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## SPECIFICATION FOR APPROVAL

|                         |                           |
|-------------------------|---------------------------|
| CUSTOMER                | Blume-AVM                 |
| CERTIFIED<br>MODEL/TYPE | TVR10471-V                |
| PART NO.                | TVR10471KOAR631V(RoHS+HF) |
| APPLICATION             |                           |
| CUSTOMER P/N            |                           |
| ISSUE DATE              | Jan.12.2023               |
| REV. NO.                |                           |
| REV. DATE               |                           |

| FOR CUSTOMER APPROVAL | CHECKED BY     |
|-----------------------|----------------|
|                       | Yuan Yuan      |
|                       | APPROVED BY    |
|                       | Huaifang Zhang |





| REV. NO | REV. DATE | REVISED CONTENT |
|---------|-----------|-----------------|
|         |           |                 |



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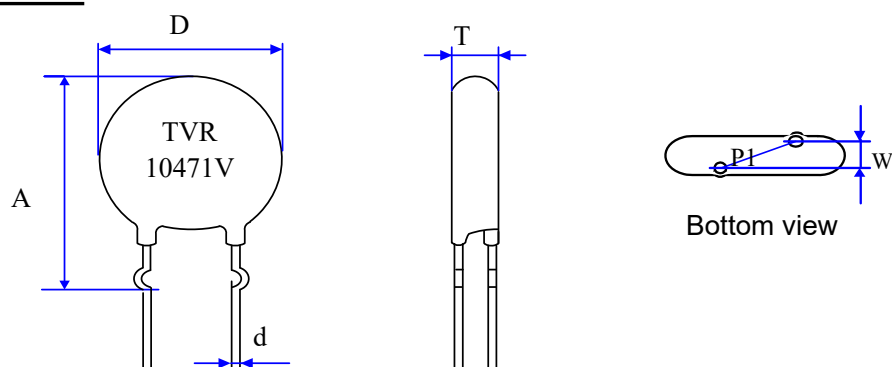
Part Number Code

Example :

**TVR**    **10**    **471**    **K**    **O**    **AR**    **631V**  
(1)        (2)        (3)        (4)        (5)        (6)        (7)

| No. | Item                          | Digit | Specification                                                                     |
|-----|-------------------------------|-------|-----------------------------------------------------------------------------------|
| (1) | Product Type                  | TVR   | Thinking varistor TVR type                                                        |
| (2) | Body Size                     | 10    | φ 10 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     | ±10%                                                                              |
| (5) | Appearance                    | O     | Kink -out Lead ; Epoxy Coating                                                    |
| (6) | Packaging                     | A     | Repositioning tapping ( hole pitch: 12.7mm)                                       |
|     |                               | R     | reel                                                                              |
| (7) | Optional Suffix               | 631V  | RoHS+HF compliance &Multisurge series & meet the type 5 application in UL1449-5th |

## Structure and Dimensions



( unit : mm )

| Body Size | D        | P             | d               | A max. | T       | W             |
|-----------|----------|---------------|-----------------|--------|---------|---------------|
| $\phi 10$ | 9.5~12.5 | 7.5 $\pm$ 0.5 | 0.80 $\pm$ 0.02 | 15.0   | 4.4~6.6 | 2.6 $\pm$ 1.0 |

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

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

| Part No.         | Varistor Voltage<br>(@ 1mA DC) | Max. Continuous Voltage |                 | Max. Clamping<br>Voltage<br>(8/20 $\mu$ S) |              | Max. Surge<br>Current<br>(8/20 $\mu$ S) |
|------------------|--------------------------------|-------------------------|-----------------|--------------------------------------------|--------------|-----------------------------------------|
|                  | $V_{1mA}$<br>(V)               | $V_{AC(rms)}$<br>(V)    | $V_{DC}$<br>(V) | $V_p$<br>(V)                               | $I_p$<br>(A) | $I$<br>(A)                              |
| TVR10471KOAR631V | 470 $\pm$ 10 %                 | 300                     | 385             | 775                                        | 25           | 3500                                    |

| Part No.         | Max. Energy<br>(10/1000 $\mu$ S) | Rated Power | Impulse Response Time | Max. Leakage Current at<br>75% $V_{1mA}$ | Operating Temperature Range | Storage temperature Range |
|------------------|----------------------------------|-------------|-----------------------|------------------------------------------|-----------------------------|---------------------------|
|                  | W<br>(J)                         | P<br>(W)    | nSec                  | $I_L(\mu\text{A})$                       | ( $^\circ\text{C}$ )        | ( $^\circ\text{C}$ )      |
| TVR10471KOAR631V | 85                               | 0.4         | <25                   | 20                                       | -40 ~ +105                  | -40 ~ +125                |

## Reliability

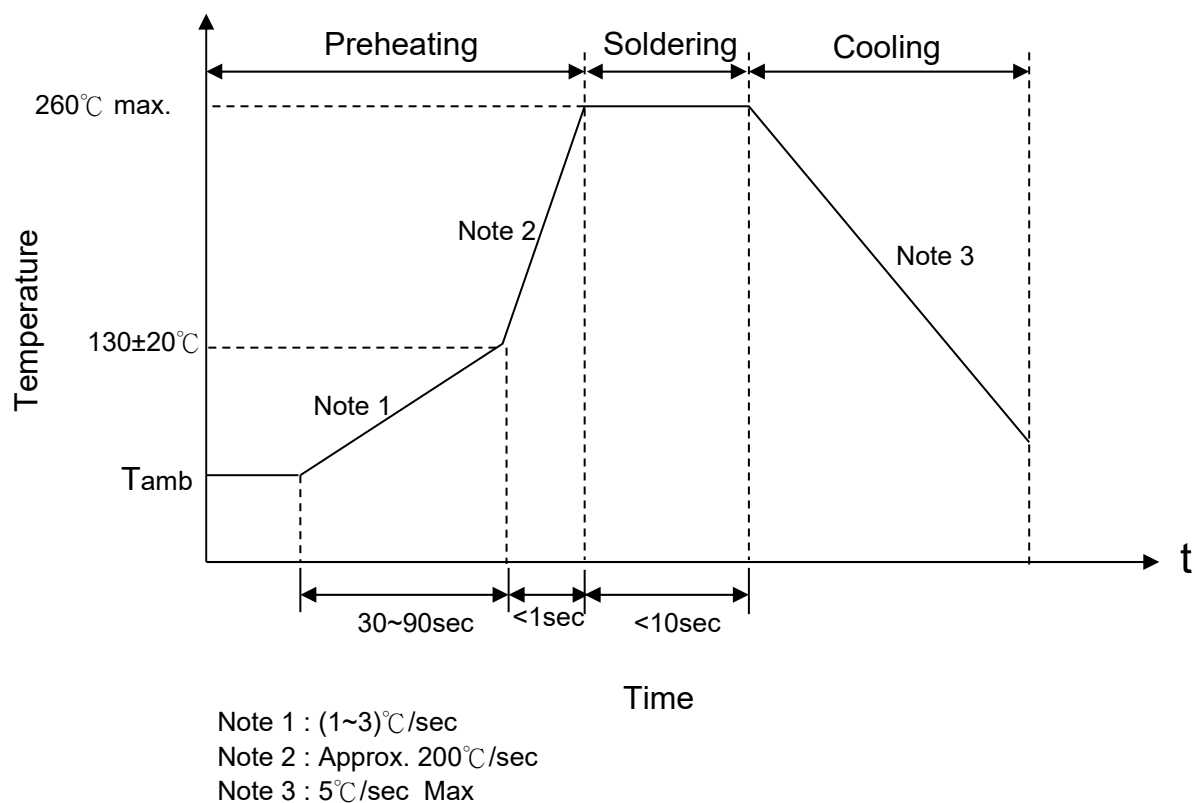
| Item                          | Standard               | Test conditions / Methods                                                                                                                                                                                                                                                                                                                                                                 | Specifications                                                                     |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
|-------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------|------------------|-----|------------|--------|--------|------------------|--------------------------------------------------|---|---------|--------|---|------------------|-------|--------------------------------------------------|
| Tensile Strength of Terminals | IEC60068-2-21          | Gradually applying the force specified and keeping the unit fixed for 10±1 sec.<br><table><tr><td>Terminal diameter (mm)</td><td>Force (Kg)</td></tr><tr><td>0.5&lt;d≤0.8</td><td>1.0</td></tr><tr><td>0.8&lt;d≤1.25</td><td>2.0</td></tr><tr><td>1.25&lt;d</td><td>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<br>  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.<br><table><tr><td>Terminal diameter (mm)</td><td>Force (Kg)</td></tr><tr><td>0.5&lt;d≤0.8</td><td>0.5</td></tr><tr><td>0.8&lt;d≤1.25</td><td>1.0</td></tr><tr><td>1.25&lt;d</td><td>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<br>  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<br>Amplitude:0.75mm or 98m/S <sup>2</sup><br>Direction:3 mutually perpendicular directions,2hrs each.                                                                                                                                                                                                                                                             | ΔV/V <sub>1mA</sub>   ≤5%<br>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<br>  ΔV/V <sub>1mA</sub>   ≤5%                                   |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| High Temperature Storage      | IEC60068-2-2           | 125 ± 5 °C , 1000 ± 24 hrs                                                                                                                                                                                                                                                                                                                                                                | No visible damage<br>  ΔV/V <sub>1mA</sub>   ≤5%                                   |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| Damp Heat, Steady State       | IEC 60068-2-78         | The test is divided into two groups .<br>a.40 ± 2°C , 90 ~ 95 % RH , 1344 hrs<br>b.40 ± 2°C , 90 ~ 95 % RH , at 10%V <sub>DC</sub> , 1344 hrs                                                                                                                                                                                                                                             | No visible damage<br>  ΔV/V <sub>1mA</sub>   ≤10%<br>Insulation Resistance ≥ 100MΩ |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| Rapid Change of Temperature   | IEC60068-2-14          | The conditions shown below shall be repeated 5 cycles<br><table><tr><td>Step</td><td>Temperature (°C)</td><td>Period (minutes)</td></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>105 ± 2</td><td>30 ± 3</td></tr><tr><td>4</td><td>Room temperature</td><td>5 ± 3</td></tr></table>                  | Step                                                                               | Temperature (°C) | Period (minutes) | 1   | -40 ± 3    | 30 ± 3 | 2      | Room temperature | 5 ± 3                                            | 3 | 105 ± 2 | 30 ± 3 | 4 | Room temperature | 5 ± 3 | No visible damage<br>  ΔV/V <sub>1mA</sub>   ≤5% |
| Step                          | Temperature (°C)       | Period (minutes)                                                                                                                                                                                                                                                                                                                                                                          |                                                                                    |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| 1                             | -40 ± 3                | 30 ± 3                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                    |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| 2                             | Room temperature       | 5 ± 3                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                    |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| 3                             | 105 ± 2                | 30 ± 3                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                    |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| 4                             | Room temperature       | 5 ± 3                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                    |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |
| High Temp. Load               | MIL-STD-202 Method 108 | 105± 2 °C , 1000 ± 24 hrs, at V <sub>DC</sub> or V <sub>rms</sub> (Max. Operating Voltage)                                                                                                                                                                                                                                                                                                | ΔV/V <sub>1mA</sub>   ≤10%<br>No visible damage                                    |                  |                  |     |            |        |        |                  |                                                  |   |         |        |   |                  |       |                                                  |



| Item                                        | Standard                  | Test conditions / Methods                                                                                                                                                                                                                                                                                                                                                            | Specifications                                      |
|---------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| 8/20 $\mu$ S<br>Surge Life                  | IEC 61051-1 4.6           | 10 pulses( 8/20 $\mu$ S) , unipolar, interval 30 secs,amplitude corr. to max. Surge current derating curves for 20 $\mu$ S.                                                                                                                                                                                                                                                          | $ \Delta V/V_{1mA}  \leq 10\%$<br>No visible damage |
| 10/1000 $\mu$ S<br>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\%$<br>No visible damage |
| Varistor<br>Voltage<br>Temp.<br>Coefficient | Specification<br>Standard | $\frac{V_{1mA} \text{ at } 105^{\circ}\text{C} - V_{1mA} \text{ at } 25^{\circ}\text{C}}{V_{1mA} \text{ at } 25^{\circ}\text{C}} \times \frac{1}{80} \times 100 (\% / ^{\circ}\text{C})$<br>$\frac{V_{1mA} \text{ at } -40^{\circ}\text{C} - V_{1mA} \text{ at } 25^{\circ}\text{C}}{V_{1mA} \text{ at } 25^{\circ}\text{C}} \times \frac{1}{65} \times 100 (\% / ^{\circ}\text{C})$ | $-0.05 \leq TC \leq 0.05 (\% / ^{\circ}\text{C})$   |
| Voltage<br>Proof                            | IEC 61051-1 4.9           | Metal balls method, 2500 Vac 1 min                                                                                                                                                                                                                                                                                                                                                   | No visible damage                                   |

## Soldering Recommendation

### ■ Wave Soldering Profile



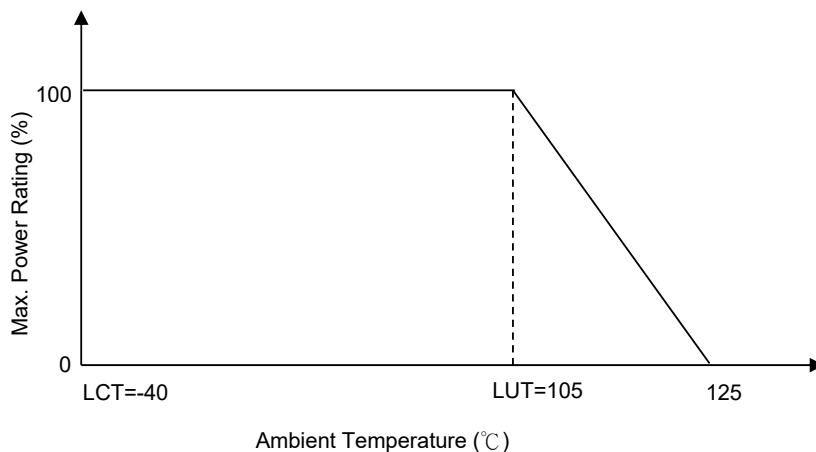
### ■ Recommended Reworking Conditions with Soldering Iron

| Item                              | Conditions                   |
|-----------------------------------|------------------------------|
| Temperature of Soldering Iron-tip | $360^{\circ}\text{C}$ (max.) |
| Soldering Time                    | 3 sec (max.)                 |
| Distance from Varistor            | 2 mm (min.)                  |



### Power Derating Curve

When operating temperature exceeds 105°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 -5%.



### RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS directive 2015/863/EU.

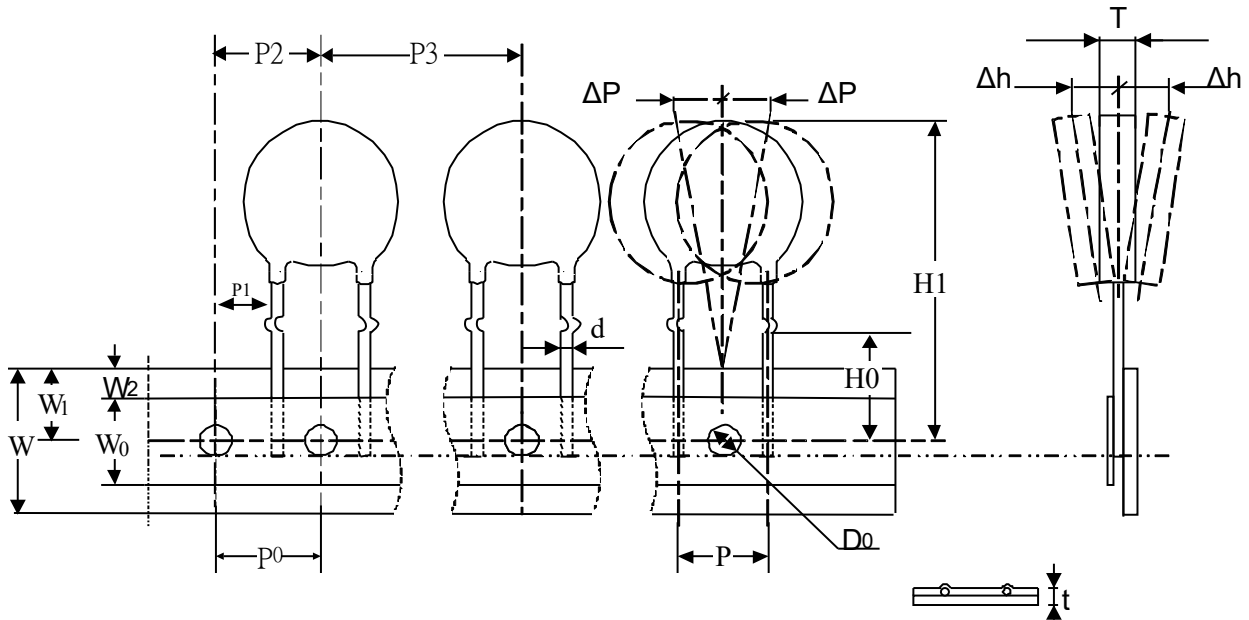
### Warehouse Storage Conditions of Products

(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

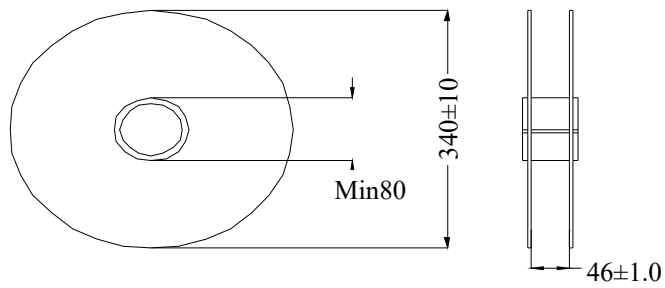


( Unit : mm )

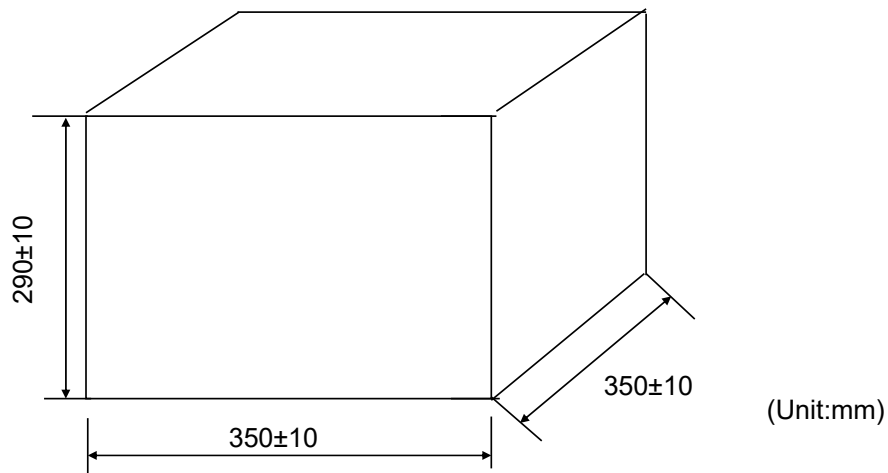
| ITEM. | $P_0$     | $P$       | $P_1$   | $P_2$     | $P_3$   | $H_0$     | $H_1$<br>Max | $W_0$   | $W_1$        | $W_2$<br>Max | $W$     | $\Delta P$<br>Max | $\Delta h$<br>Max | $D_0$     | $t$       |
|-------|-----------|-----------|---------|-----------|---------|-----------|--------------|---------|--------------|--------------|---------|-------------------|-------------------|-----------|-----------|
| Nor.  | 12.7      | 7.5       | 8.55    | 12.7      | 12.7    | 16        | 33.5         | 12      | 9            | 3            | 18      | 1.0               | 2.0               | 4         | 0.6       |
| ToL.  | $\pm 0.3$ | $\pm 0.5$ | $\pm 1$ | $\pm 1.3$ | $\pm 1$ | $\pm 0.5$ | ---          | $\pm 1$ | $+0.75/-0.5$ | ---          | $\pm 1$ | ---               | ---               | $\pm 0.2$ | $\pm 0.2$ |

## Packaging

(1) SPQ: 1000 Pcs/ Reel



(2) Outer Box: 5Reels/ Carton



Safety Approvals (Certified Model/Type :TVR10471-V)

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



- \* TUV recognized (File J50411758)



- \*VDE IEC 61051-1:2007/IEC 61051-2:1991/ IEC 61051-2-2:1991  
DIN EN 61051-1:2009/IEC 61051-2 AMD1:2009  
IEC 62368-1:2014/G.8.2 recognized(File # 5944)



- \* CQC GB/T10193-1997 ` GB/T10194-1997 recognized  
(File # CQC10001041749/CQC10001041748)

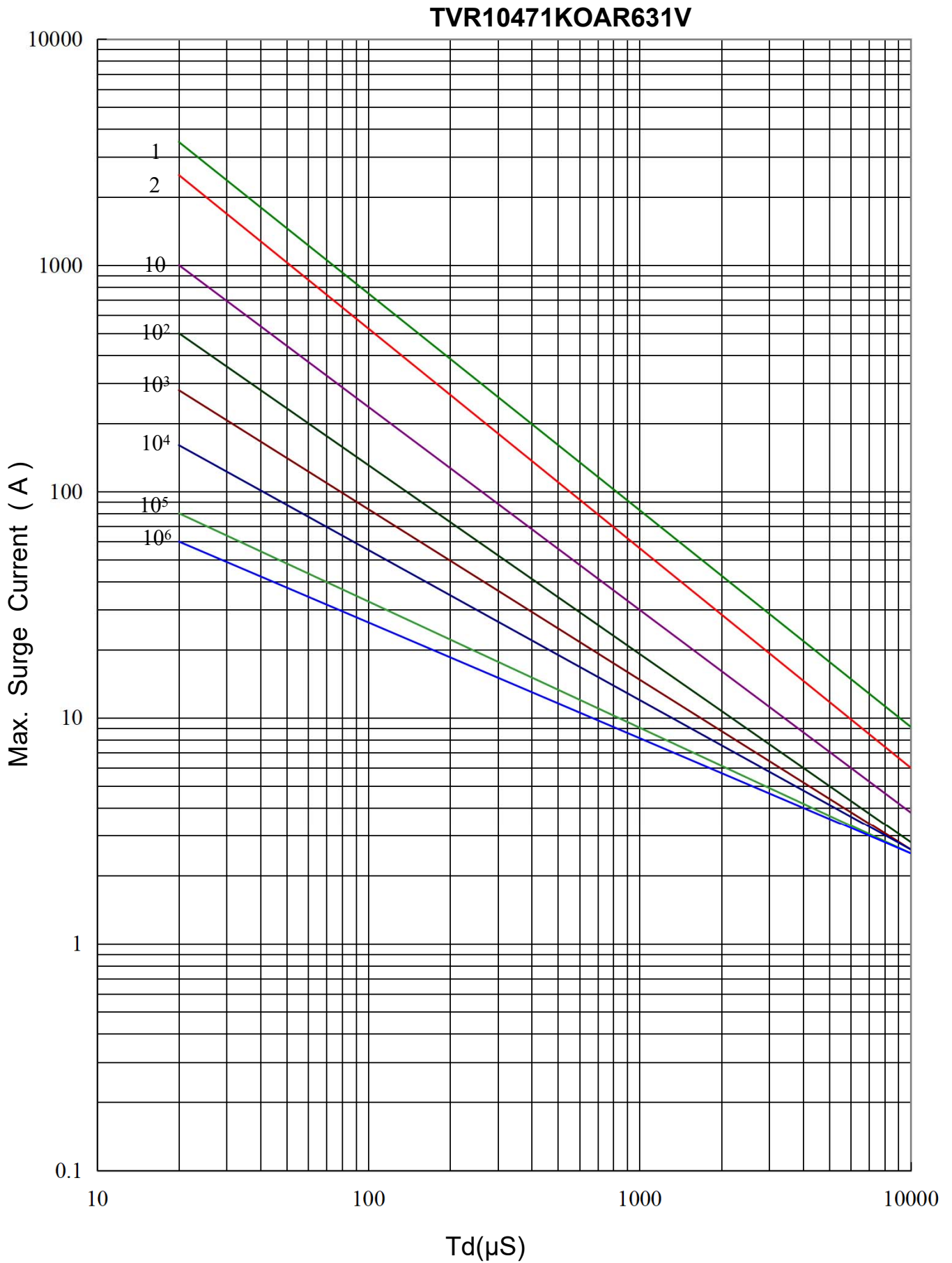
Certificates

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

Test Report

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

Max. Surge Current Derating Curves



Max. Leakage Current and Max. Clamping Voltage Curve

