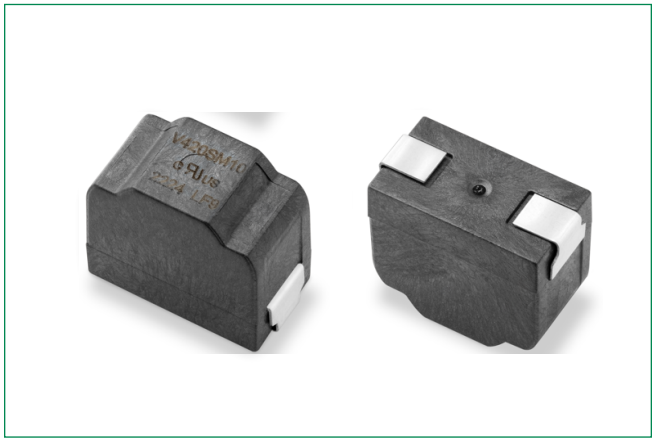
# Surface Mount Metal Oxide Varistor

## SM10 Varistor Series



## Additional Information

Resources | Accessories | Samples

## Agency Approvals

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

## 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 molding 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 surg energy / current absorption withstanding capability (130 Vac–230 Vac = 15 pulses of 6 kV / 3kA) (250 Vac–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 products
- Extends product reliability and lifespan
- Meets automotive grade product and customers' requests
- Saves PCB surface space and suitable for SMT assembly process
- Environment-friendly

## 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)[1] | | Rated Energy[2] 10/1000 µs | Rated Energy[3] 2 ms | Varistor Voltage at 1 mA DC[4] | Peak Surge Current[5] (820 µs, 1 Pulse) | Nominal Discharge Current[6] (8x20 µs, 15 Pulses) | Surge Life[7] (Voltage 1.2/50 µs, Current 8/20 µs, 6 kV/3 kA, Interval 1 minute) | Maximum Clamping Voltage at 25 A[8] (8/20 µs) | Typical Capacitance at 1 kHz |
| | $V_{RMS}$ | $V_{DC}$ | $W_{max}$ | $W_{max}$ | $V_n$ | $I_{max}$ | $I_n$ | $I_{cw}$ | $V_c$ | $C_{TYP}$ |
| | (V) | (V) | (J) | (J) | (V) | (A) | (A) | (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:**

**1.** Maximum Continuous Operating Voltage ($M_{COV}$): the maximum RMS or DC value of the voltage that may be continuously applied.

**2.** Rated Energy 10 / 1000 µs ($W_{max}$): the maximum energy that the varistor is able to withstand when exposed to a single 10/1000 µs pulse.

**3.** Rated Energy 2 ms ($W_{max}$): the maximum energy that the varistor is able to withstand when exposed to a single 2 ms rectangular pulse.

**4.** Varistor Voltage ($V_n$): the measured voltage across the varistor at 1 mA DC.

**5.** Peak Surge Current ($I_{max}$): The maximum current that the varistor is able to withstand when exposed to a single 8 / 20 µs pulse, at ambient temperature of 25 °C.

**6.** Nominal Discharge Current ($I_n$): The current that the varistor is able to withstand when exposed to fifteen 8 / 20 µs 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.

**7.** Surge Life ($I_{cw}$): The current that the varistor is able to withstand when exposed to forty combination pulses (applied in 8 groups of 5 pulses, alternatively positive and negative, with 1min interval between pulses and 1 minutes interval between groups), superimposed to $V_{RMS}$ $M_{COV}$ (synchronization 0 °C, 90 °C, 180 °C, and 270 °C).

**8.** Clamping Voltage ($V_c$): the voltage at 25 A 8/20 µs 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 | $V_n$ shift% ≤ ± 10%; No visual damage |
| Voltage Proof | IEC 61051-1 | ≥ 2.5 kV RMS |
| Insulation Resistance | IEC 61051-1 | ≥ 100 MΩ |
| Product Weight | – | 5 grams Max. |





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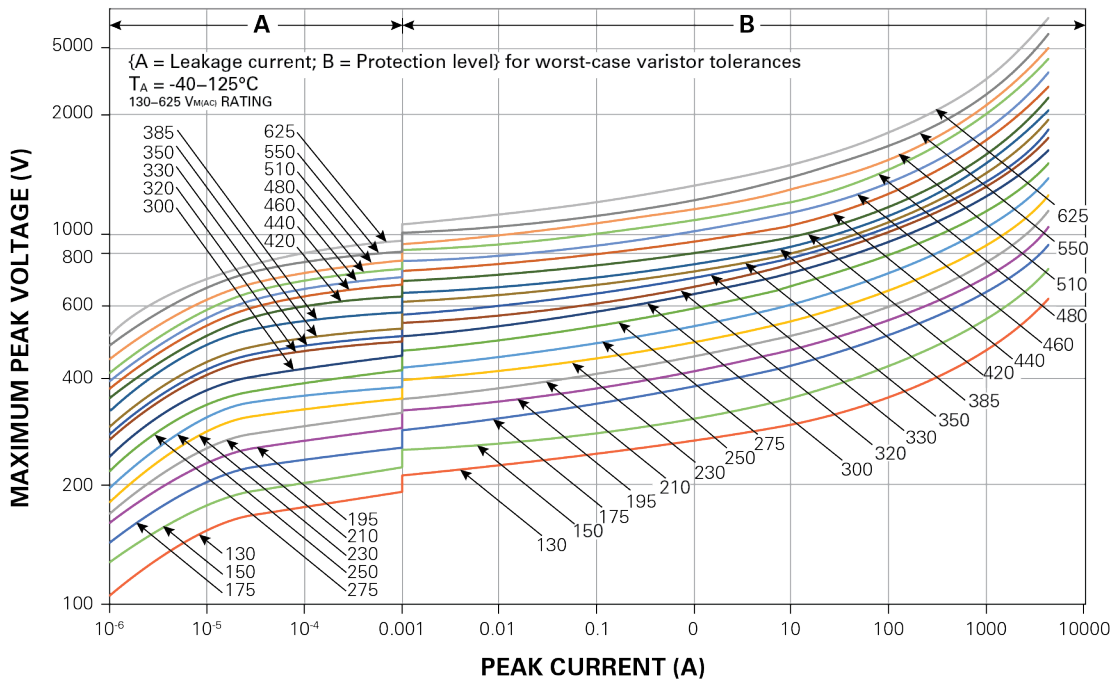
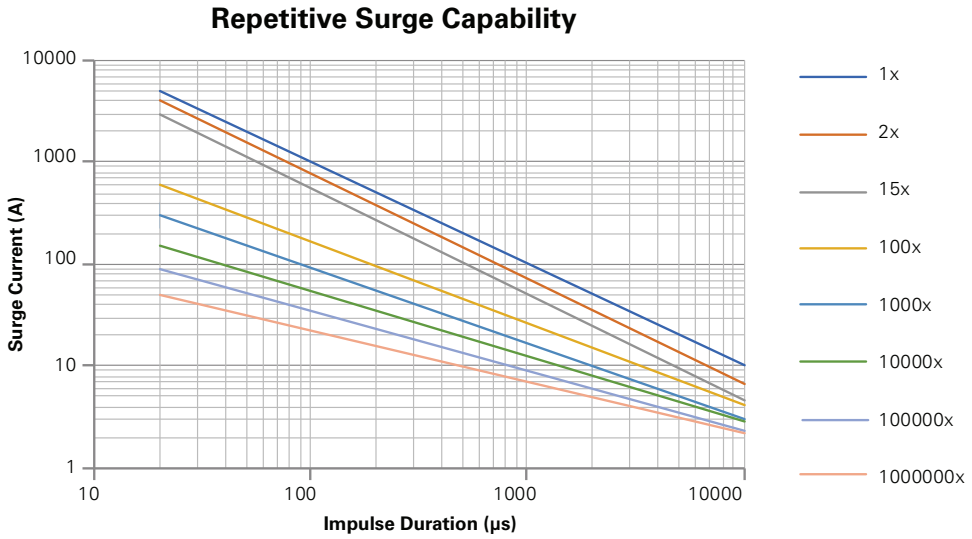
## Transient V-I Characteristic Curve: Maximum Clamping Voltage




## Derating Curves for Repetitive Surge Current



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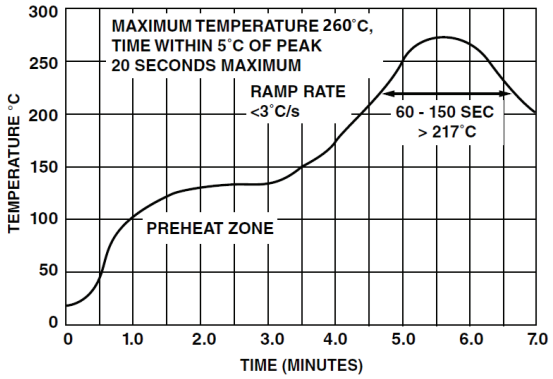
# Surface Mount Metal Oxide Varistor
SM10 Varistor Series

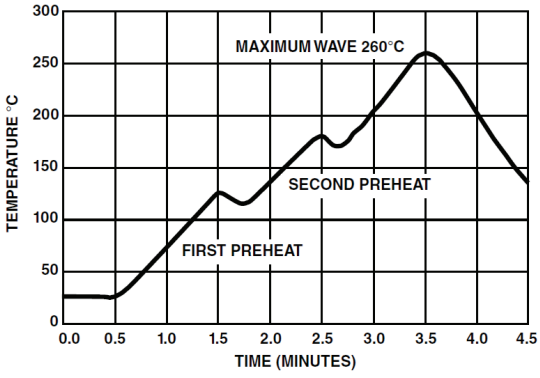
## Reflow Soldering Profile Recommendation



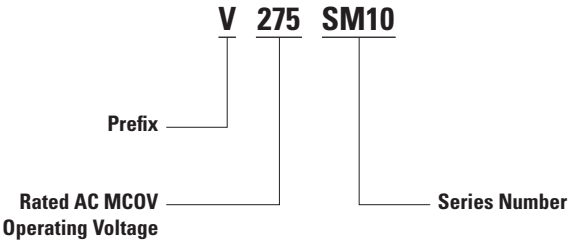

**Lead-Free Soldering Recommendations:**
The terminals of SM10 series devices are tin-plated. The recommended lead-free solder paste is SAC305 (Sn96.5Ag3.0Cu0.5) with an RMA flux, though there is a wide selection of pastes and fluxes available that should be compatible. The reflow soldering profile must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

## Wave Soldering Profile Recommendation

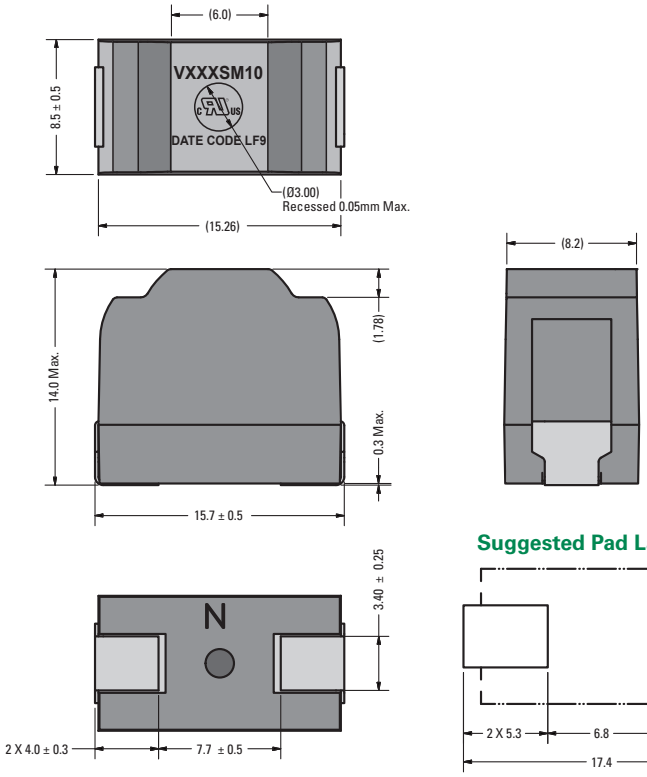



## Part Numbering System

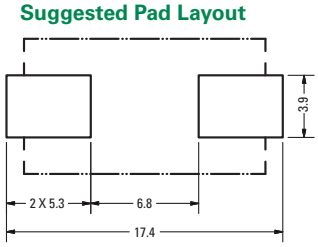



## Dimensions

**Dimensions in mm**




### Suggested Pad Layout




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

## Physical Specifications

| | |
|---|---|
| **Lead Material** | Folded Tin-plated metal leads |
| **Soldering Charecteristics** | J-STD-002 |
| **Solderability** | Molded plastic meets UL94 V-0 requirement |



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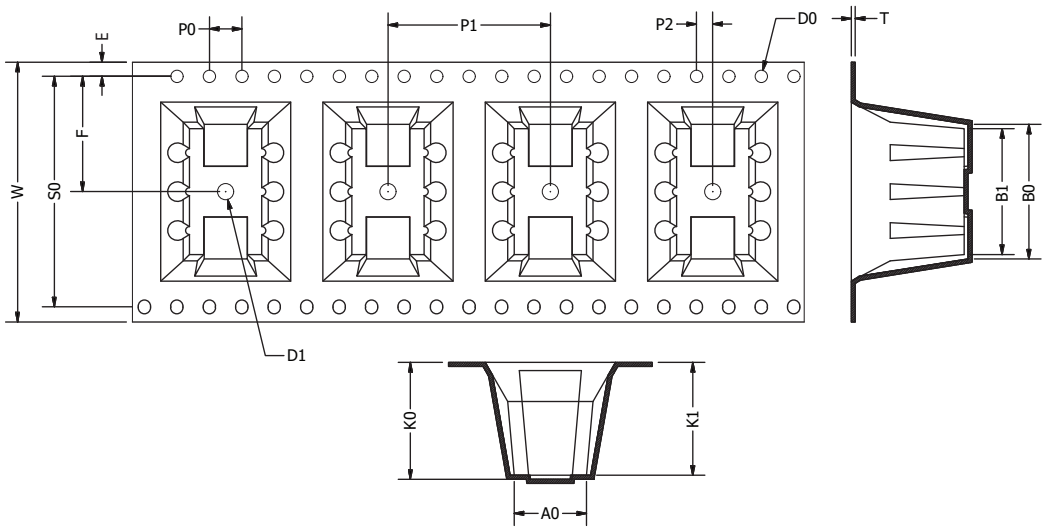
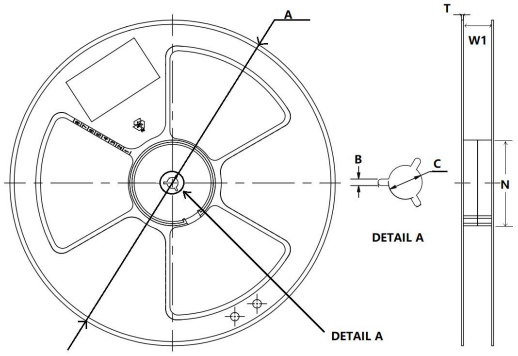
## Tape and Reel Dimension
**Dimensions in mm**

### 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 devices per reel |
| Inner Box | L400 x W395 x H62, mm | One Reel (300 Pcs.) |
| Outer Carton | L420 x W420 x H265, mm | 4 Innner Boxes (1200 Pcs.) |





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# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Littelfuse:

V130SM10 V150SM10 V195SM10 V210SM10 V230SM10 V300SM10 V330SM10 V385SM10 V440SM10 V480SM10 V510SM10 V550SM10 V625SM10 V175SM10 V250SM10 V275SM10 V320SM10 V350SM10 V420SM10 V460SM10