

Description


Metal Oxide Varistors (MOVs) are rated for specific AC line operating voltages. Exceeding these limits through the application of a sustained abnormal over-voltage condition could result in overheating and damage to the MOV. This condition is specifically identified and addressed in the UL 1449 TVSS Standard – called Limited Current Abnormal Overvoltage test.

The Littelfuse TMOV25S™ (Thermal MOV) Series addresses this test condition in a single integrated package. The TMOV® Series is based on the Littelfuse UltraMOV™ Series which meets the surge suppressor component recognition requirements of UL 1449 for both cord connected and permanently connected TVSS end products. Additionally, the TMOV® Varistor incorporates a patented integrated thermally responsive element within the body of the device which will open-circuit the varistor in case of overheating due to the abnormal over-voltages per UL 1449 requirements–Note 1.

The TMOV® Series is designed to meet the Abnormal Over-voltage requirements of UL 1449 (Abnormal Over-voltage Limited Current requirements up to and including the 10A/7hrs requirement).

The TMOV® Varistor can be wave soldered without any need for special or expensive assembly processes.

Agency Approvals

Agency	Agency File Number	Status
	UL1449 ⁴ “Ed. 3	Pending

- Under UL1449 limited current testing parts rated >420V will not open due to 600V voltage limit. Devices with ratings >420V have not yet been evaluated.
- Regarding thermal cut-offs for ratings up to 420VAC.

CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or other conditions above those indicated in the operational sections of this specification is not implied.

Applications

- TVSS Products
- AC Panel Protection Modules
- AC Line Power Supplies
- Surge Protected Strip Connectors
- AC Power Meters
- Inverters, AC/DC power supplies, etc.
- UPS (Uninterruptible Power Supply)

Features

- RoHS Compliant and Lead-free
- Patented integrated thermal protection device - Patent #US6636403
- Designed to facilitate compliance to UL1449 3rd Edition for TVSS product
- Standard Operating Voltage Range Compatible with Common AC Line Voltages (115VAC to 750VAC)
- Wave solderable
- High peak surge current rating up to 20kA at single 8/20µS impulse
- Meets UL 1449 Abnormal Over-voltage test (Conforms to limited current testing at 0.5A, 2.5A, 5A and 10A)
- Standard lead form and spacing option
- Low leakage
- -55°C to +85°C operating temperature range

Absolute Maximum Ratings

• For ratings of individual members of a series, see Device Ratings and Specifications chart.

	TMOV25S™ Series	Units
Continuous:		
AC Voltage Range ($V_{M(A)C(R)M(S)}$)	115 to 750	V
Transient:		
Peak Pulse Current (I_{TM})		
For 8x20µs Current Wave, single pulse	20,000	A
Single-Pulse Energy Capability		
For 2ms Current Wave	170 to 670	J
Operating Ambient Temperature Range (T_A)	-55 to +85	°C
Storage Temperature Range (T_{STG})	-55 to +125	°C
Temperature Coefficient (α_V) of Clamping Voltage (V_C) at Specified Test Current	<0.01	%/°C
Hi-Pot Encapsulation (COATING Isolation Voltage Capability)	2,500	V
Under UL 1449 Limited Current Test Procedure-see NOTE#1	600	V
COATING Insulation Resistance	1,000	MΩ

Note#1 - Under UL1449 limited current testing parts rated >420V will not open due to 600V voltage limit. Devices with ratings >420V have not yet been evaluated.

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Device Ratings & Specifications

Part Number		Maximum Rating (85°C)			Specifications (25 °C)					
		Continuous		Transient	Varistor Voltage at 1mA Test Current		Clamping Voltage at 100A Current 8/20µs	UL 1449 3 rd Edition	Nominal Discharge Current	Typical Capacitance
		AC Volts	Energy 2ms	Peak Current 8/20µs						
Part Number	Branding	$V_{M(A)C(R)M(S)} / MCOV$	W_{TM}	$I_{TM} \times 1 \times \text{Pulse}$	$V_{N(D)C} \text{ Min}$	$V_{N(D)C} \text{ Max}$	V_C	VPR ²	I_N	C
		(V)	(J)	(A)	(V)		(V)	(V)	(A)	(pF)
TMOV25SP115M	P25T115M	115	170	20000	162	198	295	400	5800	3200
TMOV25SP130M	P25T130M	130	190	20000	184	226	335	500	5800	2800
TMOV25SP140M	P25T140M	140	210	20000	200	240	355	500	5800	2500
TMOV25SP150M	P25T150M	150	220	20000	216	264	390	500	5800	2300
TMOV25SP175M	P25T175M	175	250	20000	243	297	450	600	5800	1900
TMOV25SP230M	P25T230M	230	300	20000	324	396	585	700	5800	1500
TMOV25SP250M	P25T250M	250	330	20000	351	429	640	800	5800	1400
TMOV25SP275M	P25T275M	275	350	20000	387	473	700	900	5800	1250
TMOV25SP300M	P25T300M	300	370	20000	423	517	765	1000	5800	1150
TMOV25SP320M	P25T320M	320	390	20000	459	561	825	1000	5800	1080
TMOV25SP385M	P25T385M	385	430	20000	558	682	1010	1200	5800	900
TMOV25SP420M	P25T420M	420	460	20000	612	748	1100	1500	5800	820
TMOV25SP440M	P25T440M	440	470	20000	643	787	1160	n/a	5800	790
TMOV25SP460M	P25T460M	460	490	20000	675	825	1220	n/a	5800	750
TMOV25SP510M	P25T510M	510	520	20000	738	902	1335	n/a	5800	680
TMOV25SP550M	P25T550M	550	550	20000	819	1001	1475	n/a	5800	630
TMOV25SP625M	P25T625M	625	600	20000	900	1100	1625	n/a	5800	550
TMOV25SP750M	P25T750M	750	670	20000	1080	1320	1950	n/a	5800	460

Thermal Characteristics

Typical time to open circuit under UL 1449 Abnormal Overvoltage Limited Current Test:

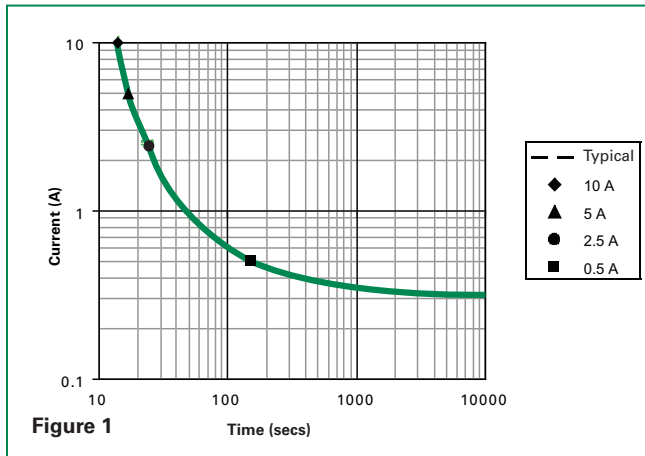


Figure 1

Current, Energy, Power Derating Curve

For applications exceeding 85°C ambient temperature, the peak surge current and energy ratings must be reduced as shown below.

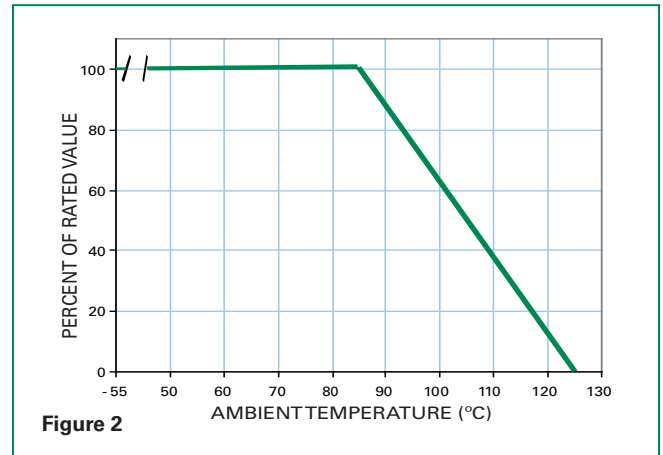


Figure 2

Transient V-I Characteristic Curves

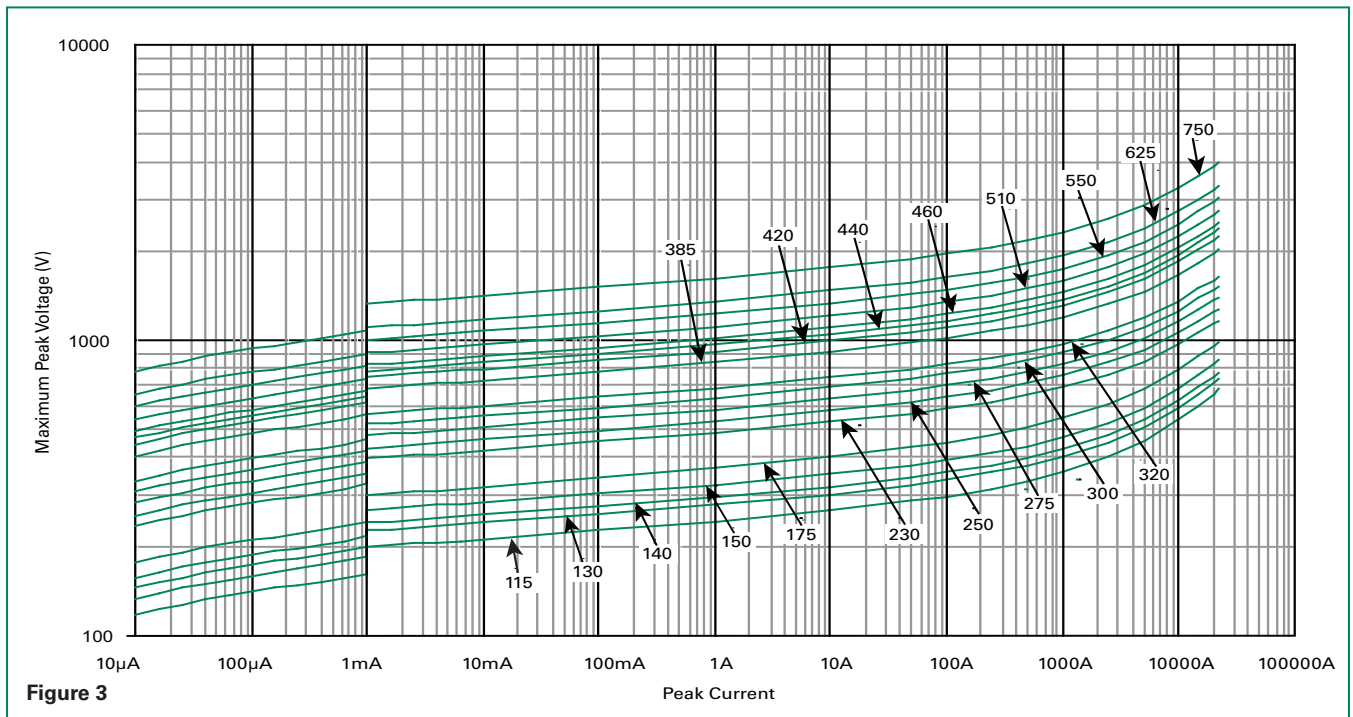


Figure 3

TMOV25S™ Series

Pulse Rating Curve

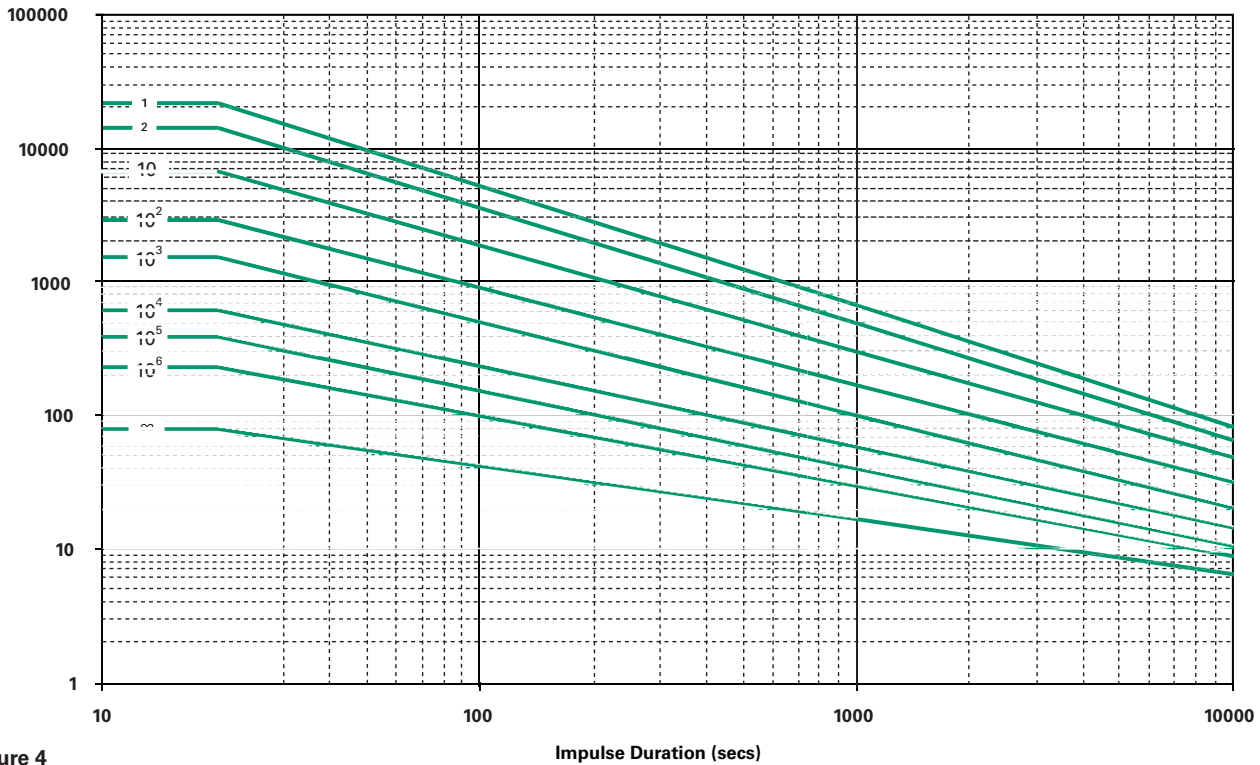


Figure 4

Wave Solder Profile

Because the TMOV25S™ Series contains a thermally responsive device, care must be taken when soldering the device into place. Two soldering methods are possible. Firstly, hand soldering: We recommend the use of pliers to heat-sink the leads of the device. Secondly, wave-soldering: This is a strenuous process requiring pre-heat stages to reduce the stresses on devices.

It is critically important that all preheat stage and the solder bath temperatures are rigidly controlled. The recommended solder for the TMOV® Series is a 62/36/2 (Sn/Pb/Ag), 60/40 (Sn/Pb) or 63/37 (Sn/Pb). Littelfuse also recommends an RMA solder flux. SAC solders (SnAgCu) are recommended for Lead-free applications.

Soldering Profile

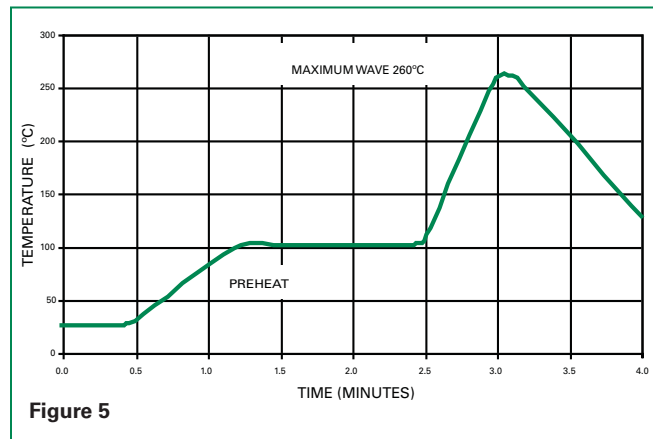


Figure 5

Physical Specifications

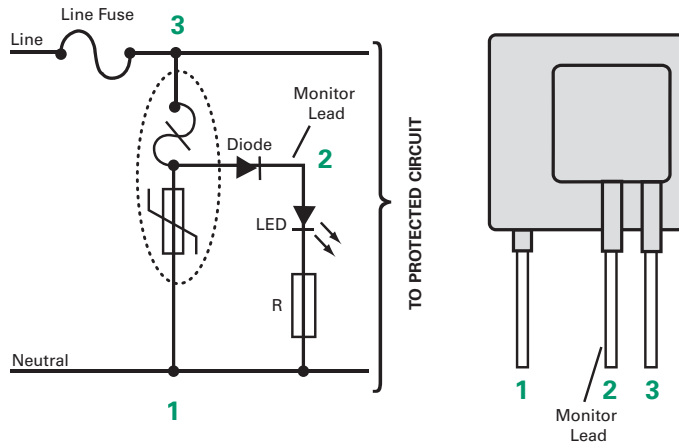
Lead Material	Tin-coated Copper wire
Soldering Characteristics	Solderability per MIL-STD-202, Method 208E
Insulating Material	Cured, flame retardant epoxy polymer meets UL94V-0 requirements
Device Labeling	Marked with LF, voltage, UL logos, and date code

Environmental Specifications

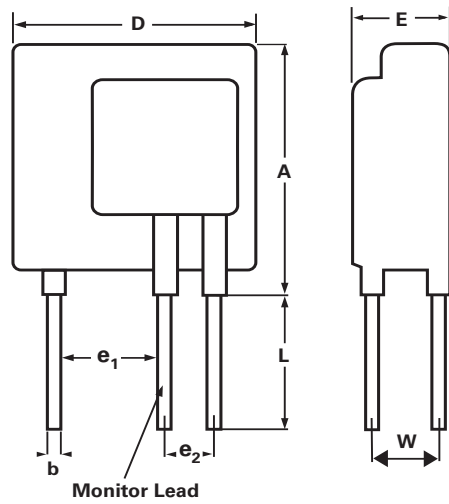
Operating/Storage Temperature	-40°C to +85°C
Passive Aging	+85°C, 1000 hours -/+10% typical voltage change
Humidity Aging	+85°C, 85%R.H., 1000 hours -/+10% typical voltage change
Thermal Shock	+85°C to -40°C 5 times -/+10% typical voltage change
Solvent Resistance	MIL-STD-202, Method 215F
Moisture Sensitivity	Level 1, J-STD-020C

Application Example

The application example left shows how the indicator lead on the TMOV® can be used to indicate that thermal element has been opened. This signifies that the circuit is no longer protected from transients by the MOV.



Dimensions

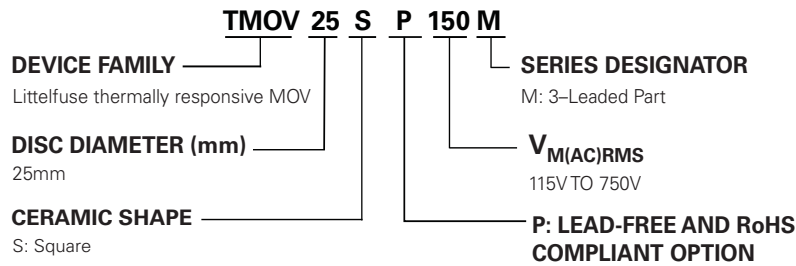


Product Dimensions (mm)

Part Number	W _{MIN}	W _{MAX}	E	A _{MAX}	B _{MIN}	B _{MAX}	D _{MAX}	e ₁	e ₂	L
TMOV25SP115M	1.5	2.7	11.7	34.5	0.95	1.05	28	12.7+/-1	6.5+/-1	12.7 Min.
TMOV25SP130M	1.6	2.9	11.9							
TMOV25SP140M	1.7	3.0	12.0							
TMOV25SP150M	1.8	3.1	12.1							
TMOV25SP175M	1.9	3.3	12.3							
TMOV25SP230M	2.0	3.4	12.4							
TMOV25SP250M	2.1	3.5	12.5							
TMOV25SP275M	2.3	3.7	12.7							
TMOV25SP300M	2.4	3.9	12.9							
TMOV25SP320M	2.6	4.1	13.1							
TMOV25SP385M	3.0	4.7	13.7							
TMOV25SP420M	3.3	5.0	14.0							
TMOV25SP440M	3.4	5.2	14.2							
TMOV25SP460M	3.6	5.4	14.4							
TMOV25SP510M	3.9	5.7	14.7							
TMOV25SP550M	4.2	6.2	15.2							
TMOV25SP625M	4.6	6.6	15.6							
TMOV25SP750M	5.4	7.7	16.7							

For 14mm ratings above 420 V_{RMS} contact factory for specifications.

Part Numbering System



Term Definitions

Rated AC Voltage ($V_{M(AC)RMS}$) – MCOV

This is the maximum continuous sinusoidal RMS voltage that may be applied. This voltage may be applied at any temperature up to the maximum operating temperature of the device.

Maximum Non-Repetitive Surge Current (I_{TM})

This is the maximum peak current which may be applied for a single 8/20 μ s impulse, with rated line voltage also applied, without causing device failure. The pulse can be applied to the device in either polarity with the same confidence factor.

Nominal Discharge Current (I_N)

Peak value of the current, selected by the manufacturer, through the SPD having a current waveshape of 8/20 μ s where the SPD remains functional after 15 surges.

Voltage Protection Rating (V_{PR})

A rating selected from a list of preferred values as given in UL 1449 and assigned to each mode of protection. The value of VPR is determined as the nearest highest value taken from UL 1449 to the measured limiting voltage determined during the transient-voltage surge suppression test using the combination wave generator at a setting of 6kV, 3kA.

UL 1449

An Underwriters Laboratory standard covering the safety requirements for Surge Protective Devices intended for permanently connected, cord-connected and direct plug-in applications.

Limited Current Abnormal Over-voltage Test

An AC over-voltage condition applied to a Surge Protective Device according to UL 1449, Section 39.4. The short circuit current is limited by series connected resistors to 10A, 5A, 2.5A, 0.5A and 0.125A. The condition is maintained for 7 hours or until the device under test is disconnected from the AC supply or the current or temperature reaches equilibrium.

Maximum Non-Repetitive Surge Energy (W_{TM})

This is the maximum rated transient energy which may be dissipated for a single current pulse at a specified impulse duration, with the rated RMS voltage applied, without causing device failure.

Nominal Voltage ($V_{N(DC)}$)

This is the voltage at which the device changes from the off (standby state) to the on (clamping state) and enters its conduction mode of operation. The voltage value is usually characterised at the 1mA point and has a specified minimum and maximum voltage range.