

α Therm



**PROVIDING A TOTAL SOLUTION FOR
HIGH STANDARD SAFETY CIRCUIT PROTECTION**

Alpha Therm GmbH: Ihr Offizieller Vertriebskanal für SETsafe/SETfuse

Die Alpha Therm GmbH mit Sitz in Plankstadt, Deutschland, ist stolz darauf, der offizielle Vertriebskanal für SETsafe/SETfuse in Deutschland, Europa und weltweit zu sein. Unsere langjährige Partnerschaft mit SETsafe/SETfuse basiert auf einem erfolgreichen und vertrauensvollen Geschäftsmodell.

Wir repräsentieren SETsafe/SETfuse auf internationalen Messen wie der Electronica, InterSolar, ees und vielen weiteren. Von kleinen Standardsicherungen bis hin zu komplexen, kundenspezifischen Automotive-Projekten – wir haben alles erfolgreich umgesetzt. Mit unserer umfassenden Lagerhaltung in Deutschland gewährleisten wir schnelle und zuverlässige Lieferungen.

Kontaktieren Sie uns! Unser kompetentes Team berät Sie ausführlich und findet die optimale Lösung für Ihre Anforderungen. Vertrauen Sie auf Alpha Therm GmbH und SETsafe/SETfuse – Ihre Partner für innovative Sicherheitslösungen.

Kontakt:

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Alpha Therm GmbH: Your Official Distribution Channel for SETsafe/SETfuse

Alpha Therm GmbH, based in Plankstadt, Germany, is proud to be the official distribution channel for SETsafe/SETfuse in Germany, Europe, and worldwide. Our long-standing partnership with SETsafe/SETfuse is built on a successful and trustworthy business model.

We represent SETsafe/SETfuse at international trade fairs such as Electronica, InterSolar, ees, and many more. From small standard fuses to complex, customized automotive projects, we have successfully handled it all. With our extensive warehousing in Germany, we ensure fast and reliable deliveries.

Contact us today! Our competent team will provide you with detailed advice and find the optimal solution for your requirements. Trust Alpha Therm GmbH and SETsafe/SETfuse – your partners for innovative safety solutions.

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TFMOV

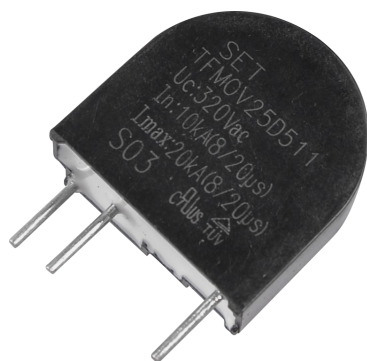
Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

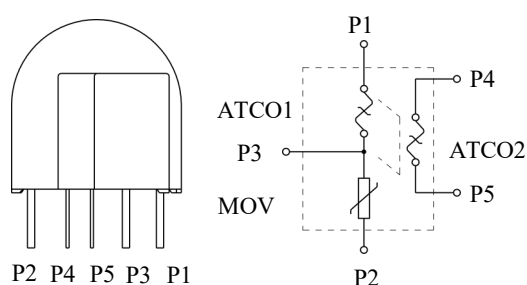
Description

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 TFMOV25D 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 ~ 10) kA; Maximum continuous operating voltage: (17 ~ 750) VAC; Safety certificates: UL, cUL, TUV, CQC; RoHS, REACH compliant.

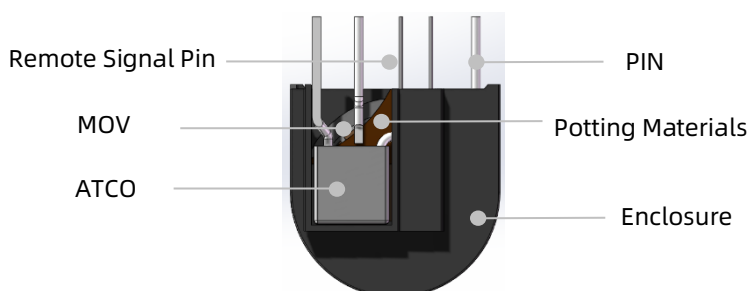


Schematics



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)

TFMOV

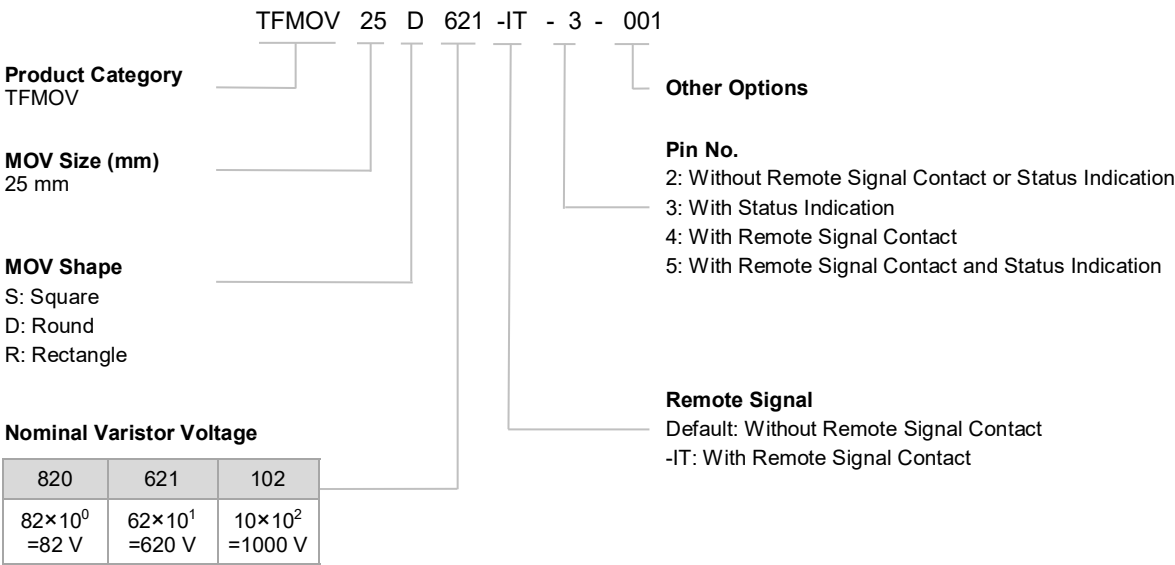
Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

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
	EN 61643-11	J 50210179	Class II
	GB 4943.1-2011 GB 8898-2011	CQC15001125794	Class II
Environment	RoHS & REACH	Compliant	

Part Numbering System

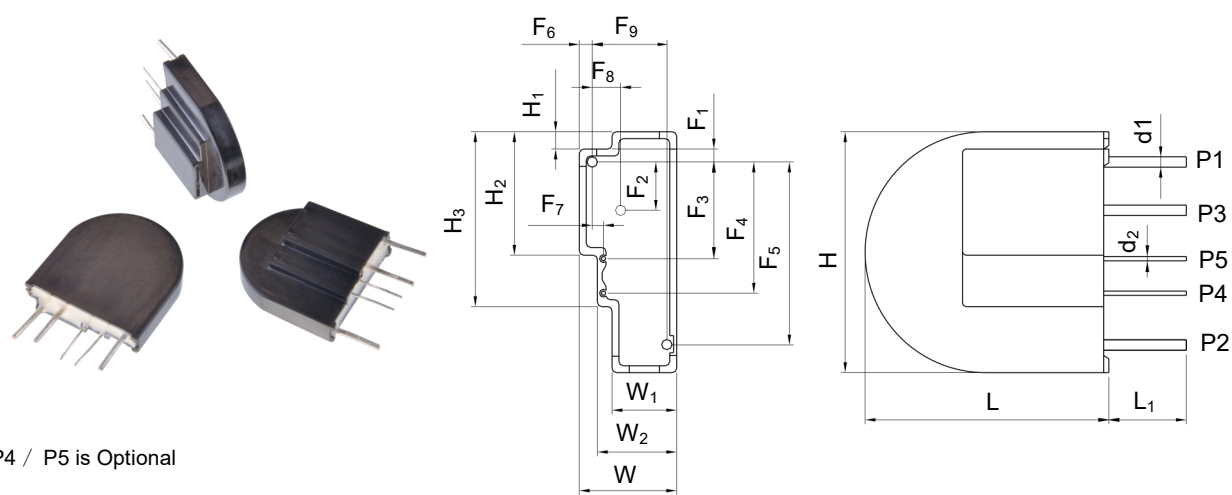


Reminder:
 Part numbering system in the datasheet is only for selecting correct parameter and product features. Before placing order, please contact us for specifications and use the part number and product code in the specifications to place order to ensure the part is correct. Product code is the unique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

TFMOV

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series



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 (±0.5)	H (±1.0)	H ₁ (±0.5)	H ₂ (±0.5)	H ₃ (±1.0)	d ₁ (-0.05,+0.15)
25D270 ~ 121	28.3	9.0	9.4	5.6	7.3	27.9	2.0	14.3	20.3	1.20
25D151 ~ 271	28.3	9.0	9.8	6.0	7.6	27.9	2.0	14.3	20.3	1.20
25D301 ~ 471	28.3	9.0	11.3	7.5	9.2	27.9	2.0	14.3	20.3	1.20
25D511 ~ 681	28.3	9.0	12.3	8.5	10.2	27.9	2.0	14.3	20.3	1.20
25D751 ~ 821	28.3	9.0	13.3	9.5	11.2	27.9	2.0	14.3	20.3	1.20
25D911 ~ 122	28.3	9.0	15.8	12.0	13.7	27.9	2.0	14.3	20.3	1.20
Nominal Varistor Voltage	d ₂ (±0.05)	F ₁ (±0.5)	F ₂ (±0.5)	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)
25D270 ~ 121	0.50	1.5	5.6	11.2	15.2	21.2	1.5	1.3	3.3	6.9
25D151 ~ 271	0.50	1.5	5.6	11.2	15.2	21.2	1.5	1.3	3.3	7.3
25D301 ~ 471	0.50	1.5	5.6	11.2	15.2	21.2	1.5	1.3	3.3	8.8
25D511 ~ 681	0.50	1.5	5.6	11.2	15.2	21.2	1.5	1.3	3.3	9.8
25D751 ~ 821	0.50	1.5	5.6	11.2	15.2	21.2	1.5	1.3	3.3	10.8
25D911 ~ 122	0.50	1.5	5.6	11.2	15.2	21.2	1.5	1.3	3.3	13.3

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Specifications

Model	Max. Continuous Operating Voltage		Varistor Voltage @1 mA DC		Clamping Voltage (Max.)		Nominal Dis-charge Current (8/20 μ s)	Max. Dis-charge Current (8/20 μ s)	Voltage Clamping Ratio ^a		Max. Energy (Joule)	Typical Capacitance (Reference)	Thermal Fuse
	U_c		Min.	Max.	V_C	I_P	I_n	I_{max}	R_{cl}	I_n	10/1000 μ s	@1 kHz	UL 60691 E214712
	(VAC)	(VDC)	(V)		(V)	(A)	(kA)			(kA)	(J)	(pF)	
TFMOV25D270x	17	22	24	31	53	30	1.5	3	4.6	1.5	30	26500	VT Series U_L :690 VAC I_L :15 A / 16 A
TFMOV25D330x	20	26	30	36	65	30	1.5	3	4.6	1.5	35	18000	
TFMOV25D390x	25	31	35	43	77	30	1.5	3	4.6	1.5	40	13500	
TFMOV25D470x	30	38	42	52	93	30	3	6	4.3	3	50	11500	
TFMOV25D560x	35	45	50	62	110	30	3	6	3.8	3	60	10500	
TFMOV25D680x	40	56	61	75	135	30	3	6	3.8	3	70	9050	
TFMOV25D820x	50	65	74	90	135	150	5	10	3.2	5	80	7700	
TFMOV25D101x	60	85	90	110	165	150	5	10	3.2	5	100	6300	
TFMOV25D121x	75	100	108	132	200	150	5	10	3.2	5	120	5200	
TFMOV25D151x	95	125	135	165	250	150	5	10	3.2	5	160	4300	
TFMOV25D181x	115	150	162	198	300	150	5	10	2.3	5	175	3500	
TFMOV25D201x	130	170	185	225	340	150	10	20	2.3	10	190	3200	
TFMOV25D221x	140	180	198	242	360	150	10	20	2.3	10	200	2900	
TFMOV25D241x	150	200	216	264	395	150	10	20	2.3	10	220	2650	
TFMOV25D271x	175	225	243	297	455	150	10	20	2.3	10	255	2400	
TFMOV25D301x	190	250	270	330	500	150	10	20	2.3	10	275	2100	
TFMOV25D331x	210	275	297	363	550	150	10	20	2.3	10	300	1900	
TFMOV25D361x	230	300	324	396	595	150	10	20	2.3	10	330	1750	
TFMOV25D391x	250	320	351	429	650	150	10	20	2.3	10	360	1600	
TFMOV25D431x	275	350	387	473	710	150	10	20	2.3	10	380	1500	
TFMOV25D471x	300	385	423	517	775	150	10	20	2.3	10	400	1400	
TFMOV25D511x	320	415	459	561	845	150	10	20	2.3	10	420	1250	
TFMOV25D561x	350	460	504	616	925	150	10	20	2.3	10	440	1150	
TFMOV25D621x	385	505	558	682	1025	150	10	20	2.3	10	450	1050	
TFMOV25D681x	420	560	612	748	1120	150	10	20	2.3	10	460	950	
TFMOV25D751x	460	615	675	825	1240	150	10	20	2.3	10	510	850	
TFMOV25D821x	510	670	738	902	1355	150	10	20	2.3	10	520	830	
TFMOV25D911x	550	745	819	1001	1500	150	10	20	2.3	10	620	730	
TFMOV25D102x	625	825	900	1100	1650	150	10	20	2.3	10	690	660	
TFMOV25D112x	680	895	990	1210	1815	150	10	20	2.3	10	760	600	
TFMOV25D122x	750	1000	1080	1320	1980	150	10	20	2.3	10	820	530	

TFMOV

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Note:

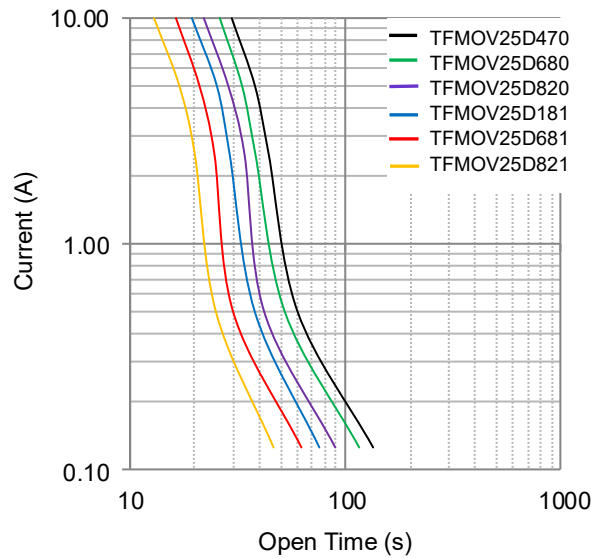
a: $R_{cl} = \frac{V_C}{V_N}$, $U_p \geq V_C$, V_C : Clamping Voltage (@ I_n), V_N : Varistor Voltage, U_p : Voltage Protection Level.

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.

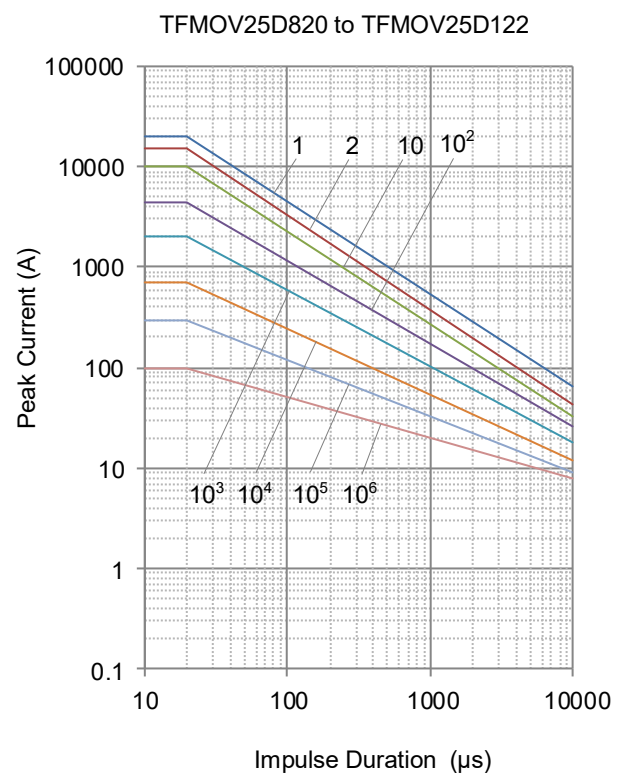
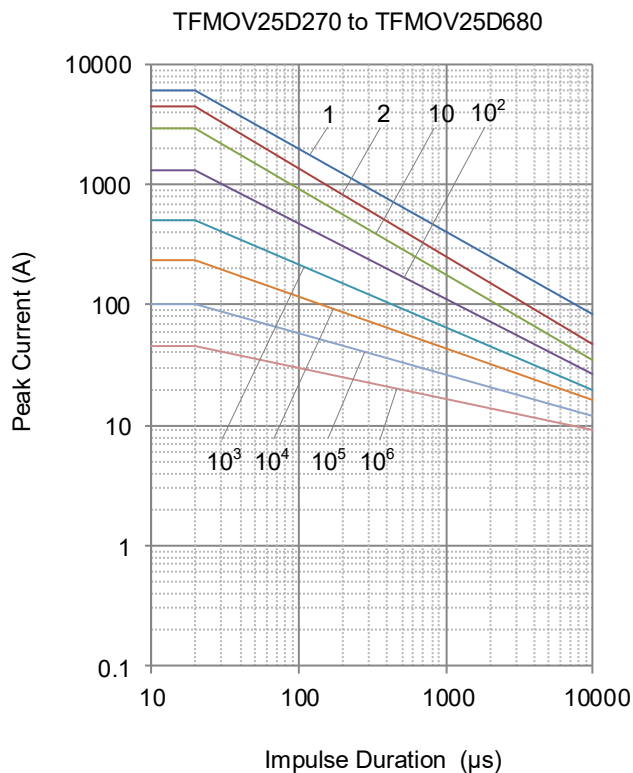
Performance Curve for Reference

Limited Current Test Curve (UL 1449 clause 44.4)



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

Max. Peak Current Derating Curve



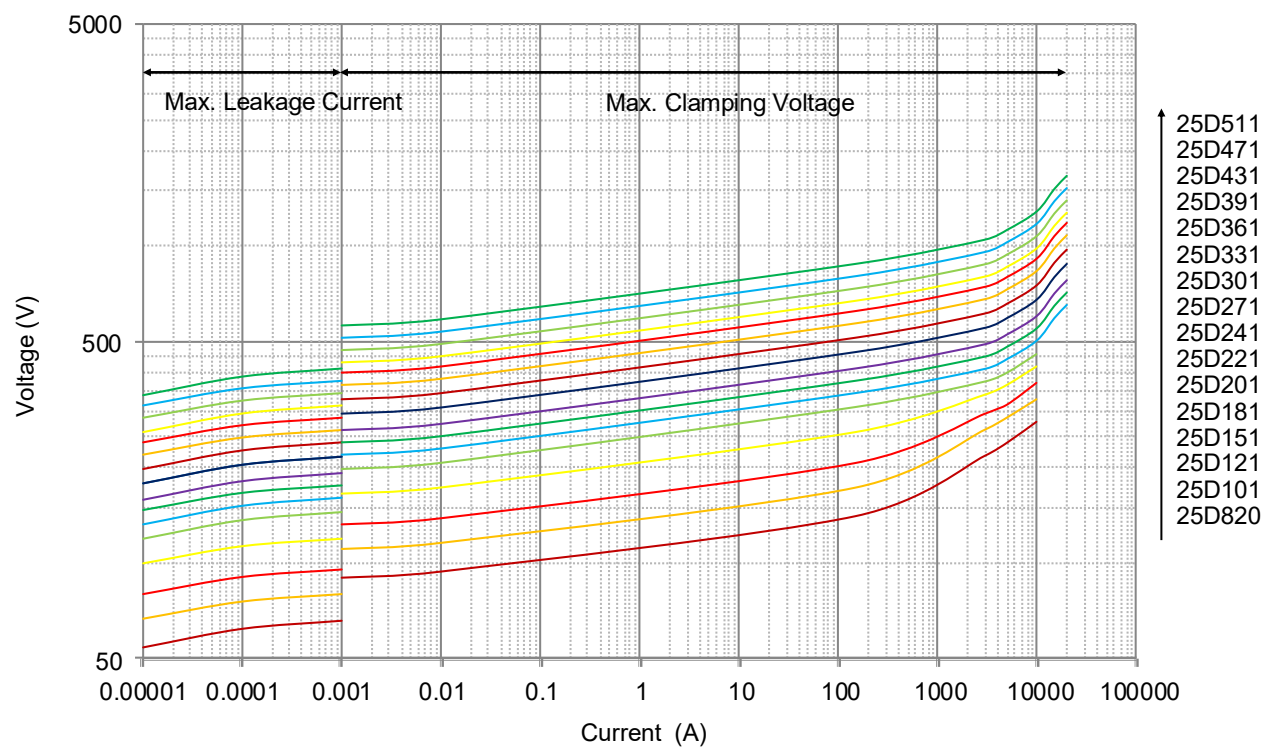
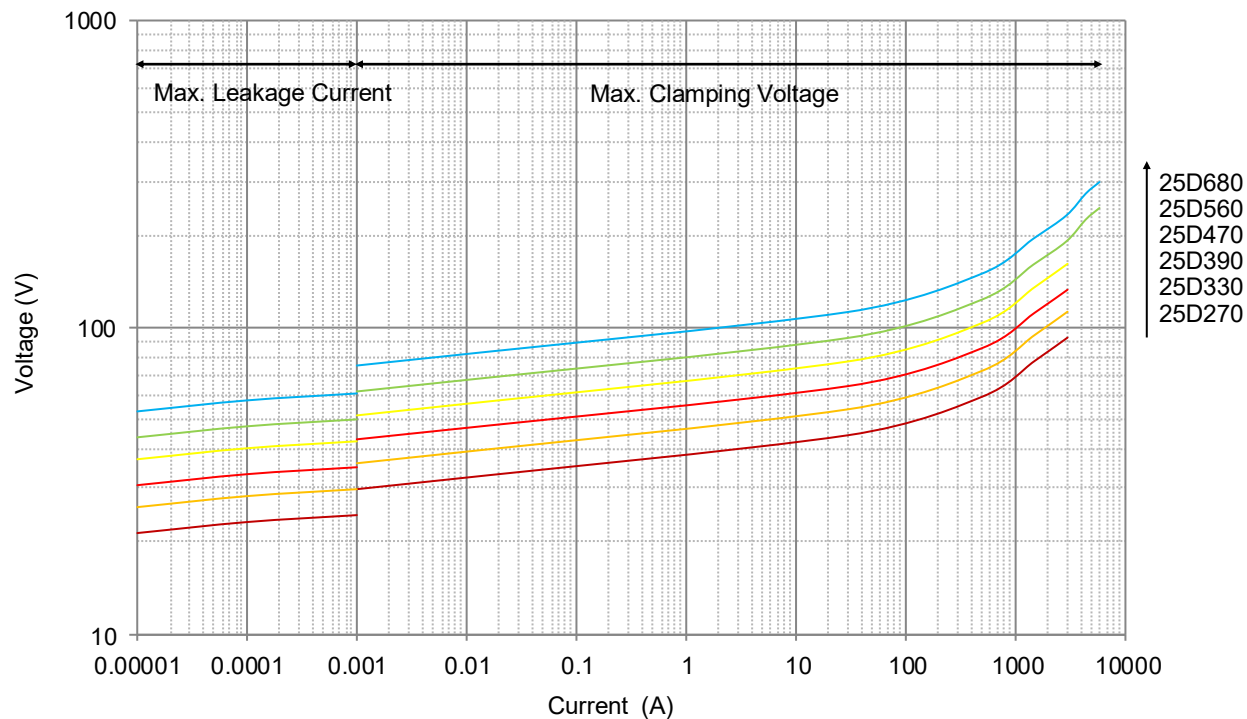
Note: 1, 2, 10, 10², 10³, 10⁴, 10⁵, 10⁶ Stand for number of repetitions.

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TFMOV25D Series

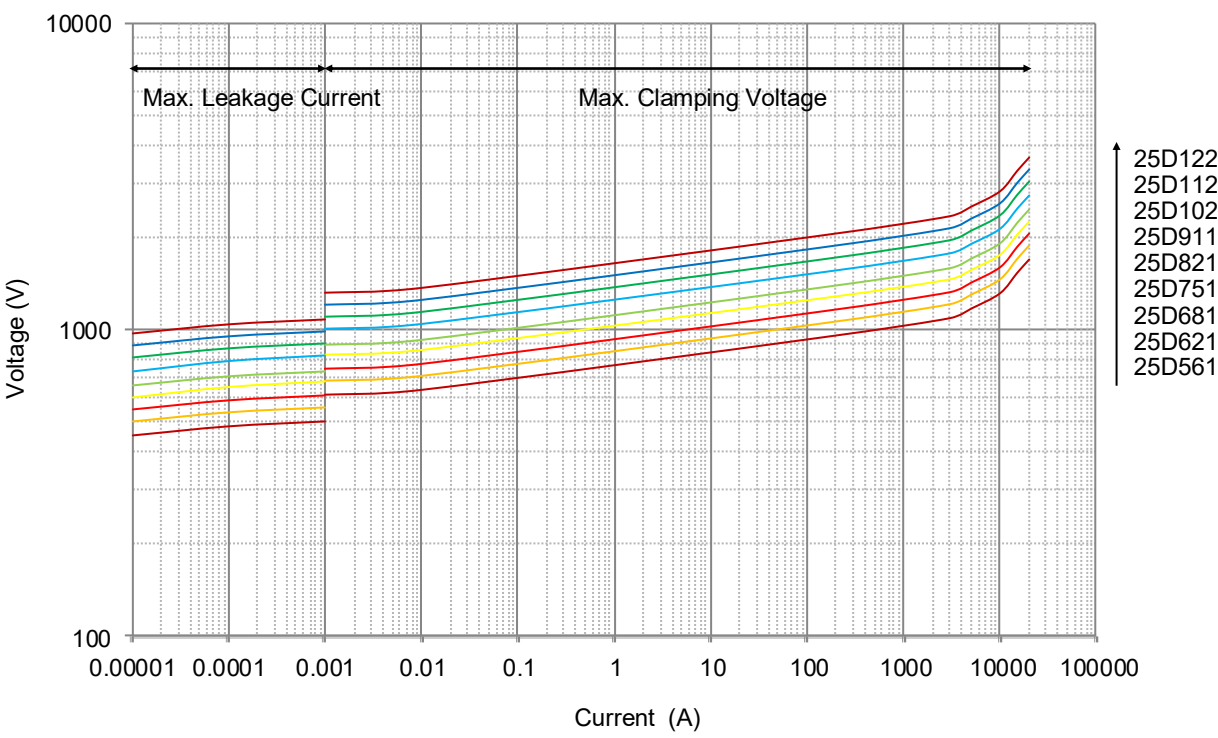
Voltage-Current Characteristic Curves



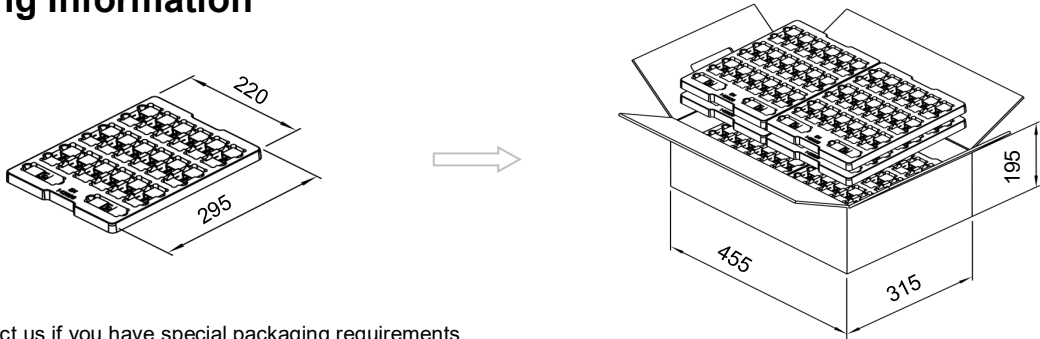
TFMOV

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series



Packaging Information



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

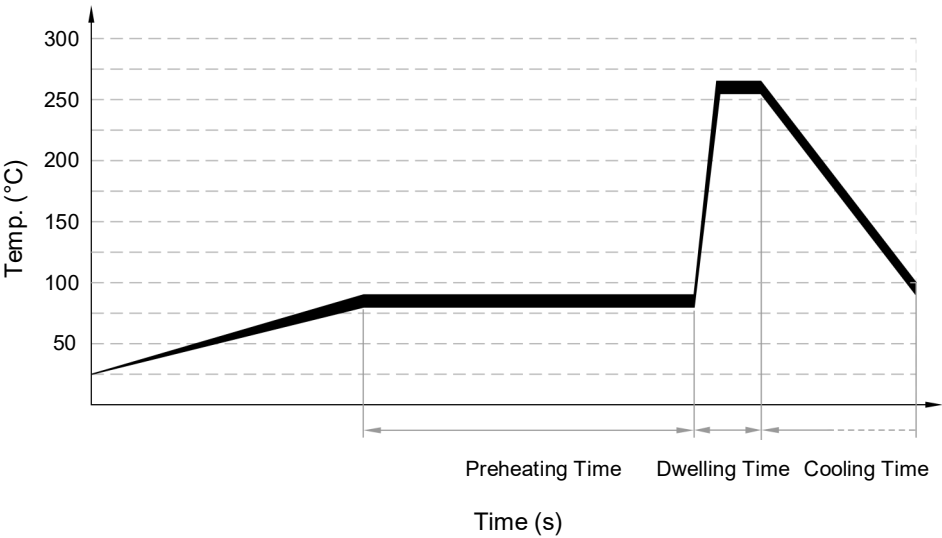
Item	Nominal Varistor Voltage	Tray	Carton
Dimensions (mm)	N/A	295 × 220	455 × 315 × 195
Quantity (PCS)	270 ~ 271	40	800
	301 ~ 821	40	640
	911 ~ 122	40	480

TFMOV

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

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

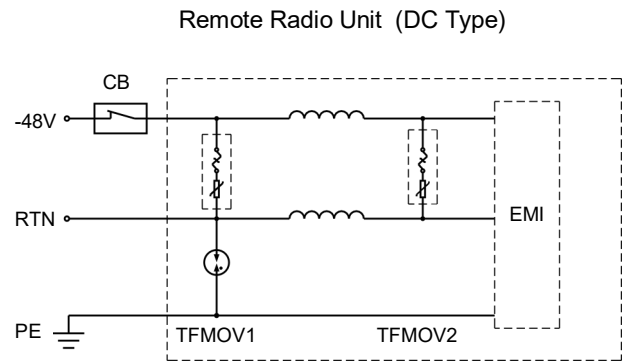
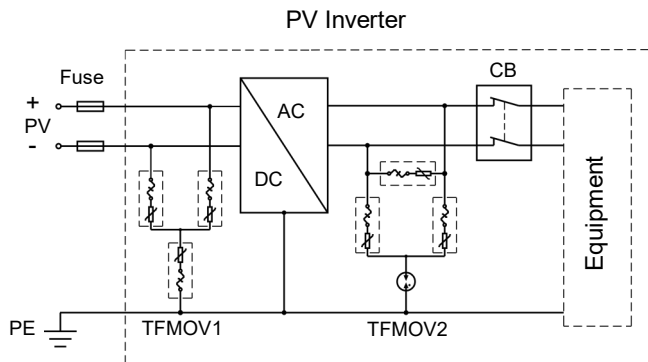
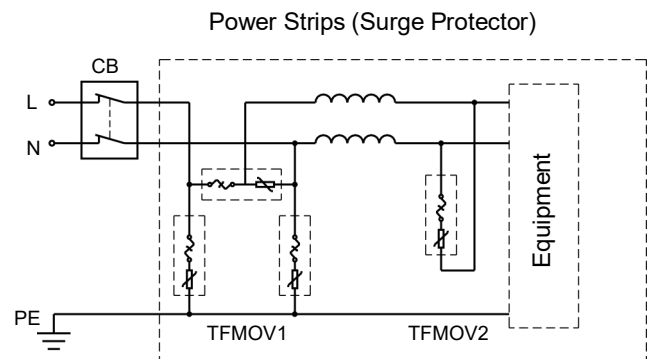
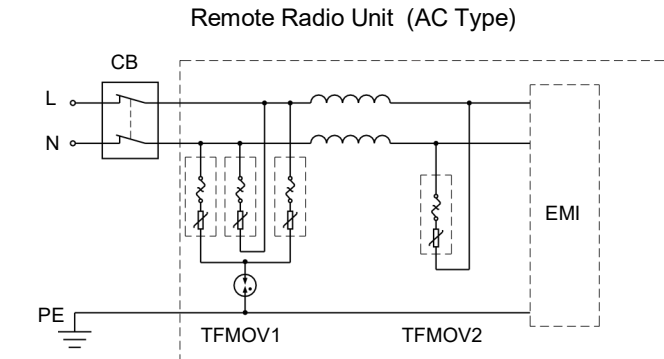
Item	Condition
Iron Temperature	350 °C (Max.)
Soldering Time	4 seconds (Max.)
Distance between Soldering Point and the Bottom of Product	2 mm (Min.)

TFMOV

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Application Options



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

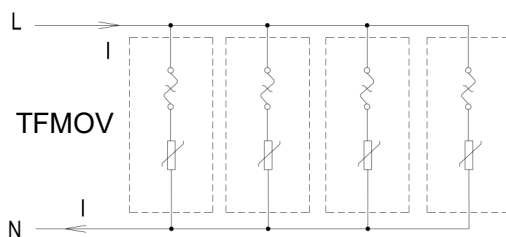


Figure .1

The Design Recommended

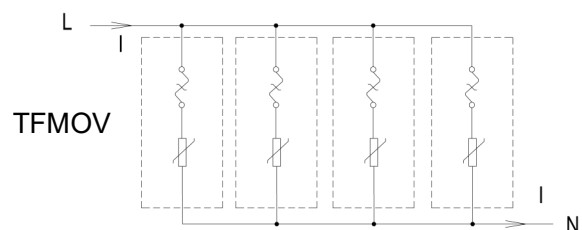
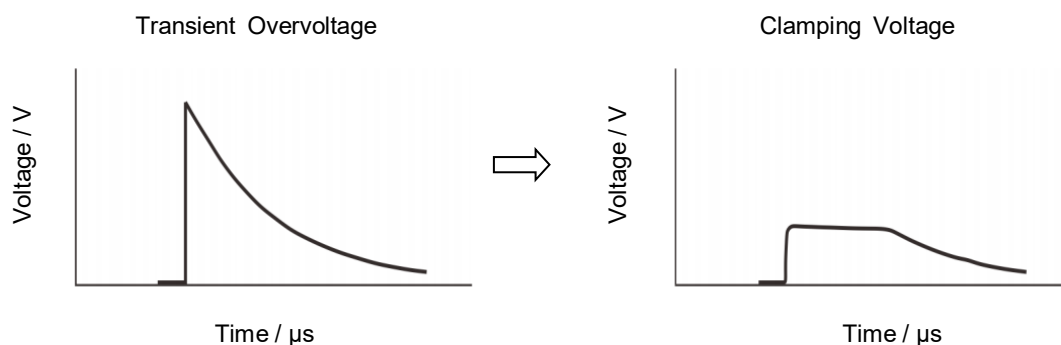


Figure .2

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.

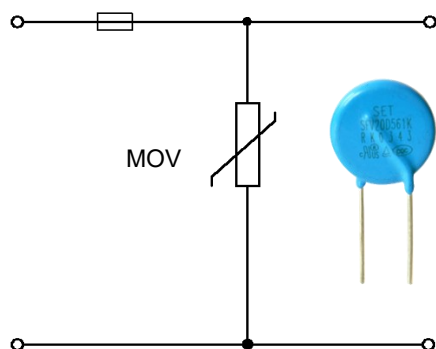


Figure a Typical surge protection circuit

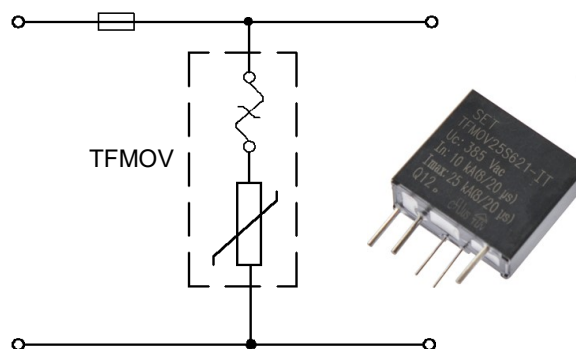


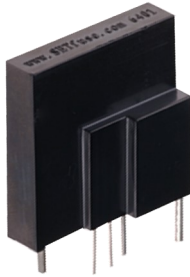
Figure b: High reliability surge protection circuit

TFMOV

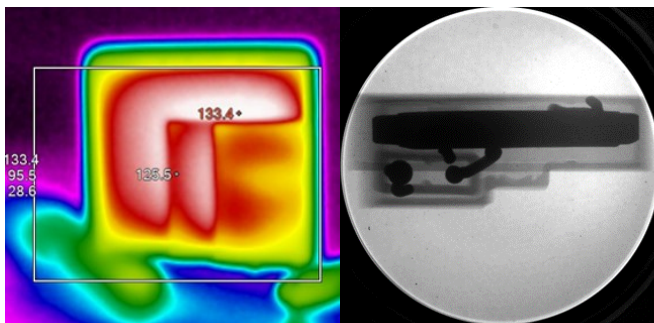
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Benefits



Safety

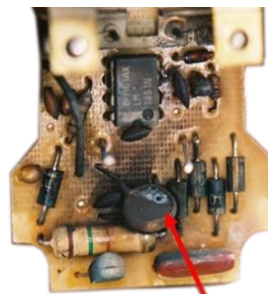


TFMOV Failure Simulation

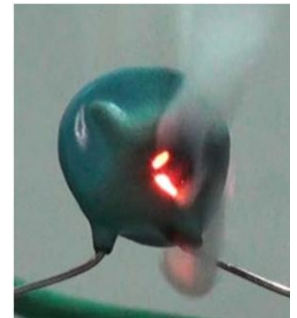
During the electrical performance degrading of varistor, the inbuilt ATCO will open the circuit when the leakage current of varistor increases to tens of micro Amperes. As shown in the figure above, this is a safe open circuit failure.



Hidden Danger



Hole in Varistor



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 μ s	8/20 Current Impulse Current impulse with a nominal virtual front time of 8 μ s and a nominal time to half-value of 20 μ s. — (IEC 61643-11)
1.2/50 μ s	1.2/50 Voltage Impulse Voltage impulse with a nominal virtual front time of 1.2 μ s and a nominal time to half-value of 50 μ s. — (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 μ s. — (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 μ s 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 μ s 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

TFMOV

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

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 pressure 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.

TFMOV

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

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

Rated Voltage U_n (V)		Nominal Discharge Current I_n (kA)										Model		Maximum Continuous Operating Voltage U_n (V)	
		AC	DC	1	1.5	2.5	3	4	5	5	5			AC	DC
690V	600V													750	1000
														680	895
480V														625	825
														550	745
347V	400V													510	670
														460	615
	254													420	560
220	277V													385	505
														350	460
230V														320	415
	300V													300	385
														275	350
														250	320
	120													230	300
	130V													210	275
														190	250
														175	225
110V														150	200
														140	180
														130	170
														115	150
48V	60V													95	125
														75	100
	36V													60	85
														50	65
24V														40	56
														35	45
														30	38
12V														25	31
														20	26
														17	22

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

[illegible]

TFMOV

Thermal Fuse & MOV (TFMOV)

TFMOV25D Series

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

Rated Voltage U_n (V)		Model		Maximum Continuous Operating Voltage U_n (V)		Nominal Discharge Current I_n (kA)		AC		DC	
690V	600V										
480V		TFMOV20K122x	TFMOV34S122x	TFMOV40K122x	TFMOV40K122x						
		TFMOV20K112x	TFMOV34S112x	TFMOV40K112x	TFMOV40K112x						
		TFMOV20K102x	TFMOV34S102x	TFMOV40K102x	TFMOV40K102x						
		TFMOV20K911x	TFMOV34S911x	TFMOV40K911x	TFMOV40K911x						
347V	400V	TFMOV20K821x	TFMOV34S821x	TFMOV40K821x	TFMOV40K821x						
		TFMOV20K751x	TFMOV34S751x	TFMOV40K751x	TFMOV40K751x						
		TFMOV20K681x	TFMOV34S681x	TFMOV40K681x	TFMOV40K681x						
	254	TFMOV20K621x	TFMOV34S621x	TFMOV40K621x	TFMOV40K621x						
220	277V	TFMOV20K561x	TFMOV34S561x	TFMOV40K561x	TFMOV40K561x						
		TFMOV20K511x	TFMOV34S511x	TFMOV40K511x	TFMOV40K511x						
	230V	TFMOV20K471x	TFMOV34S471x	TFMOV40K471x	TFMOV40K471x						
		TFMOV20K431x	TFMOV34S431x	TFMOV40K431x	TFMOV40K431x						
120		TFMOV20K391x	TFMOV34S391x	TFMOV40K391x	TFMOV40K391x						
	120	TFMOV20K361x	TFMOV34S361x	TFMOV40K361x	TFMOV40K361x						
		TFMOV20K331x	TFMOV34S331x	TFMOV40K331x	TFMOV40K331x						
	130V	TFMOV20K301x	TFMOV34S301x	TFMOV40K301x	TFMOV40K301x						
110V		TFMOV20K271x	TFMOV34S271x	TFMOV40K271x	TFMOV40K271x						
		TFMOV20K241x	TFMOV34S241x	TFMOV40K241x	TFMOV40K241x						
	110V	TFMOV20K221x	TFMOV34S221x	TFMOV40K221x	TFMOV40K221x						
		TFMOV20K201x	TFMOV34S201x	TFMOV40K201x	TFMOV40K201x						
48V	60V		TFMOV34S121Lx								
			TFMOV34S101Lx								
	36V		TFMOV34S820Lx								
	24V										
12V											
	12V										

Thermal Fuse & MOV (TFMOV)

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

Rated Voltage U_n (V)