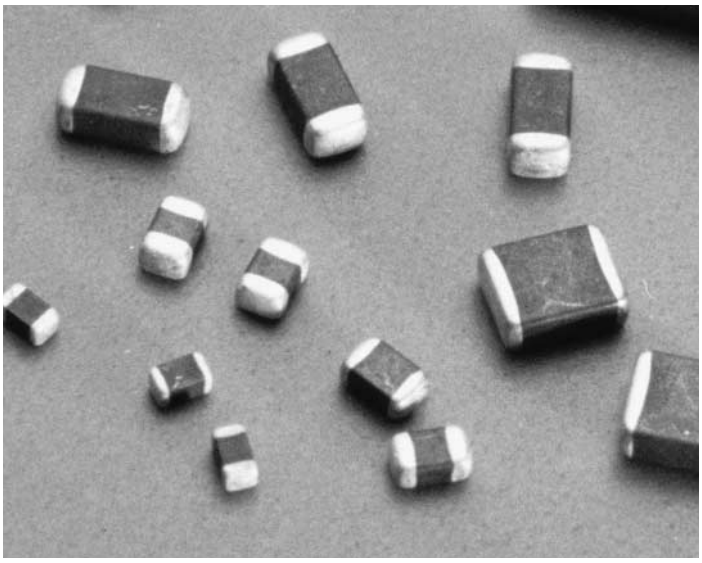
MLE Varistor Series

The MLE Series family of Transient Voltage Suppression devices are based on the Littelfuse Multilayer fabrication technology. These components are designed to suppress ESD events, including those specified in IEC 61000-4-2 or other standards used for Electromagnetic Compliance testing. The MLE Series is typically applied to protect integrated circuits and other components at the circuit board level operating at 18VDC, or less.

The fabrication method and materials of these devices result in capacitance characteristics suitable for high frequency attenuation/low-pass filter circuit functions, thereby providing suppression and filtering in a single device.

The MLE Series is manufactured from semiconducting ceramics and is supplied in a leadless, surface mount package. The MLE Series is compatible with modern reflow and wave soldering procedures.

Littelfuse Inc. manufactures other Multilayer Series products. See the ML Series data sheet for higher energy/peak current transient applications. See the AUML Series for automotive applications and the MLN Quad Array. For high speed applications see the MHS series.



Features

- Rated for ESD (IEC-61000-4-2)
- Characterized for Impedance and Capacitance
- -55°C to +125°C Operating Temperature Range
- Leadless 0402, 0603, 0805, and 1206 sizes
- Operating Voltages up to $18V_{M(DC)}$
- Multilayer Ceramic Construction Technology

Applications

- Protection of Components and Circuits Sensitive to ESD Transients Occurring on Power Supplies, Control and Signal Lines
- Suppression of ESD Events Such as Specified in IEC-61000-4-2 or MIL-STD-883C Method-3015.7, for Electromagnetic Compliance (EMC)
- Used in Mobile Communications, Computer/EDP Products, Medical Products, Hand Held/Portable Devices, Industrial Equipment, Including Diagnostic Port Protection and I/O Interfaces

MLE Varistor Series

Absolute Maximum Ratings For ratings of individual members of a series, see device ratings and specifications table.

	MLE SERIES	UNITS
Continuous:		
Steady State Applied Voltage:		
DC Voltage Range ($V_{M(DC)}$)	≤18	V
Operating Ambient Temperature Range (T_A)	-55 to + 125	°C
Storage Temperature Range (T_{STG})	-55 to + 150	°C

Device Ratings and Specifications

	PART NUMBER	MAX CONTINUOUS WORKING VOLTAGE -55°C TO 125°C (NOTE 1) $V_{M(DC)}$ (V)	PERFORMANCE SPECIFICATIONS (25°C) NOMINAL VOLTAGE V_{NOM} AT 1mA DC MIN (V)	NOMINAL VOLTAGE V_{NOM} AT 1mA DC MAX (V)	MAXIMUM CLAMPING VOLTAGE AT SPECIFIED CURRENT (8/20μS) Vc (V)	MAXIMUM ESD CLAMP VOLTAGE (NOTE 2) (NOTE 3) 8kV CONTACT Clamp (V)	MAXIMUM ESD CLAMP VOLTAGE (NOTE 2) (NOTE 4) 15kV AIR Clamp (V)	TYPICAL CAPACITANCE AT 1MHz (pF)	MAXIMUM LEAKAGE $I_{L\ MAX}$ (μA)	MAXIMUM LEAKAGE AT APPLIED VOLTAGE V_{DC}
NEW	V18MLE0402	18	22	28	50 at 10A	<125	<160	<40	0.1	3.5
									0.3	5.5
									2	15
									10	18
	V18MLE0603	18	22	28	50 at 10A	<75	<85	<100	0.1	3.5
									0.3	5.5
									5.0	15
									25	18
	V18MLE0603L	18	22	28	50 at 10A	<100	<140	<60	0.1	3.5
									0.3	5.5
									5.0	15
									25	18
	V18MLE0805	18	22	28	50 at 10A	<70	<75	<500	0.2	3.5
									0.5	5.5
									5.0	15
									25	18
	V18MLE0805L	18	22	28	50 at 10A	<75	<135	<100	0.2	3.5
									0.5	5.5
									5.0	15
									25	18
	V18MLE1206	18	22	28	50 at 10A	<65	<65	<1700	0.5	3.5
									1.0	5.5
									5.0	15
									25	18

NOTES:
1. For applications of 18V_{DC} or less. Higher voltages available, contact your Littelfuse Sales Representative.
2. Tested with IEC-61000-4-2 Human Body Model (HBM) discharge test circuit.
3. Direct discharge to device terminals (IEC preferred test method).
4. Corona discharge through air (represents actual ESD event).
5. Capacitance may be customized, contact your Littelfuse Sales Representative.

MLE Varistor Series

Typical Performance Curves

For applications exceeding 125°C ambient temperature, the peak surge current and energy ratings must be reduced as shown in Figure 1.

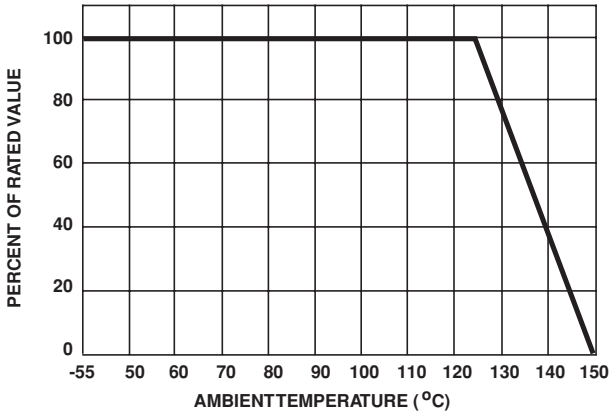


FIGURE 1. PEAK CURRENT AND ENERGY DERATING CURVE

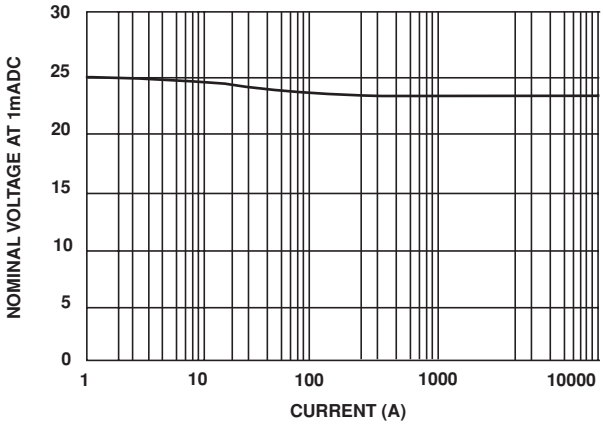


FIGURE 2. NOMINAL VOLTAGE STABILITY TO MULTIPLE ESD IMPULSES (8KV CONTACT DISCHARGES PER IEC 61000-4-2)

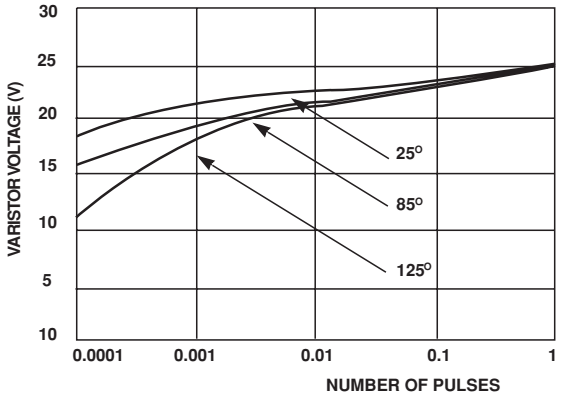


FIGURE 3. STANDBY CURRENT AT NORMALIZED VARISTOR VOLTAGE AND TEMPERATURE

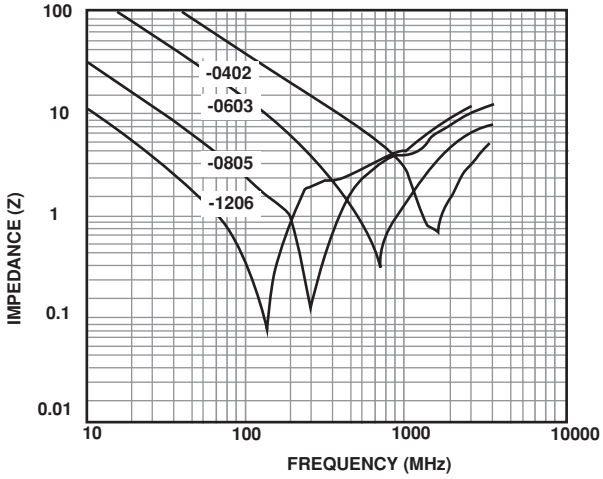


FIGURE 4. IMPEDANCE (Z) vs FREQUENCY TYPICAL CHARACTERISTIC

MLE Varistor Series

Soldering Recommendations

The principal techniques used for the soldering of components in surface mount technology are Infrared (IR) re-flow, vapour phase re-flow, and wave soldering. When wave soldering, the MLE suppressor is attached to the circuit board by means of an adhesive. The assembly is then placed on a conveyor and run through the soldering process to contact the wave. With IR and vapour phase re-flow, the device is placed in a solder paste on the substrate. As the solder paste is heated, it reflows and solders the unit to the board.

The recommended solder for the MLE suppressor is a 62/36/2 (Sn/Pb/Ag), 60/40 (Sn/Pb), or 63/37 (Sn/Pb). Littelfuse also recommends an RMA solder flux.

Wave soldering is the most strenuous of the processes. To avoid the possibility of generating stresses due to thermal shock, a preheat stage in the soldering process is recommended, and the peak temperature of the solder process should be rigidly controlled. For 0402 size devices, IR re-flow is recommended.

When using a reflow process, care should be taken to ensure that the MLE chip is not subjected to a thermal gradient steeper than 4 degrees per second; the ideal gradient being 2 degrees per second. During the soldering process, preheating to within 100 degrees of the solder's peak temperature is essential to minimize thermal shock. Examples of the soldering conditions for the MLE series of suppressors are given in the tables below.

Once the soldering process has been completed, it is still necessary to ensure that any further thermal shocks are avoided. One possible cause of thermal shock is hot printed circuit boards being removed from the solder process and subjected to cleaning solvents at room temperature. The boards must be allowed to cool gradually to less than 50°C before cleaning.

Termination Options

Littelfuse offers two types of electrode termination finish for the MLE series:

1. Silver/Platinum (standard) (Not 0402 and 0603 sizes)
2. Silver/Palladium (optional)
3. Nickel Barrier (optional for 0402-1210 package size)

(The ordering information section describes how to designate them.)

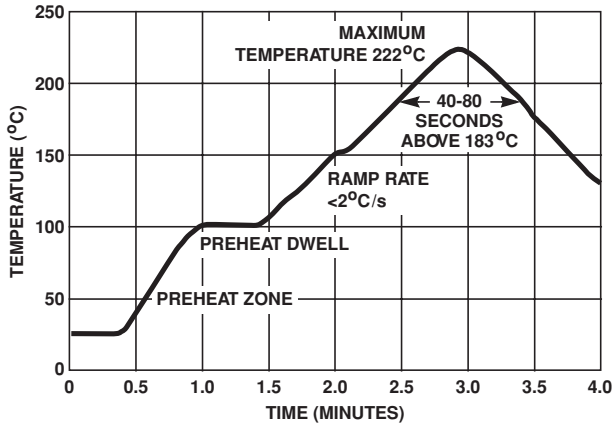


FIGURE 5. REFLOW SOLDER PROFILE

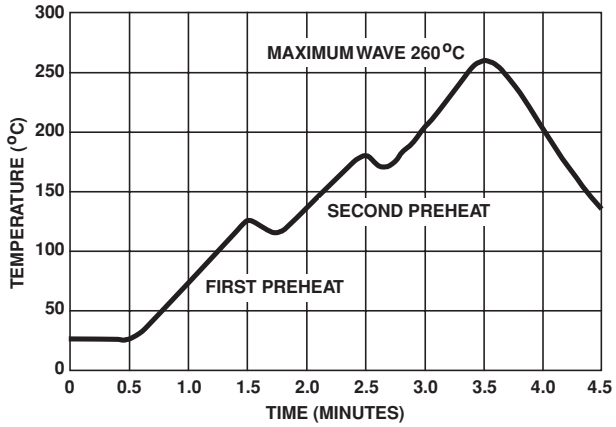


FIGURE 6. WAVE SOLDER PROFILE

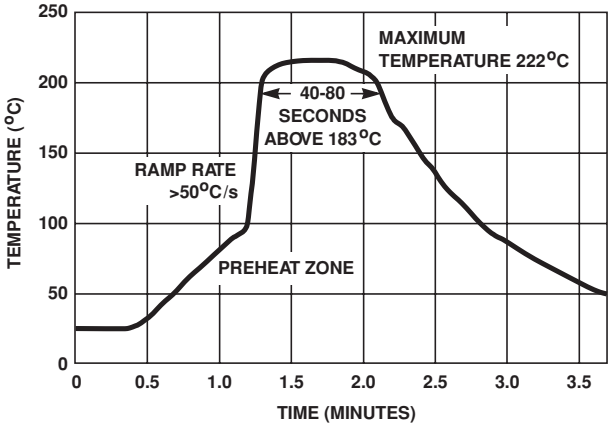
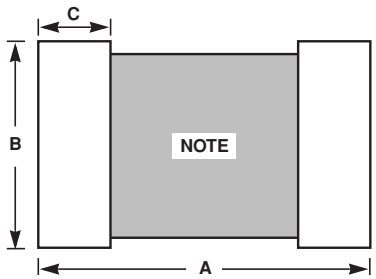


FIGURE 7. VAPOR PHASE SOLDER PROFILE

MLE Varistor Series

Recommended Pad Outline



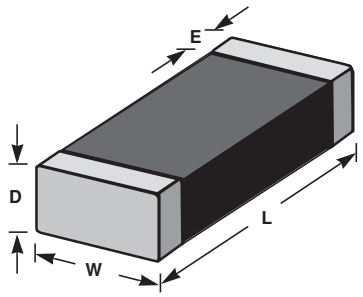
NOTE: Avoid metal runs in this area.

TABLE 1: PAD LAYOUT DIMENSIONS

	RECOMMENDED PAD SIZE DIMENSIONS							
	1206 SIZE DEVICE		0805 SIZE DEVICE		0603 SIZE DEVICE		0402 SIZE DEVICE	
DIMENSION	IN	MM	IN	MM	IN	MM	IN	MM
A	0.160	4.06	0.120	3.05	0.100	2.54	0.067	1.70
B	0.065	1.65	0.050	1.27	0.030	0.76	0.020	0.51
C	0.040	1.02	0.040	1.02	0.035	0.89	0.024	0.61

MLE Varistor Series

Mechanical Dimensions



DIMENSION	DEVICE DIMENSIONS							
	1206 SIZE		0805 SIZE		0603 SIZE		0402 SIZE	
	IN	MM	IN	MM	IN	MM	IN	MM
D Max	0.071	1.80	0.043	1.1	0.035	0.9	0.024	0.6
E	0.02±0.01	0.50±0.25	0.02±0.01	0.50±0.25	0.015±0.008	0.4±0.2	0.010±0.006	0.25±0.15
L	0.125±0.012	3.20±0.03	0.079±0.008	2.01±0.2	0.063±0.006	1.6±0.15	0.039±0.004	1.0±0.1
W	0.06±0.011	1.60±0.28	0.049±0.008	1.25±0.2	0.032±0.006	0.8±0.15	0.020±0.004	0.5±0.1

Ordering Information

VXXMLE TYPES

V 18 MLE 1206 X X X

DEVICE FAMILY
Littelfuse TVSS Device

MAXIMUM DC WORKING VOLTAGE

MULTILAYER SERIES DESIGNATOR

DEVICE SIZE:
i.e., 120 mil x 60 mil
(3mm x 1.5mm)

CAPACITANCE OPTION
No Letter: Standard
L: Low Capacitance Version

END TERMINATION OPTION
No Letter: Ag/Pt (Standard)
W: Ag/Pd
N: Nickel Barrier (0402-1210) For 0402 package size, Nickel Barrier termination is subject to availibility. Please contact a Littelfuse sales representative.

PACKING OPTIONS
A: Bulk Pack (not 0402 size)
H: 7in (178mm) Diameter Reel
T: 13in (330mm) Diameter Reel (not 0402 size)

Standard Shipping Quantities

DEVICE SIZE	"13"INCH REEL ("T"OPTION)	"7"INCH REEL ("H"OPTION)	BULK PACK ("A"OPTION)
1206	10,000	2,500	2500
0805	10,000	2,500	2500
0603	10,000	2,500	2500
0402	N/A	10,000	N/A

MLE Varistor Series

Tape and Reel Specifications

- Conforms to EIA - 481-1, Revision A
- Can be supplied to IEC publication 286 - 3

SYMBOL	DESCRIPTION	DIMENSIONS IN MILLIMETERS	
		0402 Size	0603, 0805, & 1206 Sizes
A_0	Width of Cavity	Dependent on Chip Size to Minimize Rotation.	
B_0	Length of Cavity	Dependent on Chip Size to Minimize Rotation.	
K_0	Depth of Cavity	Dependent on Chip Size to Minimize Rotation.	
W	Width of Tape	8 ±0.2	
F	Distance Between Drive Hole Centers and Cavity Centers	3.5 ±0.05	
E	Distance Between Drive Hole Centers and Tape Edge	1.75 ±0.1	
P_1	Distance Between Cavity Centers	2±0.05	4 ±0.1
P_2	Axial Drive Distance Between Drive Hole Centers & Cavity Centers	2 ±0.1	
P_0	Axial Drive Distance Between Drive Hole Centers	4 ±0.1	
D_0	Drive Hole Diameter	1.55 ±0.05	
D_1	Diameter of Cavity Piercing	N/A	1.05 ±0.05
T_1	Top Tape Thickness	0.1 Max