

# Surface Mount Metal Oxide Varistor

## SM10 Series



### Description

Littelfuse SM10 Varistor Series is the first surface-mount Metal Oxide Varistor (MOV) with ultra-high surge current handling capability, specifically designed for primary circuit transient voltage surge protection. The SM10 Varistor Series is constructed with an MOV disc and tin-plated terminals within a polymer molded package, which is fully qualified in lead-free soldering and compatible with both reflow and wave soldering process.

### Features & Benefits

- High operating temperature: 125 °C
- High surge energy/current absorption withstanding capability (130–230 Vac = 15 pulses of 6 kV / 3 kA) (250–625 Vac = 40 pulses of 6 kV / 3 kA)
- AEC-Q200 qualified
- Vertical surface mountable
- RoHS compliant, Halogen-free, and Pb-free
- More reliable and suitable for high operating temperature environments
- Extends product reliability and lifespan
- Meets automotive grade product and customers' requests
- Saves PCB surface space and suitable for SMT assembly process
- Environment-friendly

### Additional Information



Resources



Accessories



Samples

### Agency Approvals

Agency	Standards	Agency File Number
	UL 1449 CSA C22.2 No. 269.5	E320116
	IEC / EN 61051-1 IEC / EN 61051-2 IEC 61051-2-2 Annex Q of IEC / EN 60950-1 Annex G of IEC / EN 62368-1	J50544693

### Applications

- Electricity power storage
- Electric vehicle on-board and off-board charger
- General electronic and electrical products

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### Electrical Specifications

Part Number	Specifications (125 °C)		Specifications (25 °C)							
	Maximum Continuous Operating Voltage (MCOV) <sup>1</sup>		Rated Energy <sup>2</sup> 10/1000 $\mu$ s	Rated Energy <sup>3</sup> 2 ms	Varistor Voltage at 1 mA DC <sup>4</sup>	Peak Surge Current <sup>5</sup> (8/20 $\mu$ s, 1 Pulse)	Nominal Discharge Current <sup>6</sup> (8/20 $\mu$ s, 15 Pulses)	Surge Life <sup>7</sup> (6 kV 1.2/50 $\mu$ s/ 3 kA 8/20 $\mu$ s, 1 minute between pulses)	Maximum Clamping Voltage at 25 A (8/20 $\mu$ s) <sup>8</sup>	Typical Capacitance at 1 kHz
	V <sub>RMS</sub>	V <sub>DC</sub>	W <sub>max</sub>	W <sub>max</sub>	V <sub>n</sub>	I <sub>max</sub>	I <sub>n</sub>	Combination Wave Pulse Withstand	V <sub>c</sub>	C <sub>TYP</sub>
	(V)	(V)	(J)	(J)	(V)	(A)	(A)	(No. of Pulses)	(V)	(pF)
V130SM10	130	170	48	34	205 ± 10%	5000	3000	15	340	600
V150SM10	150	200	53	40	240 ± 10%	5000	3000	15	395	580
V175SM10	175	225	60	46	270 ± 10%	5000	3000	15	455	560
V195SM10	195	250	65	49	300 ± 10%	5000	3000	15	495	540
V210SM10	210	270	69	52	330 ± 10%	5000	3000	15	545	520
V230SM10	230	300	75	60	360 ± 10%	5000	3000	15	595	500
V250SM10	250	320	80	65	390 ± 10%	5000	3000	40	650	490
V275SM10	275	350	83	71	430 ± 10%	5000	3000	40	710	420
V300SM10	300	385	87	76	470 ± 10%	5000	3000	40	775	380
V320SM10	320	420	90	80	510 ± 10%	5000	3000	40	840	260
V330SM10	330	435	92	84	530 ± 10%	5000	3000	40	875	255
V350SM10	350	460	95	86	560 ± 10%	5000	3000	40	930	250
V385SM10	385	505	100	90	620 ± 10%	5000	3000	40	1025	200
V420SM10	420	560	105	95	680 ± 10%	5000	3000	40	1120	190
V440SM10	440	585	107	98	710 ± 10%	5000	3000	40	1180	185
V460SM10	460	615	110	100	750 ± 10%	5000	3000	40	1240	180
V480SM10	480	640	84	79	780 ± 10%	5000	3000	40	1280	175
V510SM10	510	670	86	81	820 ± 10%	5000	3000	40	1350	170
V550SM10	550	720	88	83	910 ± 10%	5000	3000	40	1500	165
V625SM10	625	720	90	85	1000 ± 10%	5000	3000	40	1650	160

#### Notes:

- Maximum Continuous Operating Voltage (MCOV): the maximum RMS or DC value of the voltage that may be continuously applied.
- Rated Energy 10 / 1000  $\mu$ s (W<sub>max</sub>): the maximum energy that the varistor is able to withstand when exposed to a single 10/1000  $\mu$ s pulse.
- Rated Energy 2 ms (W<sub>max</sub>): the maximum energy that the varistor is able to withstand when exposed to a single 2 ms rectangular pulse.
- Varistor Voltage (V<sub>n</sub>): the measured voltage across the varistor at 1 mA DC.
- Peak Surge Current (I<sub>max</sub>): The maximum current that the varistor is able to withstand when exposed to a single 8 / 20  $\mu$ s pulse, at ambient temperature of 25 °C.
- Nominal Discharge Current (I<sub>n</sub>): The current that the varistor is able to withstand when exposed to fifteen 8 / 20  $\mu$ s pulses (15 pulses applied in 3 groups of 5 pulses, with 1min interval between pulses and 30 minutes interval between groups), superimposed to VRMS MCOV.
- Surge Life : the number of times the varistor is able to withstand 6 kV (1.2/50  $\mu$ s) / 3 kA (8/20  $\mu$ s) combination pulses. The pulses are applied in groups of 5 pulses, alternatively positive and negative, with 1min interval between pulses and 1 minutes interval between groups, superimposed to V<sub>RMS</sub> MCOV (synchronization 0°, 90°, 180°, and 270°).
- Clamping Voltage (V<sub>c</sub>): the voltage at 25 A 8/20  $\mu$ s current wave shape.

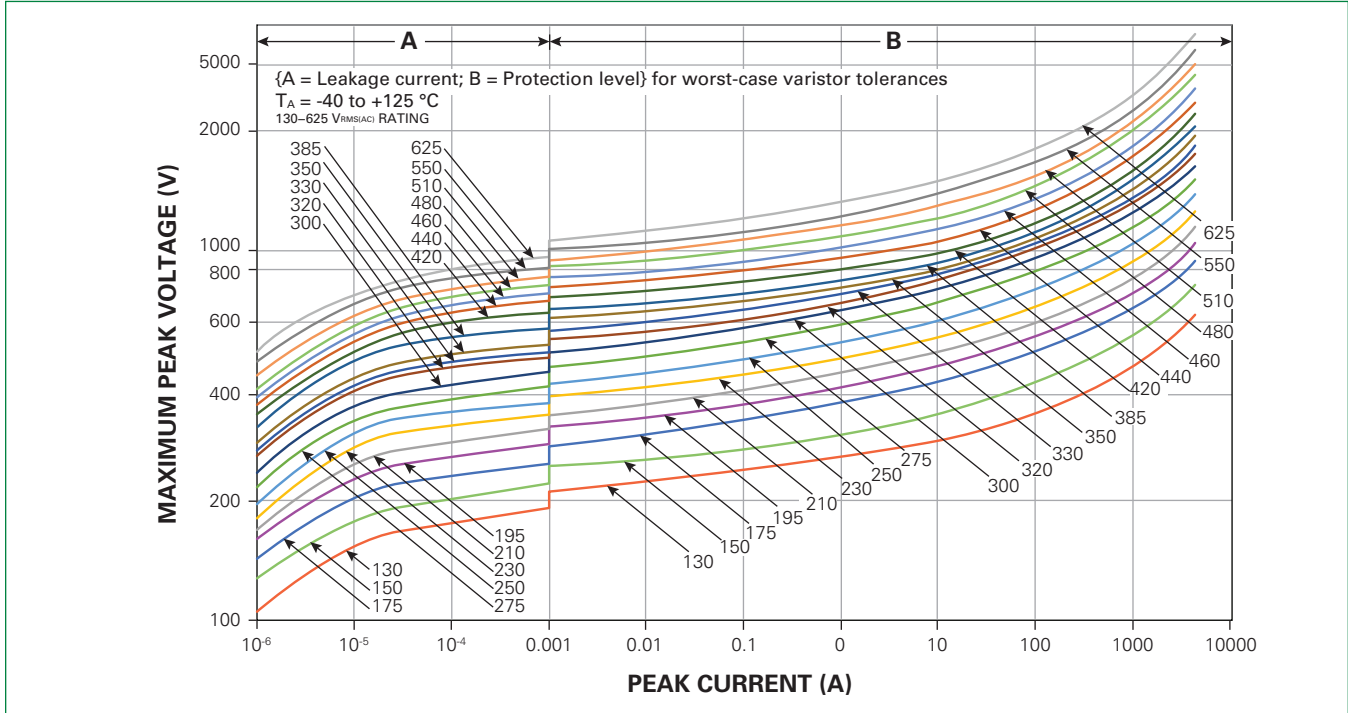
### Environmental Specifications

Climatic Category	IEC 60068-1	40 / 125 / 56 (Lower temp / Upper temp / Duration of damp heat, steady state test)
Operating Temperature	IEC 61051-1	-40 °C / +125 °C
Storage Temperature	–	-40 °C / +150 °C
Solvent Resistance	MIL STD 202, Method 215	Marking is visible and no visual damage
Moisture Sensitivity	Level 1, J-STD-020	V <sub>n</sub> shift $\pm$ 10%; No visual damage
Voltage Proof	IEC 61051-1	$\geq$ 2.5 kV RMS
Insulation Resistance	IEC 61051-1	$\geq$ 100 M $\Omega$
Product Weight	–	5 grams Max.

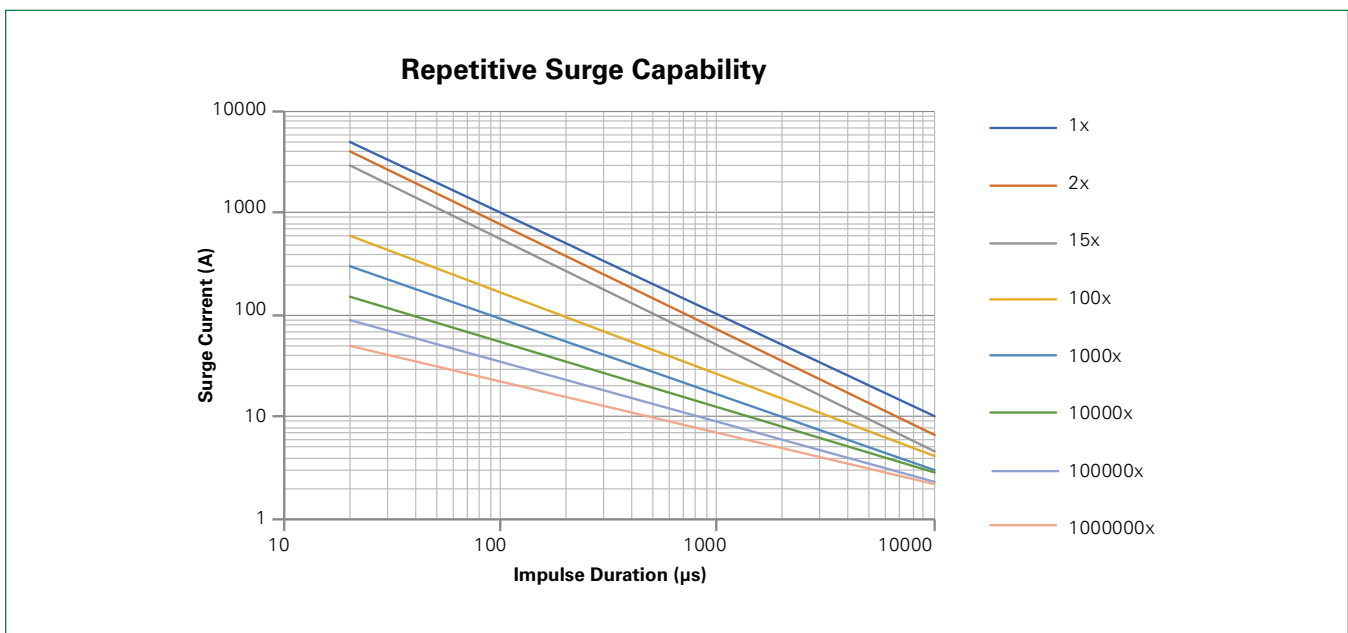
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### Transient V-I Characteristic Curve: Maximum Clamping Voltage



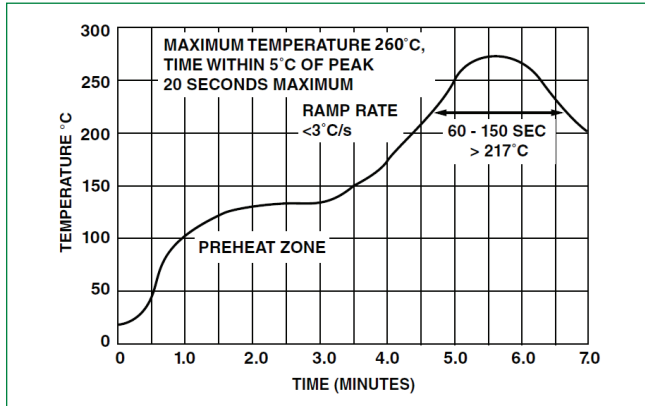
### Derating Curves for Repetitive Surge Current



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### Reflow Soldering Profile Recommendation



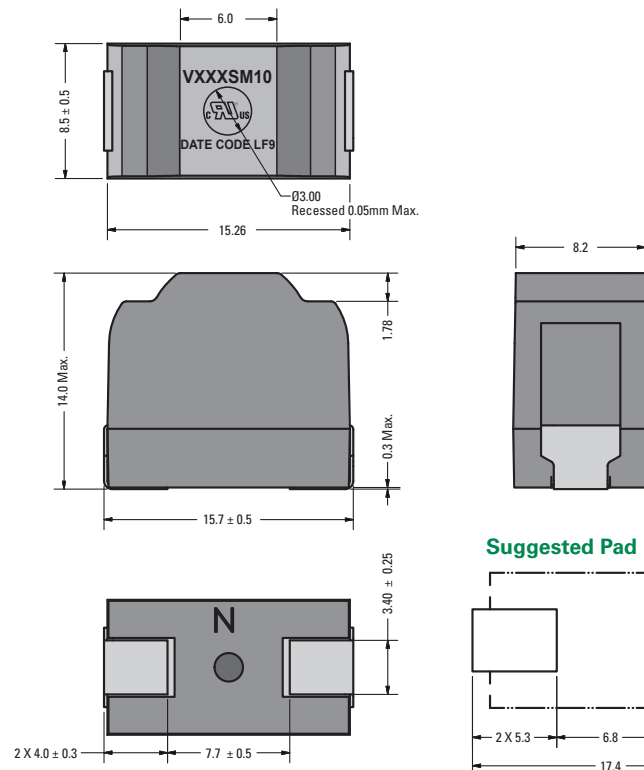
#### Lead-Free Soldering Recommendations:

The terminals of SM10 series devices are tin-plated. The recommended lead-free solder paste is SAC305 (Sn96.5Ag3.0Cu0.5) with an RMA flux, though there is a wide selection of pastes and fluxes available that should be compatible. The reflow soldering profile must be constrained by the maximums in the "Lead-Free Reflow Soldering Profile".

**Note:** The Lead-free paste, flux and profile were used for evaluation purposes by Littelfuse based on industry standards and practices. There are multiple choices of all three available, so it is advised that the customer explores the optimum combination for their process as processes vary considerably from site to site.

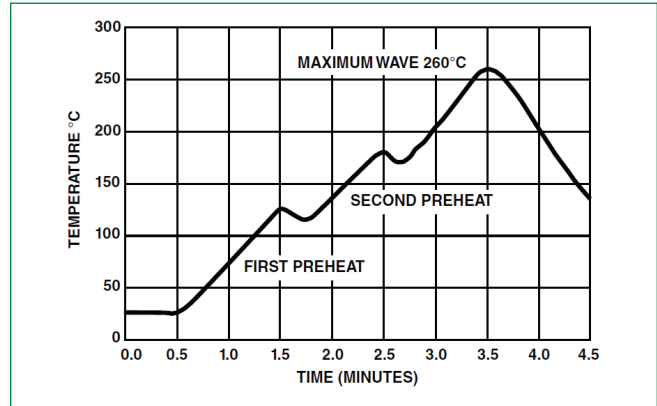
### Dimensions

Dimensions in mm

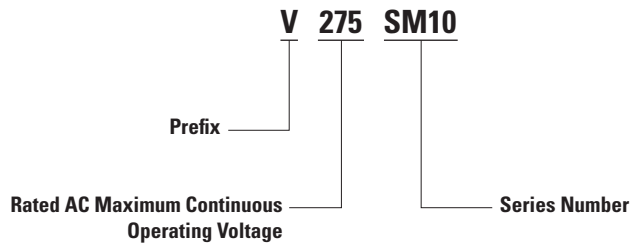


**Note:** Cavity number "N" from injection moulding on housing bottom surface is recessed to 0.1 mm maximum.

### Wave Soldering Profile Recommendation



### Part Numbering System



### Physical Specifications

<b>Lead Material</b>	Folded Tin-plated metal leads
<b>Soldering Characteristics</b>	J-STD-002
<b>Solderability</b>	Molded plastic meets UL94 V-0 requirement

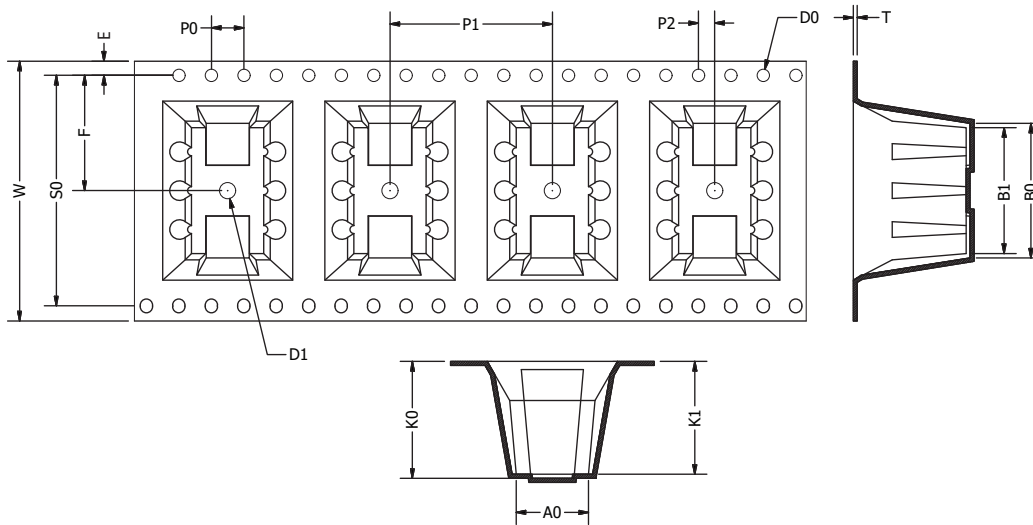
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### Tape and Reel Dimension

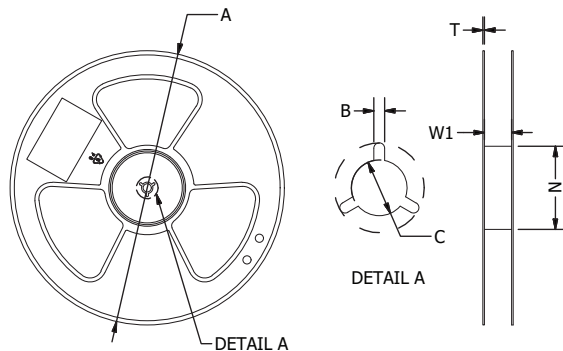
Dimensions in mm

#### Carrier Tape



Symbol	Spec
A0	8.9 ± 0.1
B0	16.6 ± 0.1
B1	15.5 ± 0.1
K0	14.4 ± 0.1
K1	13.9 ± 0.1
P0	4.0 ± 0.1
P1	20.0 ± 0.1
P2	2.0 ± 0.1
W	32.0 ± 0.3
T	0.5 ± 0.05
E	1.75 ± 0.1
F	14.2 ± 0.1
D0	1.5 + 0.1/0
D1	2.00 + 0.1/0
S0	28.4 ± 0.1

#### Plastic Reel



Symbol	Spec
A	381 ± 1.0
B	2.5 ± 0.2
N	100.0 ± 0.5
C	13.5 ± 0.2
T	2.2 ± 0.2
W1	32.8 ± 0.2

**Notes:**

1. All Dimensions per EIA-481-c
2. 10 Pitches Cumulative Tolerance on Tape ±0.20 mm
3. Packing Quantity for 15 Inch (380 mm) Reel: 300 pcs per Reel

### Packaging

Packaging Option	Packaging Specification	Quantity
Reel	See plastic reel drawing above	300 Pcs. per reel
Inner Box	L400 x W395 x H62, mm	One Reel (300 Pcs.)
Outer Carton	L420 x W420 x H265, mm	4 Inner Boxes (1200 Pcs.)

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