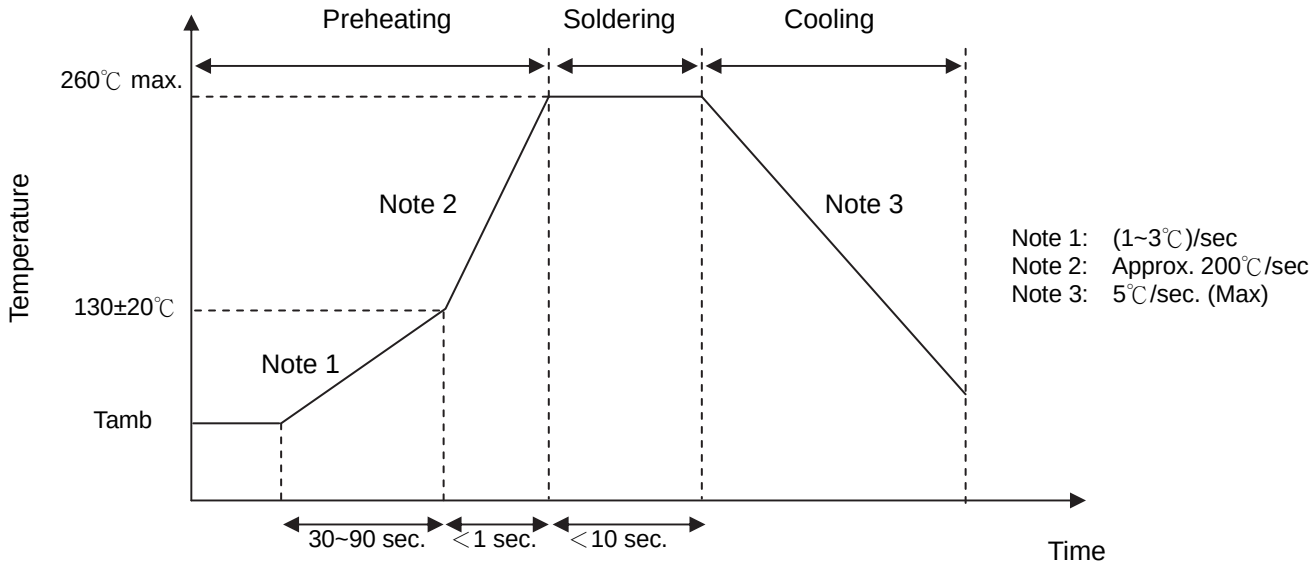


Max. Leakage Current and Max. Clamping Voltage Curves (TVT20201 ~ TVT20122)



■ 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	IEC 60068-2-21	Gradually apply the specified force and keep the unit fixed for 10±1 sec. Terminal diameter (mm) / Terminal cross-sectional area (mm^2) / Force (Kg) 0.5<d≦0.8 / 0.2＜S≦0.5 / 1.0 0.8<d≦1.25 / 0.5＜S≦1.2 / 2.0 1.25<d / 1.2<S / 4.0	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ 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°, and then return to the original position. Repeat the procedure in the opposite direction. Terminal diameter (mm) / Terminal cross-sectional area (mm^2) / Force (Kg) 0.5<d≦0.8 / 0.2＜S≦0.5 / 0.5 0.8<d≦1.25 / 0.5＜S≦1.2 / 1.0 1.25<d / 1.2<S / 2.0	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
Vibration	IEC 61051-1	Frequency range: 10 ~ 55 Hz Amplitude: 0.75mm or 98 m/s^2 Direction: 3 mutually perpendicular directions, 2 hrs each.	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ 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	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
High Temperature Storage	IEC 60068-2-2	110±5℃ x 1000± 24 hrs	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
Damp Heat, Steady State	IEC 60068-2-78	a. 40±2℃, 90 ~ 95 % RH, 1344 hrs b. 40±2℃, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ No visible damage 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	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 5\%$ No visible damage
Endurance at Upper Category Temperature	IEC 61051-1	85±2℃, 1000±24 hrs at V_{DC} or V_{rms} (Max. Continuous Voltage)	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ 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.	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ 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.	$\lvert\triangle V_{1mA}/V_{1mA}\rvert \leqq 10\%$ No visible damage
Operating Duty Cycle Test	UL 1449 3rd	6KV/3KA 1.2/50μs+8/20μs combination waveform with Vac(@ Deg 90) for 15 times. Interval time between tests is 60 secs. (For TVT14 and TVT20 series test only)	$\lvert\triangle V_p/V_p\rvert \leqq 10\%$ No visible damage

■ Reliability

Item	Standard	Test Conditions / Methods	Specifications
Limited Current Abnormal Overvoltage Test	UL 1449 3rd	Test voltage: refer to UL 1449 3rd Table 39.1 Short current condition: Series: TVT14 — Short Current (Isc , A): 0.125A, 0.5A, 2.5A, 5A Series: TVT20 — Short Current (Isc , A): 0.5A, 2.5A, 5A, 10A Each of four previously untested TVT samples to be connected to an ac power supply having an open circuit voltage equal to Uoc. The power supply is to incorporate a series variable resistor that can be adjusted to obtain the short-circuit values (Isc) respectively. The four samples are to be energized for 7 hrs, or until current to, or body temperature attain equiubrium, or until the sample becomes disconnected from the ac supply.	No flame
Voltage Proof	IEC 61051-1	Metal balls method, 2500 V_{ac} 1 min	No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA@85℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{60}\times100\%(\%/°C)$, $\frac{V_{1mA@-40℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{65}\times100\%(\%/°C)$	-0.05≦T_C≦0.05 (%/℃)

■ Packaging

● Bulk Packing

Series	Quantity (pcs/bag)
TVT14	50
TVT20	25

■ Warehouse 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

ELITALIA www.elitaliaweb.it info@elitaliaweb.it

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

■ Features

1. RoHS compliant
2. Halogen-free series are available
3. Body size: Φ25mm ~ Φ 60mm
4. Wide operating voltage range
5. Excellent clamping ratio
6. Bidirectional and symmetrical V/I characteristics
7. Large withstanding surge current capability
8. Excellent thermal stable ability
9. Operating temperature range: -40°C ~ +85°C
   Storage temperature range：-40°C ~ +110°C
10. Agency recognition: UL/cUL
11. UL 1449 3rd for SPD Type 2 application

■ Recommended Applications

1. Power distribution
2. Communication power
3. Antenna
4. New energy
5. Lighting
6. Rail traffic system
7. Industrial equipment

■ Part Number Code

Φ25mm~Φ60mm

T	V	A	3	4	6	2	1	K	Q	K	Q	E			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Type	
TVA	THINKING Varistor TVA Series

Size	
25	Φ25mm
32	Φ32mm
34	34*34mm
40	Φ40mm
60	Φ60mm

Varistor Voltage (V_{1mA})	
621	$62x10^1$V=620V
102	$10x10^2$V=1000V

Tolerance of V_{1mA}	
K	±10%

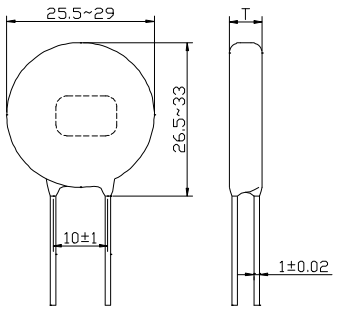
Structure
AAAA~ZZZZ

Optional Suffix	
001~999	RoHS compliant

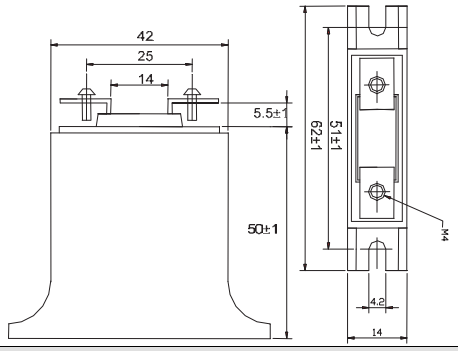
■ Structures and Dimensions

TVA 25 Type **(Unit: mm)**

GKGE



BKBL



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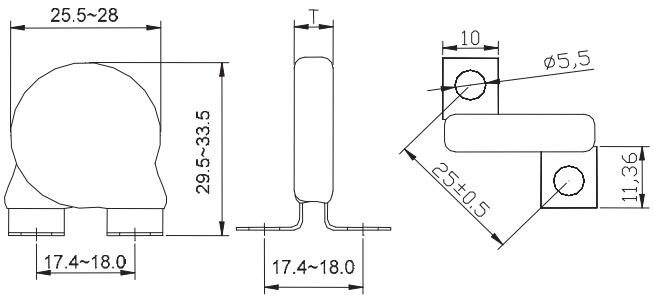

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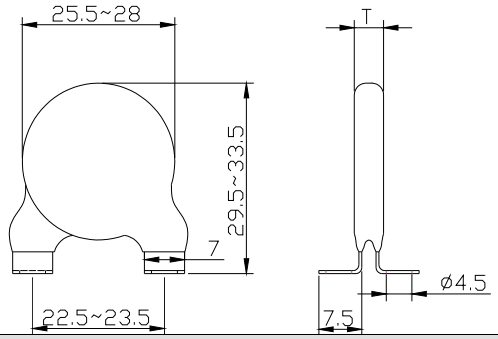

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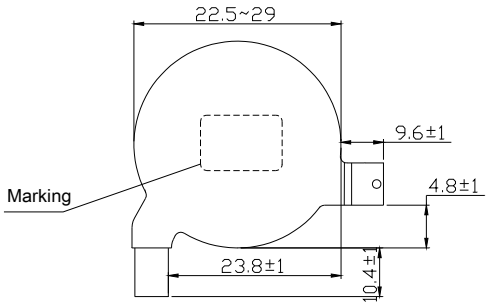
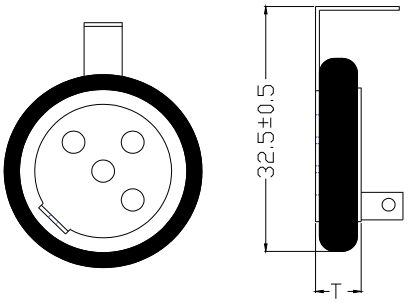
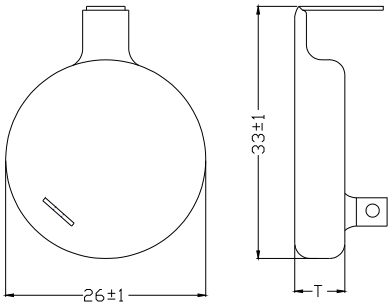


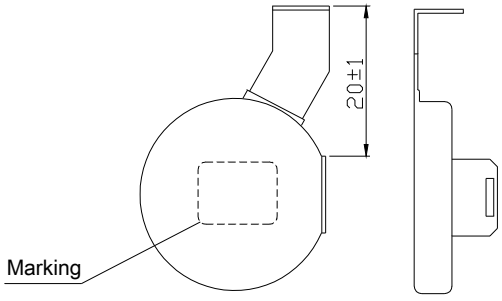
QCDD



QCDE



QCFE

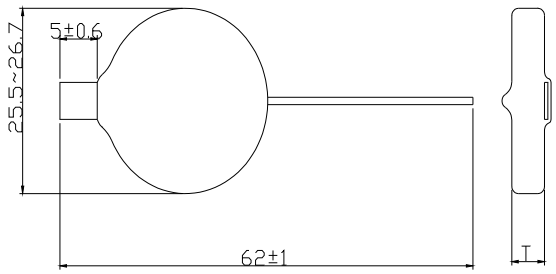


Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

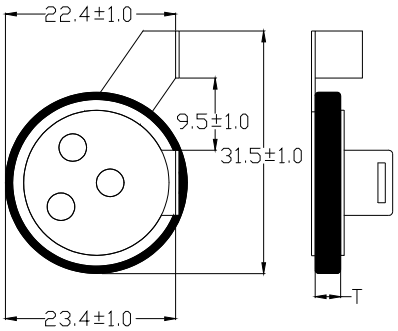
■ Structures and Dimensions

TVA 25 Type **(Unit: mm)**

QCGE



QDBD



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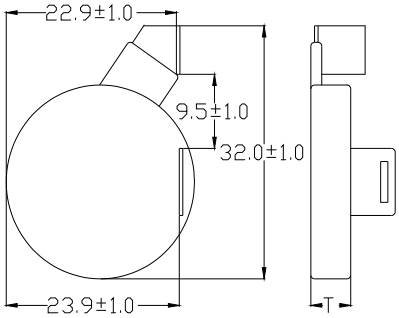

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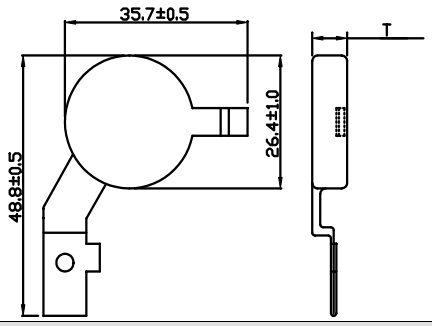
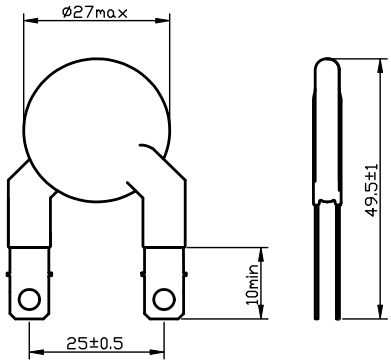
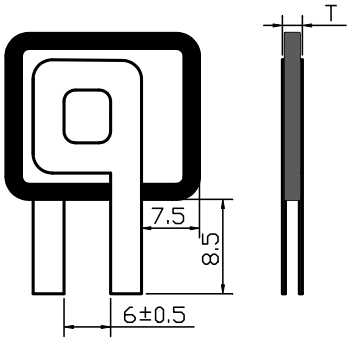


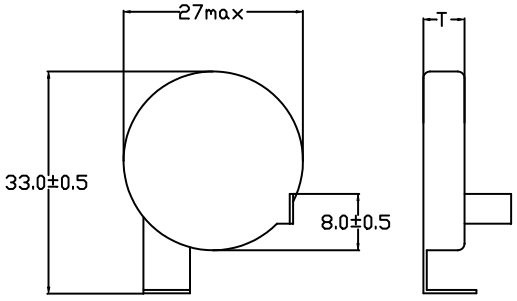
QGKE



QHHD



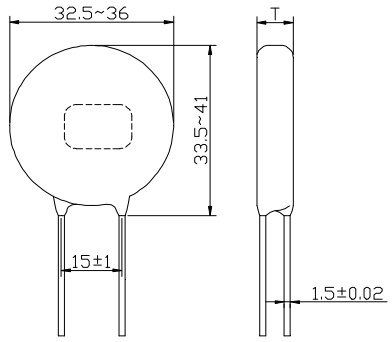
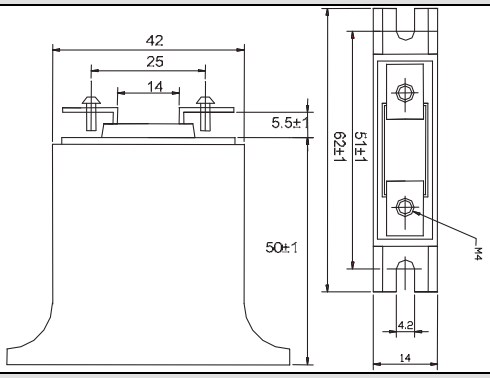
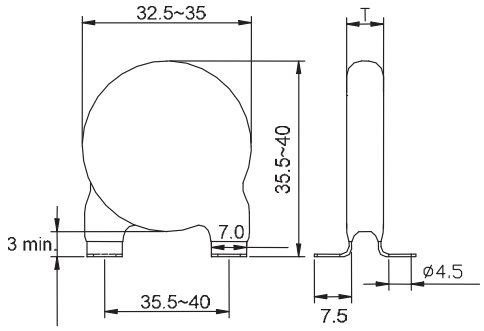
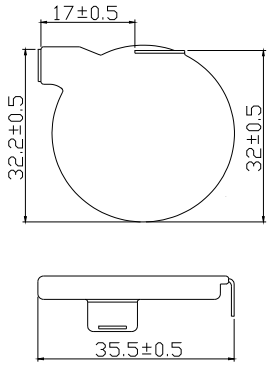
QHRE



Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

TVA 32 Type **(Unit: mm)**

GKGE	BKBL
	
QAFE	**QBOE**
	
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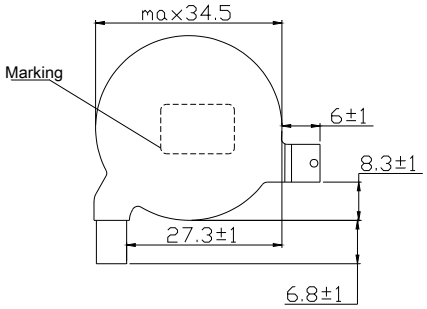
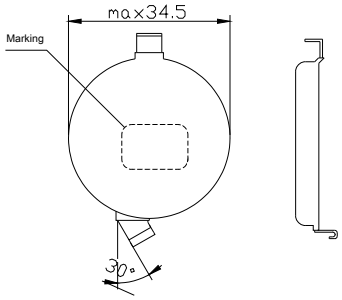
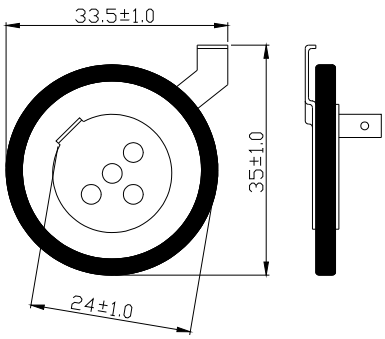
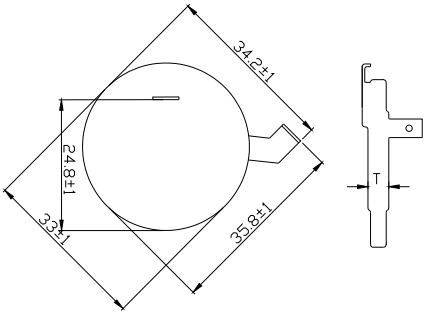
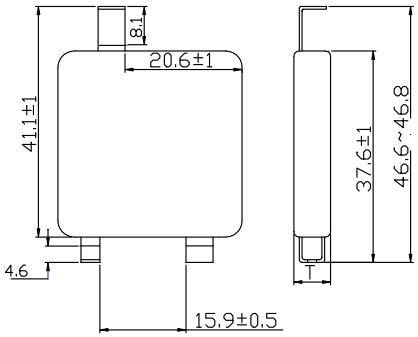
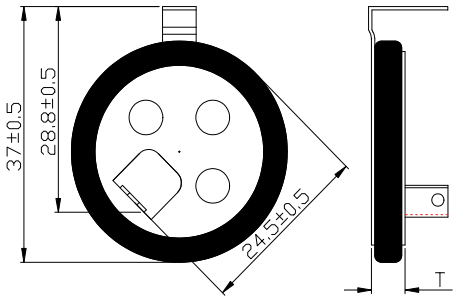
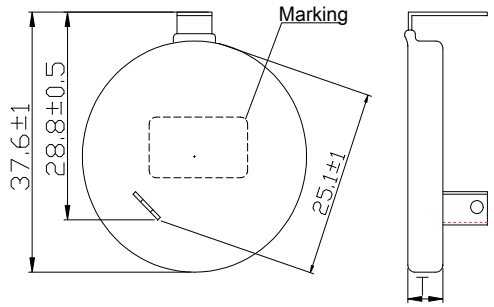
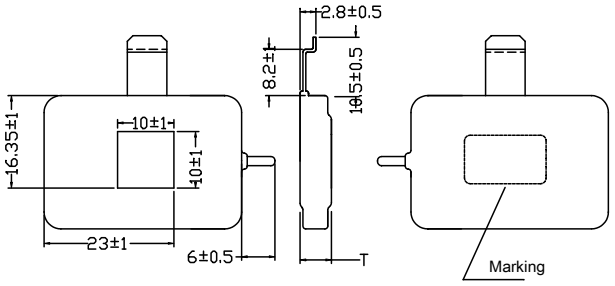
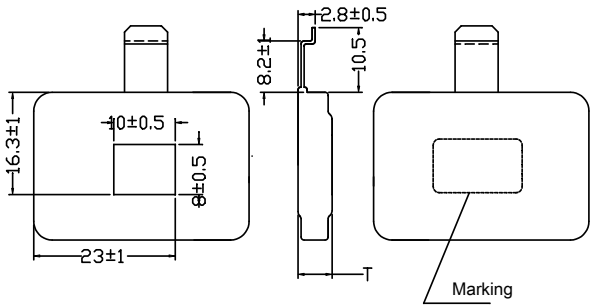
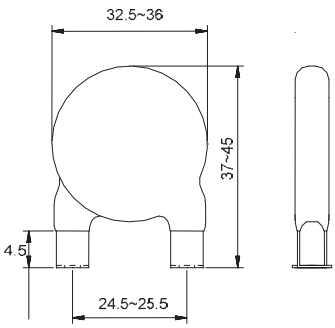
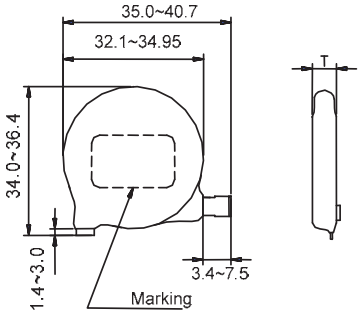
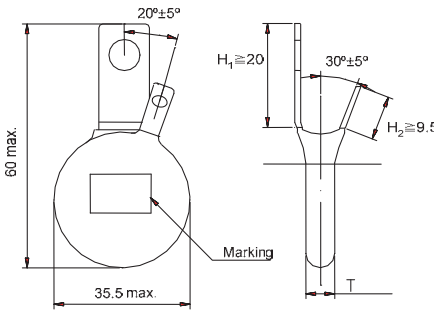
	
QDDD	**QDDE**
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

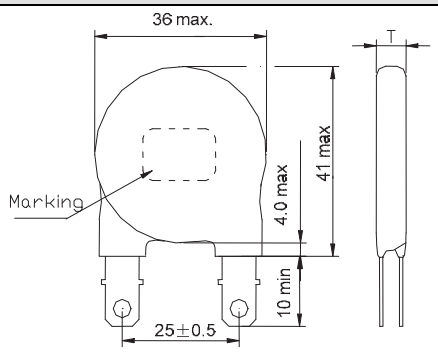
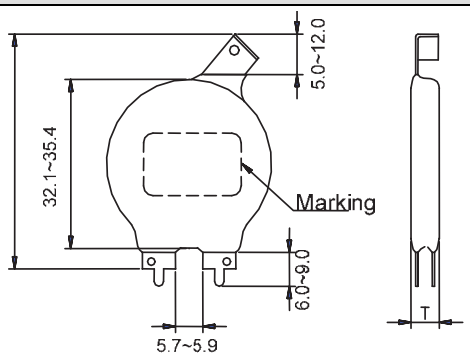
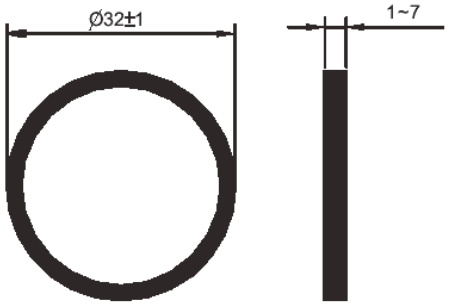
TVA 32 Type **(Unit: mm)**

QDSE	QDWD
	
QDWE	**QFYE**
	
QFZE	**QKDE**
	
QKLS	**QKVE**
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

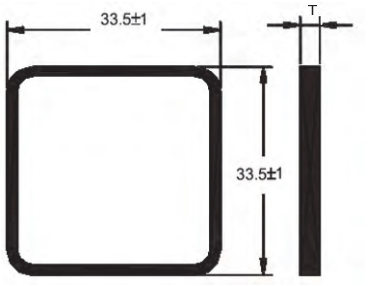
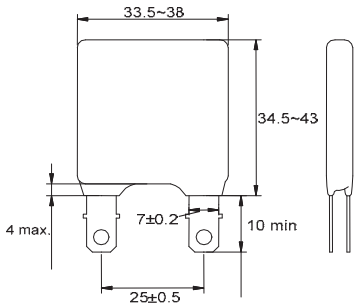
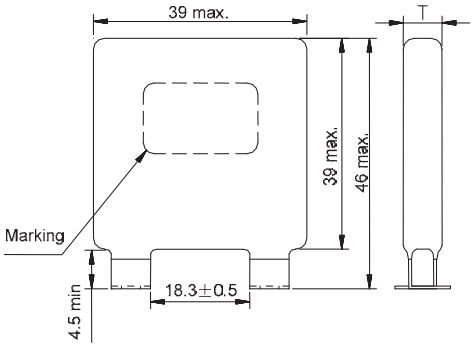
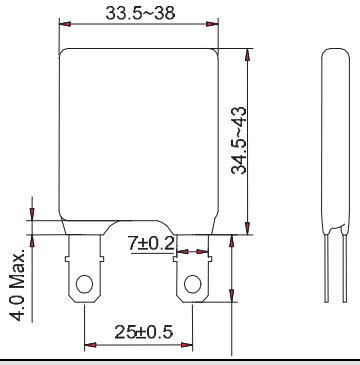
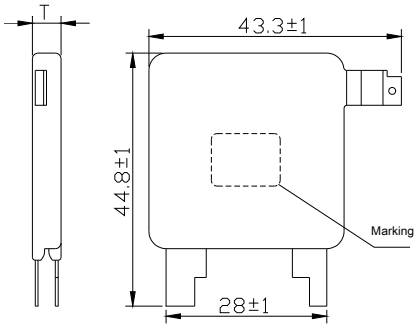
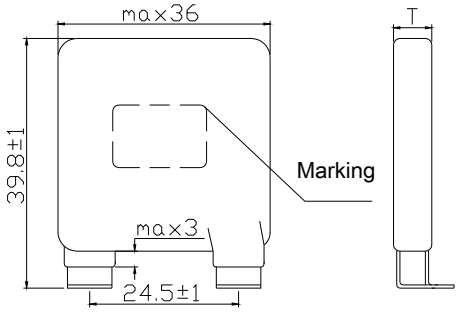
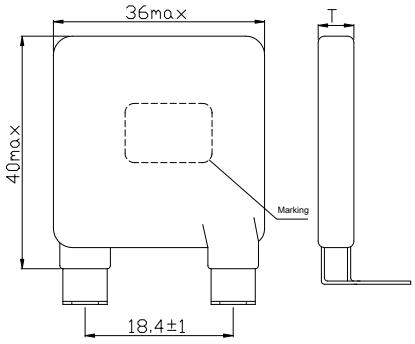
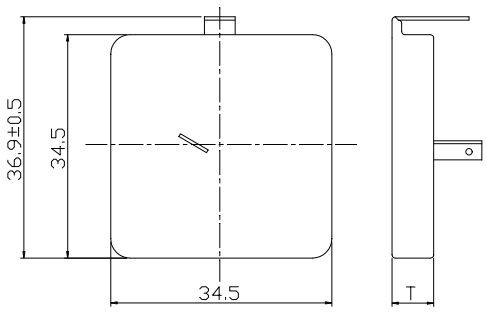
TVA 32 Type **(Unit: mm)**

QKQE	QKUS
	
YKYN	
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

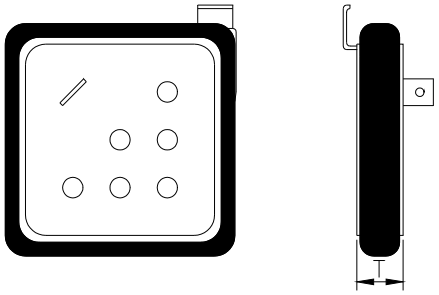
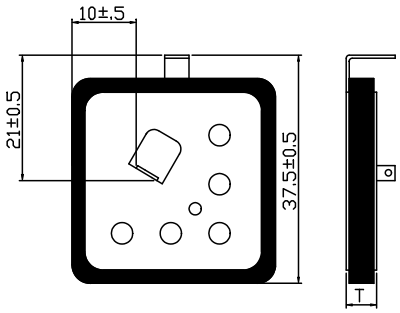
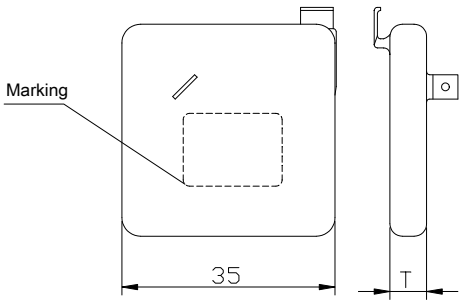
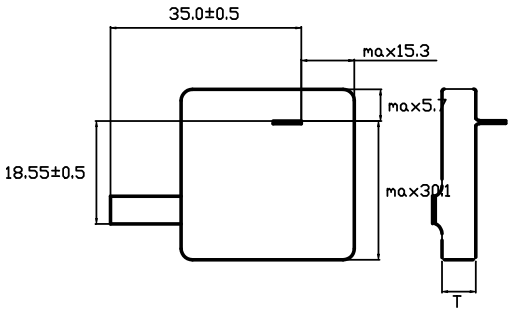
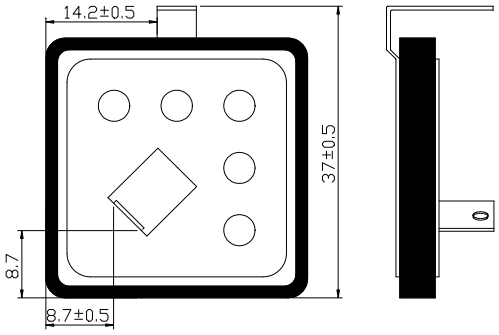
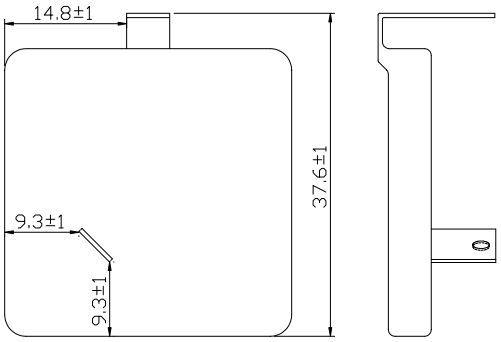
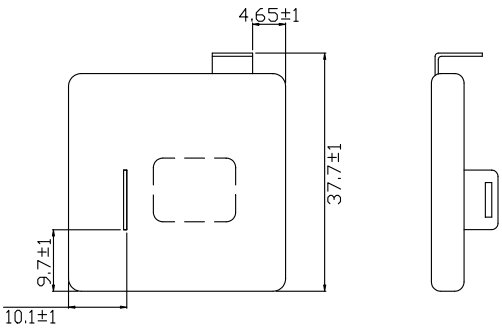
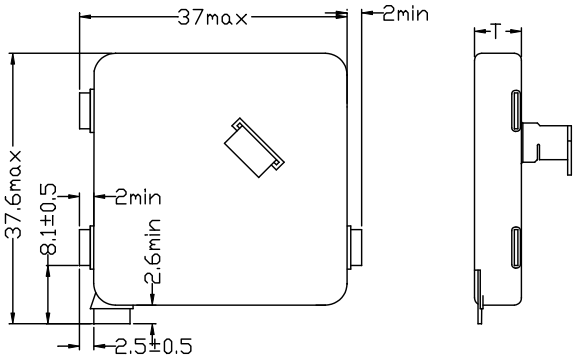
TVA 34 Type **(Unit: mm)**

YKYN	QKQE
	
QKDE	**QKQS**
	
QCKE	**QDZE**
	
QFQE	**QBYE**
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

TVA 34 Type **(Unit: mm)**

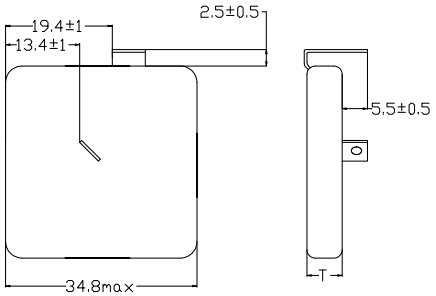
QCCD	QBYD
	
QCCE	**QBRE**
	
QEHD	**QEHE**
	
QEXE	**QFSE**
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

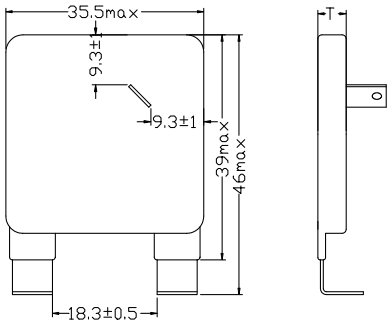
■ Structures and Dimensions

TVA 34 Type **(Unit: mm)**

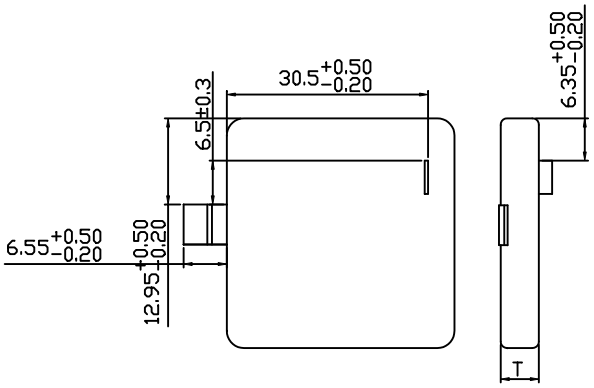
QFTE



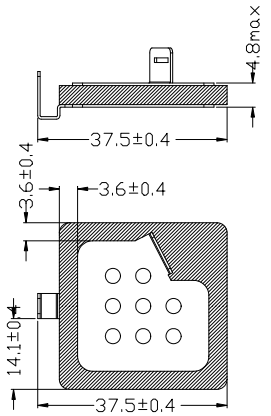
QHJE



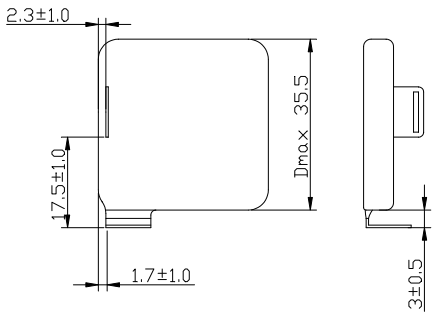
QHCE



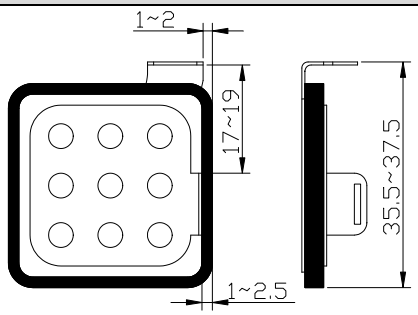
QHWD



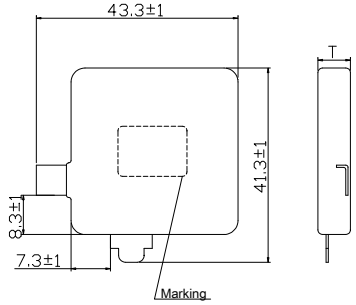
QBAE



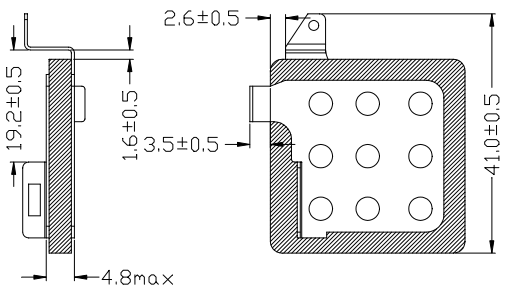
QBAD



QDKE



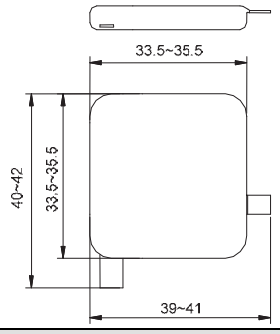
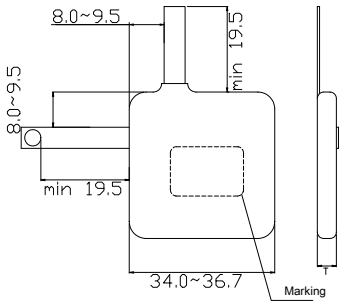
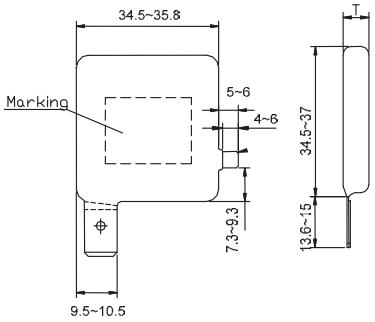
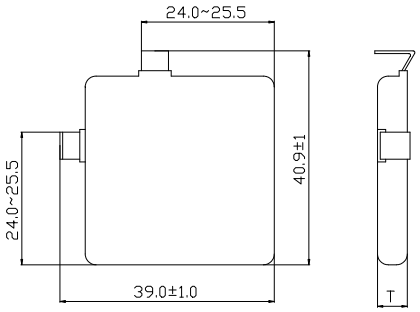
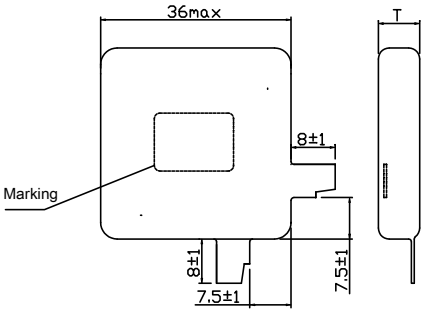
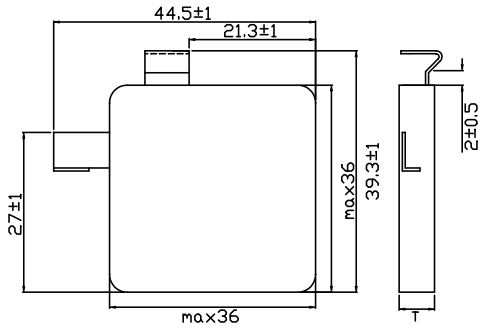
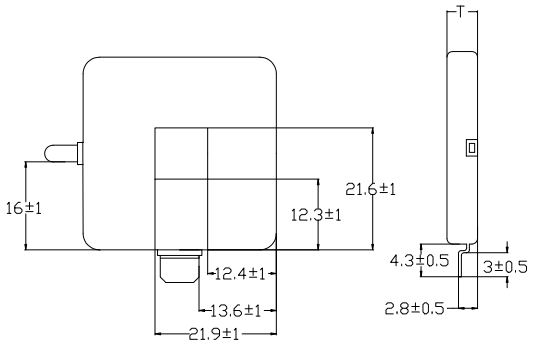
QHXD



Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

TVA 34 Type **(Unit: mm)**

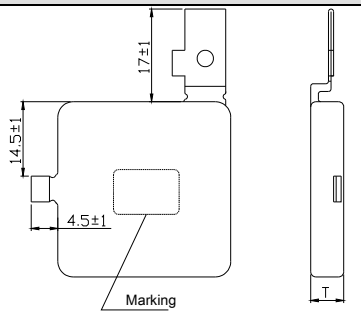
QADE/QADS	QCIE
	
QKXE	**QCLE**
	
QFME	**QGCE**
	
QGVE	
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

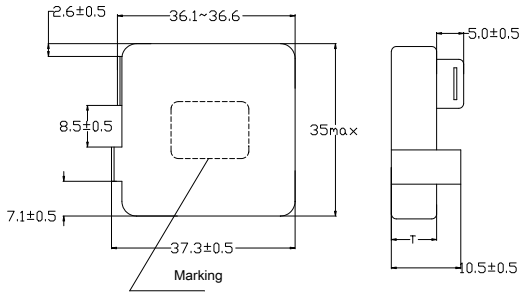
■ Structures and Dimensions

TVA 34 Type **(Unit: mm)**

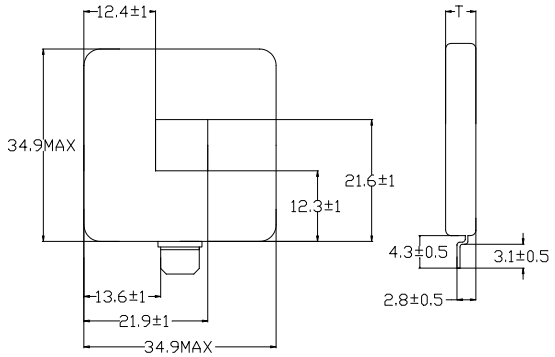
QDIE



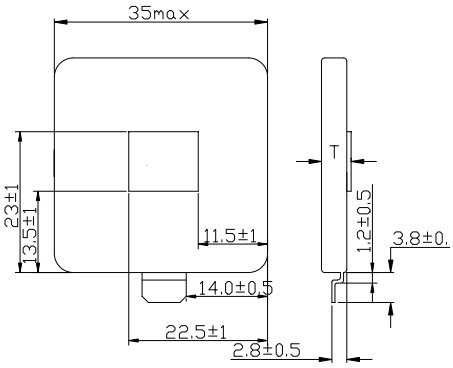
QFIE



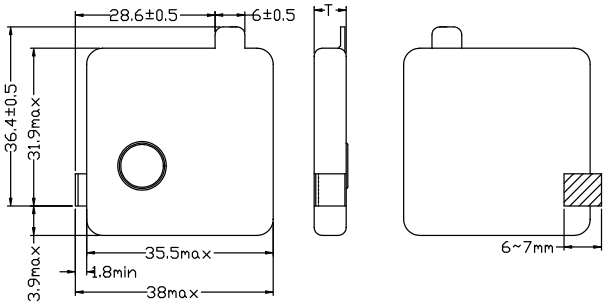
QGUE



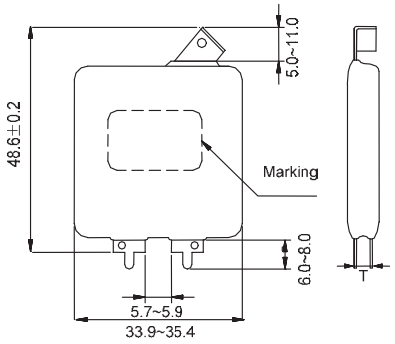
QGLE



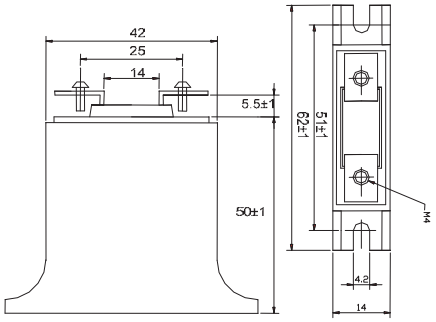
QFJE



QKUS



BKBL

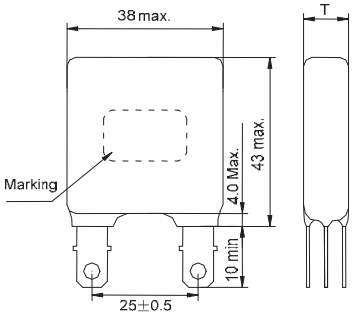


Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

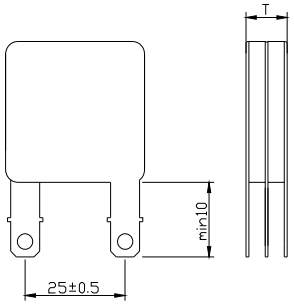
■ Structures and Dimensions

TVA 34-T Type (T is the parallel structure of two discs) **(Unit: mm)**

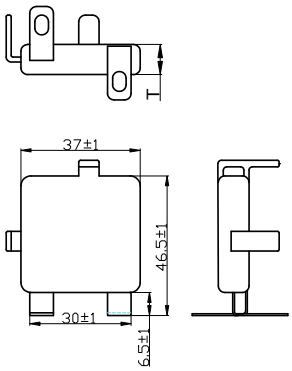
TKTS



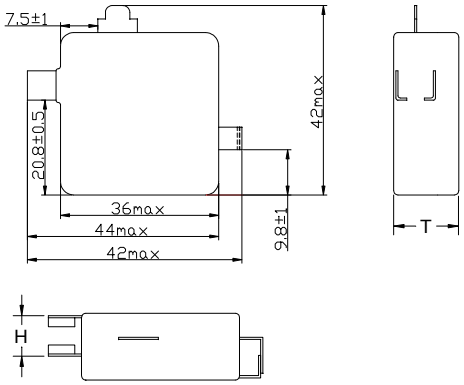
TKTS



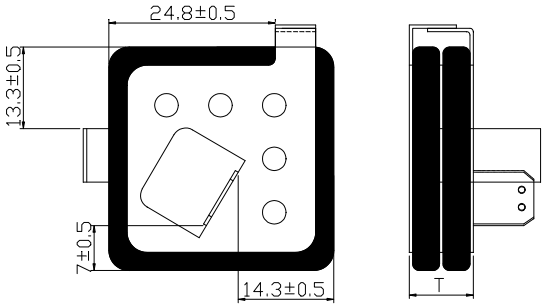
TATS



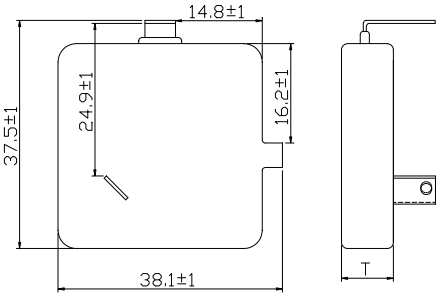
THSE



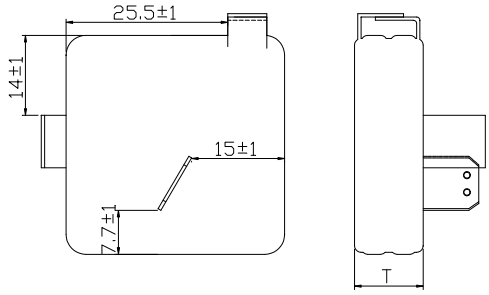
TDXD



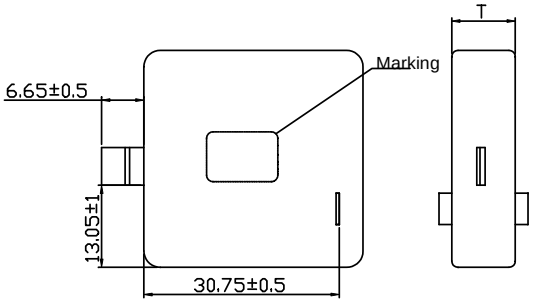
TBYE



TDXE



THCE

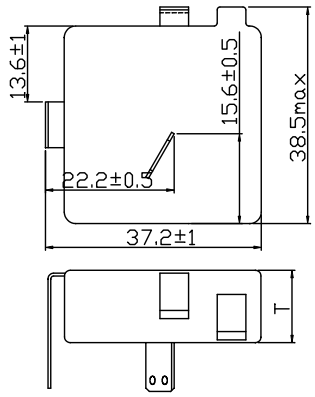


Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

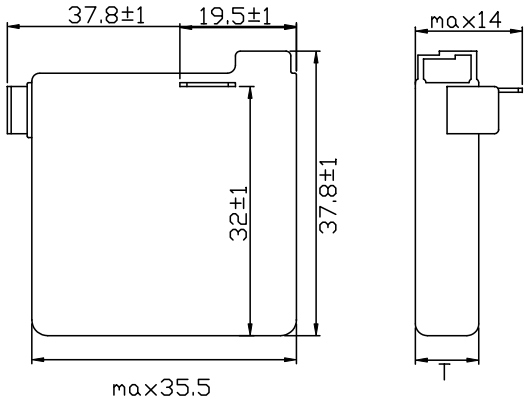
■ Structures and Dimensions

TVA 34-T Type (T is the parallel structure of two discs) **(Unit: mm)**

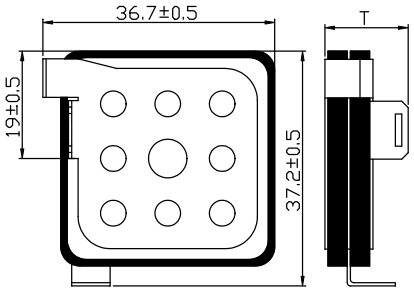
THED



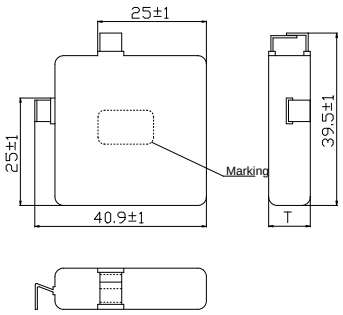
TBAE



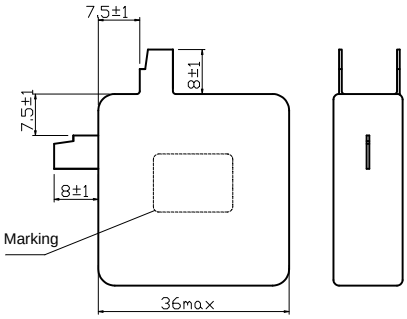
TBAD



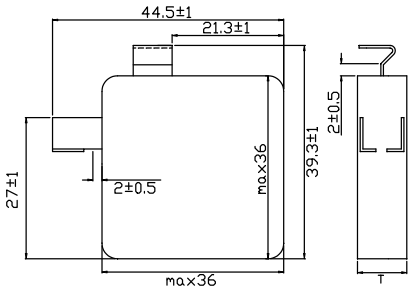
TCLE



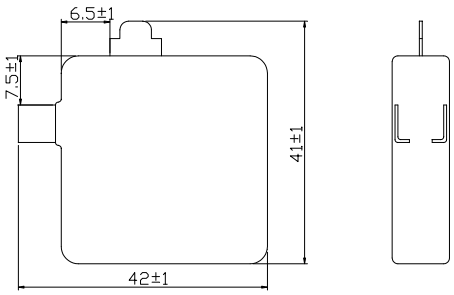
TFME



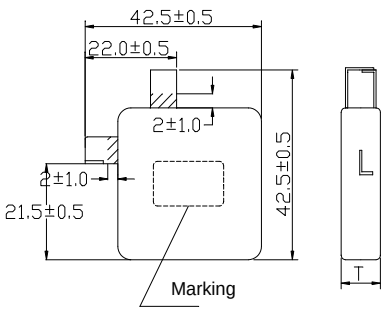
TGCE



TDPE



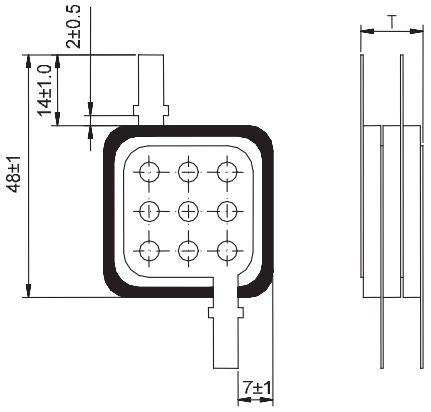
TGYE



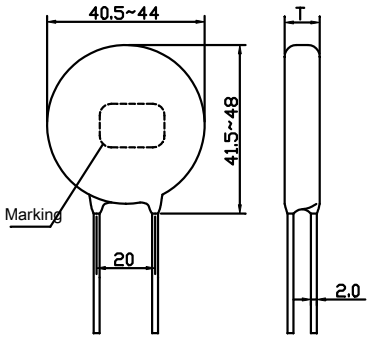
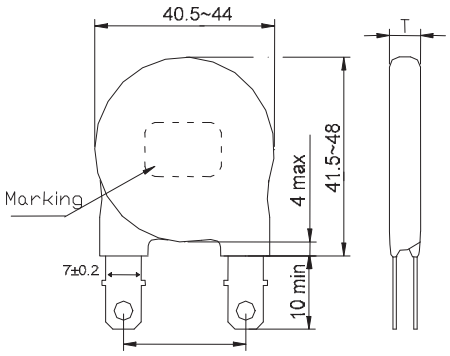
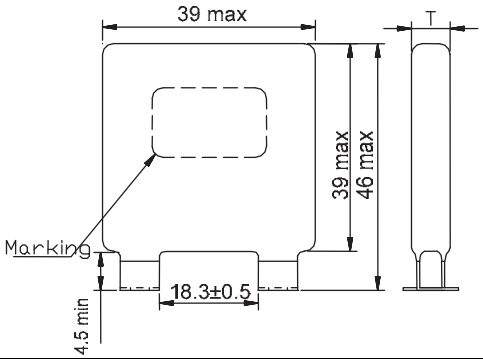
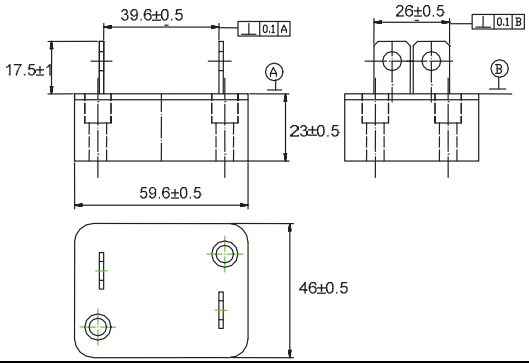
Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

TVA 34-T Type (T is the parallel structure of two discs) **(Unit: mm)**

TKNN	
	

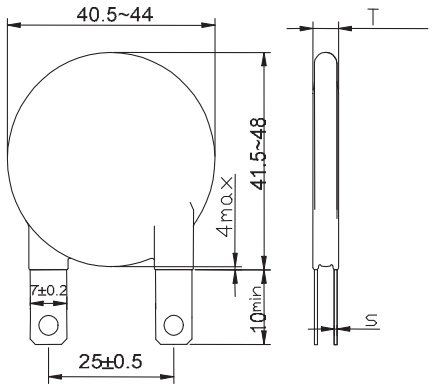
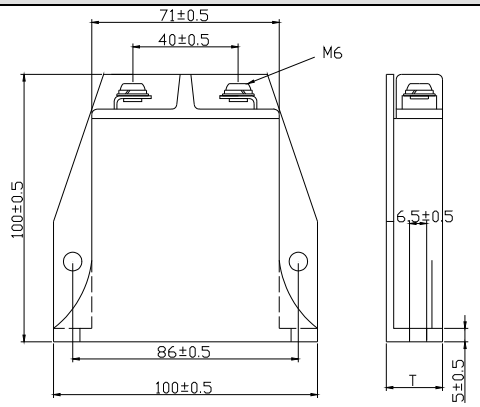
TVA 40 Type **(Unit: mm)**

GKGE	QKQE
	
QKDE	**BKCL**
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

■ Structures and Dimensions

TVA 60 type **(Unit: mm)**

QKQE	60KB
	

Note 1: T is the thickness of the product.
Note 2: The specifications of thickness are available upon request.

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

■ Electrical Characteristics

25mm Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current*1 (8/20μs)	Surge Operating Duty Test *2 (8/20μs)		Max. Energy (2ms)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (KA)	Imax (KA)	In (KA)	Wmax (J)	P (W)	Cp (pF)	UL 1449 3rd&cUL	UL 1414 & cUL
TVA25201K□□□□	200(180~220)	130	170	340	150	25	20	10	128	1.0	2200	√	√
TVA25221K□□□□	220(198~242)	140	180	365	150	25	20	10	135	1.0	2000	√	√
TVA25241K□□□□	240(216~264)	150	200	395	150	25	20	10	146	1.0	1900	√	√
TVA25271K□□□□	270(243~297)	175	225	455	150	25	20	10	170	1.0	1600	√	√
TVA25361K□□□□	360(324~396)	230	300	595	150	25	20	10	190	1.0	1300	√	√
TVA25391K□□□□	390(351~429)	250	320	650	150	25	20	10	210	1.0	1100	√	√
TVA25431K□□□□	430(387~473)	275	350	710	150	25	20	10	220	1.0	1000	√	√
TVA25471K□□□□	470(423~517)	300	385	775	150	25	20	10	225	1.0	950	√	√
TVA25511K□□□□	510(459~561)	320	415	845	150	25	20	10	230	1.0	900	√	√
TVA25561K□□□□	560(504~616)	350	450	930	150	25	20	10	235	1.0	800	√	√
TVA25621K□□□□	620(558~682)	385	505	1025	150	25	20	10	240	1.0	700	√	√
TVA25681K□□□□	680(612~748)	420	560	1120	150	25	20	10	250	1.0	650	√	√
TVA25751K□□□□	750(675~825)	460	615	1240	150	25	20	10	275	1.0	600	√	√
TVA25781K□□□□	780(702~858)	485	640	1290	150	25	20	10	290	1.0	550	√	√
TVA25821K□□□□	820(738~902)	510	670	1355	150	25	20	10	300	1.0	520	√	√
TVA25911K□□□□	910(819~1001)	550	745	1500	150	25	20	10	340	1.0	500	√	√
TVA25951K□□□□	950(855~1045)	575	765	1570	150	25	20	10	355	1.0	450	√	√
TVA25102K□□□□	1000(900~1100)	625	825	1650	150	25	20	10	375	1.0	430	√	√
TVA25112K□□□□	1100(990~1210)	680	895	1815	150	25	20	10	390	1.0	400	√	√
TVA25122K□□□□	1200(1080~1320)	750	980	2000	150	25	20	10	420	1.0	370	√	√

Note: □□□□ is structure code and please refers to the dimensions.

1) For “GKGE structure: Max. Surge Current (8/20μs) test condition is 15KA*1 time.

2) Surge Operating Duty Test is the specification refers to IEC61643-1, class Ⅱ.

3) UL 1449 3rd / cUL File No. E314979 , UL 1414 & cUL File No. E186499.

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

32mm Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current *1 (8/20μs)	Surge Operating Duty Test *2 (8/20μs)		Max. Energy (2ms)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (KA)	Imax (KA)	In (KA)	Wmax (J)	P (W)	Cp (pF)	UL 1449 3rd & cUL	UL 1414 & cUL
TVA32201K□□□□	200(180~220)	130	170	340	200	30	30	15	210	1.2	3900	√	√
TVA32221K□□□□	220(198~242)	140	180	365	200	30	30	15	225	1.2	3500	√	√
TVA32241K□□□□	240(216~264)	150	200	395	200	30	30	15	240	1.2	3300	√	√
TVA32271K□□□□	270(243~297)	175	225	455	200	30	30	15	250	1.2	2800	√	√
TVA32361K□□□□	360(324~396)	230	300	595	200	30	30	15	300	1.2	2200	√	√
TVA32391K□□□□	390(351~429)	250	320	650	200	30	30	15	330	1.2	2000	√	√
TVA32431K□□□□	430(387~473)	275	350	710	200	30	30	15	360	1.2	1800	√	√
TVA32471K□□□□	470(423~517)	300	385	775	200	30	30	15	405	1.2	1700	√	√
TVA32511K□□□□	510(459~561)	320	415	845	200	30	30	15	430	1.2	1600	√	√
TVA32561K□□□□	560(504~616)	350	450	930	200	30	30	15	470	1.2	1400	√	√
TVA32621K□□□□	620(558~682)	385	505	1025	200	30	30	15	550	1.2	1250	√	√
TVA32681K□□□□	680(612~748)	420	560	1120	200	30	30	15	600	1.2	1150	√	√
TVA32751K□□□□	750(675~825)	460	615	1240	200	30	30	15	660	1.2	1100	√	√
TVA32781K□□□□	780(702~858)	485	640	1290	200	30	30	15	680	1.2	1050	√	√
TVA32821K□□□□	820(738~902)	510	670	1355	200	30	30	15	550	1.2	950	√	√
TVA32911K□□□□	910(819~1001)	550	745	1500	200	30	30	15	620	1.2	900	√	√
TVA32951K□□□□	950(855~1045)	575	765	1570	200	30	30	15	660	1.2	850	√	√
TVA32102K□□□□	1000(900~1100)	625	825	1650	200	30	30	15	690	1.2	800	√	√
TVA32112K□□□□	1100(990~1210)	680	895	1815	200	30	30	15	760	1.2	750	√	√
TVA32122K□□□□	1200(1080~1320)	750	980	2000	200	30	30	15	800	1.2	650	√	√
TVA32182K□□□□	1800(1620~1980)	1000	1465	2970	200	25	25	12.5	1200	1.2	450	√	√

Note: □□□□ is structure code and please refers to the dimensions.

1) For “GKGE” structure: Max. Surge Current (8/20μs) test condition is 25KA*1time.

2) Surge Operating Duty Test is the specification refers to IEC61643-1, class Ⅱ.

3) UL 1449 3rd / cUL File No. E314979 , UL 1414 & cUL File No. E186499.

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

34*34mm Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Surge Operating Duty Test*1 (8/20μs)		Max. Energy (2ms)	Rated Power	Reference Capacitance @1KHz	Safety Approvals		
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (KA)	Imax (KA)	In (KA)	Wmax (J)	P (W)	Cp (pF)	UL 1449 3rd&cUL	UL 1414 &cUL	TUV
TVA34201K□□□□	200(180~220)	130	170	340	300	50	40	20	310	1.4	5600	√	√	√
TVA34221K□□□□	220(198~242)	140	180	365	300	50	40	20	340	1.4	5000	√	√	√
TVA34241K□□□□	240(216~264)	150	200	395	300	50	40	20	360	1.4	4800	√	√	√
TVA34271K□□□□	270(243~297)	175	225	455	300	50	40	20	400	1.4	4100	√	√	√
TVA34361K□□□□	360(324~396)	230	300	595	300	50	40	20	460	1.4	3200	√	√	√
TVA34391K□□□□	390(351~429)	250	320	650	300	50	40	20	490	1.4	2800	√	√	√
TVA34431K□□□□	430(387~473)	275	350	710	300	50	40	20	550	1.4	2600	√	√	√
TVA34471K□□□□	470(423~517)	300	385	775	300	50	40	20	595	1.4	2400	√	√	√
TVA34511K□□□□	510(459~561)	320	415	845	300	50	40	20	640	1.4	2300	√	√	√
TVA34561K□□□□	560(504~616)	350	450	930	300	50	40	20	710	1.4	2000	√	√	√
TVA34621K□□□□	620(558~682)	385	505	1025	300	50	40	20	800	1.4	1800	√	√	√
TVA34681K□□□□	680(612~748)	420	560	1120	300	50	40	20	910	1.4	1700	√	√	√
TVA34751K□□□□	750(675~825)	460	615	1240	300	50	40	20	1000	1.4	1600	√	√	√
TVA34781K□□□□	780(702~858)	485	640	1290	300	50	40	20	1030	1.4	1500	√	√	√
TVA34821K□□□□	820(738~902)	510	670	1355	300	50	40	20	860	1.4	1400	√	√	√
TVA34911K□□□□	910(819~1001)	550	745	1500	300	50	40	20	960	1.4	1300	√	√	√
TVA34951K□□□□	950(855~1045)	575	765	1570	300	50	40	20	1000	1.4	1200	√	√	√
TVA34102K□□□□	1000(900~1100)	625	825	1650	300	50	40	20	1050	1.4	1150	√	√	√
TVA34112K□□□□	1100(990~1210)	680	895	1815	300	50	40	20	1200	1.4	1050	√	√	√
TVA34122K□□□□	1200(1080~1320)	750	980	2000	300	50	40	20	1310	1.4	950	√	√	√
TVA34182K□□□□	1800(1620~1980)	1000	1465	2970	300	40	30	15	1800	1.4	700	√	√	√

Note: □□□□ is structure code and please refers to the dimensions.

1) Surge Operating Duty Test is the specification refers to IEC61643-1, class Ⅱ.

2) UL 1449 3rd / cUL File No. E314979 , UL 1414 & cUL File No. E186499 , TUV File No. J 50182629.

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

34-T mm Series (T is the parallel structure of two discs)

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Surge Operating Duty Test*1 (8/20μs)		Max. Energy (2ms)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (KA)	Imax (KA)	In (KA)	Wmax (J)	P (W)	Cp (pF)	UL1449 3rd&cUL	UL 1414 &cUL
TVA34201KT□□□	200(180~220)	130	170	340	500	80	70	40	410	1.6	14040	√	
TVA34221KT□□□	220(198~242)	140	180	365	500	80	70	40	451	1.6	12760	√	
TVA34241KT□□□	240(216~264)	150	200	395	500	80	70	40	490	1.6	11700	√	
TVA34271KT□□□	270(243~297)	175	225	455	500	80	70	40	550	1.6	10400	√	
TVA34361KT□□□	360(324~396)	230	300	595	500	80	70	40	730	1.6	7800	√	
TVA34391KT□□□	390(351~429)	250	320	650	500	80	70	40	800	1.6	7200	√	√
TVA34431KT□□□	430(387~473)	275	350	710	500	80	70	40	860	1.6	6600	√	√
TVA34471KT□□□	470(423~517)	300	385	775	500	80	70	40	950	1.6	6100	√	√
TVA34511KT□□□	510(459~561)	320	415	845	500	80	70	40	1000	1.6	5800	√	√
TVA34561KT□□□	560(504~616)	350	450	930	500	80	70	40	1100	1.6	5100	√	√
TVA34621KT□□□	620(558~682)	385	505	1025	500	80	70	40	1200	1.6	4600	√	√
TVA34681KT□□□	680(612~748)	420	560	1120	500	80	70	40	1500	1.6	4300	√	√
TVA34751KT□□□	750(675~825)	460	615	1240	500	80	70	40	1650	1.6	4100	√	√
TVA34781KT□□□	780(702~858)	485	640	1290	500	80	70	40	1700	1.6	3800	√	√
TVA34821KT□□□	820(738~902)	510	670	1355	500	80	70	40	1350	1.6	3600	√	√
TVA34911KT□□□	910(819~1001)	550	745	1500	500	80	70	40	1500	1.6	3300	√	√
TVA34951KT□□□	950(855~1045)	575	765	1570	500	80	70	40	1560	1.6	3000	√	√
TVA34102KT□□□	1000(900~1100)	625	825	1650	500	80	70	40	1650	1.6	2900	√	√
TVA34112KT□□□	1100(990~1210)	680	895	1815	500	80	70	40	1800	1.6	2700	√	√
TVA34122KT□□□	1200(1080~1320)	750	980	2000	500	80	70	40	2000	1.6	2500	√	√

Note: □□□□ is structure code and please refers to the dimensions.

1) Surge Operating Duty Test is the specification refers to IEC61643-1, class Ⅱ.

2) UL 1449 3rd / cUL File No. E314979 , UL 1414 & cUL File No. E186499.

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

40mm Series

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current*1 (8/20μs)	Surge Operating Duty Test*2 (8/20μs)		Max. Energy (2ms)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (KA)	Imax (KA)	In (KA)	Wmax (J)	P (W)	Cp (pF)	UL1449 3rd&cUL	UL 1414 &cUL
TVA40201K□□□□	200(180~220)	130	170	340	300	50	40	20	310	1.4	6000	√	√
TVA40221K□□□□	220(198~242)	140	180	365	300	50	40	20	340	1.4	5500	√	√
TVA40241K□□□□	240(216~264)	150	200	395	300	50	40	20	360	1.4	5000	√	√
TVA40271K□□□□	270(243~297)	175	225	455	300	50	40	20	400	1.4	4500	√	√
TVA40361K□□□□	360(324~396)	230	300	595	300	50	40	20	460	1.4	3500	√	√
TVA40391K□□□□	390(351~429)	250	320	650	300	50	40	20	490	1.4	3000	√	√
TVA40431K□□□□	430(387~473)	275	350	710	300	50	40	20	550	1.4	2800	√	√
TVA40471K□□□□	470(423~517)	300	385	775	300	50	40	20	595	1.4	2600	√	√
TVA40511K□□□□	510(459~561)	320	415	845	300	50	40	20	640	1.4	2500	√	√
TVA40561K□□□□	560(504~616)	350	450	930	300	50	40	20	710	1.4	2200	√	√
TVA40621K□□□□	620(558~682)	385	505	1025	300	50	40	20	800	1.4	2000	√	√
TVA40681K□□□□	680(612~748)	420	560	1120	300	50	40	20	910	1.4	1800	√	√
TVA40751K□□□□	750(675~825)	460	615	1240	300	50	40	20	1000	1.4	1700	√	√
TVA40781K□□□□	780(702~858)	485	640	1290	300	50	40	20	1030	1.4	1600	√	√
TVA40821K□□□□	820(738~902)	510	670	1355	300	50	40	20	860	1.4	1500	√	√
TVA40911K□□□□	910(819~1001)	550	745	1500	300	50	40	20	960	1.4	1400	√	√
TVA40951K□□□□	950(855~1045)	575	765	1570	300	50	40	20	1000	1.4	1300	√	√
TVA40102K□□□□	1000(900~1100)	625	825	1650	300	50	40	20	1050	1.4	1200	√	√
TVA40112K□□□□	1100(990~1210)	680	895	1815	300	50	40	20	1200	1.4	1100	√	√
TVA40122K□□□□	1200(1080~1320)	750	980	2000	300	50	40	20	1310	1.4	1000	√	√
TVA40182K□□□□	1800(1620~1980)	1000	1465	2970	300	40	30	15	1800	1.4	750	√	√

Note: □□□□ is structure code and please refers to the dimensions.

1) For “GKGE” structure: Max. Surge Current (8/20μs) test condition is 40KA*1time.

2) Surge Operating Duty Test is the specification refers to IEC61643-1, class Ⅱ.

3) UL 1449 3rd / cUL File No. E314979 , UL 1414 & cUL File No. E186499.

Metal Oxide Varistor：TVA Series

Disc/Block Type Varistor for Lightning Protection

60mm Series

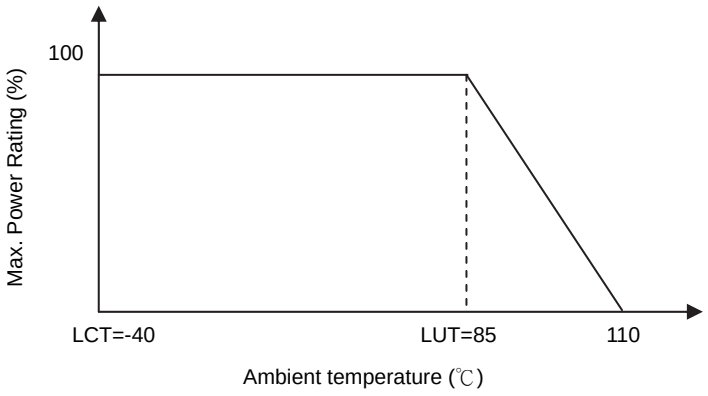
Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Surge Operating Duty Test *1 (8/20μs)		Max. Energy (2ms)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (KA)	Imax (KA)	In (KA)	Wmax (J)	P (W)	Cp (pF)	UL1449 3rd& cUL	UL 1414 &cUL
TVA60431K□□□□	430(387~473)	275	350	710	500	80	70	35	860	1.6	6600		√
TVA60471K□□□□	470(423~517)	300	385	775	500	80	70	35	950	1.6	6100		√
TVA60511K□□□□	510(459~561)	320	415	845	500	80	70	35	1000	1.6	5800		√
TVA60561K□□□□	560(504~616)	350	450	930	500	80	70	35	1100	1.6	5100		√
TVA60621K□□□□	620(558~682)	385	505	1025	500	80	70	35	1200	1.6	4600	√	√
TVA60681K□□□□	680(612~748)	420	560	1120	500	80	70	35	1500	1.6	4300		√
TVA60751K□□□□	750(675~825)	460	615	1240	500	80	70	35	1650	1.6	4100		√
TVA60781K□□□□	780(702~858)	485	640	1290	500	80	70	35	1700	1.6	3800		√
TVA60821K□□□□	820(738~902)	510	670	1355	500	80	70	35	1350	1.6	3600		√
TVA60911K□□□□	910(819~1001)	550	745	1500	500	80	70	35	1500	1.6	3300		√
TVA60951K□□□□	950(855~1045)	575	765	1570	500	80	70	35	1560	1.6	3000		√
TVA60102K□□□□	1000(900~1100)	625	825	1650	500	80	70	35	1650	1.6	2900		√
TVA60112K□□□□	1100(990~1210)	680	895	1815	500	80	70	35	1800	1.6	2700		√
TVA60122K□□□□	1200(1080~1320)	750	980	2000	500	80	70	35	2000	1.6	2500		√
TVA60182K□□□□	1800(1620~1980)	1000	1465	2970	500	70	60	30	3000	1.6	1800		√

Note: □□□□ is structure code and please refers to the dimensions.

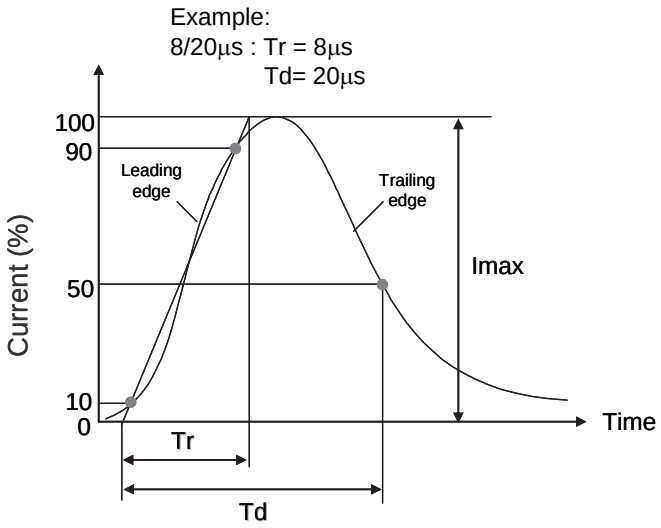
1) Surge Operating Duty Test is the specification refers to IEC61643-1, class Ⅱ

2) UL 1449 3rd / cUL File No. E314979 , UL 1414 & cUL File No. E186499.

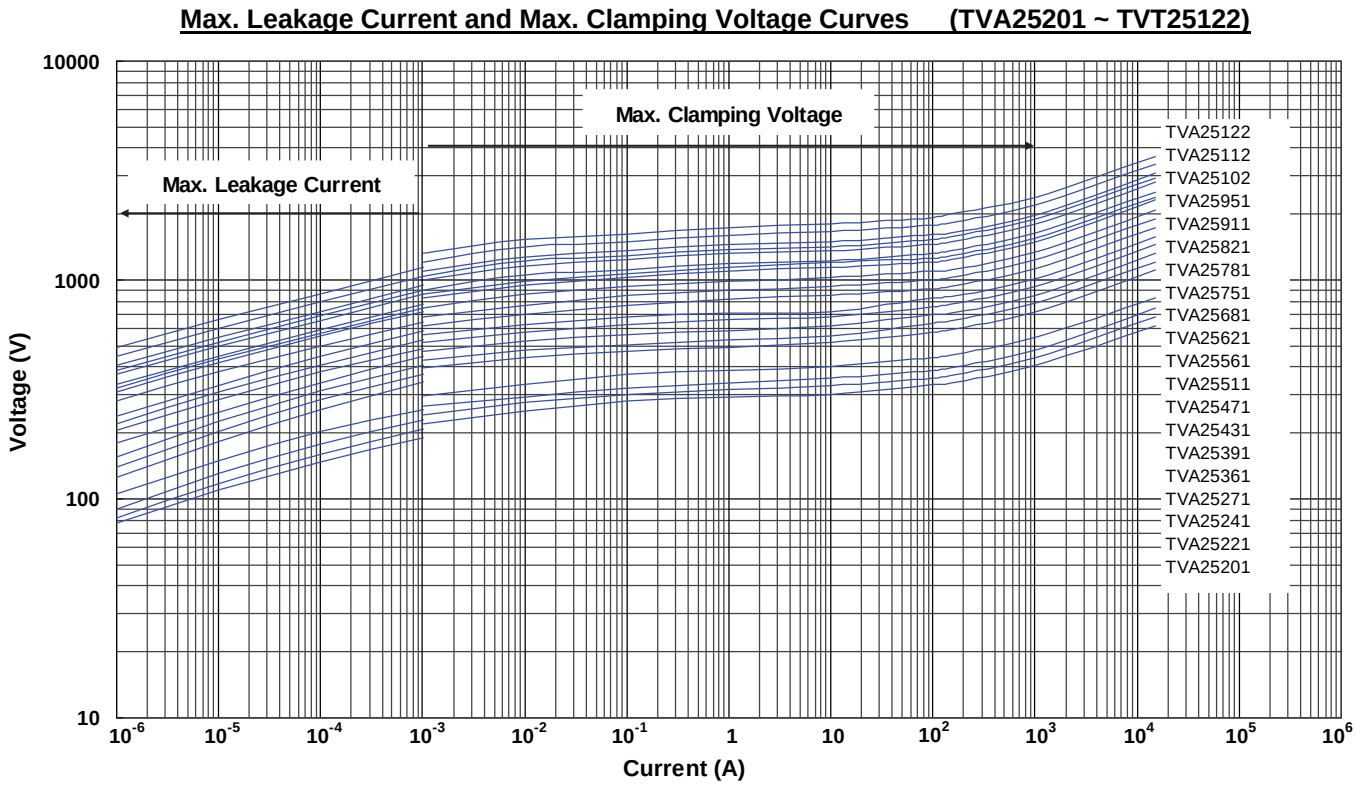
■ Power Derating Curve



■ Surge Current Standard Waveform

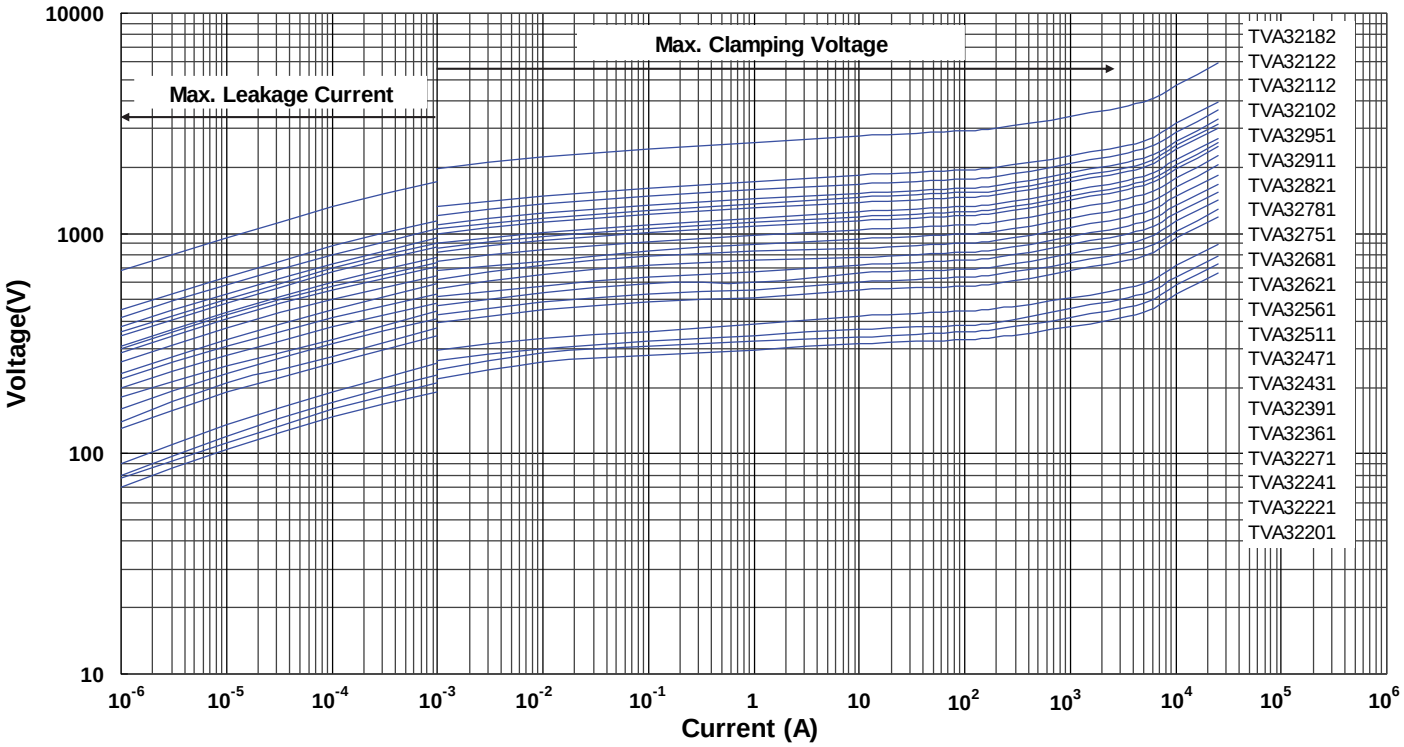


■ Max. Leakage Current and Max. Clamping Voltage Curves

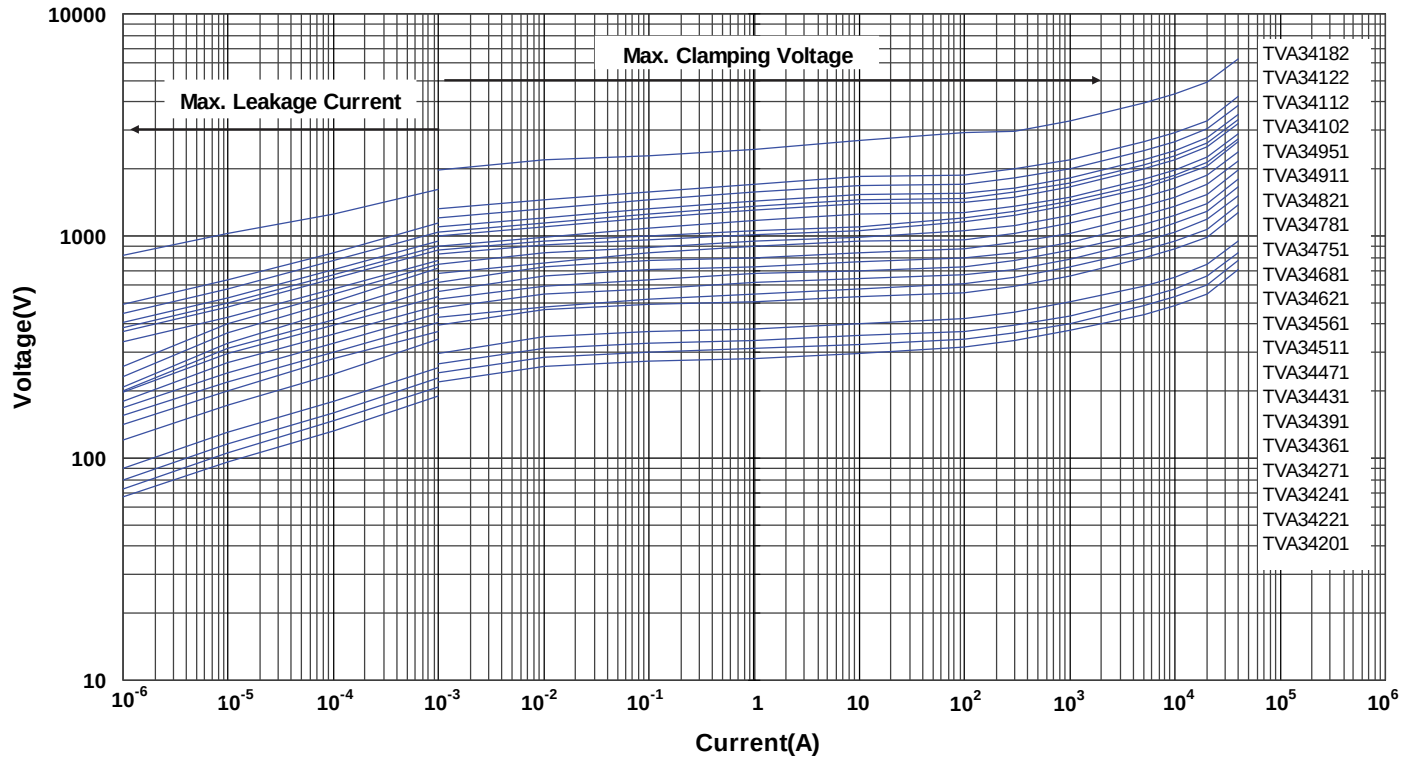


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVA32201 ~ TVT32182)

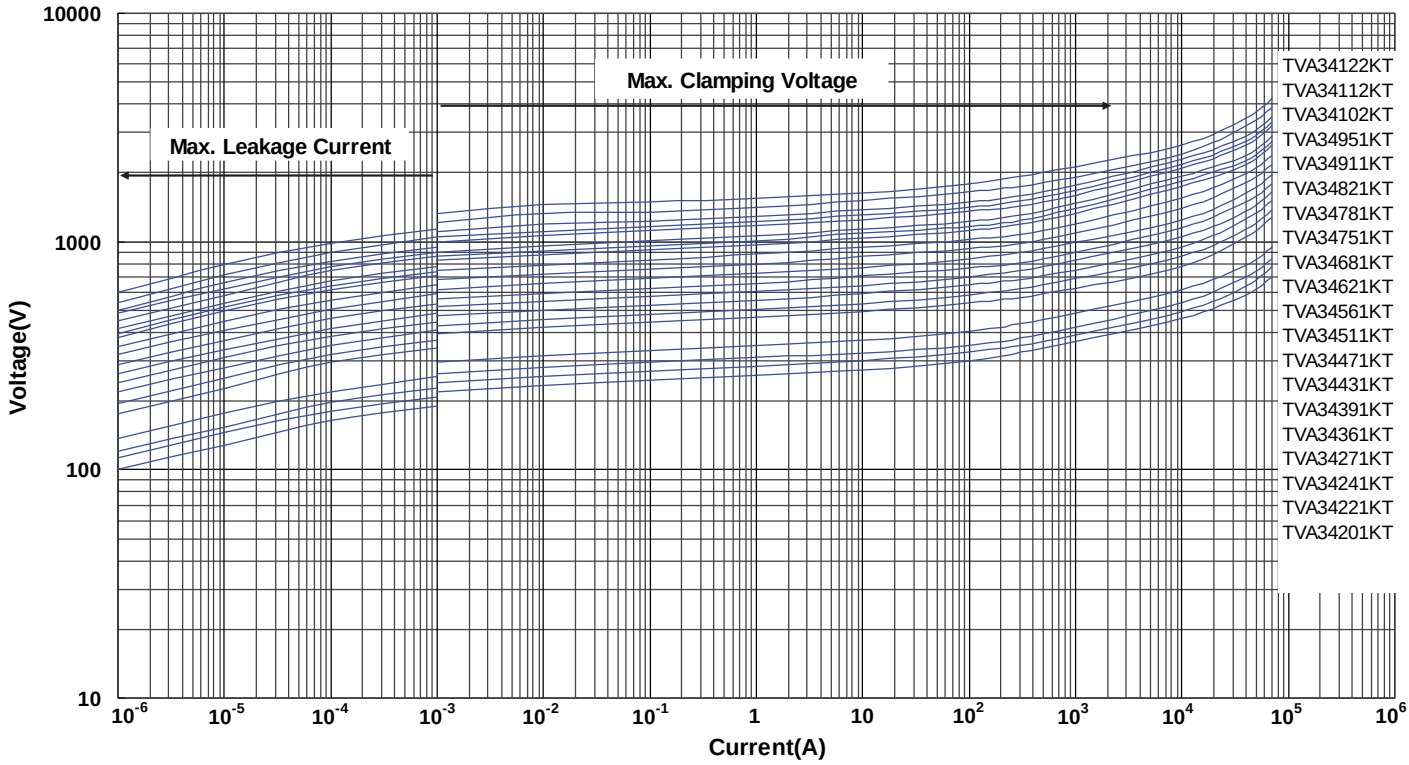


Max. Leakage Current and Max. Clamping Voltage Curves (TVA34201 ~ TVT34182)

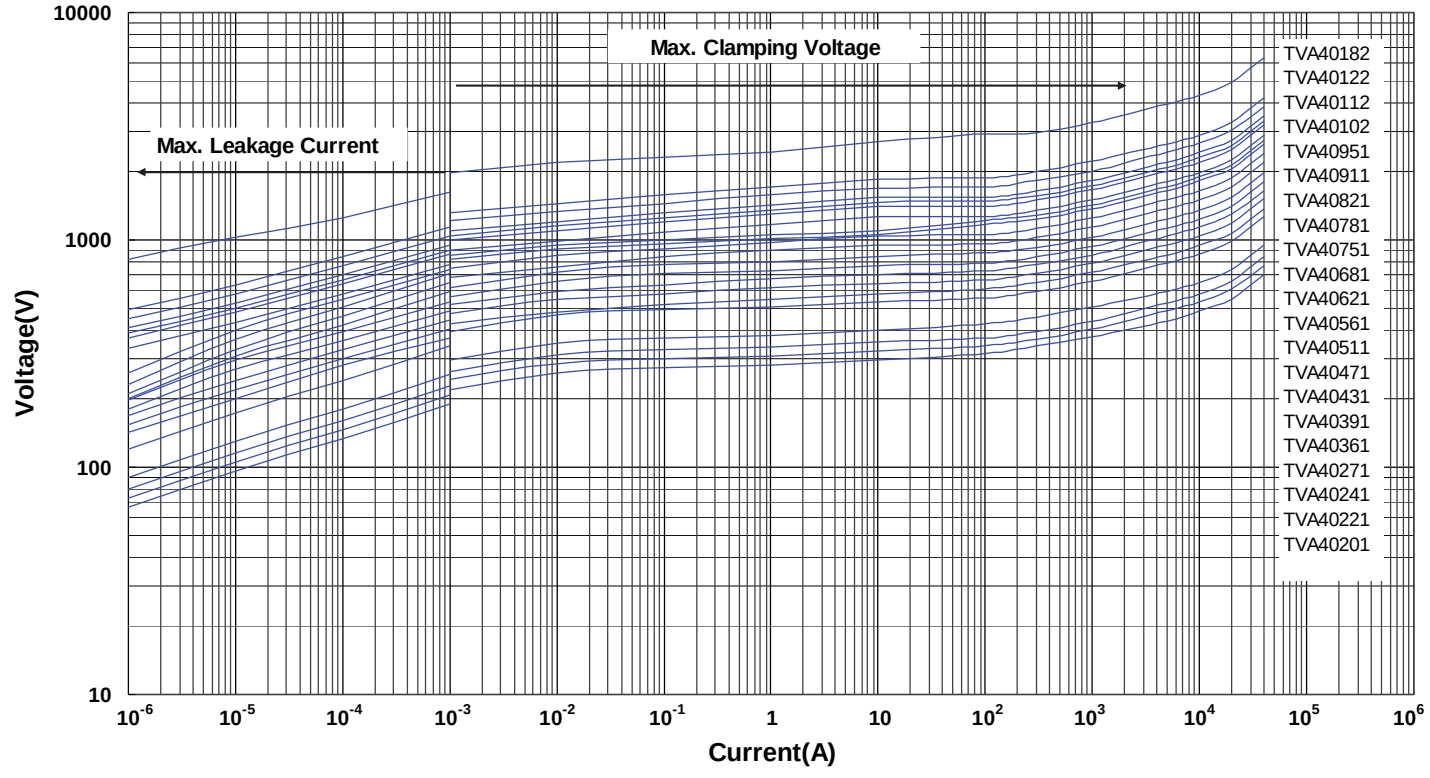


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVA34201KT ~ TVT34122KT)

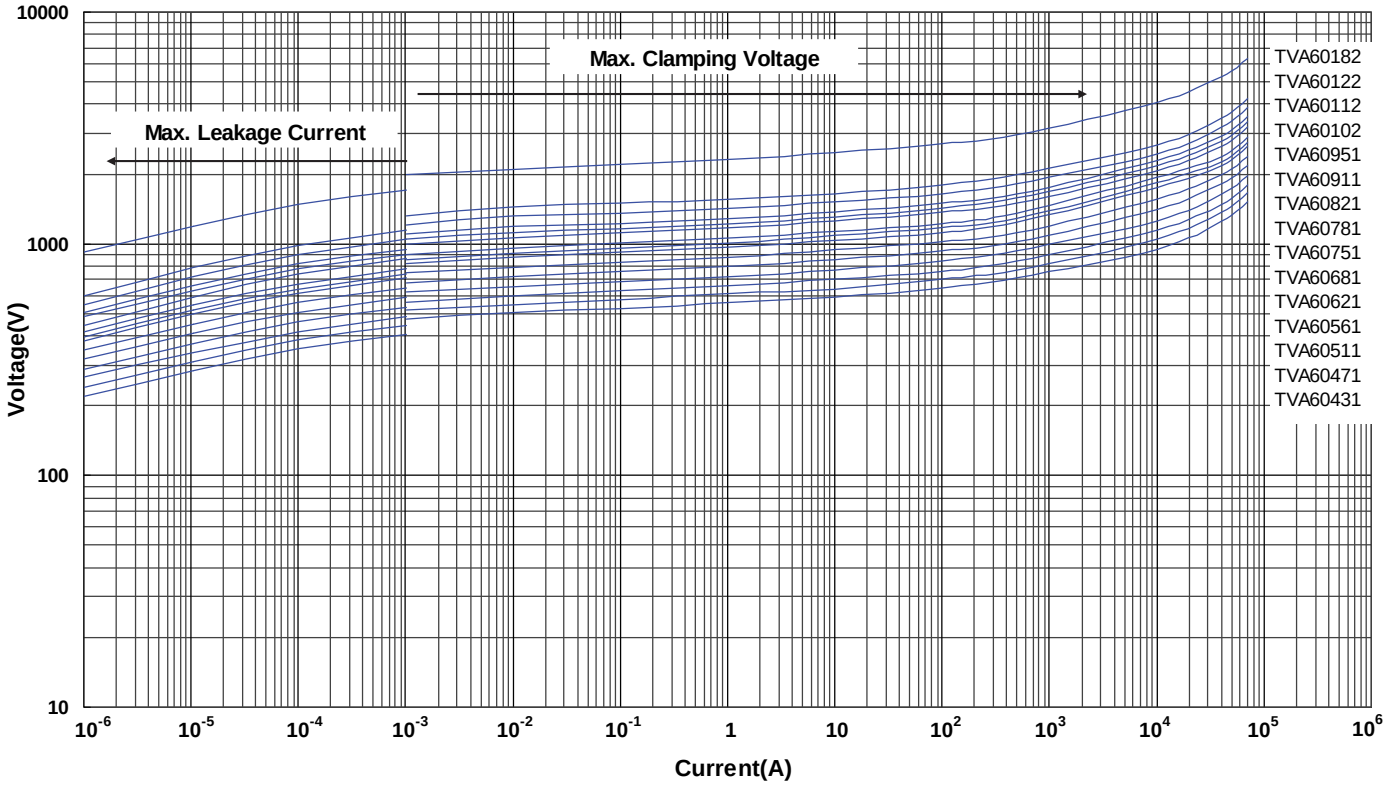


Max. Leakage Current and Max. Clamping Voltage Curves (TVA40201 ~ TVT40182)



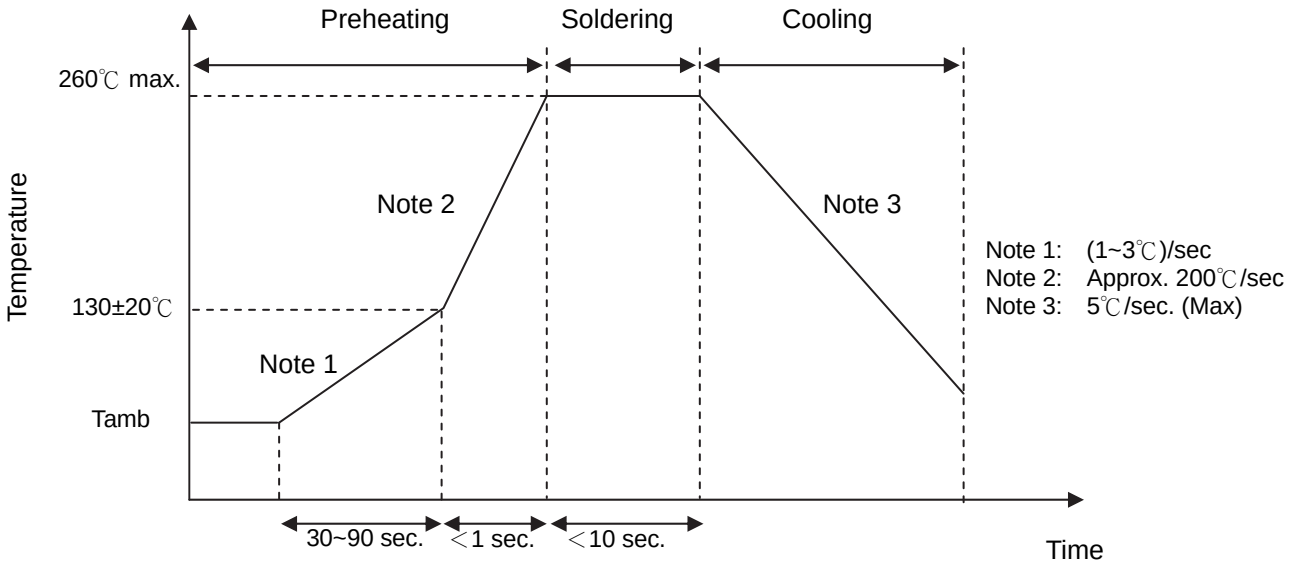
■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVA60431 ~ TVT60182)



■ 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	IEC 60068-2-21	Gradually apply the specified force and keep the unit fixed for 10±1 sec. Terminal cross-sectional area (mm^2) / Terminal diameter (mm) / Force (Kg) 0.5<S≦1.2 / 0.8<d≦1.25 / 2.0 1.2<S / 1.25<d / 4.0	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Vibration (Optional)	IEC 61051-1	Frequency range: 10~55Hz Amplitude: 0.75mm or $98m/s^2$ Direction: 3 mutually perpendicular directions, 2 hrs each.	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Solderability	IEC 60068-2-20	245±3℃, 3±0.3 sec (For Lead wire structure)	At least 95% of terminal electrode is covered by new solder
Resistance to Soldering Heat	IEC 60068-2-20	260±3℃, 10±1 sec	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
High Temperature Storage	IEC 60068-2-2	110±5℃ x 1000±24 hrs	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Damp Heat, Steady State	IEC 60068-2-78	a. 40±2℃, 90 ~ 95 % RH, 1344 hrs b. 40±2℃, 90 ~ 95 % RH, at 10%Vdc,1344 hrs	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage Insulation Resistance ≧100MΩ
Rapid Change of Temperature (optional)	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 / 15±3 3 / 85±2 / 30±3 4 / Room temperature / 15±3	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Endurance at Upper Category Temperature	IEC 61051-1	85±2℃, 1000±24 hrs at V_{DC} or V_{rms} (Max. Continuous Voltage)	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage
8/20μs Surge Operating Duty Test	IEC 61643-11	a. Measured limiting voltage @ 0.1In, 0.2In, 0.5In, 1.0In, Imax b. Operating duty test: In*15 times	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage
Climatic Sequence	IEC 61051-1	a. dry heat at 85°C,16hrs b. damp heat ,1st cycle: 55℃, 95RH, 24hrs (IEC60068-2-30) c. cold, -40°C, 2 hrs d. damp heat, additional 5 cycles,120 hrs	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage Insulation Resistance ≧100MΩ
Voltage Proof	IEC 61051-1	Metal balls method, 2500 V_{ac} 1 min	No visible damage

■ Packaging

Note: Packaging quantity varies with product structure. Please contact THINKING sales rep for detailed information.

● Bulk Packing (For Lead Wire Structure)

Series	Part No.	Quantity (pcs/bag)
TVA25, Lead Structure	TVA25201~561	50
	TVA25621~122	40
TVA32, Lead Structure	TVA32201~561	25
	TVA32621~182	20

● Box Packing (For Plastic Housing Structure)

Structure	Code	Quantity (pcs/box)
Plastic Housing	KB	60
	KC	28

■ Warehouse 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

Metal Oxide Varistor：TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

■ Features

1. RoHS compliant
2. Available for SMT flow/reflow soldering
3. Low profile and space saving
4. Large capability to withstand high surge current
5. Low inductance construction with excellent response
6. Encapsulation material according to UL94-V0
7. Operating temperature range: -40°C ~ +85°C
   Storage temperature range: -40°C ~ +125°C
8. Agency recognition: UL/cUL
9. UL 1449 3rd SPD Type Application: for SPD "Other" Applications

■ Recommended Applications

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

■ Part Number Code

T	V	B	7	S	1	8	0	K	R			
1	2	3	4	5	6	7	8	9	10	11	12	13

Product Type	
TVB	THINKING Varistor TVB Series

Size (EIA)	
7	3225
9	4032

Varistor Voltage (V_{1mA})	
180	$18x10^0V=18V$
241	$24x10^1V=240V$

Packaging	
B	Bulk
R	Reel

Optional Suffix
001~999

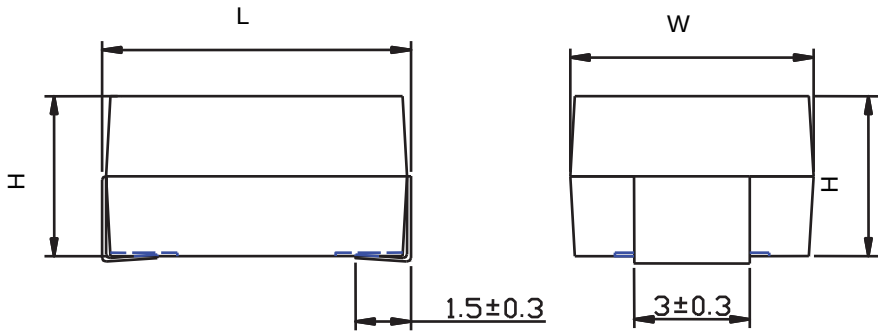
Terminal Type	
S	Standard
T	Telecom

Tolerance of V_{1mA}	
K	±10%

Metal Oxide Varistor：TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

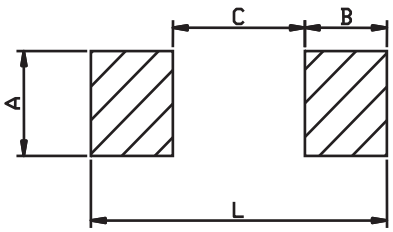
■ Structures and Dimensions



(Unit: mm)

Size (EIA)	Varistor Voltage Range (V)	L	W	H
3225	V_{1mA}=180 ~ 271	8.0+/- 0.3	6.3+/- 0.3	3.2+/- 0.3
	V_{1mA}=361 ~ 561			4.5+/- 0.3
4032	V_{1mA}=180 ~ 271	10.2+/- 0.3	8.0+/- 0.3	3.2+/- 0.3
	V_{1mA}=301 ~ 751			4.5+/- 0.3

● Soldering Pads



(Unit: mm)

Item		A	B	C	L
Size (EIA)	3225	3.5	2.8	4.5	10.1
	4032	3.5	2.8	6.5	12.1

Metal Oxide Varistor：TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

■ Electrical Characteristics

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Max. Energy (10/1000μs)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
										UL	cUL
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (A)	Wmax (J)	P (W)	Cp (pF)	UL 1449 3rd.: E314979	
TVB7S180	18 (16~20)	11	14	36	1.0	150	0.6	0.01	1750	√	√
TVB7S220	22 (20~24)	14	18	43	1.0	150	0.7	0.01	1450	√	√
TVB7S270	27 (24~30)	17	22	53	1.0	150	0.9	0.01	1200	√	√
TVB7S330	33 (30~36)	20	26	65	1.0	150	1.1	0.01	980	√	√
TVB7S390	39 (35~43)	25	31	77	1.0	150	1.2	0.01	850	√	√
TVB7S470	47 (42~52)	30	38	93	1.0	150	1.5	0.01	720	√	√
TVB7S560	56 (50~62)	35	45	110	1.0	150	1.8	0.01	620	√	√
TVB7S680	68 (61~75)	40	56	135	1.0	150	2.2	0.01	520	√	√
TVB7S820	82 (74~90)	50	65	135	5.0	400	2.5	0.1	300	√	√
TVB7S101	100 (90~110)	60	85	165	5.0	400	3.0	0.1	250	√	√
TVB7S121	120 (108~132)	75	100	200	5.0	400	4.0	0.1	210	√	√
TVB7S151	150 (135~165)	95	125	250	5.0	400	6.0	0.1	135	√	√
TVB7S181	180 (162~198)	115	150	300	5.0	400	6.5	0.1	110	√	√
TVB7S201	200 (180~220)	130	170	340	5.0	400	7.0	0.1	100	√	√
TVB7S221	220 (198~242)	140	180	360	5.0	400	7.5	0.1	95	√	√
TVB7S241	240 (216~264)	150	200	395	5.0	400	9.0	0.1	90	√	√
TVB7S271	270 (243~297)	175	225	455	5.0	400	9.5	0.1	75	√	√
TVB7S361	360 (324~396)	230	300	595	5.0	400	10.0	0.1	60	√	√
TVB7S391	390 (351~429)	250	320	650	5.0	400	11.0	0.1	55	√	√
TVB7S431	430 (387~473)	275	350	710	5.0	400	13.0	0.1	50	√	√
TVB7S471	470 (423~517)	300	385	775	5.0	400	15.0	0.1	45	√	√
TVB7S511	510 (459~561)	320	410	845	5.0	400	16.5	0.1	40	√	√
TVB7S561	560 (504~616)	350	450	930	5.0	400	18.0	0.1	35	√	√

Metal Oxide Varistor：TVB Series

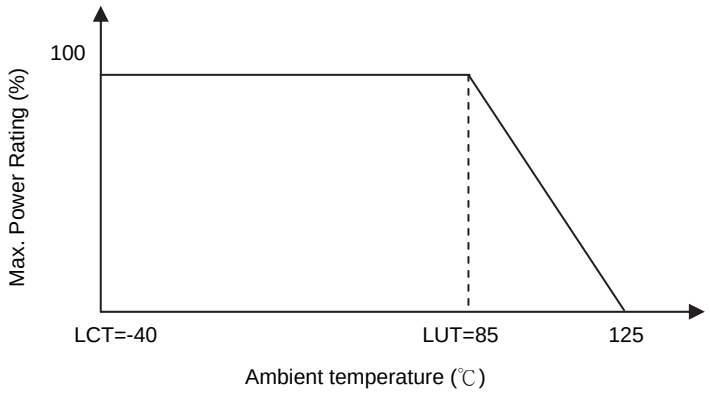
Plastic Encapsulated Type Varistor for Surge Protection

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Max. Energy (10/1000μs)	Rated Power	Reference Capacitance @1KHz	Safety Approvals	
										UL	cUL
	V_{1mA} (V)	$V_{AC(rms)}$ (V)	V_{DC} (V)	V_P (V)	I_P (A)	Imax (A)	Wmax (J)	P (W)	Cp (pF)	UL 1449 3rd.: E314979	
TVB9S180	18 (16~20)	11	14	36	2.5	300	1.1	0.02	2750	√	√
TVB9S220	22 (20~24)	14	18	43	2.5	300	1.3	0.02	2300	√	√
TVB9S270	27 (24~30)	17	22	53	2.5	300	1.6	0.02	1900	√	√
TVB9S330	33 (30~36)	20	26	65	2.5	300	2.0	0.02	1600	√	√
TVB9S390	39 (35~43)	25	31	77	2.5	300	2.4	0.02	1400	√	√
TVB9S470	47 (42~52)	30	38	93	2.5	300	2.8	0.02	1200	√	√
TVB9S560	56 (50~62)	35	45	110	2.5	300	3.4	0.02	1050	√	√
TVB9S680	68 (61~75)	40	56	135	2.5	300	4.1	0.02	900	√	√
TVB9S820	82 (74~90)	50	65	135	10	1200	6.5	0.25	530	√	√
TVB9S101	100 (90~110)	60	85	165	10	1200	7.0	0.25	480	√	√
TVB9S121	120 (108~132)	75	100	200	10	1200	9.0	0.25	430	√	√
TVB9S151	150 (135~165)	95	125	250	10	1200	11.0	0.25	260	√	√
TVB9S181	180 (162~198)	115	150	300	10	1200	13.0	0.25	220	√	√
TVB9S201	200 (180~220)	130	170	340	10	1200	15.0	0.25	200	√	√
TVB9S221	220 (198~242)	140	180	360	10	1200	18.0	0.25	180	√	√
TVB9S241	240 (216~264)	150	200	395	10	1200	18.5	0.25	170	√	√
TVB9S271	270 (243~297)	175	225	455	10	1200	21.0	0.25	150	√	√
TVB9S301	300 (270~330)	195	250	500	10	1200	21.5	0.25	140	√	√
TVB9S331	330 (297~363)	215	275	550	10	1200	22.0	0.25	120	√	√
TVB9S361	360 (324~396)	230	300	595	10	1200	23.0	0.25	115	√	√
TVB9S391	390 (351~429)	250	320	650	10	1200	25.0	0.25	105	√	√
TVB9S431	430 (387~473)	275	350	710	10	1200	29.0	0.25	95	√	√
TVB9S471	470 (423~517)	300	385	775	10	1200	30.0	0.25	90	√	√
TVB9S511	510 (459~561)	320	410	845	10	1200	33.0	0.25	85	√	√
TVB9S561	560 (504~616)	350	450	930	10	1200	33.0	0.25	80	√	√
TVB9S621	620 (558~682)	395	510	1020	10	1200	35.0	0.25	60	√	√
TVB9S681	680 (612~748)	420	560	1120	10	1200	35.0	0.25	55	√	√
TVB9S751	750 (675~825)	460	615	1235	10	1200	50.5	0.25	55	√	√

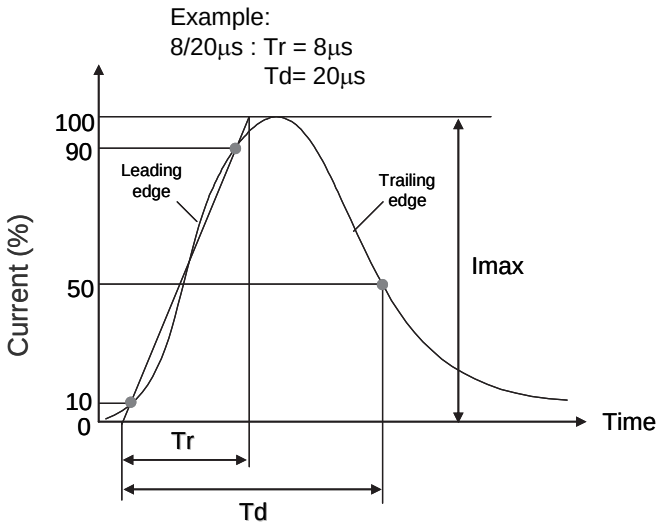
Metal Oxide Varistor：TVB Series

Plastic Encapsulated Type Varistor for Surge Protection

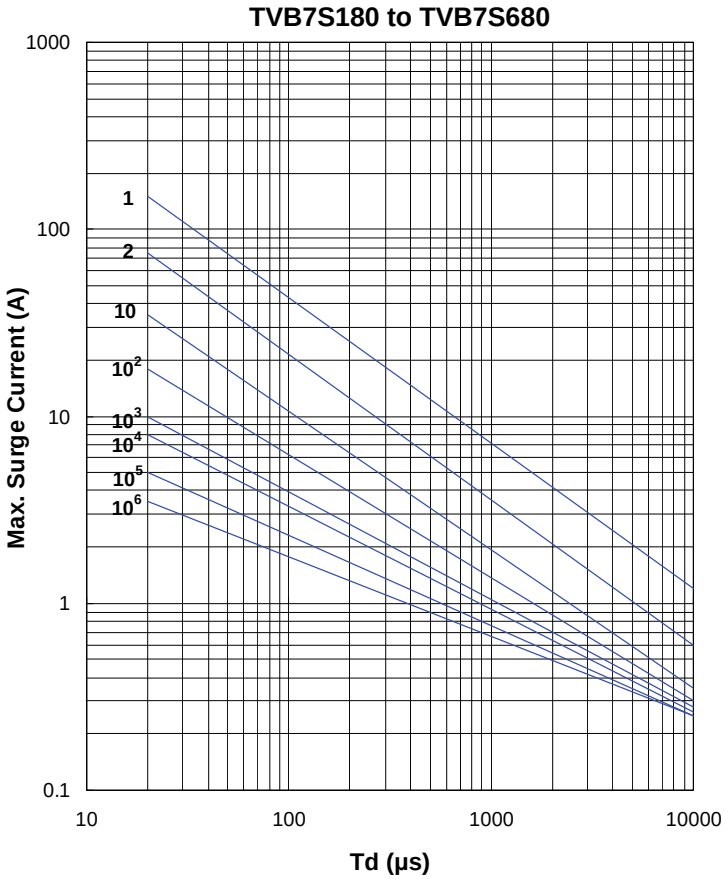
■ Power Derating Curve

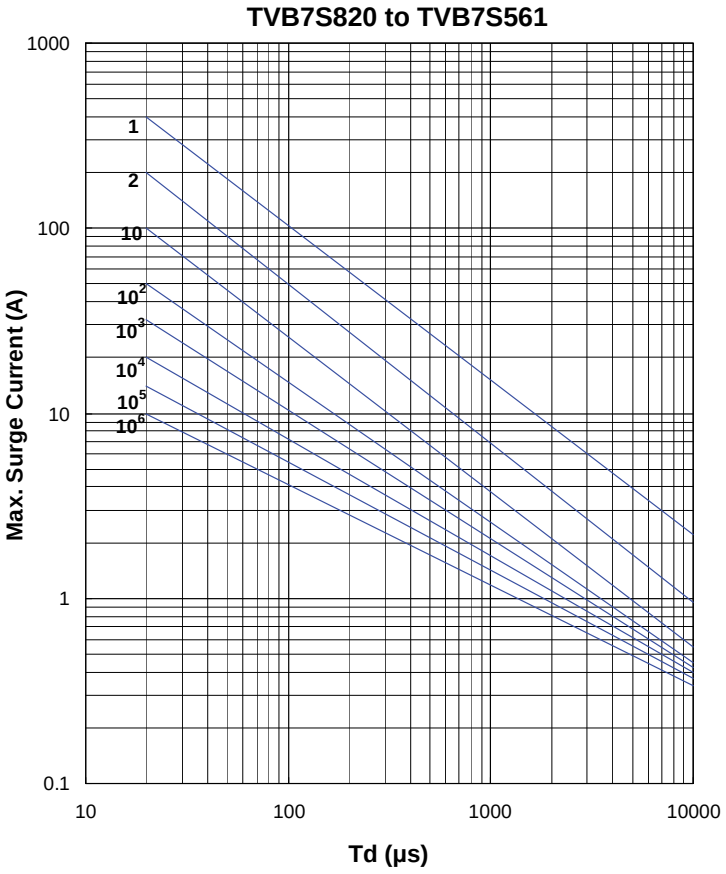


■ Surge Current Standard Waveform



■ Max. Surge Current Derating Curves

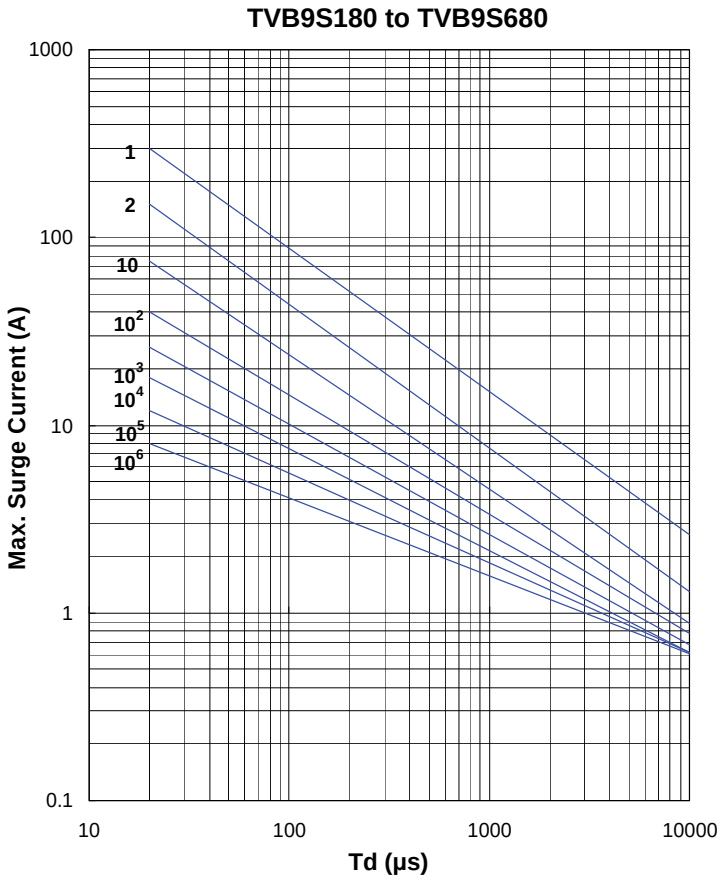


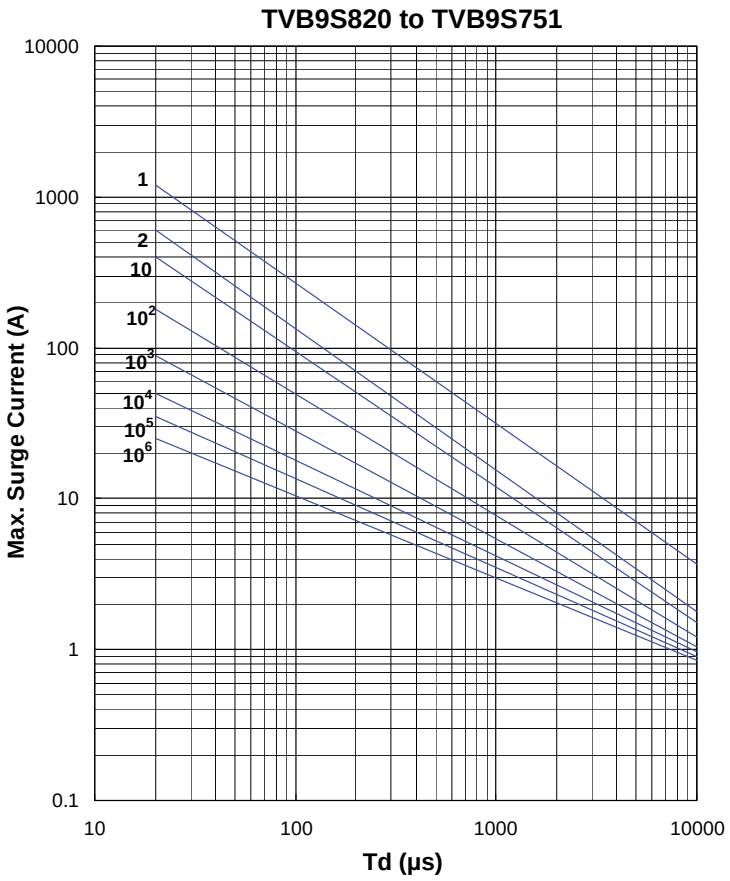


Metal Oxide Varistor：TVB Series

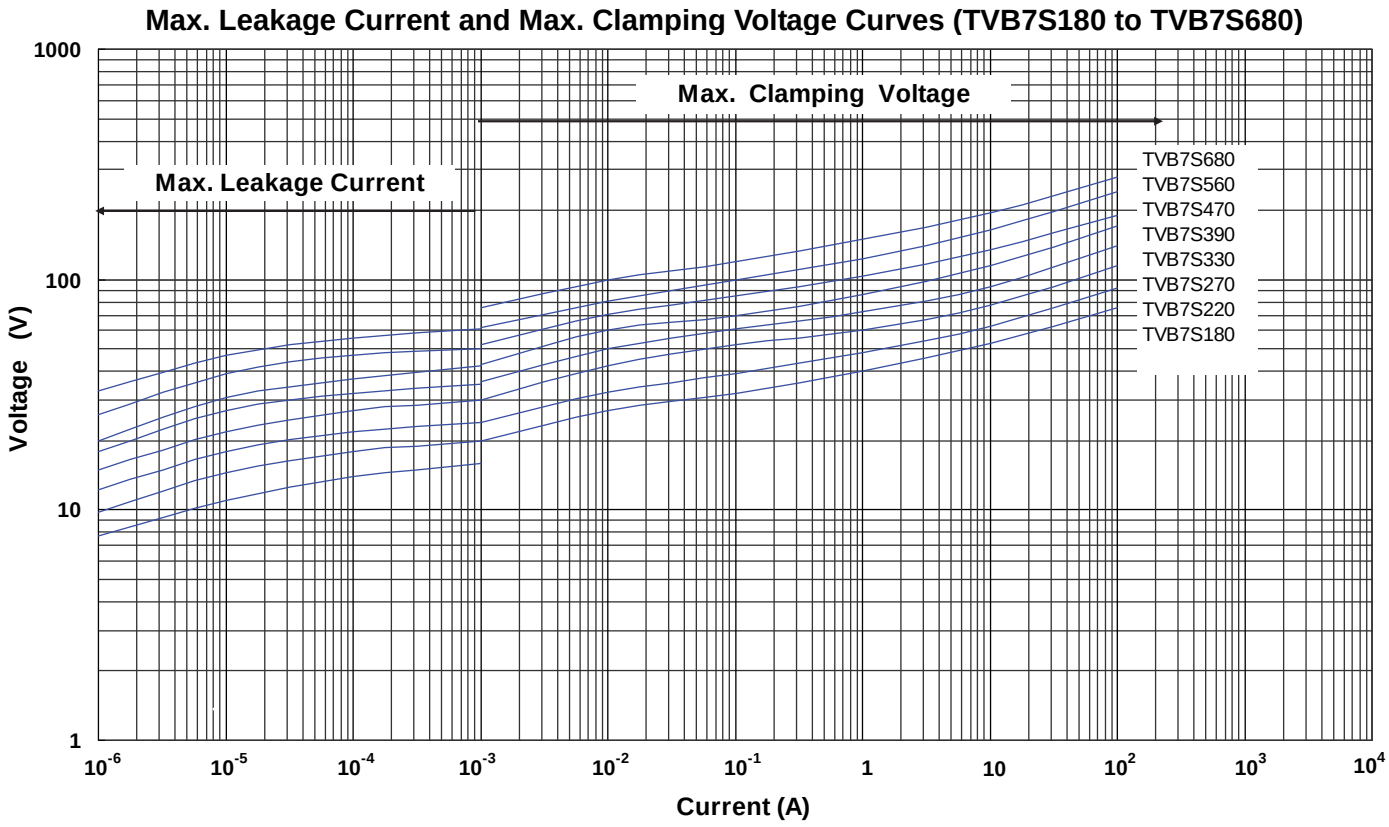
Plastic Encapsulated Type Varistor for Surge Protection

■ Max. Surge Current Derating Curves



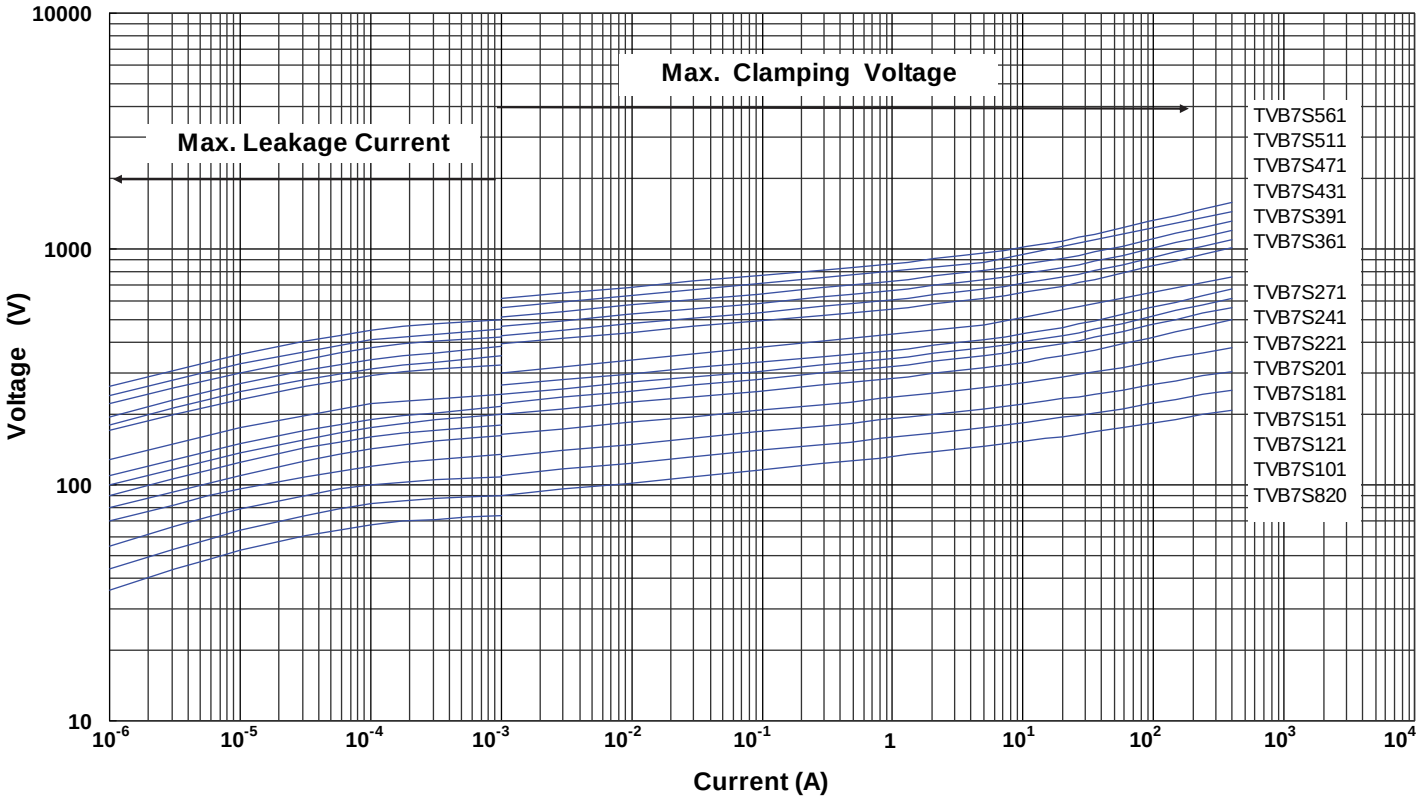


■ Max. Leakage Current and Max. Clamping Voltage Curves

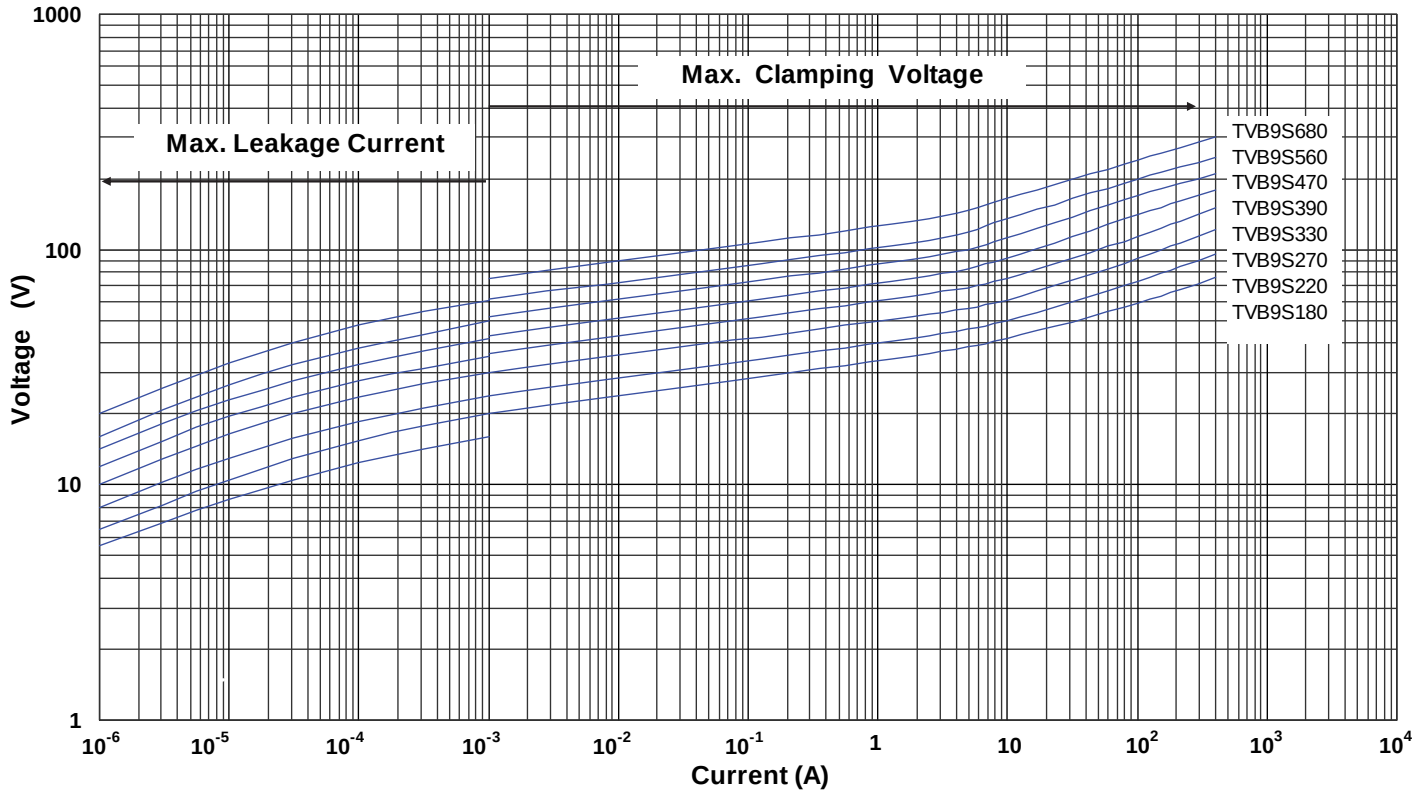


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVB7S820 to TVB7S561)

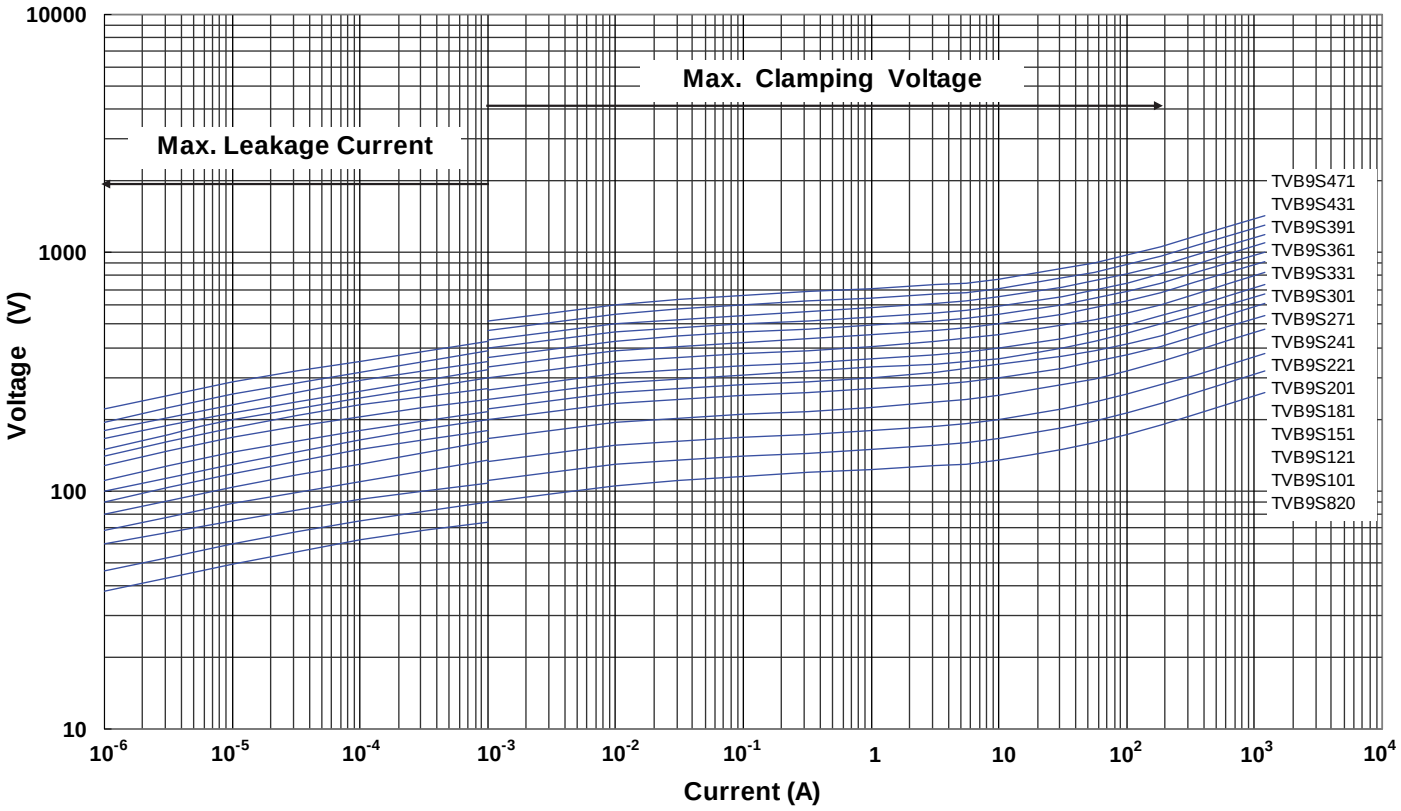


Max. Leakage Current and Max. Clamping Voltage Curves (TVB9S180 to TVB9S680)

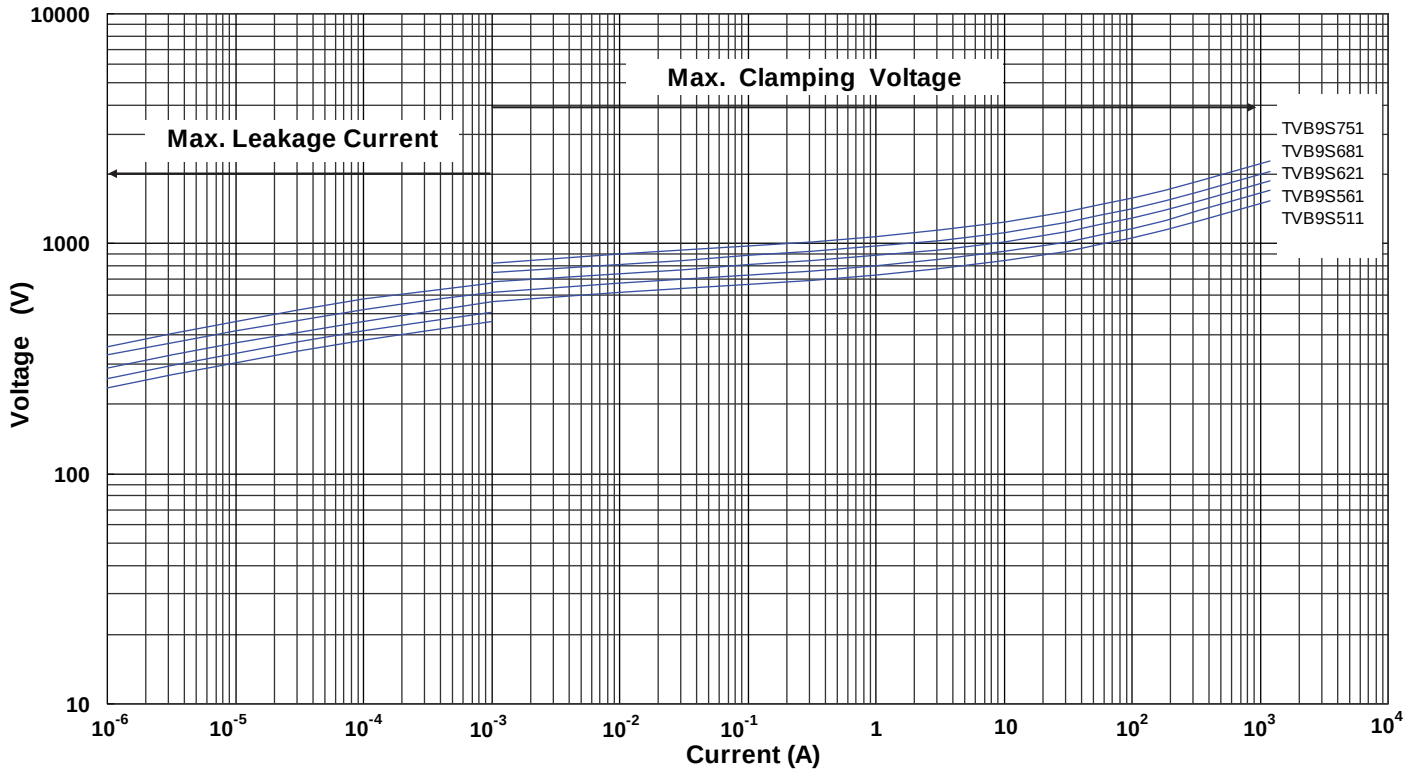


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVB9S820 to TVB9S471)

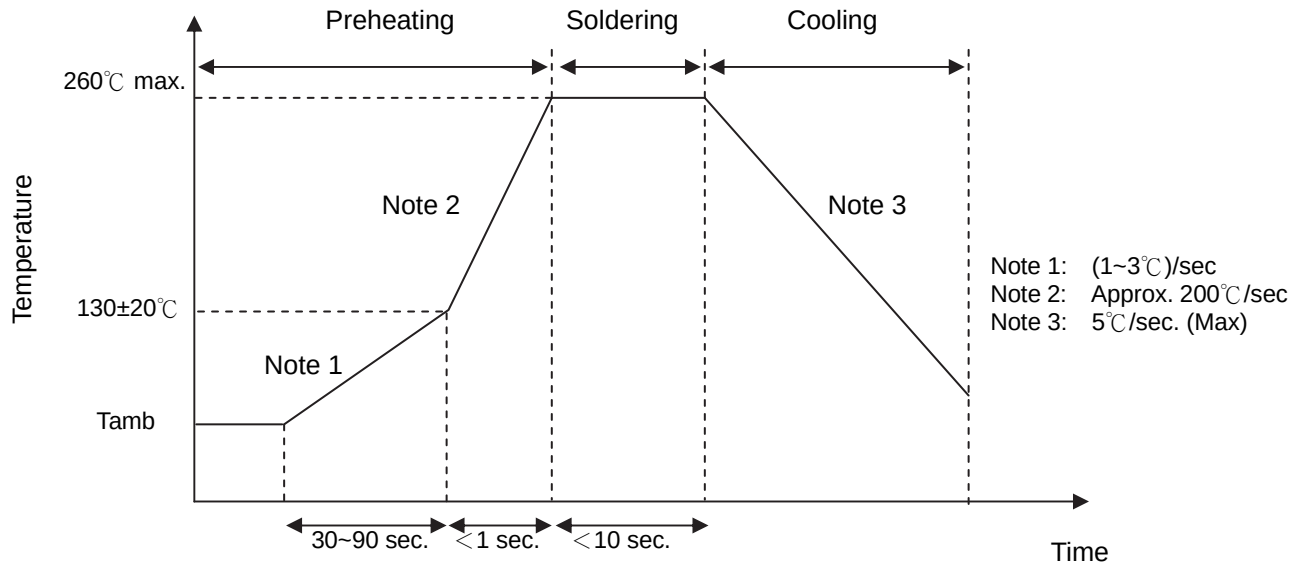


Max. Leakage Current and Max. Clamping Voltage Curves (TVB9S511 to TVB9S751)

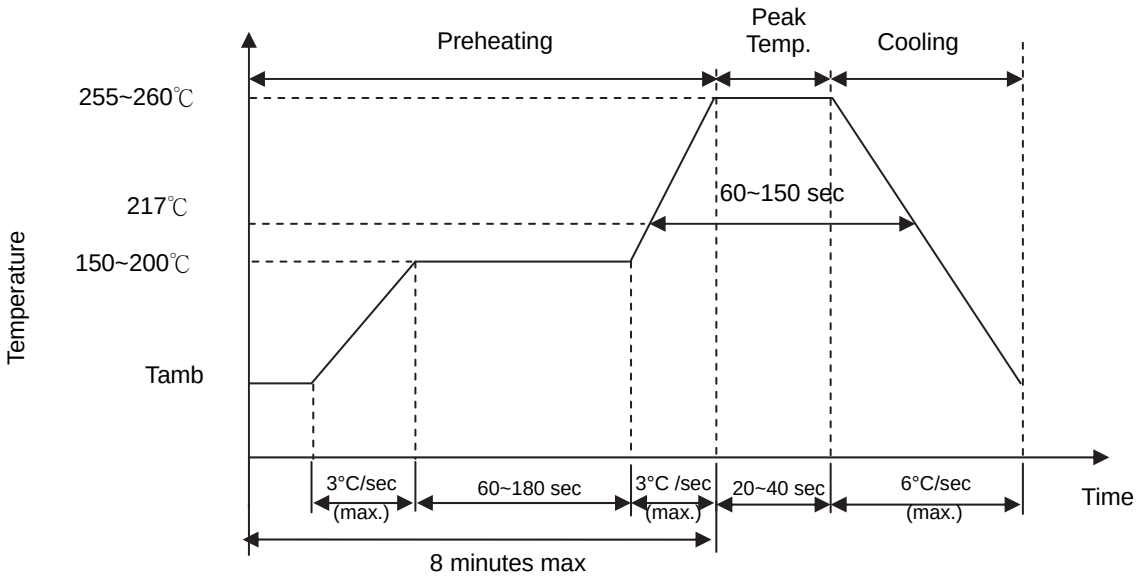


■ Soldering Recommendation

● Wave Soldering Profile



● IR-reflow Soldering Profile



● Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	350℃ (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ3 mm (max.)

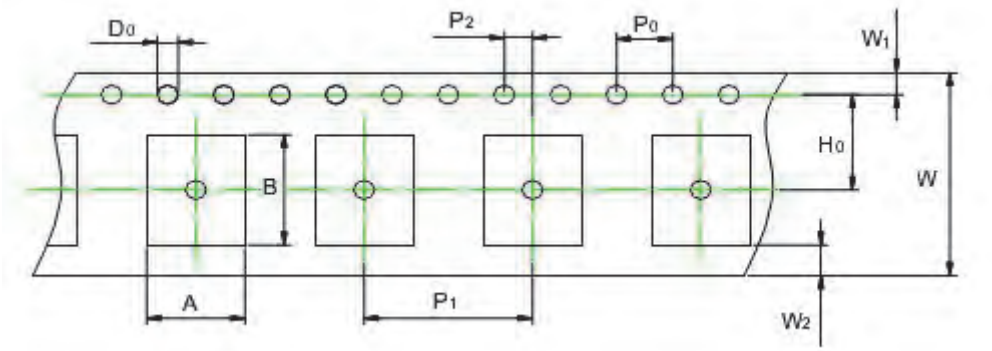
■ Reliability

<table>
<tr><th>Item</th><th>Standard</th><th>Test conditions / Methods</th><th>Specifications</th></tr>
<tr><td>Vibration</td><td>IEC 61051-1</td><td>Frequency range: 10~55Hz
Amplitude: 0.75mm or 98m/s^2
Direction: 3 mutually perpendicular directions, 2 hrs each.</td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 5\%$
No visible damage</td></tr>
<tr><td>Solderability</td><td>IEC 60068-2-20</td><td>245±3℃, 3±0.3 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±3℃,
5±1 sec for TVB7S Series
10±1 sec for TVB9S Series</td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 5\%$
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>$|\triangle V_{1mA}/V_{1mA}| \leqq 5\%$
No visible damage</td></tr>
<tr><td>Damp Heat, Steady State</td><td>IEC60068-2-78</td><td>a. 40±2℃, 90 ~ 95 % RH, 1344 hrs.
b. 40±2℃, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs</td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 5\%$
No visible damage
Insulation Resistance≧ 100MΩ</td></tr>
<tr><td>Rapid Change of Temperature</td><td>IEC 60068-2-14</td><td>The conditions shown below shall be repeated 5 cycles
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Period (minutes)</th></tr>
<tr><td>1</td><td>-40±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temperature</td><td>5±3</td></tr>
<tr><td>3</td><td>85±2</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temperature</td><td>5±3</td></tr>
</table></td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 5\%$
No visible damage</td></tr>
<tr><td>Endurance at Upper Category Temperature</td><td>IEC 61051-1</td><td>85±2℃, 1000±24 hrs at V_{DC} or V_{rms} (Max. Continuous Voltage)</td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 10\%$
No visible damage</td></tr>
<tr><td>8/20μs Surge Life</td><td>IEC 61051-1</td><td>8/20μs waveform, 10 surge currents, unipolar, interval 30 sec,
amplitude corresponding to max. surge current derating curves for 20μs.</td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 10\%$
No visible damage</td></tr>
<tr><td>10/1000μs Surge Life</td><td>IEC 61051-1</td><td>10/1000μs waveform, 10 surge currents, unipolar, interval 2 mins,
amplitude corresponding to max. surge current derating curves for 1000μs.</td><td>$|\triangle V_{1mA}/V_{1mA}| \leqq 10\%$
No visible damage</td></tr>
<tr><td>Voltage Proof</td><td>IEC 61051-1</td><td>Metal balls method, 2500 V_{ac} 1 min</td><td>No visible damage</td></tr>
<tr><td>Varistor VoltageTemp. Coefficient</td><td>Specification Standard</td><td>$\frac{V_{1mA@85℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{60}\times 100\%(\%/°C)$, $\frac{V_{1mA@-40℃}-V_{1mA@25℃}}{V_{1mA@25℃}}\times\frac{1}{65}\times 100\%(\%/°C)$</td><td>-0.05≦TC≦0.05 (%/℃)</td></tr>
</table>

■ Packaging

● Taping Specification

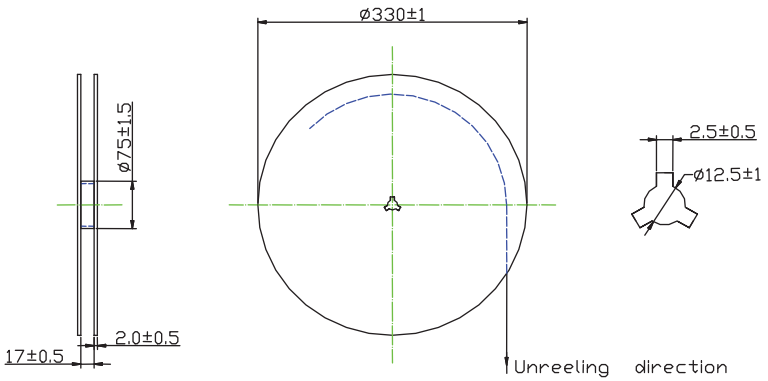
16mm plastic embossed



(Unit: mm)

Item		A*B	P_0	P_1	P_2	H_0	W	W_1	W_2	D_0
Size	3225	7.0*8.7	4.0	12.0	2.0	7.5	16	1.75	0.75	1.5
	4032	8.6*10.6								
Tolerance		+/- 0.2	+/- 0.1	+/- 0.1	+/- 0.05	+/- 0.05	+/- 0.3	+/- 0.1	Min.	+0.1/-0

● Quantity



(Unit: mm)

Size	Quantity (pcs/reel)
3225	1,000
4032	1,000

■ Warehouse 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

Metal Oxide Varistor：TVM-B Series

SMD Type for Surge Suppressor

Features

1. RoHS & Halogen Free (HF) compliant
2. EIA size: 0402 ~ 2220
3. Operating voltage: 5.5Vdc ~ 85Vdc
4. High surge suppress capability
5. Bidirectional and symmetrical V/I characteristics
6. Multilayer ceramic construction technology
7. Variable capacitance
8. Operating temperature range: -40℃ ~ +85℃
   Storage temperature range: -40℃ ~ +125℃

Recommended Applications

1. Power system
2. Motherboard/notebook computer
3. Scanner
4. Handheld devices
5. Digital video
6. Set-top box

Part Number Code

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

Product Type	
TVM	THINKING SMD Varistor TVM Series

Series	
B	B series

Varistor Voltage (V_{1mA})	
12R	12.5V
180	$18x10^0$V=18V
330	$33x10^0$V=33V

Tolerance of V_{1mA}	
K	±10%
L	±15%
M	±20%

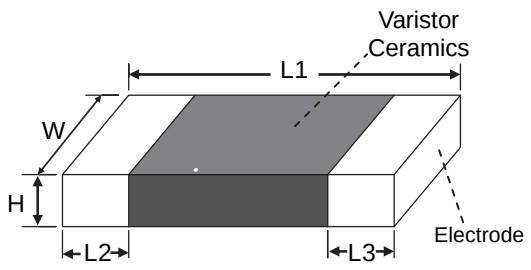
Packaging	
R	Reel
B	Bulk

Optional Suffix	
Y	RoHS & HF Compliant

Size (EIA)	
0	0402
1	0603
2	0805
3	1206
4	1210
5	1812
6	2220

Typical Capacitance (@1KHz)	
150	15×10^0=15pF
231	23×10^1=230pF
152	15×10^2=1500pF

Structure and Dimensions



(Unit: mm)

Series	Size (EIA)	L1	W	Hmax.	L2 and L3
TVM0	0402	1.00±0.15	0.50±0.10	0.60	0.20±0.10
TVM1	0603	1.60±0.15	0.80±0.15	0.95	0.35±0.15
TVM2	0805	2.00±0.20	1.25±0.20	1.00	0.40±0.20
TVM3	1206	3.20±0.30	1.60±0.20	1.50	0.50±0.20
TVM4	1210	3.20±0.30	2.50±0.25	1.50	0.50±0.20
TVM5	1812	4.50±0.40	3.20±0.30	1.50	0.60±0.30
TVM6	2220	5.70±0.40	5.00±0.30	2.00	0.60±0.30

Metal Oxide Varistor：TVM-B Series

SMD Type for Surge Suppressor

■ Electrical Characteristics

Part No.	Varistor Voltage (@ 1mA DC)		Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Max. Energy (10/1000μs)	Rate Power	Typical Capacitance @1KHz
	V_{1mA}	$\triangle V_{1mA}$	$V_{AC(rms)}$	V_{DC}	V_p	I_p	Imax	Wmax	P	Cp
	(V)	(±%)	(V)	(V)	(V)	(A)	(A)	(J)	(W)	(pF)
TVM0B080M231	8	20	4	5.5	19	1	10	0.05	0.003	230
TVM1B080M951	8	20	4	5.5	19	1	30	0.1	0.003	950
TVM2B080M152	8	20	4	5.5	19	1	60	0.1	0.005	1500
TVM3B080M482	8	20	4	5.5	17	1	150	0.3	0.008	4800
TVM4B080M822	8	20	4	5.5	17	2.5	250	0.4	0.01	8200
TVM5B080M183	8	20	4	5.5	17	5	500	0.8	0.015	18000
TVM6B080M293	8	20	4	5.5	17	10	1000	1.4	0.02	29000
TVM0B110M161	11	20	6	8	27	1	10	0.05	0.003	160
TVM1B110M601	11	20	6	8	27	1	30	0.1	0.003	600
TVM2B110M142	11	20	6	8	27	1	60	0.2	0.005	1400
TVM3B110M392	11	20	6	8	25	1	200	0.4	0.008	3900
TVM4B110M752	11	20	6	8	25	2.5	300	0.7	0.01	7500
TVM5B110M153	11	20	6	8	25	5	500	1	0.015	15000
TVM6B110M253	11	20	6	8	25	10	1200	3.6	0.02	25000
TVM0B12RM141	12.5	20	7	9	30	1	10	0.05	0.003	140
TVM1B12RM571	12.5	20	7	9	30	1	30	0.1	0.003	570
TVM2B12RM112	12.5	20	7	9	29	1	60	0.2	0.005	1100
TVM0B150L121	15	15	8	11	33	1	10	0.05	0.003	120
TVM1B150L521	15	15	8	11	33	1	30	0.1	0.003	520
TVM2B150L951	15	15	8	11	33	1	60	0.2	0.005	950
TVM3B150L252	15	15	8	11	30	1	200	0.5	0.008	2500
TVM4B150L482	15	15	8	11	30	2.5	400	1	0.01	4800
TVM5B150L103	15	15	8	11	30	5	800	1.8	0.015	10000
TVM6B150L183	15	15	8	11	30	10	1200	4.2	0.02	18000
TVM0B180K800	18	10	11	14	35	1	10	0.05	0.003	80
TVM1B180K421	18	10	11	14	35	1	30	0.2	0.003	420
TVM2B180K671	18	10	11	14	35	1	60	0.2	0.005	670
TVM3B180K152	18	10	11	14	33	1	200	0.5	0.008	1500
TVM4B180K292	18	10	11	14	33	2.5	400	1.2	0.01	2900
TVM5B180K552	18	10	11	14	33	5	800	1.9	0.015	5500
TVM6B180K123	18	10	11	14	33	10	1200	5.4	0.02	12000
TVM0B220K600	22	10	14	18	44	1	10	0.05	0.003	60
TVM1B220K301	22	10	14	18	40	1	30	0.2	0.003	300
TVM2B220K431	22	10	14	18	40	1	60	0.3	0.005	430
TVM3B220K122	22	10	14	18	42	1	200	0.5	0.008	1200
TVM4B220K242	22	10	14	18	38	2.5	400	1.5	0.01	2400
TVM5B220K502	22	10	14	18	38	5	800	2.3	0.015	5000
TVM6B220K103	22	10	14	18	38	10	1200	5.8	0.02	10000

Metal Oxide Varistor：TVM-B Series

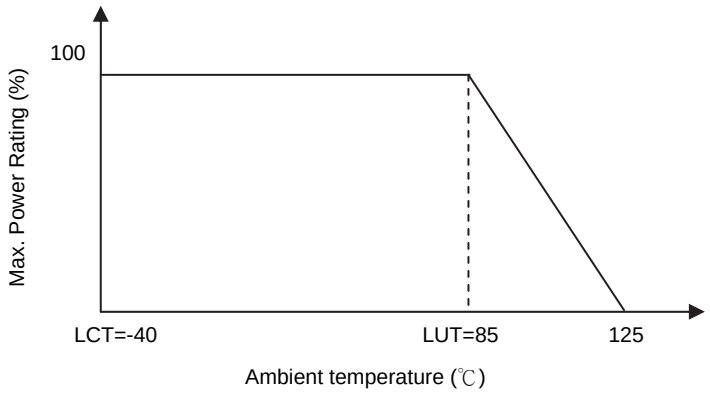
SMD Type for Surge Suppressor

Part No.	Varistor Voltage (@ 1mA DC)		Max. Continuous Voltage		Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Max. Energy (10/1000μs)	Rate Power	Typical Capacitance @1KHz
	V_{1mA}	$\triangle V_{1mA}$	$V_{AC\ (rms)}$	V_{DC}	V_p	I_p	Imax	Wmax	P	Cp
	(V)	(±%)	(V)	(V)	(V)	(A)	(A)	(J)	(W)	(pF)
TVM0B270K500	27	10	17	22	55	1	10	0.05	0.003	50
TVM1B270K181	27	10	17	22	46	1	30	0.2	0.003	180
TVM2B270K331	27	10	17	22	46	1	60	0.3	0.005	330
TVM3B270K102	27	10	17	22	48	1	200	0.6	0.008	1000
TVM4B270K202	27	10	17	22	44	2.5	400	1.7	0.01	2000
TVM5B270K402	27	10	17	22	44	5	800	2.7	0.015	4000
TVM6B270K772	27	10	17	22	44	10	1200	7.2	0.02	7700
TVM0B330K400	33	10	20	26	63	1	10	0.05	0.003	40
TVM1B330K151	33	10	20	26	56	1	30	0.3	0.003	150
TVM2B330K301	33	10	20	26	56	1	60	0.3	0.005	300
TVM3B330K801	33	10	20	26	54	1	200	0.7	0.008	800
TVM4B330K132	33	10	20	26	54	2.5	400	1.9	0.01	1300
TVM5B330K322	33	10	20	26	54	5	800	3	0.015	3200
TVM6B330K582	33	10	20	26	54	10	1200	7.8	0.02	5800
TVM1B390K101	39	10	25	31	67	1	30	0.3	0.003	100
TVM2B390K181	39	10	25	31	67	1	60	0.3	0.005	180
TVM3B390K651	39	10	25	31	65	1	200	1	0.008	650
TVM4B390K102	39	10	25	31	65	2.5	300	1.7	0.01	1000
TVM5B390K252	39	10	25	31	65	5	800	3.7	0.015	2500
TVM6B390K412	39	10	25	31	65	10	1200	9.6	0.02	4100
TVM2B470K151	47	10	30	38	77	1	60	0.3	0.005	150
TVM3B470K381	47	10	30	38	77	1	200	1.1	0.008	380
TVM4B470K901	47	10	30	38	77	2.5	300	2	0.01	900
TVM5B470K202	47	10	30	38	77	5	800	4.2	0.015	2000
TVM6B470K302	47	10	30	38	77	10	1200	12	0.02	3000
TVM3B560K301	56	10	35	45	90	1	100	0.4	0.008	300
TVM4B560K601	56	10	35	45	90	2.5	250	2	0.01	600
TVM5B560K122	56	10	35	45	90	5	500	4	0.015	1200
TVM6B560K202	56	10	35	45	90	10	1000	7.7	0.02	2000
TVM3B680K251	68	10	40	56	110	1	100	0.5	0.008	250
TVM4B680K451	68	10	40	56	110	2.5	250	2.3	0.01	450
TVM5B680K102	68	10	40	56	110	5	500	4.8	0.015	1000
TVM6B680K152	68	10	40	56	110	10	1000	9	0.02	1500
TVM3B820K181	82	10	50	65	135	1	100	0.6	0.008	180
TVM4B820K301	82	10	50	65	135	2.5	200	1.6	0.01	300
TVM5B820K601	82	10	50	65	135	5	400	4.5	0.015	600
TVM6B820K102	82	10	50	65	135	10	800	5.6	0.02	1000
TVM3B101K151	100	10	60	85	146	1	100	0.7	0.008	150
TVM4B101K161	100	10	60	85	165	2.5	200	2	0.01	160
TVM5B101K301	100	10	60	85	165	5	400	5.8	0.015	300
TVM6B101K601	100	10	60	85	165	10	800	6.8	0.02	600

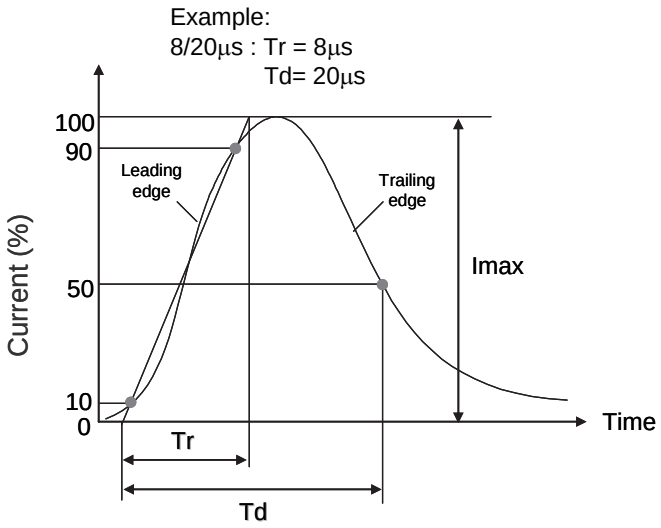
Metal Oxide Varistor：TVM-B Series

SMD Type for Surge Suppressor

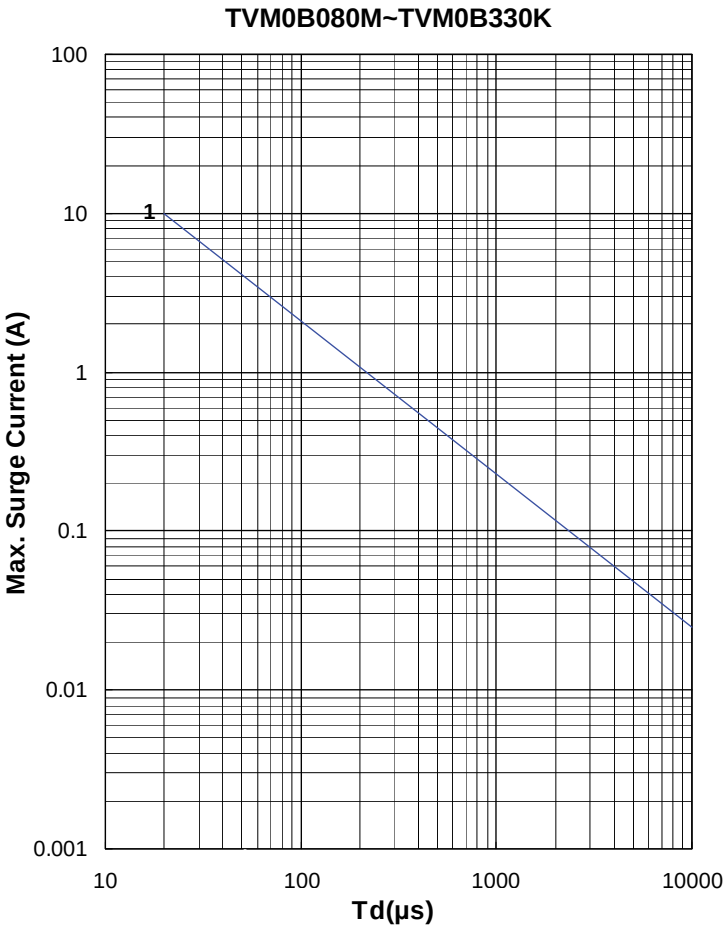
■ Power Derating Curve

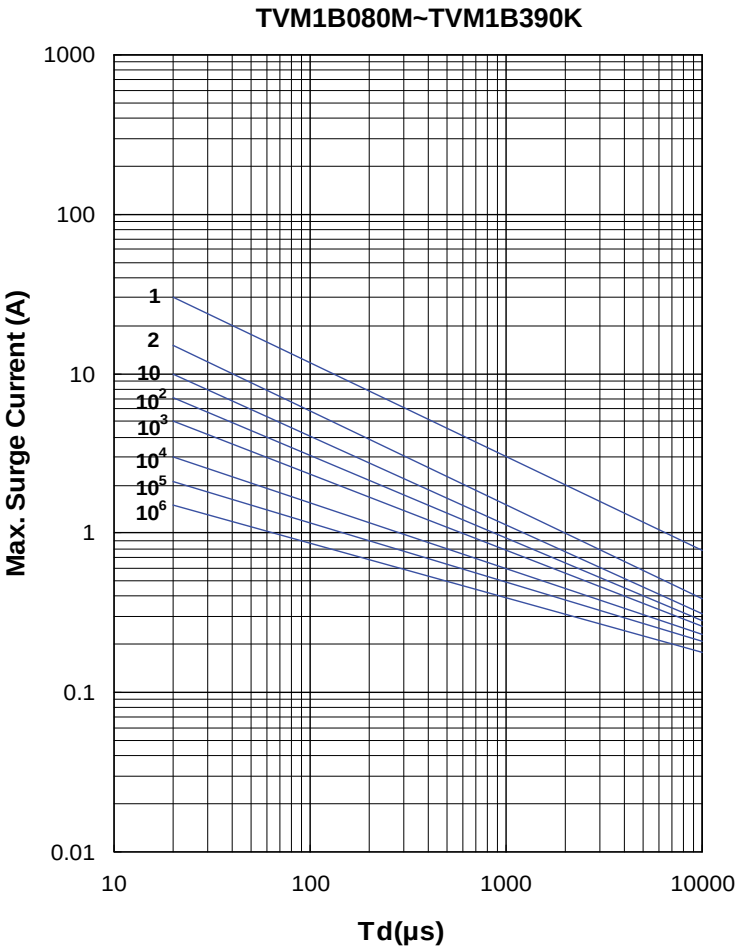


■ Surge Current Standard Waveform



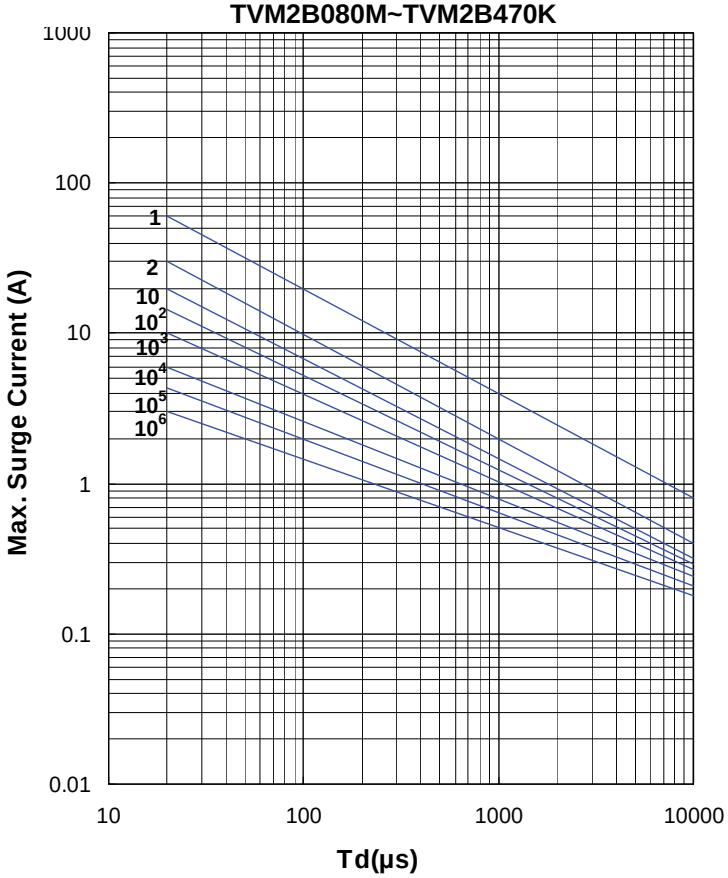
■ Max. Surge Current Derating Curves



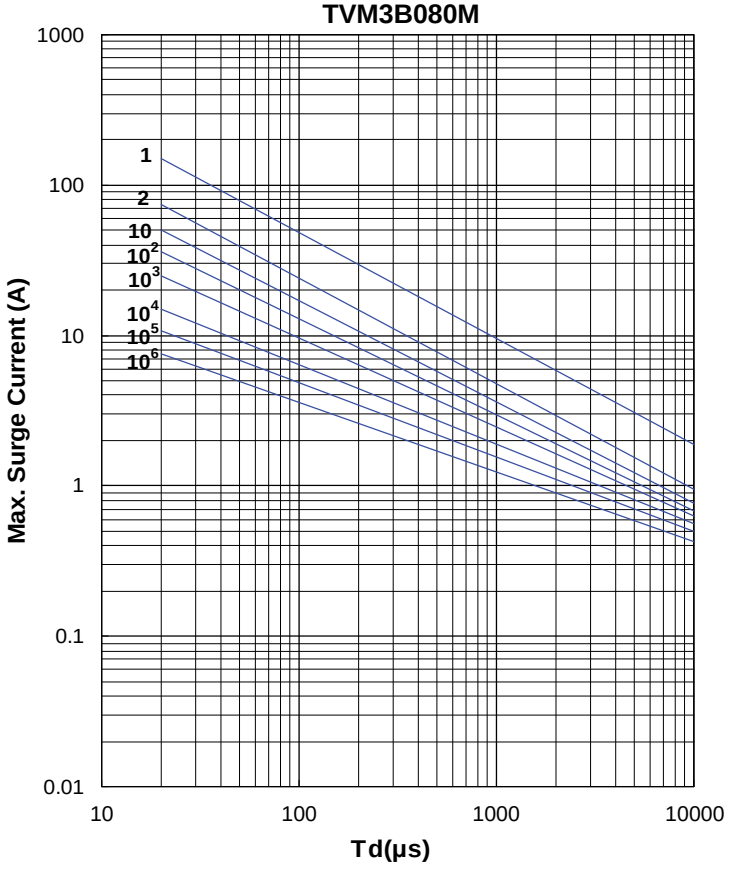


■ Max. Surge Current Derating Curves

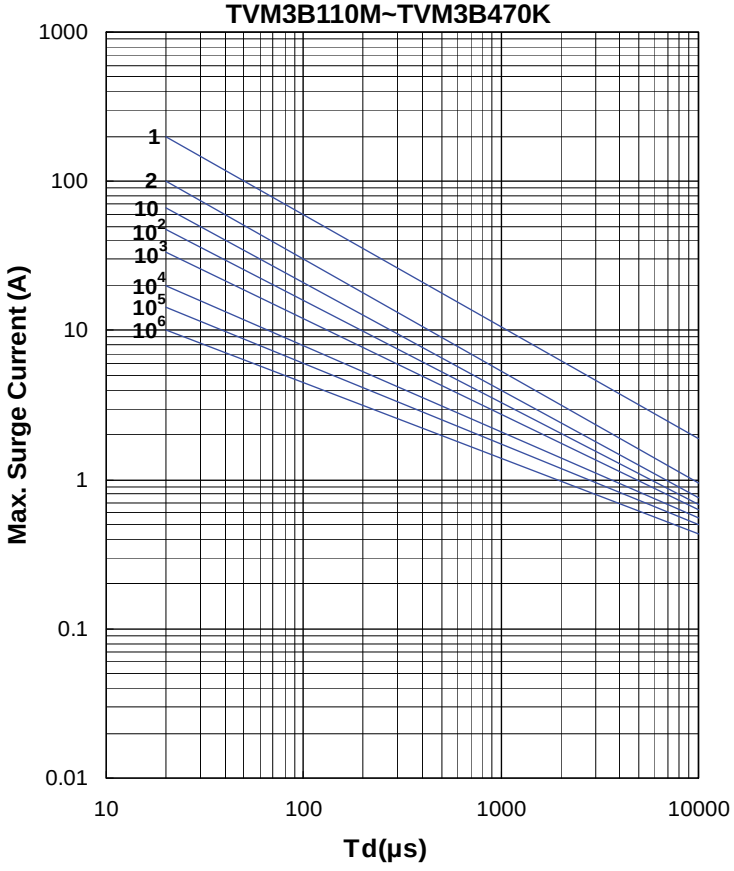
TVM2B080M~TVM2B470K



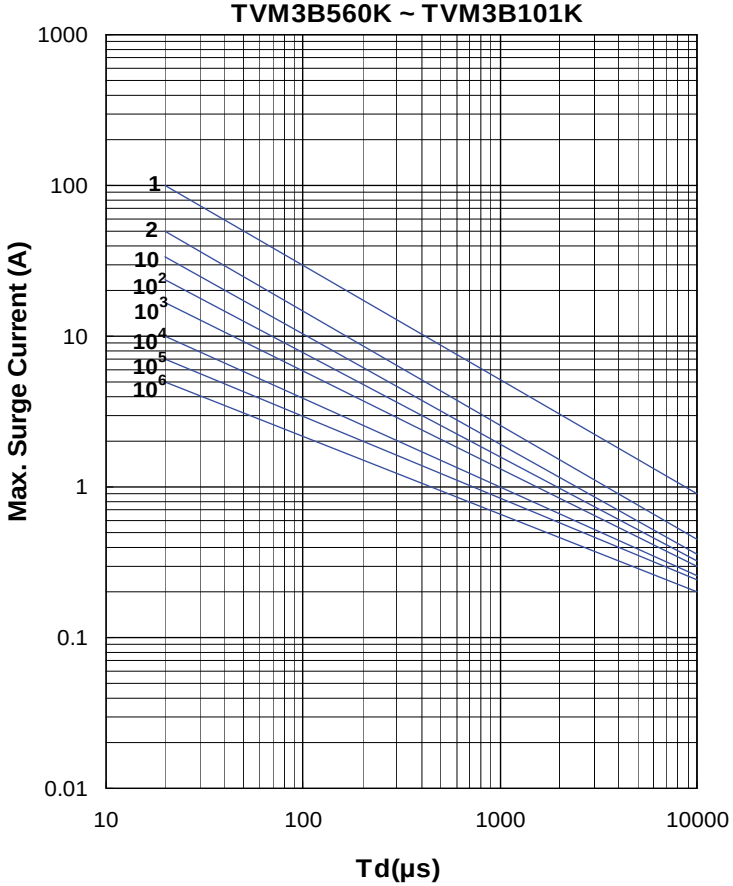
TVM3B080M



TVM3B110M~TVM3B470K

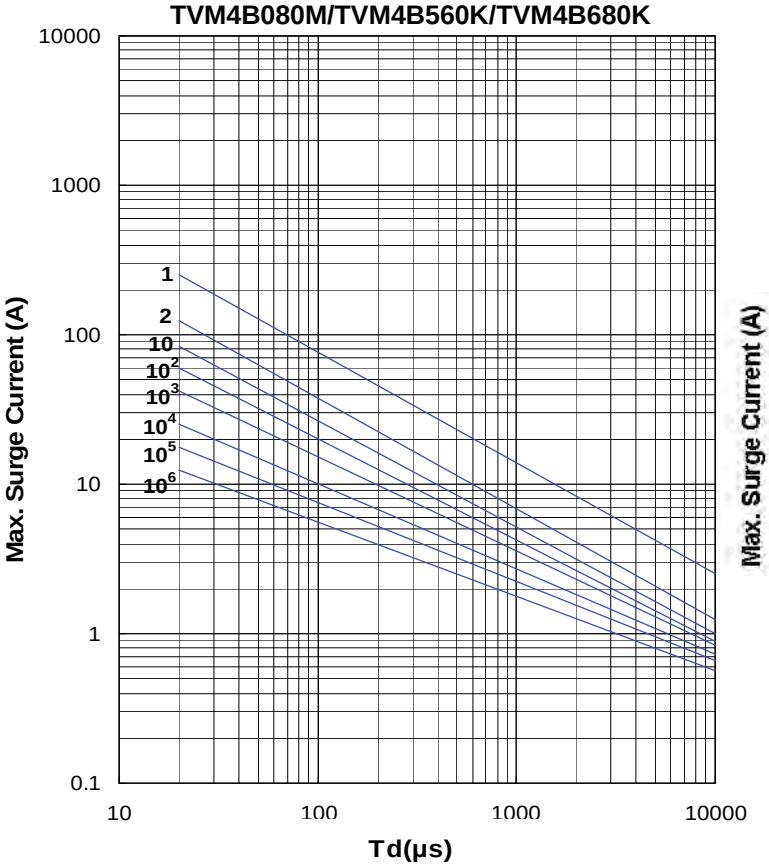


TVM3B560K ~ TVM3B101K

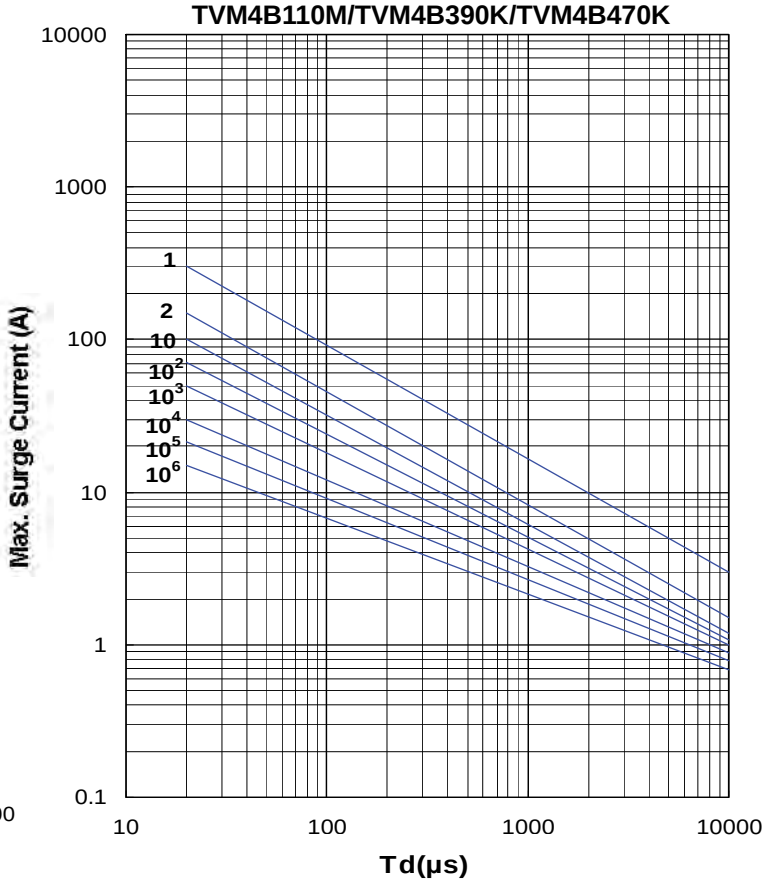


■ Max. Surge Current Derating Curves

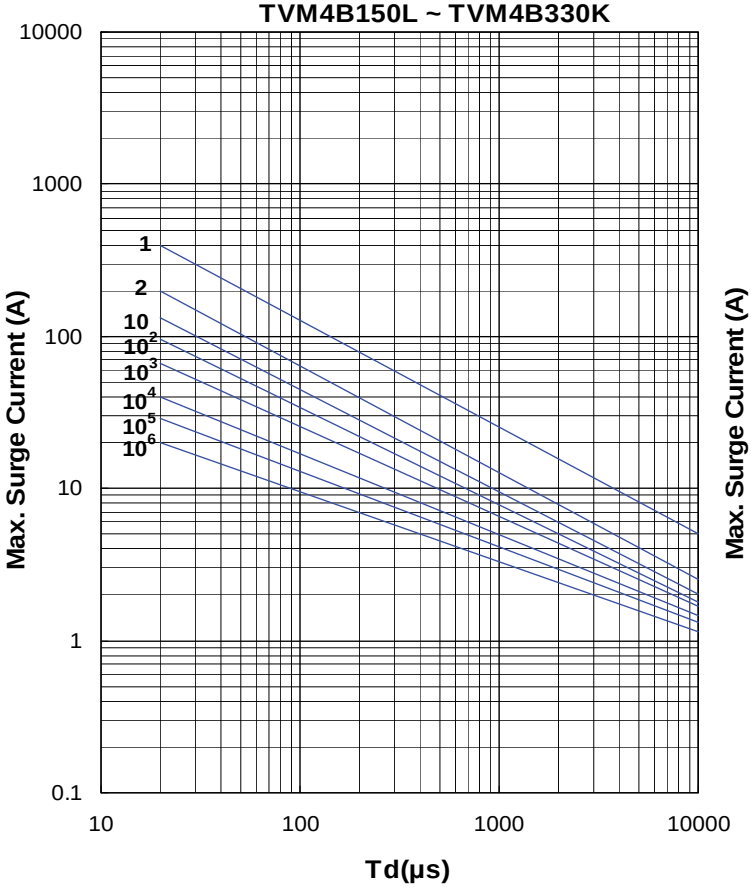
TVM4B080M/TVM4B560K/TVM4B680K



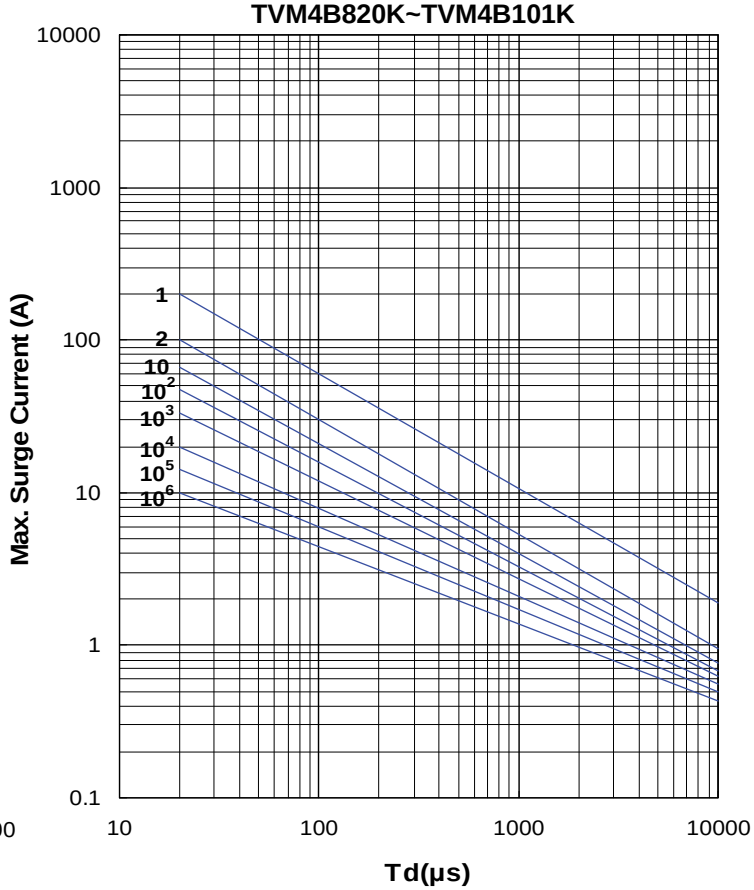
TVM4B110M/TVM4B390K/TVM4B470K



TVM4B150L ~ TVM4B330K

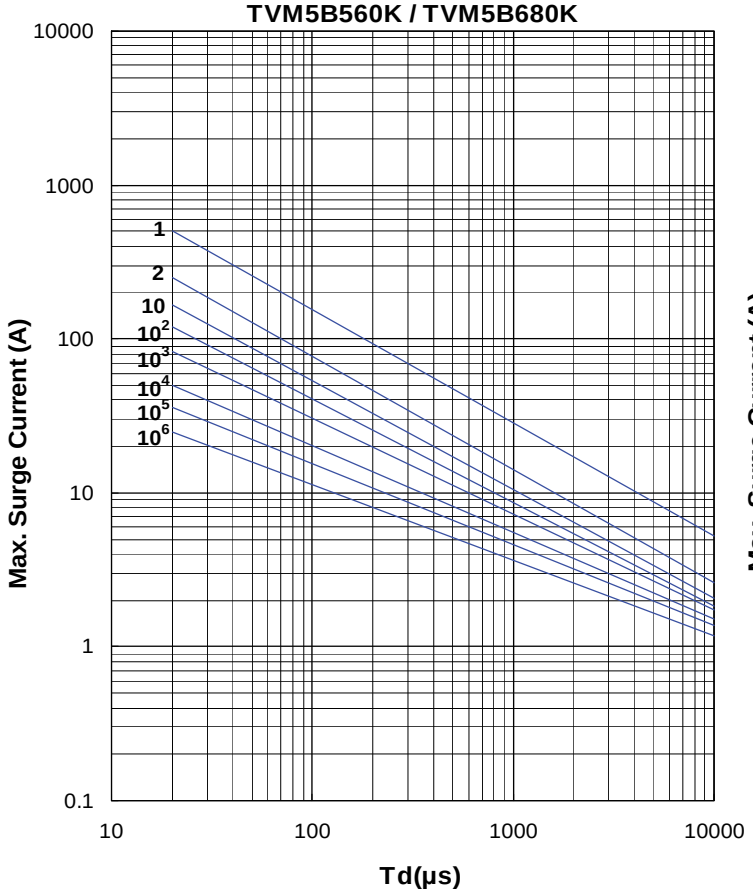


TVM4B820K~TVM4B101K

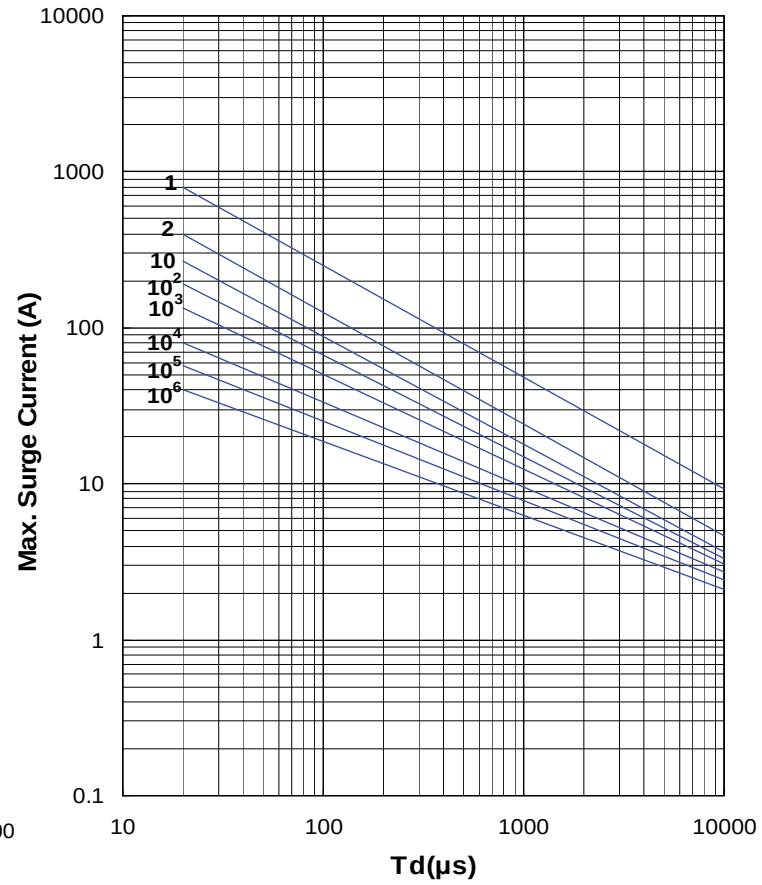


■ Max. Surge Current Derating Curves

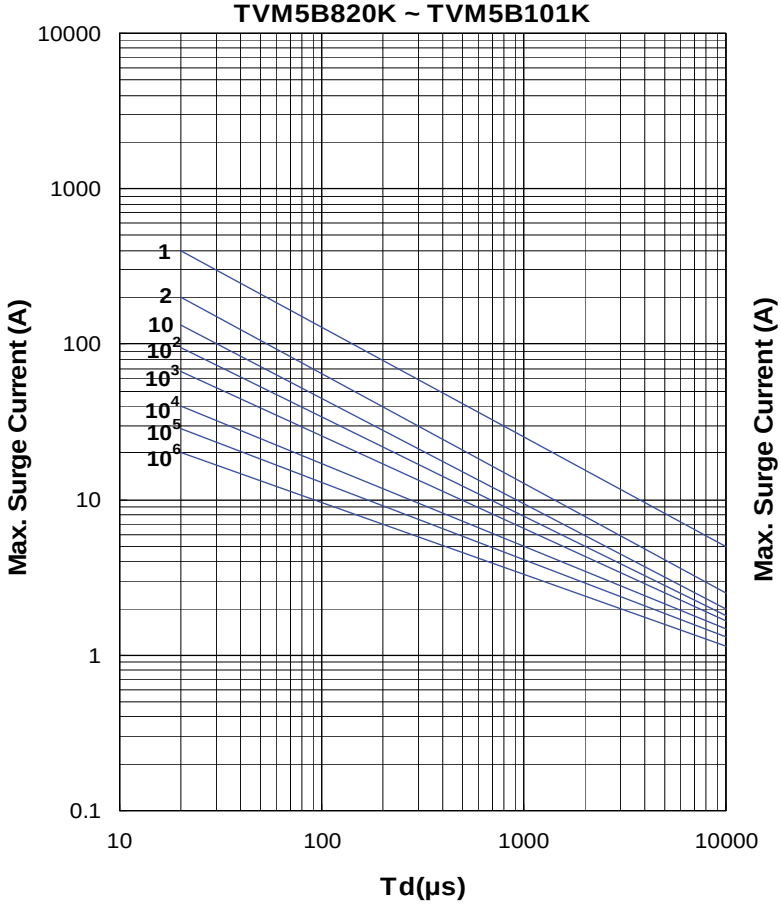
TVM5B080M / TVM5B110M/
TVM5B560K / TVM5B680K



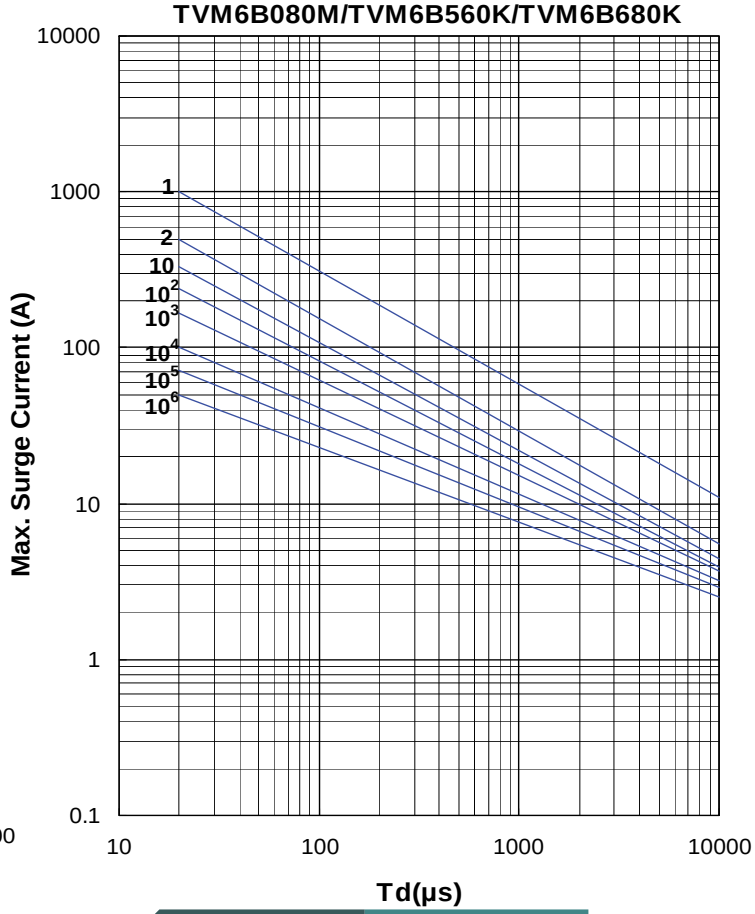
TVM5B150L~TVM5B470K



TVM5B820K ~ TVM5B101K



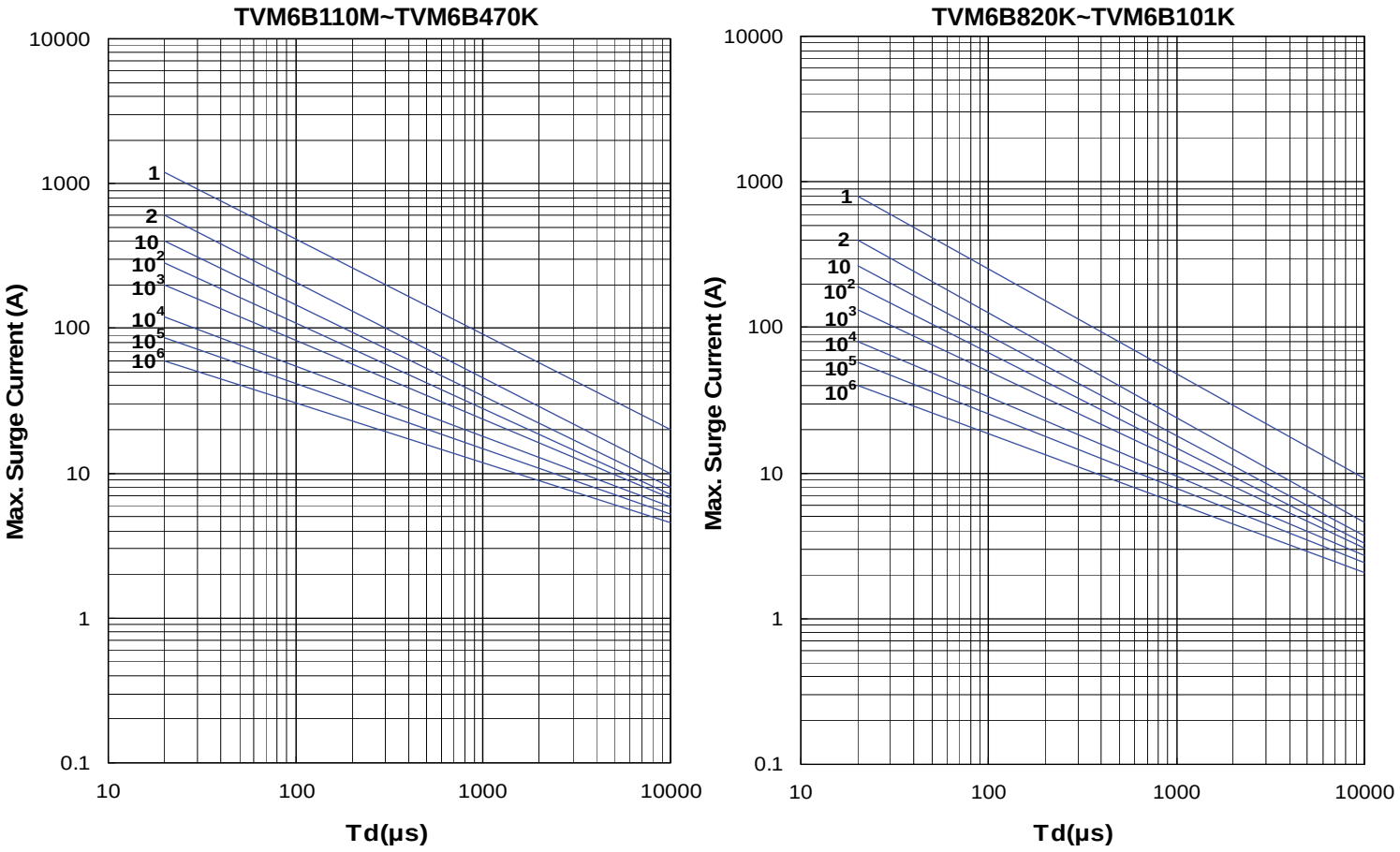
TVM6B080M/TVM6B560K/TVM6B680K



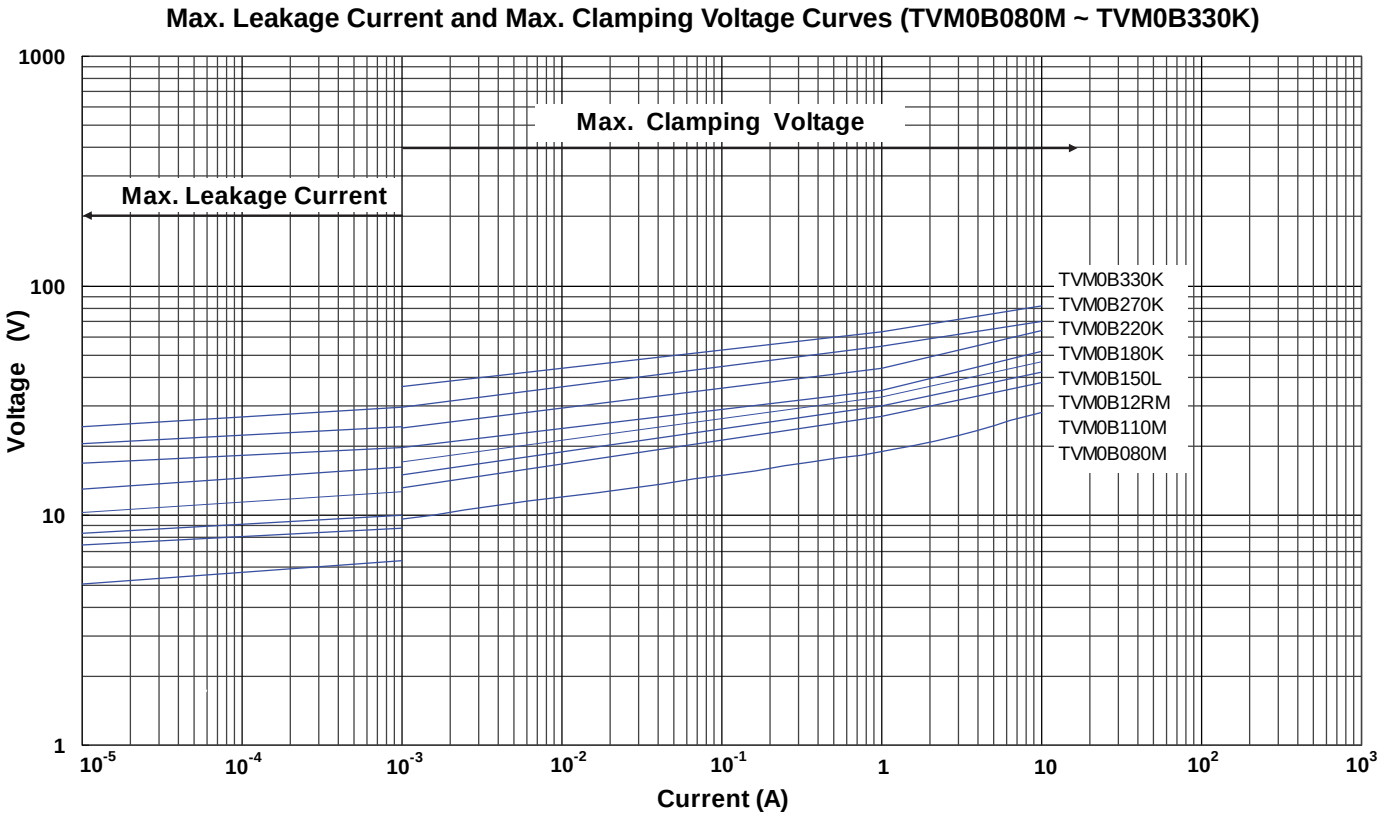
Metal Oxide Varistor：TVM-B Series

SMD Type for Surge Suppressor

■ Max. Surge Current Derating Curves

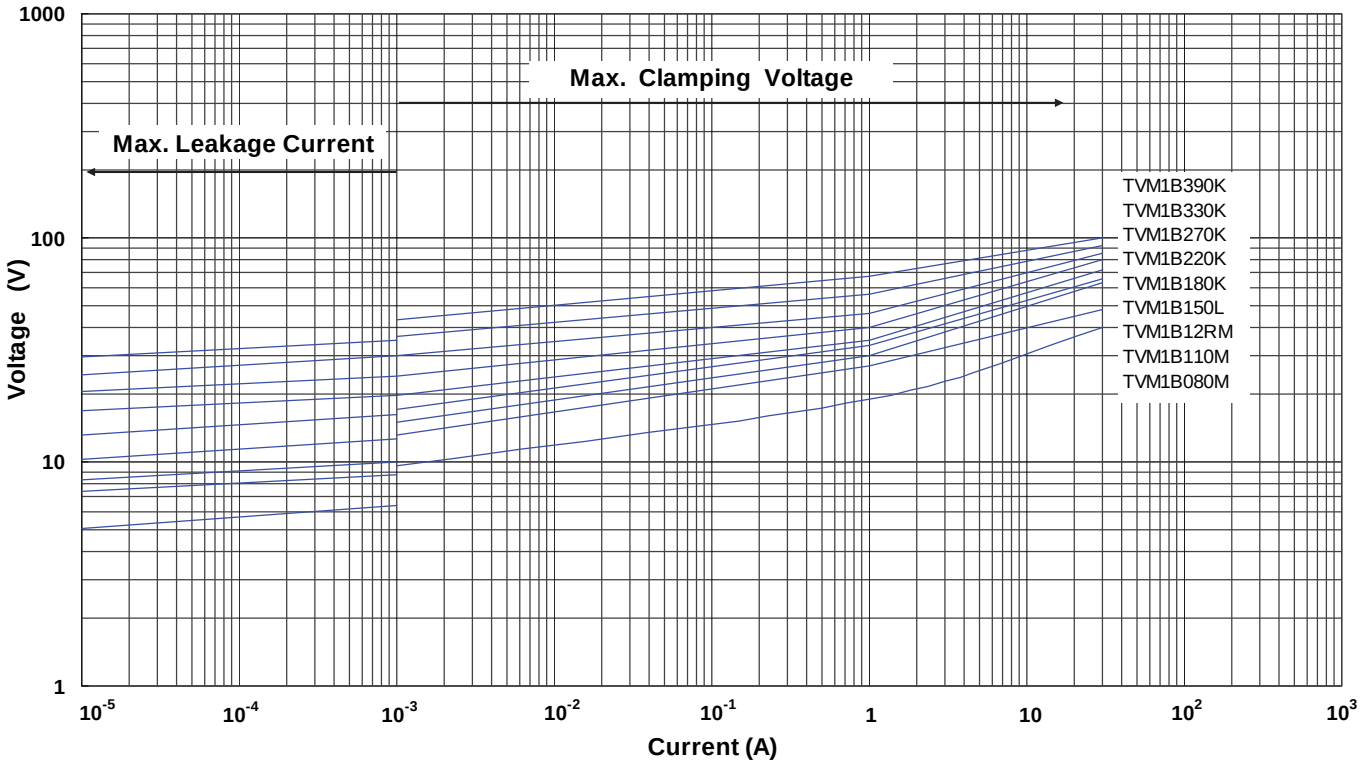


■ Max. Leakage Current and Max. Clamping Voltage Curves

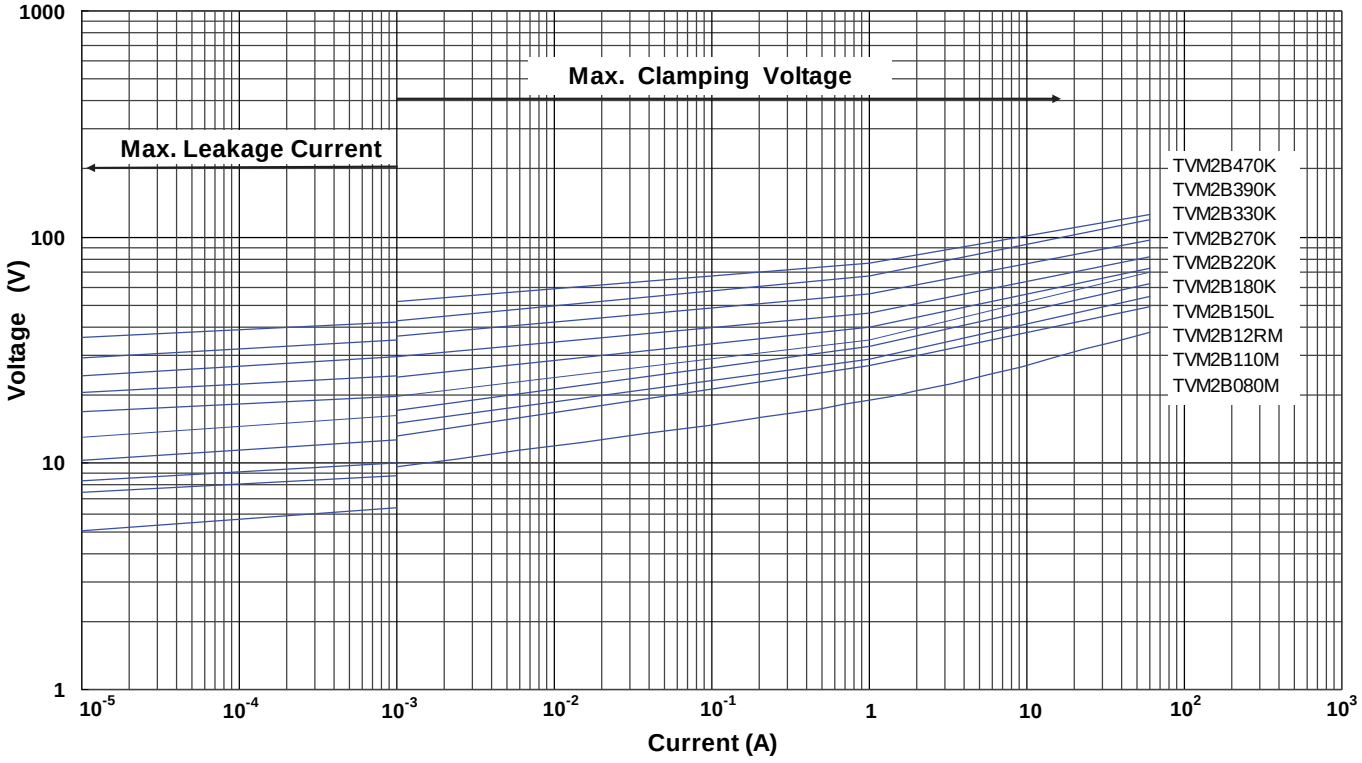


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVM1B080M ~ TVM1B390K)

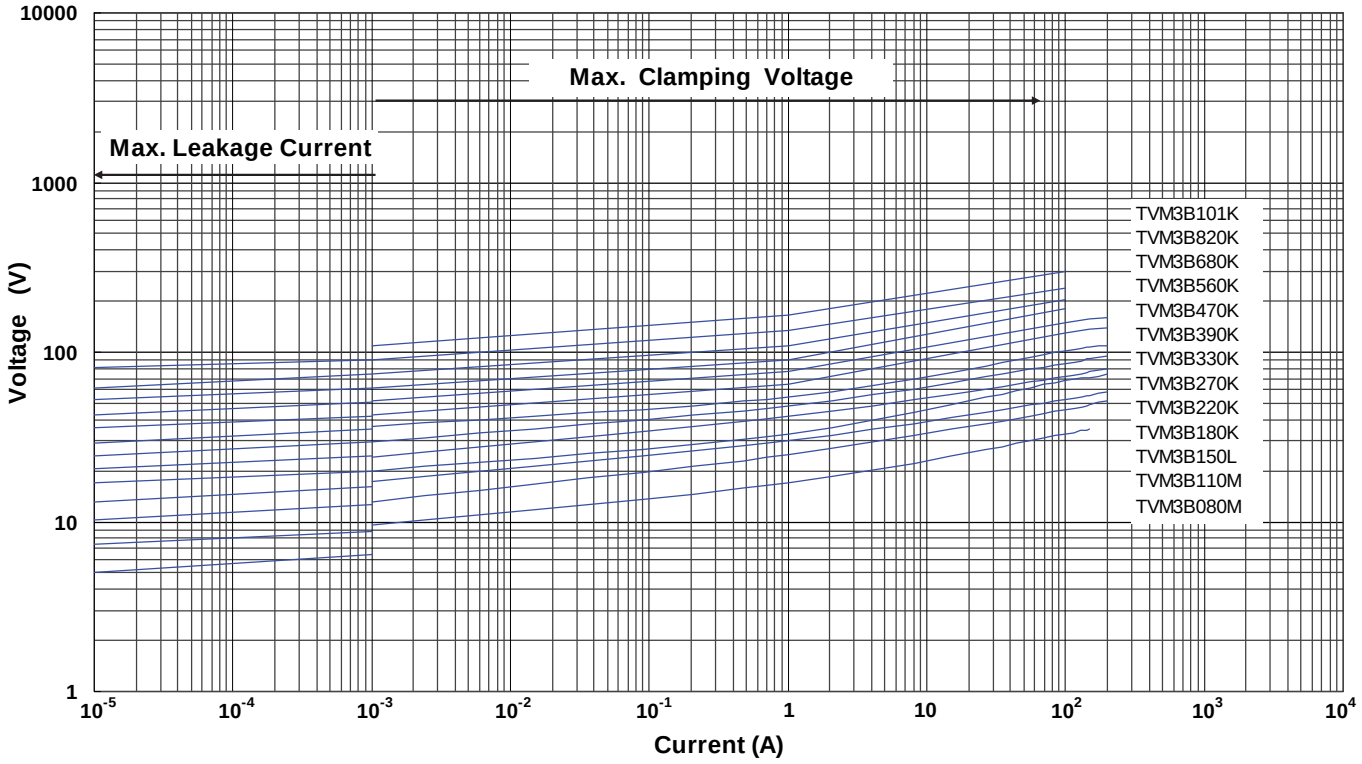


Max. Leakage Current and Max. Clamping Voltage Curves (TVM2B080M ~ TVM2B470K)

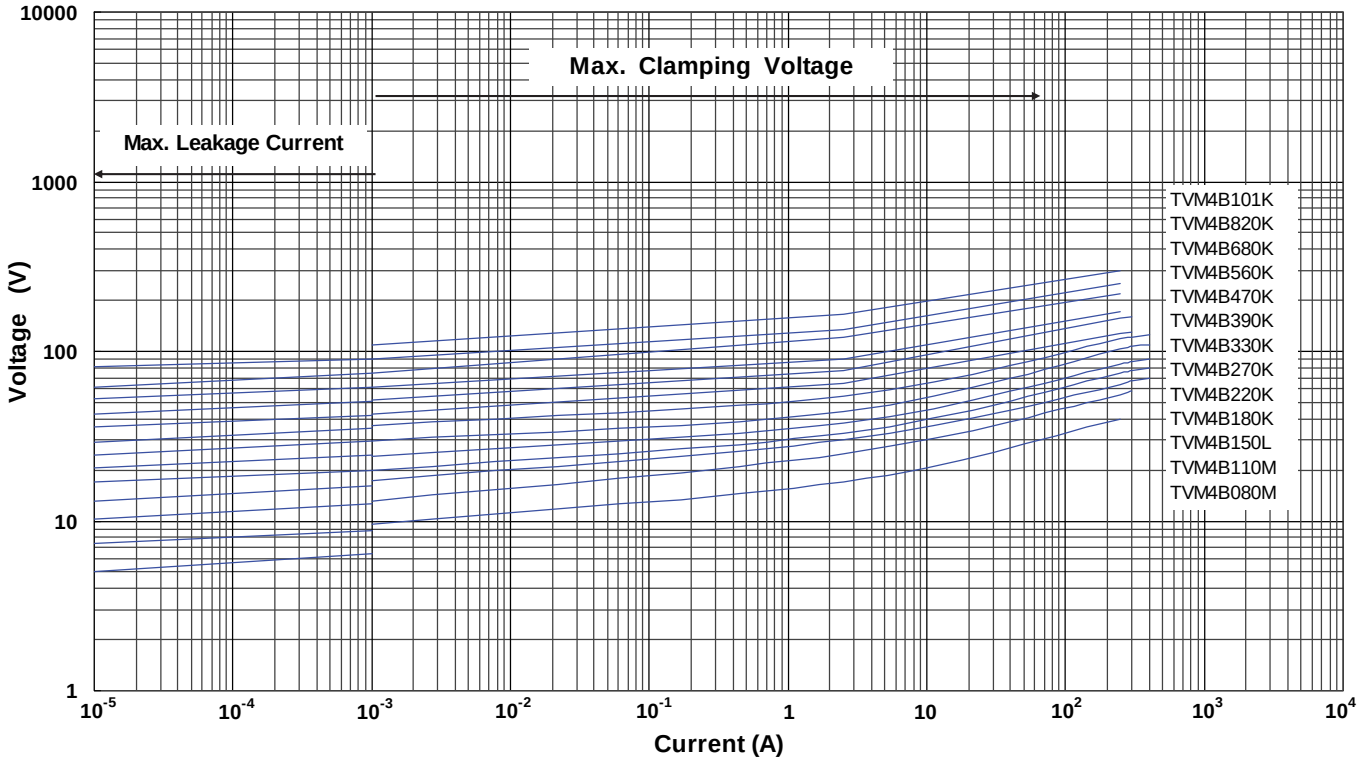


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVM3B080M ~ TVM3B101K)

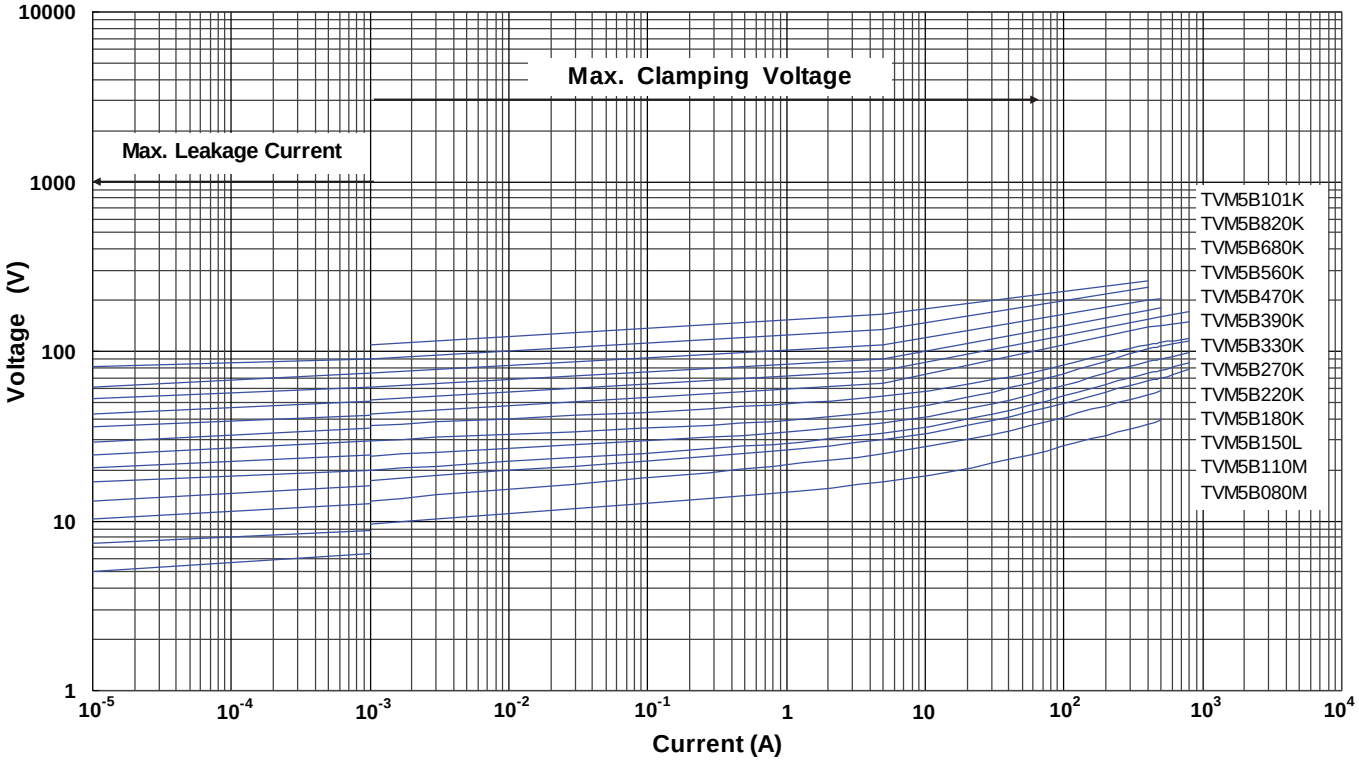


Max. Leakage Current and Max. Clamping Voltage Curves (TVM4B080M ~ TVM4B101K)

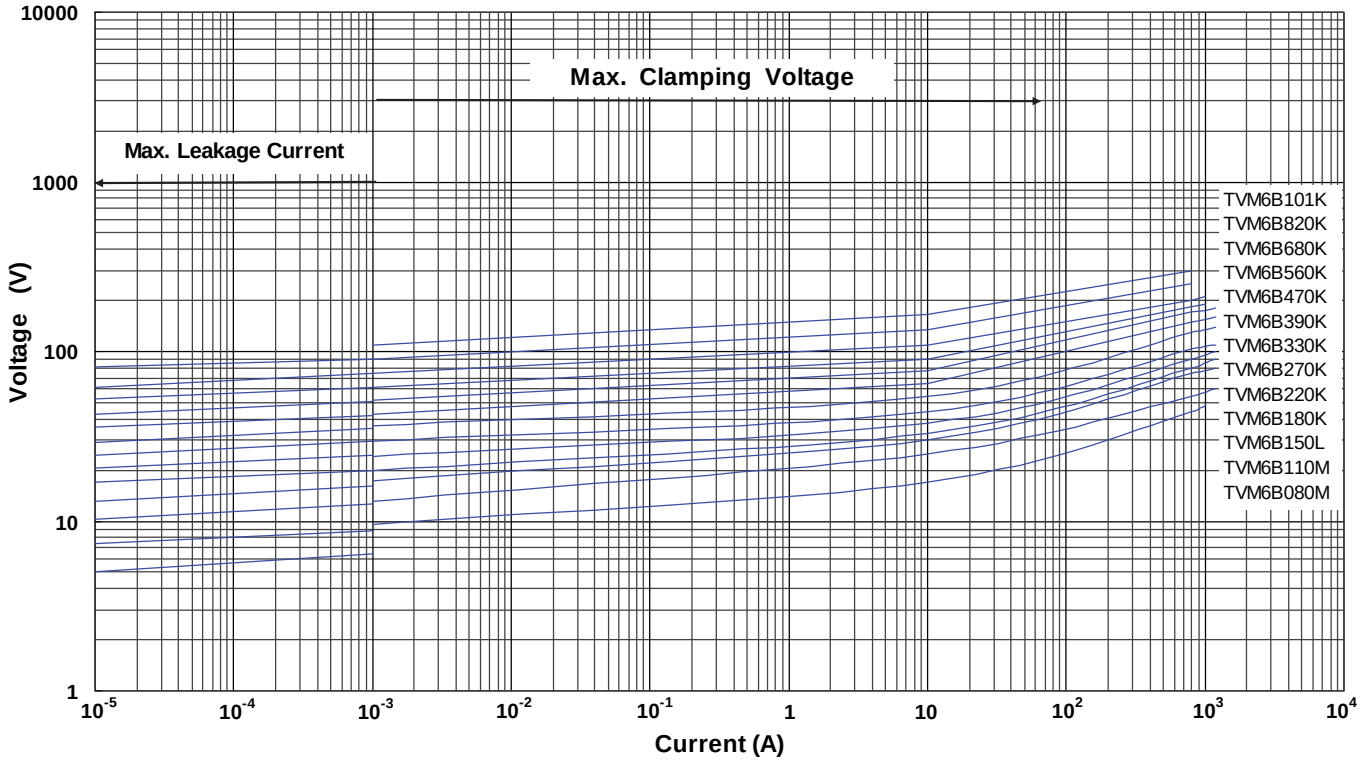


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVM5B080M ~ TVM5B101K)

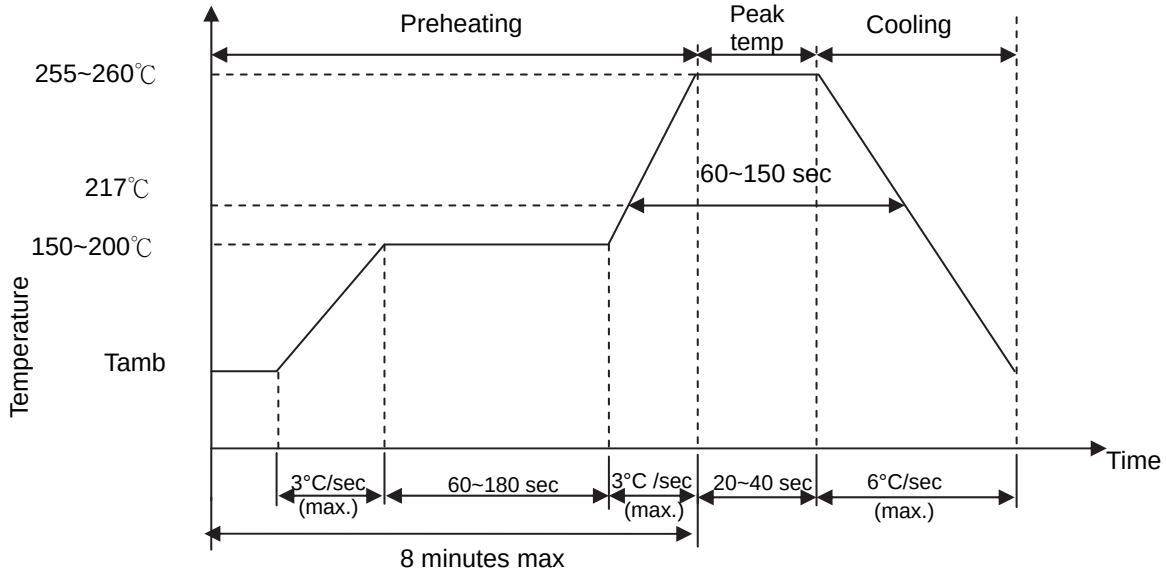


Max. Leakage Current and Max. Clamping Voltage Curves (TVM6B080M ~ TVM6B101K)



■ Soldering Recommendation

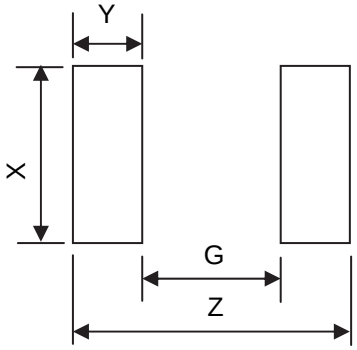
● IR-reflow Soldering Profile



● Reworking Conditions with Soldering Iron

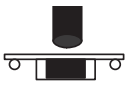
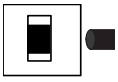
Item	Conditions
Temperature of Soldering Iron-tip	360℃ (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ 3mm (max.)
Caution: Please do not touch the component surface with soldering iron directly to avoid its damage.	

■ Recommended Soldering Pad Dimensions



Size	Z (mm)	G (mm)	X (mm)	Y (mm)
0402	1.7	0.5	0.6	0.6
0603	3.0	1.0	1.0	1.0
0805	3.4	1.0	1.4	1.2
1206	4.5	2.1	1.8	1.2
1210	4.5	2.1	2.8	1.2
1812	6.0	3.0	3.6	1.5
2220	7.2	4.2	5.5	1.5

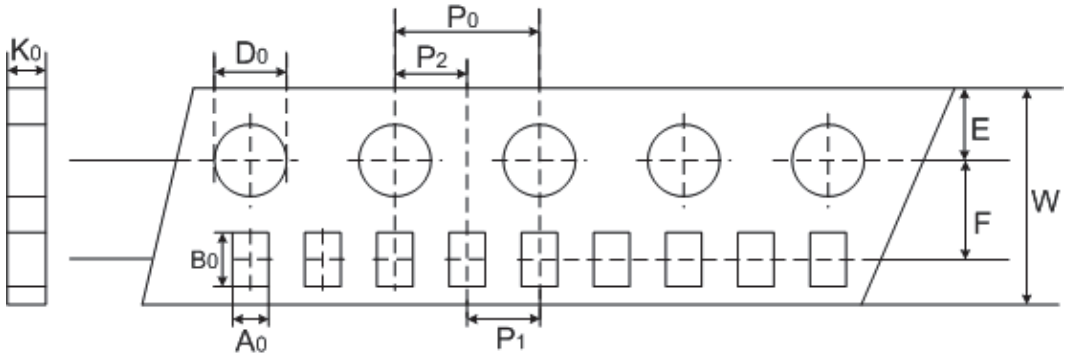
■ Reliability

<table>
<tr><th>Item</th><th>Standard</th><th>Test conditions / Methods</th><th>Specifications</th></tr>
<tr><td>Bending Strength</td><td>IEC 60068-2-21</td><td>Warp: 2mm ; Speed<0.5mm/sec
Duration: 10 sec on PCB  </td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
<tr><td>Adhesion</td><td>Specification Standard</td><td>Speed＜0.5mm/sec on PCB  </td><td>≧0.5Kgf
the terminal electrode shall be break off not the chip element</td></tr>
<tr><td>Damp Heat Load, Steady State</td><td>IEC 60068-2-78</td><td>40±2℃ 90~95% RH
500±24 hrs at V_{DC}</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$
No visible damage</td></tr>
<tr><td>High Temp. Storage</td><td>IEC 61051-1</td><td>125±5 ℃ x 1000±24 hrs</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
<tr><td>Rapid Change of Temperature</td><td>IEC 61051-1</td><td>The conditions shown below shall be repeated 5 cycles on PCB.
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Period (minutes)</th></tr>
<tr><td>1</td><td>-40±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temperature</td><td>5±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>5±3</td></tr>
</table></td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
<tr><td>High Temp. Load</td><td>IEC 61051-1</td><td>85±2 ℃ 1000±24 hrs at V_{DC}</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
<tr><td>Low Temp. Load</td><td>Specification Standard</td><td>-40±5 ℃ 1000±24 hrs at V_{DC}</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
<tr><td>Max. Energy</td><td>Specification Standard</td><td>10/1000μs Waveform, Wmax, 1 surge current</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$
No visible damage</td></tr>
<tr><td>Vibration</td><td>IEC 61051-1</td><td>Frequency range: 10~55Hz
Amplitude: 0.75mm or 98m/s^2
Direction: 3 mutually perpendicular directions, 2 hrs each</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
<tr><td>Varistor Voltage Temp. Coefficient</td><td>Specification Standard</td><td>Measure V_{1mA} at -40℃, 25℃, 125℃</td><td>$\lvert Tc \rvert \leqq 0.05$ (%/℃)</td></tr>
<tr><td>Climatic Sequence</td><td>IEC 61051-1</td><td>a. 125℃ x 16 hrs
b. 1st cycle : 55℃ 93%RH x 24 hrs
c. -40℃ x 2 hrs
d. 5 cycles : 55℃ 93%RH x 24 hrs/cycle</td><td>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$
No visible damage</td></tr>
<tr><td>Solderability</td><td>IEC 60068-2-58</td><td>245±5℃ 3±0.3 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>$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$
No visible damage</td></tr>
</table>

■ Packaging

● Taping Specification

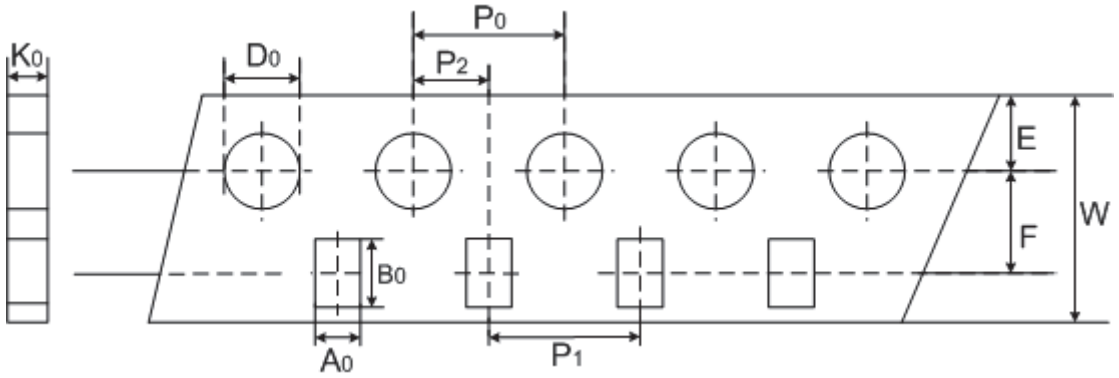
For 0402 Series



(Unit: mm)

Index / Size	A_0 ±0.05	B_0 ±0.12	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	K_0 ±0.1
0402	0.62	1.12	8	1.75	3.5	2	2	4	1.55	0.60

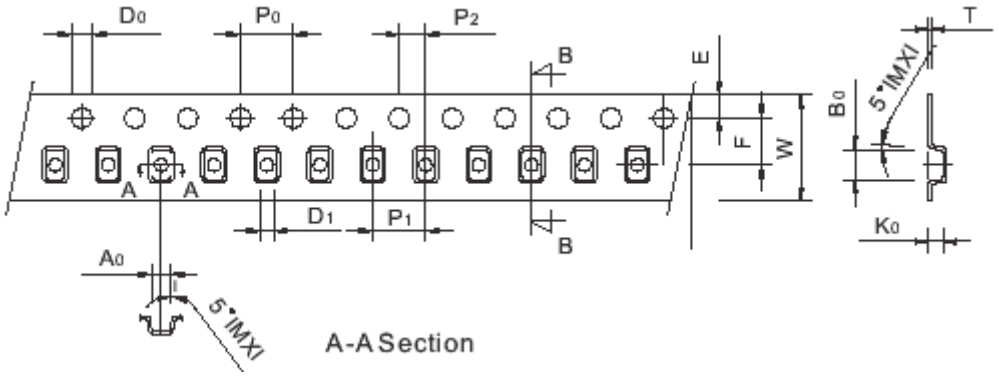
For 0603~0805 Series



(Unit: mm)

Index / Size	A_0 ±0.2	B_0 ±0.2	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	K_0 ±0.1
0603	1.1	1.9	8	1.75	3.5	4	2	4	1.55	0.95
0805	1.5	2.3	8	1.75	3.5	4	2	4	1.55	1.00

For 1206~ 2220 Series

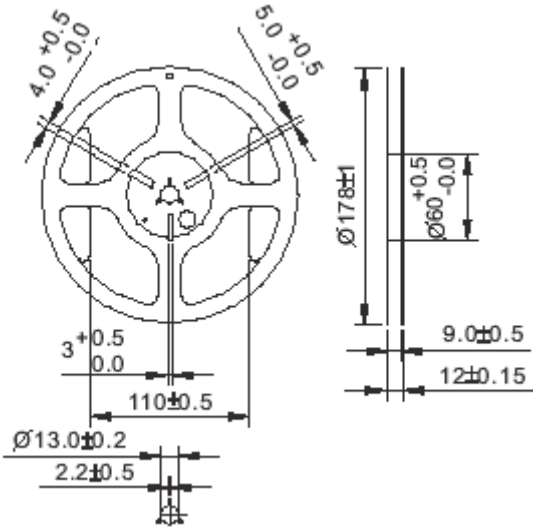


(Unit: mm)

Index / Size	A_0 ±0.2	B_0 ±0.2	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	D_1 ±0.1	T ±0.1
1812	3.65	4.96	12	1.75	5.5	8	2	4	1.55	1.5	0.25
2220	5.50	6.25	12	1.75	5.5	8	2	4	1.55	1.5	0.25

- **Quantity**

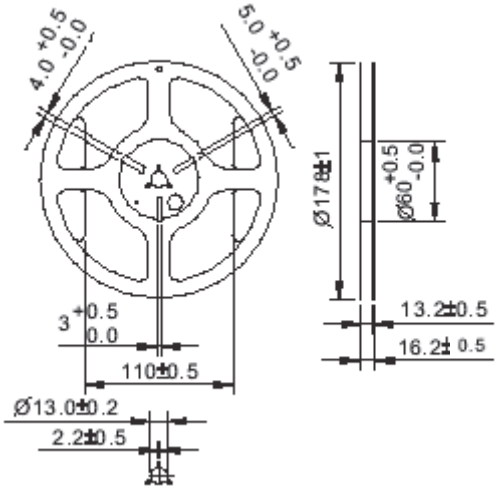
For 0402~1210 Series



Size	Quantity (pcs/reel)
0402	10,000
0603	4,000
0805	3,500
1206	2,500
1210	2,500

(Unit: mm)

For 1812~2220 Series



Size	Quantity (pcs/reel)
1812	1,000
2220	1,000

(Unit: mm)

■ Warehouse 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