

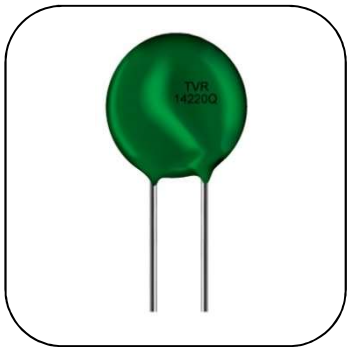
# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



■ Feature

- 1. High energy absorption, particularly for load dump
- 2. Jump-start capable (5 minutes)
- 3. AEC-Q200 qualified
- 4. Superior resistance to cyclic temperature stress
- 5. Operating temperature range: -40°C~+125 °C
- 6. Agency approval: UL, TUV, CQC



■ Recommended Applications

- 1. Automotive electronics
- 2. Low voltage circuit of power supply application
- 3. Low voltage circuit of industrial application

■ Part Number Code

|              |                              |           |       |                                     |                          |                               |      |            |                                  |           |                                             |                 |                                                                           |                       |    |
|--------------|------------------------------|-----------|-------|-------------------------------------|--------------------------|-------------------------------|------|------------|----------------------------------|-----------|---------------------------------------------|-----------------|---------------------------------------------------------------------------|-----------------------|----|
| T            | V                            | R         | 0     | 7                                   | 4                        | 3                             | 1    | K          | L                                | A         | R                                           | Q               | 0                                                                         | 0                     | M  |
| 1            | 2                            | 3         | 4     | 5                                   | 6                        | 7                             | 8    | 9          | 10                               | 11        | 12                                          | 13              | 14                                                                        | 15                    | 16 |
| Product Type |                              | Body Size |       | Varistor Voltage(V <sub>1mA</sub> ) |                          | Tolerance of V <sub>1mA</sub> |      | Appearance |                                  | Packaging |                                             | Optional Suffix |                                                                           | Internal Control Code |    |
| TVR          | THINKING Varistor TVR Series | 07        | Φ7mm  | 220                                 | 22x10 <sup>0</sup> V=22V | K                             | ±10% | L          | Straight lead, silicon coating   | AR        | Tape & reel packing (hole pitch:12.7mm)     | M               | Varistor for automotive applications (When internal control code is used) | Q00~QZZ               |    |
|              |                              | 10        | Φ10mm |                                     |                          | L                             | ±15% | W          | Outer kink lead, silicon coating | ER        | Tape & reel packing (hole pitch:15.0mm)     |                 |                                                                           |                       |    |
|              |                              | 14        | Φ14mm |                                     |                          | M                             | ±20% |            |                                  | AB        | Tape & ammo box packing (hole pitch:12.7mm) |                 |                                                                           |                       |    |
|              |                              | 20        | Φ20mm |                                     |                          |                               |      |            |                                  | EB        | Tape & ammo box packing (hole pitch:15.0mm) |                 |                                                                           |                       |    |
|              |                              |           |       |                                     |                          |                               |      |            |                                  | Blank     | Bulk                                        |                 |                                                                           |                       |    |

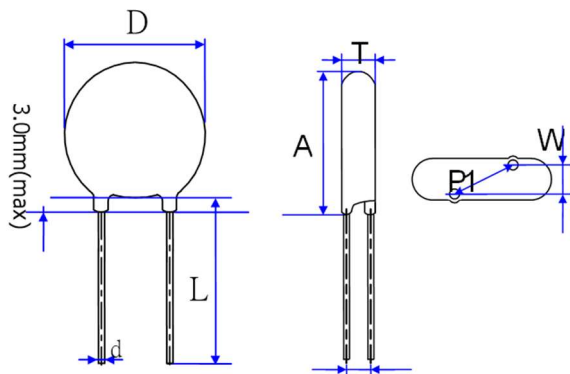
# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



### Structure & Dimensions

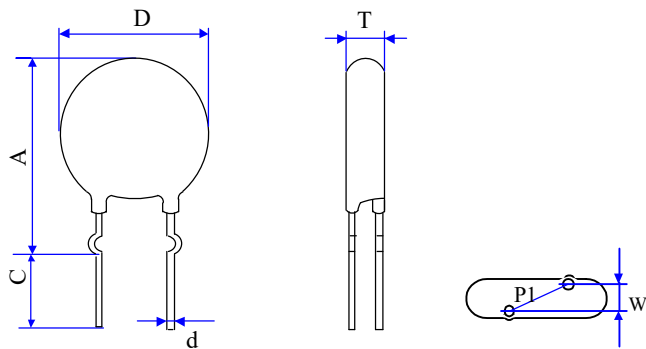
#### L Type (Straight Lead)



(Unit: mm)

| Series  | D         | Amin. | Lmin | $\Phi d\pm0.02$ | $P1\pm1.0$ | T & W                                                  |
|---------|-----------|-------|------|-----------------|------------|--------------------------------------------------------|
| TVR07-M | 7.5~9.6   | 11.0  | 26.5 | 0.6             | 5.0        | Please refer to<br>Electrical<br>Characteristics Table |
| TVR10-M | 11.0~14.4 | 15.0  | 26.5 | 0.8             | 7.5        |                                                        |
| TVR14-M | 14.4~18.0 | 18.5  | 26.5 | 0.8             | 7.5        |                                                        |
| TVR20-M | 20.0~24.0 | 25.5  | 22.5 | 1.0             | 10.0       |                                                        |

#### W Type (Outer Kink Lead)



(Unit: mm)

| Series  | Dmax. | Amax | Cmin | $\Phi d\pm0.02$ | $P1\pm1.0$ | T & W                                                  |
|---------|-------|------|------|-----------------|------------|--------------------------------------------------------|
| TVR10-M | 14.4  | 20.0 | 20.0 | 20              | 0.8        | Please refer to<br>Electrical<br>Characteristics Table |
| TVR14-M | 18.0  | 22.5 | 22.5 | 20              | 0.8        |                                                        |

Note: Size of C is customized, and tolerance of cut lead product is  $\pm0.5$  (Please refer to minimal size in the chart above if customers do not request). Popular minimal size of cut lead products is  $3.5\pm0.5$ mm.

# Varistor: TVR-M Series

Dip Type Varistor for Automotive Application (Low Voltage Series)



## Electrical Characteristics

### Low Voltage Series

| Part No.         | Varistor Voltage<br>(@ 1mA DC) | Max.<br>Continuous<br>Voltage | Max.<br>Clamping<br>Voltage<br>(8/20μs) |                | Max.<br>Surge<br>Current<br>(8/20μs) | V <sub>jump</sub><br>(5min) | Rated<br>Power | Max.<br>Energy<br>(10/1000μs) | Load Dump<br>(ISO7637 Pulse<br>5a, 10 times) | Dimension        |                  |     |
|------------------|--------------------------------|-------------------------------|-----------------------------------------|----------------|--------------------------------------|-----------------------------|----------------|-------------------------------|----------------------------------------------|------------------|------------------|-----|
|                  | V <sub>1mA</sub>               | V <sub>DC</sub>               | V <sub>P</sub>                          | I <sub>P</sub> | I <sub>max</sub>                     | (V)                         | P              | W <sub>max</sub>              |                                              | T <sub>min</sub> | T <sub>max</sub> | W±1 |
|                  | (V)                            | (V)                           | (V)                                     | (A)            | (A)                                  |                             | (W)            | (J)                           |                                              | (J)              | (mm)             |     |
| 12V Power System |                                |                               |                                         |                |                                      |                             |                |                               |                                              |                  |                  |     |
| TVR07180         | 18(14.4~21.6)                  | 14                            | 36                                      | 2.5            | 500                                  | 20                          | 0.02           | 1.1                           | 12                                           | 2.3              | 3.9              | 1.3 |
| TVR10180         | 18(14.4~21.6)                  | 14                            | 36                                      | 5              | 1000                                 | 20                          | 0.05           | 2.6                           | 25                                           | 2.7              | 4.3              | 1.3 |
| TVR14180         | 18(14.4~21.6)                  | 14                            | 36                                      | 10             | 2000                                 | 20                          | 0.1            | 5.2                           | 50                                           | 2.7              | 4.3              | 1.3 |
| TVR20180         | 18(14.4~21.6)                  | 14                            | 36                                      | 20             | 3000                                 | 20                          | 0.2            | 13                            | 100                                          | 3.1              | 4.7              | 1.3 |
| TVR07220         | 22(18.7~26.0)                  | 18                            | 43                                      | 2.5            | 500                                  | 25                          | 0.02           | 1.3                           | 12                                           | 2.4              | 4.1              | 1.4 |
| TVR10220         | 22(18.7~26.0)                  | 18                            | 43                                      | 5              | 1000                                 | 25                          | 0.05           | 3.2                           | 25                                           | 2.8              | 4.5              | 1.4 |
| TVR14220         | 22(18.7~26.0)                  | 18                            | 43                                      | 10             | 2000                                 | 25                          | 0.1            | 6.3                           | 50                                           | 2.8              | 4.5              | 1.4 |
| TVR20220         | 22(18.7~26.0)                  | 18                            | 43                                      | 20             | 3000                                 | 25                          | 0.2            | 16                            | 100                                          | 3.2              | 4.9              | 1.4 |
| TVR07270         | 27(23.0~31.1)                  | 22                            | 53                                      | 2.5            | 500                                  | 30                          | 0.02           | 1.6                           | 12                                           | 2.6              | 4.3              | 1.5 |
| TVR10270         | 27(23.0~31.1)                  | 22                            | 53                                      | 5              | 1000                                 | 30                          | 0.05           | 3.9                           | 25                                           | 3.0              | 4.7              | 1.5 |
| TVR14270         | 27(23.0~31.1)                  | 22                            | 53                                      | 10             | 2000                                 | 30                          | 0.1            | 7.8                           | 50                                           | 3.0              | 4.7              | 1.5 |
| TVR20270         | 27(23.0~31.1)                  | 22                            | 53                                      | 20             | 3000                                 | 30                          | 0.2            | 19                            | 100                                          | 3.4              | 5.1              | 1.5 |
| TVR07330         | 33(30~36)                      | 26                            | 65                                      | 2.5            | 500                                  | 36                          | 0.02           | 2.0                           | 12                                           | 2.9              | 4.5              | 1.7 |
| TVR10330         | 33(30~36)                      | 26                            | 65                                      | 5              | 1000                                 | 36                          | 0.05           | 4.8                           | 25                                           | 3.3              | 4.9              | 1.7 |
| TVR14330         | 33(30~36)                      | 26                            | 65                                      | 10             | 2000                                 | 36                          | 0.1            | 9.5                           | 50                                           | 3.3              | 4.9              | 1.7 |
| TVR20330         | 33(30~36)                      | 26                            | 65                                      | 20             | 3000                                 | 36                          | 0.2            | 24                            | 100                                          | 3.7              | 5.3              | 1.7 |
| 24V Power System |                                |                               |                                         |                |                                      |                             |                |                               |                                              |                  |                  |     |
| TVR07390         | 39(35~43)                      | 31                            | 77                                      | 2.5            | 500                                  | 42                          | 0.02           | 2.4                           | 12                                           | 2.9              | 4.5              | 1.8 |
| TVR10390         | 39(35~43)                      | 31                            | 77                                      | 5              | 1000                                 | 42                          | 0.05           | 5.6                           | 25                                           | 3.4              | 5.1              | 1.8 |
| TVR14390         | 39(35~43)                      | 31                            | 77                                      | 10             | 2000                                 | 42                          | 0.1            | 11                            | 50                                           | 3.4              | 5.1              | 1.8 |
| TVR20390         | 39(35~43)                      | 31                            | 77                                      | 20             | 3000                                 | 42                          | 0.2            | 28                            | 100                                          | 3.6              | 5.3              | 1.8 |
| TVR07470         | 47(42~52)                      | 38                            | 93                                      | 2.5            | 500                                  | 50                          | 0.02           | 2.8                           | 12                                           | 2.5              | 5.1              | 1.9 |
| TVR10470         | 47(42~52)                      | 38                            | 93                                      | 5              | 1000                                 | 50                          | 0.05           | 6.8                           | 25                                           | 2.9              | 5.5              | 1.9 |
| TVR14470         | 47(42~52)                      | 38                            | 93                                      | 10             | 2000                                 | 50                          | 0.1            | 14                            | 50                                           | 2.9              | 5.5              | 1.9 |
| TVR20470         | 47(42~52)                      | 38                            | 93                                      | 20             | 3000                                 | 50                          | 0.2            | 34                            | 100                                          | 3.9              | 5.9              | 1.9 |
| TVR07560         | 56(50~62)                      | 45                            | 110                                     | 2.5            | 500                                  | 59                          | 0.02           | 3.4                           | 12                                           | 2.7              | 5.55             | 2.4 |
| TVR10560         | 56(50~62)                      | 45                            | 110                                     | 5              | 1000                                 | 59                          | 0.05           | 8.1                           | 25                                           | 3.1              | 5.95             | 2.4 |
| TVR14560         | 56(50~62)                      | 45                            | 110                                     | 10             | 2000                                 | 59                          | 0.1            | 16                            | 50                                           | 3.1              | 5.95             | 2.4 |
| TVR20560         | 56(50~62)                      | 45                            | 110                                     | 20             | 3000                                 | 59                          | 0.2            | 41                            | 100                                          | 3.5              | 6.35             | 2.4 |

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## Dip Type Varistor for Automotive Application (Low Voltage Series)



### ■ Agency Approval 12V Power Supply

| Certified Model No. | Agency                                                                            |                                                                                                                                                                  |
|---------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |  |                                                                               |
|                     | EN/IEC 61051-1,<br>IEC 61051-2,<br>IEC 61051-2-2                                  | GB/T10193<br>GB/T10194                                                                                                                                           |
|                     | J 50259116<br>J 50405420                                                          | TVR07-M CQC15001128790 CQC15001128788<br>TVR10-M CQC13001090356 CQC13001090357<br>TVR14-M CQC15001128796 CQC15001128834<br>TVR20-M CQC15001128792 CQC15001128793 |
| TVR07180            | -                                                                                 | √                                                                                                                                                                |
| TVR10180            | -                                                                                 | √                                                                                                                                                                |
| TVR14180            | √                                                                                 | √                                                                                                                                                                |
| TVR20180            | √                                                                                 | √                                                                                                                                                                |
| TVR07220            | -                                                                                 | √                                                                                                                                                                |
| TVR10220            | -                                                                                 | √                                                                                                                                                                |
| TVR14220            | √                                                                                 | √                                                                                                                                                                |
| TVR20220            | √                                                                                 | √                                                                                                                                                                |
| TVR07270            | -                                                                                 | √                                                                                                                                                                |
| TVR10270            | -                                                                                 | √                                                                                                                                                                |
| TVR14270            | √                                                                                 | √                                                                                                                                                                |
| TVR20270            | √                                                                                 | √                                                                                                                                                                |
| TVR07330            | -                                                                                 | √                                                                                                                                                                |
| TVR10330            | -                                                                                 | √                                                                                                                                                                |
| TVR14330            | √                                                                                 | √                                                                                                                                                                |
| TVR20330            | √                                                                                 | √                                                                                                                                                                |

Note: If CQC certificates for other plants of THINKING group are required, please contact our sales window.

# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



Agency Approval

24V Power Supply

| Certified Model No. | Agency                                                                            |                                                                                                                                                                  |
|---------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |  |                                                                               |
|                     | EN/IEC 61051-1,<br>IEC 61051-2,<br>IEC 61051-2-2                                  | GB/T10193<br>GB/T10194                                                                                                                                           |
|                     | J 50259116<br>J 50405420                                                          | TVR07-M CQC15001128790 CQC15001128788<br>TVR10-M CQC13001090356 CQC13001090357<br>TVR14-M CQC15001128796 CQC15001128834<br>TVR20-M CQC15001128792 CQC15001128793 |
| TVR07390            | -                                                                                 | √                                                                                                                                                                |
| TVR10390            | -                                                                                 | √                                                                                                                                                                |
| TVR14390            | √                                                                                 | √                                                                                                                                                                |
| TVR20390            | √                                                                                 | √                                                                                                                                                                |
| TVR07470            | -                                                                                 | √                                                                                                                                                                |
| TVR10470            | -                                                                                 | √                                                                                                                                                                |
| TVR14470            | √                                                                                 | √                                                                                                                                                                |
| TVR20470            | √                                                                                 | √                                                                                                                                                                |
| TVR07560            | -                                                                                 | √                                                                                                                                                                |
| TVR10560            | -                                                                                 | √                                                                                                                                                                |
| TVR14560            | √                                                                                 | √                                                                                                                                                                |
| TVR20560            | √                                                                                 | √                                                                                                                                                                |

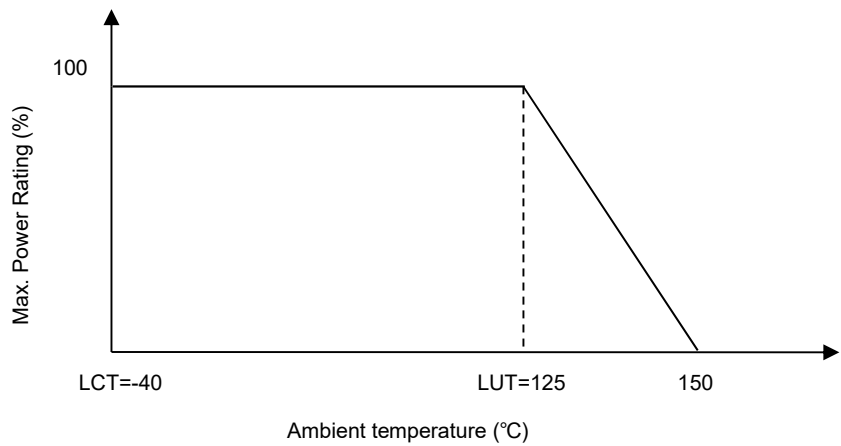
Note: If CQC certificates for other plants of THINKING group are required, please contact our sales window.

# Varistor: TVR-M Series

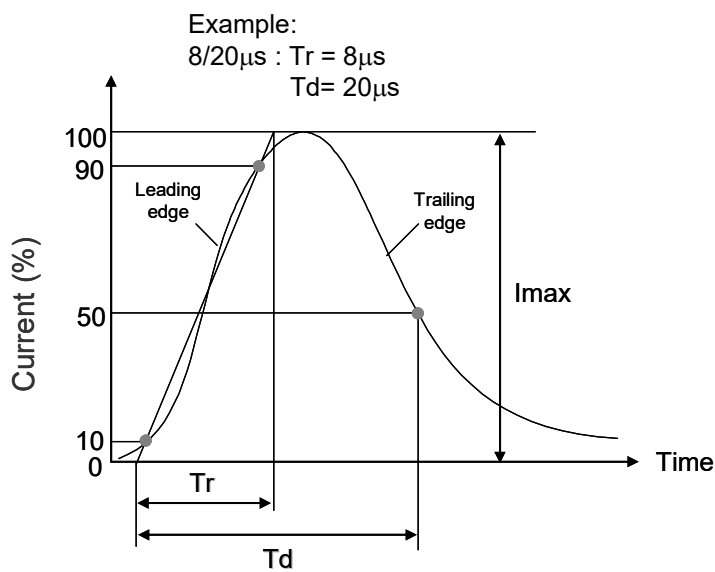
## Dip Type Varistor for Automotive Application (Low Voltage Series)



■ Power Derating Curve



■ Surge Current Standard Waveform



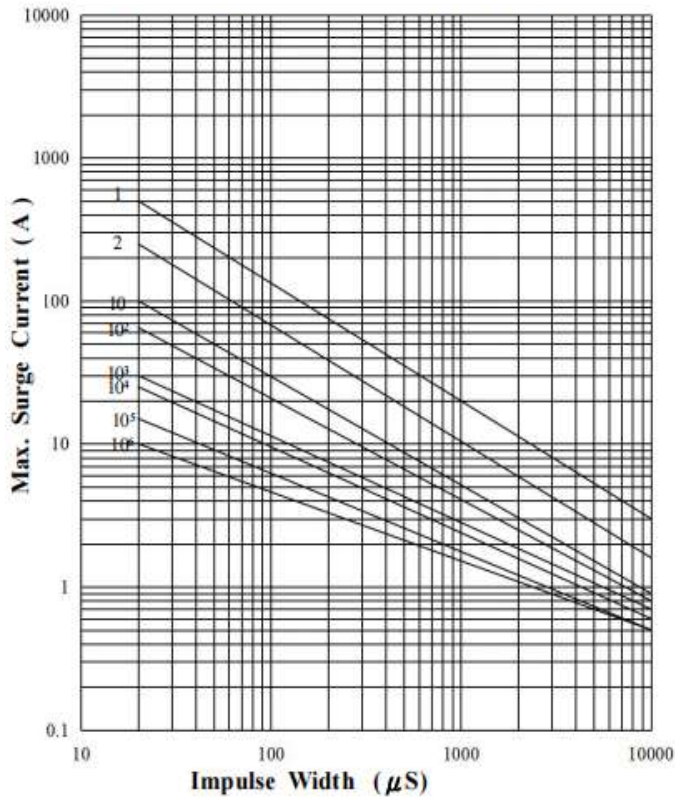
# Varistor: TVR-M Series

Dip Type Varistor for Automotive Application (Low Voltage Series)

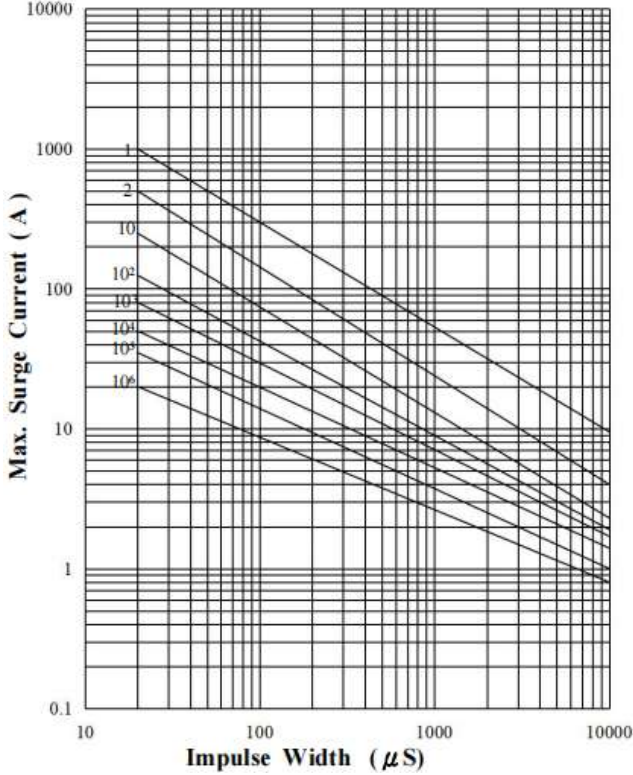


■ Max. Surge Current Derating Curves

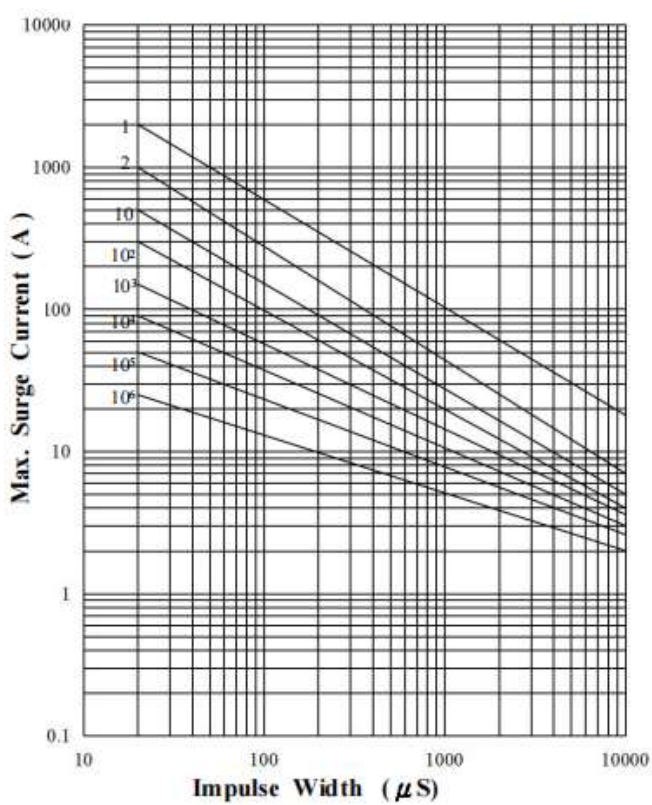
TVR07180M to TVR07560M



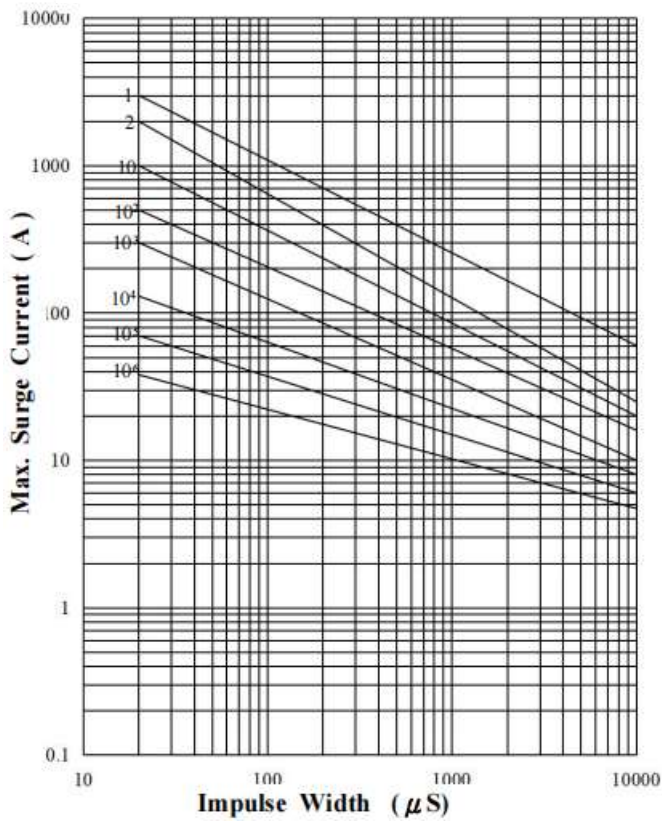
TVR10180M to TVR10560M



TVR14180M to TVR14560M



TVR20180M to TVR20560M



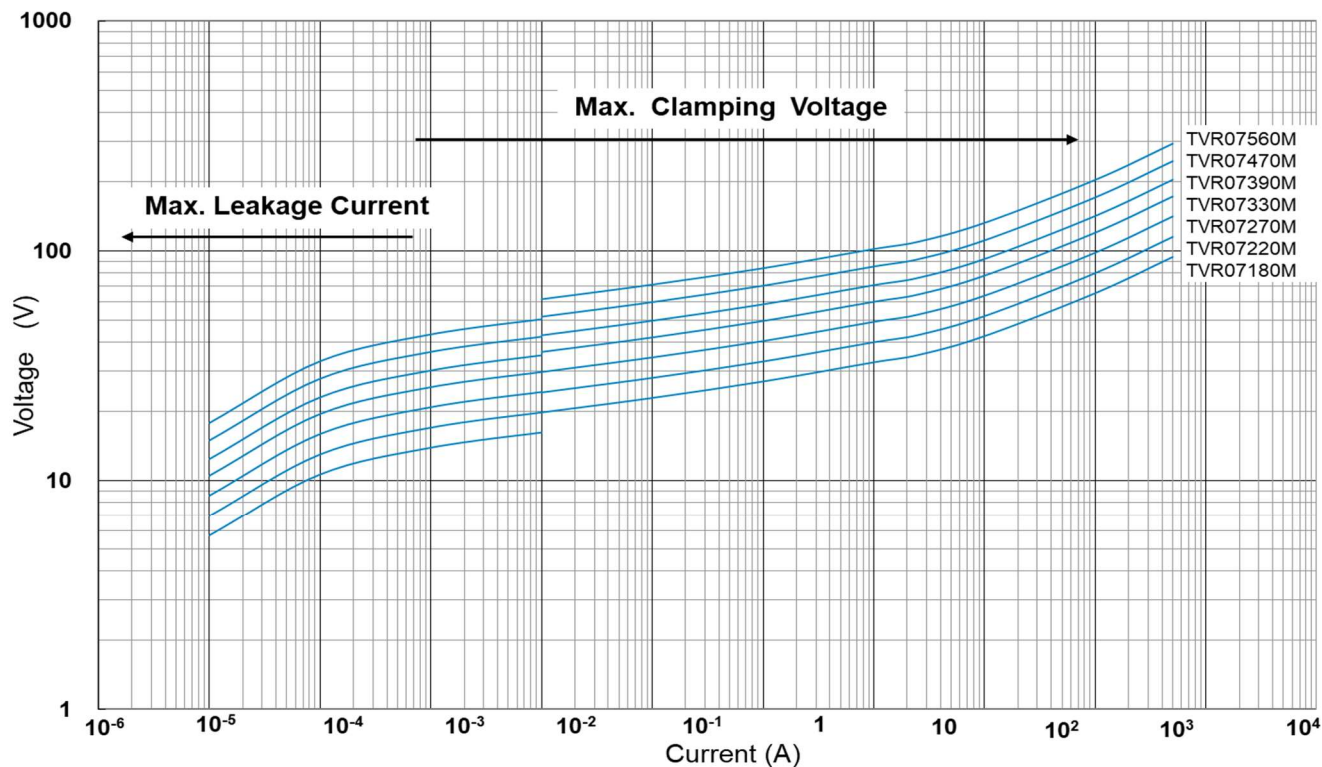
# Varistor: TVR-M Series

Dip Type Varistor for Automotive Application (Low Voltage Series)

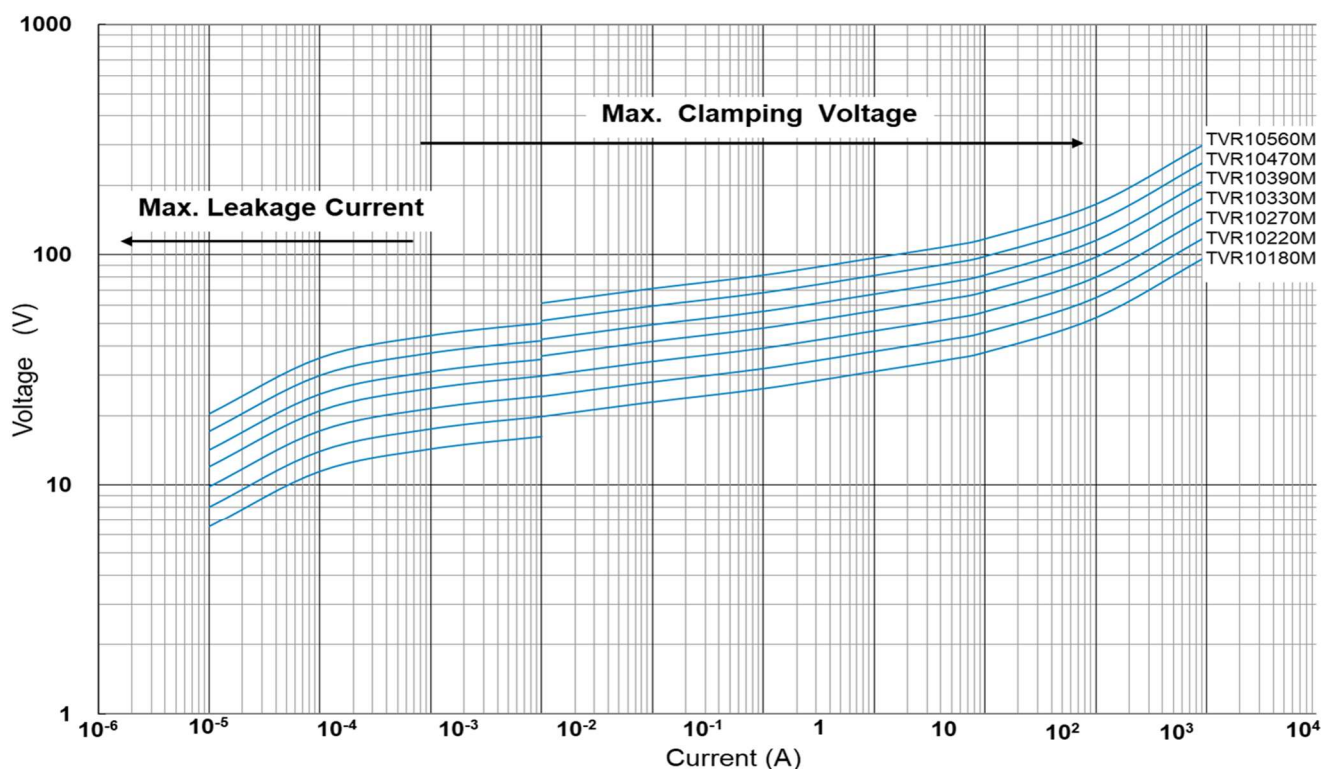


## ■ Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVR07180M to TVR07560M)



Max. Leakage Current and Max. Clamping Voltage Curves (TVR10180M to TVR10560M)



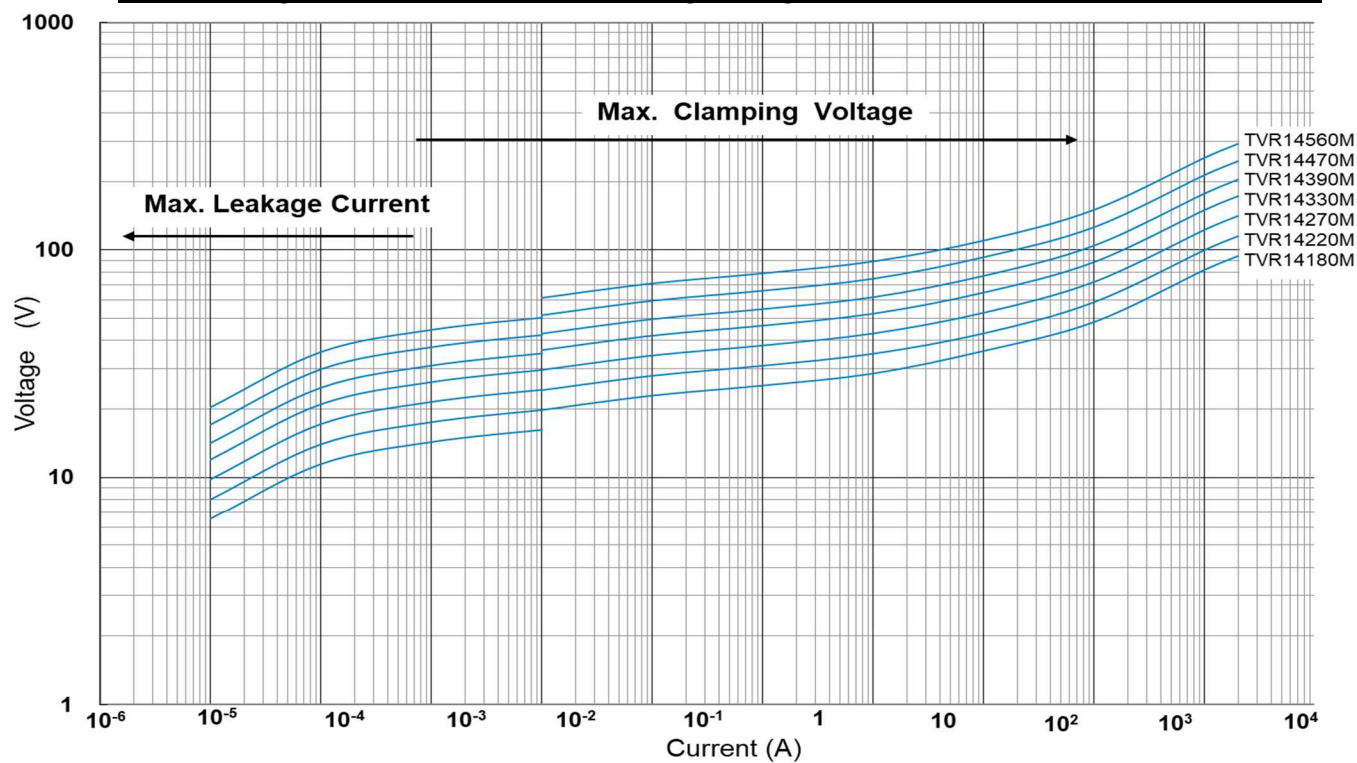
# Varistor: TVR-M Series

Dip Type Varistor for Automotive Application (Low Voltage Series)

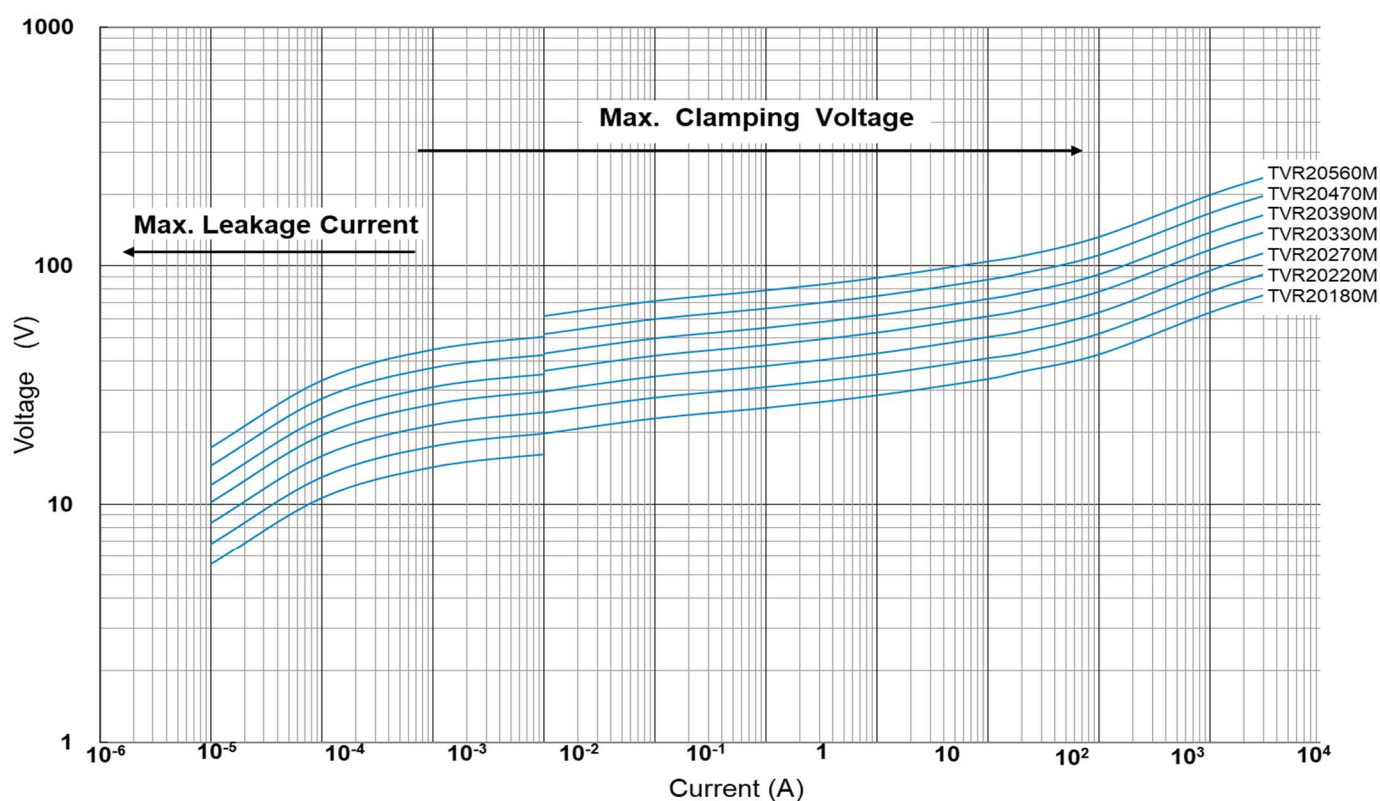


## ■ Max. Leakage Current and Max. Clamping Voltage Curves

**Max. Leakage Current and Max. Clamping Voltage Curves (TVR14180M to TVR14560M)**



**Max. Leakage Current and Max. Clamping Voltage Curves (TVR20180M to TVR20680M)**



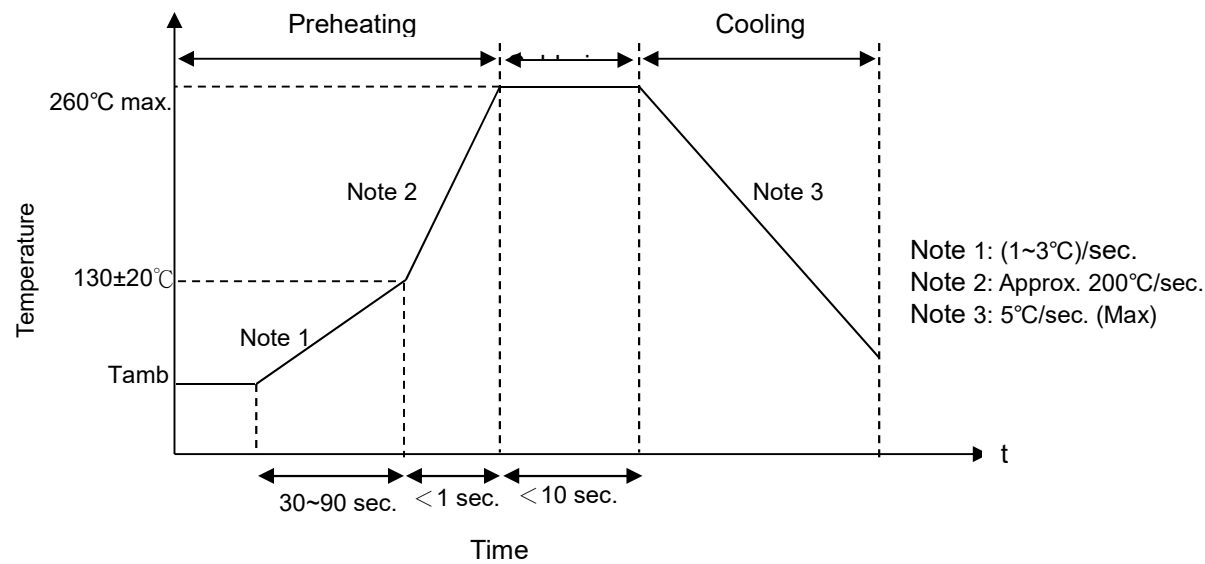
# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



### Soldering Recommendation

#### IR-reflow Soldering Profile



#### Recommended 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    | Φ3 mm (max.) |

# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



### ■ Reliability (based on AEC-Q200 Rev-D)

| Item                                | Standard                | Test conditions / Methods                                                                                                                                                                                                                          | Specifications                                                                                    |
|-------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Varistor voltage                    | Specification Standard  | The voltage between two terminals with the specified measuring current applied is called Vv                                                                                                                                                        | To meet the specified value                                                                       |
| Clamping voltage                    | Specification Standard  | The maximum voltage between two terminals with the specified standard impulse current (8/20 μs) applied                                                                                                                                            | To meet the specified value                                                                       |
| High Temperature Exposure (Storage) | MIL-STD-202 Method 108  | Test temp.: 150 +3/-0°C<br>Duration: 1000 h Unpowered<br>Measurement at 24±2 hours after test conclusion.                                                                                                                                          | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Resistance to Soldering Heat        | MIL-STD-202 Method 210  | No pre-heat of samples.<br>Temperature 260 ±5°C, Time 10 ±1 s<br>Immersion and emersion rate 25mm/s ±6 mm/s<br>Number of heat cycles 1                                                                                                             | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Vibration                           | MIL-STD-202 Method 204  | Acceleration 5 g's<br>Sweep time: 20 min<br>Frequency range: 10 to 2000 Hz<br>3×12 cycles                                                                                                                                                          | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Solderability                       | J-STD-002               | Steam aging 8hr@93±3°C, 245±5°C, 5 +0/-0.5sec                                                                                                                                                                                                      | At least 95% of terminal electrode is covered by new solder                                       |
| Terminal Strength                   | MIL-STD-202 Method 211  | 1. Pull test (2.27 kg)<br>2. Wire-lead bend test (227 g)<br>Duration of the applied forces: 10 ±1sec                                                                                                                                               | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Biased Humidity                     | MIL-STD-202 Method 103  | Test temp.: 125°C<br>Rel. humidity of air: 85%<br>Duration: 1000 h<br>Test Power Bias at 85%(+5%/-0%) of rated varistor voltage=230Vdc<br>Measurement at 24±2 hours after test conclusion                                                          | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Operational Life                    | MIL-STD-202 Method 108  | Test temp.: 125 +3/-0°C<br>Duration: 1000 h Test Power: Bias at 85%(+5%/-0%) of rated varistor voltage                                                                                                                                             | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Temperature Cycling                 | JESD22 Method JA-104    | Lower test temp. : -40 +0/-10°C<br>Upper test temp. : 125 +15/-0°C<br>Soak time at lower or upper temp. : 15 min<br>Transfer time: 5 mins<br>Cycle time: 2 Cycles/hr<br>Number of cycles: 1000<br>Measurement at 24±2 hours after test conclusion. | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Mechanical Shock                    | MIL-STD-202, Method 213 | Peak value 100g's Half sine Waveform<br>Normal duration (D): 6ms<br>In 3 directions perpendicularly intersecting each other (total 18 times)                                                                                                       | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Thermal Shock                       | Specification Standard  | Lower test temp. : -55 +0/-3°C<br>Upper test temp. : 125 +3/-0°C<br>Maximum transfer time: 20 seconds.<br>Dwell time: 15 minutes. Air-Air.<br>Number of cycles: 300                                                                                | No visible damage<br>  $\Delta V_{1mA}/V_{1mA}$   ≤ 10%<br>  $\Delta V_{clamp}/V_{clamp}$   ≤ 10% |
| Load Dump                           | ISO-7637                | ISO 7637, test pulse 5, load dump simulator, 10 pulses in with a one minute interval per pulse                                                                                                                                                     | $\Delta V_{1mA}/V_{1mA}$   ≤ 15%                                                                  |
| Resistance to solvents              | MIL-STD-202 Method 215  | Add aqueous wash chemical- OKEM Clean or equivalent.<br>Do not use banned solvents                                                                                                                                                                 | No visible damage                                                                                 |

# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



### Package

#### Taping Specification

##### L Type (Straight Lead)

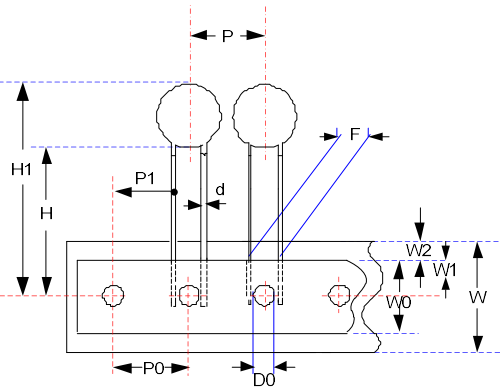


Figure A

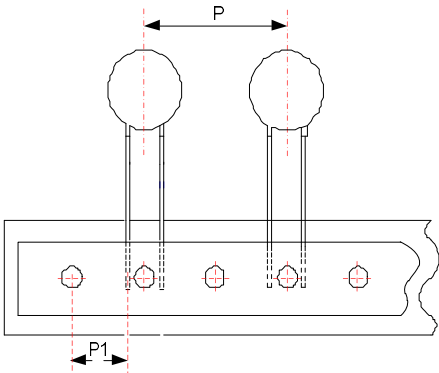


Figure B

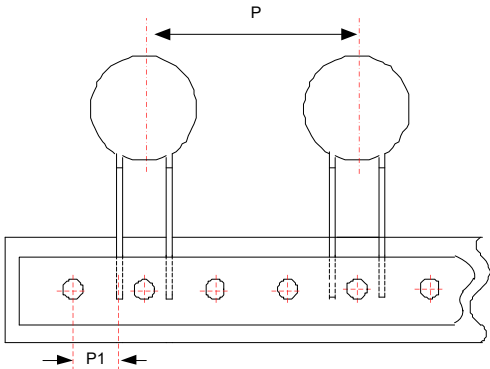


Figure C

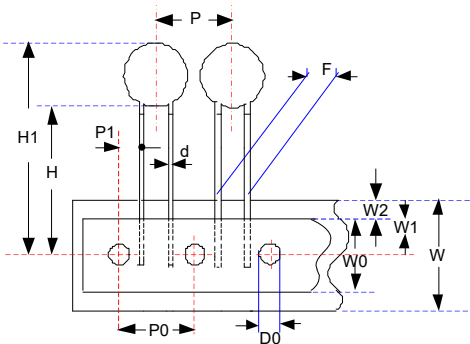


Figure D

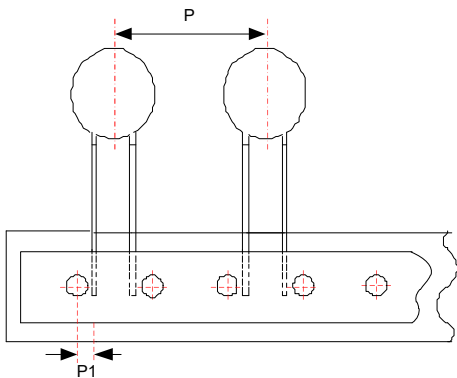
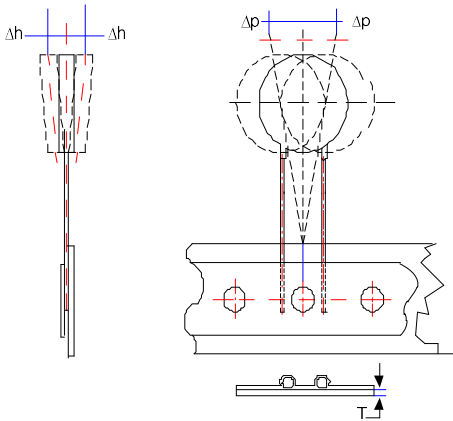


Figure E



(Unit: mm)

| Taping Code                 | Body Size | P <sub>0</sub> | F    | P    | P <sub>1</sub> | H     | H <sub>1</sub> | d     | W <sub>0</sub> | W <sub>1</sub> | W <sub>2</sub> | W       | Δ P  | Δ h  | D <sub>0</sub> | T    | Figure |
|-----------------------------|-----------|----------------|------|------|----------------|-------|----------------|-------|----------------|----------------|----------------|---------|------|------|----------------|------|--------|
|                             |           | ±0.3           | ±1   | ±1   | ±1             | +2/-0 | Max.           | ±0.02 | ±1             | +0.75/-0.5     | Max            | +1/-0.5 | Max. | Max. | ±0.2           | ±0.2 |        |
| A<br>(P <sub>0</sub> :12.7) | 07-M      | 12.7           | 5.0  | 12.7 | 3.55           | 18    | 31             | 0.6   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | D      |
|                             | 10-M      | 12.7           | 7.5  | 12.7 | 8.55           | 18    | 33.5           | 0.8   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | A      |
|                             | 14-M      | 12.7           | 7.5  | 25.4 | 8.55           | 18    | 38             | 0.8   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | B      |
|                             | 20-M      | 12.7           | 10.0 | 38.1 | 7.20           | 18    | 40.5           | 1.0   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | C      |
| E<br>(P <sub>0</sub> :15.0) | 07-M      | 15             | 5.0  | 15.0 | 4.70           | 18    | 31             | 0.6   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | D      |
|                             | 10-M      | 15             | 7.5  | 15.0 | 3.35           | 18    | 33.5           | 0.8   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | D      |
|                             | 14-M      | 15             | 7.5  | 30.0 | 3.35           | 18    | 38             | 0.8   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | E      |
|                             | 20-M      | 15             | 10.0 | 30.0 | 9.50           | 18    | 40.5           | 1.0   | 12             | 9              | 3              | 18      | 1    | 2    | 4              | 0.6  | B      |

# Varistor: TVR-M Series

## Dip Type Varistor for Automotive Application (Low Voltage Series)



■ Quantity

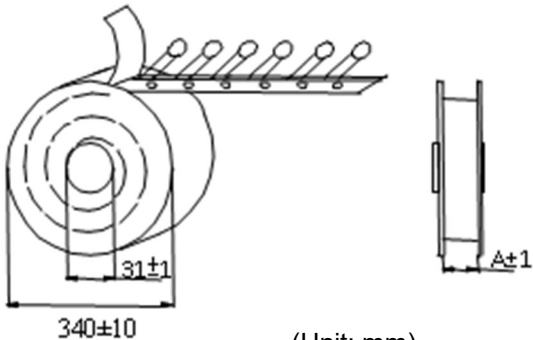
● Bulk Packing

| Series           | Quantity of Straight Lead Type (pcs/bag) | Quantity of Cut Lead Type (pcs/bag) | Quantity of Kink Lead Type (pcs/bag) |
|------------------|------------------------------------------|-------------------------------------|--------------------------------------|
| TVR07(180~560)-M | 250                                      | 250                                 | 200                                  |
| TVR10(180~560)-M | 200                                      | 200                                 | 200                                  |
| TVR14(180~560)-M | 100                                      | 100                                 | 100                                  |
| TVR20(180~560)-M | Box Packing: 600 pcs                     | 50                                  | 50                                   |

● Reel Packing

First Reel Packing

| Series           | A (mm) | Quantity (pcs/reel) |
|------------------|--------|---------------------|
| TVR07(180~560)-M | 46     | 1,500               |
| TVR10(180~560)-M | 55     | 750                 |
| TVR14(180~470)-M |        | 1,000               |
| TVR14(560)-M     |        | 750                 |
| TVR20(180~560)-M |        | 500                 |



(Unit: mm)

Second Reel Packing

| Series           | A (mm) | Quantity (pcs/reel)<br>P0=12.7mm | Quantity (pcs/reel)<br>P0=15mm |
|------------------|--------|----------------------------------|--------------------------------|
| TVR07(180~560)-M | 46     | 1,500                            | 1,500                          |
| TVR10(180~560)-M |        | 1,000                            | 1,000                          |
| TVR14(180~470)-M |        | 800                              | 800                            |
| TVR14(560)-M     |        | 750                              | 750                            |
| TVR20(180~560)-M | 55     | 500                              | 500                            |

# Varistor: TVR-M Series

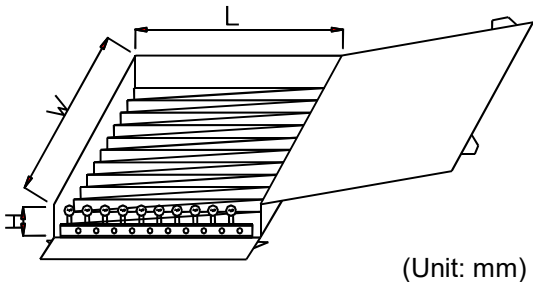
## Dip Type Varistor for Automotive Application (Low Voltage Series)



### Quantity

#### Ammo Packing

| Series           | Quantity<br>(pcs/box)<br>P0=12.7mm | Quantity<br>(pcs/box)<br>P0=15.0mm |
|------------------|------------------------------------|------------------------------------|
| TVR07(180~560)-M | 1,200                              | 1,100                              |
| TVR10(180~560)-M | 900                                | 800                                |
| TVR14(180~560)-M | 500                                | 450                                |
| TVR20(180~560)-M | 350                                | 300                                |



| Series        | W±5 | L±5 | H±5 |
|---------------|-----|-----|-----|
| TVR05~TVR20-M | 345 | 275 | 55  |

### Warehouse Storage Conditions of Products

- Storage Conditions:
  - Storage Temperature: -10°C ~+40°C
  - Relative Humidity: ≤75%RH
  - Thermistors must be kept away from sunlight and stored in a non-corrosive atmosphere.
- Period of Storage: 1 year