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## SPECIFICATION FOR APPROVAL

CUSTOMER \_\_\_\_\_

CERTIFIED  
MODEL/TYPE

TVR14471

PART NO.

TVR14471KOER9BY (RoHS)

APPLICATION \_\_\_\_\_

CUSTOMER P/N \_\_\_\_\_

ISSUE DATE

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REV. DATE \_\_\_\_\_

FOR CUSTOMER APPROVAL	CHECKED BY
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	APPROVED BY
	Huaifang Zhang





**REVISED RECORD SHEET**

REV. NO	REV. DATE	REVISED CONTENT



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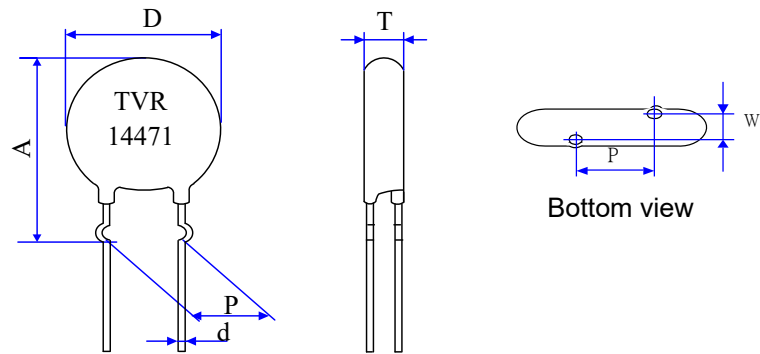
Part Number Code

Example :

**TVR**    **14**    **471**    **K**    **O**    **ER**    **9BY**  
 (1)        (2)        (3)        (4)        (5)        (6)        (7)

No.	Item	Digit	Specification
(1)	Product Type	TVR	Thinking varistor TVR type
(2)	Body Size	14	φ 14 mm
(3)	Varistor Voltage	471	Refer to "Optional Suffix"
(4)	Tolerance of $V_{1mA}$	K	Refer to "Optional Suffix"
(5)	Appearance	O	Kink -out Lead ; Epoxy Coating
(6)	Packaging	E	Repositioning tapping ( hole pitch: 15.0mm)
		R	reel
(7)	Optional Suffix	9BY	1.Max.Surge Current(8/20μS)(1time):6000A 2.Max.Surge Current(8/20μS)(2times):5000A 3.Max.Energy(10/1000μS):175J 4.RoHS compliance 5.Tmax:5.7mm 6.V1mA:423-490V

Structure and Dimensions



( unit : mm )

Body Size	D	P	d	A max.	Tmax	W
φ 14	13.5~16.0	7.5±0.5	0.80±0.02	22.5	5.7	2.6±1.0

\*Coating material rating:UL 94 V-0

Electrical Characteristics ( Ambient Ta=25 °C )

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20μS)		Max. Clamping Voltage (6KV/3KA)	Max. Clamping Voltage (8KV/4KA)	Max. Surge Current (8/20μS)
	V <sub>1mA</sub> (V)	V <sub>AC(rms)</sub> (V)	V <sub>DC</sub> (V)	V <sub>p</sub> (V)	I <sub>p</sub> (A)	V <sub>p</sub> (V)	V <sub>p</sub> (V)	I (A)
TVR14471KOER9BY	423~490	300	385	775	50	1140	1200	6000

Part No.	Max. Energy (10/1000μS)	Rated Power	Impulse Response Time	Max. Leakage Current at 75%V <sub>1mA</sub>	Operating Temperature Range	Storage temperature Range	Applications		
	W (J)	P (W)	nSec	I <sub>L</sub> (μA)	( °C )	( °C )	UL 1449	IEC 60950-1	IEC 60065
TVR14471KOER9BY	175	0.6	<25	20	-40 ~ +85	-40 ~ +125	SPD Type 5	Annex Q	Clause 14.12

Reliability

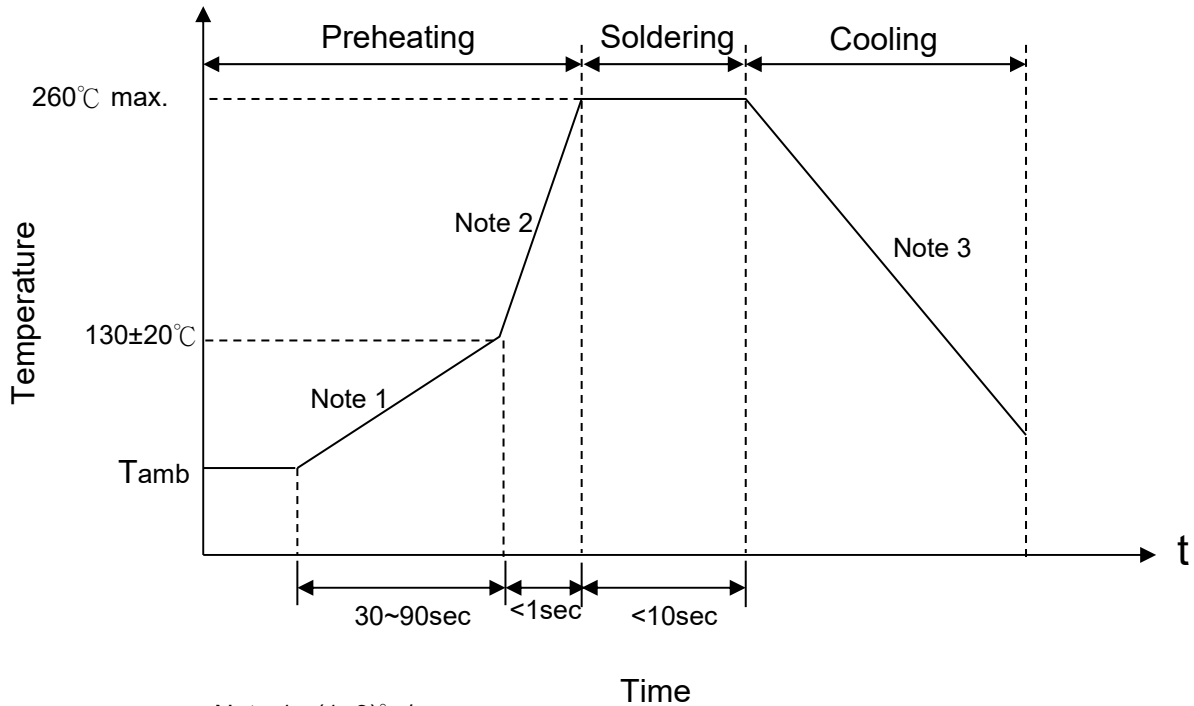
Item	Standard	Test conditions / Methods	Specifications															
Tensile Strength of Terminals	IEC60068-2-21	Gradually applying the force specified and keeping the unit fixed for 10±1 sec.  <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Terminal diameter (mm)</td> <td style="text-align: center;">Force (Kg)</td> </tr> <tr> <td style="text-align: center;">0.5&lt;d≤0.8</td> <td style="text-align: center;">1.0</td> </tr> <tr> <td style="text-align: center;">0.8&lt;d≤1.25</td> <td style="text-align: center;">2.0</td> </tr> <tr> <td style="text-align: center;">1.25&lt;d</td> <td style="text-align: center;">4.0</td> </tr> </table>	Terminal diameter (mm)	Force (Kg)	0.5<d≤0.8	1.0	0.8<d≤1.25	2.0	1.25<d	4.0	No visible damage   ΔV/V <sub>1mA</sub>   ≤5%							
Terminal diameter (mm)	Force (Kg)																	
0.5<d≤0.8	1.0																	
0.8<d≤1.25	2.0																	
1.25<d	4.0																	
Bending Strength of Terminals	IEC60068-2-21	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.  <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Terminal diameter (mm)</td> <td style="text-align: center;">Force (Kg)</td> </tr> <tr> <td style="text-align: center;">0.5&lt;d≤0.8</td> <td style="text-align: center;">0.5</td> </tr> <tr> <td style="text-align: center;">0.8&lt;d≤1.25</td> <td style="text-align: center;">1.0</td> </tr> <tr> <td style="text-align: center;">1.25&lt;d</td> <td style="text-align: center;">2.0</td> </tr> </table>	Terminal diameter (mm)	Force (Kg)	0.5<d≤0.8	0.5	0.8<d≤1.25	1.0	1.25<d	2.0	No visible damage   ΔV/V <sub>1mA</sub>   ≤5%							
Terminal diameter (mm)	Force (Kg)																	
0.5<d≤0.8	0.5																	
0.8<d≤1.25	1.0																	
1.25<d	2.0																	
Vibration	IEC 60068-2-6	Frequency range:10~55Hz Amplitude:0.75mm or 98m/S <sup>2</sup> Direction:3 mutually perpendicular directions,2hrs each.	ΔV/V <sub>1mA</sub>   ≤5% No visible damage															
Solderability	IEC60068-2-20	245 ± 3 °C , 3 ± 0.3 sec	At least 95% of terminal electrode is covered by new solder															
Resistance to Soldering Heat	IEC60068-2-20	260 ± 3 °C , 10 ± 1 sec	No visible damage   ΔV/V <sub>1mA</sub>   ≤5%															
High Temperature Storage	IEC60068-2-2	125 ± 5 °C , 1000 ± 24 hrs	No visible damage   ΔV/V <sub>1mA</sub>   ≤5%															
Damp Heat, Steady State	IEC 60068-2-78	The test is divided into two groups . a.40 ± 2°C , 90 ~ 95 % RH , 1344 hrs b.40 ± 2°C , 90 ~ 95 % RH , at 10%V <sub>DC</sub> , 1344 hrs	No visible damage   ΔV/V <sub>1mA</sub>   ≤10% Insulation Resistance ≥ 100MΩ															
Rapid Change of Temperature	IEC60068-2-14	The conditions shown below shall be repeated 5 cycles  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">-40 ± 3</td> <td style="text-align: center;">30 ± 3</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Room temperature</td> <td style="text-align: center;">5 ± 3</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">85 ± 2</td> <td style="text-align: center;">30 ± 3</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">Room temperature</td> <td style="text-align: center;">5 ± 3</td> </tr> </tbody> </table>	Step	Temperature (°C)	Period (minutes)	1	-40 ± 3	30 ± 3	2	Room temperature	5 ± 3	3	85 ± 2	30 ± 3	4	Room temperature	5 ± 3	No visible damage   ΔV/V <sub>1mA</sub>   ≤5%
Step	Temperature (°C)	Period (minutes)																
1	-40 ± 3	30 ± 3																
2	Room temperature	5 ± 3																
3	85 ± 2	30 ± 3																
4	Room temperature	5 ± 3																
High Temp. Load	MIL-STD-202 Method 108	85 ± 2 °C , 1000 ± 24 hrs, at V <sub>DC</sub> or V <sub>rms</sub> (Max. Operating Voltage)	ΔV/V <sub>1mA</sub>   ≤10% No visible damage															



Item	Standard	Test conditions / Methods	Specifications
8/20 $\mu$ S Surge Life	IEC 61051-1 4.6	10,000 pulses( 8/20 $\mu$ S ) , unipolar, interval 10 secs, amplitude corr. to max. Surge current derating curves for 20 $\mu$ S	$ \Delta V/V_{1mA}  \leq 10\%$ No visible damage
10/1000 $\mu$ S Surge Life	IEC 61051-1 4.6	10/1000 $\mu$ S waveform, 10 surge currents,unipolar,interval 2mins, amplitude corr. to max. surge current derating curves for 1000 $\mu$ S	$ \Delta V/V_{1mA}  \leq 10\%$ No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA} \text{ at } 85^{\circ}\text{C} - V_{1mA} \text{ at } 25^{\circ}\text{C}}{V_{1mA} \text{ at } 25^{\circ}\text{C}} \times \frac{1}{60} \times 100 (\% / ^{\circ}\text{C})$ $\frac{V_{1mA} \text{ at } -40^{\circ}\text{C} - V_{1mA} \text{ at } 25^{\circ}\text{C}}{V_{1mA} \text{ at } 25^{\circ}\text{C}} \times \frac{1}{65} \times 100 (\% / ^{\circ}\text{C})$	$-0.05 \leq TC \leq 0.05 (\% / ^{\circ}\text{C})$
Voltage Proof	IEC 61051-1 4.9	Metal balls method, 2500 Vac 1 min	No visible damage

## Soldering Recommendation

### Wave Soldering Profile



- Note 1 : (1~3)°C/sec  
 Note 2 : Approx. 200°C/sec  
 Note 3 : 5°C/sec Max

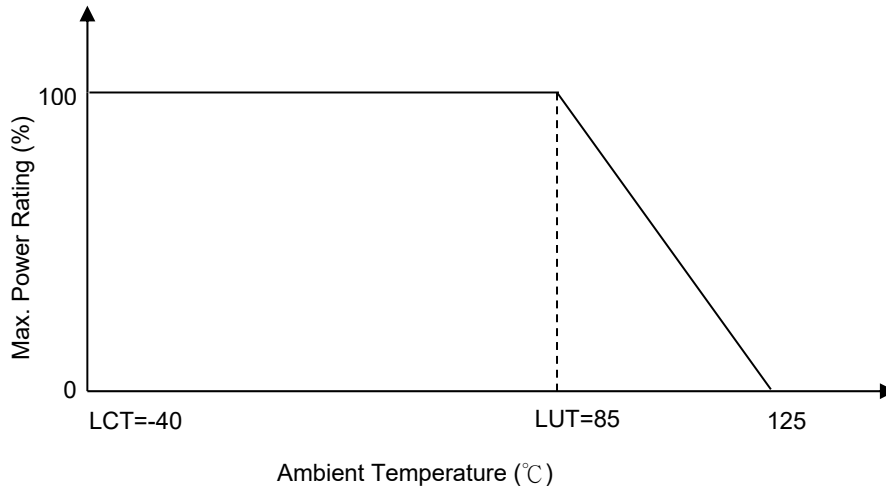
### Recommended Reworking Conditions with Soldering Iron

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



### Power Derating Curve

When operating temperature exceeds 85°C, the power, the Max.continuous operation Voltage, the Max.Surge Current and the Max.Energy should be derated as below figure, the derated coefficient is -2.5%.



### RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS directive 2011/65/EU.

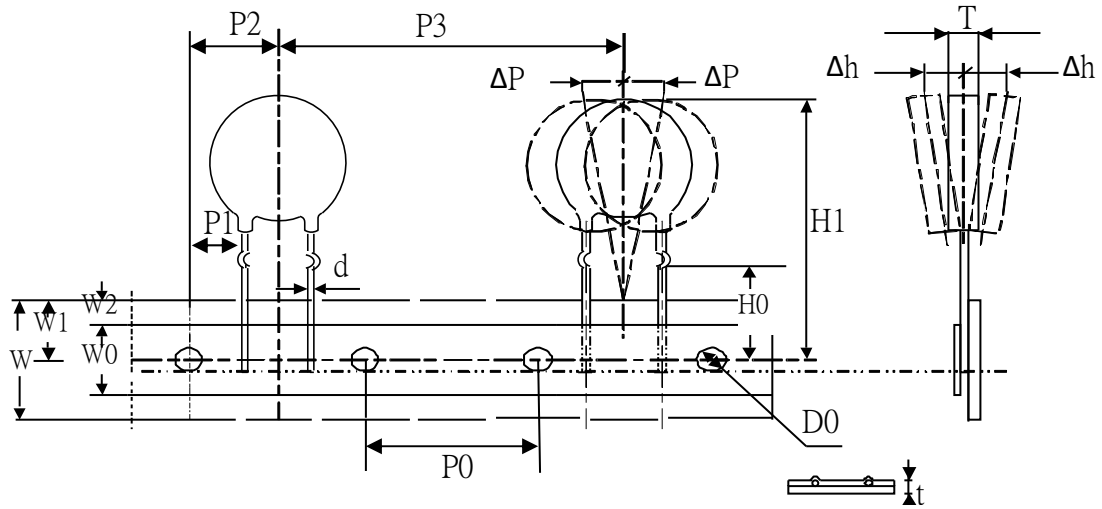
### Warehouse Storage Conditions of Products

(I) Storage Conditions :

- 1.Storage Temperature : -10°C~+40°C
- 2.Relative Humidity :  $\leq 75\%RH$
- 3.Keep away from corrosive atmosphere and sunlight.

(II) Period of Storage : 1 year

Taping and Dimensions

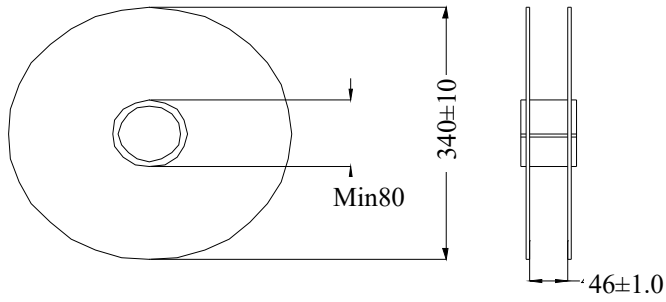


ITEM.	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	H <sub>0</sub>	H <sub>1</sub> Max	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub> Max	W	Δp Max	Δh Max	D <sub>0</sub>	t
Nor.	15	3.35	7.5	30	16	38	12	9	3	18	1.0	2.0	4	0.6
ToL.	±0.3	±1	±1.3	±1	±0.5	---	±1	+0.75/ -0.5	---	±1	---	---	±0.2	±0.2

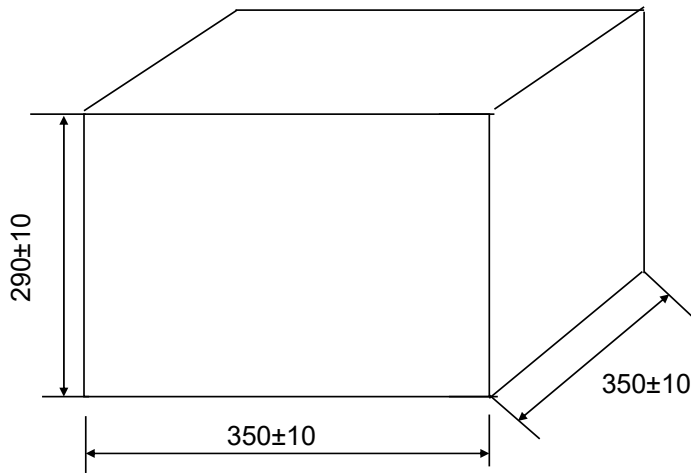
(Unit:mm)

Packaging

(1) SPQ: 500 Pcs/ Reel



(2) Outer Box: 5Reels/ Carton



(Unit:mm)

Safety Approvals (Certified Model/Type :TVR14471)

- \* UL 1449 4th / cUL recognized (File # E314979)
- UL1449 (file number E314979) for use in SPD Type 5
- Meet the surge requirements 6KV/3KA combination wave of IEC 60950-1 Annex Q and IEC 60065 14.12



- \* CSA 22.2 recognized (File # 97495)



- \* VDE IEC 61051-1:2007-04 / IEC 61051-2:1991
- IEC 61051-2-2:1991/IEC 60950-1:2013 Annex Q recognized (File # 40031391)



- \* CQC GB/T10193-1997 ` GB/T10194-1997 recognized  
(File # CQC03001005165/CQC03001007654)

Certificates

- (1) IATF 16949 certificate
- (2) ISO 9001 certificate

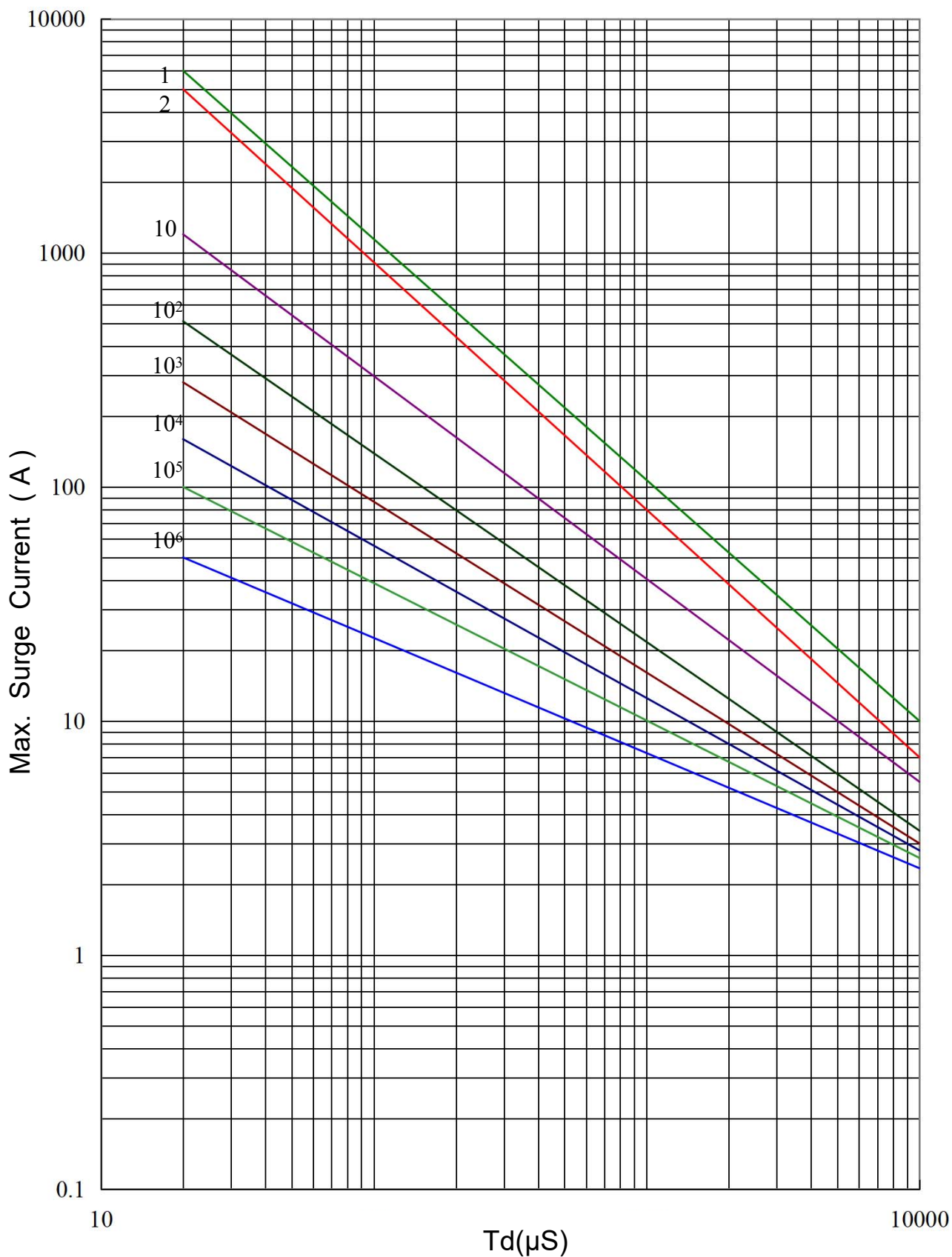
Test Report

- (1) RoHS test report



Max. Surge Current Derating Curves

**TVR14471KOER9BY**





Max. Leakage Current and Max. Clamping Voltage Curve

