RoHS 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

- RoHS Compliant
- 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

Size

Metric	EIA
1005	0402
1608	0603
2012	0805
3216	1206

RoHS 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

	MAX CONTINUOUS WORKING VOLTAGE -55°C TO 125°C	PERFORMANCE SPECIFICATIONS (25 °C)					
		NOMINAL VOLTAGE		MAXIMUM CLAMPING VOLTAGE AT SPECIFIED CURRENT (8/20μS)	MAXIMUM ESD CLAMP VOLTAGE (NOTE 2)		TYPICAL CAPACITANCE AT 1MHz
	(NOTE 1) $V_{M(DC)}$	V_{NOM} AT 1mA DC		Vc	(NOTE 3) 8kV CONTACT	(NOTE 4) 15kV AIR	
PART NUMBER	(V)	MIN (V)	MAX (V)	(V)	Clamp (V)	Clamp (V)	(pF)
V18MLE0402	18	22	28	50 at 1A	<125	<160	<55
V18MLE0603	18	22	28	50 at 2A	<75	<85	<125
V18MLE0603L	18	22	28	50 at 1A	<100	<140	<100
V18MLE0805	18	22	28	50 at 5A	<70	<75	<500
V18MLE0805L	18	22	28	50 at 2A	<75	<135	<100
V18MLE1206	18	22	28	50 at 10A	<65	<65	<1700

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.
6. Leakage current ratings are at 18 VDC and 25μA maximum.

RoHS 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.

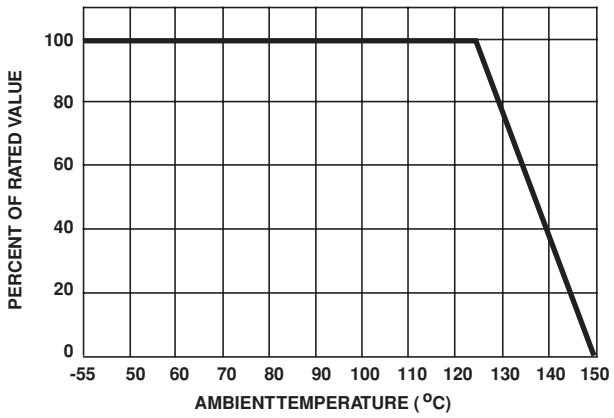


FIGURE 1. PEAK CURRENT AND ENERGY DERATING CURVE

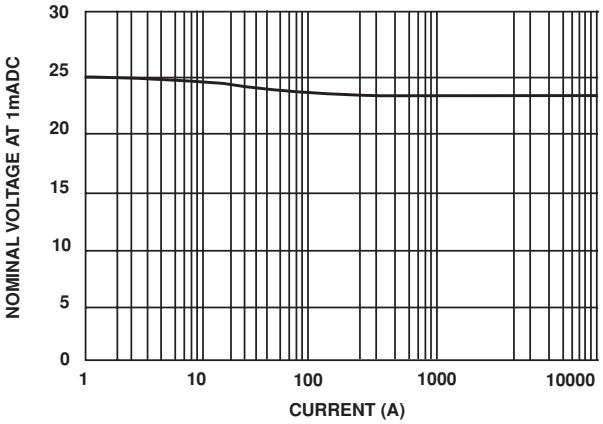


FIGURE 2. NOMINAL VOLTAGE STABILITY TO MULTIPLE ESD IMPULSES (8KV CONTACT DISCHARGES PER IEC 61000-4-2)

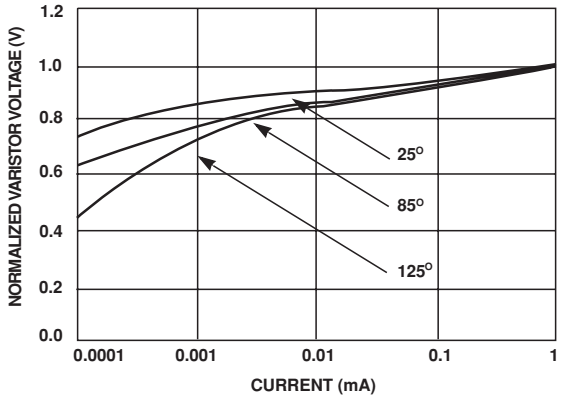


FIGURE 3. STANDBY CURRENT AT NORMALIZED VARISTOR VOLTAGE AND TEMPERATURE

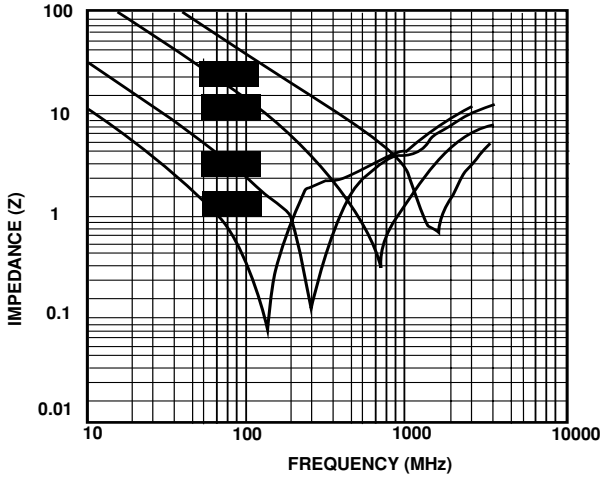


FIGURE 4. IMPEDANCE (Z) vs FREQUENCY TYPICAL CHARACTERISTIC

RoHS MLE Varistor Series

Soldering Recommendations

Lead (Pb) Soldering Recommendations

The principal techniques used for the soldering of components in surface mount technology are IR Re-flow & Wave soldering. Typical profiles are shown in Figures 5 & 6

The termination options available for each solder technique are:

Reflow	Wave
1. Nickel Barrier (preferred)	1. Nickel Barrier (preferred)
2. Silver/Platinum	2. Silver/Palladium

The recommended solder for the ML 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.

When using a reflow process, care should be taken to ensure that the ML 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 solderís peak temperature is essential to minimize thermal shock.

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.

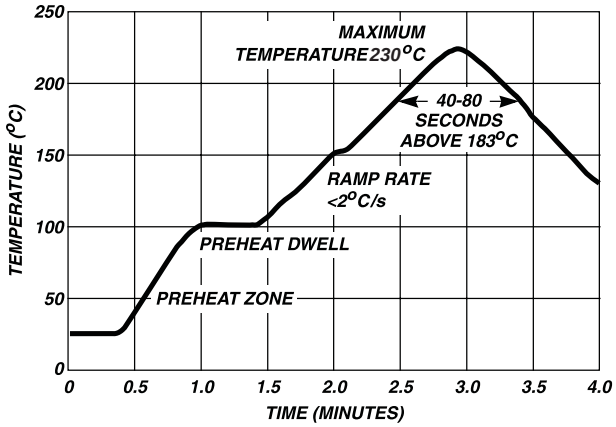


FIGURE 5. REFLOW SOLDER PROFILE

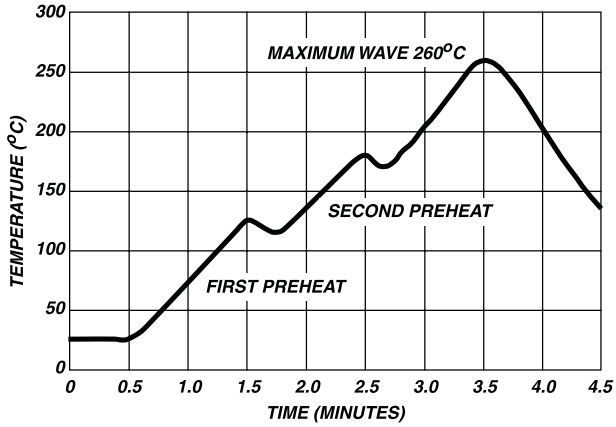


FIGURE 6. WAVE SOLDER PROFILE

Lead-Free (Pb-free) Soldering Recommendations

Littelfuse offers the Nickel-Barrier termination finish for the optimum Pb-free solder performance.

The preferred solder is 96.5/3.0/0.5 (SnAgCu) with an RMA flux, but there is a wide selection of pastes & fluxes available with which the nickel barrier parts should be compatible.

The reflow profile must be constrained by maximums shown in Figure7. For Pb-free Wave soldering, Figure 6 still applies.

Note: the Pb-free paste, flux & profile were used for evaluation purposes by Littelfuse, based upon industry standards & practices. There are multiple choices of all three available, it is advised that the customer explores the optimum combination for their process as processes vary considerably from site to site.

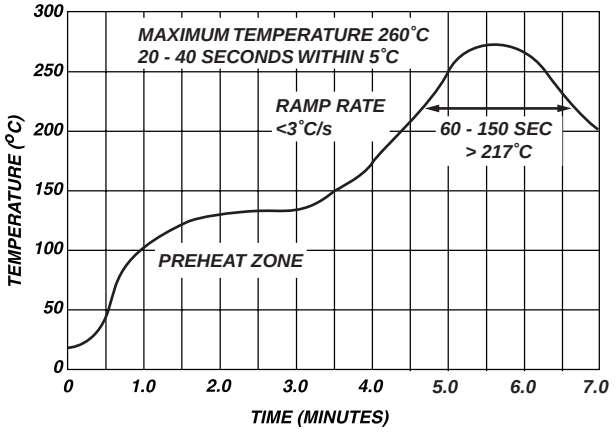
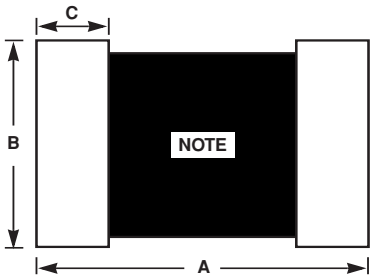


FIGURE 7. LEAD-FREE RE-FLOW PROFILE

RoHS MLE Varistor Series

Recommended Pad Outline



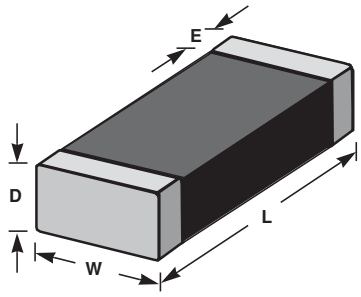
NOTE: Avoid metal runs in this area.

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

RoHS 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
W: Ag/Pd
N: Nickel Barrier (0402-1206)

PACKING OPTIONS
A: Bulk Pack (not 0402 size)
H: 7in (178mm) Diameter Reel (0603-1206 sizes only)
R: 7in (178mm) Diameter Reel (0402 sizes only)
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

RoHS 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