TFMOV

Thermal Fuse & MOV（TFMOV）

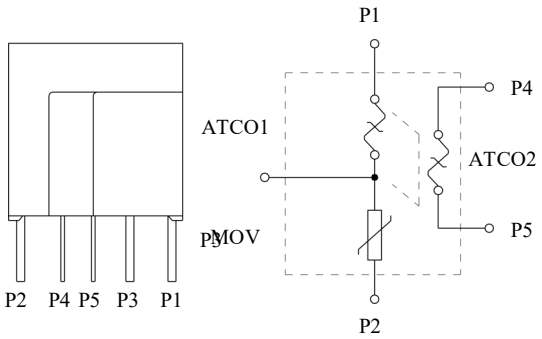
TFMOV20S Series

Description

Thermal Fuse & MOV (TFMOV) is a thermally protected varistor that has all the characteristics of a thermally protected varistor (MOV). TFMOV has all the characteristics of a varistor (MOV) with thermal protection, and there are two types of deterioration: natural deterioration due to long -term operation and deterioration due to an abnormal surge. When a surge occurs, the leakage current of the degraded MOV continues to increase, causing the surface temperature of the MOV to continue to rise and the possibility of fire. At this time, the thermal cutoff (fusible alloy) in the TFMOV senses the abnormal temperature and operates (blows) to disconnect the MOV from the main circuit to protect the entire circuit, and the MOV itself will not continue to heat up and catch fire.

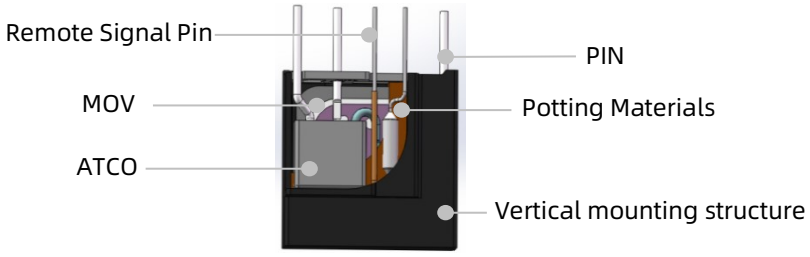
SETsafe | SETfuse Thermal Protection Varistors - Fusible Alloy TFMOV20S Series are mainly composed of Varistors (MOV), Thermal Cutoffs (Fusible Alloy) (ATCO), Flame Retardant Cases and Metal Components (Pins), Potting Materials. Vertical mounting structure; Nominal discharge current: (1.5 ~ 7.5) kA; Maximum continuous operating voltage: (17 ~ 750) VAC; Safety certifi-cates: UL, cUL, TUV; RoHS, REACH compliant.

Schematics



TFMOV(ATCO)

Structure



TFMOV(ATCO)

Features

- Thermal Protection, High Reliability
- Small Size
- Remote Signal Contact for Failure Indication (Optional)
- High Energy Capacity
- Epoxy 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)

Agency Approvals

Agency Symbol	Standards	The File No. and certification No. obtained by SETsafe | SETfuse	Category
	UL 1449	E322662	Type 4CA
	CSA C22.2 NO. 269, CSA ECN 516	E322662	Type 4CA
	IEC/EN 61643-11	J 50210179	Class II
Environment	RoHS & REACH	Compliant	

Part Numbering System

TFMOV 20 S 621 -IT - 3 - 001

Product Category
TFMOV

MOV Size (mm)
20 mm

MOV Shape
S: Square
D: Round
R: Rectangle

Nominal Varistor Voltage

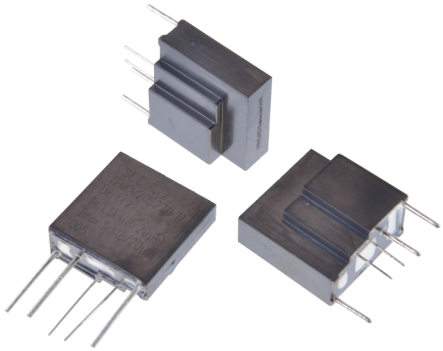
820	621	102
82×10^0 =82 V	62×10^1 =620 V	10×10^2 =1000 V

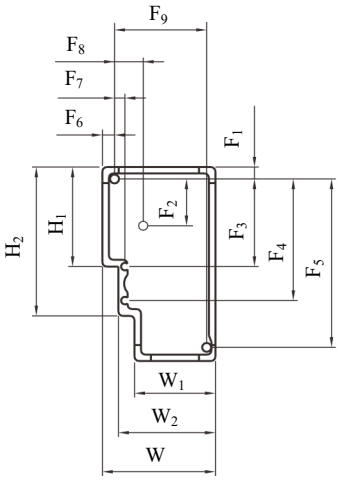
Other Options

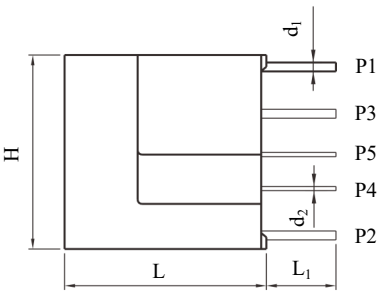
Pin No.
2: Without Remote Signal Contact or Status Indication
3: With Status Indication
4: With Remote Signal Contact
5: With Remote Signal Contact and Status Indication

Remote Signal
Default: Without Remote Signal Contact
-IT: With Remote Signal Contact

Reminder:
Part numbering system in the datasheet is only for selecting correct parameter and product features. Before placing order, please contact us for specifications and use the part number and product code in the specifications to place order to ensure the part is correct. Product code is the unique indentification.







Note:
Pin P3 / P4 / P5 is Optional
Unit: mm

Nominal Varistor Voltage	L (±1.0)	L_1 (±1.0)	W (±1.0)	W_1 (±1.0)	W_2 (±1.0)	H (±1.0)	H_1 (±0.5)	H_2 (±0.5)	F_1 (±0.5)	F_2 (±0.5)
270 ~ 121	23.2	8.0	9.1	5.4	7.8	22.8	11.7	17.5	1.4	5.5
151 ~ 271	23.2	8.0	9.5	5.8	7.7	22.8	11.7	17.5	1.4	5.5
301 ~ 471	23.2	8.0	11.0	7.3	9.2	22.8	11.7	17.5	1.4	5.5
511 ~ 681	23.2	8.0	12.0	8.3	10.2	22.8	11.7	17.5	1.4	5.5
751 ~ 821	23.2	8.0	13.0	9.3	11.2	22.8	11.7	17.5	1.4	5.5
911 ~ 122	23.2	8.0	15.5	11.8	13.7	22.8	11.7	17.5	1.4	5.5
Nominal Varistor Voltage	**F_3 (±0.5)**	**F_4 (±0.5)**	**F_5 (±0.5)**	**F_6 (±0.5)**	**F_7 (±0.5)**	**F_8 (±0.5)**	**F_9 (±0.5)**	**d_1 (-0.05,+0.15)**	**d_2 (±0.05)**	
180 ~ 121	10.3	14.3	19.8	1.4	1.2	3.3	6.7	1.05	0.50	
151 ~ 271	10.3	14.3	19.8	1.4	1.2	3.3	7.1	1.05	0.50	
301 ~ 471	10.3	14.3	19.8	1.4	1.2	3.3	8.6	1.05	0.50	
511 ~ 681	10.3	14.3	19.8	1.4	1.2	3.3	9.6	1.05	0.50	
751 ~ 821	10.3	14.3	19.8	1.4	1.2	3.3	10.6	1.05	0.50	
911 ~ 122	10.3	14.3	19.8	1.4	1.2	3.3	13.1	1.05	0.50	

Specifications

Model	Max. Continuous Operating Voltage		Varistor Voltage @1 mA DC		Clamping Voltage (Max.)		Nominal Dis-charge Current (8/20 μs)	Max. Dis-charge Current (8/20 μs)	Voltage Clamping Ratio[a]		Max. Energy (Joule)	Typical Capaci-tance (Reference)	Thermal Fuse
	U_c		Min.	Max.	V_C	I_P	I_n	I_{max}	R_{cl}	I_n	10/1000 μs	@1 kHz	UL 60691 E214712
	(VAC)	(VDC)	(V)		(V)	(A)	(kA)			(kA)	(J)	(pF)	
TFMOV20S270x	17	22	24	31	53	25	1.5	3	4.6	1.5	23	15600	VT Series U_t: 690 VAC I_t: 15 A/16 A
TFMOV20S330x	20	26	30	36	65	25	1.5	3	4.6	1.5	29	13800	
TFMOV20S390x	25	31	35	43	77	25	1.5	3	4.6	1.5	33.5	10200	
TFMOV20S470x	30	38	42	52	93	25	2.5	5	4.3	2.5	41	8880	
TFMOV20S560x	35	45	50	62	110	25	2.5	5	3.8	2.5	49	7800	
TFMOV20S680x	40	56	61	75	135	25	2.5	5	3.8	2.5	59	7000	
TFMOV20S820x	50	65	74	90	135	125	5	10	3.2	5	67	5880	
TFMOV20S101x	60	85	90	110	165	125	5	10	3.2	5	84	4800	
TFMOV20S121x	75	100	108	132	200	125	5	10	3.2	5	102	4000	
TFMOV20S151x	95	125	135	165	250	125	5	10	3.2	5	127	3200	
TFMOV20S181x	115	150	162	198	300	125	5	10	3.2	5	156	2650	
TFMOV20S201x	130	170	185	225	340	125	7.5	15	2.3	7.5	170	2400	
TFMOV20S221x	140	180	198	242	360	125	7.5	15	2.3	7.5	185	2160	
TFMOV20S241x	150	200	216	264	395	125	7.5	15	2.3	7.5	200	2000	
TFMOV20S271x	175	225	243	297	455	125	7.5	15	2.3	7.5	230	1800	
TFMOV20S301x	190	250	270	330	500	125	7.5	15	2.3	7.5	250	1560	
TFMOV20S331x	210	275	297	363	550	125	7.5	15	2.3	7.5	270	1440	
TFMOV20S361x	230	300	324	396	595	125	7.5	15	2.3	7.5	305	1320	
TFMOV20S391x	250	320	351	429	650	125	7.5	15	2.3	7.5	330	1200	
TFMOV20S431x	275	350	387	473	710	125	7.5	15	2.3	7.5	365	1160	
TFMOV20S471x	300	385	423	517	775	125	7.5	15	2.3	7.5	420	1020	
TFMOV20S511x	320	415	459	561	845	125	7.5	15	2.3	7.5	430	935	
TFMOV20S561x	350	460	504	616	925	125	7.5	15	2.3	7.5	455	850	
TFMOV20S621x	385	505	558	682	1025	125	7.5	15	2.3	7.5	465	780	
TFMOV20S681x	420	560	612	748	1120	125	7.5	15	2.3	7.5	480	720	
TFMOV20S751x	460	615	675	825	1240	125	7.5	15	2.3	7.5	500	635	
TFMOV20S821x	510	670	738	902	1355	125	7.5	15	2.3	7.5	520	600	
TFMOV20S911x	550	745	819	1001	1500	125	7.5	15	2.3	7.5	550	525	
TFMOV20S102x	625	825	900	1100	1650	125	7.5	15	2.3	7.5	610	480	
TFMOV20S112x	680	895	990	1210	1815	125	7.5	15	2.3	7.5	675	430	
TFMOV20S122x	750	1000	1080	1320	1980	125	7.5	15	2.3	7.5	740	380	

Note:

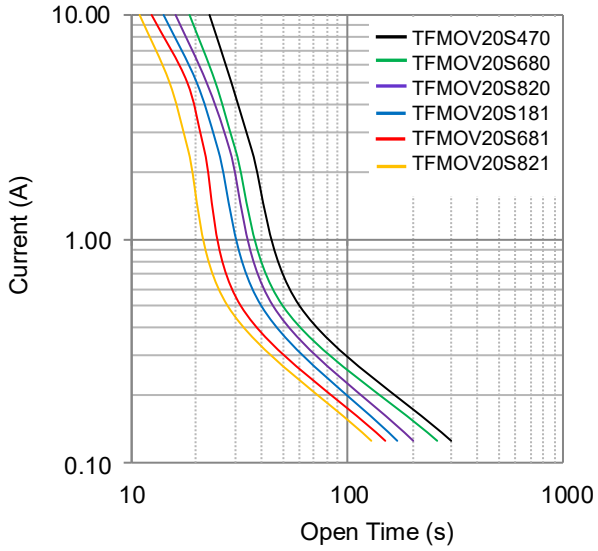
a: $R_{cl} = \frac{V_C}{V_N}$, $U_p \geq V_C$, V_C: Clamping Voltage (@ I_n), V_N: Varistor Voltage, U_p: Voltage Protection Level.

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.

Performance Curve for Reference

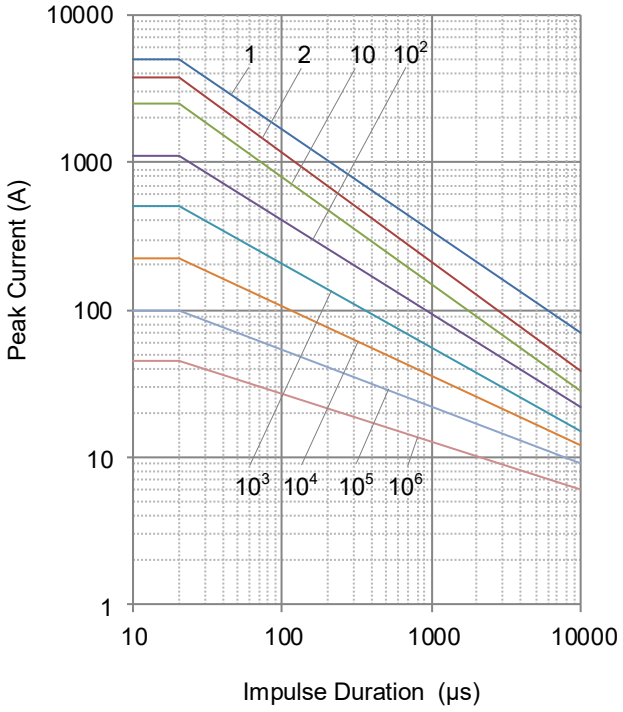
Limited Current Test Curve (UL 1449 clause 44.4)



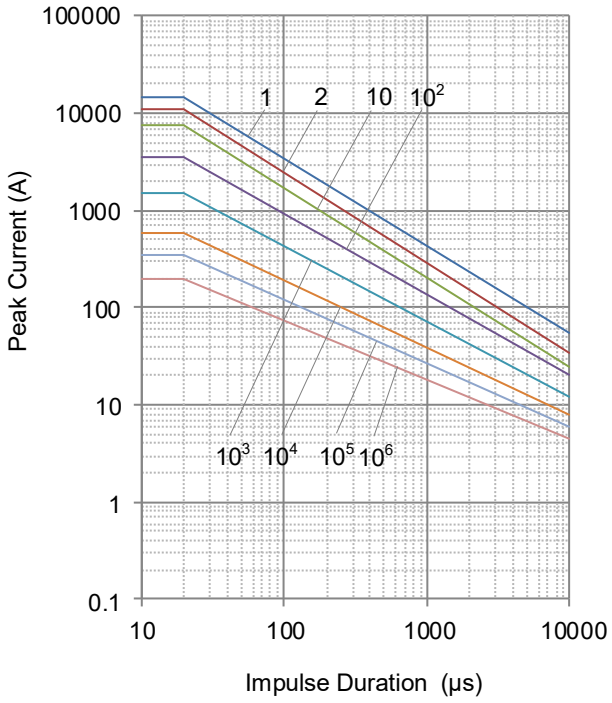
Note: The limited current test curve is for reference only.

Max. Peak Current Derating Curve

TFMOV20S270 to TFMOV20S680

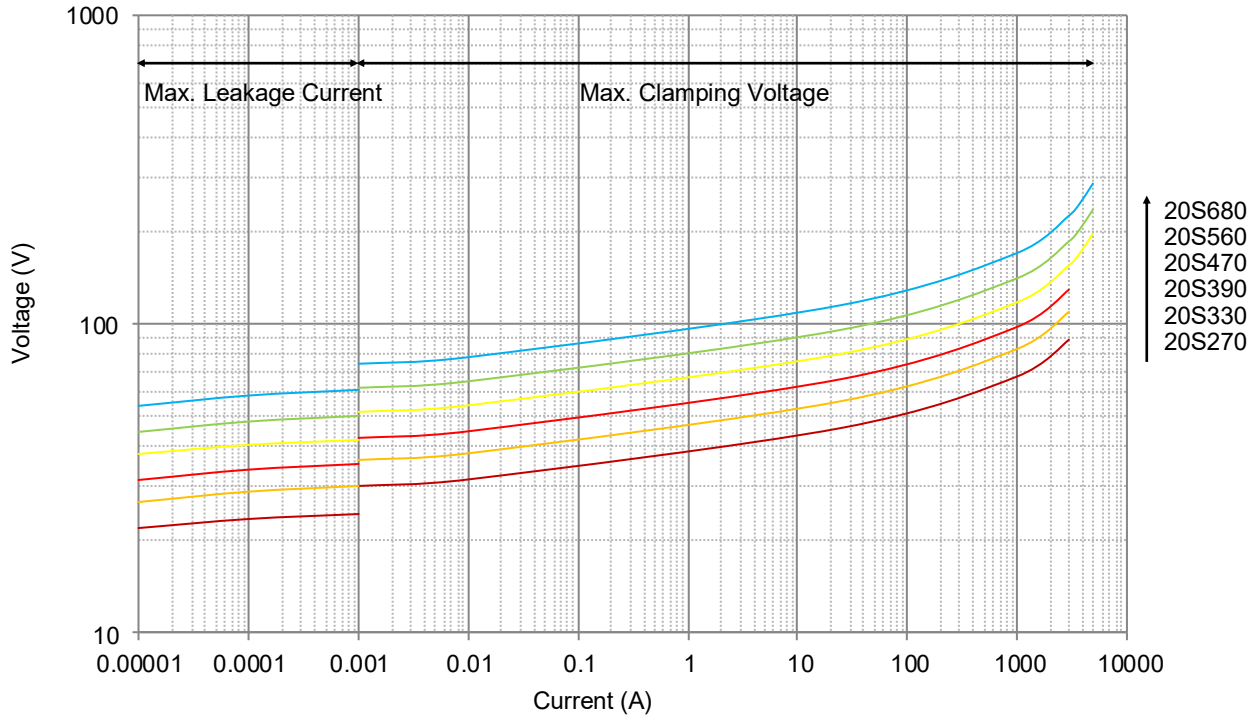


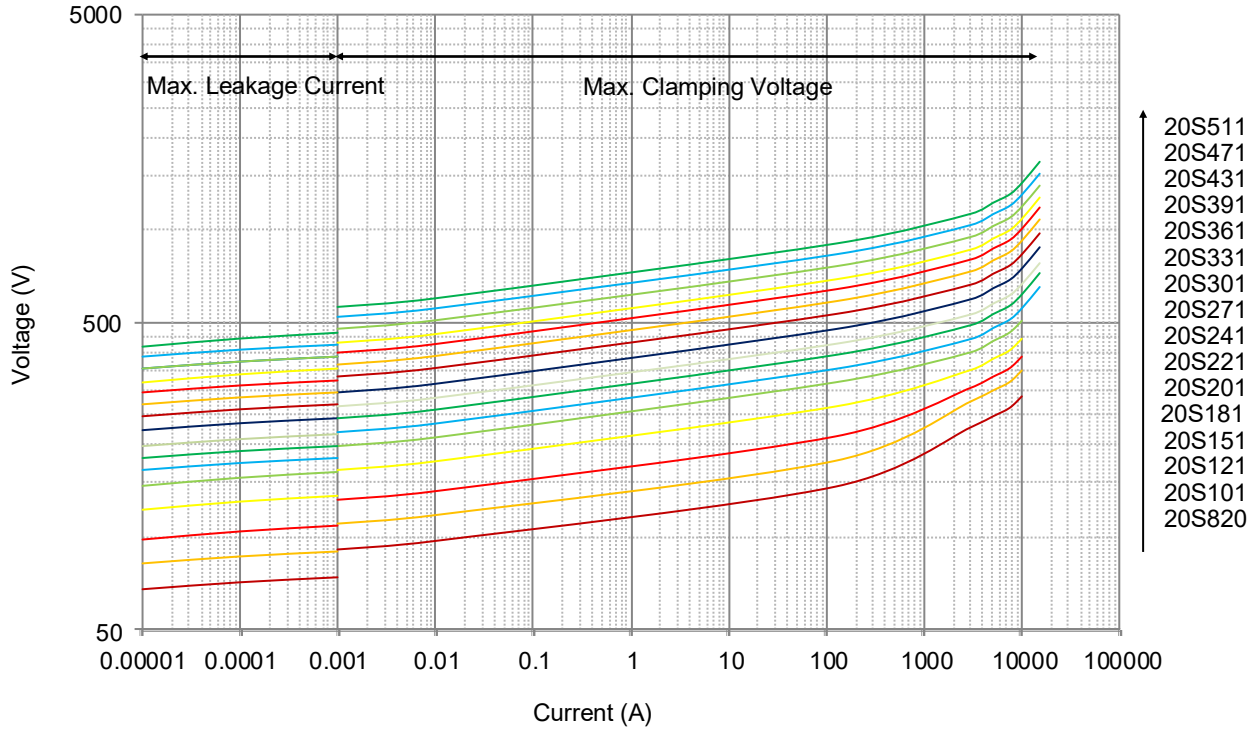
TFMOV20S820 to TFMOV20S122

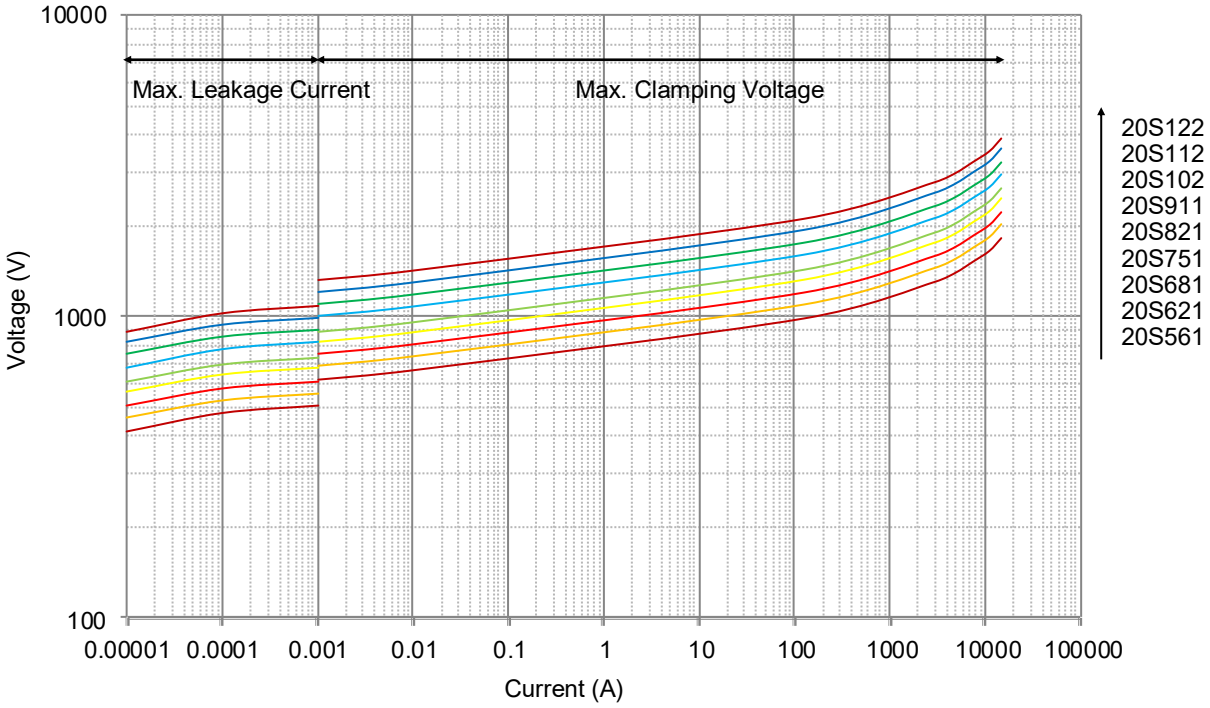


Note: 1, 2, 10, 10^2, 10^3,10^4, 10^5, 10^6 Stand for number of repetitions.

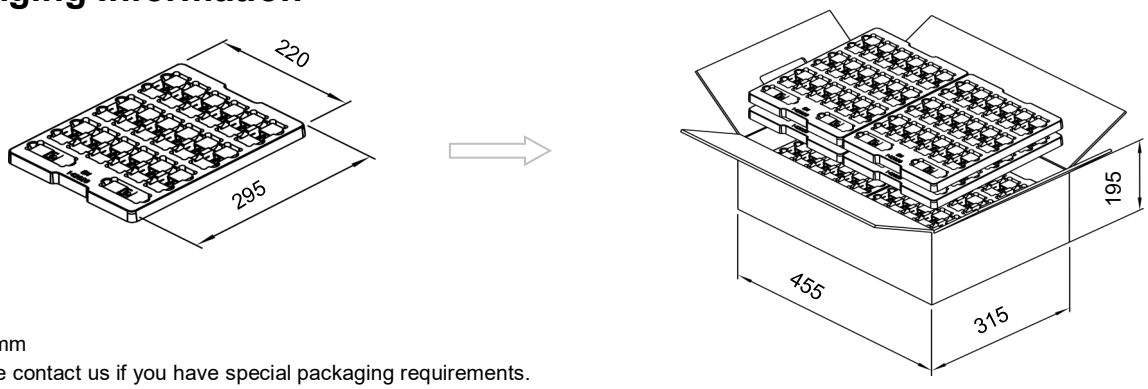
Voltage-Current Characteristic Curves







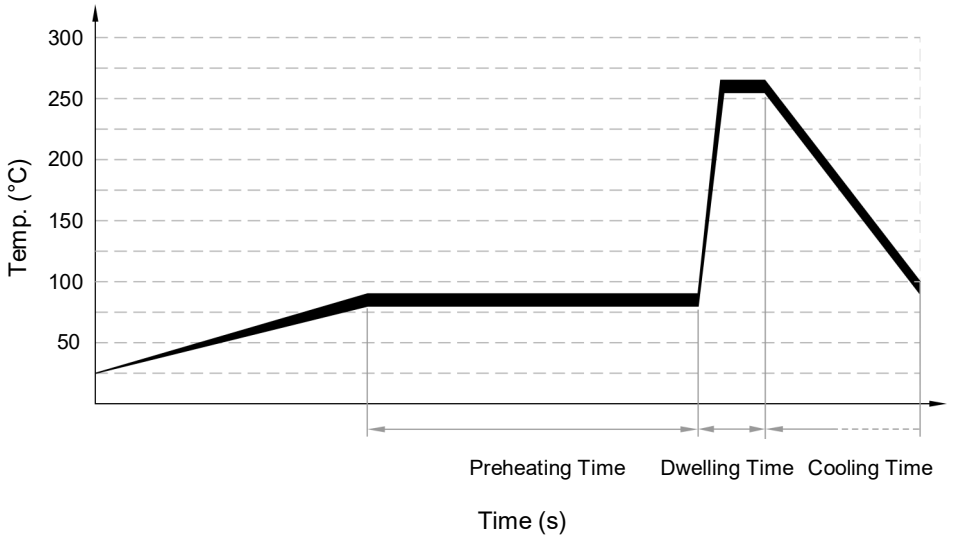
Packaging Information



Unit: mm
Please contact us if you have special packaging requirements.

Item	Nominal Varistor Voltage	Tray	Carton
Dimensions (mm)	N/A	295 × 220	455 × 315 × 195
Quantity (PCS)	270 ~ 271	40	960
	301 ~ 681	40	800
	751 ~ 122	40	640

Wave Soldering Parameters (Reference)



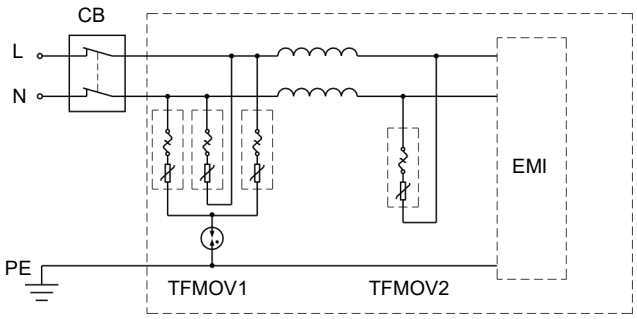
Item	Temp. (°C)	Time (s)
Preheating	80 to 90	60 to 150
Dwelling	250 to 260	2 to 4

Recommended Hand-Soldering Parameters

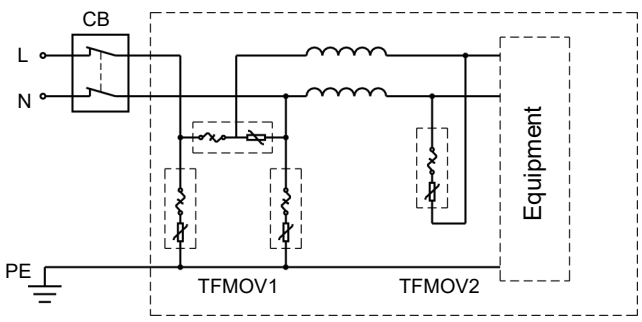
Item	Condition
Iron Temperature	350 °C (Max.)
Soldering Time	4 seconds (Max.)
Distance between Soldering Point and the Bottom of Product	2 mm (Min.)

Application Options

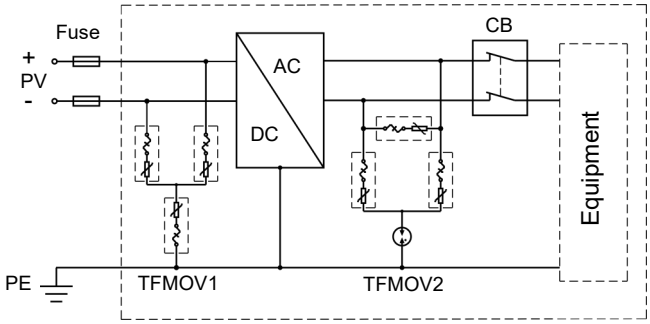
Remote Radio Unit (AC Type)



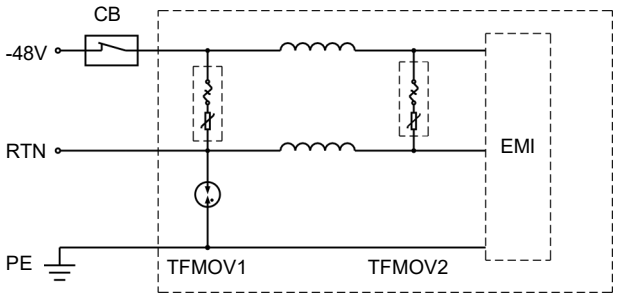
Power Strips (Surge Protector)



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

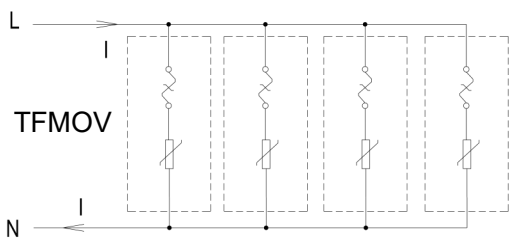


Figure .1

The Design Recommended

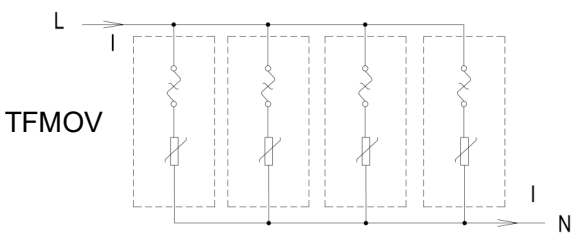
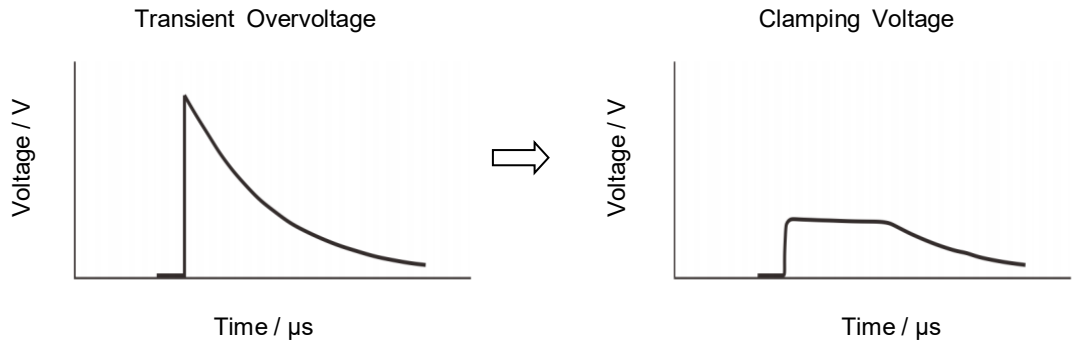


Figure .2

MOV Operation Principle



MOV Thermal Protection

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.

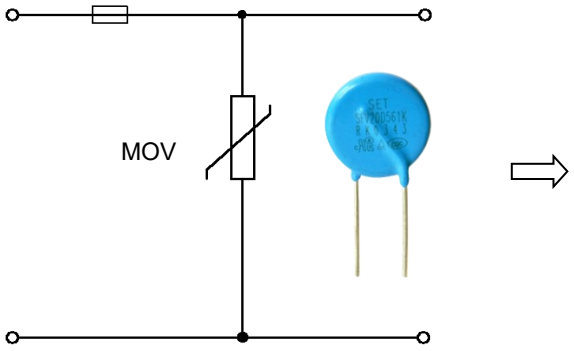


Figure a Typical surge protection circuit

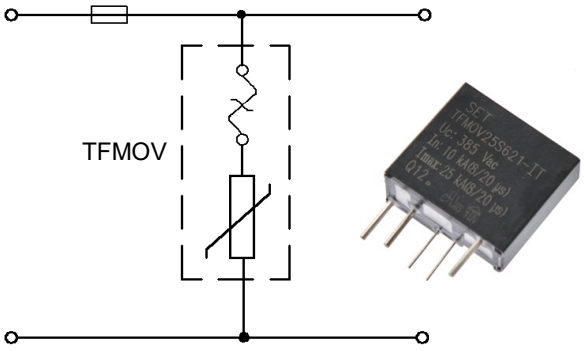
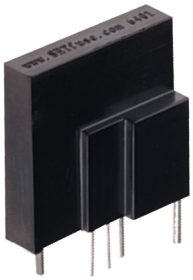


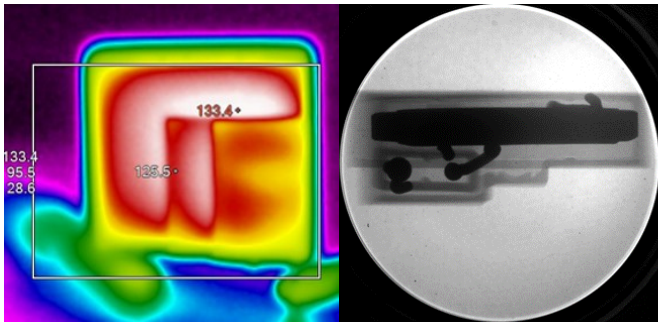
Figure b: High reliability surge protection circuit

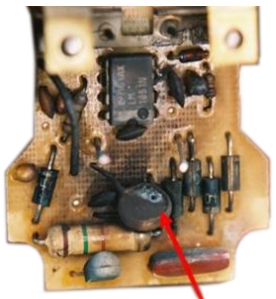
Benefits



Safety

Hidden Danger





TFMOV Failure Simulation

During the electrical performance degrading of varistor, the inbuilt ATCO 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.

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.

Glossary

Item	Description
V_N	**Nominal Varistor Voltage** Voltage, at specified d.c. current used as a reference point in the component characteristic.
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 μs. — (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 μs 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.
C_V	**Capacitance** Capacitance across the MOV measured at a specified frequency and voltage.
Modes of protection	**Modes of protection** 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 wave shape. — (IEC 61643-11)
TCO	**Thermal-Link** A non-resettable device incorporating a THERMAL ELEMENT which will open a circuit once only when exposed for a sufficient length of time to a temperature in excess of that for which it has been designed.
ATCO	**Alloy Thermal-Link** Alloy Type Thermal-Link, Alloy is the thermal element.
MOV	**Varistors** A resistive device with nonlinear voltammetry characteristics

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. Frequency range is from 47 Hz to 63 Hz.
2. The voltage applied continuously to the TFMOV can not exceed its maximum continuous operating voltage U_c.
3. When atmosphere press is from 80 kPa to 106 kPa, the related altitude shall be from 2000 meters to - 500 meters.
4. Do not touch the product body or pins directly when power is on, to avoid electric shock.
5. 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.

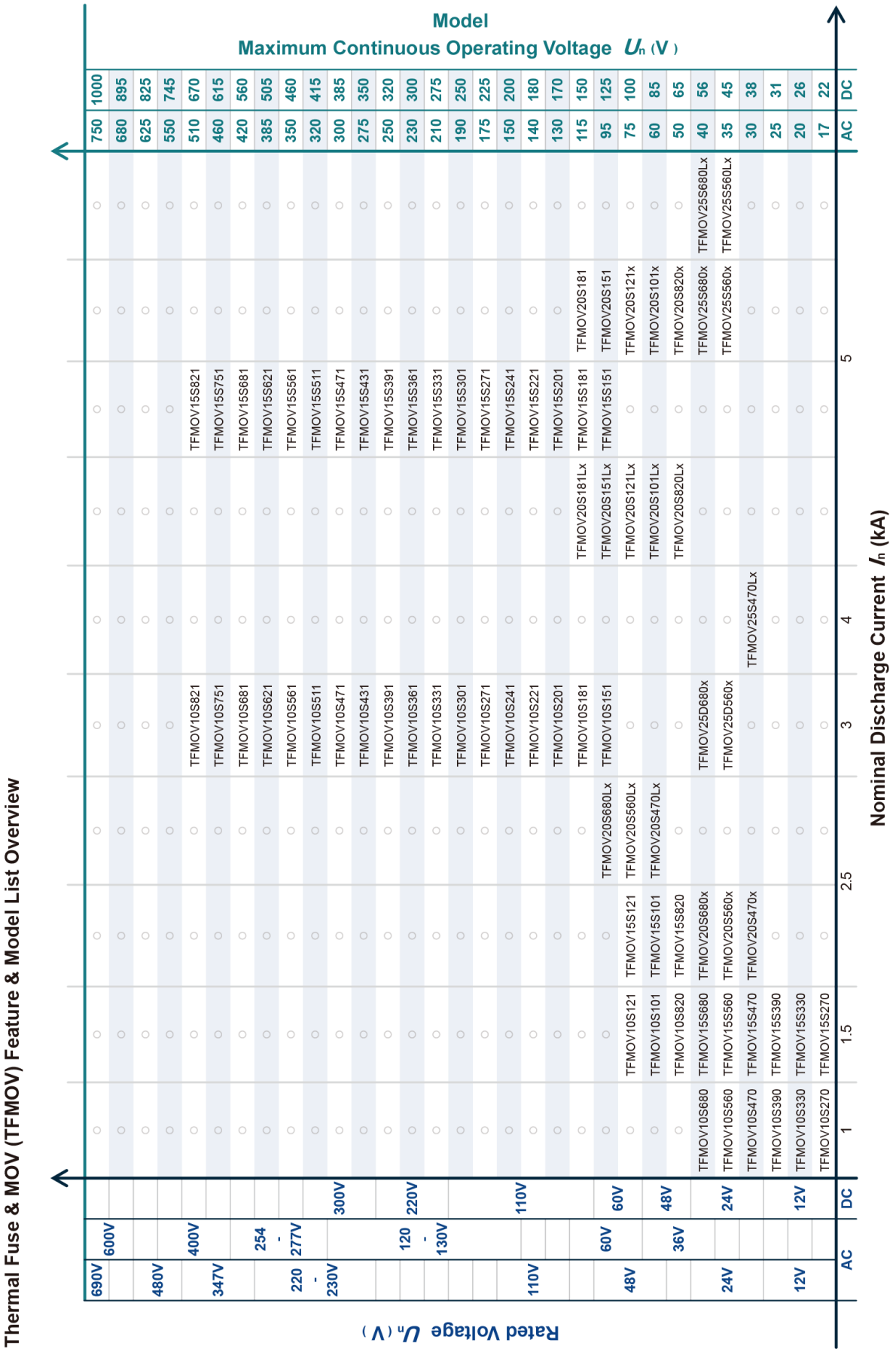
Installation Position

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

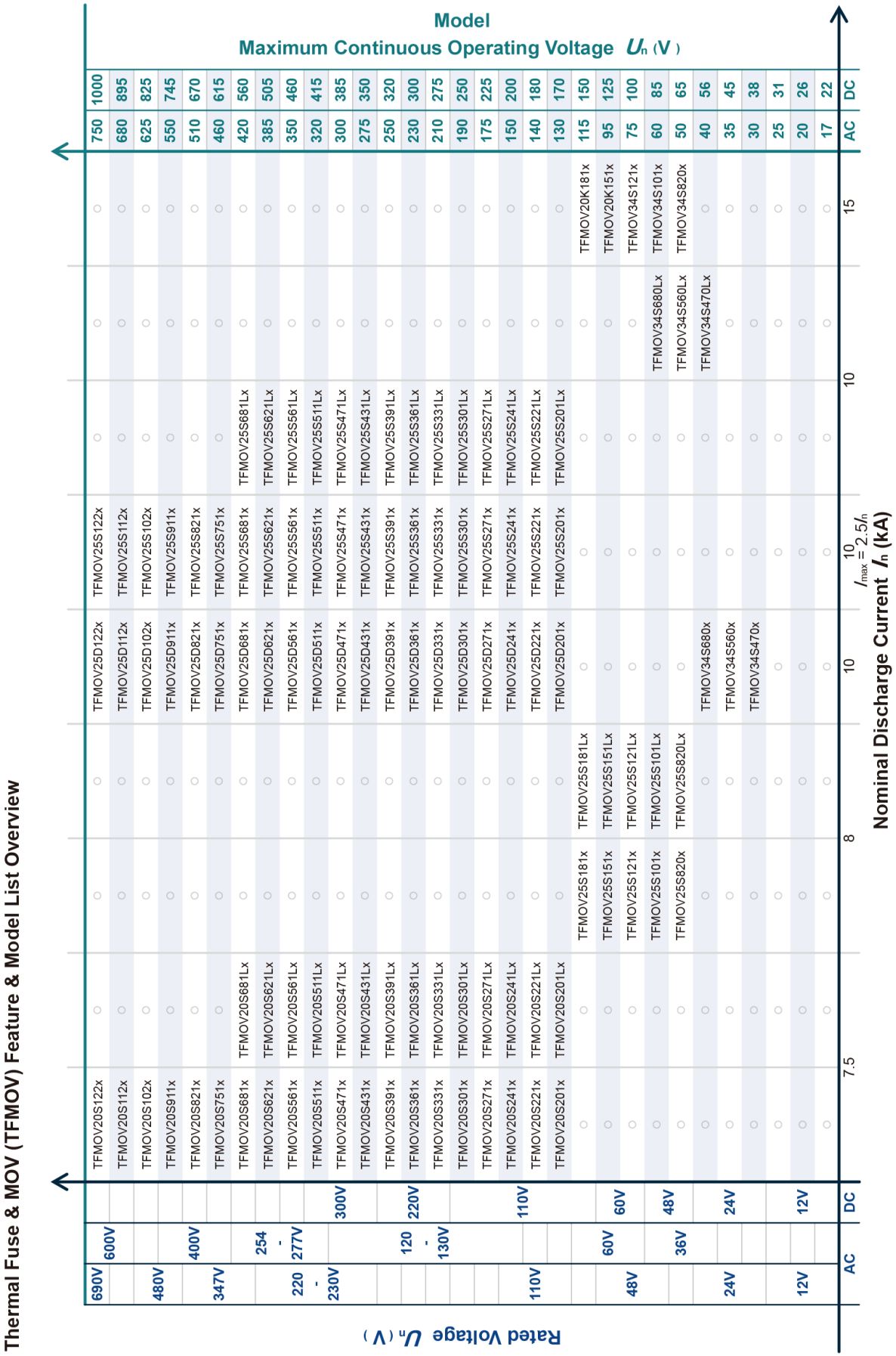
Mechanical Stress

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

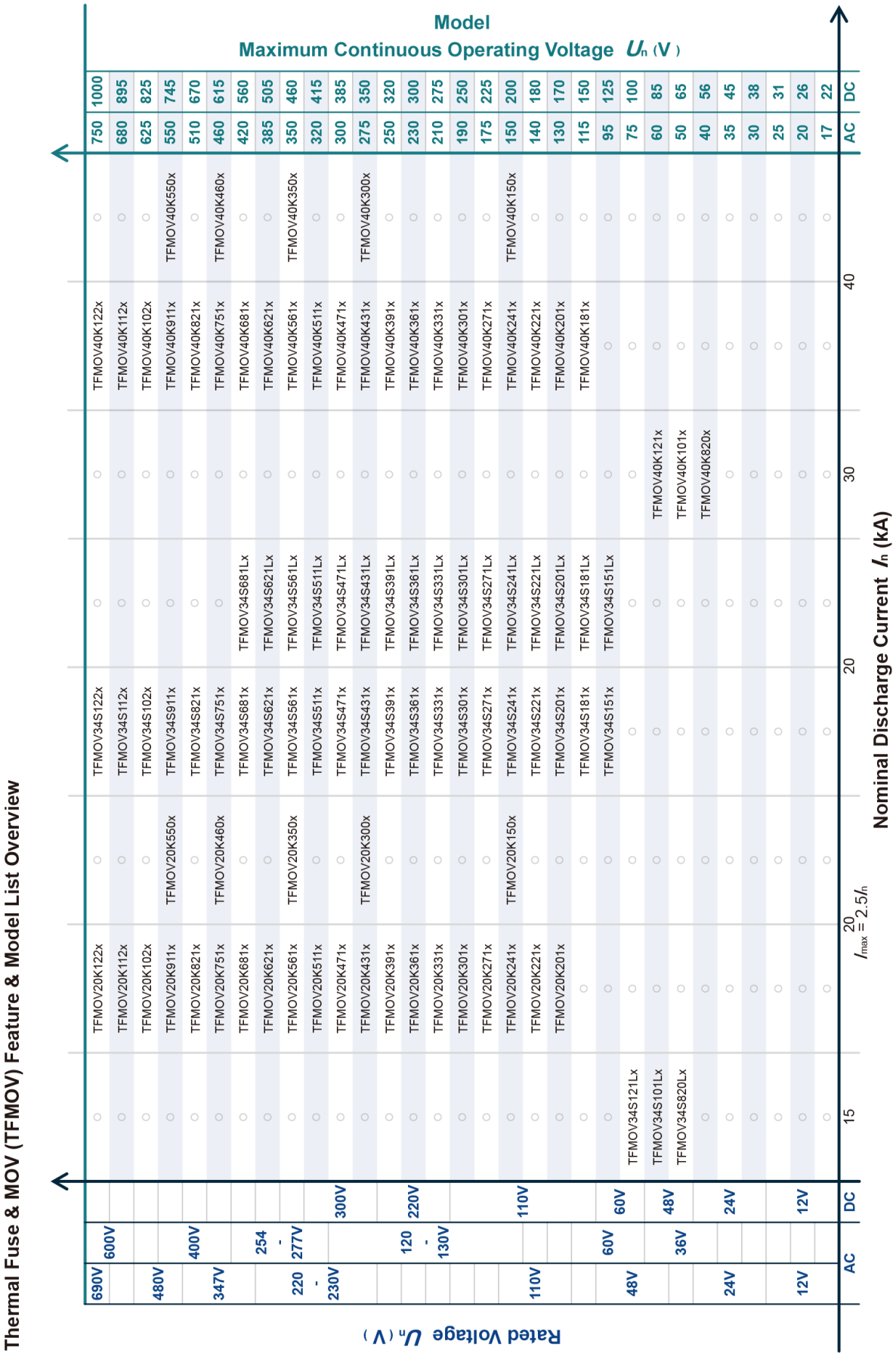
Thermal Fuse & MOV (TFMOV) Feature & Model List Overview



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



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



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