M3 Varistor Series
Radial Lead Varistors

Additional Information

Resources | Accessories | Samples

Agency Approvals

Agency	Standards	Agency File Number
	UL 1449 CSA C22.2 No. 269-5	E320116
	IEC 61051-1 IEC 61051-2 IEC 61051-2-2 Annex Q of IEC 60950-1 Annex G of IEC 62368-1	J50453530
	GB/T 10193 GB/T 10194 GB 4943.1 GB 8898	CQC19001232957

Description

The M3 Varistor Series is a compact MOV with high surge current withstanding and energy absorption capabilities. It is designed to meet the 6 kV/3 kA (1.2/50 µs, 8/20 µs) combination wave surge as required by Annex G of IEC 62368-1, and 3 kA (E130~E420), 2 kA (E440~E625), Nominal Discharge Current (In) as required by UL 1449.

Features & Benefits

- High operating temperature: 105° C
- UL 1449 and CSA C22.2 No. 269-5 Recognized. CQC, IEC 60950-1 Annex Q and IEC 62368-1Annex G Compliant
- Passed Needle Flame Test per IEC 61051-1
- RoHS compliant, Halogen-free, and Pb-free
- More reliable and suitable for high operating temperature products
- Compliant with global safety standards
- Suitable for operational environments requiring V0 flammability rating
- Environment-friendly

Applications

- Home appliance
- Outdoor LED lighting driver/power supply
- Switch Mode Power Supply (SMPS)
- Surge Protection Device (SPD) Type 2, Type 3, and Type 4CA
- Ground Fault Circuit Interrupter (GFCI)

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Electrical Specifications

Part Number	Maximum Continuous Operating Voltage (MCOV)		Rated Energy (2 ms or 10/1000 µs, 1x Pulse)	Maximum Peak Current (8/20 µs, 1x Pulse)	Nominal Discharge Current (8/20 µs, 15 Pulses)	Rated Average Dissipation Power	Combination Pulse (Voltage 1.2/50 µs, Current 8/20 µs 10 Pulses)
	V_{RMS} (V)	V_{DC} (V)	W_{max} (J)	I_{max} (A)	I_n (A)	P_{max} (W)	
M3E130E5LB7	130	170	34	4500	3000	0.4	6 kV / 3 kA
M3E140E5LB7	140	180	36	4500	3000	0.4	6 kV / 3 kA
M3E150E5LB7	150	200	40	4500	3000	0.4	6 kV / 3 kA
M3E175E5LB7	175	225	46	4500	3000	0.4	6 kV / 3 kA
M3E195E5LB7	195	250	49	4500	3000	0.4	6 kV / 3 kA
M3E210E5LB7	210	275	52	4500	3000	0.4	6 kV / 3 kA
M3E230E5LB7	230	300	60	4500	3000	0.4	6 kV / 3 kA
M3E250E5LB7	250	320	65	4500	3000	0.4	6 kV / 3 kA
M3E275E5LB7	275	350	71	4500	3000	0.4	6 kV / 3 kA
M3E300E5LB7	300	385	76	4500	3000	0.4	6 kV / 3 kA
M3E320E5LB7	320	420	84	4500	3000	0.4	6 kV / 3 kA
M3E330E5LB7	330	435	84	4500	3000	0.4	6 kV / 3 kA
M3E350E5LB7	350	460	86	4500	3000	0.4	6 kV / 3 kA
M3E385E5LB7	385	505	88	4500	3000	0.4	6 kV / 3 kA
M3E420E5LB7	420	560	95	4500	3000	0.4	6 kV / 3 kA
M3E440E5LB7	440	585	98	4500	2000	0.4	4 kV / 2 kA
M3E460E5LB7	460	615	100	4500	2000	0.4	4 kV / 2 kA
M3E510E5LB7	510	670	110	4500	2000	0.4	4 kV / 2 kA
M3E550E5LB7	550	745	112	4500	2000	0.4	4 kV / 2 kA
M3E625E5LB7	625	825	130	4500	2000	0.4	4 kV / 2 kA

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Electrical Characteristics Under 25° C

Part Number	Branding	Varistor Voltage at 1 mA DC	Varistor Voltage Shift at 1 mA	Clamping Voltage (8/20 µs)		Typical Capacitance at 1 kHz
		V_n (V)	%	V_C (V)	I_{PK} (A)	C_{TYP} (pF)
M3E130E5LB7	E130	205	± 10	340	50	600
M3E140E5LB7	E140	220	± 10	360	50	560
M3E150E5LB7	E150	240	± 10	395	50	520
M3E175E5LB7	E175	270	± 10	455	50	450
M3E195E5LB7	E195	300	± 10	495	50	420
M3E210E5LB7	E210	330	± 10	545	50	390
M3E230E5LB7	E230	360	± 10	595	50	370
M3E250E5LB7	E250	390	± 10	650	50	340
M3E275E5LB7	E275	430	± 10	710	50	320
M3E300E5LB7	E300	470	± 10	775	50	290
M3E320E5LB7	E320	510	± 10	840	50	270
M3E330E5LB7	E330	530	± 10	875	50	265
M3E350E5LB7	E350	560	± 10	930	50	240
M3E385E5LB7	E385	620	± 10	1025	50	230
M3E420E5LB7	E420	680	± 10	1120	50	200
M3E440E5LB7	E440	710	± 10	1180	50	175
M3E460E5LB7	E460	750	± 10	1240	50	150
M3E510E5LB7	E510	820	± 10	1355	50	140
M3E550E5LB7	E550	910	± 10	1500	50	130
M3E625E5LB7	E625	1000	± 10	1650	50	120

General Technical Data

Operating temperature	-40 to +105° C
Storage temperature	-40 to +125° C
Electric strength (Voltage Rating)	≥ 2.5 kV_{RMS}
Insulation resistance	≥ 100 MΩ

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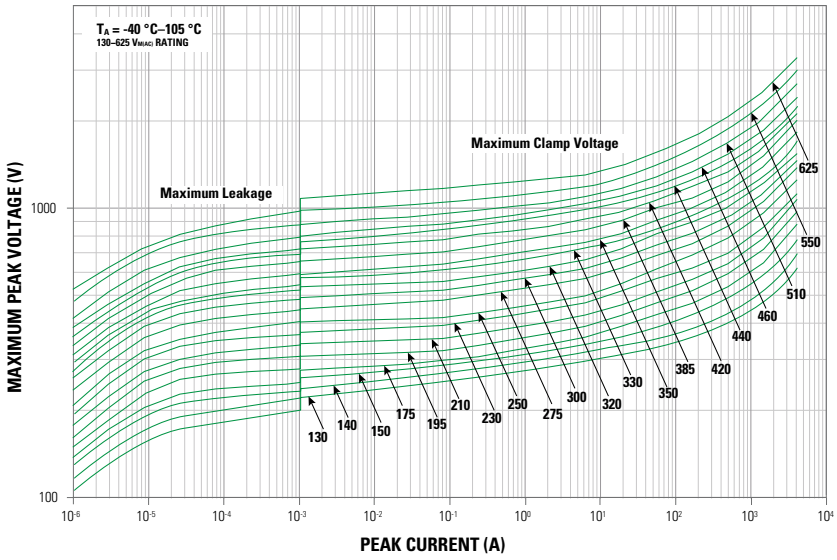
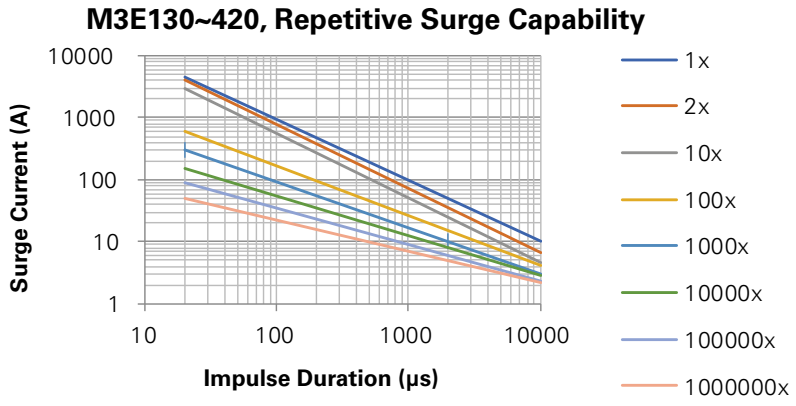
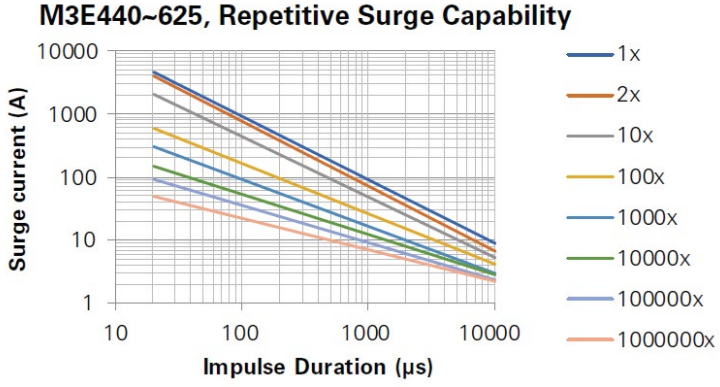
Transient V-I Characteristic Curve: Maximum Clamping Voltage



Pulse Rating Curve





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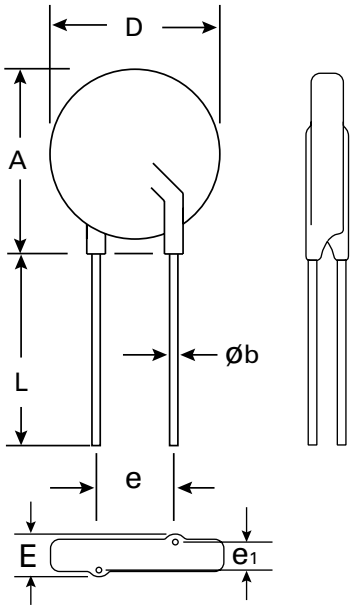
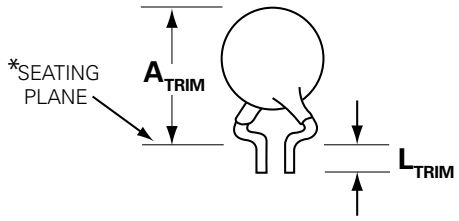
Product Dimensions (mm)





*Seating plane interpretation per IEC-717

Part Number	A_{Max}	$A_{TRIM\ Max}$	Øb	D_{Max}	e	e1	E_{Max}	L	L_{TRIM} = L4
M3E130E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.0 ± 1.0	6.0	5.0 ± 0.8	3.5 ± 1.0
M3E140E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.0 ± 1.0	6.0	5.0 ± 0.8	3.5 ± 1.0
M3E150E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.1 ± 1.0	6.0	5.0 ± 0.8	3.5 ± 1.0
M3E175E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.1 ± 1.0	6.0	5.0 ± 0.8	3.5 ± 1.0
M3E195E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.2 ± 1.0	6.2	5.0 ± 0.8	3.5 ± 1.0
M3E210E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.4 ± 1.0	6.3	5.0 ± 0.8	3.5 ± 1.0
M3E230E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.5 ± 1.0	6.5	5.0 ± 0.8	3.5 ± 1.0
M3E250E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.6 ± 1.0	6.6	5.0 ± 0.8	3.5 ± 1.0
M3E275E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	2.8 ± 1.0	6.8	5.0 ± 0.8	3.5 ± 1.0
M3E300E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.0 ± 1.0	7.0	5.0 ± 0.8	3.5 ± 1.0
M3E320E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.2 ± 1.0	7.2	5.0 ± 0.8	3.5 ± 1.0
M3E330E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.3 ± 1.0	7.4	5.0 ± 0.8	3.5 ± 1.0
M3E350E5LB7	16	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.4 ± 1.0	7.5	5.0 ± 0.8	3.5 ± 1.0
M3E385E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.7 ± 1.0	7.8	5.0 ± 0.8	3.5 ± 1.0
M3E420E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	4.0 ± 1.0	8.1	5.0 ± 0.8	3.5 ± 1.0
M3E440E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.6 ± 1.2	7.7	5.0 ± 0.8	3.5 ± 1.0
M3E460E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	3.8 ± 1.5	7.9	5.0 ± 0.8	3.5 ± 1.0
M3E510E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	4.1 ± 1.5	8.3	5.0 ± 0.8	3.5 ± 1.0
M3E550E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	4.4 ± 1.5	8.8	5.0 ± 0.8	3.5 ± 1.0
M3E625E5LB7	17	19.5	0.80 ± 0.05	12.5	7.5 ± 1.0	4.8 ± 1.5	9.2	5.0 ± 0.8	3.5 ± 1.0

Note: "L" is measured as the shortest distance between the endpoint of epoxy coating and the endpoint of wire lead when facing MOV marking side.

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Electrical Reliability

Test Item	Reference Standard	Test methods / Description	Specification Limit
Varistor Voltage (Vn or Uv)	IEC 61051-1	The voltage between the varistor leads with the measuring current of 1 mADC @ 30 ms	To meet the specified value
Clamping Voltage	IEC 61051-1	The voltage measured across the varistor leads with the specified impulse current during the application of an 8/20 µs current waveform	To meet the specified value
Maximum Peak Current	IEC 61051-1	The maximum current that can be passed by a varistor with one pulse of 8/20 µs waveform at ambient temperature of 25 °C	| ΔVn/Vn | ≤10% (measured in direction of surge current); No visible damage
Rated Energy	IEC 61051-1	The rated energy that the varistor is able to withstand one pulse when it is exposed to 2 ms rectangular waveform (or 10/1000 µs waveform) at ambient temperature of 25 °C	| ΔVn/Vn | ≤10% (measured in direction of surge current); No visible damage
Combination Pulse	IEC 61051-2	Voltage 1.2/50 µs, Current 8/20 µs with V_{RMS} MCOV applied, 10 pulses in one direction, one pulse per minute	| ΔVn/Vn | ≤10% (measured in direction of surge current); No visible damage
Nominal Discharge Current	UL 1449	8/20 µs waveform with V_{RMS} MCOV applied, 15 pulses in 3 groups (30 minutes interval between every two groups, 1 minute interval between every two pulses)	| ΔVn/Vn | ≤10% (measured in direction of surge current); No visible damage
Endurance at Upper Category Temperature	IEC 61051-1	After having continuously applied V_{RMS} MCOV at 105±2 °C for 1000 hours, the specimen shall be stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of Vn shall be measured	| ΔVn/Vn | ≤10%; No visible damage
Voltage Proof	IEC 61051-1	Metal balls method, 2500 Vac for 60±5 seconds. The complete varistor is placed in a container holding metal balls with maximum 1.6 mm diameter such that only the terminations of the varistor are protruding. The specified voltage shall be applied between both terminations of the specimen connected together and the electrode inserted into the metal balls	No breakdown; No flashover
Rapid Change of Temperature	IEC 60068-2-14	Test Na. 5 cycles*, -40 to 105 °C, dwell time 30 minutes at each extreme *Tested additionally to 50 cycles	| ΔVn/Vn | ≤10%; No visible damage
Climatic Sequence	IEC 61051-1	The specimen shall be subjected to: a) Dry heat at +105 °C, 16 hours, in accordance with Test Bb of IEC 60068-2-2 b) Damp heat, 1st cycle: 55 °C, 93% RH, 24 hours, in accordance with Test Db of IEC 60068-2-30 c) Cold at -40 °C, 2 hours, in accordance with Test Ab of IEC 60068-2-1 d) Damp heat, additional 5 cycles: 55 °C, 93% RH, 24 h/cycle, in accordance with Test Db of IEC 60068-2-30. e) Specimen shall be stored at room temperature and normal humidity for 1 to 2 hours	| ΔVn/Vn | ≤10%; No visible damage
High Temperature Storage (Dry Heat)	MIL-STD-202, Method 108A	In accordance with Test Condition D, 125±3 °C for 1000hrs, without voltage applied. After completion of the test, the specimen shall be allowed to recover at room temperature for 1 to 2 hours	| ΔVn/Vn | ≤10%; No visible damage
Damp Heat, Steady State	IEC 61051-1	Conducted in accordance with Test Cab of IEC 60068-2-78. The specimen are divided into two groups. Both groups shall be subjected to 40±2 °C, 90 to 95% RH for 56 days with Group 1 without voltage applied and Group 2 with 10% of VDC MCOV. Both groups are then stored at room temperature and normal humidity for 1 to 2 hours.	| ΔVn/Vn | ≤10%; No visible damage

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Test Item	Reference Standard	Test methods / Description	Specification Limit
Solderability	IEC 61051-1	In accordance with Test Ta, Method 1 (solder bath) of IEC 60068-2-20, Lead Free Solder (Sn96.5Ag3Cu.5): 245±3° C, 3±0.3 seconds. After dipping the terminations to a depth of approximately 3 mm from the varistor body in a soldering bath of 245° C for 3 seconds, the terminations shall be visually examined with normal eyesight or with the assistance of a magnifier capable of giving a magnification of 4X to 25X	At least 95% of the dipped surface is covered by new solder. No more than small amount of scattered imperfections such as pin-holes or un-wetted or de-wetted areas
Resistance to Soldering Heat	IEC 61051-1	In accordance with Test Tb, Method 1 (solder bath) of IEC 60068-2-20 shall be dipped into a solder bath having a temperature of 260±3° C to a point 2.0~2.5 mm from varistor body of the specimen, be held there for 10 ±1 seconds, and then be stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of V_n shall be measured and the specimen shall be visually examined	| ΔVn/Vn | ≤5%; No visible damage
Tensile Strength	IEC 61051-1	In accordance with Test Ua_1 of IEC 60068-2-21 applying the force specified below and keeping the unit fixed for 10 seconds. Force for wire diameter: Ø 0.6 mm = 10 N Ø 0.8 mm = 10 N Ø 1.0 mm = 20 N	| ΔVn/Vn | ≤5%; No break of solder joint, no wire break
Vibration	IEC 61051-1	After repeatedly applying a sinusoidal harmonic vibration as below, the change of V_n and mechanical damages shall be examined. Pulse shape: Sine wave Amplitude: 0.75 mm Frequency range: 10 Hz to 55 Hz Duration: 6 hours (2 hours each, 3 directions)	| ΔVn/Vn | ≤5%; No visible damage
Shock	IEC 61051-1	In accordance with Test Ea of IEC 60068-2-27. A half-sine pulse with 11 m/s^2 duration and 490 m/s^2 maximum acceleration shall be used. Three shocks in each axis (x, y, and z) and direction (positive and negative) were applied (totaling 36 shocks in total)	| ΔVn/Vn | ≤5%; No visible damage
Fire Hazard	IEC 61051-1	Test methods/Description: Needle flame test method in accordance with IEC 60695-11-5 for a duration of 30 s	No ignition of MOV or ignition of underlying layer
Resistance to solvents	MIL-STD-202 Method 215K	Solvent 1, inspect at 3X maximum for marking; Inspect at 10X maximum for part damage	| ΔVn/Vn | ≤5%; Marking visible; Coating not damaged

Note: Nominal varistor voltage per UL 1449 is Vn and Uv per IEC 61051-1

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Part Numbering System

M3E 320 E XX X X Xxxxx

Series Name

Voltage Rating
V_{rms}: 130 Vac - 625 Vac

Epoxy Coated

Lead Form
Blank or L1: Straight 25.4 mm minimum
L2: Outer Crimp
L3: In-line
L4: Trimmed to 3.5 mm with Outer Crimp in Bulk Pack
L5: Inner Crimp
5L: Trimmed to 5mm Straight Wire in Bulk Pack

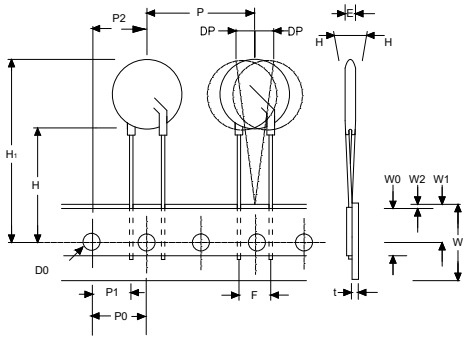
Blank or Other Nonstandard Option

Lead Spacing
5: 5 mm Lead Spacing
7: 7.5 mm Lead Spacing
1: 10 mm Lead Spacing

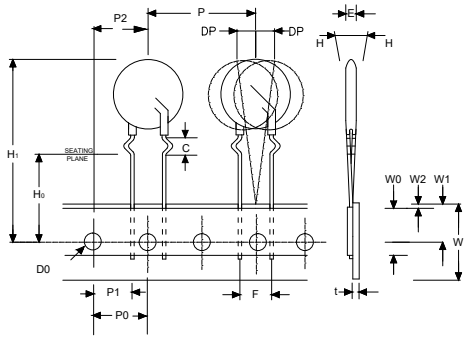
Packing
Blank or B: Bulk Packing
T: Tape & Reel
A: Ammo Pack

Tape Specifications for Reel and Ammo Pack Items

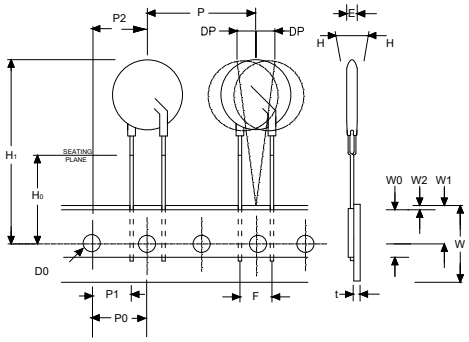
Straight Leads L1



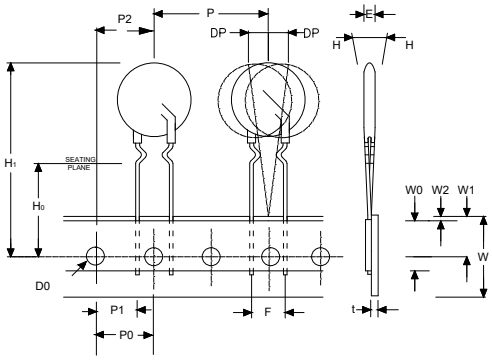
Crimped Leads L2



In-line Leads L3



Inner Crimped Leads L5



Notes:
- Confirms to ANSI and EIA specifications
- Can be supplied to IEC Publication 286-2
- Radial devices on tape are offered with crimped leads, straight leads, or on-line leads. See Ordering Information
- For 10mm devices, 'P' (Component Pitch) is 12.7 mm, when 'F' (Lead Space) is 5 mm
- 10 mm parts are available on tape and reel up to 510 Vac only
- 10 mm devices with 5.0mm lead spacing option will be taped at 12.7 mm component pitch and 1000 pieces per reel

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Symbol	Description	Model Size
		10 mm
B_1	Component Top to Seating Place	19.5 Max
C	Crimp Length	2.6 Typ
P	Pitch of Component	25.4±1.0
P_0	Feed Hole Pitch	12.7±0.2
P_1	Feed Hole Center to Pitch	8.85±0.7
P_2	Hole Center to Component Center	12.7±0.7
F	Lead to Lead Distance	7.5±0.8
Δh	Component Alignment	2.0 Max
W	Tape Width	18.0+1.0/-0.52
W_0	Hold Down Tape Width	12.0±0.3
W_1	Hole Position	9.0+0.75/-0.50
W_2	Hold Down Tape Position	0.5 Max
H	Height from Tape Center to Component Base	18.0+2.0/-0.0
H_0	Seating Plane Height	16.0±0.5
H_1	Component Height	36.0 Max
D_0	Feed Hole Diameter	4.0±0.2
t	Total Tape Thickness	0.7±0.2
Δp	Component Alignment	3° C Max, 1.00 mm

For information on tape and reel packaging quantities, please refer to the Ordering Notes section at the end of this document.

Ordering Notes

For standard parts, use the **BASE PART** designator only.

For parts with non-standard options (such as additional form, packaging and lead space options) use,
BASE PART + OPTION CODE.

OPTION CODE items are subject to availability and minimum order requirements. Please contact a Littelfuse representative if you require additional information

OPTION CODES:

X2855: Nickel Barrier **COATED WIRE OPTION**

All standard parts use tinned copper clad steel wire. Nickel Barrier Coated Wire is available as an option, consisting of Copper Wire with a flashing of Nickel followed by a top coating of Tin.

To order: append standard model **BASE PART** number with "X2855." Example:

Standard Model	Order As
M3E320E5LB7	M3E320E5LB7X2855

PACKAGING:

Littelfuse M3 Varistor Series are shipped standard in bulk pack with straight leads and lead spacing outlined in the dimensions sections of this document. Contact a Littelfuse representative to discuss non-standard options.

Standard Bulk Pack Quantity

V_{RMS} MCOV	Standard Bulk Pack Quantity
130–275	1000
300–625	700

Tape and Reel Quantity

V_{RMS} MCOV	Shipping Quantity/Reel
130–625	500

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