

Integrated Overcurrent/Overvoltage/Overtemperature Solutions for industrial equipment

2PRO LVM2P-015R10431 DEVICE

The 2Pro LVM2P-015R10431 device is an integrated overcurrent/overvoltage/overtemperature circuit protection device that helps protect a wide variety of low-power systems against damage caused by overvoltage faults, including lightning strikes, ESD surges, loss of neutral, incorrect input voltage and power induction.

The RoHS-compliant 2Pro device combines a PolySwitch polymeric positive temperature coefficient (PPTC) overcurrent device with a metal oxide varistor (MOV) component into one innovative, thermally protected device to help provide resettable current limiting for overcurrent protection and voltage clamping during overvoltage events. This single-device approach helps manufacturers meet industry test requirements, reduce component count, and improve equipment reliability.

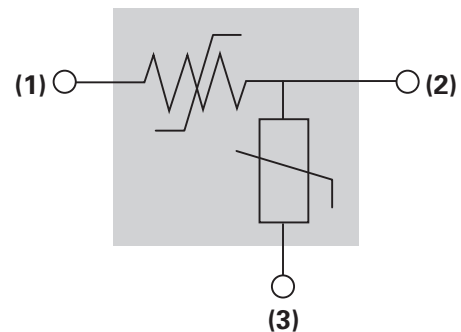
The 2Pro LVM2P-015R10431 devices help provide protection for AC Mains LED lighting systems, PLC network adapters, cell phone chargers, AC/DC power supplies*, modem power supplies, AC-panel protection modules, AC power meters, white goods and home and professional appliances.

HOW IT WORKS

Under normal operating conditions, the AC line voltage applied to an MOV is not expected to exceed the device's maximum continuous operating voltage rating, V_{ACRMS} . However, occasionally overvoltage transients may occur that exceed these limits. By integrating PPTC technology with the MOV, the 2Pro device helps provide increased overcurrent and thermal protection under conditions where the MOV is exposed to prolonged continuous overvoltage events that exceed its rated specifications. In the event of an overvoltage transient, the PPTC element of the 2Pro device heats up and goes into a high resistance, helping to reduce the risk of MOV device failure.

LVM2P-015R10431 devices are 10mm radial-leaded devices that utilize three leads. In the following electrical schematic, the lead (1) is connected to the PPTC element, lead (2) is connected to the MOV/PPTC series connection (providing a path to ground), and lead (3) is connected to the MOV.

Electrical Schematic



PROTECTING AGAINST THERMAL RUNAWAY

In AC line applications, loss of neutral may occur so that the MOV is exposed to a higher level of sustained overvoltage than it is rated for. The worst case scenario would be a voltage of $400V_{AC}$ instead of $230V_{AC}$, derived from a loss of neutral. In an unlimited current condition the unprotected MOV will first fall to low impedance of a few Ohms, but due to the high amount of energy it is likely to rupture rather than protect. If there are devices used on the AC line return path that limit current flow these may also overheat due to the failure of the MOV.

Standard unprotected MOVs are typically rated to $275V_{ACRMS}$ for a universal input voltage range. In a loss of neutral condition they may overheat with disastrous consequences (Fig 2), even if a fuse or power resistor is used upstream. The 2Pro device's PPTC element helps prevent thermal runaway, maintaining varistor surface temperature at less than $150^{\circ}C$, and preventing the device from reaching combustible temperatures caused by overvoltage transients.

The 2Pro device helps manufacturers comply with IEC60950 and IEC60335, and helps equipment remain operational after specified lightning tests according to IEC61000-4-5. Also, because the PPTC element is in series with the MOV no additional overcurrent protection is required, which helps reduce component count and optimize board space.

* AC/DC power supplies up to 30VA as input power for $230V_{AC}$ input voltage

BENEFITS

Single, small form factor device helps to reduce component count and footprint.

- Helps provide a safe failure mode in case of varistor overstress.
- Helps reduce warranty returns.
- Helps equipment comply with UL/IEC 60950/IEC60335
- Helps equipment comply with:
 - IEC61000-4-5 – Surge immunity test
 - IEC61000-4-4 – Electrical fast transient/burst immunity test
 - IEC61000-4-2 – Electrostatic discharge immunity test
- Reduces cost by eliminating need for additional fuse or power resistor in the power line

FEATURES

- Single overcurrent, overvoltage, overtemperature and ESD protection
- Resettable overcurrent protection
- Helps protect varistor and other components from damage caused by loss of neutral or abnormal AC input voltage
- Normal operating mode:
 - Universal Input voltage range: 85V_{AC} to 265V_{AC}
- Max input current @ 20°C: 150 mA_{RMS}
- Power range: up to 30VA for 230V_{AC} input voltage at 20°C
- High safe interrupt power: 415V_{ACRMS}/40A_{RMS}
- Inrush current limiter (capacitive loads)
- RoHS-compliant

APPLICATIONS

- Main LED lighting systems
- PLC network adapters (fast Ethernet, xDSL over the main)
- Cell phone chargers
- AC/DC power supplies up to:
 - 30VA as input power for 240V_{AC} input voltage
 - 15VA as input power for 120V_{AC} input voltage
- Modem power supply
- AC panel protection modules
- AC Line power supplies
- AC power meters
- White goods, appliances, industrial controls

Figure 1 : Typical circuit diagram utilizing the 2Pro LVM2P-015R10431 device

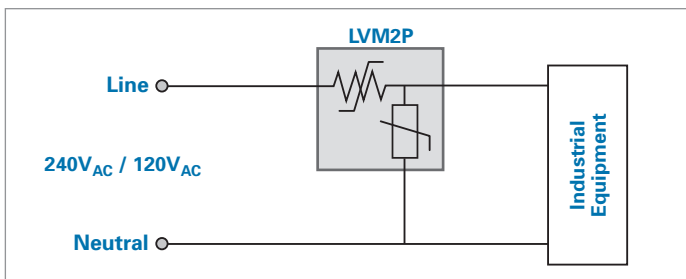


Figure 2 : Typical surface temperature vs. time for various protection schemes

The figure below illustrates the effects of abnormal overvoltage conditions (400V_{RMS}, 4A_{SC}) on three devices or a combination of devices:

- 1) LVM2P-015R10431 combination (PPTC, MOV)
- 2) Single MOV (10mm, 275V_{RMS} – ROV10-431K)
- 3) MOV/4W Power Resistor (10 Ohms)

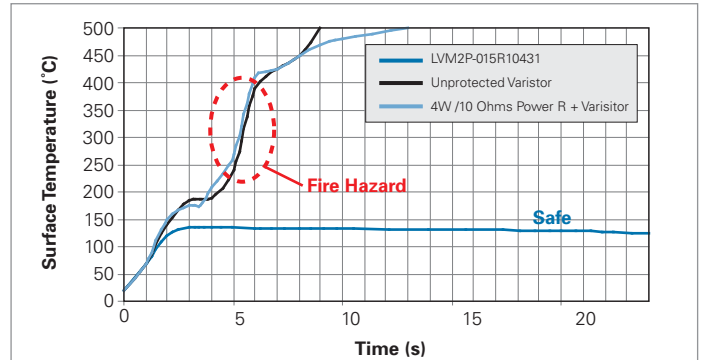


Figure 3 : Typical 2Pro LVM2P-015R10431 device response under IEC61000-4-5 surge immunity test

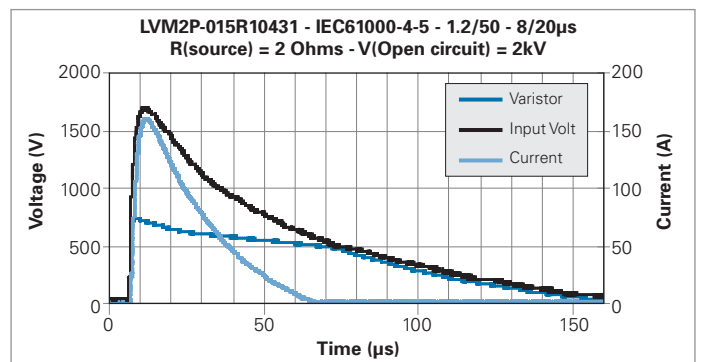
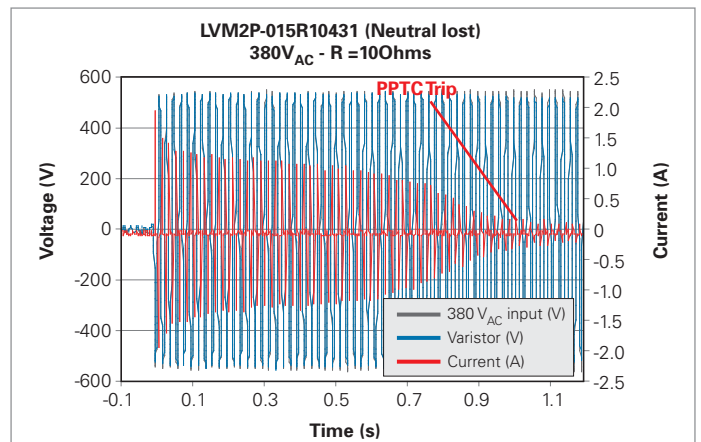


Figure 4 : Typical 2Pro LVM2P-015R10431 device response to loss of neutral event



Raychem Circuit Protection Products

308 Constitution Drive, Building H
Menlo Park, CA USA 94025-1164

Tel : (800) 227-7040, (650) 361-6900
Fax : (650) 361-4600

www.circuitprotection.com

www.circuitprotection.com.hk (Chinese)

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LVM2P-015R10431 Electrical Characteristics

LVM2P Electrical Characteristic

Overcurrent (terminals 1 - 2) – Performance ratings @ 20°C

Part Number	I _{HOLD} (A)	I _{TRIP} (A)	Resistance (Ω)			Time to Trip (s)† @ 1A	
			R min.	R max.	R1 max*	Typ	Max
LVM2P-015R10431	0.15	0.30	6.5	14.0	16.0	0.9	3

Overvoltage (terminals 2 - 3)

Part Number	Varistor Voltage V @ 1mA		DC Resistance @ 100V (MΩ)	Maximum Clamping Voltage @ 25A (V)	Rated Wattage (W)
	DC(V)	Tolerance			
LVM2P-015R10431	430	± 10%	>10	710	0.25

* Maximum device resistance at 20°C measured 1 hour post trip.

† Corresponds to operation below varistor voltages.

Surge Immunity for the assembly (Terminals 1-3) @20°C

Parameter	Voltage - Open Circuit		Current - Short Circuit		Repetitions
	Voltage (V)	Waveform (μs)	Current (A)	Waveform (μs)	
IEC / EN 61000-4-5	2000	1.2 x 50	1000	8 x 20	5 ea. Polarity