





### TMOV®34S Varistor Series



#### Description

The Littelfuse TMOV®34S thermally protected varistor series consists of a 34mm square format varistor element (MOV) with an integral thermally activated element. This element is designed to open in the event of overheating due to abnormal overvoltage, limited current conditions. Certain TMOV®34S varistor are offered with a "monitor" lead which may be connected to signalling circuitry to indicate if the MOV has been disconnected from the circuit. TMOV®34S varistor series offer quick thermal response due to the close proximity of the integrated thermal element to the MOV body. The integrated configuration also offers lower inductance than most discrete solutions resulting in improved clamping performance to fast over voltage transients.

#### Agency Approvals

| Agency  | Standard  | Agency File Number |
|---|---|--------------------|
|    | UL1449  | E320116            |
|    | QC42201-C001,<br>QC42201-A001,<br>IEC 60950-1 (Annex Q) | IECQ-C BSI 15.0009 |
|   | IEC 61051-1,<br>IEC 61051-2,<br>IEC 60950-1 (Annex Q)   | 40021525           |

#### Absolute Maximum Ratings

\* For ratings of individual members of a series, see Device Ratings and Specifications chart

| Continuous   | TMOV34S Varistor Series | Units      |
|--|-------------------------|------------|
| <b>Steady State Applied Voltage:</b>   |                         |            |
| AC Voltage Range ( $V_{MACRMS}$ )  | 115 to 750              | V          |
| <b>Transients:</b>   |                         |            |
| Peak Pulse Current ( $I_{TM}$ )  |                         |            |
| For 8/20 $\mu$ s Current Wave, single pulse  | up to 40,000            | A          |
| Single Pulse Energy Range  |                         |            |
| For 2ms Current Wave   | 280 to 1200             | J          |
| Operating Ambient Temperature Range ( $T_A$ )  | -55 to + 85             | °C         |
| Storage Temperature Range ( $T_{STG}$ )  | -55 to + 125            | °C         |
| Temperature Coefficient ( $\alpha$ ) of Clamping Voltage ( $V_C$ ) at Specified Test Current | <0.01                   | %/°C       |
| Hi-Pot Encapsulation (Isolation Voltage Capability)  | 2500                    | V          |
| COATING Insulation Resistance  | 1000                    | M $\Omega$ |

\* Contact your Littelfuse product representative to discuss alternatives and for additional information.

**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.

#### Features

- High peak current rating to 40 kA
- 55°C to +85°C operating temp
- RoHS Compliant and Lead-free Available
- Alternative design available with narrow 3mm wide monitor (right) lead
- Alternative design available with 2 leads only (no monitor lead)

#### Applications

- SPD Products
- AC Panel Protection Modules
- UPS (Uninterruptable Power Supply)
- Inverters
- AC/DC Power Supplies

#### Additional Information



Datasheet



Resources



Samples

### TMOV® 34S Series Ratings & Specifications - Standard 3 Lead Design

| Lead-free and RoHS Compliant Models | Branding     | Maximum Rating (85°C)        |                           |                                     |                                     | Specifications (25°C)                      |                        |   |                                 |
|-------------------------------------|--------------|------------------------------|---------------------------|-------------------------------------|-------------------------------------|--|------------------------|---|---------------------------------|
|                                     |              | Continuous                   |                           | Energy<br>2ms                       | Peak<br>Current<br>8 x 20µs         | Varistor Voltage<br>at 1mA<br>Test Current |                        | Maximum Clamping<br>Volt V <sub>c</sub> at 200A<br>Current (8/20µs) | Typical Capacitance<br>f = 1MHz |
|                                     |              | AC Volts                     | DC<br>Volts               |                                     |                                     | V <sub>N(DC)</sub> Min                     | V <sub>N(DC)</sub> Max |   |                                 |
|                                     |              | V <sub>M(AC)RMS</sub><br>(V) | V <sub>M(DC)</sub><br>(V) | W <sub>TM</sub><br>1 x Pulse<br>(J) | I <sub>TM</sub><br>1 x Pulse<br>(A) |  |                        | V <sub>c</sub><br>(V)   | C<br>(pF)                       |
| TMOV34S111MP                        | TMOV34S111MP | 115                          | 150                       | 280                                 | 40000                               | 162  | 198                    | 305   | 11500                           |
| TMOV34S131MP                        | TMOV34S131MP | 130                          | 175                       | 310                                 | 40000                               | 184.5                                      | 225.5                  | 345   | 10000                           |
| TMOV34S141MP                        | TMOV34S141MP | 140                          | 188                       | 340                                 | 40000                               | 198  | 242                    | 375   | 9000                            |
| TMOV34S151MP                        | TMOV34S151MP | 150                          | 200                       | 360                                 | 40000                               | 216  | 264                    | 405   | 8000                            |
| TMOV34S181MP                        | TMOV34S181MP | 180                          | 240                       | 400                                 | 40000                               | 256  | 312                    | 488   | 6800                            |
| TMOV34S201MP                        | TMOV34S201MP | 200                          | 265                       | 430                                 | 40000                               | 288  | 352                    | 540   | 6500                            |
| TMOV34S251MP                        | TMOV34S251MP | 250                          | 330                       | 490                                 | 40000                               | 351  | 429                    | 650   | 5000                            |
| TMOV34S271MP                        | TMOV34S271MP | 275                          | 369                       | 550                                 | 40000                               | 387  | 473                    | 730   | 4500                            |
| TMOV34S301MP                        | TMOV34S301MP | 300                          | 400                       | 590                                 | 40000                               | 423  | 517                    | 780   | 4050                            |
| TMOV34S321MP                        | TMOV34S321MP | 320                          | 420                       | 640                                 | 40000                               | 459  | 561                    | 830   | 3800                            |
| TMOV34S331MP                        | TMOV34S331MP | 330                          | 435                       | 650                                 | 40000                               | 476  | 581                    | 855   | 3700                            |
| TMOV34S351MP                        | TMOV34S351MP | 350                          | 460                       | 700                                 | 40000                               | 504  | 616                    | 910   | 3500                            |
| TMOV34S391MP                        | TMOV34S391MP | 385                          | 506                       | 800                                 | 40000                               | 558  | 682                    | 1005  | 3300                            |
| TMOV34S421MP                        | TMOV34S421MP | 420                          | 560                       | 910                                 | 40000                               | 612  | 748                    | 1130  | 3000                            |
| TMOV34S461MP                        | TMOV34S461MP | 460                          | 610                       | 960                                 | 40000                               | 643.5                                      | 786.5                  | 1188  | 2800                            |
| TMOV34S481MP                        | TMOV34S481MP | 480                          | 640                       | 960                                 | 40000                               | 675  | 825                    | 1240  | 2700                            |
| TMOV34S511MP                        | TMOV34S511MP | 510                          | 675                       | 960                                 | 40000                               | 738  | 902                    | 1350  | 2500                            |
| TMOV34S551MP                        | TMOV34S551MP | 550                          | 700                       | 965                                 | 40000                               | 770  | 939                    | 1415  | 2250                            |
| TMOV34S571MP                        | TMOV34S571MP | 575                          | 730                       | 990                                 | 40000                               | 819  | 1001                   | 1480  | 2200                            |
| TMOV34S621MP                        | TMOV34S621MP | 620                          | 800                       | 1010                                | 40000                               | 900  | 1100                   | 1589  | 2100                            |
| TMOV34S661MP                        | TMOV34S661MP | 660                          | 850                       | 1030                                | 40000                               | 945  | 1155                   | 1720  | 2000                            |
| TMOV34S681MP                        | TMOV34S681MP | 680                          | 890                       | 1100                                | 40000                               | 980  | 1195                   | 1772  | 1970                            |
| TMOV34S751MP                        | TMOV34S751MP | 750                          | 970                       | 1200                                | 40000                               | 1080                                       | 1320                   | 2000  | 1800                            |

**Notes :**

Same ratings and specifications apply to 2 leaded alternative design. Replace 'M' with 'E' in part number. Refer to Part Numbering System at the end of this document.

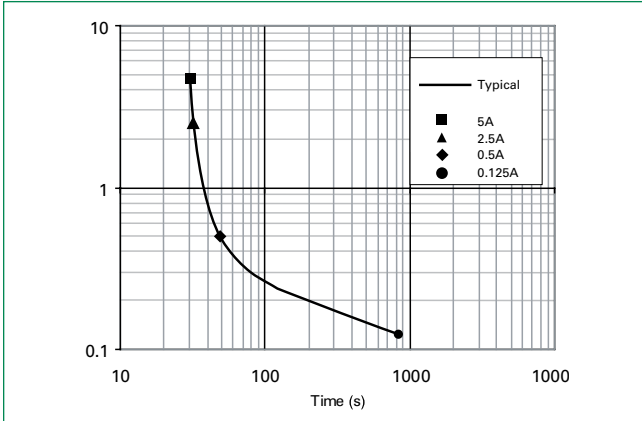
### Ratings & Specifications - Alternative 2 Lead Design

| Lead-free and RoHS Compliant Models | Branding     | Maximum Rating (85°C)        |                    |                                     |                                     | Specifications (25°C)                |                               |   |                              |
|-------------------------------------|--------------|------------------------------|--------------------|-------------------------------------|-------------------------------------|--------------------------------------|-------------------------------|---|------------------------------|
|                                     |              | Continuous                   |                    | Energy 2ms                          | Peak Current 8 x 20 µs              | Varistor Voltage at 1mA Test Current |                               | Maximum Clamping Volt V <sub>c</sub> at 200A Current (8/20µs) | Typical Capacitance f = 1MHz |
|                                     |              | AC Volts                     | DC Volts           |                                     |                                     | V <sub>N(DC) Min</sub>               | V <sub>N(DC) Max</sub>        |   |                              |
| Part Number                         |              | V <sub>M(AC)RMS</sub><br>(V) | V <sub>M(AC)</sub> | W <sub>TM</sub><br>1 x Pulse<br>(J) | I <sub>TM</sub><br>1 x Pulse<br>(A) | V <sub>N(DC) Min</sub><br>(V)        | V <sub>N(DC) Max</sub><br>(V) | V <sub>c</sub><br>(V)   | C<br>(pF)                    |
| TMOV34S111EP                        | TMOV34S111EP | 115                          | 150                | 280                                 | 40000                               | 162                                  | 198                           | 305   | 11500                        |
| TMOV34S131EP                        | TMOV34S131EP | 130                          | 175                | 310                                 | 40000                               | 184.5                                | 225.5                         | 345   | 10000                        |
| TMOV34S141EP                        | TMOV34S141EP | 140                          | 188                | 340                                 | 40000                               | 198                                  | 242                           | 375   | 9000                         |
| TMOV34S151EP                        | TMOV34S151EP | 150                          | 200                | 360                                 | 40000                               | 216                                  | 264                           | 405   | 8000                         |
| TMOV34S181EP                        | TMOV34S181EP | 180                          | 240                | 400                                 | 40000                               | 256                                  | 312                           | 488   | 6800                         |
| TMOV34S201EP                        | TMOV34S201EP | 200                          | 265                | 430                                 | 40000                               | 288                                  | 352                           | 540   | 6500                         |
| TMOV34S251EP                        | TMOV34S251EP | 250                          | 330                | 490                                 | 40000                               | 351                                  | 429                           | 650   | 5000                         |
| TMOV34S271EP                        | TMOV34S271EP | 275                          | 369                | 550                                 | 40000                               | 387                                  | 473                           | 730   | 4500                         |
| TMOV34S301EP                        | TMOV34S301EP | 300                          | 400                | 590                                 | 40000                               | 423                                  | 517                           | 780   | 4050                         |
| TMOV34S321EP                        | TMOV34S321EP | 320                          | 420                | 640                                 | 40000                               | 459                                  | 561                           | 830   | 3800                         |
| TMOV34S331EP                        | TMOV34S331EP | 330                          | 435                | 650                                 | 40000                               | 476                                  | 581                           | 855   | 3700                         |
| TMOV34S351EP                        | TMOV34S351EP | 350                          | 460                | 700                                 | 40000                               | 504                                  | 616                           | 910   | 3500                         |
| TMOV34S391EP                        | TMOV34S391EP | 385                          | 506                | 800                                 | 40000                               | 558                                  | 682                           | 1005  | 3300                         |
| TMOV34S421EP                        | TMOV34S421EP | 420                          | 560                | 910                                 | 40000                               | 612                                  | 748                           | 1130  | 3000                         |
| TMOV34S461EP                        | TMOV34S461EP | 460                          | 610                | 960                                 | 40000                               | 643.5                                | 786.5                         | 1188  | 2800                         |
| TMOV34S481EP                        | TMOV34S481EP | 480                          | 640                | 960                                 | 40000                               | 675                                  | 825                           | 1240  | 2700                         |
| TMOV34S511EP                        | TMOV34S511EP | 510                          | 675                | 960                                 | 40000                               | 738                                  | 902                           | 1350  | 2500                         |
| TMOV34S551EP                        | TMOV34S551EP | 550                          | 700                | 965                                 | 40000                               | 770                                  | 939                           | 1415  | 2250                         |
| TMOV34S571EP                        | TMOV34S571EP | 575                          | 730                | 990                                 | 40000                               | 819                                  | 1001                          | 1480  | 2200                         |
| TMOV34S621EP                        | TMOV34S621EP | 620                          | 800                | 1010                                | 40000                               | 900                                  | 1100                          | 1589  | 2100                         |
| TMOV34S661EP                        | TMOV34S661EP | 660                          | 850                | 1030                                | 40000                               | 945                                  | 1155                          | 1720  | 2000                         |
| TMOV34S681EP                        | TMOV34S681EP | 680                          | 890                | 1100                                | 40000                               | 980                                  | 1195                          | 1772  | 1970                         |
| TMOV34S751EP                        | TMOV34S751EP | 750                          | 970                | 1200                                | 40000                               | 1080                                 | 1320                          | 2000  | 1800                         |

**Notes :**

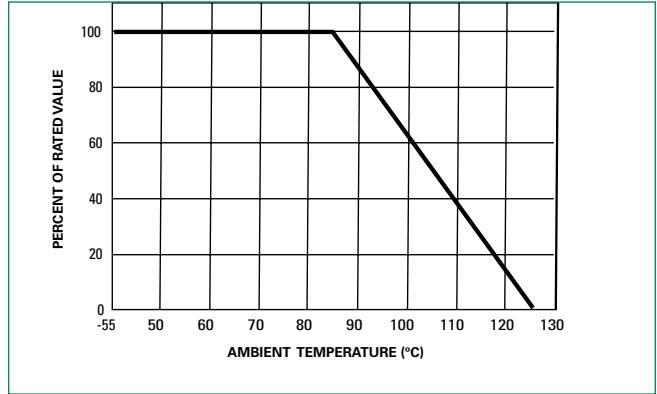
Same ratings and specifications apply to 3 leaded design. Replace 'E' with 'M' in part number. Refer to Part Numbering System at the end of this document.

**Fig. 1 Typical time to open circuit under UL1449 Abnormal Overvoltage Limited Current Test**



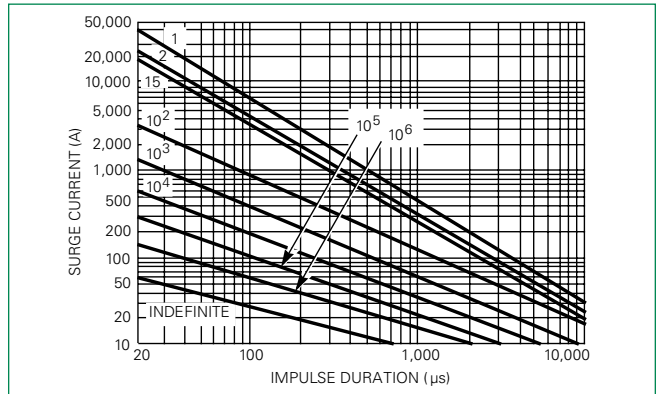
**Note:** The Industrial TMOV<sup>®</sup>34S varistor are intended, in conjunction with appropriate enclosure design, to help facilitate SPD module compliance to UL 1449 (Abnormal Overvoltage Limited Current Requirements). Under these extreme abnormal overvoltage conditions, the units will exhibit substantial heating and potential venting prior to opening. Modules should be designed to contain this possibility. Application testing is strongly recommended.

**Fig. 2. Peak Current & Energy Derating Curve**

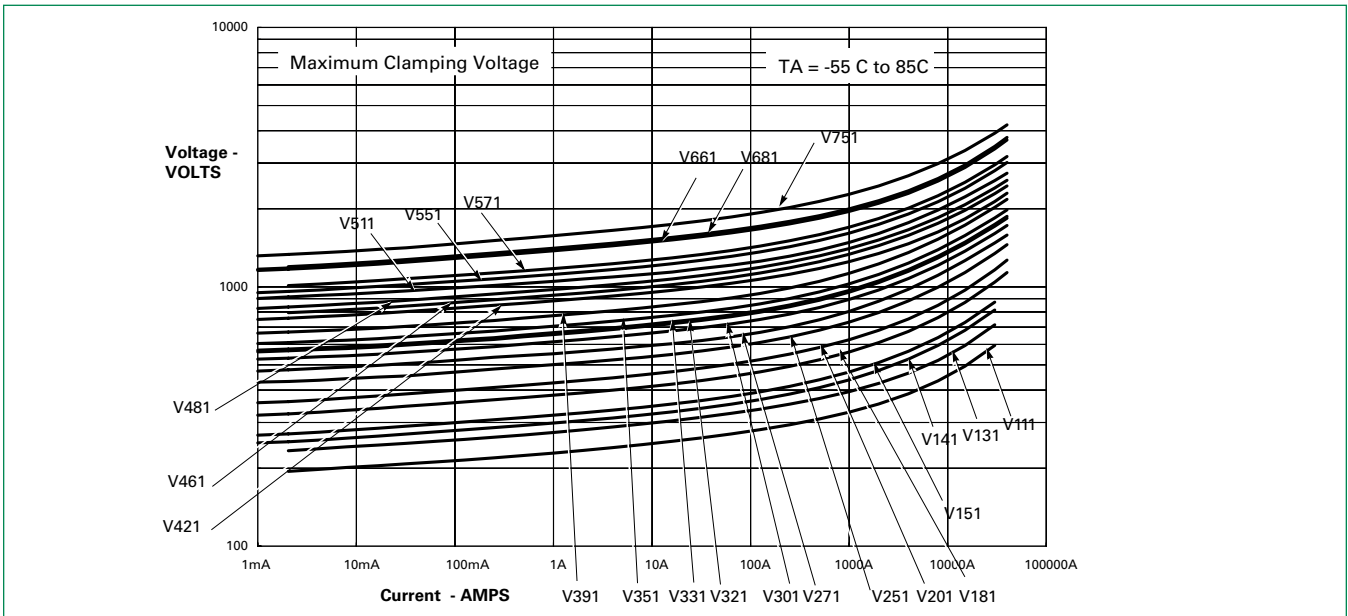


For applications exceeding 85°C ambient temperature, the peak surge current and energy ratings must be reduced as shown.

**Fig. 3 Pulse Rating Curve**

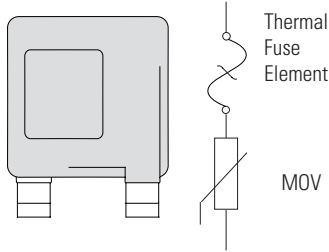


**Fig. 4 V-I Characteristic Curves**



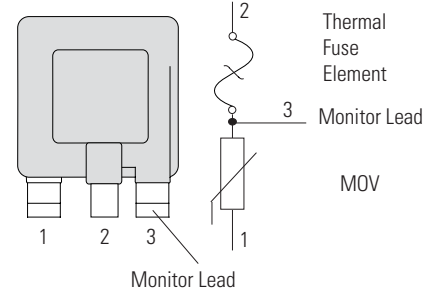
**Lead Configurations**

TMOV<sup>®</sup>34S Varistor "E" 2-Lead Varistor



Note: MOVs are non-polarized passive elements

TMOV<sup>®</sup>34S Varistor "M" 3-Lead Varistor

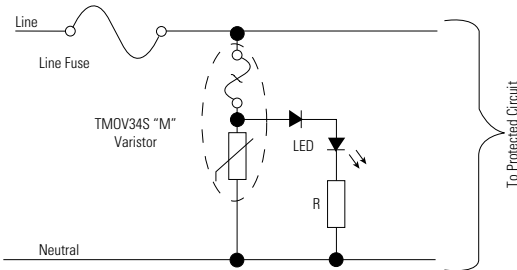


**TMOV<sup>®</sup>34S Varistor Application Examples**

The application examples below show how the monitor lead on the TMOV<sup>®</sup>34S varistor can be used to indicate that the thermal element has been opened. This signifies that the circuit is no longer protected from transients by the MOV.

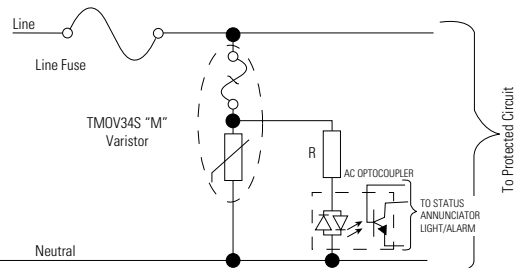
**Application Example 1**

In this case, the LED is normally on, and is off when the thermal element opens.



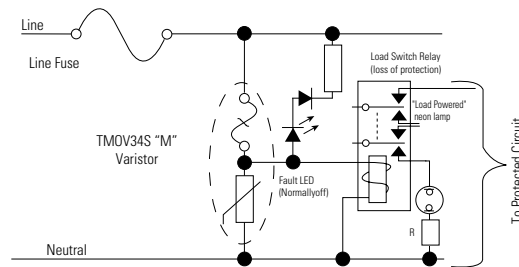
**Application Example 2**

This circuit utilizes an optocoupler to provide galvanic isolations between the TMOV<sup>®</sup>34S varistor and the indicating or alarm circuitry.



**Application Example 3**

This circuit illustrates the use of the monitoring lead of the TMOV<sup>®</sup>34S varistor to ensure that equipment is only operated when overvoltage protection present. In normal operation the load switch relay solenoid is powered via the monitor lead of the TMOV<sup>®</sup>34S varistor. In the event of the thermal element being activated, the relay will de-activate, cutting power to the protected circuit and the fault LED will illuminate.



Please note: Indicator circuits are provided as a guideline only. Verification of actual indicator circuitry is the responsibility of the end user. Component values selected must be appropriate for the specific AC line voltage service and application.

### Wave Solder Profile

Because the TMOV<sup>®</sup>34S Series varistors contain a thermal protection device, care must be taken when soldering the devices into place. Two soldering methods are possible. Firstly, hand soldering:

It is recommended to heat-sink the leads of the device. Secondly, wave-soldering: It is critically important that all preheat stage and the solder bath temperatures are rigidly controlled.

### Non Lead-free Profile

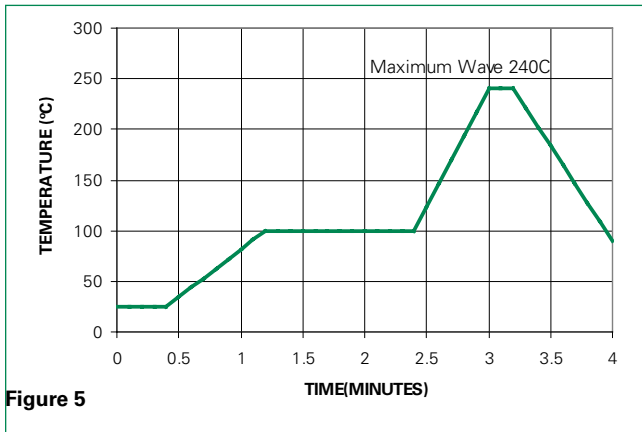


Figure 5

### Lead-free Profile

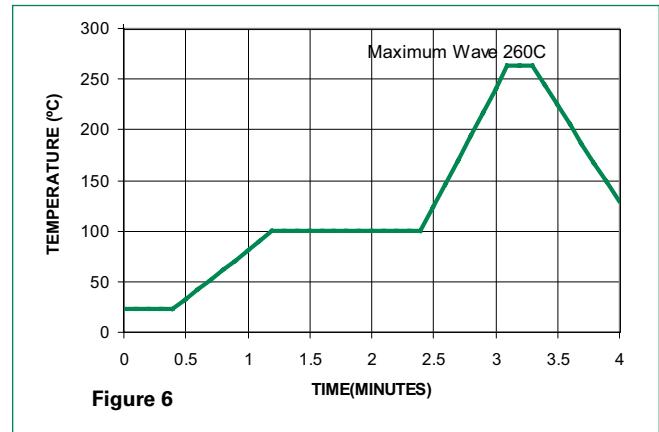


Figure 6

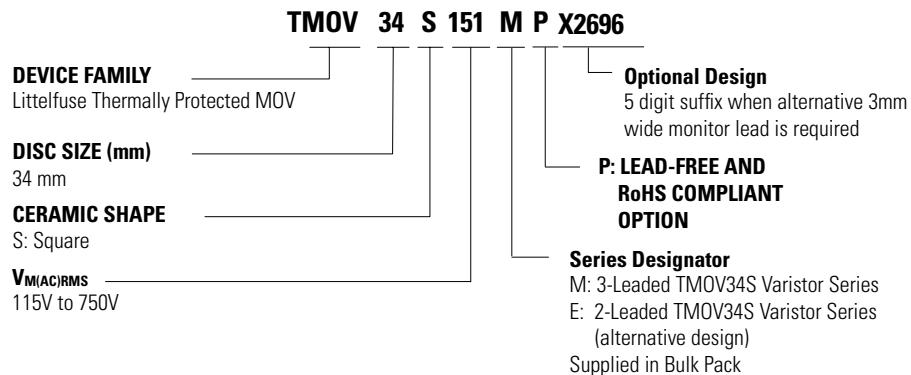
### Physical Specifications

|                                  |  |
|----------------------------------|--|
| <b>Lead Material</b>             | Tin-plated Copper  |
| <b>Soldering Characteristics</b> | Solderability per MIL-STD-202, Method 208                        |
| <b>Insulating Material</b>       | Cured, flame retardant epoxy polymer meets UL94V-0 requirements. |
| <b>Device Labeling</b>           | Marked with LF, part identifier, and date code                   |

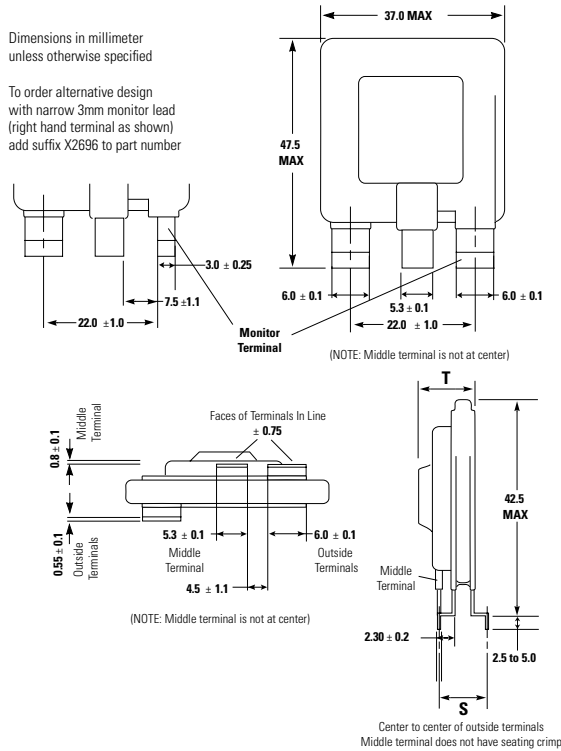
### Environmental Specifications

|                                      |   |
|--------------------------------------|---|
| <b>Operating/Storage Temperature</b> | -55°C to +85°C/<br>-55°C to +125°C          |
| <b>Humidity Aging</b>                | +85°C, 85% RH, 1000 hours<br>+/-10% voltage |
| <b>Thermal Shock</b>                 | +85°C to -40°C 5 times<br>+/-10% voltage    |
| <b>Solvent Resistance</b>            | MIL-STD-202, Method 215                     |
| <b>Moisture Sensitivity</b>          | Level 1, J-STD-020                          |

### Part Numbering System

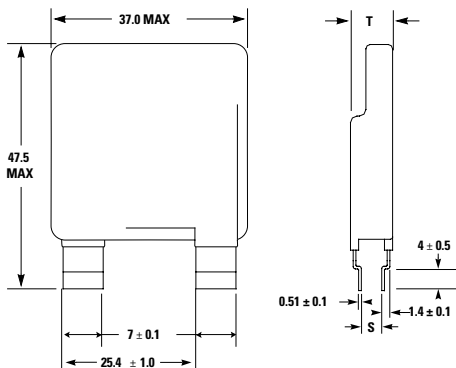


**Dimensions 3 Leaded Series**



| Part Number    | "T" Max Body Thickness | "S" Mounting Terminal Offset |
|----------------|------------------------|------------------------------|
| TMOV34S111M(P) | 11.90                  | 5.2 -/+ .65                  |
| TMOV34S131M(P) | 12.20                  | 5.5 -/+ .65                  |
| TMOV34S141M(P) | 12.30                  | 5.7 -/+ 0.85                 |
| TMOV34S151M(P) | 12.40                  | 5.9 -/+ 0.85                 |
| TMOV34S181M(P) | 12.80                  | 6.3 -/+ 0.85                 |
| TMOV34S201M(P) | 13.00                  | 6.5 -/+ 0.85                 |
| TMOV34S251M(P) | 12.75                  | 6.25 -/+ 0.85                |
| TMOV34S271M(P) | 12.95                  | 6.5 -/+ 0.85                 |
| TMOV34S301M(P) | 13.30                  | 6.8 -/+ 1.0                  |
| TMOV34S321M(P) | 13.50                  | 6.9 -/+ 1.0                  |
| TMOV34S331M(P) | 13.60                  | 7.2 -/+ 1.0                  |
| TMOV34S351M(P) | 13.80                  | 7.4 -/+ 1.0                  |
| TMOV34S391M(P) | 14.20                  | 7.6 -/+ 1.0                  |
| TMOV34S421M(P) | 14.50                  | 7.85 -/+ 1.0                 |
| TMOV34S461M(P) | 14.75                  | 8.15 -/+ 1.0                 |
| TMOV34S481M(P) | 14.95                  | 8.25 -/+ 1.0                 |
| TMOV34S511M(P) | 15.40                  | 8.6 -/+ 1.0                  |
| TMOV34S551M(P) | 15.60                  | 8.65 -/+ 1.0                 |
| TMOV34S571M(P) | 15.90                  | 8.85 -/+ 1.0                 |
| TMOV34S621M(P) | 16.40                  | 9.25 -/+ 1.0                 |
| TMOV34S661M(P) | 16.85                  | 9.65 -/+ 1.0                 |
| TMOV34S681M(P) | 17.20                  | 9.85 -/+ 1.0                 |
| TMOV34S751M(P) | 17.80                  | 10.65 -/+ 1.0                |

**Dimensions - Alternative 2 Leaded Series**



| Part Number  | T Dimension Max Body Thickness | S Dimension -- Mounting Terminal Offset |
|--------------|--------------------------------|---|
| TMOV34S111EP | 11.9                           | 2.8 -/+ .65                             |
| TMOV34S131EP | 12.2                           | 2.9 -/+ .65                             |
| TMOV34S141EP | 12.3                           | 3.0 -/+0.85                             |
| TMOV34S151EP | 12.4                           | 3.1 -/+0.85                             |
| TMOV34S181EP | 12.8                           | 3.4 -/+0.85                             |
| TMOV34S201EP | 13.0                           | 3.6 -/+0.85                             |
| TMOV34S251EP | 12.8                           | 4.0 -/+0.85                             |
| TMOV34S271EP | 13.0                           | 4.3 -/+0.85                             |
| TMOV34S301EP | 13.3                           | 4.5 -/+1.0                              |
| TMOV34S321EP | 13.5                           | 4.7 -/+1.0                              |
| TMOV34S331EP | 13.6                           | 4.8 -/+1.0                              |
| TMOV34S351EP | 13.8                           | 5.0 -/+1.0                              |
| TMOV34S391EP | 14.2                           | 5.4 -/+1.0                              |
| TMOV34S421EP | 14.5                           | 5.7 -/+1.0                              |
| TMOV34S461EP | 14.8                           | 5.9 -/+1.0                              |
| TMOV34S481EP | 15.0                           | 6.1 -/+1.0                              |
| TMOV34S511EP | 15.4                           | 6.6 -/+1.0                              |
| TMOV34S551EP | 15.6                           | 6.8 -/+1.0                              |
| TMOV34S571EP | 15.9                           | 7.1 -/+1.0                              |
| TMOV34S621EP | 16.4                           | 7.5 -/+1.0                              |
| TMOV34S661EP | 16.9                           | 7.9 -/+1.0                              |
| TMOV34S681EP | 17.2                           | 8.2 -/+1.0                              |
| TMOV34S751EP | 17.8                           | 8.8 -/+1.0                              |

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