TFMOV

Thermally Protected Varistors-Mechanical trip

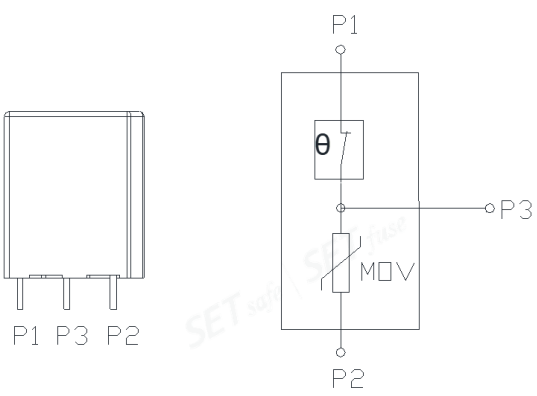
TFMOV05M Series

Description

Thermally Protected Varistors - Mechanically Off TypeThermally Protected Varistors (TFMOV) are thermally protected varistors. TFMOVs have all the characteristics of a varistor (MOV) with the added benefit of thermal protection.MOVs are subject to two types of deterioration: natural deterioration due to prolonged operation, and deterioration due to abnormal surges. When a surge occurs, the leakage current of the degraded MOV increases continuously, causing the surface temperature of the MOV to rise continuously and the possibility of fire. At this time, the heat of the MOV in TFMOV is conducted to the cryogenic alloy solder joint, which senses the abnormal temperature and operates (fuses), driving the spring slider to cut off the circuit, disconnecting the MOV from the main circuit and thus protecting the entire circuit, as well as the MOV itself will not continue to heat up, and the phenomenon of catching fire.

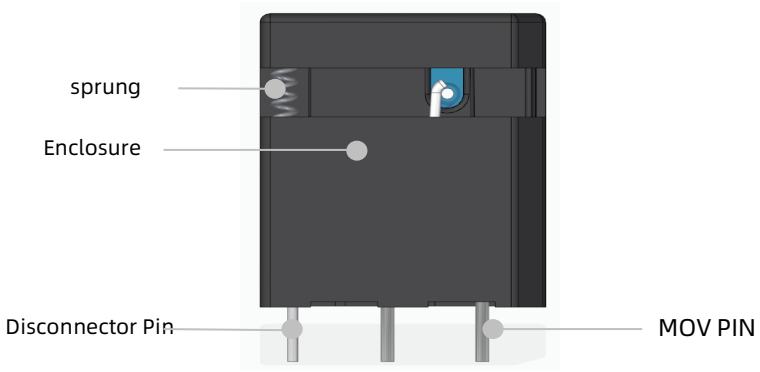
SETfuse（SETsafe | SETfuse) thermally protected varistor-mechanical release type TFMOV05M series is mainly composed of varistor (MOV), mechanical release device, flame-retardant housing and metal components (pins, springs). Nominal Discharge Current: 5kA; Maximum Continuous Operating Voltage: (50 ~ 750) VAC; Maximum Continuous Operating DC Voltage: (500 ~ 1000) VDC Safety Certification: TUV, CE; RoHS, REACH compliant.

Schematics



TFMOV（Mechanical trip）

Structure



TFMOV（Mechanical trip）

Features

- Overvoltage Protection has High Breaking Capacity and Fast Trip Response
- It Can Meet the Working Temperature of -40 ~ 105 °C
- Thermal Protection, High Reliability
- Small Size
- Remote Signal Contact for Failure Indication
- High Energy Capacity
- Sealing Material, Flame-retardant to V0 (UL 94)
- Comply with UL 1449 / IEC 61643-11

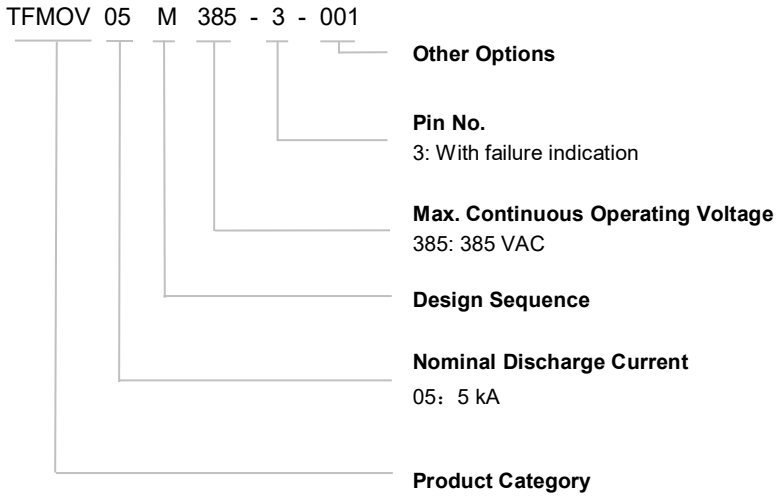
Applications

- Telecom Equipment
- String Inverter in Photovoltaic System
- AC / DC Power Supply
- Uninterruptable Power Supply (UPS)
- Surge Protective Device (SPD)
- Electric Meter
- Power Distribution Unit (PDU)
- Lightning Protection Socket

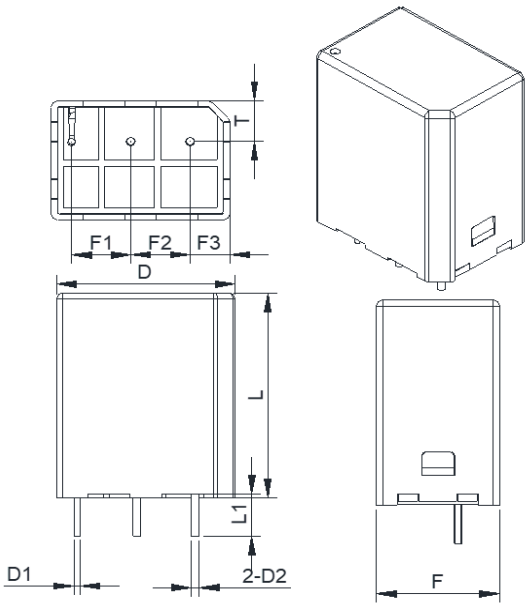
Agency Approvals

Agency Symbol	Standards	The File No. and certification No. obtained by SETsafe | SETfuse	Category
TÜVRheinland	EN 61643-11, EN 61643-31	R 50603926	Class II and Class III
CE	IEC/EN 61643-11, IEC/EN 61643-31	AN 50603238	Class II and Class III
Environment	RoHS & REACH	Compliant	

Part Numbering System



Reminder：
1. Pin number and other options are used only as identification codes for internal unique specifications and are not part of the product model
2.Part numbering system in the datasheet is only for selecting correct parameter and product features. Before plaing order, please contact us for specifications and use the part number and product code in the specification s to place order to ensure the part is correct. Product code is the unique indentification.



Note: Unit: mm
TFMOV05M385,Thickness T is 11.6 ± 0.3 mm

Max. Continuous Operating Voltage	L	L_1	D	D_1	D_2
50 ~ 420	27.0 ± 0.3	5. 0 ± 0.5	26.3 ± 0.3	0.8 ± 0.1	1. 0 ± 0.1
460 ~ 750	27.0 ± 0.3	5. 0 ± 0.5	26.3 ± 0.3	0.8 ± 0.1	1. 0 ± 0.1
Max. Continuous Operating Voltage	F	F_1	F_2	F_3	T
50 ~ 420	11.6 ± 0.3	7.5 ± 0.3	7.5 ± 0.3	5 ± 0.3	5.3 ± 0.3
460 ~ 750	15.6 ± 0.3	7.5 ± 0.3	7.5 ± 0.3	5 ± 0.3	5.3 ± 0.3

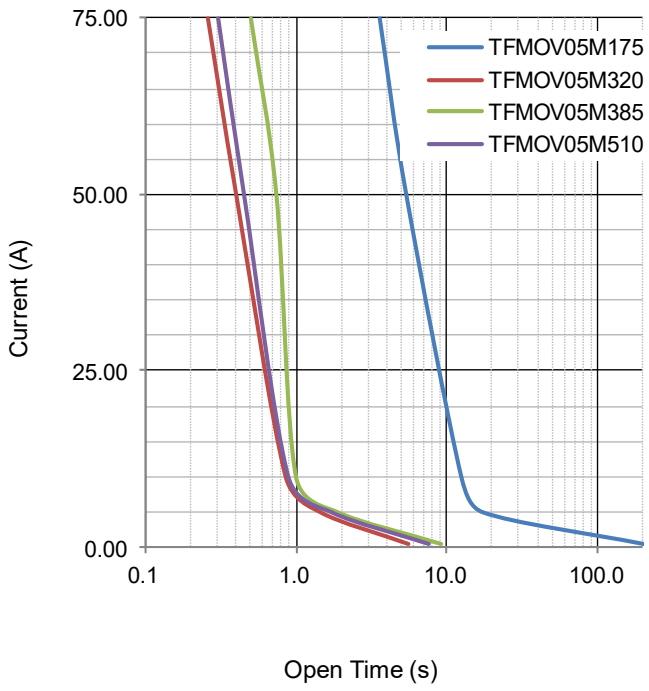
Specifications

Model	Nominal System Voltage	Nominal Varistor Voltage @1mA	Max. Continuous Operating Voltage		Nominal Discharge Current (8/20 μs)	Max. Discharge Current(8/20 μs)	Voltage Protection Level	UL1449		IEC/EN 61643-11	IEC/EN 61643-31
	U_n	V_N	MCOV		I_n	I_{max}	U_p				
	(VAC)	(V)	U_c(VAC)	U_{cpv} (VDC)	(kA)	(kA)	(V)	AC Type 4CA	DC Type 4CA	Class II	Class II
TFMOV05M50	24	82	-	65	5	10	330	○	○	●	●
TFMOV05M60	48	100	-	85	5	10	360	○	○	●	●
TFMOV05M75	60	120	-	100	5	10	400	○	○	●	●
TFMOV05M95	60	150	95	-	5	10	450	○	○	●	○
TFMOV05M115	108	180	115	-	5	10	500	○	○	●	○
TFMOV05M130	120	200	130	-	5	10	600	○	○	●	○
TFMOV05M140	120	220	140	-	5	10	650	○	○	●	○
TFMOV05M150	120	240	150	-	5	10	700	○	○	●	○
TFMOV05M175	120	270	175	-	5	10	800	○	○	●	○
TFMOV05M190	120	300	190	-	5	10	850	○	○	●	○
TFMOV05M210	120	330	210	-	5	10	900	○	○	●	○
TFMOV05M230	120	360	230	-	5	10	950	○	○	●	○
TFMOV05M250	220	390	250	-	5	10	1000	○	○	●	○
TFMOV05M275	230	430	275	-	5	10	1100	○	○	●	○
TFMOV05M300	240	470	300	-	5	10	1200	○	○	●	○
TFMOV05M320	277	510	320	-	5	10	1300	○	○	●	○
TFMOV05M350	277	560	350	-	5	10	1400	○	○	●	○
TFMOV05M385	277	620	385	500	5	10	1500	○	○	●	●
TFMOV05M420	347	680	420	560	5	10	1800	○	○	●	●
TFMOV05M460	347	750	460	600	5	10	1800	○	○	●	●
TFMOV05M510	347	820	510	670	5	10	2000	○	○	●	●
TFMOV05M550	480	910	550	720	5	10	2200	○	○	●	●
TFMOV05M625	480	1000	625	800	5	10	2400	○	○	●	●
TFMOV05M680	480	1100	680	900	5	10	2600	○	○	●	●
TFMOV05M750	480	1200	750	1000	5	10	3000	○	○	●	●

Note:
1.The Value of Voltage Protection Level (U_p) is determined according to IEC 61643-11:2011 clause 6.4.
Preferred values of voltage protection level (kV): 0.08, 0.09, 0.10, 0.12, 0.15, 0.22, 0.33, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.5, 1.8, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 8.0, 10.
2."●" indicates that the product has been certified, "○" indicates that the product is not certified.

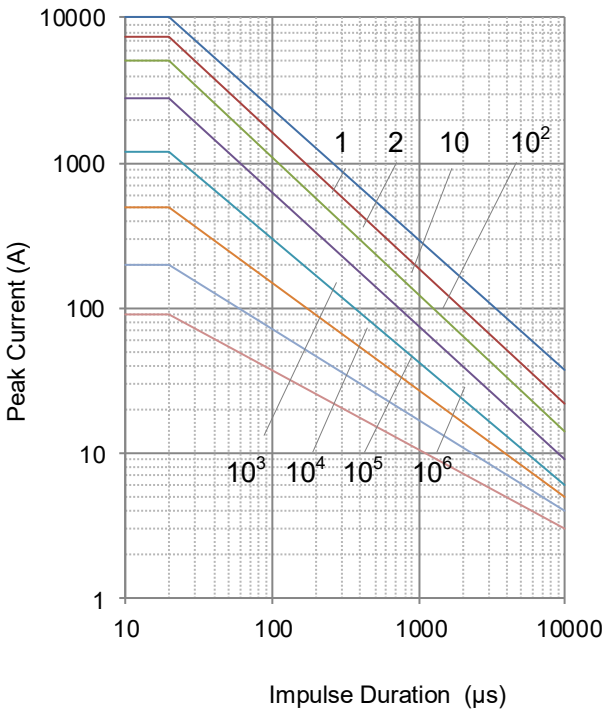
Performance Curve for Reference

Limited Current Test Curve (UL 1449 clause 44.4)



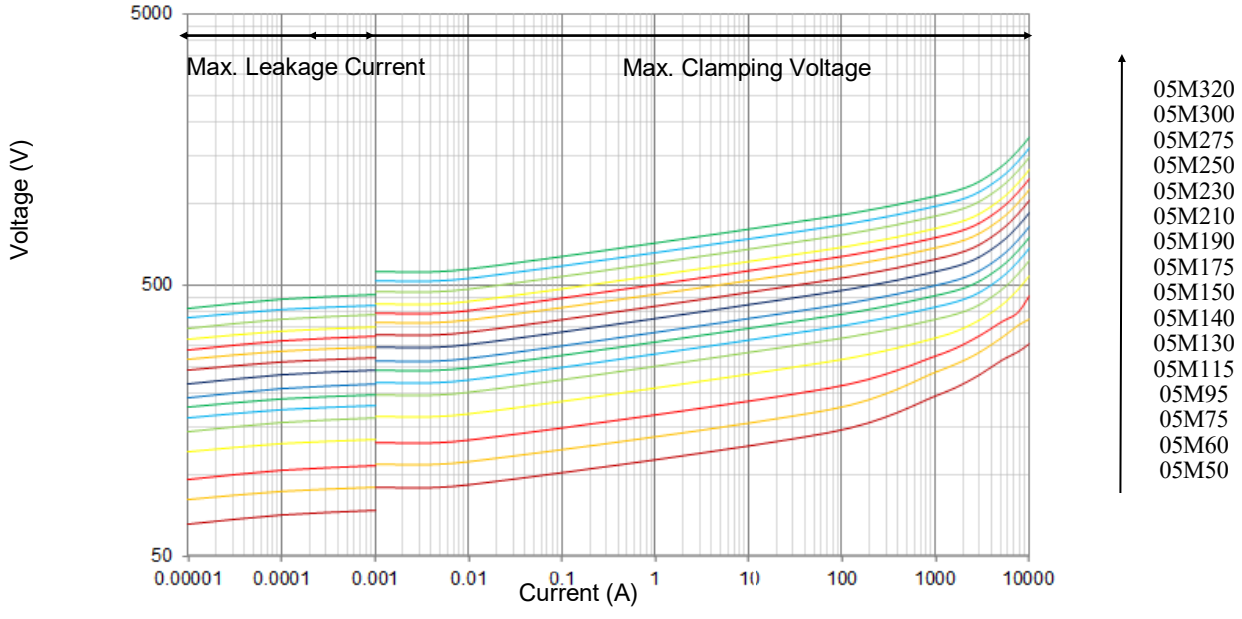
Note:
The limited current test curve is for reference only.

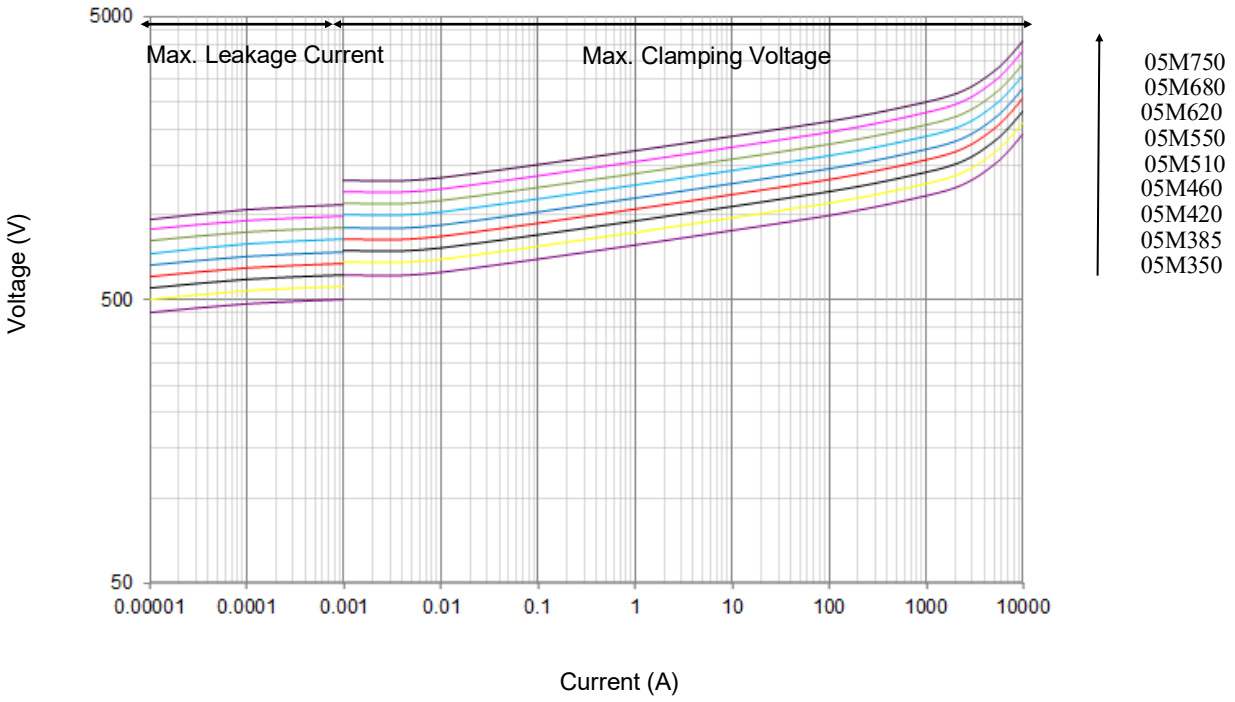
Max. Peak Current Derating Curve



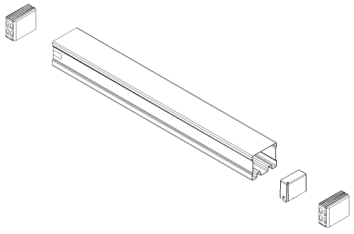
Note:
1, 2, 10, 10^2, 10^3, 10^4, 10^5, 10^6 Stand for number of repetitions.

Voltage-Current Characteristic Curves

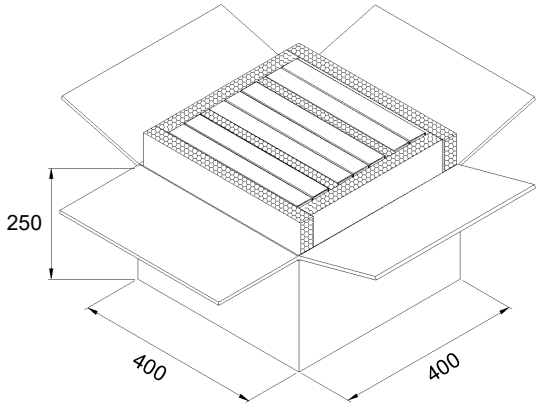




Packaging Information



35 Tubes

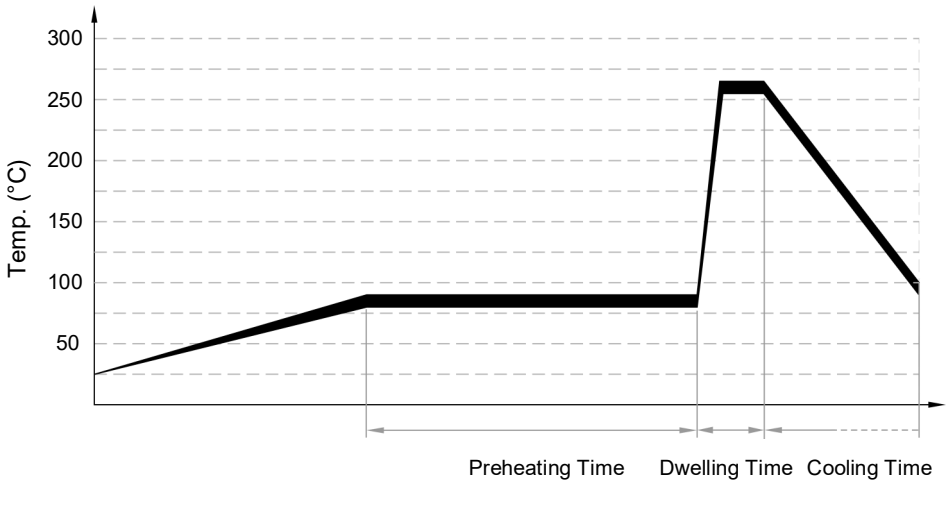


Unit: mm

Please contact us if you have special packaging requirements.

Item	Max. Continuous Operating Voltage	Tube	Carton
Dimensions (mm)	NA	295 × 220	455 × 315 × 195
Quantity (PCS)	50 ~ 420	30	480
	460 ~ 750	30	480

Wave Soldering Parameters (Reference)

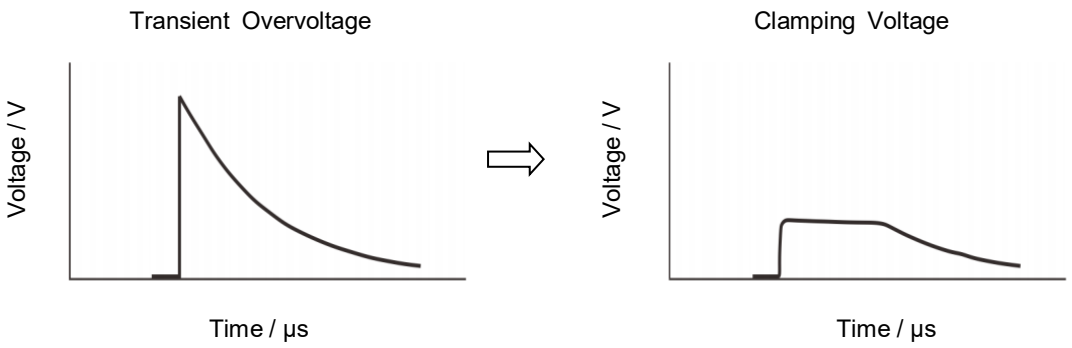


Item	Temp. (°C)	Time (s)
Preheating	80 ~ 120	60 ~150
Dwelling	250 ~ 270	4 ~ 6

Recommended Hand-Soldering Parameters

Item	Condition
Iron Temperature	350 °C (Max.)
Soldering Time	4 seconds (Max.)
Distance between Soldering Point and the Bottom of Product	2 mm (Min.)

MOV Operation Principle



Thermal Protection MOV

Figure a is a surge protection circuit commonly used in power supplies. MOV is used to suppress the surge voltage and protect the subsequent circuit. There is a risk of burning when the varistor degrades or fails. In the high-reliability surge protection circuit of Figure b, in order to improve the safety of the circuit, a thermal protection varistor TFMOV is used as the surge voltage protection element. TFMOV is a combination of varistors (MOV) and thermal protection component. When the temperature of the MOV is abnormally exceeded, the thermal fuse will be opened first, so that the failure mode of the MOV appears to be open-circuit failure.

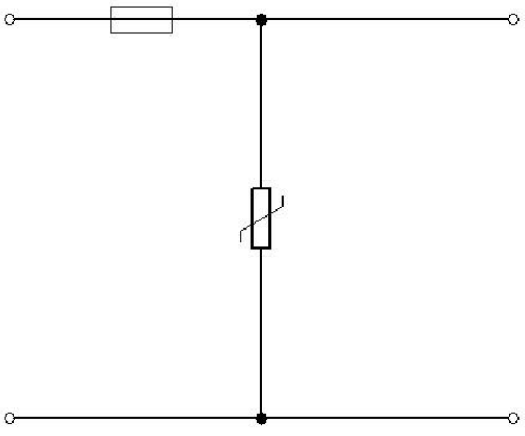


Figure a Typical surge protection circuit

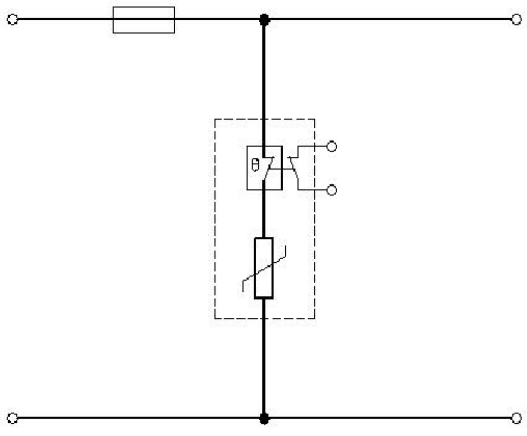
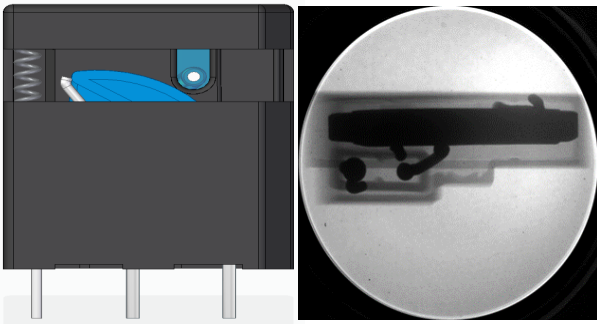


Figure b: High reliability surge protection circuit

Benefits

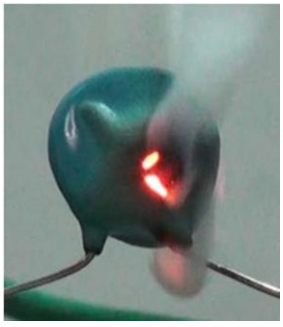
Safety



TFMOV Failure Simulation

During the electrical performance degrading of varistor, the inbuilt alloy contacts will open the circuit when the leakage current of varistor increases to tens of micro Amperes. As shown in the figure above, this is a safe open circuit failure.

Hidden Danger

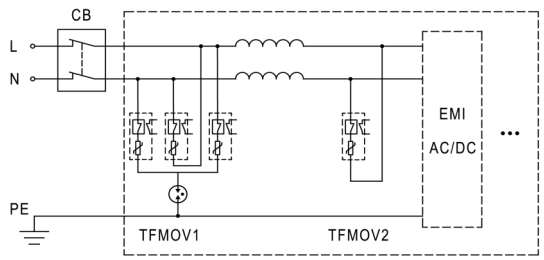


MOV Failure Simulation

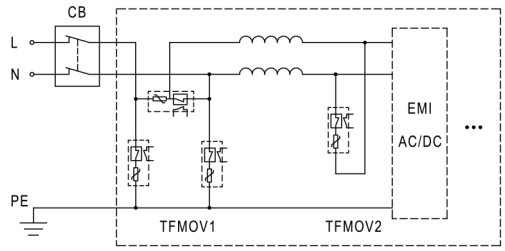
The electrical performance of varistor degrades with operating, mostly the varistor voltage drops, and leakage current increases. The heat accumulation can cause the temperature increase sharply and varistor results in thermal breakdown to short circuit status. It's very dangerous.

Application Options

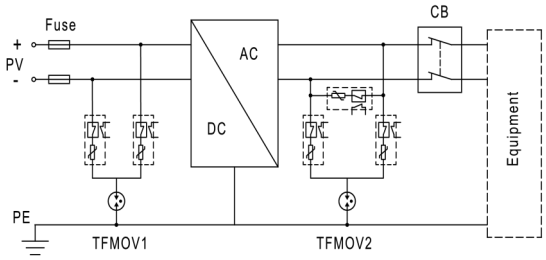
Remote Radio Unit (AC Type)



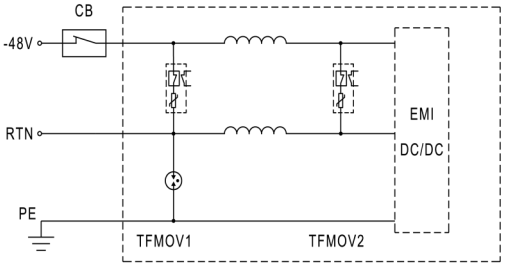
Power Strips (Surge Protector)



PV Inverter



Remote Radio Unit (DC Type)



Design

When a single TFMOV surge capacity can`t meet the requirement of customers, paralleling more TFMOVs is recommended. Due to its nonlinear current-voltage characteristics, please pay attention to below tips:

1. Use the TFMOV from the same manufacturer with same model to parallel.
2. Control the varistor voltage; Typically, the varistor voltage deviation should be less than 1% in the same group (between the Max and Min), and meet the next tip at the same time.
3. Calculate the average surge capacity for each TFMOV and keep a margin at least 10%.
4. Design the layout like Figure.2. to make sure the surge capacity is divided averagely.

The Design not Recommended

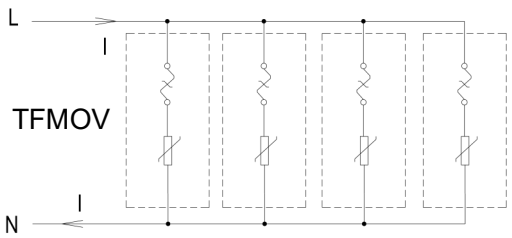


Figure .1

The Design Recommended

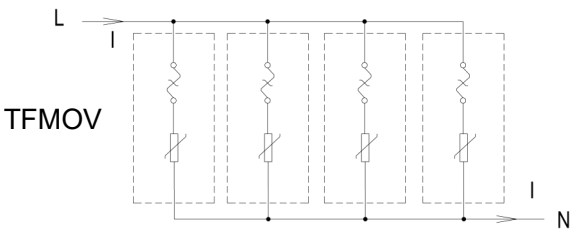


Figure .2

Glossary

Item	Description
V_N	**Nominal Varistor Voltage** Voltage, at specified d.c. current used as a reference point in the component characteristic. — (IEC 61643-11)
8/20 μs	**8/20 Current Impulse** Current impulse with a nominal virtual front time of 8 μs and a nominal time to half-value of 20 μs. — (IEC 61643-11)
1.2/50 μs	**1.2/50 Voltage Impulse** Voltage impulse with a nominal virtual front time of 1.2 μs and a nominal time to half-value of 50 μs. — (IEC 61643-11)
U_c	**Maximum Continuous Operating Voltage** Maximum r.m.s. voltage, which may be continuously applied to the SPD's mode of protection. — (IEC 61643-11)
I_n	**Nominal Discharge Current** Crest value of the current through the SPD having a current waveshape of 8/20. — (IEC 61643-11)
I_{imp}	**Impulse Discharge Current for Class I Test** Crest value of a discharge current through the SPD with specified charge transfer Q and specified energy W/R in the specified time. — (IEC 61643-11)
I_{max}	**Maximum Discharge Current** Crest value of a current through the SPD having an 8/20 waveshape and magnitude according to the manufacturers specification. I_{max} is equal to or greater than I_n. — (IEC 61643-11)
V_C	**Clamping Voltage** Peak voltage developed across the varistor terminations under standard atmospheric conditions, when passing an 8/20 μs class current pulse. — (IEC 61643-11)
C_V	**Capacitance** Capacitance across the MOV measured at a specified frequency and voltage. — (IEC 61643-11)
Modes of protection	**Mode of protection of an SPD** An intended current path, between terminals that contains protective components, e.g. line-to-line, line-to-earth, line-to-neutral, neutral-to-earth. — (IEC 61643-11)
U_p	**Voltage Protection Level** Maximum voltage to be expected at the SPD terminals due to an impulse stress with defined voltage steepness and an impulse stress with a discharge current with given amplitude and waveshape. — (IEC 61643-11)
IP	**Degree of protection of enclosure** Classification preceded by the symbol IP indicating the extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and possibly harmful ingress of water — (IEC 61643-11)
MOV	**Varistors** A resistive device with nonlinear voltammetry characteristics — (IEC 61643-11)

Patents

Name	Region	Category	Patent NO.
Varistor with In-built Alloy-Type Thermal Fuse	China	Patent for Invention	ZL 200510044661.5
A Protection Pluggable Module with Over Current、Over Voltage、and Over Temperature Protection Function	China	Utility Model	ZL 201020244488.X
A Varistor with Double Protection Function	China	Utility Model	ZL 201020255481.8
Surge Protection Module Applicable for Power Strip	China	Utility Model	ZL 201120107173.5
A Surge Protection Module Applicable for Power Strip	China	Patent for Invention	ZL 201110092261.7
A New Type of Varistor and Surge Protective Device with Thermal Protection	China	Utility Mode	ZL 201420306127.1
A Surge Protective Device	China	Utility Modeel	ZL 201420415059.2
A Varistor and Thermal Protection Component Combination	China	Utility Mode	ZL 201520376567.9
合金型温度ヒューズ付のバリスタ	Japan	Utility Mode	3142835
Varistor with an Alloy-Type Temperature Fuse	Australia	Utility Mode	2007100456
Varistor with an Alloy-Type Temperature Fuse	Taiwan	Utility Model	M 300855
Varistor with an Alloy-type Temperature Fuse	Canada	Patent for Invention	2588819
Metal Oxide Varistor with Built-in Alloy-Type Temperature Fuse	USA	Patent for Invention	US 8780521
Varistor with In-built Alloy Type Thermal Fuse (with Housing)	USA	Patent for Invention	US 9355763

ATTENTION

Usage

1. The voltage applied continuously to the TFMOV can not exceed its maximum continuous operating voltage U_c.
2. When atmosphere press is from 45 kPa to 106 kPa, the related altitude shall be from 5000 meters to - 500 meters.
3. Do not touch the product body or pins directly when power is on, to avoid electric shock.
4. Do not clean the TFMOV with strong polar solvent such as ketone, esters, benzene, halogenated hydrocarbon, to avoid damaging the enclosure.
6. It should have a reliable grounding when using these products.

Replacement

TFMOV is a non-repairable product. For safety sake, please use equivalent TFMOV for replacement.

Storage

Do not store TFMOV at high temperature, high humidity or corrosive gas environment. To avoid reducing the solderability of the pins, please use them up within 1 year after receiving the goods.

Installation Position

Do not install the TFMOV on a place that may often suffer severe continuous vibration.

Mechanical Stress

Do not take violent action such as knocking when assembling to avoid mechanical damage.

Thermal Fuse & MOV (TFMOV) Feature & Model List Overview

Rated Voltage U_n (V) AC		DC	5	10	20	20	Maximum Continuous Operating Voltage U_n (V) AC	DC	Page
690V	600V		TFMOV05M750	○	TFMOV20M750	○	750	750	
			TFMOV05M680	TFMOV10M680	TFMOV20M680	TFMOV25M680TI	680	680	
480V			TFMOV05M625	TFMOV10M625	TFMOV20M625	TFMOV25M625TI	625	625	
			○	○	○	TFMOV25M575TI	575	575	
	400V		TFMOV05M550	TFMOV10M550	TFMOV20M550	TFMOV25M550TI	550	550	
347V			TFMOV05M510	TFMOV10M510	TFMOV20M510	TFMOV25M510TI	510	510	
			TFMOV05M460	TFMOV10M460	TFMOV20M460	○	460	460	
			○	○	○	TFMOV25M440TI	440	440	
	254 - 277V		TFMOV05M420	TFMOV10M420	TFMOV20M420	○	420	420	
220 - 230V			TFMOV05M385	TFMOV10M385	TFMOV20M385	TFMOV25M385TI	385	385	
			TFMOV05M350	TFMOV10M350	TFMOV20M350	○	350	350	
		300V	TFMOV05M320	TFMOV10M320	TFMOV20M320	○	320	320	
			TFMOV05M300	TFMOV10M300	TFMOV20M300	○	300	300	
			TFMOV05M275	TFMOV10M275	TFMOV20M275	○	275	275	
	120 - 130V		TFMOV05M250	TFMOV10M250	TFMOV20M250	○	250	250	
		220V	TFMOV05M230	TFMOV10M230	TFMOV20M230	○	230	230	
			TFMOV05M210	TFMOV10M210	TFMOV20M210	○	210	210	
			TFMOV05M190	TFMOV10M190	TFMOV20M190	○	190	190	
			TFMOV05M175	TFMOV10M175	TFMOV20M175	○	175	175	
110V		110V	TFMOV05M150	TFMOV10M150	TFMOV20M150	○	150	150	
			TFMOV05M140	TFMOV10M140	TFMOV20M140	○	140	140	
			TFMOV05M130	TFMOV10M130	TFMOV20M130	○	130	130	
			TFMOV05M115	TFMOV10M115	TFMOV20M115	○	115	115	
	60V	60V	TFMOV05M95	TFMOV10M95	TFMOV20M95	○	95	95	
48V			TFMOV05M75	TFMOV10M75	TFMOV20M75	○	75	75	
		48V	TFMOV05M60	TFMOV10M60	TFMOV20M60	○	60	60	
	36V		TFMOV05M50	TFMOV10M50	TFMOV20M50	○	50	50	
			○	○	○	○	40	40	
24V		24V	○	○	○	○	35	35	
			○	○	○	○	30	30	
12V		12V	○	○	○	○	25	25	

Nominal Discharge Current I_n (kA)

Model

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