

Metal Oxide Varistor for Automotive : TVM-C Series

SMD Type for Transient Overvoltage Protection



■ Features

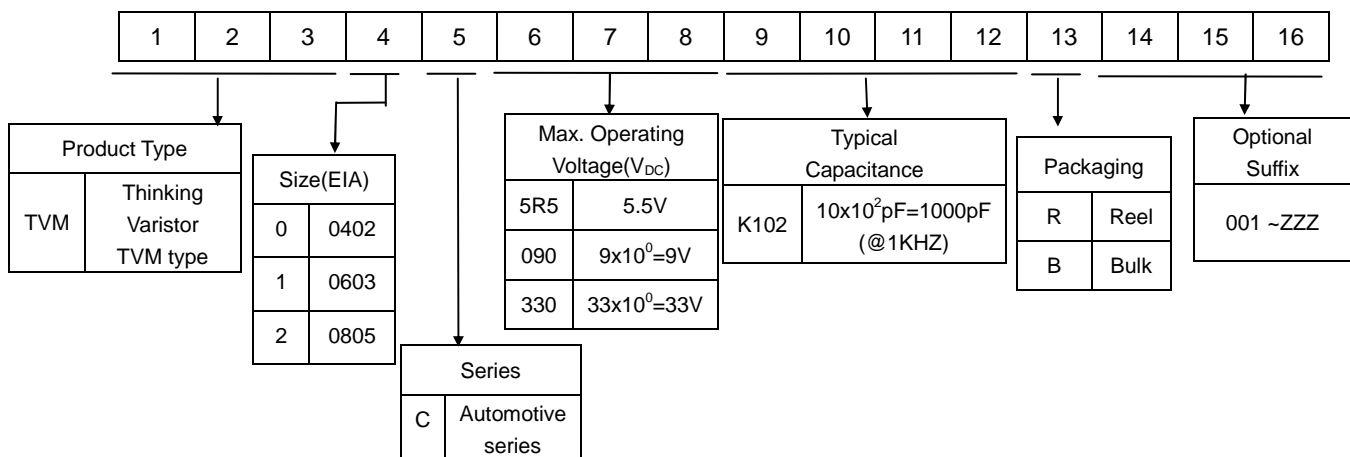
1. Qualification based on AEC-Q200 Rev-C
2. High surge suppress capability for automotive application (load dump)
3. No temperature derating up to 125 °C
4. Bidirectional and symmetrical V/I characteristics
5. Stability in high-temperature and high-humidity environment
6. RoHS compliant



■ Recommended Applications

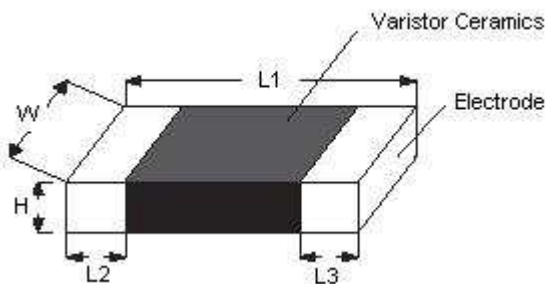
Transient overvoltage protection in automotive applications: engine management, airbag, control units, electro hydraulic brake, ABS/ESP, sunroof

■ Part Number Code



■ Structure and Dimensions

(Unit: mm)



Part No.	Size (EIA)	L1	W	H max.	L2 and L3
TVM3	1206	3.20 ±0.30	1.60±0.20	1.50	0.50±0.20
TVM4	1210	3.20 ±0.30	2.50±0.25	1.50	0.50±0.20
TVM5	1812	4.50 ±0.40	3.20±0.30	1.50	0.60±0.30
TVM6	2220	5.70±0.40	5.00±0.30	2.00	0.60±0.30

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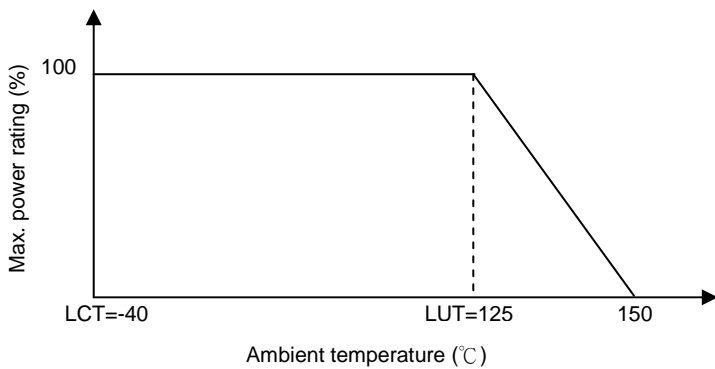


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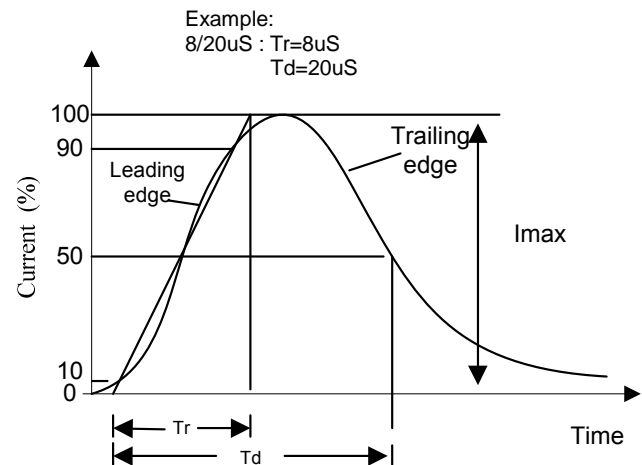
Electrical Characteristics

Type	Working Voltage		V _{jump} (5min)	Varistor Voltage V _n	Max. clamping voltage		I _{max} (8/20us)	W _{max} (10/1000us)	W _{LD} (10x)	C _{typ} (1kHz)	Operating Temp. range
	V _{rms}	V _{dc}			V _c	I _c					
	(V)	(V)	(V)	(V)	(V)	(A)	(A)	(J)	(J)	(pF)	(°C)
TVM3C160K102	14	16	24.5	24±10%	40	1	200	0.6	1.5	1000	-55~+125
TVM4C160K242					40	2.5	400	1.6	3.0	2400	
TVM5C160K452					40	5	800	2.4	6	4500	
TVM6C160K103					40	10	1200	5.8	12	10000	
TVM6C160K203					40	20	1500	10.0	25	20000	

Power Derating Curve

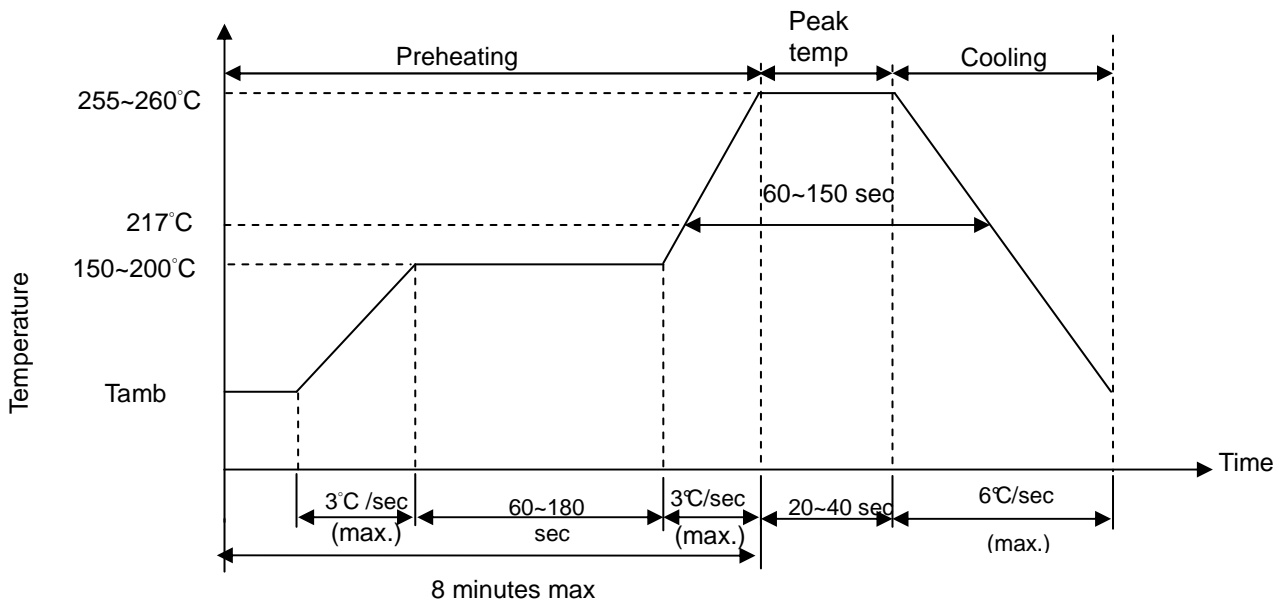


Surge Current Standard Waveform



Soldering Recommendation

IR-Reflow Soldering Profile



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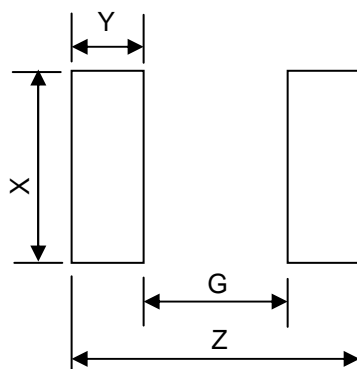


● Reworking Conditions with Soldering Iron

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

Caution: Do not touch the component surface with soldering iron directly to prevent it from damage.

■ Recommended Soldering Pad Dimensions



Size	Z (mm)	G (mm)	X (mm)	Y (mm)
1206	4.5	2.1	1.8	1.2
1210	4.5	2.1	2.8	1.2
1812	6.0	3.0	3.6	1.5
2220	7.2	4.2	5.5	1.5

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■ Reliability

Item	Standard	Test conditions / Methods	Specifications																																												
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	Test temp. : 150 +3/-0°C Duration: 1000 h Unpowered Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%																																												
Temperature Cycling	JESD22 Method JA-104	Lower test temp. : -40 +0/-3°C Upper test temp. : 125 +3/-0°C Soak time at lower or upper temp. : 1 min Cycle time : 2 Cycles/hr Number of cycles : 1000 Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%																																												
Moisture Resistance	MIL-STD-202 Method 106	Duration of 1 cycle: 24 h Number of cycles: 10 , Unpowered Measurement at 24±2 hours after test conclusion. <table border="1"> <thead> <tr> <th rowspan="2">Step</th> <th colspan="2">Temp.</th> <th>humidity</th> <th>Period</th> </tr> <tr> <th>Start</th> <th>Finish</th> <th>(%)</th> <th>(hr)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25</td> <td>65</td> <td>90~100</td> <td>2.5</td> </tr> <tr> <td>2</td> <td>65</td> <td>65</td> <td>90~100</td> <td>3</td> </tr> <tr> <td>3</td> <td>65</td> <td>25</td> <td>80~100</td> <td>2.5</td> </tr> <tr> <td>4</td> <td>25</td> <td>65</td> <td>90~100</td> <td>2.5</td> </tr> <tr> <td>5</td> <td>65</td> <td>65</td> <td>90~100</td> <td>3</td> </tr> <tr> <td>6</td> <td>65</td> <td>25</td> <td>80~100</td> <td>2.5</td> </tr> <tr> <td>7</td> <td>25</td> <td>25</td> <td>80~100</td> <td>8</td> </tr> </tbody> </table>	Step	Temp.		humidity	Period	Start	Finish	(%)	(hr)	1	25	65	90~100	2.5	2	65	65	90~100	3	3	65	25	80~100	2.5	4	25	65	90~100	2.5	5	65	65	90~100	3	6	65	25	80~100	2.5	7	25	25	80~100	8	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%
Step	Temp.			humidity	Period																																										
	Start	Finish	(%)	(hr)																																											
1	25	65	90~100	2.5																																											
2	65	65	90~100	3																																											
3	65	25	80~100	2.5																																											
4	25	65	90~100	2.5																																											
5	65	65	90~100	3																																											
6	65	25	80~100	2.5																																											
7	25	25	80~100	8																																											
Biased Humidity	MIL-STD-202 Method 103	Test temp. : 85°C Rel. humidity of air : 85% Duration: 1000 h Bias at Working Voltage Vdc. Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%																																												

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Item	Standard	Test conditions / Methods	Specifications
Operational Life	MIL-STD-202 Method 108	Test temp.: 125 +3/-0°C Duration: 1000 h Bias at Working Voltage Vdc. Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%
External Visual	MIL-STD-883 Method 2009	Inspect device construction, marking and workmanship.	No visible damage
Physical Dimension	JESD22 Method JB-100	Verify physical dimensions to the applicable device specification.	Within the specified values
Resistance to Solvents	MIL-STD-202 Method 215	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 part (by volume) of mineral spirits.	No visible damage
Mechanical Shock	MIL-STD -202-213	Test Condition F Peak value : 1500g's Half sine Waveform Normal duration (D) : 0.5ms In 3 directions perpendicularly intersecting each other (total 18 times).	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%
Vibration	MIL-STD-202 Method 204	Acceleration : 5 g's Sweep time: 20 min Frequency range: 10 to 2000 Hz 3×12 cycles	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B No pre-heat of samples. Temperature : 260±5°C, Time : 10±1s Immersion and emersion rate : 25mm/s ±6 mm/s Number of heat cycles : 1	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%
Thermal Shock	MIL-STD-202 Method 107	Lower test temp. : -55 +0/-3°C Upper test temp. : 125 +3/-0°C Maximum transfer time : 20 seconds. Dwell time : 15 minutes. Air-Air. Number of cycles : 300	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10%

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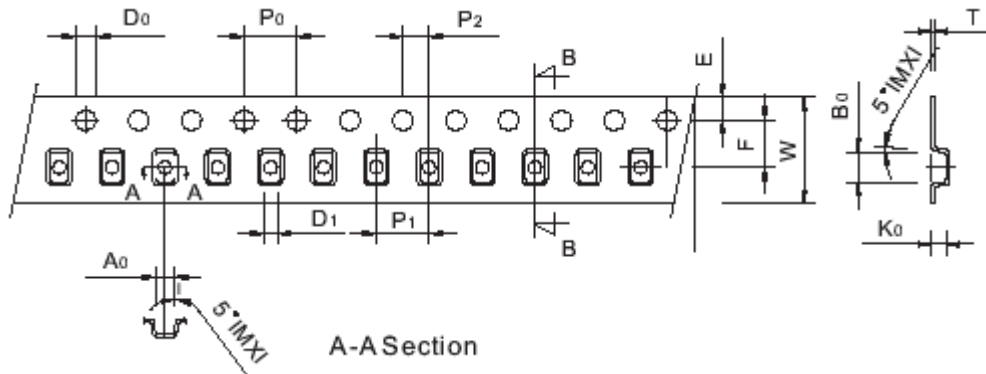


Item	Standard	Test conditions / Methods	Specifications
ESD	AEC-Q200 -002	Discharge capacitance : 150 pF Charging voltage: 30 KV Contact discharge 1 pulse in each polarity	No visible damage $\Delta V_{1mA}/V_{1mA}$ \leq 10%
Solderability	J-STD-002	a) 4 h @ 155°C dry heat Dip @235±5°C 5 +0/-0.5sec b) Steam aging 8h±15min @93±3°C Dip @260±5°C 7±0.5sec	95% of termination wetted
Electrical Characterization	Specifications	V1mA(-55°C) 、 V1mA(25°C) 、 V1mA(125°C)	Within the specified values
Board Flex	AEC-Q200 -005 (JIS-C-6429)	Bend the board : 2mm (Min.) Duration of the applied forces : 60 (+5) Sec	No visible damage $\Delta V_{1mA}/V_{1mA}$ \leq 10%
Terminal Strength	AEC-Q200 -006 (JIS-C-6429)	Apply force : 1.8kg (17.7 N) Duration of the applied forces : 60 (+1) Sec	No visible damage $\Delta V_{1mA}/V_{1mA}$ \leq 10%
Electrical Transient Conduction	ISO-7637-1	Test pulses 1 to 3	No visible damage $\Delta V_{1mA}/V_{1mA}$ \leq 10%

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■ Packaging

● Taping Specification

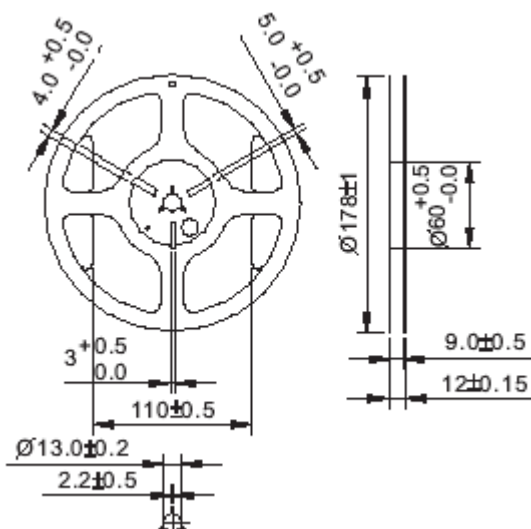


(Unit: mm)

Index	A ₀	B ₀	W	E	F	P ₁	P ₂	P ₀	D ₀	D ₁	T
Type	±0.2	±0.2	±0.2	±0.1	±0.05	±0.1	±0.05	±0.1	±0.1	±0.1	±0.1
1206	1.85	3.45	8	1.75	3.5	4	2	4	1.55	1	0.25
1210	2.75	3.55	8	1.75	3.5	4	2	4	1.55	1	0.25

Index	A ₀	B ₀	W	E	F	P ₁	P ₂	P ₀	D ₀	D ₁	T
Type	±0.2	±0.2	±0.3	±0.1	±0.05	±0.1	±0.05	±0.1	±0.1	±0.1	±0.1
1812	3.65	4.96	12	1.75	5.5	8	2	4	1.55	1.5	0.25
2220	5.50	6.25	12	1.75	5.5	8	2	4	1.55	1.5	0.25

● Quantity

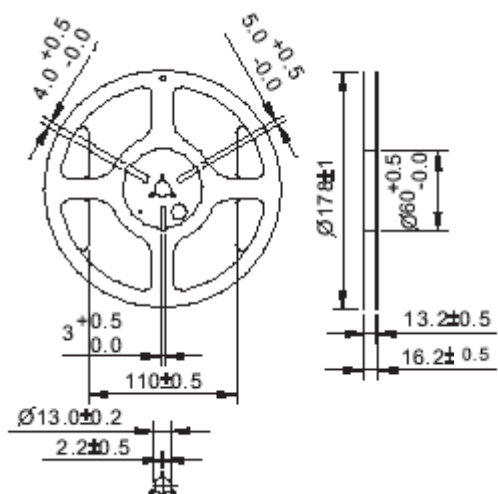


(Unit: mm)

Type	Quantity (pcs/reel)
1206	2500
1210	2500

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(Unit: mm)

Type	Quantity (pcs/reel)
1812	1000
2220	1000

■ Storage Conditions of Products

- Storage Conditions :
 1. Storage Temperature: $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
 2. Relative Humidity: $\leq 75\% \text{RH}$
 3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage : 1 year