Varistor: TVM-V Series

High Temperature SMD Type Surge Suppressor

Features

1. RoHS & Halogen Free (HF) compliant
2. EIA size: 0805~2220
3. Operating voltage: 22Vdc~85Vdc
4. High surge suppression capability
5. Bidirectional and symmetrical V/I characteristics
6. Multilayer ceramic construction technology
7. Variable capacitance
8. Operating temperature range: -55°C ~ +125°C
   Storage temperature range: -55°C ~ +150°C

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	6	B	8	2	0	K	1	0	3	R	V		
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})	
820	$82x10^0V=82V$
101	$10x10^1V=100V$

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

Packaging	
R	Reel

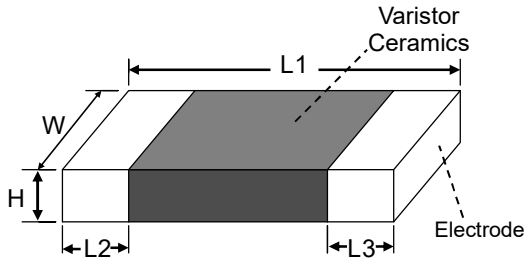
Optional Suffix	
V	High Temperature, RoHS, and HF Compliant

Size (EIA)	
2	0805
3	1206
4	1210
5	1812
6	2220

Typical Capacitance (@1KHz)	
201	$20 \times 10^1=200pF$
122	$12 \times 10^2=1200pF$
103	$10 \times 10^3=10000pF$

Structure and Dimensions

(Unit: mm)



Series	Size (EIA)	L1	W	Hmax.	L2 and L3
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[1)]	0.50±0.20
TVM5	1812	4.50±0.40	3.20±0.30	1.50[2)]	0.60±0.30
TVM6	2220	5.70±0.40	5.00±0.30	2.00[3)]	0.60±0.30

1.) Hmax: TVM4B720K302=2.75 ; TVM4B820K202=2.00 ; TVM4B101K302= 2.60
2.) Hmax: TVM5B560K122=2.50 ; TVM5B820K402=2.60
3.) Hmax: TVM6B770K802=2.50 ; TVM6B820K103=3.00 ; TVM6B101K602 = 2.50

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■ 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)
TVM2B470K201RV	47	10	30	38	77	1.0	80	0.3	0.005	200 ±20%
TVM2B560K201RV	56	10	35	45	85	1.0	150	0.3	0.005	200 ±20%
TVM3B270K102RV	27	10	17	22	48	1.0	200	0.6	0.008	1000 ±20%
TVM3B330K801RV	33	10	20	26	54	1.0	200	0.7	0.008	800 ±40%
TVM3B390K651RV	39	10	25	31	65	1.0	300	1.0	0.008	650 ±20%
TVM3B470K381RV	47	10	30	38	77	1.0	250	1.1	0.008	380 ±20%
TVM3B560K301RV	56	10	35	45	90	1.0	150	0.4	0.008	300 ±20%
TVM3B680K251RV	68	10	40	56	110	1.0	200	0.5	0.008	250 ±20%
TVM3B820K181RV	82	10	50	65	135	1.0	100	0.6	0.008	180 ±20%
TVM4B270K202RV	27	10	17	22	44	2.5	500	1.7	0.010	2000 ±20%
TVM4B390K102RV	39	10	25	31	65	2.5	300	1.7	0.010	1000 ±40%
TVM4B560K601RV	56	10	35	45	90	2.5	280	2.0	0.010	600 ±40%
TVM4B720K302RV	72	10	45	59	110	2.5	1500	2.3	0.010	3000 (max.)
TVM4B750K132RV	75	10	45	60	110	2.5	1200	2.3	0.010	1300 (max)
TVM4B820K202RV	82	10	50	65	135	2.5	1200	2.3	0.010	2000 ±30%
TVM4B101K181RV	100	10	60	85	165	2.5	350	2.0	0.010	180 ±20%
TVM4B101K302RV	100	10	60	85	180	100	1200	2.0	0.010	3000 (max.)
TVM5B390K252RV	39	10	25	31	65	5.0	800	3.7	0.015	2500 (max.)
TVM5B470K202RV	47	10	30	38	77	5.0	800	4.2	0.015	2000 (max.)
TVM5B560K122RV	56	10	35	45	90	5.0	500	4.0	0.015	1200 ±40%
TVM5B680K102RV	68	10	40	56	110	5.0	850	4.8	0.015	1000 ±20%
TVM5B750K402RV	75	10	45	60	110	2.5	2000	4.5	0.015	4000 (max)
TVM5B820K601RV	82	10	50	65	135	5.0	600	4.5	0.015	600 ±20%
TVM5B820K402RV	82	10	50	65	135	5.0	3000	4.5	0.015	4000 ±30%
TVM6B330K582RV	33	10	20	26	54	10.0	1200	7.8	0.020	5800 (max.)
TVM6B470K302RV	47	10	30	38	77	10.0	1200	12.0	0.020	3000 ±20%
TVM6B680K152RV	68	10	40	56	110	10.0	1000	9.0	0.020	1500 ±20%
TVM6B770K802RV	77	10	48	63	115	10.0	6000	15.0	0.020	8000 (max.)
TVM6B820K103RV	82	10	50	65	135	10.0	4500	21.0	0.020	10000 (max.)
TVM6B101K602RV	100	10	60	85	165	10.0	4500	15.0	0.020	6000 (max.)

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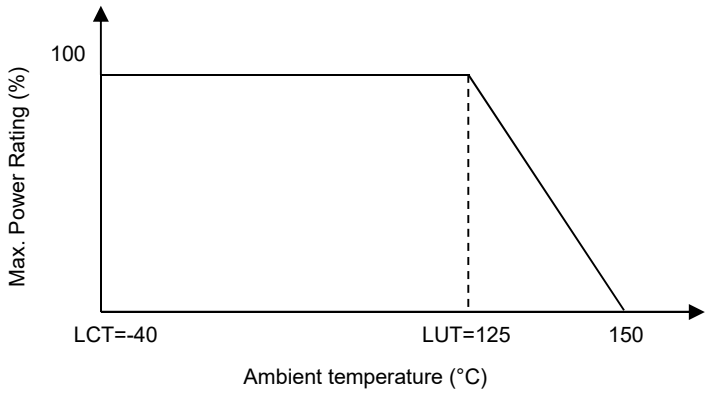
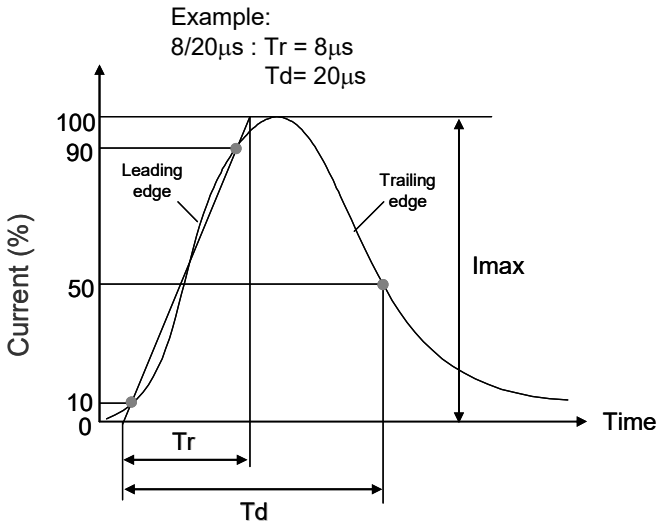
■ Power Derating Curve

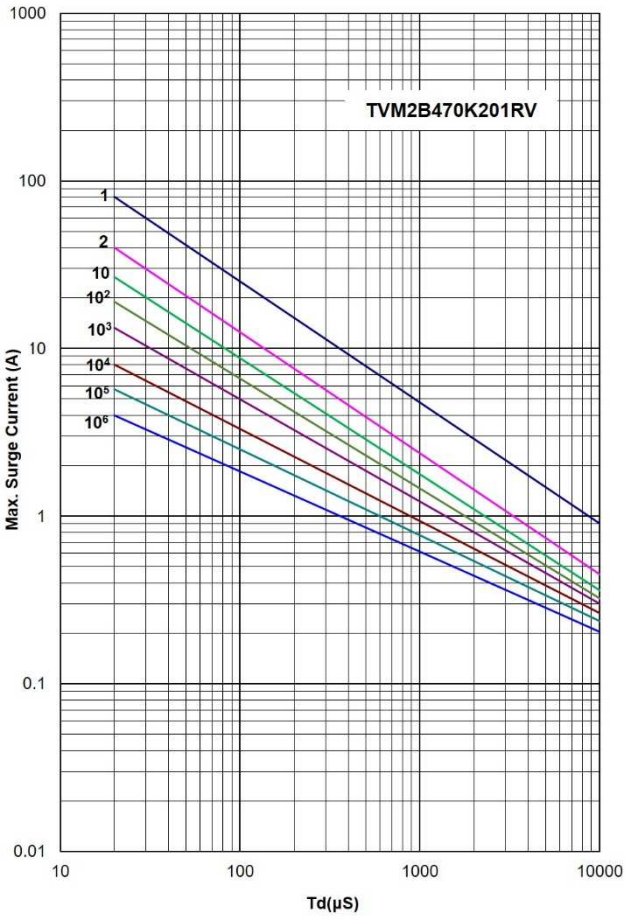


■ Surge Current Standard Waveform

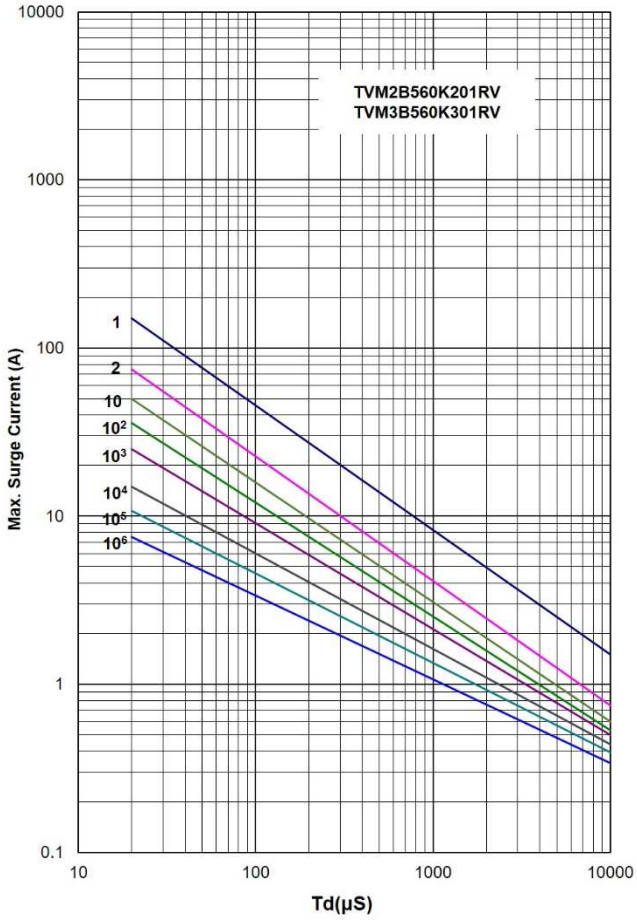


■ Max. Surge Current Derating Curves

TVM2B470K201RV

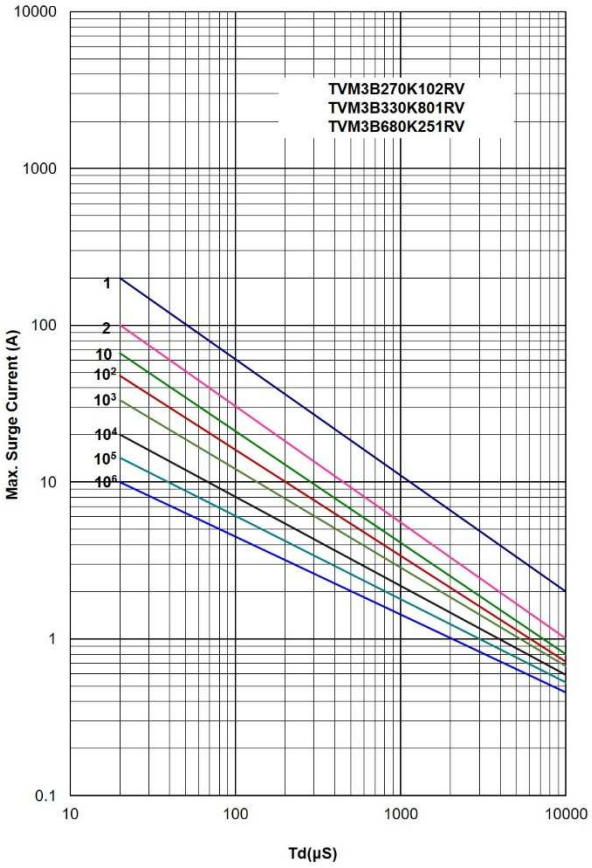


TVM2B560K201RV, TVM3B560K301RV

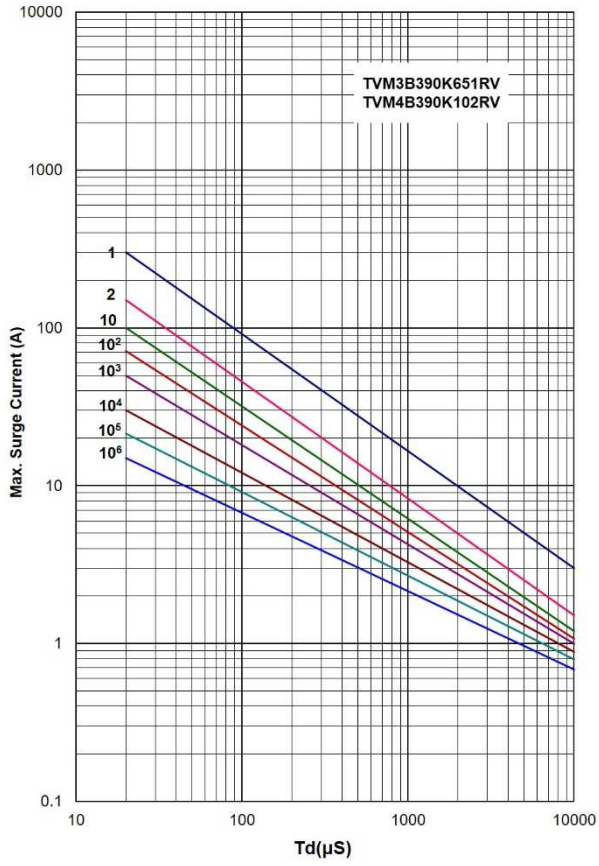


■ Max. Surge Current Derating Curves

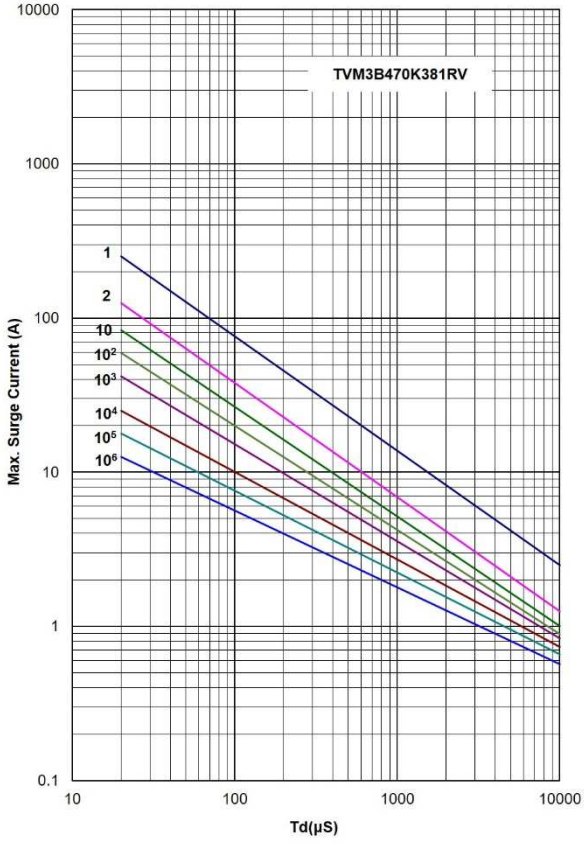
TVM3B270K102RV, TVM3B330K801RV
TVM3B680K251RV



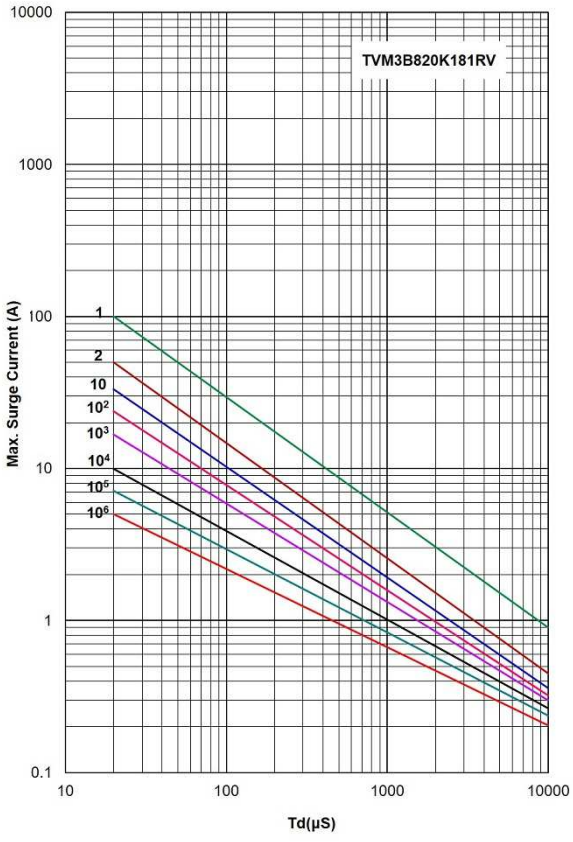
TVM3B390K651RV, TVM4B390K102RV



TVM3B470K381RV

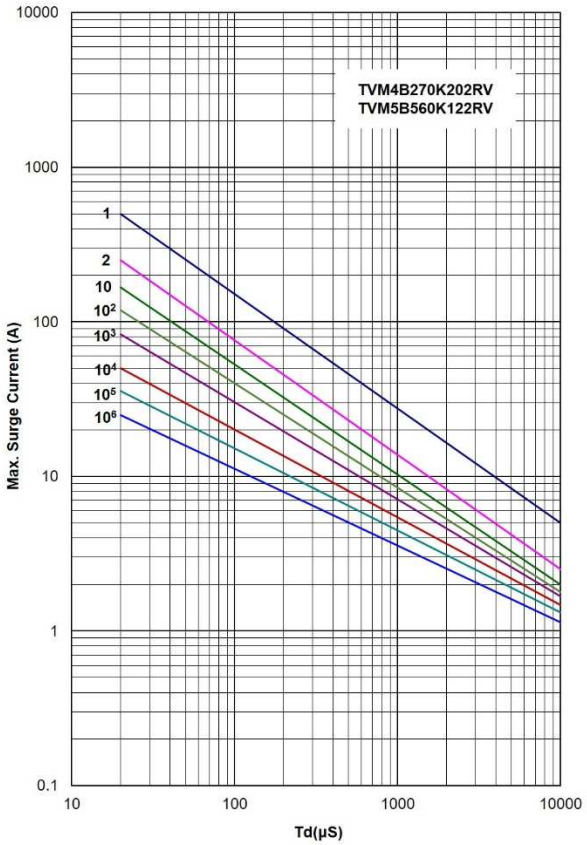


TVM3B820K181RV

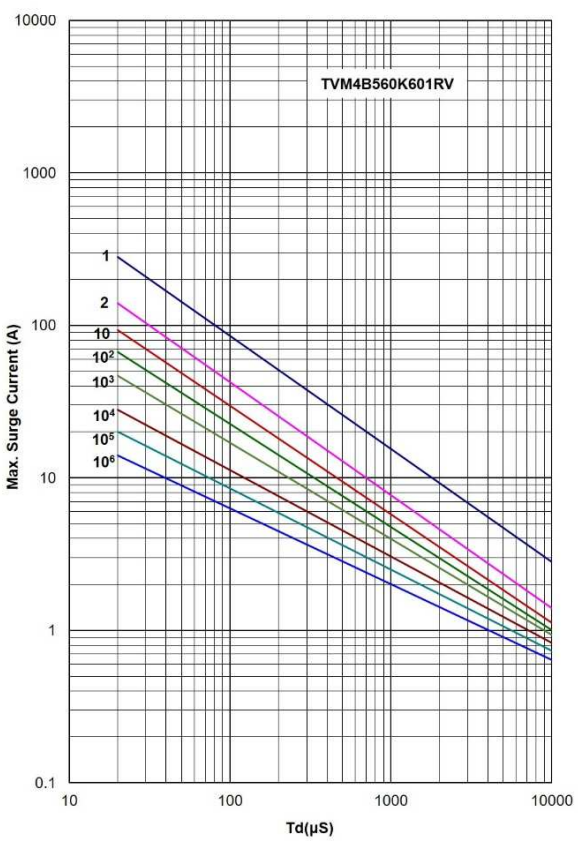


■ Max. Surge Current Derating Curves

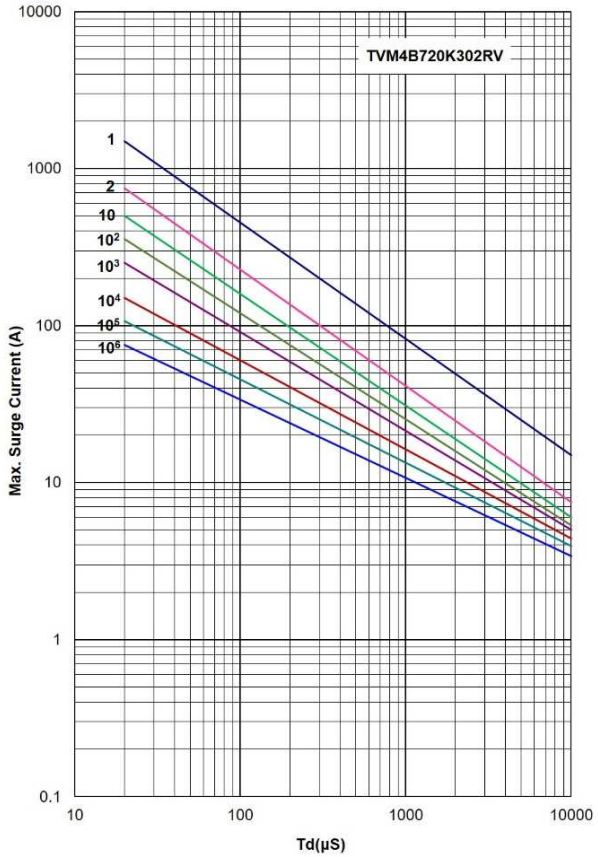
TVM4B270K202RV, TVM5B560K122RV



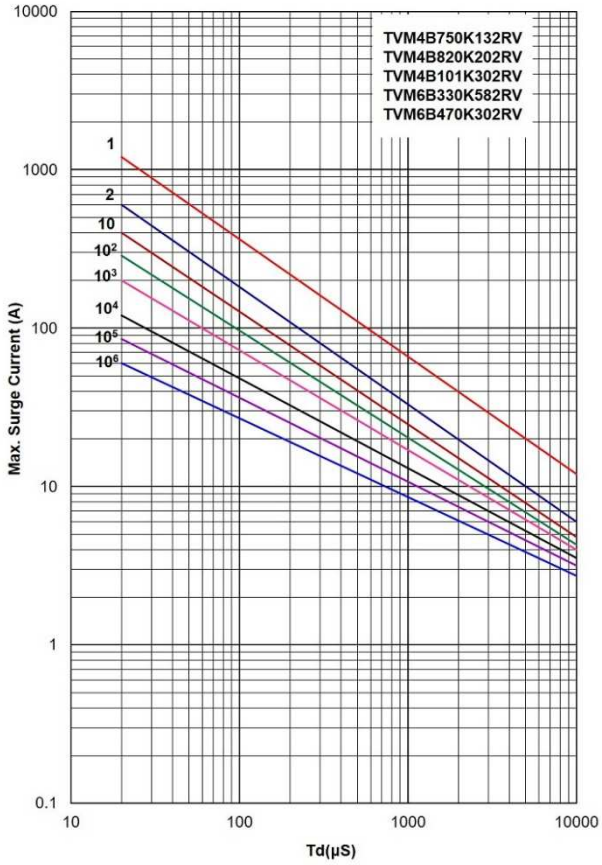
TVM4B560K601RV



TVM4B720K302RV

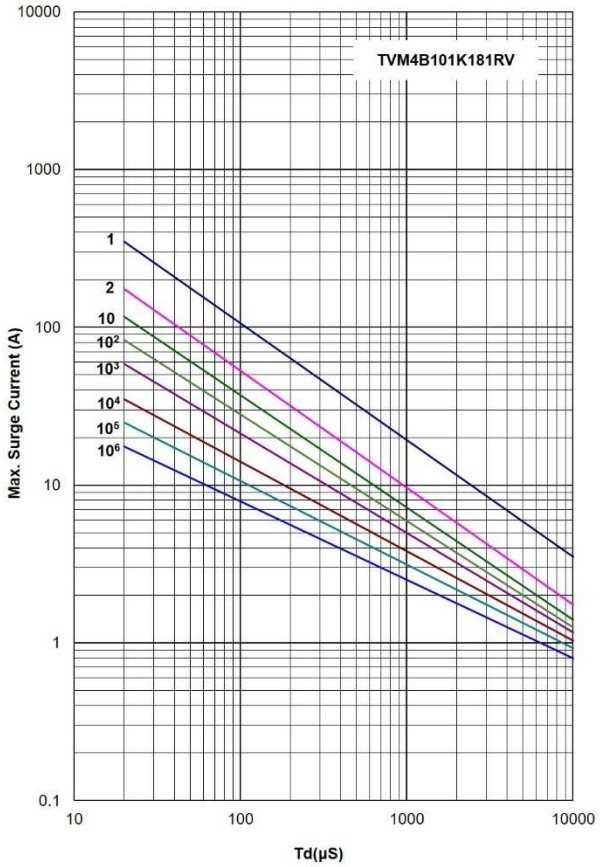


TVM4B750K132RV, TVM4B820K202RV, TVM4B101K302RV, TVM6B330K582RV, TVM6B470K302RV

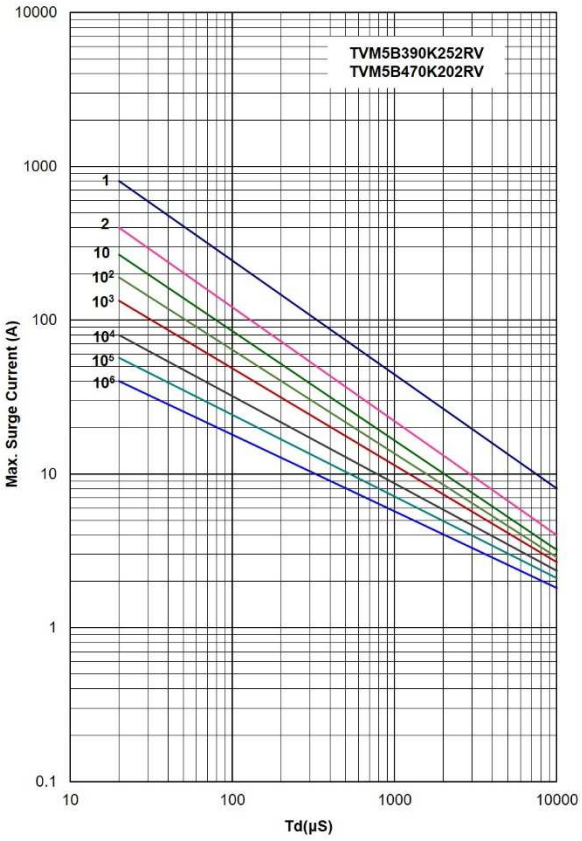


■ Max. Surge Current Derating Curves

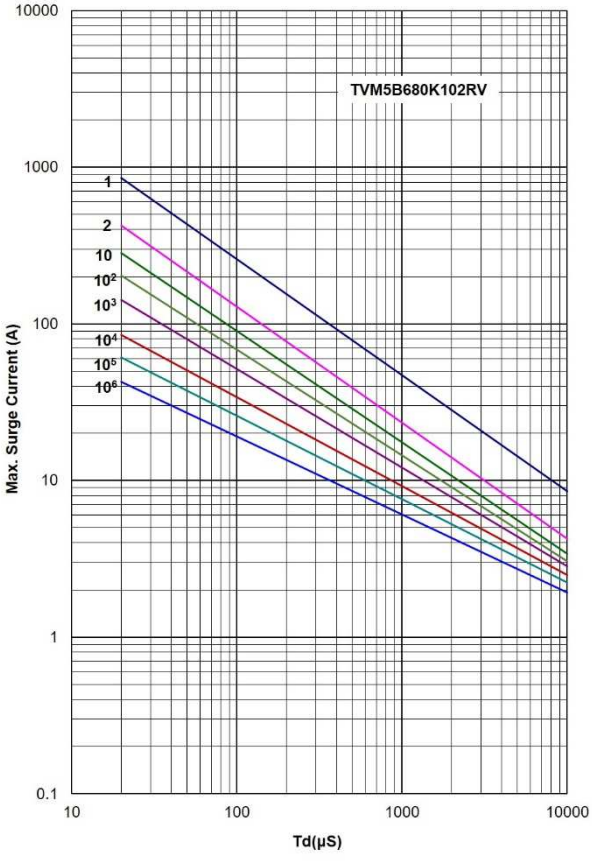
TVM4B101K181RV



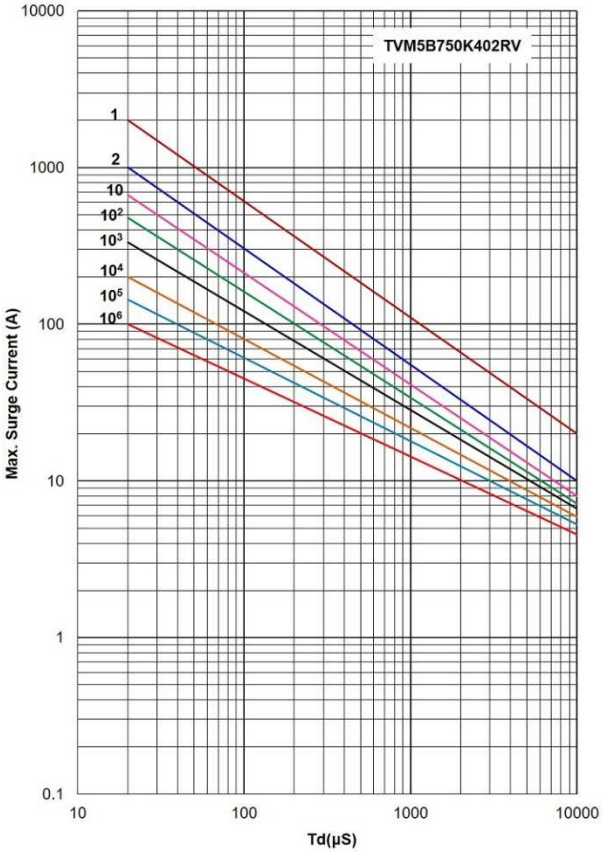
TVM5B390K252RV, TVM5B470K202RV



TVM5B680K102RV

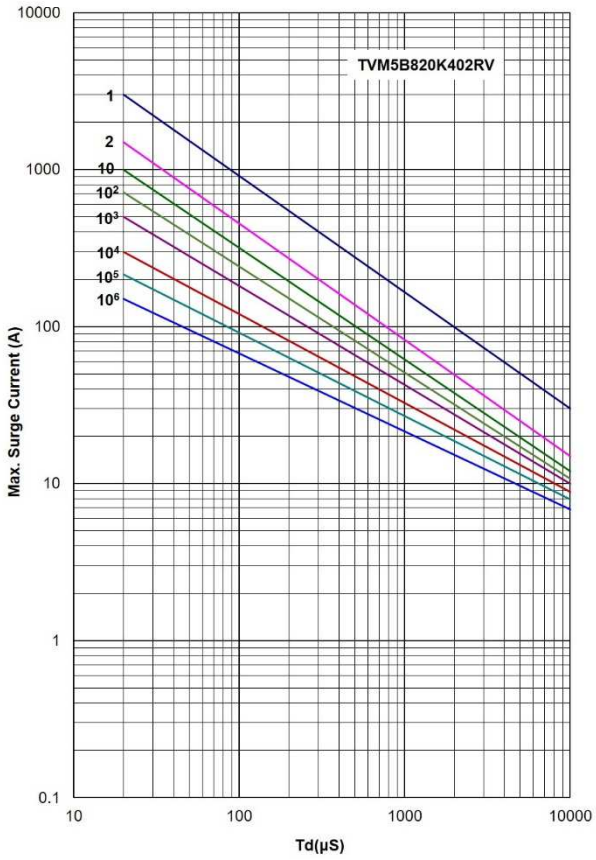


TVM5B750K402RV

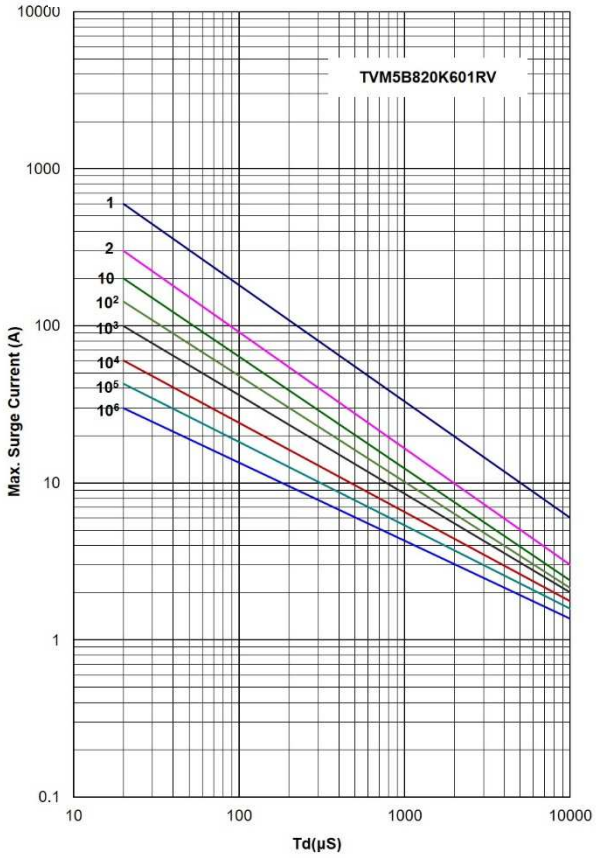


■ Max. Surge Current Derating Curves

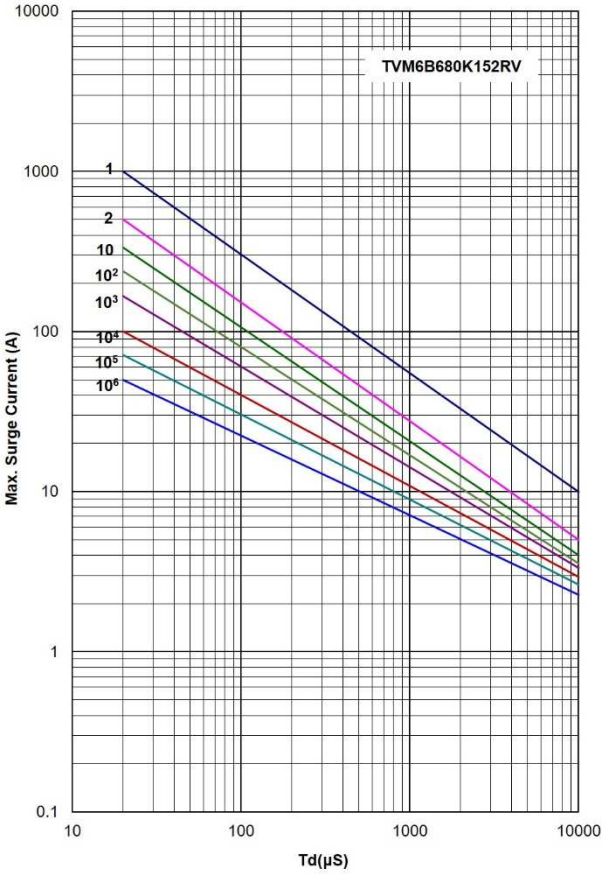
TVM5B820K402RV



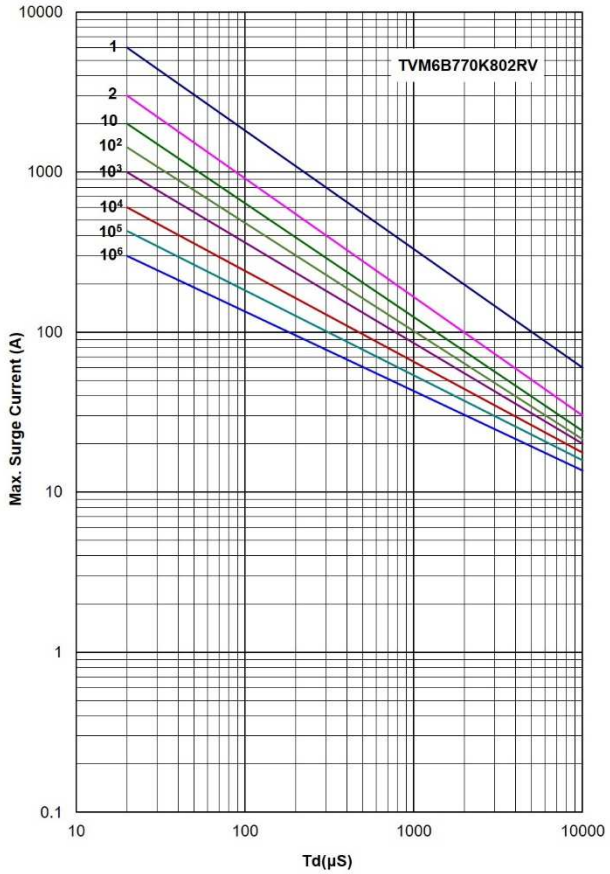
TVM5B820K601RV



TVM6B680K152RV

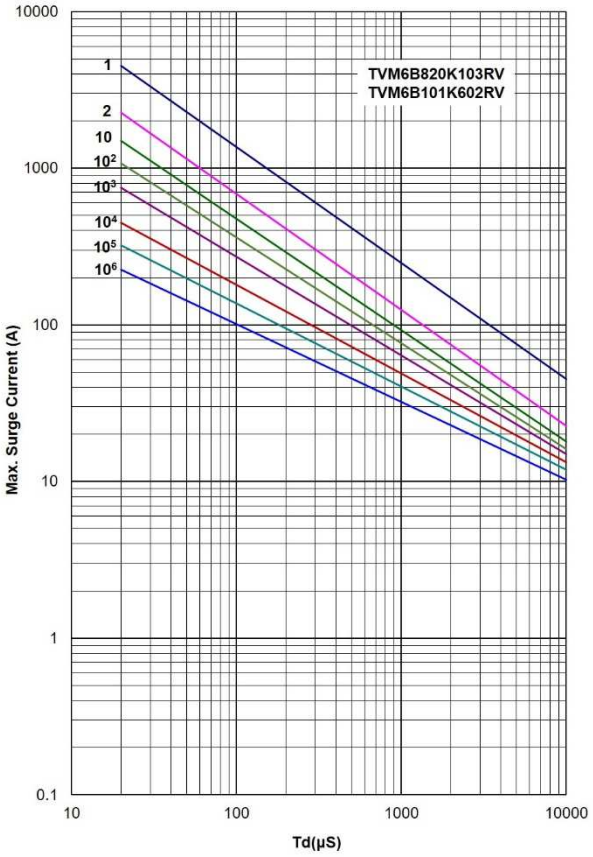


TVM6B770K802RV



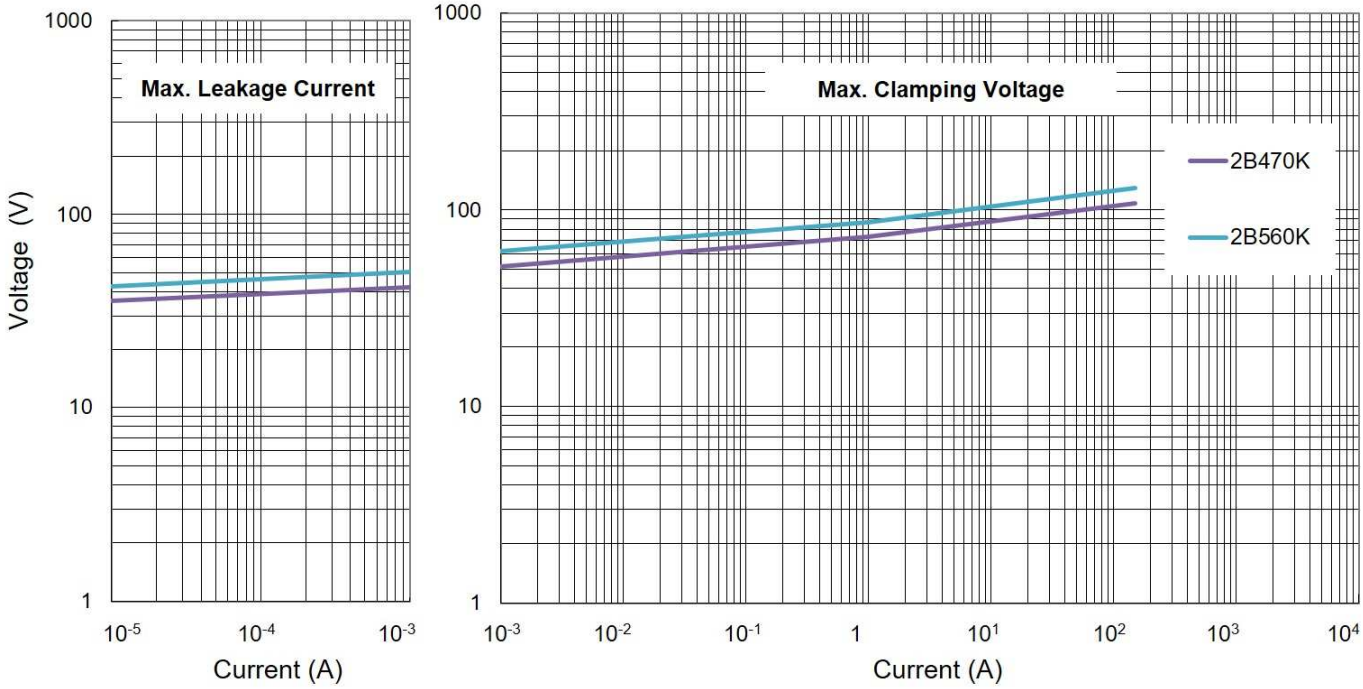
■ Max. Surge Current Derating Curves

TVM6B820K103RV, TVM6B101K602RV



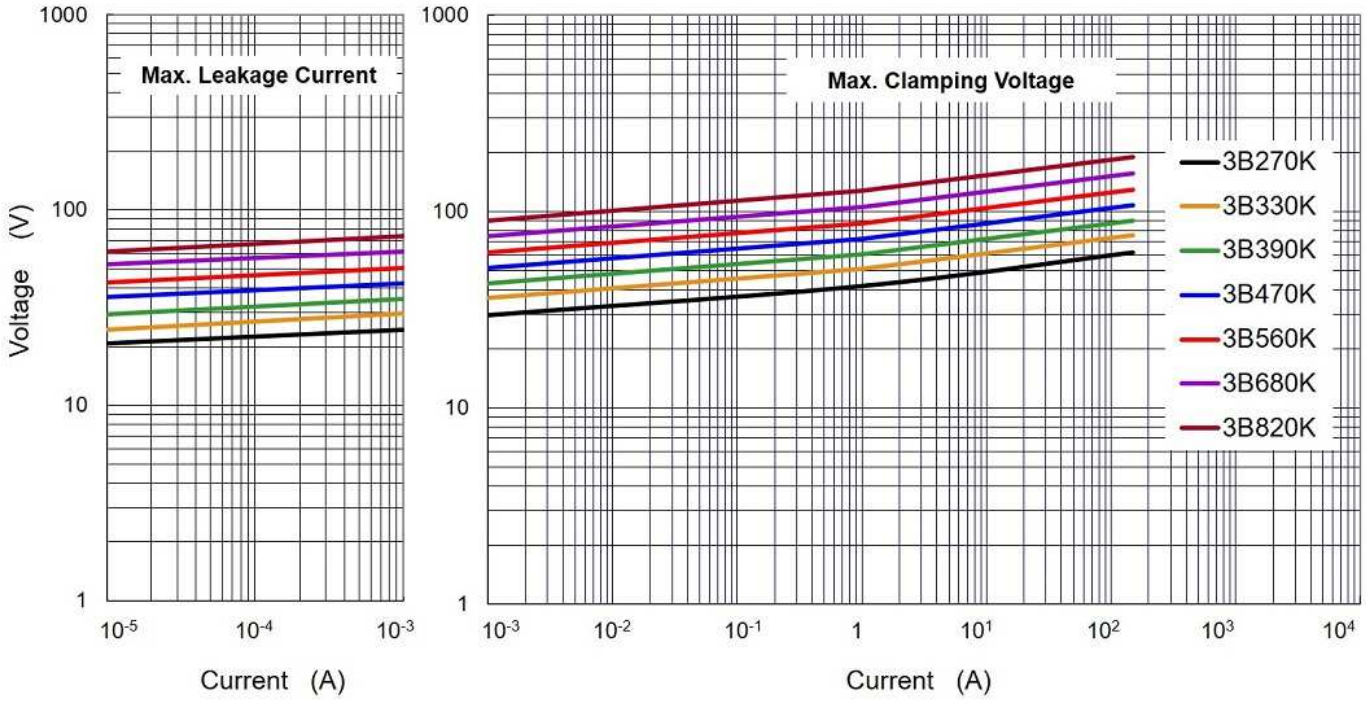
■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVM2B470K~TVM2B560K)

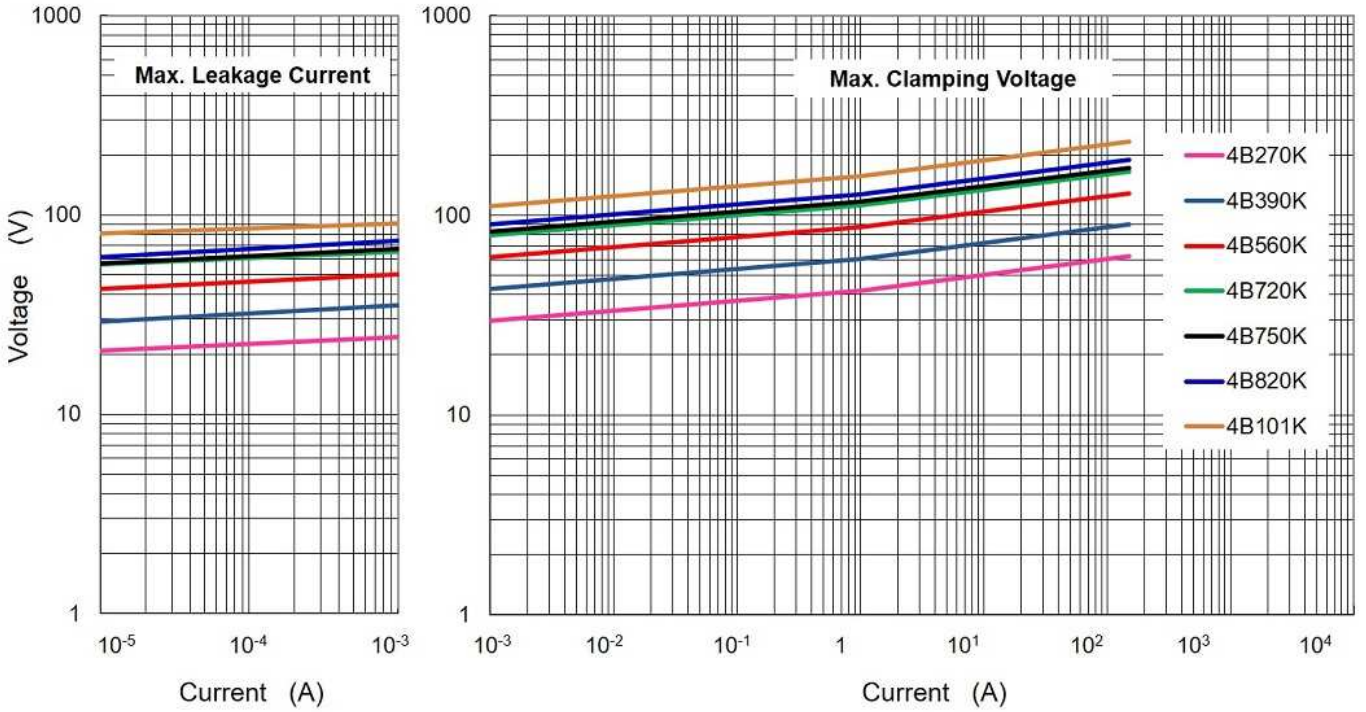


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVM3B270K~TVM3B820K)

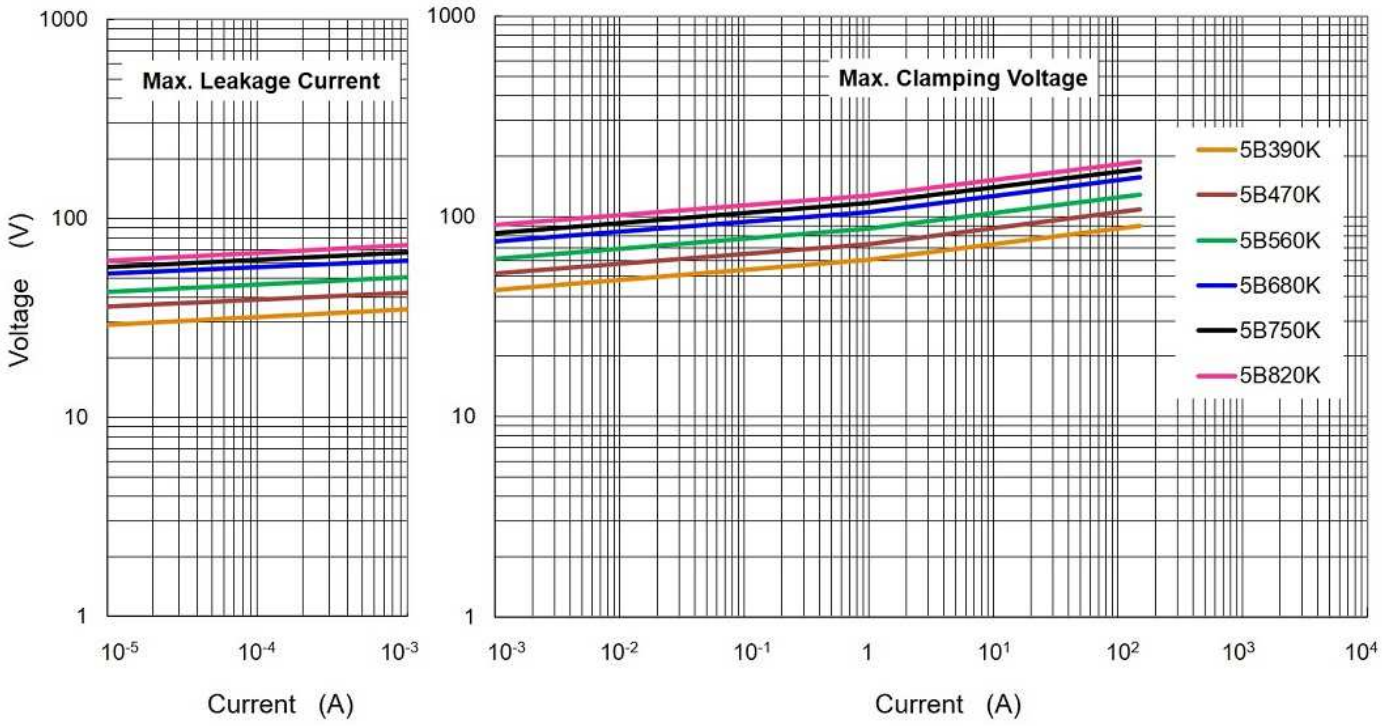


Max. Leakage Current and Max. Clamping Voltage Curves (TVM4B270K~TVM4B101K)

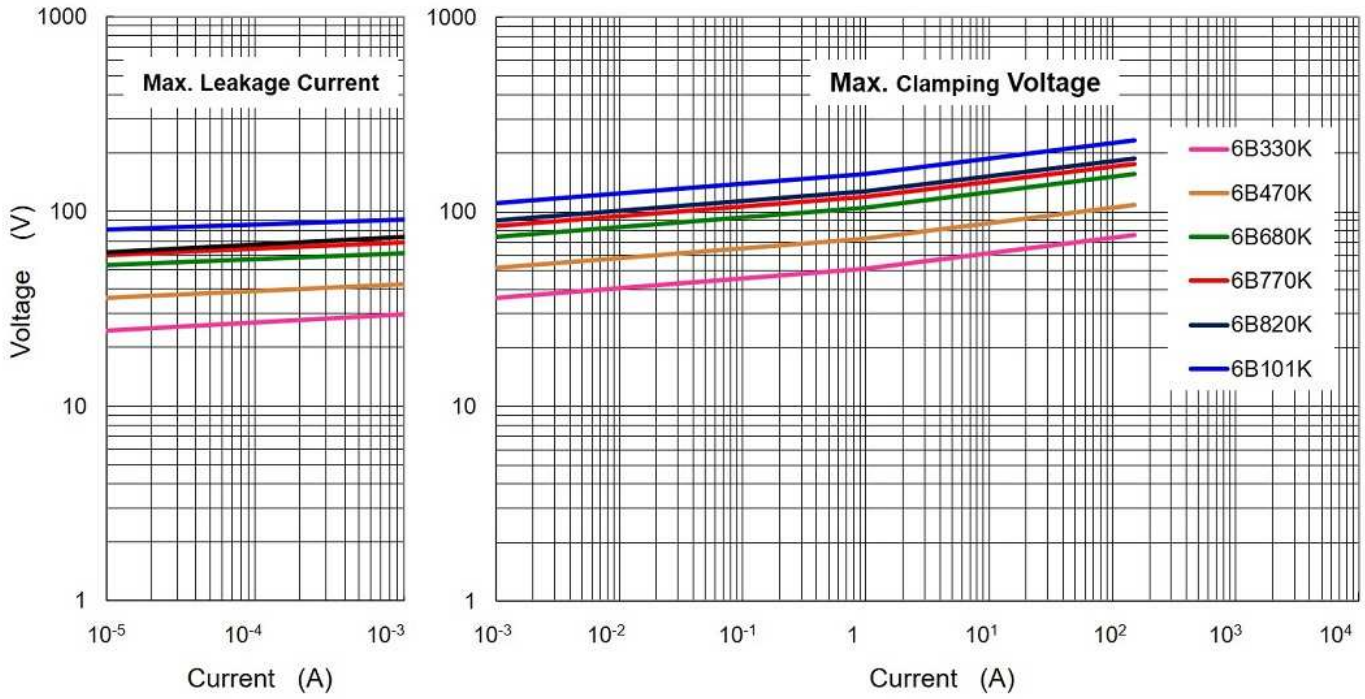


■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVM5B390K~TVM5B820K)

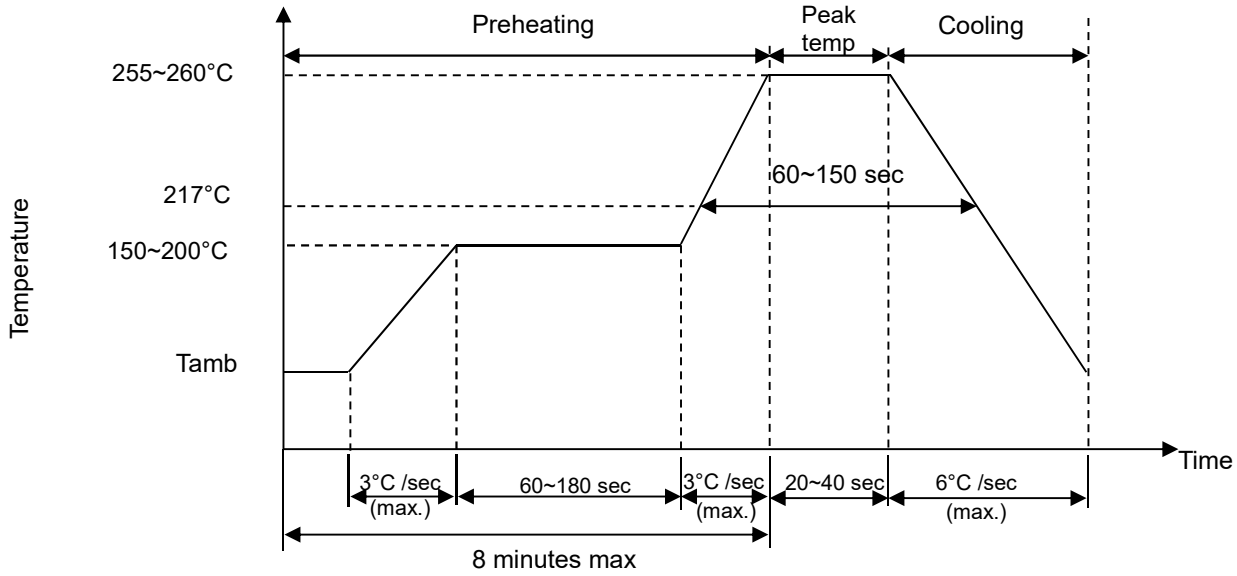


Max. Leakage Current and Max. Clamping Voltage Curves (TVM6B330K~TVM6B101K)



■ Soldering Recommendation

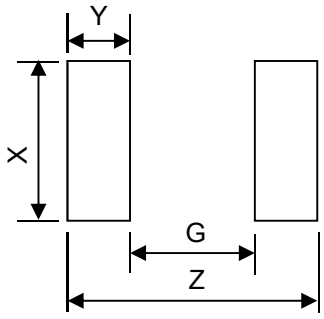
● IR-reflow Soldering Profile



● Reworking Conditions with Soldering Iron

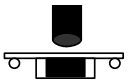
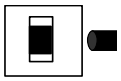
Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ 3mm (max.)
Caution: Not to touch the component surface with soldering iron directly to prevent component damage.	

■ Recommended Soldering Pad Dimensions



Size	Z (mm)	G (mm)	X (mm)	Y (mm)
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

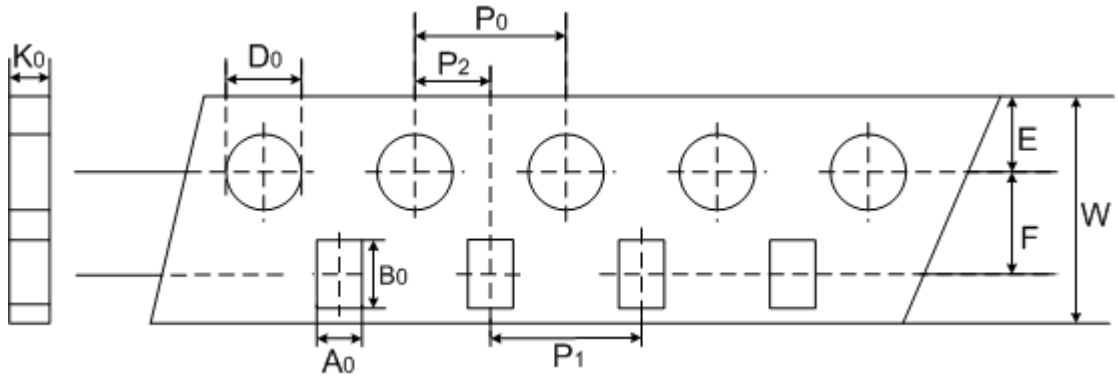
■ Reliability

Item	Standard	Test conditions / Methods	Specifications
Bending Strength	IEC 60068-2-21	Warp: 2mm ; Speed<0.5mm/sec Duration: 10 sec on PCB 	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Adhesion	IEC 60068-2-21	Speed＜0.5mm/sec on PCB 	≧0.5Kgf the terminal electrode shall be break off not the chip element
Damp Heat Load, Steady State	IEC 60068-2-78	40±2°C 90~95% RH 500±24 hrs at V_{DC}	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage
High Temp. Storage	IEC 60068-2-2	150±5°C 1000±24 hrs	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Rapid Change of Temperature	IEC 60068-2-14	The conditions shown below shall be repeated 5 cycles on PCB. Step / Temperature (°C) / Period (minutes) 1 / -55±5 / 30±3 2 / Room temperature / ≦3 3 / 150±5 / 30±3 4 / Room temperature / ≦3	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
High Temp. Load	MIL-STD-202 Method 108	125±2°C 1000±24 hrs at V_{DC}	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Low Temp. Load	IEC 60068-2-1	-55±5°C 1000±24 hrs at V_{DC}	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage
Max. Energy	IEC 61051-1	10/1000μs Waveform, Wmax, 1 surge current	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage
Max. Surge Current	IEC 61051-1	8/20μs Waveform, Imax, 1 surge current	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage
Vibration	IEC 60068-2-6	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
Varistor Voltage Temp. Coefficient	Specification Standard	Measure V_{1mA} at -40°C, 25°C, 125°C	$\lvert Tc \rvert \leqq 0.05$ (%/°C)
Climatic Sequence	IEC 61051-1	a. 125°C x 16 hrs b. 1st cycle : 55°C 93%RH x 24 hrs c. -40°C x 2 hrs d. 5 cycles : 55°C 93%RH x 24 hrs/cycle	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 10\%$ No visible damage
Solderability	IEC 60068-2-58	245±5°C 3±0.3 sec.	At least 95% of terminal electrode is covered by new solder
Resistance to Soldering Heat	IEC 60068-2-58	260±5°C 10±1 sec.	$\lvert \triangle V_{1mA} / V_{1mA} \rvert \leqq 5\%$ No visible damage

■ Packaging

● Taping Specification

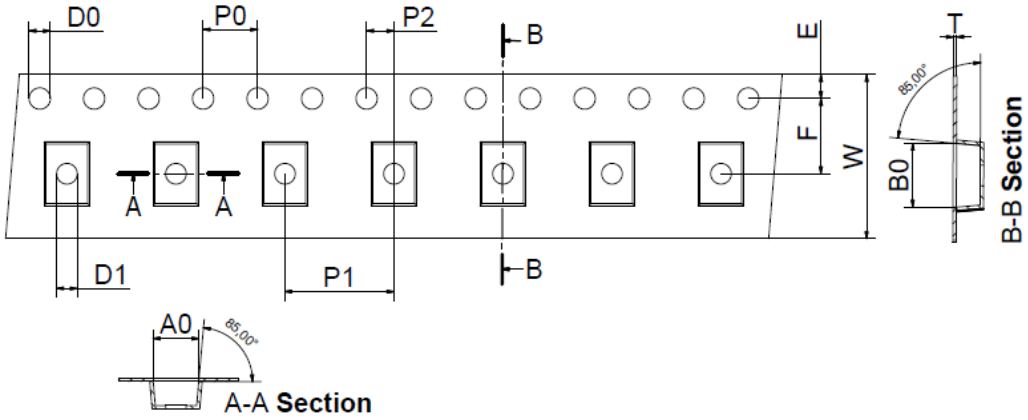
For 0805 Series



(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
0805	1.5	2.3	8	1.75	3.5	4	2	4	1.55	1.00

For 1206~2220 Series



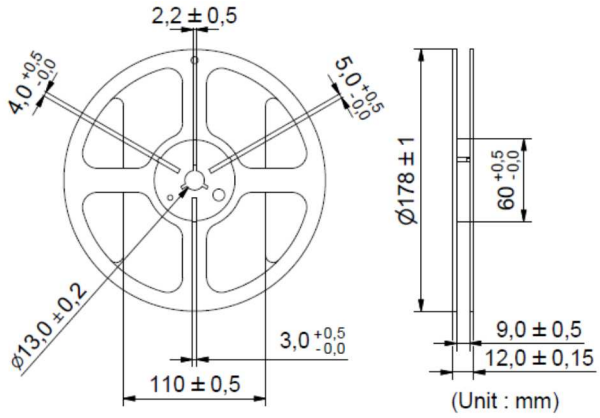
(Unit: mm)

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
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 / Size	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

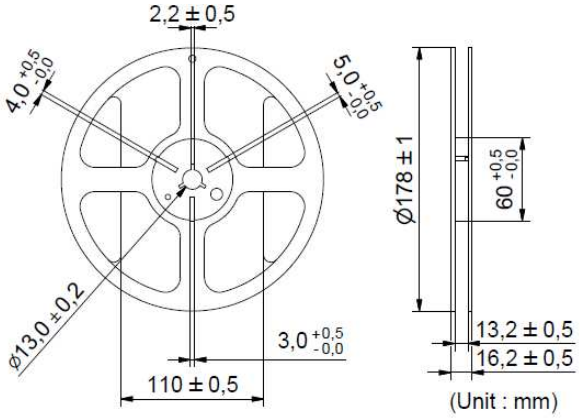
- **Quantity**

For 0805~1210 Series



Size (EIA)	Quantity (pcs/reel)
0805	3,500
1206	2,500
1210	2,500 (H<1.5) 2,000 (H=1.5~2.0) 1,500 (H>2.0)

For 1812~2220 Series



Size (EIA)	Quantity (pcs/reel)
1812	1,000 (H<1.5) 800 (H>1.5)
2220	1,000 (H<2.0) 800 (H>2.0)

■ Warehouse Storage Conditions of Products

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