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## SPECIFICATION FOR APPROVAL

CUSTOMER	Codico
CERTIFIED MODEL/TYPE	TVR20471R
PART NO.	TVR20471KSR (RoHS+HF)
APPLICATION	
CUSTOMER P/N	
ISSUE DATE	Mar.12.2016
REV. NO	
REV. DATE	

<b>FOR CUSTOMER APPROVAL</b>	<b>CHECKED BY</b>
	Yuan Yuan
	<b>APPROVED BY</b>
	Huaifang Zhang





**REVISED RECORD SHEET**

REV. NO	REV. DATE	REVISED CONTENT



<b>INDEX</b>	<b>Page</b>
■ Part Number Code	1
■ Structure and Dimensions	2
■ Electrical Characteristics	2
■ Reliability	3 ~ 4
■ Soldering Recommendation	5
■ Power Derating Curve	6
■ RoHS Compliant Declaration	6
■ Warehouse Storage Conditions of Products	6
■ Safety Approvals	7
■ Certificates	7
■ Max. Surge Current Derating Curves	8
■ Max. Leakage Current and Max. Clamping Voltage Curve	9

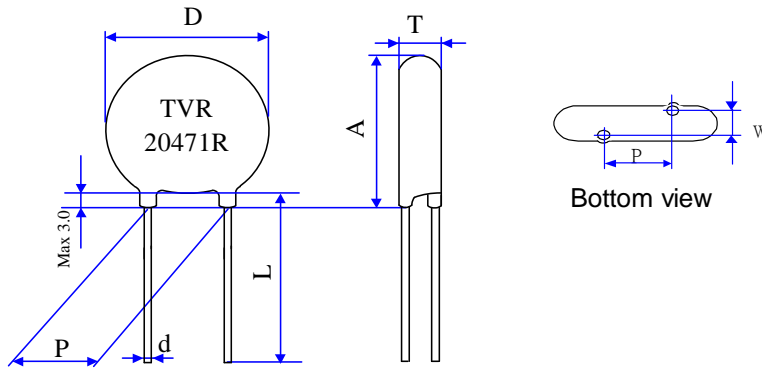
Part Number Code

Example :

**TVR**    **20**    **471**    **K**    **S**    **R**  
**(1)**    **(2)**    **(3)**    **(4)**    **(5)**    **(6)**

No.	Item	Digit	Specification
(1)	Product Type	TVR	Thinking varistor TVR type
(2)	Body Size	20	$\phi$ 20 mm
(3)	Varistor Voltage	471	$47 \times 10^1 \text{ V} = 470\text{V} (V_{1\text{mA}})$
(4)	Tolerance of $V_{1\text{mA}}$	K	$\pm 10\%$
(5)	Appearance	S	Straight lead , epoxy coating
(6)	Optional Suffix	R	RoHS+HF compliance UL Type 5 applications

Structure and Dimensions



( unit : mm )

Body Size	D	P	d	A max.	L min.	T	W
$\phi 20$	19.5~22.0	10.0 $\pm$ 1	1.00 $\pm$ 0.02	25.5	22.5	4.0~6.0	2.8 $\pm$ 1.0

**\*Coating material rating:UL 94 V-0**

Electrical Characteristics ( Ambient  $T_a=25^\circ\text{C}$  )

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20 $\mu$ S)		Max. Surge Current (8/20 $\mu$ S)	Max. Energy (10/1000 $\mu$ S)
	$V_{1mA}$ (V)	$V_{AC(rms)}$ (V)	$V_{DC}$ (V)	$V_p$ (V)	$I_p$ (A)	$I$ (A)	$W$ (J)
TVR20471KSR	470 $\pm$ 10 %	300	385	775	100	6500	220

Part No.	Rated Power	Impulse Response Time	Max. Leakage Current at 75% $V_{1mA}$	Operating Temperature Range	Storage temperature Range	Applications		
	P (W)	nSec	$I_L(\mu\text{A})$	( $^\circ\text{C}$ )	( $^\circ\text{C}$ )	UL 1449	IEC 60950-1	IEC 60065
TVR20471KSR	1	<25	20	-40 ~ +85	-40 ~ +125	SPD Type 5	Annex Q	Clause 14.12



Reliability

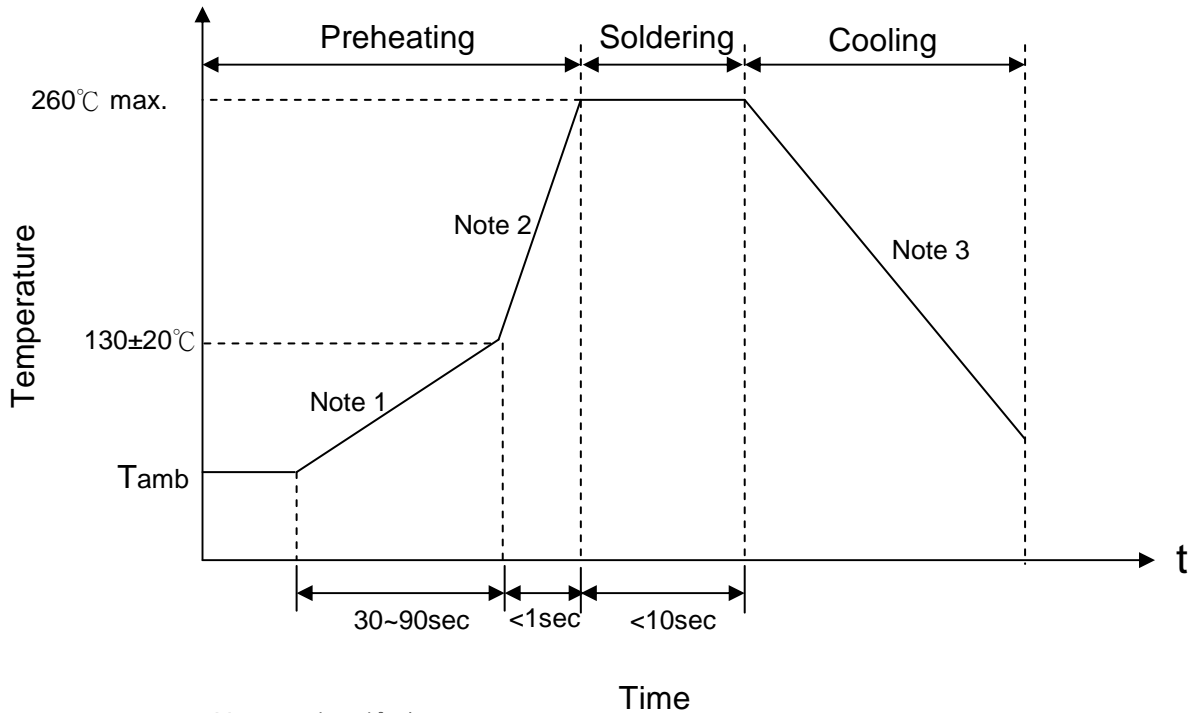
Item	Standard	Test conditions / Methods	Specifications															
Tensile Strength of Terminals	IEC60068-2-21	Gradually applying the force specified and keeping the unit fixed for 10±1 sec.  <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Terminal diameter (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
Nominal Discharge Current test	UL1449 4 <sup>th</sup>	3KA 8/20μs waveform with Vac(@ Deg 90) for 15 times. Interval time between tests is 60 secs.	ΔVp /Vp   ≤ 10 % No visible damage
8/20μS Surge Life	IEC 61051-1 4.6	10,000 pulses( 8/20 μ S ) , unipolar, interval 10 secs, amplitude corr. to max. Surge current derating curves for 20 μ S	ΔV/V <sub>1mA</sub>   ≤ 10% No visible damage
10/1000μS Surge Life	IEC 61051-1 4.6	10/1000μS waveform, 10 surge currents,unipolar,interval 2mins, amplitude corr. to max. surge current derating curves for 1000μS	ΔV/V <sub>1mA</sub>   ≤ 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 ≤ TC ≤ 0.05(%/°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

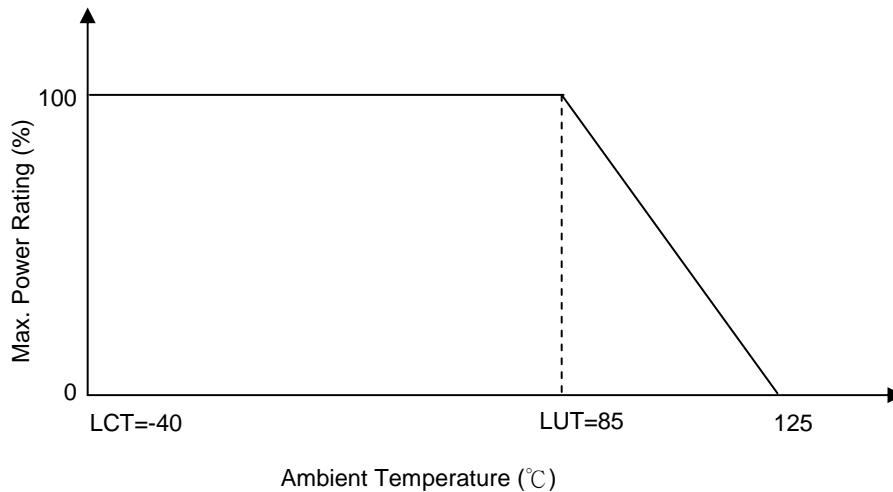
### ■ Recommended Reworking Conditions with Soldering Iron

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

Safety Approvals (Certified Model/Type :TVR20471R)

- \* UL 1449 4th / cUL recognized (File # E314979)
- UL1449 (file number E314979) for use in SPD Type 5



- \* VDE IEC 61051-1:2007-04 / IEC 61051-2:1991
- IEC 61051-2-2:1991/IEC 60950-1:2013 Annex Q recognized (File # 5944)



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

Certificates

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

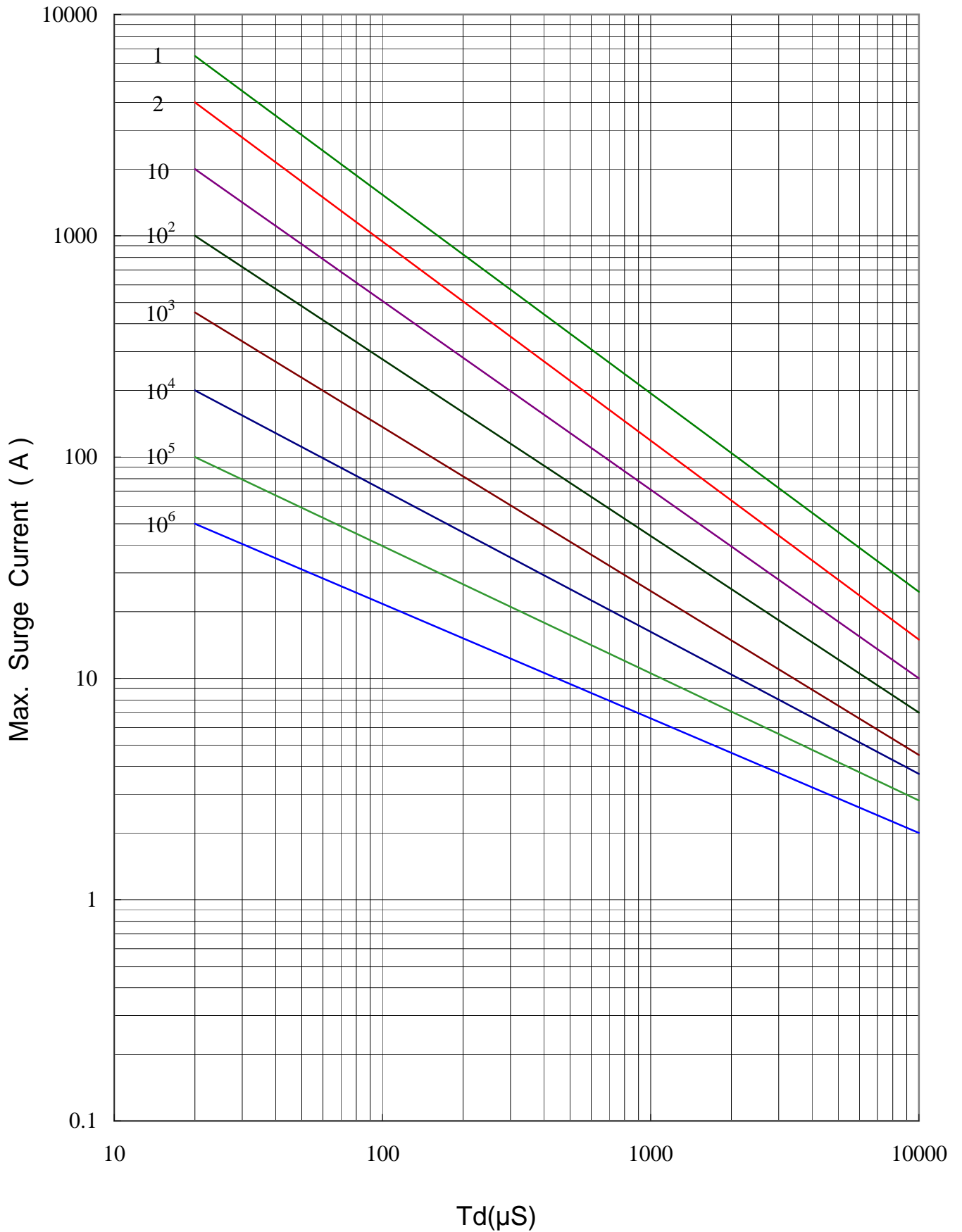
Test Report

- (1) RoHS test report
- (2) Halogen-free test report



Max. Surge Current Derating Curves

**TVR20471KSR**





Max. Leakage Current and Max. Clamping Voltage Curve

TVR20471KSR

