



MOV Varistor Device: FMOV20-H Series (Preliminary)

1. Device Ratings and Characteristics

Part Number	Maximum Continuous Voltage		Varistor Voltage (@1mA)			Maximum Clamping Voltage @Test Current (@8/20μs)		Maximum Energy (@10/1000μs)	Maximum Peak Current (@8/20μs)	Rated Power	Typical Capacitance (@1KHz)
	ACrms(V)	DC(V)	Vn(Vdc)	Min.	Max.	Vc(V)	Ip(A)	(J)	(A)	(W)	(pF)
FMOV20180-H	11	14	18	16	20	36	20	28	6000	0.3	42000
FMOV20220-H	14	18	22	20	24	43	20	36	6000	0.3	37000
FMOV20270-H	17	22	27	24	30	53	20	46	6000	0.3	29200
FMOV20330-H	20	26	33	30	36	65	20	59	6000	0.3	21400
FMOV20390-H	25	31	39	35	43	77	20	67	6000	0.3	19800
FMOV20470-H	30	38	47	42	52	93	20	85	6000	0.3	17300
FMOV20560-H	35	45	56	50	62	110	20	106	6000	0.3	14400
FMOV20680-H	40	56	68	61	75	135	20	119	6000	0.3	12600
FMOV20201-H	130	170	200	180	220	340	200	200	20000	1.0	2125
FMOV20221-H	140	180	220	198	242	360	200	215	20000	1.0	2000
FMOV20241-H	150	200	240	216	264	395	200	235	20000	1.0	1875
FMOV20271-H	175	225	270	243	297	455	200	275	20000	1.0	1625
FMOV20301-H	195	250	300	270	330	500	200	295	20000	1.0	1500
FMOV20331-H	215	275	330	297	363	550	200	320	20000	1.0	1375
FMOV20361-H	230	300	360	324	396	595	200	350	20000	1.0	1375
FMOV20391-H	250	320	390	351	429	650	200	385	20000	1.0	1375
FMOV20431-H	275	350	430	387	473	710	200	425	20000	1.0	1250
FMOV20471-H	300	385	470	423	517	775	200	450	20000	1.0	1125
FMOV20511-H	320	420	510	459	561	845	200	500	20000	1.0	1000
FMOV20561-H	350	460	560	504	616	915	200	520	20000	1.0	938
FMOV20621-H	395	510	620	558	682	1020	200	590	15000	1.0	713
FMOV20681-H	420	560	680	612	748	1120	200	650	15000	1.0	688
FMOV20751-H	465	615	750	675	825	1235	200	725	15000	1.0	663

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2. Agency Approvals

Agency	Agency Approvals	Certificate No.
	UL1449 4 th & cUL	In Process
	IEC 61051-1:2007 IEC 61051-2:1991 IEC 61051-2:1991/AMD1:2009 IEC 61051-2-2:1991 IEC 62368-1:2018/G.8.1 IEC 60950-1:2005/AMD1:2009/AMD2:2013, Annex Q	In Process

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3. Reliability

Characteristics	Standard	Test Conditions	Specifications
Robustness of terminations	IEC 60068-2-21 Test Ua1	F = 10 N (d ≤ 0.8 mm) , F = 20 N (d = 1 mm)	$\Delta V_{1mA} / V_{1mA} \leq \pm 10\%$ No visible damage
Solderability	IEC 60068-2-20 Test Ta (Method 1)	T = 235±5°C, d = 2±0.5s	Approximately ≥ 95%
Resistance to soldering heat	IEC 60068-2-20 Test Tb (Method 1A)	T = 260±5°C, d = 10±1s	$\Delta V_{1mA} / V_{1mA} \leq \pm 5\%$ No visible damage
Shock	IEC 60068-2-27 Test Ea	Pulse shape: half-sine. a = 490 m/s ² , d = 11ms. N = 6 x 3 shocks	$\Delta V_{1mA} / V_{1mA} \leq \pm 5\%$ No visible damage
Vibration	IEC 60068-2-6 Test Fc Method B4	Frequency range: 10 Hz to 55 Hz ,a = 0.75 mm or 98 m/s ² (whichever is the less), d = 3x2 h	$\Delta V_{1mA} / V_{1mA} \leq \pm 5\%$ No visible damage
Needle flame test	IEC 60695-11-5	Severity: Vertical 10 s	Duration of burning: 5 s max.
Voltage under pulse condition	IEC 61051-2	At class current, 8/20 μs,	As specified in specification
Voltage proof	IEC 61051-2	Metal balls method (4.8.1.2) 2500 V, 60 s	No breakdown or flashover
Pulse current - 8/20 μs	IEC 61051-2	8/20 μs, 10 times, I _{peak} =0.25*I _{max}	$\Delta V/V \leq \pm 10\%$ No visible damage
Pulse current - 10/1000 μs	IEC 61051-2	10/1000 μs, 10 times, I _{peak} = 0.0075* I _{max}	$\Delta V_{1mA} / V_{1mA} \leq \pm 10\%$ No visible damage
Combination pulse	IEC 62368-1	Additional test: 10 pulses (combination pulse 6KV/3KA), in one direction, 1 per min	$\Delta V_{1mA} / V_{1mA} \leq \pm 10\%$ No visible damage U ≤ 1.1 U _{initial} Voltage proof: No breakdown or flashover
Rapid change of temperature	IEC 60068-2-14 Test Na	N = 5 cycles, d = 30 min , θA = -40±3°C, θB = 85±2°C	$\Delta V_{1mA} / V_{1mA} \leq \pm 10\%$ No visible damage
Climatic sequence	IEC 60068-2-2 Test Ba IEC 60068-2-30 Test Db IEC 60068-2-1 Test Aa IEC 60068-2-30 Test Db	Dry heat, Test Ba:16±2h, T = 85±2°C Damp heat, Test Db first cycle :24h, T = 55±2°C Cold, Test Aa :2h, T = -40±3°C Damp heat Test Ba remaining cycles:5 cycle	$\Delta V_{1mA} / V_{1mA} \leq \pm 10\%$ No visible damage R _{ISO} ≥ 100MΩ Voltage proof: No breakdown or flashover
Endurance at upper category temperature	IEC 61051-1 (4.21)	T: max temperature as specified , Duration: 1000 h, Voltage: max. a. c. voltage	$\Delta V/V \leq \pm 10\%$ No visible damage R _{ISO} ≥ 1000MΩ U ≤ 1,1 U _{initial}

NOTE : Specification subject to change without notice.

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Characteristics	Standard	Test Conditions	Specifications
Damp heat (Steady state)	IEC 60068-2-78 Test Ca	T = 40±2°C, RH = 93(+2/-3)%, 56d , 4 specimens: No voltage applied ,Other 4 specimens: Applied voltage: 10% of the max. d. c. voltage	$\Delta V_{1mA}/V_{1mA} \leq \pm 10\%$ $R_{iso} \geq 100M\Omega$
Maximum Peak Current	Specification Standard	I _{max} , 8/20 μs, 1 time.	$\Delta V_{1mA}/V_{1mA} \leq \pm 10\%$ No visible damage
Nominal Discharge Current Test	UL1449 4th	I _n , 8/20 μs, 15 times, Interval 60s	$\Delta V/V \leq \pm 10\%$ No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{mAat\ 85^{\circ}C} - V_{mAat\ 25^{\circ}C}}{V_{mAat\ 25^{\circ}C}} \times \frac{1}{60} \times 100(\%/^{\circ}C)$	$0.05 \leq TC \leq 0.05(\%/^{\circ}C)$
High Temperature Storage	IEC60068-2-2	1000h, T = 125±2°C	$\Delta V/V \leq \pm 5\%$ No visible damage
Max. Energy	Specification Standard	10/1000 μs, 1 times, Max. Energy	$\Delta V/V \leq \pm 10\%$ No visible damage
Operating duty cycle test *	UL1449	6 kV/3 kA combination wave surges, phase angle of 90 (+0, -15) degrees, positive polarity 8times, negative polarity 7 times, interval of 60s.	$\Delta V/V \leq \pm 10\%$ No visible damage
Surge Immunity Test *	IEC 61000-4-5	4kV/2kA combination wave surges, phase angle of 90 (+0, -15) degrees, positive polarity 20times, negative polarity 20times, interval of 60s.	$\Delta V/V \leq \pm 10\%$ No visible damage

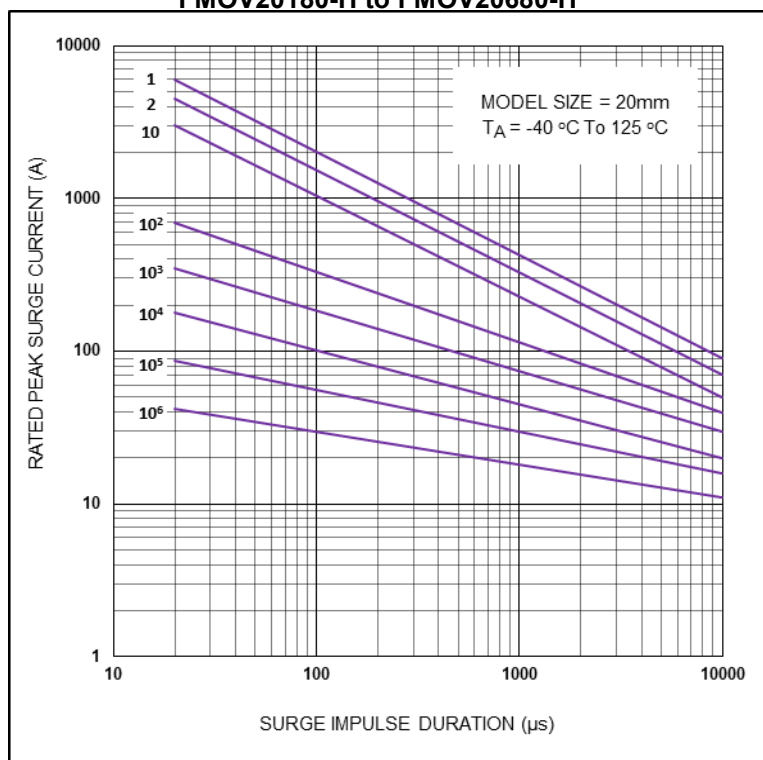
* (According to customer requirements to meet the test items)



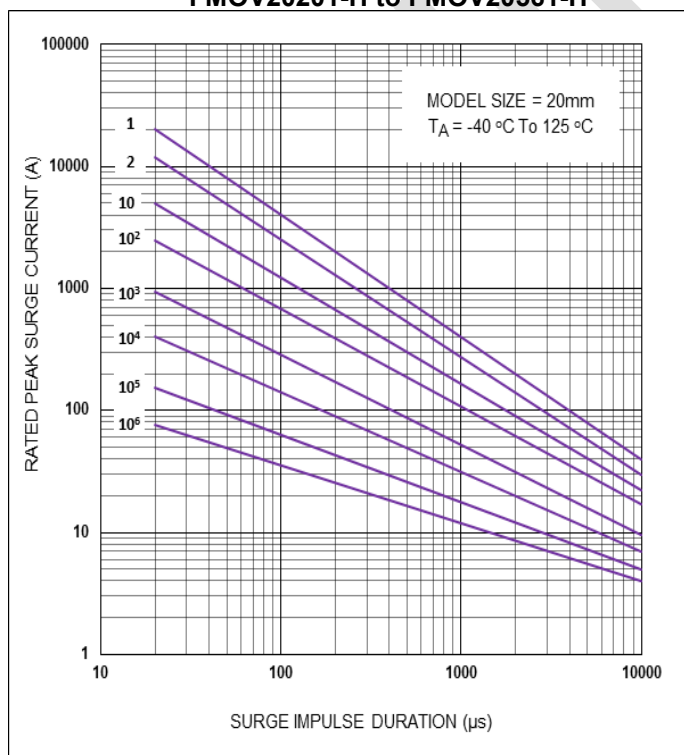
4. Impulse Life Time Rating Curves

FMOV20-H Series

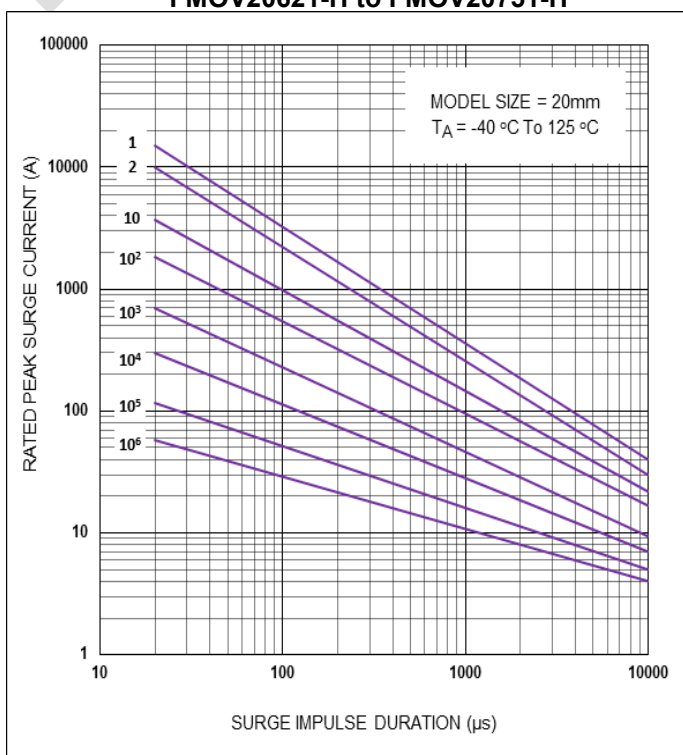
FMOV20180-H to FMOV20680-H



FMOV20201-H to FMOV20561-H



FMOV20621-H to FMOV20751-H

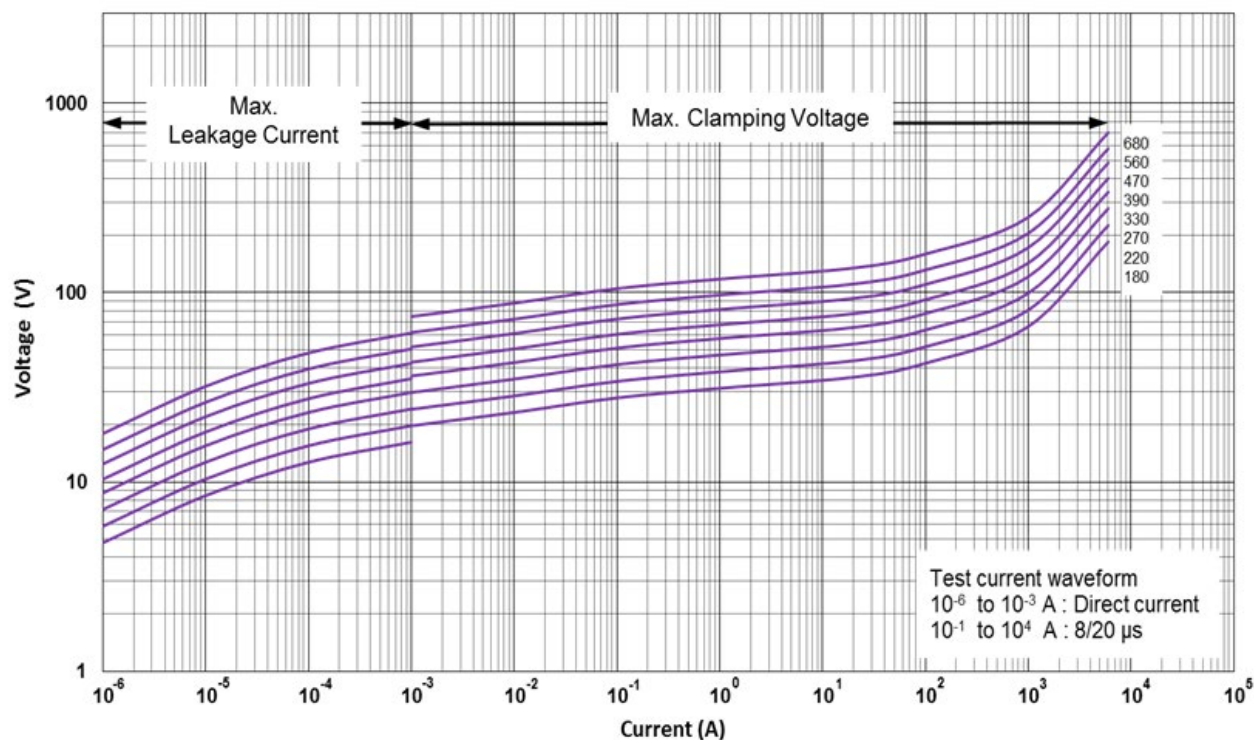


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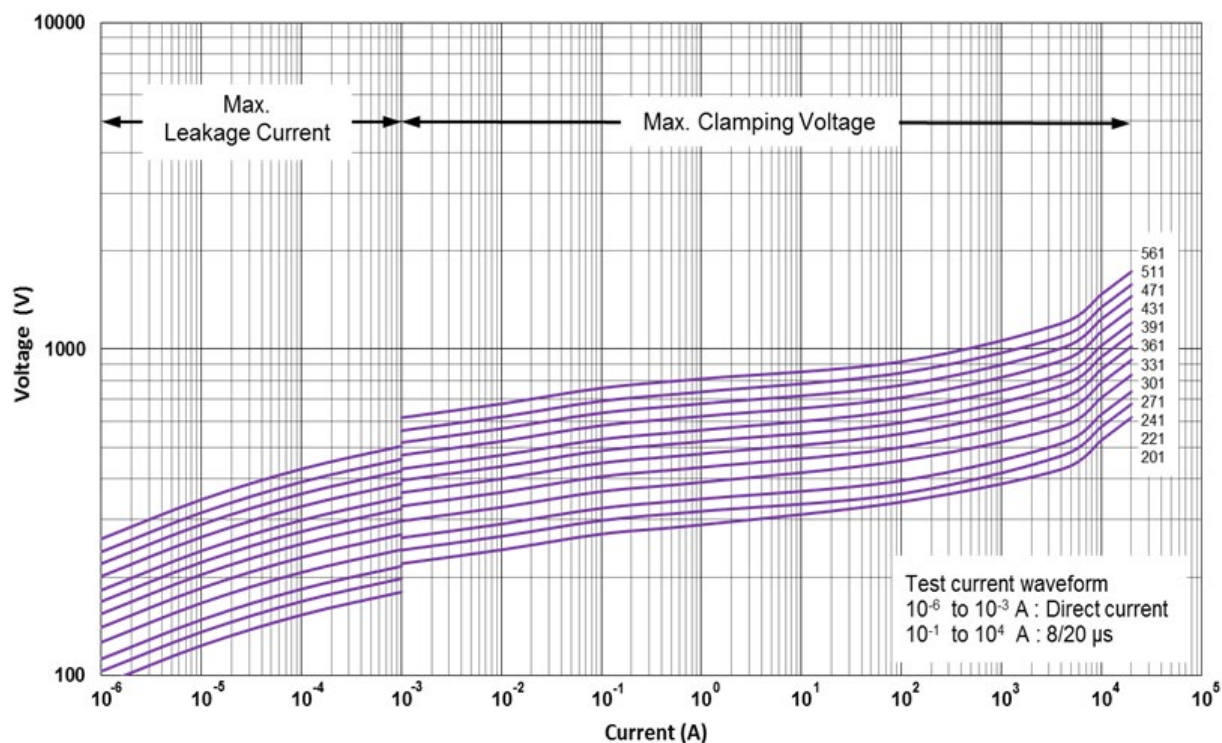


5. V-I Curves

(FMOV20180-H to FMOV20680-H)



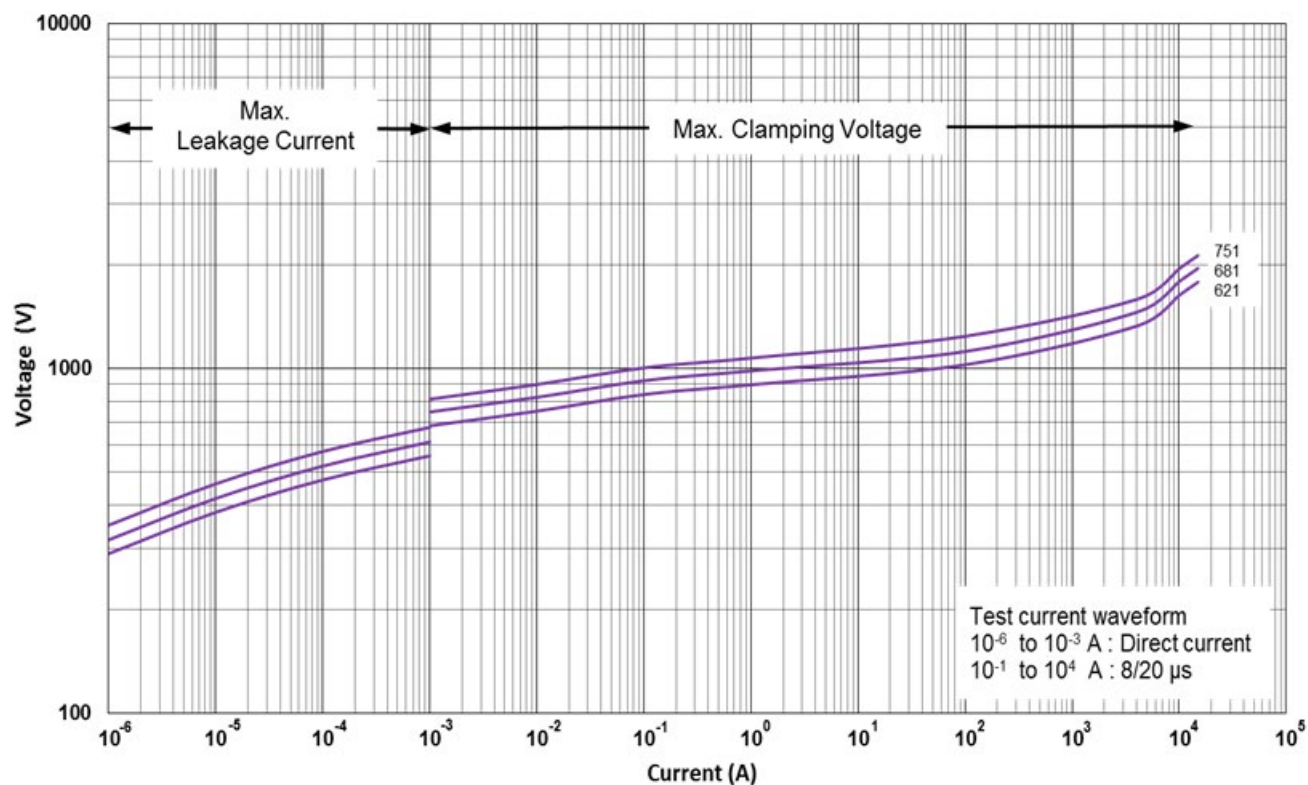
(FMOV20201-H to FMOV20561-H)



NOTE : Specification subject to change without notice.



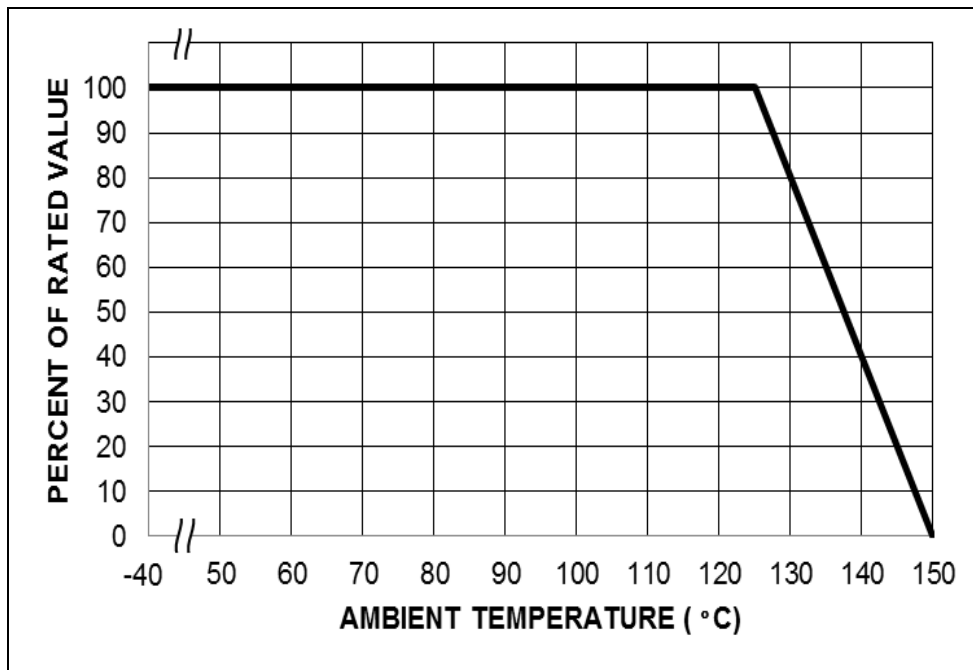
(FMOV20621-H to FMOV20751-H)



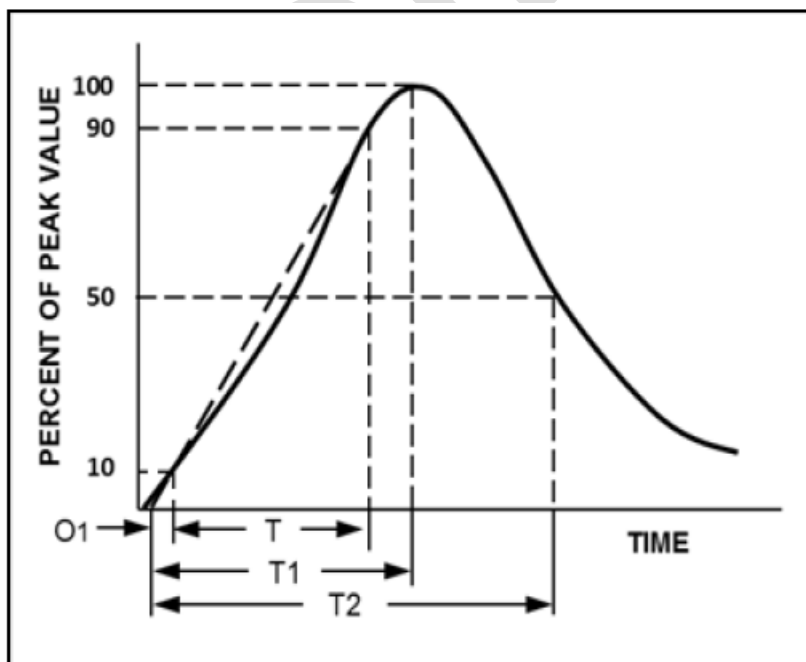


6. Power Derating Curve

Should transients occur in rapid succession, the average power dissipation is the energy (watt-seconds) per pulse times the number of pulses per second. The power so developed must be with the specifications shown on the Device Ratings and Specifications Table for the specific device. The operating values of a MOV need to be derated at high temperatures as shown above. Because varistors only dissipate a relatively small amount of average power they are not suitable for repetitive applications that involve substantial amounts of average power dissipation.



7. Surge Current Standard Waveform



O1 = Virtual Origin of Wave

T = Time from 10% to 90% of Peak

T1 = Rise Time = 1.25 x T

T2 = Decay Time

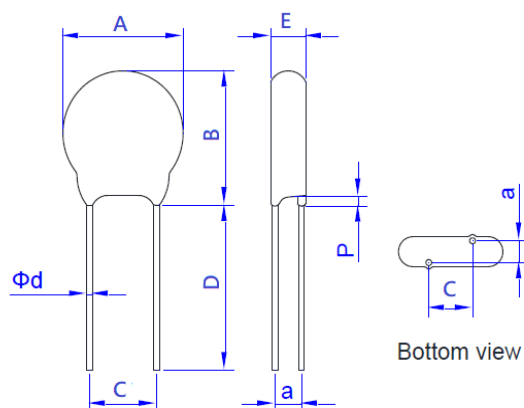
Example - For an 8/20 μ s Current Waveform:

8 μ s = T1 = Rise Time

20 μ s = T2 = Decay Time

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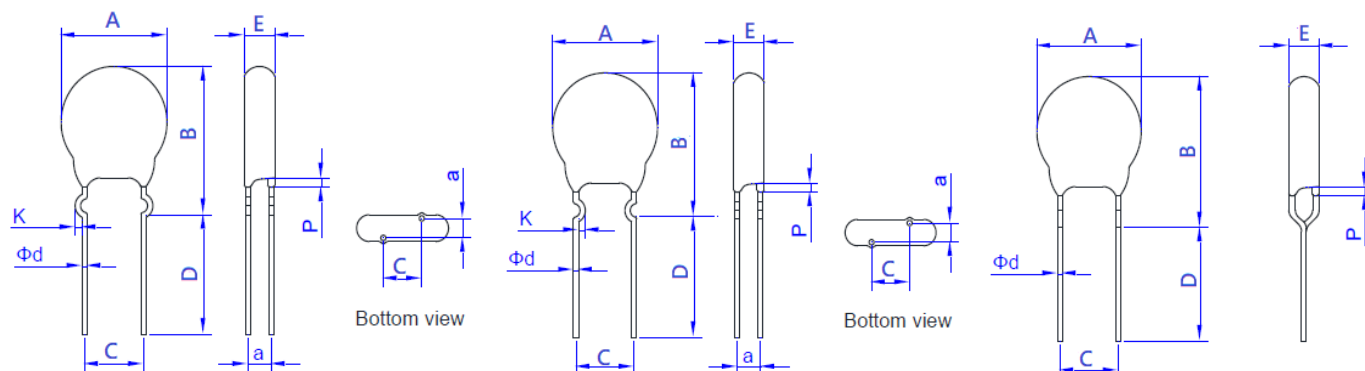
8. Dimension of Component for Standard Product



Straight Lead Type (S)

Part Number	A		B	C	D	E	P	a	Φd
	Min.	Max.	Max.	±1.0	Typ.	Max.	Max.	±1.0	±0.05
FMOV20180-H	19.5	25.0	28.0	10.0	25.0	5.3	3.0	1.5	1.00
FMOV20220-H	19.5	25.0	28.0	10.0	25.0	5.6	3.0	1.7	1.00
FMOV20270-H	19.5	25.0	28.0	10.0	25.0	5.9	3.0	1.8	1.00
FMOV20330-H	19.5	25.0	28.0	10.0	25.0	5.3	3.0	1.9	1.00
FMOV20390-H	19.5	25.0	28.0	10.0	25.0	5.5	3.0	1.9	1.00
FMOV20470-H	19.5	25.0	28.0	10.0	25.0	5.8	3.0	2.1	1.00
FMOV20560-H	19.5	25.0	28.0	10.0	25.0	6.1	3.0	2.3	1.00
FMOV20680-H	19.5	25.0	28.0	10.0	25.0	6.5	3.0	2.6	1.00
FMOV20201-H	19.5	25.0	28.0	10.0	25.0	6.2	3.0	2.0	1.00
FMOV20221-H	19.5	25.0	28.0	10.0	25.0	6.3	3.0	2.1	1.00
FMOV20241-H	19.5	25.0	28.0	10.0	25.0	6.5	3.0	2.2	1.00
FMOV20271-H	19.5	25.0	28.0	10.0	25.0	6.6	3.0	2.3	1.00
FMOV20301-H	19.5	25.0	28.0	10.0	25.0	6.8	3.0	2.5	1.00
FMOV20331-H	19.5	25.0	28.0	10.0	25.0	7.0	3.0	2.7	1.00
FMOV20361-H	19.5	25.0	28.0	10.0	25.0	7.3	3.0	2.8	1.00
FMOV20391-H	19.5	25.0	28.0	10.0	25.0	7.5	3.0	3.0	1.00
FMOV20431-H	19.5	25.0	28.0	10.0	25.0	7.8	3.0	3.2	1.00
FMOV20471-H	19.5	25.0	28.0	10.0	25.0	8.1	3.0	3.4	1.00
FMOV20511-H	19.5	25.0	28.0	10.0	25.0	8.2	3.0	3.7	1.00
FMOV20561-H	19.5	25.0	28.0	10.0	25.0	8.5	3.0	3.9	1.00
FMOV20621-H	19.5	25.0	28.0	10.0	25.0	8.8	3.0	4.3	1.00
FMOV20681-H	19.5	25.0	28.0	10.0	25.0	8.9	3.0	4.7	1.00
FMOV20751-H	19.5	25.0	28.0	10.0	25.0	9.2	3.0	5.1	1.00

Unit: mm



Outside Kink Lead (O)

Inside Kink Lead (K)

In Line Kink Lead (I)

Part Number	A		B	C	D	E	P	K		a	Φd
	Min.	Max.	Max.	±1.0	Typ.	Max.	Max.	Min.	Max.	±1.0	±0.05
FMOV20180-H	19.5	25.0	30.0	10.0	25.0	5.3	3.0	1.0	1.8	1.5	0.80
FMOV20220-H	19.5	25.0	30.0	10.0	25.0	5.6	3.0	1.0	1.8	1.7	0.80
FMOV20270-H	19.5	25.0	30.0	10.0	25.0	5.9	3.0	1.0	1.8	1.8	0.80
FMOV20330-H	19.5	25.0	30.0	10.0	25.0	5.3	3.0	1.0	1.8	1.9	0.80
FMOV20390-H	19.5	25.0	30.0	10.0	25.0	5.5	3.0	1.0	1.8	1.9	0.80
FMOV20470-H	19.5	25.0	30.0	10.0	25.0	5.8	3.0	1.0	1.8	2.1	0.80
FMOV20560-H	19.5	25.0	30.0	10.0	25.0	6.1	3.0	1.0	1.8	2.3	0.80
FMOV20680-H	19.5	25.0	30.0	10.0	25.0	6.5	3.0	1.0	1.8	2.6	0.80
FMOV20201-H	19.5	25.0	30.0	10.0	25.0	6.2	3.0	1.0	1.8	2.0	0.80
FMOV20221-H	19.5	25.0	30.0	10.0	25.0	6.3	3.0	1.0	1.8	2.1	0.80
FMOV20241-H	19.5	25.0	30.0	10.0	25.0	6.5	3.0	1.0	1.8	2.2	0.80
FMOV20271-H	19.5	25.0	30.0	10.0	25.0	6.6	3.0	1.0	1.8	2.3	0.80
FMOV20301-H	19.5	25.0	31.0	10.0	25.0	6.8	3.0	1.0	1.8	2.5	0.80
FMOV20331-H	19.5	25.0	31.0	10.0	25.0	7.0	3.0	1.0	1.8	2.7	0.80
FMOV20361-H	19.5	25.0	31.0	10.0	25.0	7.3	3.0	1.0	1.8	2.8	0.80
FMOV20391-H	19.5	25.0	31.0	10.0	25.0	7.5	3.0	1.0	1.8	3.0	0.80
FMOV20431-H	19.5	25.0	31.0	10.0	25.0	7.8	3.0	1.0	1.8	3.2	0.80
FMOV20471-H	19.5	25.0	31.0	10.0	25.0	8.1	3.0	1.0	1.8	3.4	0.80
FMOV20511-H	19.5	25.0	31.0	10.0	25.0	8.2	3.0	1.0	1.8	3.7	0.80
FMOV20561-H	19.5	25.0	31.0	10.0	25.0	8.5	3.0	1.0	1.8	3.9	0.80
FMOV20621-H	19.5	25.0	31.0	10.0	25.0	8.8	3.0	1.0	1.8	4.3	0.80
FMOV20681-H	19.5	25.0	31.0	10.0	25.0	8.9	3.0	1.0	1.8	4.7	0.80
FMOV20751-H	19.5	25.0	31.0	10.0	25.0	9.2	3.0	1.0	1.8	5.1	0.80

Unit: mm

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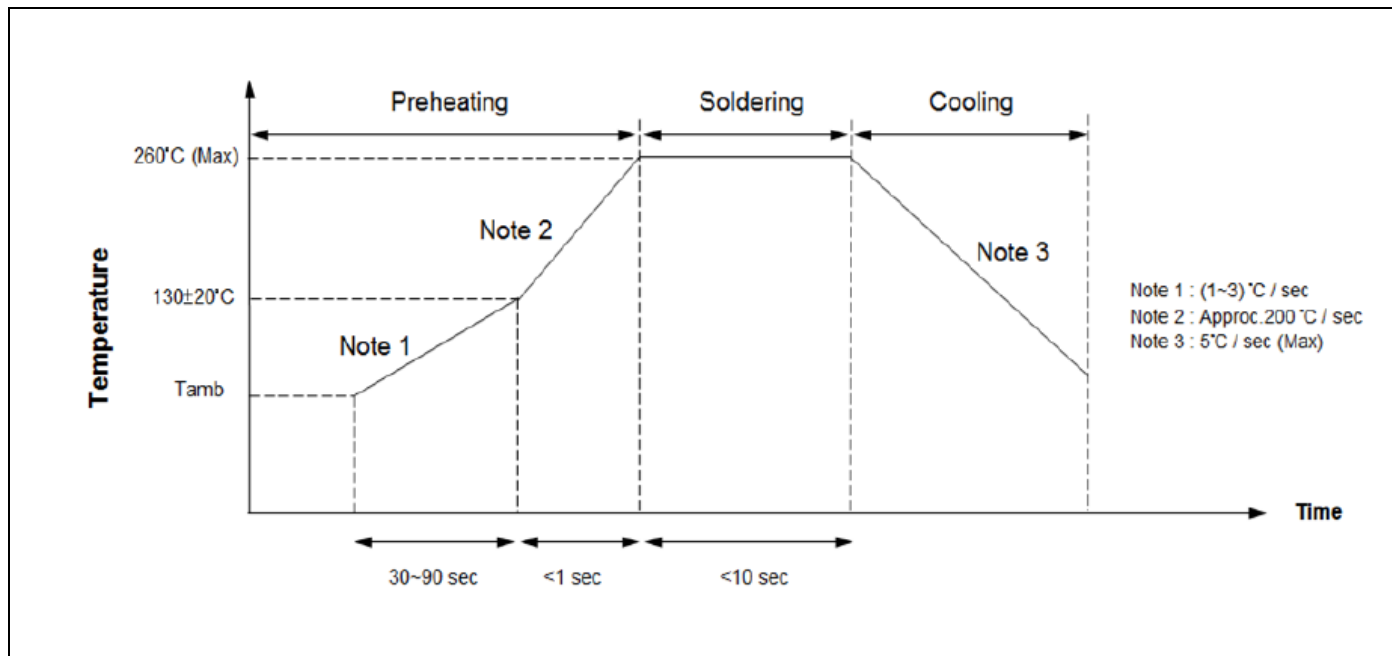
10. Packaging Specifications

Bulk Product Packing

Series	Straight Lead Type Quantity (pcs/bag)	Outside Kink Lead Type Quantity (pcs/bag)	Inside Kink Lead Type Quantity (pcs/bag)	In Line Kink Lead Type Quantity (pcs/bag)
FMOV20-H Series	250	250	250	250



11. Solder Recommendation



Recommendation Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of soldering Iron-tip	360°C (Max)
Soldering Time	3 sec (Max)
Distance from Varistor	2mm (Min)

RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS Directive 2002/95/EC

Storage Conditions of Products

(I) Storage Conditions:

- Storage Temperature: -10°C ~ +40°C
- Relative Humidity: ≤ 75%RH
- Keep away from corrosive atmosphere and sunlight
- Solvent Resistance: MIL-STD-202, Method 215F
- Moisture Sensitivity: Level 1, J-STD-020

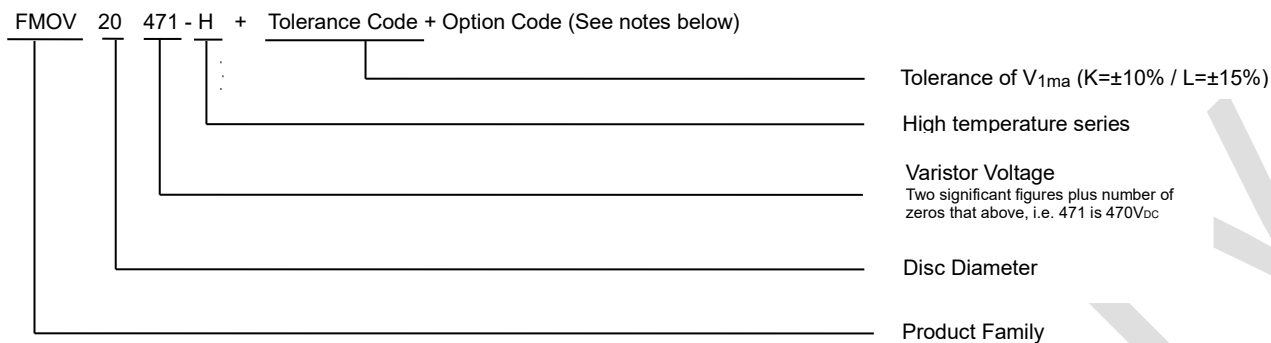
(II) Period of Storage: 1 year

NOTE : Specification subject to change without notice.

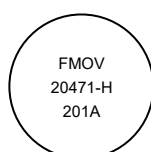


12. Part Numbering and Marking System

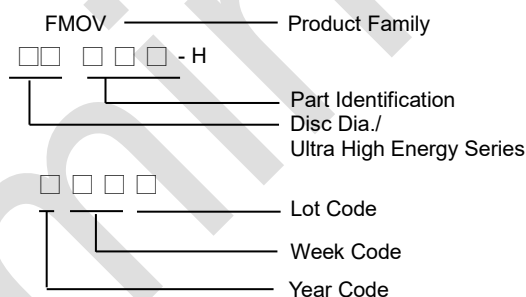
Part Numbering System



Marking System



Example



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13. Order Notes:

Main Part Code:

Part No + Tolerance Code + Packaging + Lead Type Designators + Option Code

Ordering examples:

Straight Lead Bulk Pack (Standard)	Straight Lead (Short Cut) Bulk Pack	Straight Lead Tape & Reel Pack	Straight Lead Flat Box Pack
FMOV20471-HKBS	FMOV20471-HKBSXXX	-	-

Outside Kink Lead Bulk Pack	Outside Kink Lead (Short Cut) Bulk Pack	Outside Kink Lead Tape & Reel Pack	Outside Kink Lead Flat Box Pack
FMOV20471-HKBO	FMOV20471-HKBOXXX	-	-

Inside Kink Lead Bulk Pack	Inside Kink Lead (Short Cut) Bulk Pack	Inside Kink Lead Tape & Reel Pack	Inside Kink Lead Flat Box Pack
FMOV20471-HKBK	FMOV20471-HKKBXXX	-	-

In Line Kink Lead Bulk Pack	In Line Kink Lead (Short Cut) Bulk Pack	In Line Kink Lead Tape& Reel Pack	In Line Kink Lead Flat Box Pack
FMOV20471-HKBI	FMOV20471-HKBIXXX	-	-