

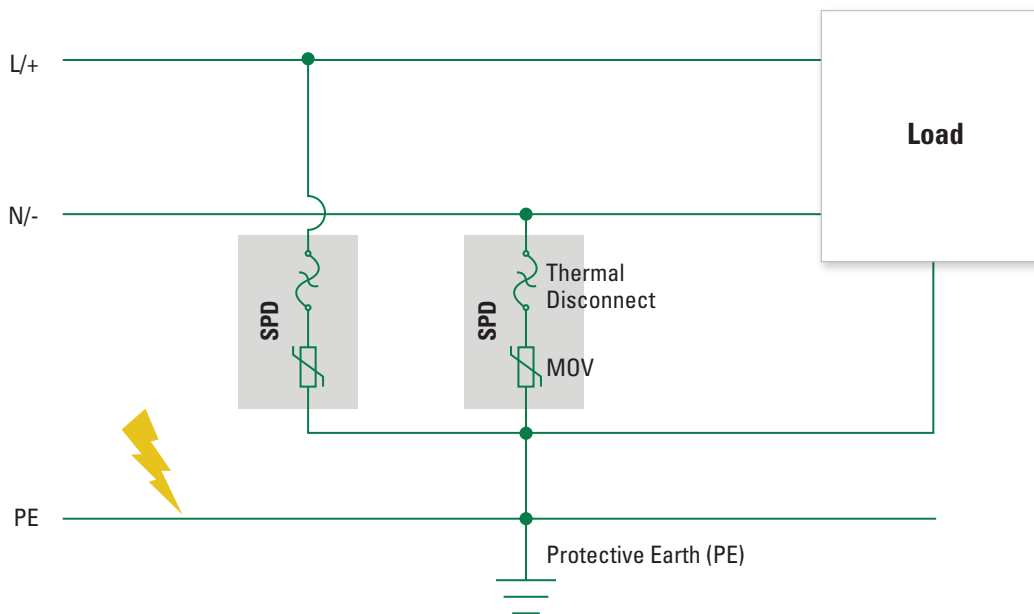
# Protect Your Building and Home with Littelfuse Components for Surge Protective Devices (SPDs)

## Make Your Surge Protective Devices More Robust with LST Varistors featuring Littelfuse Thermally Protected Varistor Technology

With intelligent devices propagating throughout homes and building, surge protection has become very important. Voltage surge sources can include lightning, induced power surges, industrial and switching surges, and nuclear electromagnetic pulses. A commercial or industrial facility will have surge protection devices at the incoming AC line, at power distribution, and near critical electrically powered equipment. Type 1 and Type 2 Surge Protection Devices are growing at a CAGR\* 5.5%. The 2020 National Electrical Code® requires all new homes in the U.S. to have Type 1 or Type 2 SPDs. Seventy percent adoption of this code is expected by 2020 NEC®. NEC claims that \$15,000 of electrical equipment can be damaged in the home.

### How do Surge Protection Devices work?

The basic function of SPDs is to limit the surge voltage amplitude to a defined level so dielectric strength of equipment is not exceeded. During voltage surge the LST/MOV inside SPD will quickly become a low impedance path to divert surge away from the load. This lasts for the duration of the surge voltage which is typically a few microseconds. The equipment is safeguarded and continues to operate. An example of a circuit with common mode<sup>1</sup> protection is shown in **Figure 1**.



**Figure 1. Surge Protection Device activated by voltage surge**

*Source:* \*CAGR from [Market & Markets](#) & [Grandview Research](#) average

1. Common mode shown in the example protects between active lines and protective conductor. SPDs could also be placed between active lines for normal (differential) mode voltage protection.

## Key protection components inside Surge Protection Devices

**1 Overcurrent protection**

- Fuse

**3 Overvoltage protection**

- MOV
- Thermally Protected Varistor

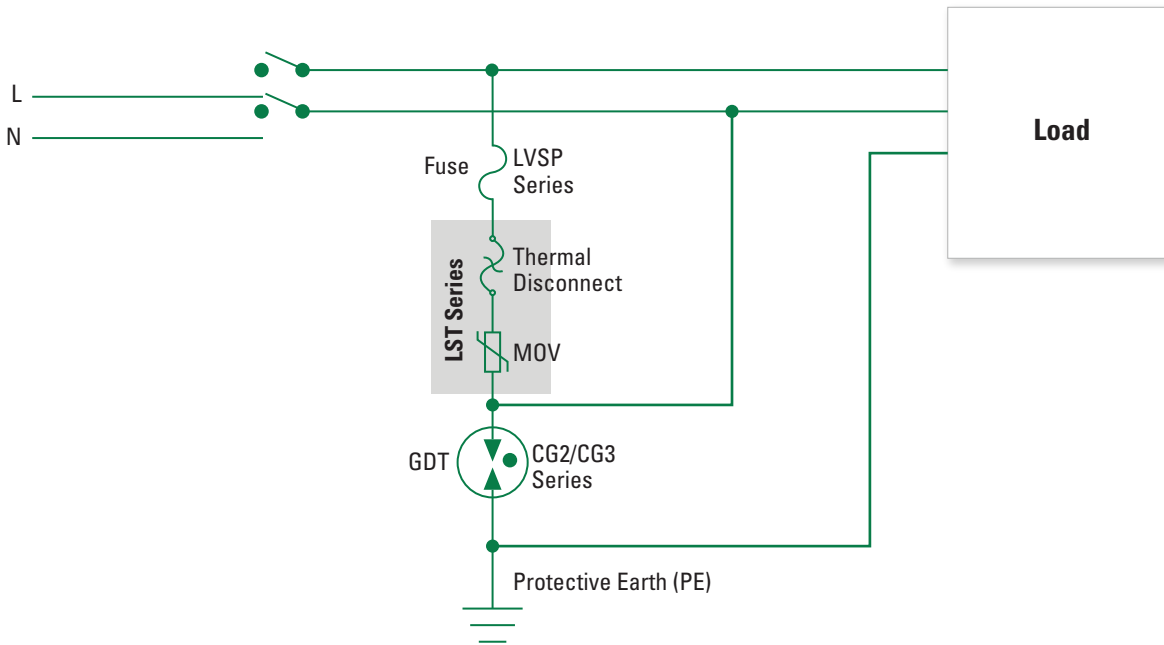
**2 Overvoltage protection**

- GDT

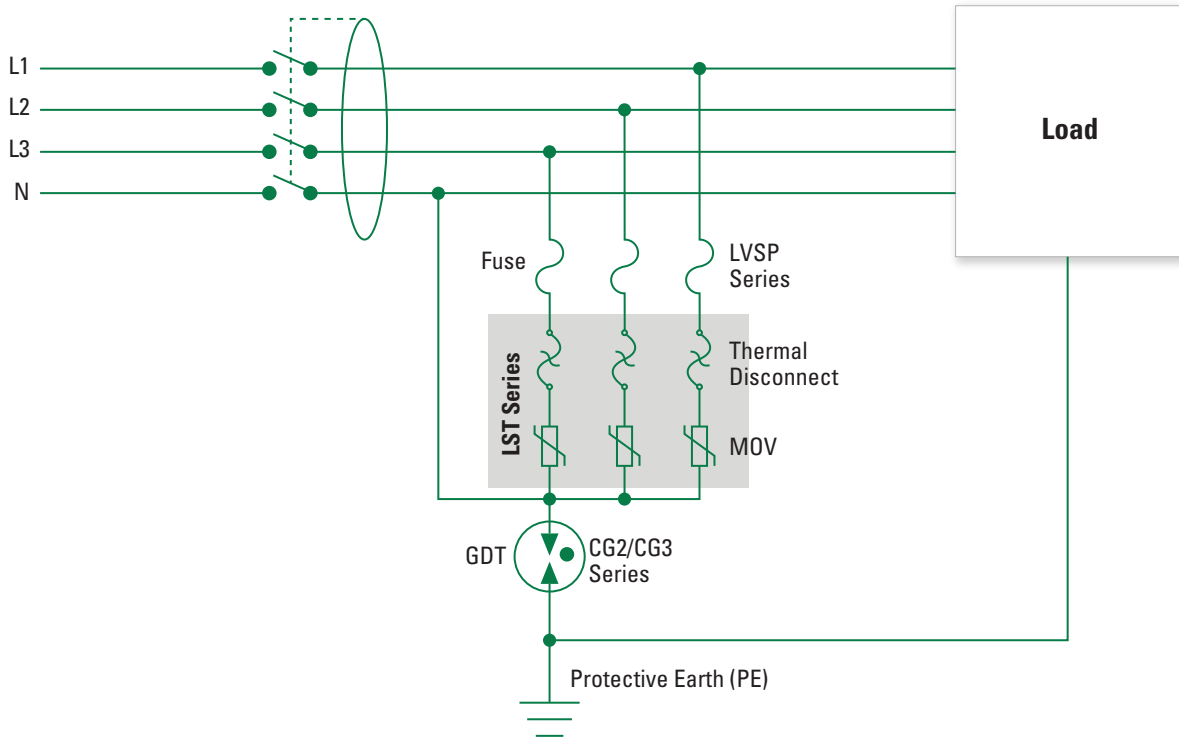
- SPDs come in different configurations depending on operating voltage, AC line type, and protection requirements.
- Fuses can be integrated within SPDs or external.

**Figure 2. Littelfuse Components are Core to Type 1 and Type 2 SPDs**

The below two circuit diagrams for single phase (**Figure 3**) and three phase (**Figure 4**) SPDs highlight three key protection components inside an SPD.



**Figure 3. Single-Phase load protection**



**Figure 4. Three-Phase load protection**

## Recommended Littelfuse Product Series for Protecting SPDs

A **varistor** is required for voltage surge protection along with thermal disconnect. The Littelfuse new varistor [LST Series](#) is designed for Type 1 and Type 2 Surge Protective Devices (SPDs). Constructed with a proprietary thermally protected varistor technology (TMOV) developed by Littelfuse, this new varistor series incorporates both a built-in thermal disconnects function and electric arc shield. This combination provides additional robust protection to prevent catastrophic failure and fire hazard even under the extreme circumstances of abnormal overvoltage conditions or varistor end-of-life. The LST varistor series offers these key benefits:



- Facilitate meeting UL1449 listed Type 1 or Type 2 standards by incorporating 200 kA SCCR, 20 kA  $I_n$ , UL1449 Type 4 recognized component assembly.
- Flexibility of using 50 kA and 75 kA  $I_{max}$  rated devices with the same footprint on PCB.
- More options for designing remote indication/monitoring of SPD product or system through mechanically triggered AC and DC rated microswitch (Normally Open/Normally Closed, pin length, 2 pin/3 pin/without pin).
- Clear LST working status indication through a visual tab option that notifies service technicians and maintenance engineers to replace LST at end-of-life in order to continue optimal surge protection for the end-product.
- Wide operating voltage range up to 690 Vac for 50 kA version, up to 550 Vac for 75 kA version.



### TMOV Varistor Series

The Littelfuse [TMOV](#) thermally protected varistors represent a new development in integrated circuit protection. TMOV is comprised of radial leaded MOV (Metal Oxide Varistor) with an integrated thermally activated element designed to open in the event of overheating due to the abnormal overvoltage, limited current, conditions outlined in UL 1449.

- Patented integrated thermal protection device - Patent #US6636403.
- Designed to facilitate compliance to UL1449 3<sup>rd</sup> Edition for SPD product.
- High peak surge current rating up to 10 kA.

A **Fuse** is integrated into an SPD for overcurrent protection (some SPDs have an external fuse). The Littelfuse Varistor Surge Protection ([LVSP](#)) Fuses are intended for the protection of SPDs. The LVSP Series has been designed to survive the 8x20  $\mu$ s lightning surges described in various Standards (UL1449, IEC61000-4-5, and IEEE C62.41) without opening. This allows the SPDs to perform the necessary suppression. The LVSP Series is not rated for continuous current, and the ratings are to specific 8x20  $\mu$ s surge capability.



- Very current limiting under AC short-circuits conditions.
- Available in multiple mounting configurations (cartridge, bolt-in, PC board mount).
- Provides short circuit protection in SPDs and complements the Littelfuse line of overvoltage products (HA, HB34, TMOV<sup>®</sup>, and iTMOV<sup>®</sup> varistors as well as the AK10 series TVS diodes).

**Gas discharge tubes (GDTs)** are often used between neutral and ground to minimize leakage current. Littelfuse CG2 or CG3 series provide a high degree of surge protection in a small size making them ideal for SPDs.



#### High Voltage GDT–CG3 Series

Littelfuse [CG3](#) two electrode high voltage (1.0–7.5 kV) devices are designed for surge protection and high isolation applications, and for applications for which bias voltages or signal levels of several hundred volts are normally present.

- Rugged ceramic-metal construction.
- Low capacitance (<1.5 pF).
- Available in Tape and Reel packaging.
- Available with or without leads.

Apart from these three key protection components, some of the latest SPDs can offer features such as voltage surge data and protection status through Wi-Fi which should also include ESD protection. Littelfuse TVS diode arrays such as [AQ1003-01LTG](#) can be used for ESD protection.

## Conclusion

Surge protection is an important consideration for homes, commercial buildings, and industrial facilities. Using best practices and key components will support good designs and safeguard end-product solutions.