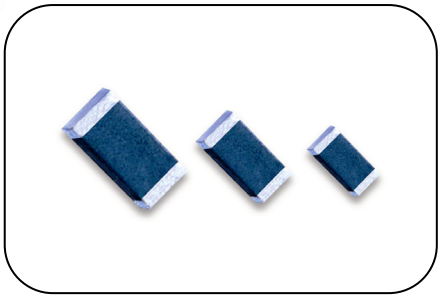
# Metal Oxide Varistor：TVM-G Series

## SMD Type For ESD Suppressor (Low Clamping Series)

### ■ Features

1. RoHS compliant
2. Low clamping voltage
3. EIA size 0402, 0603, 0805
4. Working voltage: 5.5 ~ 30 Vdc
5. Bidirectional and symmetrical V/I characteristics
6. Multilayer ceramic construction technology
7. Rate for ESD protection
8. Variable capacitance
9. -40 ~ +125℃ operating temperature range

### ■ Recommended Applications

1. Cellular phones
2. I/O port for mother board
3. LCD Module
4. Data line (USB, RS232)
5. PDA
6. Bluetooth headset

### ■ Part No. Code

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Product Type | |
|---|---|
| TVM | Thinking SMD Varistor TVM Type |

| Size | |
|---|---|
| 0 | 0402 |
| 1 | 0603 |
| 2 | 0805 |

| Type Series | |
|---|---|
| G | G Series |

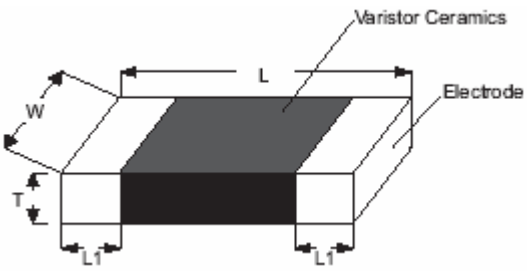
| Max. Working Voltage(Vdc) | |
|---|---|
| 090 | $9x10^0$=9V |
| 330 | $33x10^0$=33V |
| 5R5 | 5.5V |

| Typical Capacitance | |
|---|---|
| M101 | $10x10^1$=100pF (@1MHZ) |

| Packaging | |
|---|---|
| R | Taping |
| B | Bulk |

| Internal Control Code |
|---|
| 001 ~ZZZ |

### ■ Dimensions




(Unit:mm)

| Part No | Size | L | W | T | L1 |
|---|---|---|---|---|---|
| TVM0 | 0402 | 1.00± 0.15 | 0.50± 0.10 | 0.60max | 0.20±0.10 |
| TVM1 | 0603 | 1.60±0.15 | 0.80±0.15 | 0.95max | 0.25±0.15 |
| TVM2 | 0805 | 2.00±0.20 | 1.25±0.20 | 1.20max | 0.40±0.20 |

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### ■ Characteristics

| Part No. | Max. Working Voltage | Varistor Voltage | Max. Clamping Voltage (8/20us ) | | Max. Surge Current (8/20us) | Max. Energy (10/1000us) | Typical Capacitance |
|---|---|---|---|---|---|---|---|
| | $V_{dc}$ | $V_{1mA}$ | $V_p$ | $I_p$ | $I_{max}$ | $W_{max}$ | C@1MHz |
| | (V) | (V) | (V) | (A) | (A) | (J) | (pF) |
| TVM0G5R5M100 | 5.5 | 8.8~13.2 | 35 | 1 | 1 | 0.01 | 10 |
| TVM0G5R5M400 | 5.5 | 8.8~13.2 | 30 | 1 | 4 | 0.02 | 40 |
| TVM0G5R5M900 | 5.5 | 8.8~13.2 | 30 | 1 | 10 | 0.05 | 90 |
| TVM0G5R5M261 | 5.5 | 8.8~13.2 | 25 | 1 | 20 | 0.05 | 260 |
| TVM0G5R5M411 | 5.5 | 8.8~13.2 | 25 | 1 | 20 | 0.05 | 410 |
| TVM1G5R5M761 | 5.5 | 8.0~12.0 | 25 | 1 | 30 | 0.1 | 760 |
| TVM2G5R5M991 | 5.5 | 8.0~12.0 | 25 | 1 | 40 | 0.1 | 990 |
| TVM0G090M220 | 9 | 11~16 | 38 | 1 | 2 | 0.02 | 22 |
| TVM0G090M400 | 9 | 11~16 | 35 | 1 | 4 | 0.02 | 40 |
| TVM0G090M141 | 9 | 11~16 | 30 | 1 | 20 | 0.05 | 140 |
| TVM0G090M201 | 9 | 11~16 | 30 | 1 | 20 | 0.05 | 200 |
| TVM1G090M220 | 9 | 11~16 | 40 | 1 | 2 | 0.02 | 22 |
| TVM1G090M491 | 9 | 11~16 | 29 | 1 | 30 | 0.1 | 490 |
| TVM2G090M521 | 9 | 11~16 | 29 | 1 | 40 | 0.1 | 520 |
| TVM0G140M400 | 14 | 15.9~21.5 | 42 | 1 | 4 | 0.02 | 40 |
| TVM0G140M900 | 14 | 15.9~21.5 | 38 | 1 | 20 | 0.05 | 90 |
| TVM0G140M151 | 14 | 15.9~21.5 | 38 | 1 | 20 | 0.05 | 150 |
| TVM1G140M181 | 14 | 15.9~21.5 | 37 | 1 | 30 | 0.1 | 180 |
| TVM2G140M321 | 14 | 15.9~20.3 | 34 | 1 | 40 | 0.1 | 320 |
| TVM2G140M561 | 14 | 15.9~20.3 | 32 | 1 | 120 | 0.3 | 560 |
| TVM0G180M030 | 18 | 46~75 | 135 | 1 | 1 | 0.01 | 3 |
| TVM0G180M120 | 18 | 22~28 | 55 | 1 | 2 | 0.03 | 12 |
| TVM0G180M300 | 18 | 22~28 | 52 | 1 | 4 | 0.05 | 30 |
| TVM0G180M500 | 18 | 22~28 | 50 | 1 | 20 | 0.05 | 50 |
| TVM1G180M030 | 18 | 46~75 | 135 | 1 | 1 | 0.01 | 3 |
| TVM1G180M120 | 18 | 22~28 | 55 | 1 | 2 | 0.025 | 12 |
| TVM1G180M121 | 18 | 22~28 | 50 | 1 | 30 | 0.1 | 120 |
| TVM2G180M291 | 18 | 22~28 | 44 | 1 | 40 | 0.1 | 290 |
| TVM2G180M521 | 18 | 22~28 | 44 | 1 | 120 | 0.3 | 520 |
| TVM1G260M111 | 26 | 31~38 | 60 | 1 | 30 | 0.1 | 110 |
| TVM2G260M141 | 26 | 29.5~38.5 | 60 | 1 | 40 | 0.1 | 140 |
| TVM2G260M221 | 26 | 29.5~38.5 | 60 | 1 | 100 | 0.3 | 220 |
| TVM1G300M900 | 30 | 37~46 | 74 | 1 | 30 | 0.1 | 90 |
| TVM2G300M900 | 30 | 37~46 | 72 | 1 | 30 | 0.1 | 90 |

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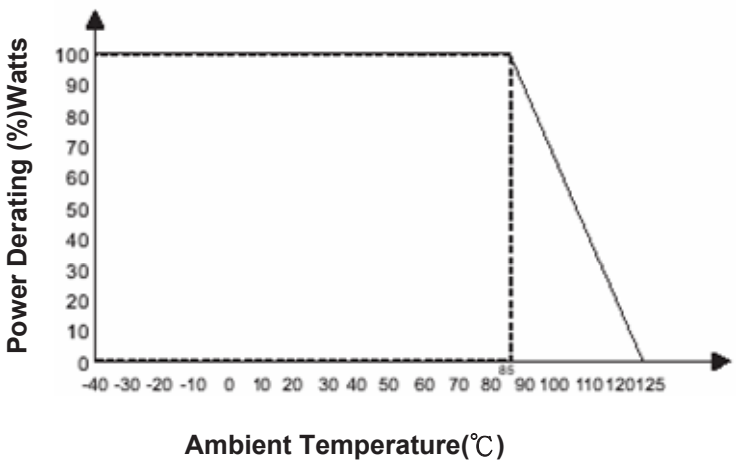
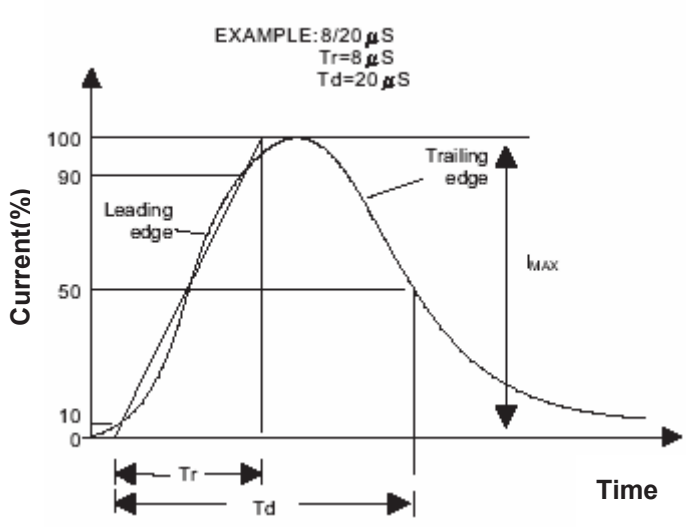
■ **Operating Temperature vs. Power Derating Curve**

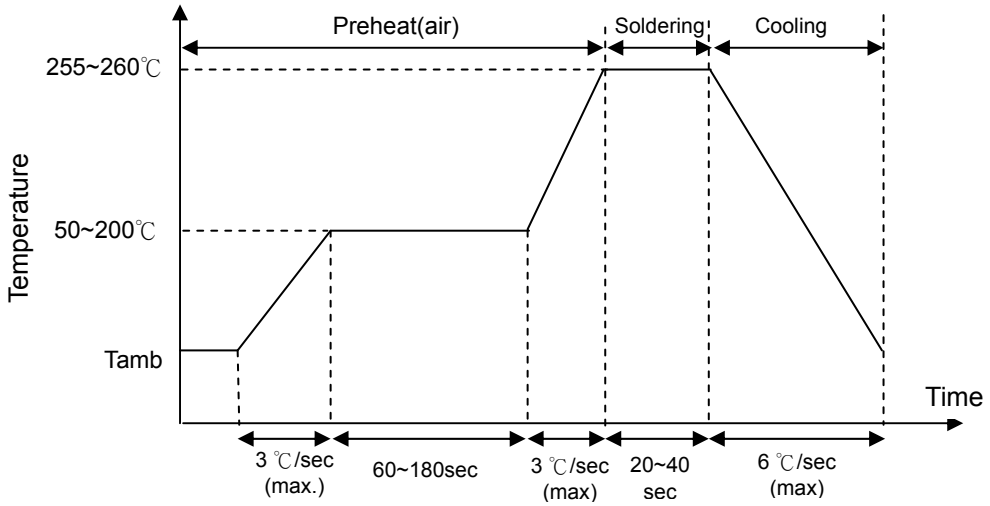



■ **Surge Current Standard Waveform**

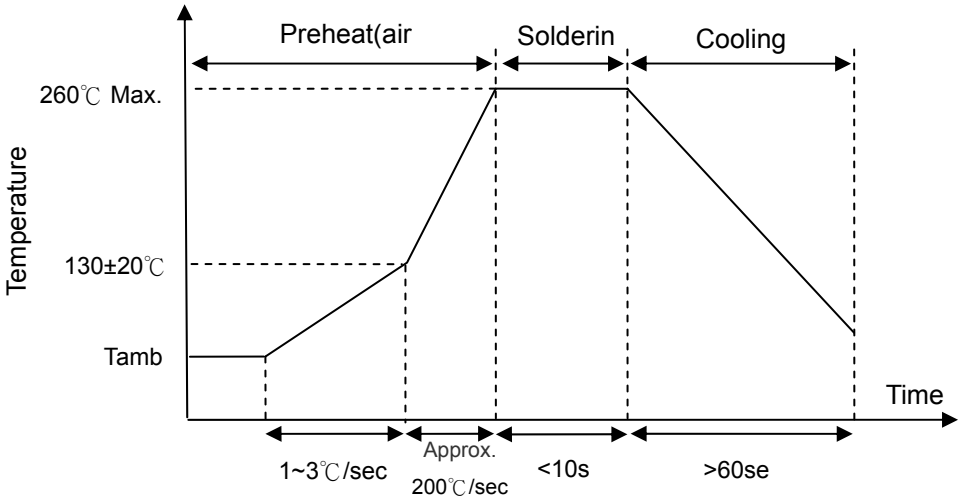



■ **Soldering Recommendation**

● **IR-Reflow Soldering Profile**



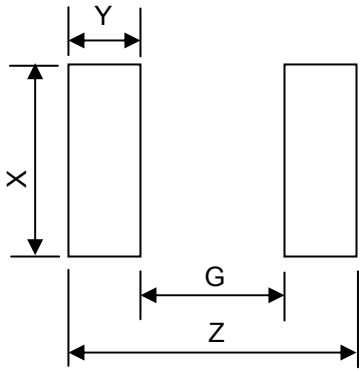

● **Wave Flow Soldering Profile**



- **Reworking Conditions With Soldering Iron**

| Item | Conditions |
|---|---|
| Temperature of Soldering Iron-tip | 360℃ (max.) |
| Diameter of Soldering Iron-tip | Φ 3mm (max.) |
| Soldering Time | 3 sec (max.) |

## ■ Recommended Pad dimensions




| Size | Z (mm) | G (mm) | X (mm) | Y (mm) |
|---|---|---|---|---|
| 0402 | 2.1~2.2 | 0.4~0.5 | 0.6~0.7 | 0.9~1.0 |
| 0603 | 2.7~2.8 | 0.6~0.7 | 0.9~1.0 | 1.0~1.1 |
| 0805 | 3.1~3.2 | 0.6~0.7 | 1.4~1.5 | 1.2~1.3 |

Followed Standard:IPC-SM-782A

## ■ Storage condition of products

- Storage Conditions :
  1. Storage Temperature: -10℃~+40℃
  2. Relative humidity: ≦75%RH
  3. Varistor must be kept away from sunlight and stored in a non-corrosive atmosphere.
- Period of Storage : 1 year

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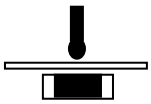
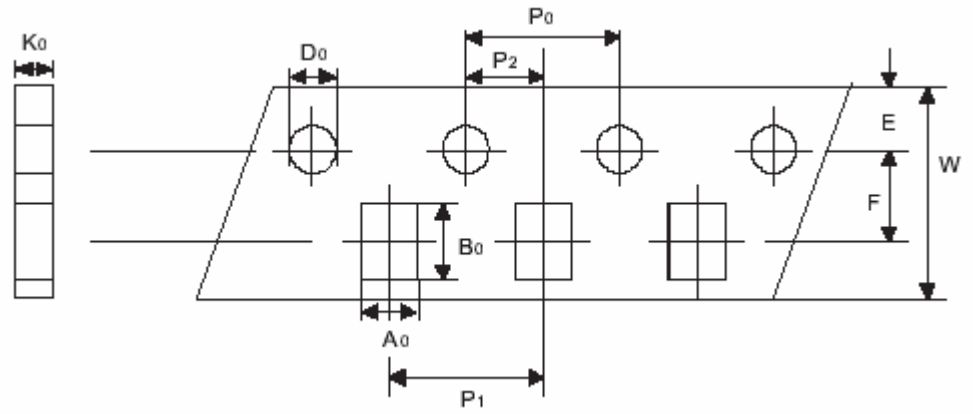
### ■ Reliability test

<table>
<tr><th>Item</th><th>Standard</th><th>Test conditions / Methods</th><th>Specifications</th></tr>
<tr><td>Bending Strength</td><td>IEC 1051-14.10.3</td><td>Warp : 2mm ; Speed ＜ 0.5mm/sec.<br>Duration : 10 sec on PCB.<br>  </td><td>| △V/V<sub>1mA</sub> | ≦ 5 %<br>No visible damage</td></tr>
<tr><td>Soldering Strength</td><td>Specification Standard</td><td>Speed<0.5mm/sec. on PCB<br>  <br>w</td><td>W≧0.5Kgf<br>the terminal electrode shall be break off nor the chip element</td></tr>
<tr><td>Damp Heat Load</td><td>IEC 1051-14.18</td><td>40±2℃ 90~95% RH<br>500±24HRS at $V_{DC}$</td><td>| △V/V<sub>1mA</sub> | ≦ 10 %<br>No visible damage</td></tr>
<tr><td>High Temp. Storage</td><td>IEC 1051-14.17.3</td><td>125±5 ℃ x 1000±24HRS</td><td>| △V/V<sub>1mA</sub> | ≦ 5 %<br>No visible damage</td></tr>
<tr><td>Thermal Shock</td><td>IEC 1051-14.13</td><td>The thermal shock conditions shown below shall be repeated 5 cycles on PCB
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Period (minutes)</th></tr>
<tr><td>1</td><td>-40±5</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temperature</td><td>5±3</td></tr>
<tr><td>3</td><td>125±5</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temperature</td><td>5±3</td></tr>
</table></td><td>| △V/V<sub>1mA</sub> | ≦ 5 %<br>No visible damage</td></tr>
<tr><td>High Temp. Load</td><td>IEC 1051-14.20</td><td>85±2 ℃ 1000±24HRS at $V_{DC}$</td><td>| △V/V<sub>1mA</sub> | ≦ 5 %<br>No visible damage</td></tr>
<tr><td>Low Temp. Load</td><td>Specification Standard</td><td>-40±5 ℃ 1000±24HRS at $V_{DC}$</td><td>| △V/V<sub>1mA</sub> | ≦ 5 %<br>No visible damage</td></tr>
<tr><td>Max. Energy</td><td>Specification Standard</td><td>10/1000 μS Waveform, Wmax, 1 surge current</td><td>| △V/V<sub>1mA</sub> | ≦ 10 %<br>No visible damage</td></tr>
<tr><td>Vibration</td><td>IEC 1051-14.16</td><td>Frequency range : 10~55Hz<br>Amplitude : 0.75mm or 98m/S$^2$<br>Duration : 6HRS(3x2HRS)</td><td>| △V/V<sub>1mA</sub> | ≦ 5 %<br>No visible damage</td></tr>
<tr><td>Varistor Voltage Temp. Coefficient</td><td>Specification Standard</td><td>measure $V_{1mA}$ at -40℃ 、25℃ 、125℃</td><td>|Tc| ≦0.05%/℃</td></tr>
<tr><td>Climatic Sequence</td><td>IEC 1051-14.17</td><td>a. 125℃ x 16HRS<br>b. 1st cycle : 55℃ 93%RH x 24HRS<br>c. -40℃ x 2HRS<br>d. 5 cycles : 55℃ 93%RH x 24HRS/Cycle</td><td>| △V/V<sub>1mA</sub> | ≦ 10 %<br>No visible damage</td></tr>
<tr><td>Solderability</td><td>IEC 60068-2-20</td><td>235±5℃ 2±0.5 sec</td><td>At least 95% of terminal electrode is covered by new solder</td></tr>
<tr><td>Resistance to soldering heat</td><td>IEC 60068-2-20</td><td>260±5℃ 10±1 sec</td><td>| △V/V<sub>1mA</sub> | ≦ 5 %</td></tr>
<tr><td>Electrostatic Discharge (ESD)</td><td>IEC 61000-4-2</td><td>Contact Discharge Test Voltage：8KV<br>Air Discharge Test Voltage：15KV<br>Number of Test Pulse：20 times<br>Polarity：Positive/Negative<br>Discharge Network：150pF,330Ω<br>Operating Temperature：15~35℃<br>Operating Humidity：25~75%</td><td>| △V/V<sub>1mA</sub> | ≦ 10 %<br>No visible damage</td></tr>
</table>

## ■ Packaging

### ● Taping Specification

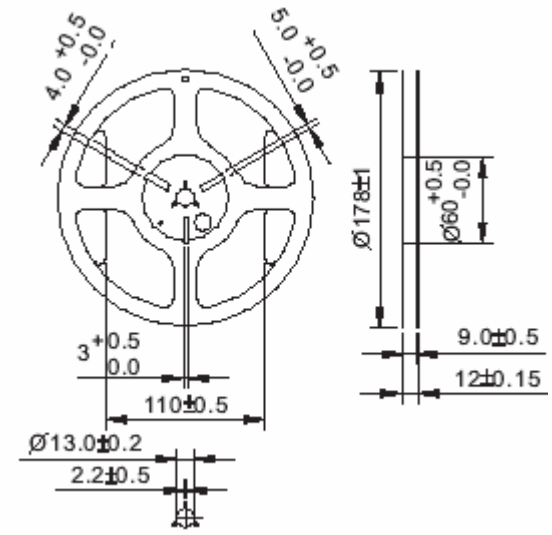



(Unit: mm)

| Index / Type | $A_0$ ±0.05 | $B_0$ ±0.12 | W ±0.2 | E ±0.1 | F ±0.05 | $P_1$ ±0.1 | $P_2$ ±0.05 | $P_0$ ±0.1 | $D_0$ ±0.1 | $K_0$ ±0.1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0402 | 0.62 | 1.12 | 8 | 1.75 | 3.5 | 2 | 2 | 4 | 1.55 | 0.60 |

| Index / Type | $A_0$ ±0.2 | $B_0$ ±0.2 | W ±0.2 | E ±0.1 | F ±0.05 | $P_1$ ±0.1 | $P_2$ ±0.05 | $P_0$ ±0.1 | $D_0$ ±0.1 | $K_0$ ±0.1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0603 | 1.1 | 1.9 | 8 | 1.75 | 3.5 | 4 | 2 | 4 | 1.55 | 0.95 |
| 0805 | 1.5 | 2.3 | 8 | 1.75 | 3.5 | 4 | 2 | 4 | 1.55 | 0.95 |

### ● Quantity




(Unit: mm)

| Type | Quantity (pcs/reel) |
|---|---|
| 0402 | 10000 |
| 0603 | 4000 |
| 0805 | 3500 |