

Thermally Protected Metal Oxide Varistor



◆ Product Introduction

The Thermal-Overload Type Metal Oxide Varistor (TMOV) integrates a built-in thermal fuse within its metal oxide core. It possesses the standard MOV's rapid discharge capabilities for surge protection and overvoltage protection. When a device experiences prolonged overvoltage or abnormal overheating, the integrated thermal fuse will automatically disconnect the circuit, effectively eliminating the risk of short circuits and potential fires associated with conventional varistors. It is available in both a two-terminal and a three-terminal version with fault signal output. It has been certified to UL1449 safety standards and achieves UL94 V-0 flammability rating. It is available in a wide range of voltage and ceramic dimensions, making it suitable for applications requiring stringent fire safety, such as charging stations, solar inverters, and power supplies, as well as surge protection modules. It provides dual protection: surge protection and overheating prevention.

◆ Features

1. TMOV integrated thermal protection surge arrestors
2. The maximum surge current rating is 6,000 Amps.
3. Designed specifically to meet the UL1449 standards for TVSS products.
4. DC 1mA reference voltage (V_{1mA}) with a wide operating range: 82V ~ 1200V
5. Rated current: 5A
6. Nominal operating temperature: 136°C
7. It exhibits a fast response to transient overvoltage and also possesses current-limiting capabilities.
8. Strong ability to absorb transient energy.
9. Low clamping ratio, no follow-up flow
10. Optional three-pin version, with status indicator functionality.
11. Compliant with J-STD-020, with a moisture sensitivity level (MSL) of Class 1.
12. Operating temperature: -40°C ~ +85°C
13. Storage temperature: -40°C ~ +85°C
14. Safety Certification: UL certified, certificate number: E327997

◆ Application

1. AC power lines, AC/DC power supply
2. Protection for semiconductor devices such as transistors, diodes, integrated circuits, thyristors, and bidirectional thyristors
3. Surge protection for consumer electronics
4. Surge protection for industrial electronic products
5. Surge protection for household appliances, gas, and oil equipment.
6. Relays and solenoid surge protectors
7. Communication distribution protection module

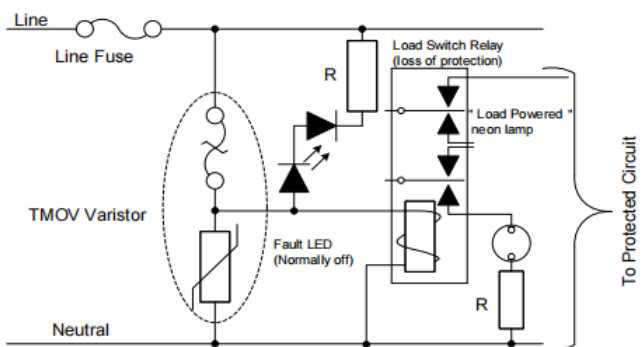
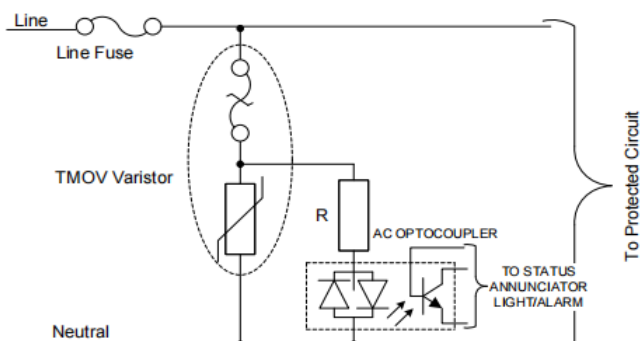
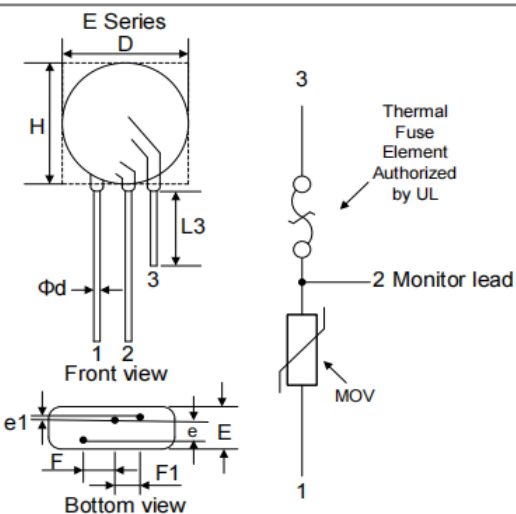
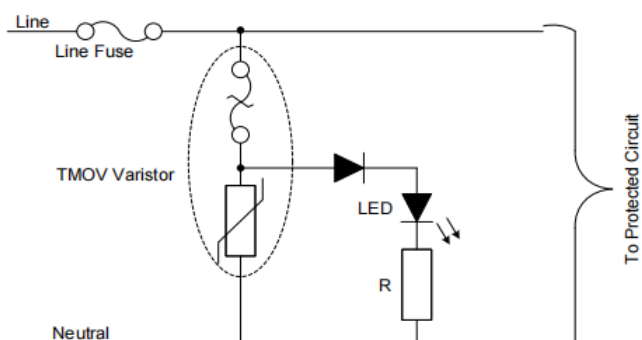
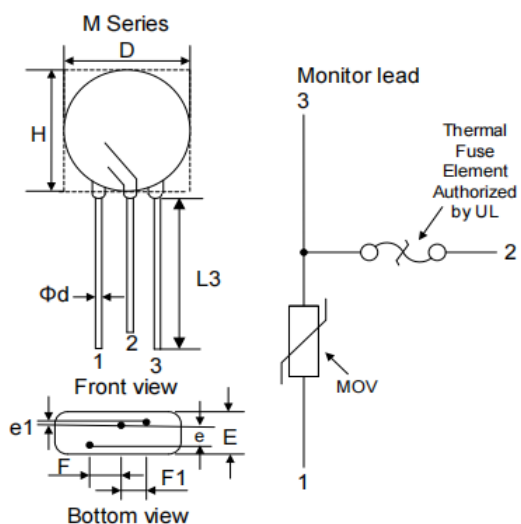
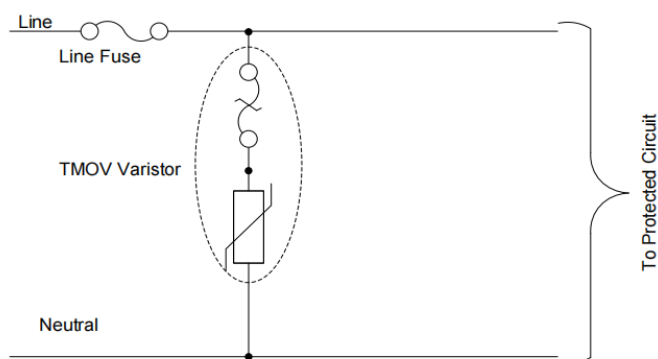
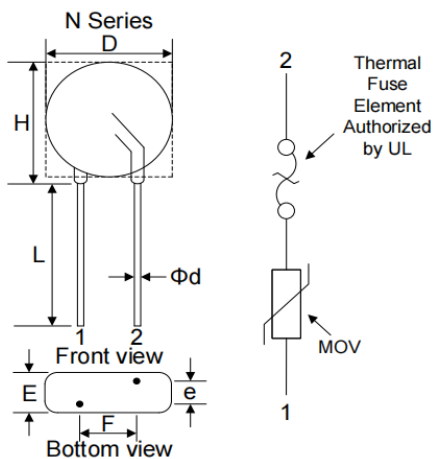
◆ Coding principles

1	2	3	4		5		6	7	10	11
Varistor voltage		Tolerance		Type		Component diameter		Pin spacing		
820	82V	K	±10%	M	Different Internal defect	14	Φ14mm	No suffix	7.5mm(N type)	
101	100V			E		20	Φ20mm	-P12.5	12.5mm(N type)	
102	1000V			N		25	Φ25mm			

YAGEO SENSOR

◆ 14mm Series

● Pin configurations and applications



◆ 14mm Series

● Pin configurations and applications

Symbols		B'S M / E / N varistor		
		Unit:mm		
		14M	14E	14N
D (max.)		19.0	19.0	19.0
H (max.)		21.1	21.0	21.0
F (±1 .0)		7.5	7.5	7.5
F1 (±1 .0)		5.0	5.0	-
e (max.)	820K~121K	2.8	2.8	2.8
	151K~391K	3.8	3.8	3.8
	431K~621K	5.5	5.5	5.5
	681K~911K	7.8	7.8	7.8
	102K~122K	10.0	10.0	10.0
e1	820K~121K	1.3±0.8	1.3±0.8	-
	151K~391K			
	431K~621K			
	681K~911K			
	102K~122K			
E (max.)	820K~121K	8.8	8.8	8.8
	151K~391K	9.8	9.8	9.8
	431K~621K	11.5	11.5	11.5
	681K~911K	13.8	13.8	13.8
	102K~122K	16.0	16.0	16.0
L (min.)		20.0	20.0	20.0
L3 (min.)		10.0	10.0	-
Φd (±0 .05)		0.8		

◆ 14mm Series

● Electrical Characteristics

Part number	Maximum allowed voltage		Varistor Voltage	Maximum holding voltage		Maximum peak current (8/20 μ s)		Maximum energy (Joule)		Rated power	Typical capacitors (Reference value)
	VAC (V)	VDC (V)	V1mA (V)	IP (A)	VC (V)	1 time	2 times	10/100 μ s	2ms	(W)	@1KHz (pf)
							(A)				
820KM(E,N)14	50	65	82(74~90)	50	135	4500	2500	27	22	0.6	2400
101KM(E,N)14	60	85	100(90~110)	50	165	4500	2500	33	28	0.6	2000
121KM(E,N)14	75	100	120(108~132)	50	200	4500	2500	40	32	0.6	1700
151KM(E,N)14	95	125	150(135~165)	50	250	6000	4500	50	35	0.6	1300
181KM(E,N)14	115	150	180(162~198)	50	300	6000	4500	55	40	0.6	1100
201KM(E,N)14	130	170	200(180~220)	50	340	6000	4500	60	50	0.6	1000
221KM(E,N)14	140	180	220(198~242)	50	360	6000	4500	70	55	0.6	900
241KM(E,N)14	150	200	240(216~264)	50	395	6000	4500	75	60	0.6	830
271KM(E,N)14	175	225	270(243~297)	50	455	6000	4500	80	70	0.6	740
301KM(E,N)14	190	250	300(270~330)	50	500	6000	4500	90	75	0.6	670
331KM(E,N)14	210	275	330(297~363)	50	550	6000	4500	100	80	0.6	610
361KM(E,N)14	230	300	360(324~396)	50	595	6000	4500	110	90	0.6	560
391KM(E,N)14	250	320	390(351~429)	50	650	6000	4500	125	100	0.6	510
431KM(E,N)14	275	350	430(387~473)	50	710	6000	4500	136	110	0.6	460
471KM(E,N)14	300	385	470(423~517)	50	775	6000	4500	140	125	0.6	430
511KM(E,N)14	320	415	510(459~561)	50	845	6000	4500	155	136	0.6	390
561KM(E,N)14	350	460	560(504~616)	50	925	6000	4500	175	140	0.6	360
621KM(E,N)14	385	505	620(558~682)	50	1025	6000	4500	190	150	0.6	320
681KM(E,N)14	420	560	680(612~748)	50	1120	6000	4500	200	155	0.6	290
751KM(E,N)14	460	615	750(675~825)	50	1240	6000	4500	225	160	0.6	270

◆ 14mm Series

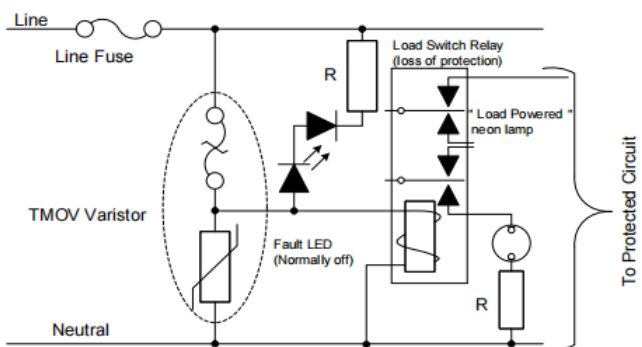
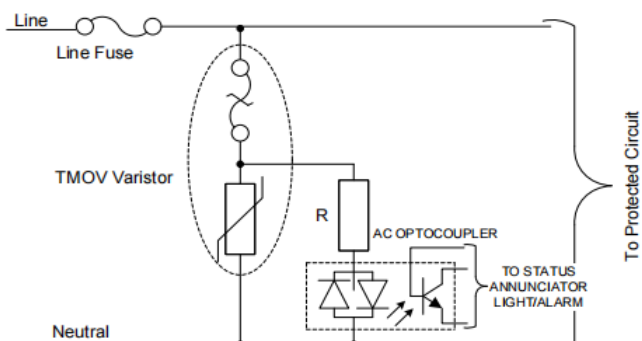
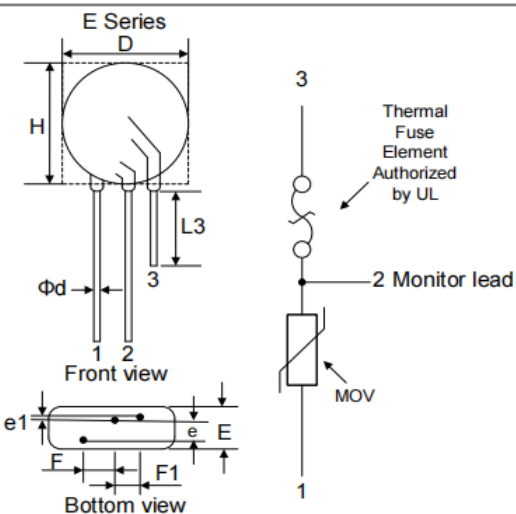
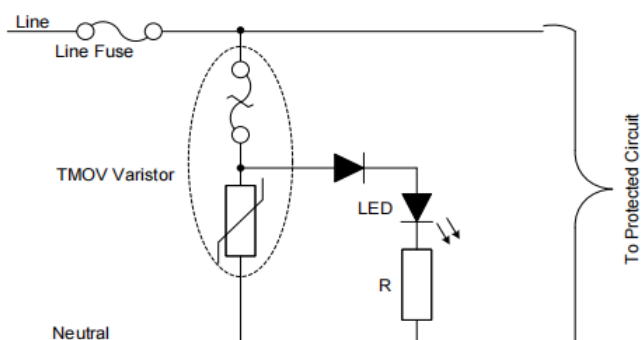
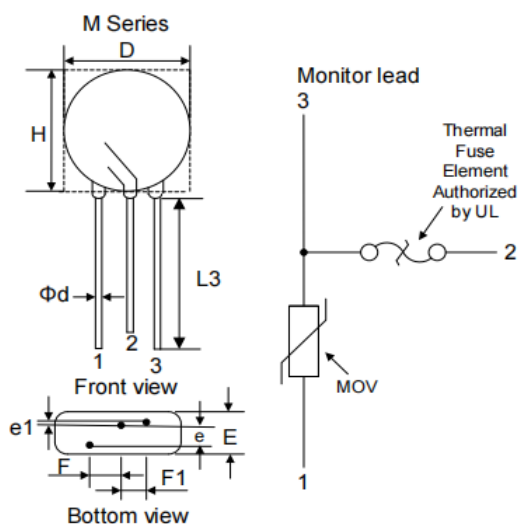
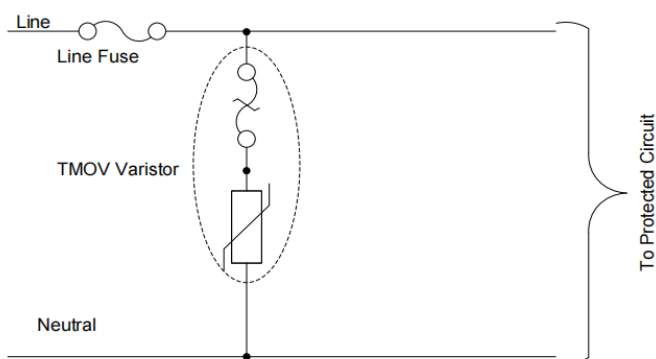
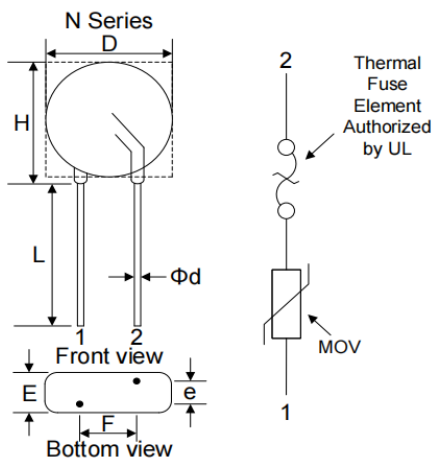
● Electrical Characteristics

Part number	Maximum allowed voltage		Varistor Voltage	Maximum holding voltage		Maximum peak current (8/20μs)		Maximum energy (Joule)		Rated power	Typical capacitors (Reference value)
	VAC (V)	VDC (V)	V1mA (V)	IP (A)	VC (V)	1 time	2 times	10/100 0μs	2ms	(W)	@1KHz (pf)
						(A)					
781KM(E,N)14	485	640	780(702~858)	50	1290	6000	4500	240	165	0.6	260
821KM(E,N)14	510	670	820(738~902)	50	1355	6000	4500	245	170	0.6	240
911KM(E,N)14	550	745	910(819~1001)	50	1500	6000	4500	255	180	0.6	220
102KM(E,N)14	625	825	1000(900~1100)	50	1650	6000	4500	280	190	0.6	200
112KM(E,N)14	680	895	100(990~1210)	50	1815	6000	4500	310	205	0.6	180
122KM(E,N)14	750	990	1200(1080~1320)	50	1980	6000	4500	338	215	0.6	150

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◆ 20mm series

● Pin configurations and applications



◆ 20mm series

● Pin configurations and applications

Symbols		B'S M / E / N varistor		
		Units:mm		
		20M	20E	20N
D (max.)		24.0	24.0	24.0
H (max.)		26.0	26.0	26.0
F (± 1.0)		7.5	7.5	12.5 7.5
F1 (± 1.0)		5.0	5.0	-
e (max.)	180K~121K	3.0	3.0	3.0
	151K~391K	3.8	3.8	3.8
	431K~621K	5.5	5.5	5.5
	681K~911K	7.8	7.8	7.8
	102K~122K	10.0	10.0	10.0
e1	180K~121K	1.5 $\pm$ 1.0	1.5 $\pm$ 1.0	-
	151K~391K			
	431K~621K			
	681K~911K			
	102K~122K			
E (max.)	180K~121K	9.0	9.0	9.0
	151K~391K	9.8	9.8	9.8
	431K~621K	11.5	11.5	11.5
	681K~911K	13.8	13.8	13.8
	102K~122K	16.0	16.0	16.0
L (min.)		20.0	20.0	20.0
L3 (min.)		10.0	10.0	-
Φd (± 0.05)		1.0		

Note: The standard pin spacing for the 20N series is 7.5 millimeters.

◆ 20mm series

● Electrical Characteristics

Part number	Maximum allowed voltage		Varistor Voltage	Maximum holding voltage		Maximum peak current (8/20μs)		Maximum energy (Joule)		Rated power	Typical capacitors (Reference value)
	VAC (V)	VDC (V)		IP (A)	VC (V)	1 time	2 times	10/100 0μs	2ms		
						(A)					
180KM(E,N)20	11	14	18(15~21.6)	20	36	3000	2000	13	10	0.2	28500
220KM(E,N)20	14	18	22(19.5~26)	20	43	3000	2000	16	12	0.2	18500
270KM(E,N)20	17	22	27(24~31)	20	53	3000	2000	19	14	0.2	13000
330KM(E,N)20	20	26	33(29.5~36.5)	20	65	3000	2000	24	18	0.2	11500
390KM(E,N)20	25	31	39(35~43)	20	77	3000	2000	28	21	0.2	8500
470KM(E,N)20	30	38	47(42~52)	20	93	5000	3000	34	25	0.2	7400
560KM(E,N)20	35	45	56(50~62)	20	110	5000	3000	41	30	0.2	6500
680KM(E,N)20	40	56	68(61~75)	20	135	5000	3000	49	37	0.2	5800
820KM(E,N)20	50	65	82(74~90)	100	135	6500	4500	56	42	1.0	4900
101KM(E,N)20	60	85	100(90~110)	100	165	6500	4500	70	52	1.0	4000
121KM(E,N)20	75	100	120(108~132)	100	200	6500	4500	85	63	1.0	3300
151KM(E,N)20	95	125	150(135~165)	100	250	10000	8000	100	70	1.0	2700
181KM(E,N)20	115	150	180(162~198)	100	300	10000	8000	110	80	1.0	2200
201KM(E,N)20	130	170	200(185~225)	100	340	10000	8000	140	100	1.0	2000
221KM(E,N)20	140	180	220(198~242)	100	365	10000	8000	155	110	1.0	1800
241KM(E,N)20	150	200	240(216~264)	100	395	10000	8000	170	120	1.0	1650
271KM(E,N)20	175	225	270(243~297)	100	455	10000	8000	190	135	1.0	1500
301KM(E,N)20	190	250	300(270~330)	100	500	10000	8000	205	145	1.0	1300
331KM(E,N)20	210	275	330(297~363)	100	550	10000	8000	215	150	1.0	1200
361KM(E,N)20	230	300	360(324~396)	100	595	10000	8000	225	160	1.0	1100

Note: Leakage current (@83% of 1mA reference voltage): Leakage current ≤ 50 microamps (180K-680K); Leakage current ≤ 35 microamps (820K-122K)

◆ 20mm series

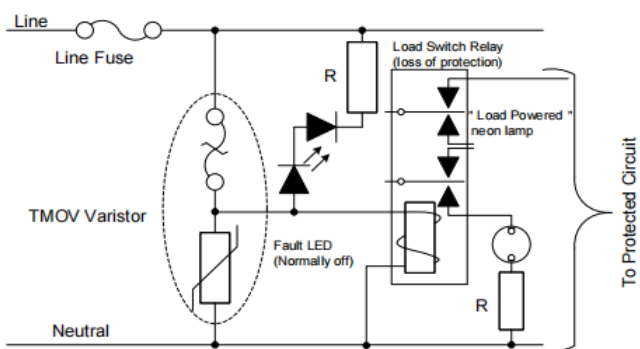
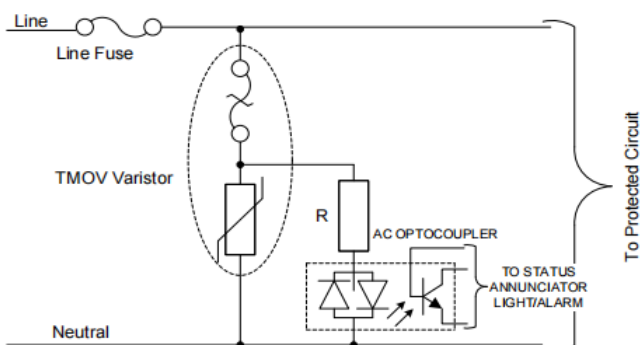
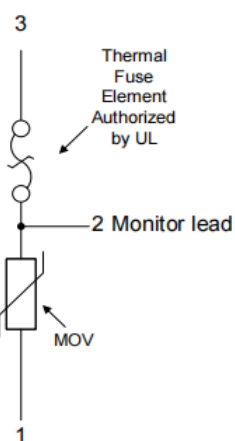
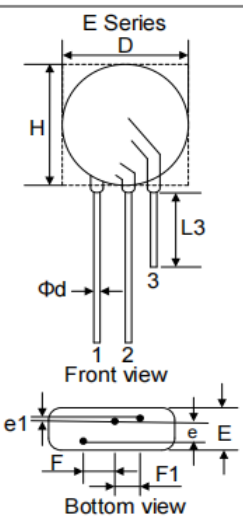
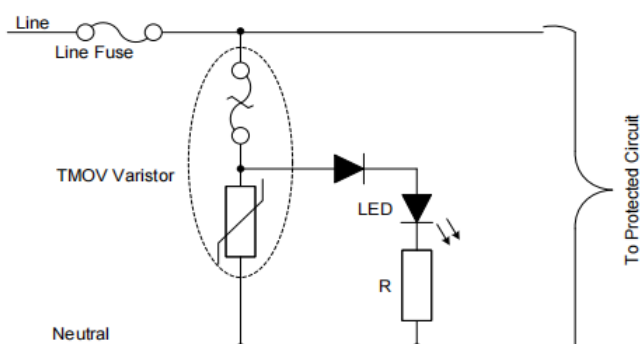
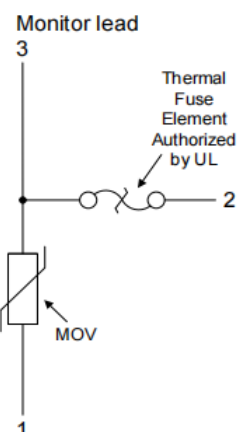
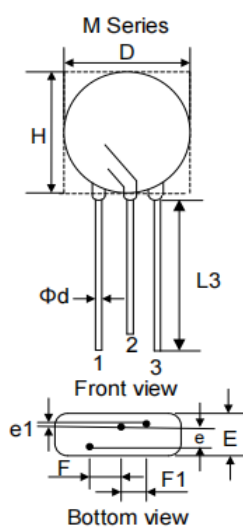
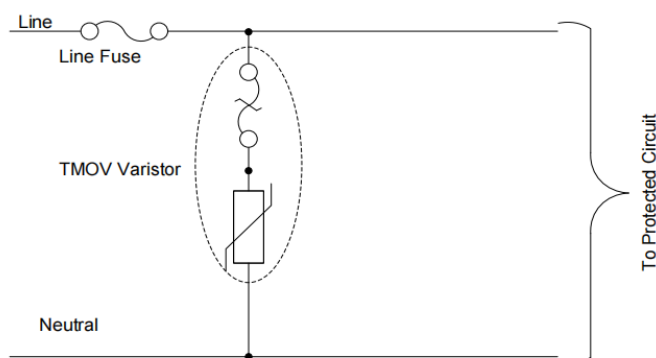
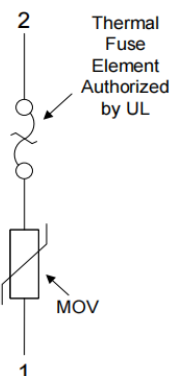
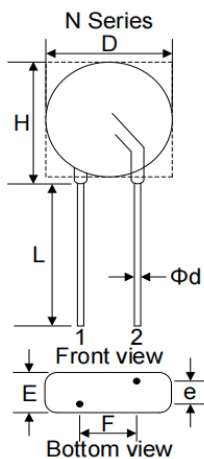
● Electrical Characteristics

Part number	Maximum allowed voltage		Varistor Voltage V1mA (V)	Maximum holding voltage		Maximum peak current (8/20μs)		Maximum energy (Joule)		Rated power (W)	Typical capacitors (Reference value) @1KHz (pf)
	VAC (V)	VDC (V)		IP (A)	VC (V)	1 time	2 times	10/100 0μs	2ms		
						(A)					
391KM(E,N)20	250	320	390(351~429)	100	650	10000	8000	240	170	1.0	1000
431KM(E,N)20	275	350	430(387~473)	100	710	10000	8000	270	190	1.0	930
471KM(E,N)20	300	385	470(423~517)	100	775	10000	8000	350	250	1.0	850
511KM(E,N)20	320	415	510(459~561)	100	845	10000	8000	380	270	1.0	780
561KM(E,N)20	350	460	560(504~616)	100	920	10000	8000	400	280	1.0	710
621KM(E,N)20	385	505	620(558~682)	100	1025	10000	8000	425	300	1.0	650
681KM(E,N)20	420	560	680(612~748)	100	1120	10000	8000	435	310	1.0	600
751KM(E,N)20	460	615	750(675~825)	100	1240	10000	8000	455	327	1.0	530
781KM(E,N)20	485	640	780(702~858)	100	1290	10000	8000	461	335	1.0	510
821KM(E,N)20	510	670	820(738~902)	100	1355	10000	8000	475	344	1.0	500
911KM(E,N)20	550	745	910(819~1001)	100	1500	10000	8000	500	350	1.0	440
102KM(E,N)20	625	825	1000(900~1100)	100	1650	10000	8000	560	400	1.0	400
112KM(E,N)20	680	895	1100(990~1210)	100	1815	10000	8000	610	430	1.0	360
122KM(E,N)20	750	990	1200(1080~1320)	100	1980	10000	8000	650	460	1.0	320

Note: Leakage current (@83% of 1mA reference voltage): Leakage current ≤ 50 microamps (180K-680K); Leakage current ≤ 35 microamps (820K-122K)

◆ 25mm series

● Pin configurations and applications



◆ 20mm series

● Pin configurations and applications

Symbols		B'S M / E / N varistor		
		Units:mm		
		25M	25E	25N
D (max.)		29.0	29.0	29.0
H (max.)		32.0	32.0	32.0
F (± 1.0)		7.5	7.5	12.5 7.5
F1 (± 1.0)		5.0	5.0	-
e Max.	151K~391K	3.8	3.8	3.8
	431K~621K	5.5	5.5	5.5
	681K~911K	7.8	7.8	7.8
	102K~122K	10.0	10.0	10.0
e1	151K~391K	2.3 $\pm$ 1.0	2.3 $\pm$ 1.0	-
	431K~621K			
	681K~911K			
	102K~122K			
E Max.	151K~391K	11.8	11.8	11.8
	431K~621K	13.5	13.5	13.5
	681K~911K	15.8	15.8	15.8
	102K~122K	18.0	18.0	18.0
L (min.)		20.0	20.0	20.0
L3 (min.)		10.0	10.0	-
Φd (± 0.05)		1.0		

Note: The default pin spacing for the 20N series is 7.5mm.

◆ 25mm series

● Electrical Characteristics

Part number	Maximum allowed voltage		Varistor Voltage V1mA (V)	Maximum holding voltage		Maximum peak current (8/20μs)		Maximum energy (Joule)		Rated power (W)	Typical capacitors (Reference value) @1KHz (pf)
	VAC (V)	VDC (V)		IP (A)	VC (V)	1 time	2 times	10/100 0μs	2ms		
						(A)					
151KM(E,N)25	95	125	150(135~165)	150	250	15000	12000	160	105	1.20	4300
181KM(E,N)25	115	150	180(162~198)	150	300	15000	12000	175	120	1.20	3500
201KM(E,N)25	130	170	200(185~225)	150	340	15000	12000	210	150	1.20	3200
221KM(E,N)25	140	180	220(198~242)	150	365	15000	12000	230	165	1.20	2900
241KM(E,N)25	150	200	240(216~264)	150	395	15000	12000	255	180	1.20	2650
271KM(E,N)25	175	225	270(243~297)	150	455	15000	12000	285	205	1.20	2400
301KM(E,N)25	190	250	300(270~330)	150	500	15000	12000	310	220	1.20	2100
331KM(E,N)25	210	275	330(297~363)	150	550	15000	12000	325	231	1.20	1900
361KM(E,N)25	230	300	360(324~396)	150	595	15000	12000	340	240	1.20	1750
391KM(E,N)25	250	320	390(351~429)	150	650	15000	12000	360	250	1.20	1600
431KM(E,N)25	275	350	430(387~473)	150	710	15000	12000	440	310	1.20	1500
471KM(E,N)25	300	385	470(423~517)	150	775	15000	12000	490	345	1.20	1400
511KM(E,N)25	320	415	510(459~561)	150	845	15000	12000	530	370	1.20	1250
561KM(E,N)25	350	460	560(504~616)	150	920	15000	12000	560	390	1.20	1150
621KM(E,N)25	385	505	620(558~682)	150	1025	15000	12000	590	410	1.20	1050
681KM(E,N)25	420	560	680(612~748)	150	1150	15000	12000	620	430	1.20	950
751KM(E,N)25	460	615	750(675~825)	150	1240	15000	12000	630	440	1.20	850
781KM(E,N)25	485	640	780(702~858)	150	1290	15000	12000	675	470	1.20	800
821KM(E,N)25	510	670	820(738~902)	150	1355	15000	12000	690	480	1.20	750
911KM(E,N)25	550	745	910(819~1001)	150	1500	15000	12000	715	500	1.20	700

Note: Leakage current (@83% V1mA): $IR \leq 35\mu A$ (151k ~ 122k)

◆ 25mm series

● Electrical Characteristics

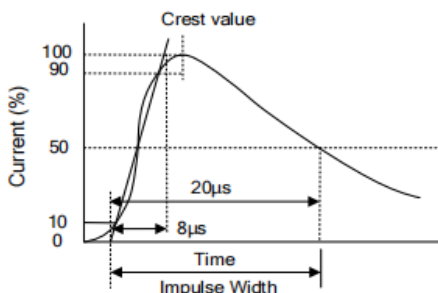
Part number	Maximum allowed voltage		Varistor Voltage	Maximum holding voltage		Maximum peak current (8/20μs)		Maximum energy (Joule)		Rated power	Typical capacitors (Reference value)	
	VAC (V)	VDC (V)		V1mA (V)	IP (A)	VC (V)	1 time	2 times	10/100 0μs			2ms
							(A)					
102KM(E,N)25	625	825	1000(900~1100)	150	1650	15000	12000	750	505	1.20	650	
112KM(E,N)25	680	895	1100(990~1210)	150	1815	15000	12000	780	550	1.20	600	
1221M(E,N)25	750	990	1200(1080~1320)	150	1980	15000	12000	840	590	1.20	550	

Note: Leakage current (@83% V1mA): $IR \leq 35\mu A$ (151k ~ 122k)

YAGEO SENSOR

◆ KM Series

● Electrical specifications

Experimental project	Experimental conditions/methods	Performance Requirements
Tensile strength	The voltage measured between the two terminals when a specified test DC current of 1mA is applied, is recorded as V_b .	Meet the specified requirements.
Bend resistance of the pin	The recommended maximum alternating current voltage (RMS) or maximum direct current voltage for sustainable application.	
Maximum clamp voltage	The maximum voltage between the two pins under specified surge current conditions. Pulse width: 8/20 microseconds. 	
Rated power consumption	The maximum average power that the device can withstand within the specified operating temperature range.	
Maximum allowable energy	After applying a 10/1000us or 2ms pulse, the change in voltage should not exceed +10% Maximum allowable energy	
Capable of withstanding surge currents	After applying a standard 8/20μs pulse current, the change in voltage should not exceed ±10% of the maximum current.	≤0.05%/°C
Maximum power consumption	$\left \frac{V_{1mA@85^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{60} \times 100\% (\%/^{\circ}C) \right $ $\left \frac{V_{1mA@-40^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{65} \times 100\% (\%/^{\circ}C) \right $	

◆ KM Series

● Mechanical Properties

Experimental project	Experimental conditions/methods	Performance Requirements								
Curvature-derived strength	The specified load was applied gradually, and the device was kept stationary for a continuous period of 10±1seconds. <table><tr><th>Terminal diameter (mm)</th><th>Force (kg)</th></tr><tr><td>0.5<d≤0.8</td><td>1.0</td></tr><tr><td>0.8<d≤1.25</td><td>2.0</td></tr><tr><td>1.25<d</td><td>4.0</td></tr></table>	Terminal diameter (mm)	Force (kg)	0.5<d≤0.8	1.0	0.8<d≤1.25	2.0	1.25<d	4.0	No visible damage ΔV1mA/V1mA ≤5%
Terminal diameter (mm)	Force (kg)									
0.5<d≤0.8	1.0									
0.8<d≤1.25	2.0									
1.25<d	4.0									
Durability of bent pins	Secure the sample, applying the specified load to each pin; bend the pin.Return to the initial position after a 90° turn, then repeat the same turn in the opposite direction <table><tr><th>Terminal diameter (mm)</th><th>Force (kg)</th></tr><tr><td>0.5<d≤0.8</td><td>0.5</td></tr><tr><td>0.8<d≤1.25</td><td>1.0</td></tr><tr><td>1.25<d</td><td>2.0</td></tr></table>	Terminal diameter (mm)	Force (kg)	0.5<d≤0.8	0.5	0.8<d≤1.25	1.0	1.25<d	2.0	No visible damage ΔV1mA/V1mA ≤5%
Terminal diameter (mm)	Force (kg)									
0.5<d≤0.8	0.5									
0.8<d≤1.25	1.0									
1.25<d	2.0									
Vibration resistance	Frequency range: 10~55 Hz Amplitude: 0.75 mm or acceleration of 98 m/s² Vibration direction: Three mutually perpendicular axes, each operating for 2 hours.	No visible damage ΔV1mA/V1mA ≤5%								
Solderability	Tin melting temperature: 245±5℃ Tinning time: 2±0.5 seconds	Tin coverage≥95%								
High-temperature resistance for welding	Tin melting temperature: 260±5℃ Tinning time: No more than 10 seconds	No visible damage ΔV1mA/V1mA ≤10%								

◆ KM Series

● Reliability

Experimental project	Experimental conditions/methods	Performance Requirements															
High-temperature storage test	Ambient temperature: $85\pm 2^{\circ}\text{C}$ Duration: 1000 hours	$ \Delta V_{1\text{mA}}/V_{1\text{mA}} \leq 5\%$															
Low-temperature storage test	Ambient temperature: $-40\pm 2^{\circ}\text{C}$ Duration: 1000 hours	$ \Delta V_{1\text{mA}}/V_{1\text{mA}} \leq 5\%$															
Moisture resistance testing	Ambient temperature: $40\pm 2^{\circ}\text{C}$, relative humidity 90 ~ 95% RH Duration: 1000 hours	$ \Delta V_{1\text{mA}}/V_{1\text{mA}} \leq 5\%$															
Temperature cycling test	The temperature variation is tested under the following conditions on the PCB: five cycles. <table border="1"> <thead> <tr> <th>Steps</th><th>Temperature ($^{\circ}\text{C}$)</th><th>Cycle (minutes)</th></tr> </thead> <tbody> <tr> <td>1</td><td>-40 ± 3</td><td>30 ± 3</td></tr> <tr> <td>2</td><td>Room temperature</td><td>15 ± 3</td></tr> <tr> <td>3</td><td>85 ± 3</td><td>30 ± 3</td></tr> <tr> <td>4</td><td>Room temperature</td><td>15 ± 3</td></tr> </tbody> </table>	Steps	Temperature ($^{\circ}\text{C}$)	Cycle (minutes)	1	-40 ± 3	30 ± 3	2	Room temperature	15 ± 3	3	85 ± 3	30 ± 3	4	Room temperature	15 ± 3	No visible damage $\Delta V_{1\text{mA}}/V_{1\text{mA}} \leq 5\%$
Steps	Temperature ($^{\circ}\text{C}$)	Cycle (minutes)															
1	-40 ± 3	30 ± 3															
2	Room temperature	15 ± 3															
3	85 ± 3	30 ± 3															
4	Room temperature	15 ± 3															
High-temperature load test	Ambient temperature: $85\pm 2^{\circ}\text{C}$ Duration: 1000 hours Load condition: Maximum allowable continuous operating voltage under AC conditions.	$ \Delta V_{1\text{mA}}/V_{1\text{mA}} \leq 10\%$															
Wet heat load test	Ambient temperature: $40\pm 2^{\circ}\text{C}$, relative humidity 90 ~ 95% RH Duration: 1000 hours Load: Maximum allowable continuous operating voltage	No visible damage $\Delta V_{1\text{mA}}/V_{1\text{mA}} \leq 10\%$															
Pressure test	metal sphere electrode method, 2500 volts AC, with a continuous voltage of 1 Minute	No visible damage															