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# IEC 62368-1 Overvoltage requirements

-  Consumer electronics
-  Datacenter & cloud
-  Building automation
-  Appliances
-  Mobile & wearables

*Users must independently evaluate the suitability of and test each product selected for their own specific applications. It is the User's sole responsibility to determine fitness for a particular system or use based on their own performance criteria, conditions, specific application, compatibility with other parts, and environmental conditions. Users must independently provide appropriate design and operating safeguards to minimize any risks associated with their applications and products. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [littelfuse.com/disclaimer-electronics](https://www.littelfuse.com/disclaimer-electronics).*

# IEC 62368-1: Global safety standard applies to a wide range of electrical and electronic equipment up to 600 V

## IEC 62368-1\*

<b>IEC 60950-1†</b> (Information and communication technology equipment)	<b>IEC 60065†</b> (Audio/video and similar electronic equipment)	<b>Other equipment‡</b>
 <p><b>Point-of-sale equipment</b></p>  <p><b>Banking equipment</b></p>  <p><b>Office equipment</b></p>  <p><b>Telecommunication equipment</b></p>	 <p><b>Audio &amp; video equipment, and musical instruments</b></p> 	 <p><b>Smart IoT appliances</b></p>  <p><b>Battery-powered electronic devices</b></p>

\* UL/EN/CSA have created versions of 62368-1 based on IEC62368-1.

† Standards replaced by IEC 62368-1. All products, sub-assemblies, and components previously covered under these standards are covered under UL/IEC 62368-1.

‡ Other equipment comprises of two product types: products not covered under any product safety standard, such as smart IoT equipment, and products covered under various standards, such as battery-powered consumer electronic devices.

# Minimum transient voltage withstand rating is determined by the AC mains voltage

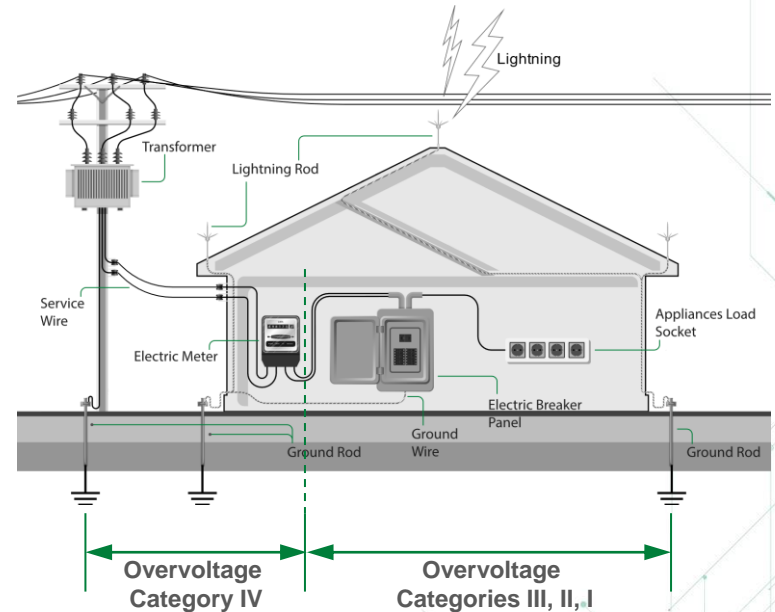
## Electrical and electronic equipment and transients

Transient voltages are determined based on the system voltage and where, in a distribution system, the equipment it is connected (overvoltage category)

PCs, routers, notebooks, tablets, and their power supplies fall within Overvoltage Category II

Table 12 in section 5.4 specifies the following: 120 VAC power supplies will need to withstand  $1500 V_{pk}$ ; 240 VAC power supplies need to withstand  $2500 V_{pk}$

## Overvoltage categorization



# Additional tests included in the standard to ensure compliance when using varistors

Tests	Unreliable earth/ground bond  Non-industrial plug examples	Reliable earth/ground bond ‡  Industrial plug examples
Varistor overload test * (Annex G.8.2.2)	✓	✓
Temporary overvoltage test † (Annex G.8.2.3)	✓	✓
Basic insulation requirement (Clause 5.4.9.1)	✓	Not required

**Table notes:** (Detailed list of tests provided in supplementary slide).

\* Test not required if varistor voltage rating is greater than  $2 \times V_R$ .


† Test not required if varistor voltage rating is  $(1.1 \times V_R) + 1200$  or greater.

‡ Reliable earth: permanently connected equipment, cord connected mains equipment used in a location having equipotential bonding (restricted access area, telecommunication center, and others), or stationary pluggable equipment that has instructions for installation of the conductor to a building by a skilled person.

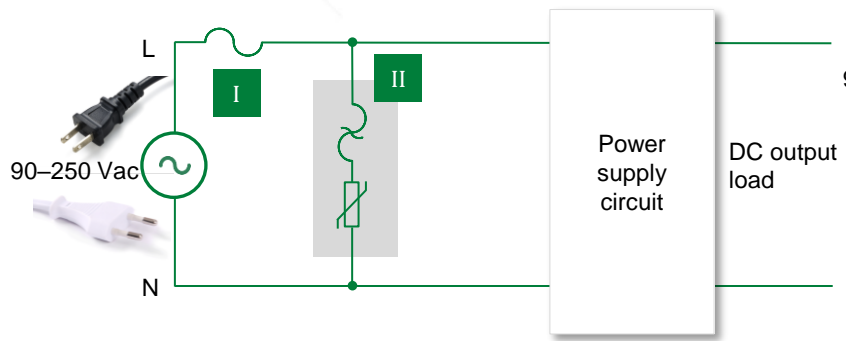
**Abbreviation:**

$V_R$ : rated voltage of AC mains or upper voltage of AC mains voltage range.

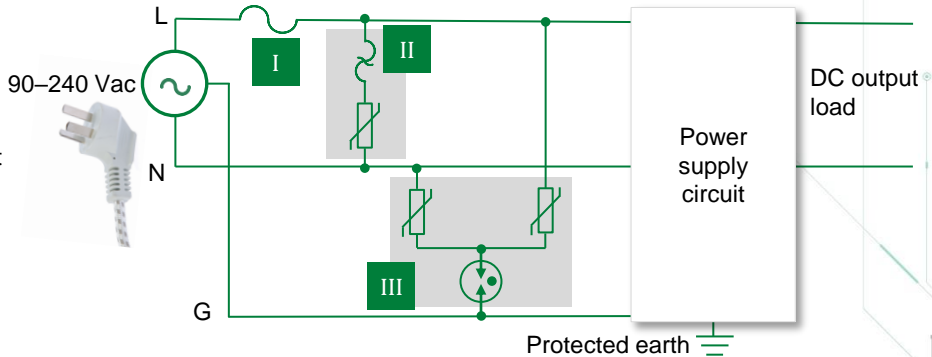
# Solution recommendations for universal power adapters with two-prong and three-prong plugs

 Click on the product series in the table below for more info

## Differential mode protection



## Differential & Common mode protection



	Technology	Product series	Function in application	Benefits and considerations
I	Fuse	<a href="#">2153.15*</a>	Protects the power stage from overcurrent events	Small, through-hole device with high breaking capacity and high surge withstand capability
		<a href="#">39213150000</a>		Multiple ampere ratings in compact design
II	TMOV	<a href="#">TMOV14RP300E*</a>	Protects the power supply unit from voltage transients and lightning. Meets minimum allowable MCOV (1.25 x 240 V). Exceeds minimum surge requirements of Overvoltage category II	Integrated thermal protection avoids overheating caused during abnormal voltage events; low energy let-through and clamping voltage
	MOV	<a href="#">V10E420P</a>		Smallest form-factor, higher clamping voltage than other solutions
	SIDACTor® + MOV	<a href="#">P2300</a> + <a href="#">V10E300P</a>		Lowest leakage current (nA)
	TVS Diode	<a href="#">AK3-380C-Y</a>		Best clamping and surge life
III	MOV + GDT	<a href="#">V10E300P</a> + <a href="#">CG3 3.3*</a>	Protects the power supply unit from voltage transients and lightning. Meets requirements for common mode protection	Only permitted solution for common mode protection; lowest leakage current

\* This is the primary recommendation. Other products shown can be considered based on design requirements

# Surge protection solutions compared

Features	TMOV	MOV	SIDACtor™ + MOV	High Power TVS Diode	GDT + MOV
Suggested Protection Modes (When ground is unreliable)	L-L L-N	L-L L-N	L-L L-N	L-L L-N	L-G & N-G (Mains to PE)
Continuous voltage withstand rating	300 V	420 V	480 V (180 V + 300 V)	380 V	2940 V (2640 V + 300 V)
Clamping voltage (combination surge: 6 kV/3 kA)	1.18 kV	1.66 kV	1.3 kV*	520 V	1.3 kV
Let-through energy during surge event	↘↘	↘↘↘	↘↘	↘	↘↘
Leakage current	Medium (μA)	Medium (μA)	Low (nA)	Medium (μA)	Very low (pA)
Lifetime after multiple surge events	Good	Fair	Very Good	Excellent	Good
PCB footprint surface area	■	■	■	■	■
Price	\$\$	\$	\$\$\$	\$\$\$\$	\$\$

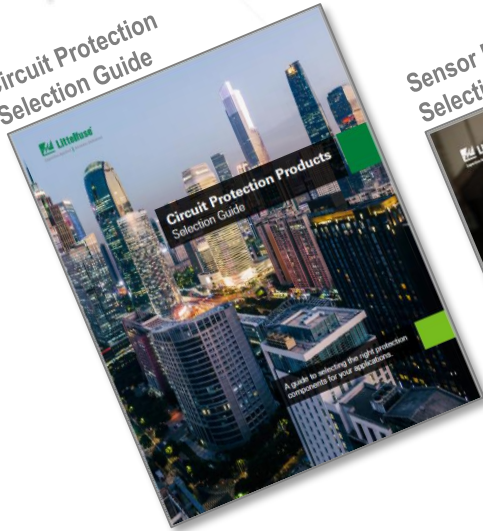
- TMOV is recommended for most differential mode protection applications.
- GDT + MOV is the recommended solution between mains and protective earth (per IEC 62368-1, clause 5.5.7).

**Note:**

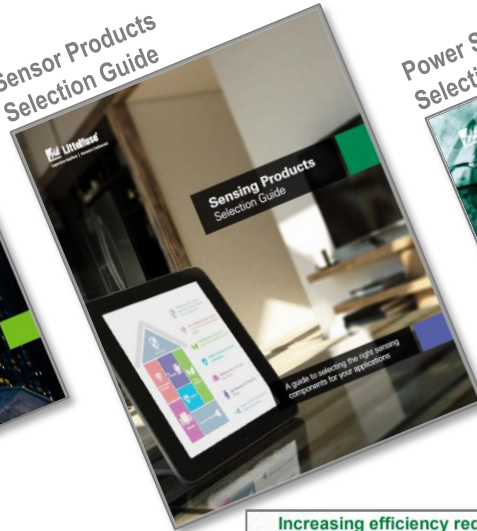
\* Lower clamping is possible with use of a lower voltage MOV and higher rated SIDACtor. Requires review with agency providing certification to the standard

# Additional information can be found at [Littelfuse.com](http://Littelfuse.com)

## Circuit Protection Selection Guide



## Sensor Products Selection Guide



## Power Semiconductor Selection Guide



## Designing with TMOV Application Note



Click on images to open the catalog

### Power Supply Spotlight

**Increasing efficiency requirements and increasing power needs are driving new generation of chargers**

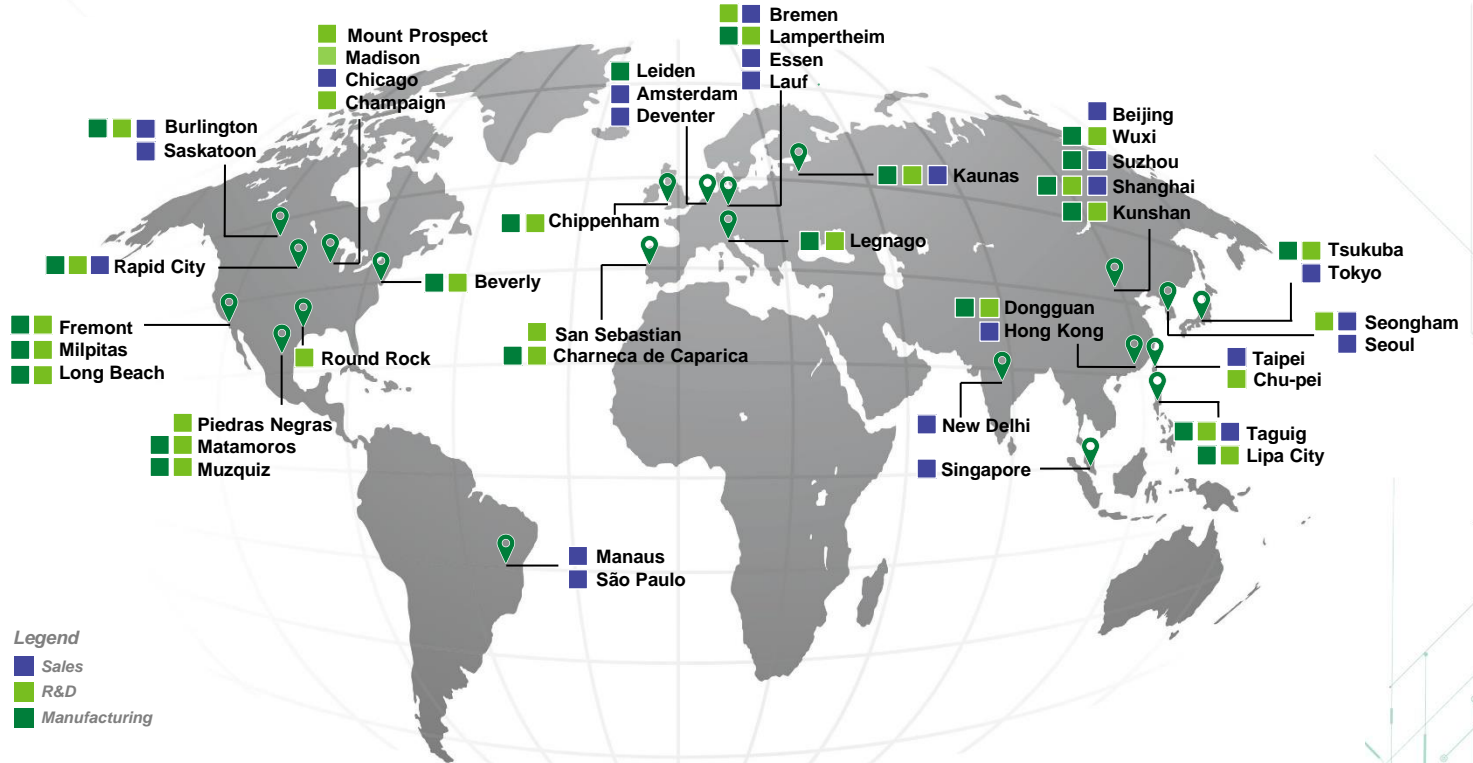
10 W	20 W	40 W	100 W	200 W	500 W	1 MW+
<b>Typical applications</b>						
<b>Littelfuse solutions</b>						
Fuse		Fuse, PPTC		Fuse		
TVS diode		MOV, TVS diode		MOV, TVS diode, GDT		
Schottky diode		MOSFET		MOSFET		
Digital temperature indicator		NTC		Schottky diode		

Acronym: TPC: Thermal voltage protection; MCV: metal oxide varistor; TPC: negative temperature coefficient; GDT: gas discharge tube; © 2021 Littelfuse, Inc.



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