

Multilayer Surface Mount ESD Suppressor/Filter

April 1997

Features

- Rated for ESD (IEC-1000-4-2)
- Characterized for Impedance and Capacitance
- -55°C to 125°C Operating Temperature Range
- Leadless 0603, 0805, and 1206 Chip Sizes
- Operating Voltage up to 18V_{M(DC)}
- Multilayer Ceramic Construction

Applications

- Protection of Components and Circuits Sensitive to ESD Transients Occurring on Power Supply, Control and Signal Lines
- Suppression of ESD Events Such as Specified in IEC-1000-4-2 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

Description

The MLE Series is a family of Transient Voltage Suppression devices based on the Harris Multilayer fabrication technology. These components are designed to suppress ESD events, including those specified in IEC1000-4-2 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.

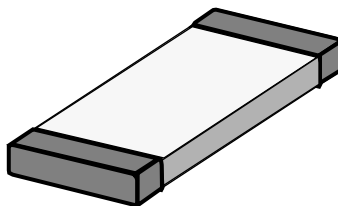
Additionally, the fabrication method and materials of these devices result in capacitance characteristics suitable for high frequency attenuation/low-pass filter circuit functions, thereby, providing suppression and filtering in a single device.

The MLE Series is manufactured from semiconducting ceramics, providing bidirectional voltage clamping and is supplied in leadless, surface mount form compatible with modern reflow and wave soldering procedures.

Harris manufactures other Multilayer Series products. See the ML Series Data Sheet (Harris AnswerFAX, 407-724-7800, doc. #2461) for higher energy/peak current transient applications. See the AUML Series for automotive applications (AnswerFAX doc. #3387).

Packaging

MLE SERIES (LEADLESS CHIP)



MLE 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

MODEL NUMBER	MAXIMUM CONTINUOUS WORKING VOLTAGE -55°C to 125°C	PERFORMANCE CHARACTERISTICS (25°C)						
		NOMINAL VOLTAGE		TYPICAL ESD CLAMP VOLTAGE (NOTE 2)		TYPICAL CAPACITANCE AT 1MHz (NOTE 5)	MAXIMUM LEAKAGE	
	V _{NOM} AT 1mA DC		I _L MAX				AT APPLIED VOLTAGE	
	(V)	MIN (V)	MAX (V)	(8kV CONTACT NOTE 3) PEAK (V)	(15kV AIR NOTE 4) PEAK (V)	(pF)	(μA)	V _{DC}
V18MLE0603	18	22	28	<140	<85	<100	0.1	3.5
							0.3	5.5
							5.0	15
							25	18
V18MLE0805	18	22	28	<95	<75	<500	0.2	3.5
							0.5	5.5
							5.0	15
							25	18
V18MLE1206	18	22	28	<75	<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 Sales.
2. Tested with IEC-1000-4-2 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 Sales.

Typical Performance Curves

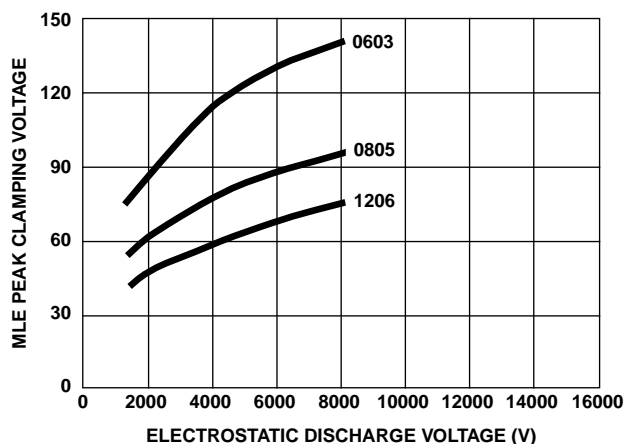


FIGURE 1. CLAMPING CHARACTERISTIC FOR CONTACT METHOD ESD PER IEC-1000-4-2, RANGE 0.5kV TO 8.0kV

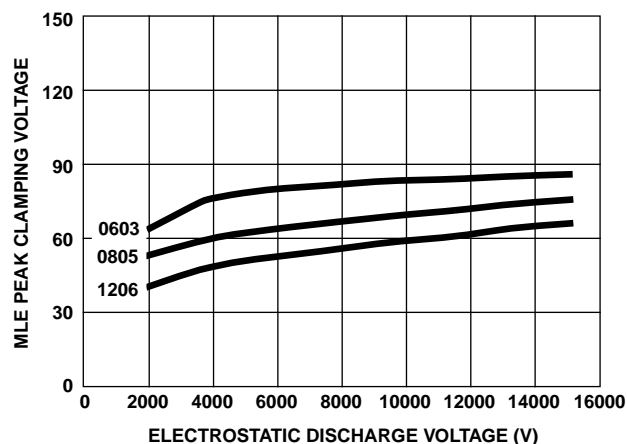


FIGURE 2. CLAMPING CHARACTERISTIC FOR AIR DISCHARGE METHOD ESD PER IEC1000-4-2, RANGE 2kV TO 15kV

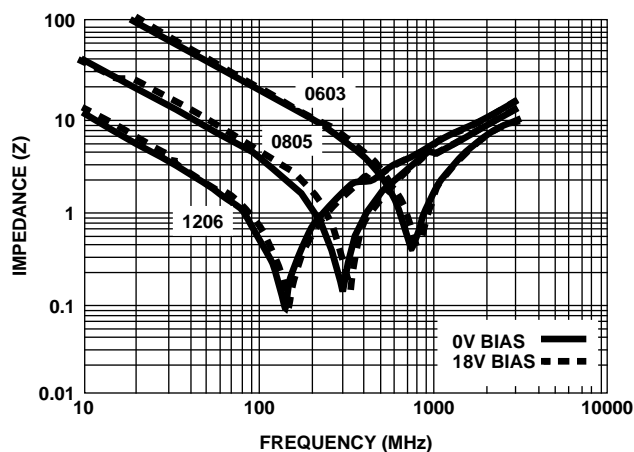


FIGURE 3. IMPEDANCE (Z) vs FREQUENCY TYPICAL CHARACTERISTIC WITH 0V AND 18V_{DC} BIAS

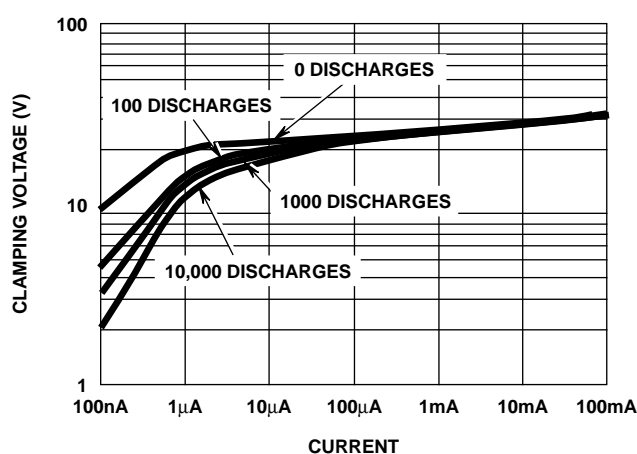


FIGURE 4. V18MLE0805 LEAKAGE CHARACTERISTIC STABILITY AFTER 10,000 x 8kV CONTACT ESD IMPULSES

NOTE: Figure 4 is an example of device clamping characteristics in the Standby (or "Leakage") current region of operation. It is intended to illustrate the stability of the device after the application of multiple, 8kV ESD CONTACT discharges per IEC 1000-4-2. Note that the discharges were applied in one polarity only and the measurements were made in that same polarity.

Soldering Recommendations

The principal techniques used for the soldering of components in surface mount technology are Infra Red (IR) Reflow, Vapour Phase Reflow, 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 Reflow, 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.

With the MLE suppressor, the recommended solder is a 62/36/2 (Sn/Pb/Ag), 60/40 (Sn/Pb), or 63/37 (Sn/Pb). Harris 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.

MLE Series

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 solders 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 gradually cool to less than 50°C before cleaning.

For reflow soldering operations, the standard silver platinum (Ag/Pt) termination finish is recommended.

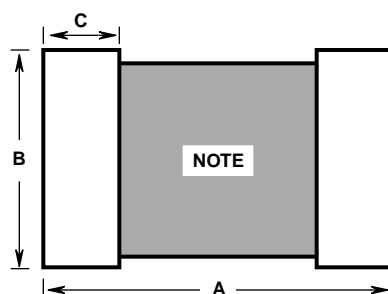
For wave soldering operations, the optional silver palladium (Ag/Pd) termination finish is recommended. To order append "W" to standard model number, e.g., V18MLE0603W.

RECOMMENDED TEMPERATURE PROFILE FOR VAPOR PHASE REFLOW	
TEMPERATURE (°C)	TIME (SECONDS)
25-90	8
90-150	13
150-222	3
222-222	10
222-80	7
80-25	10

RECOMMENDED TEMPERATURE PROFILE FOR WAVE SOLDER	
TEMPERATURE (°C)	TIME (SECONDS)
25-125	60
125-180	60
180-260	60
260-260	5
260-180	60
180-80	60
80-25	60

RECOMMENDED TEMPERATURE PROFILE FOR INFRARED (IR) REFLOW	
TEMPERATURE (°C)	TIME (SECONDS)
25-60	60
60-120	60
120-155	30
155-155	60
155-220	60
220-220	10
220 - 50	60

Recommended Pad Outline

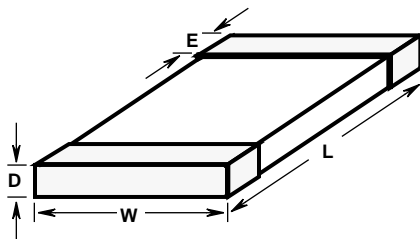


NOTE: Avoid metal runs in this area.

SYMBOL	RECOMMENDED PAD SIZE DIMENSIONS					
	FOR 1206 SIZE DEVICE		FOR 0805 SIZE DEVICE		FOR 0603 SIZE DEVICE	
	IN	MM	IN	MM	IN	MM
A	0.203	5.15	0.144	3.66	0.11	2.8
B	0.103	2.62	0.084	2.13	0.064	1.62
C	0.065	1.65	0.058	1.48	0.044	1.12

MLE Series

Dimensional Outline



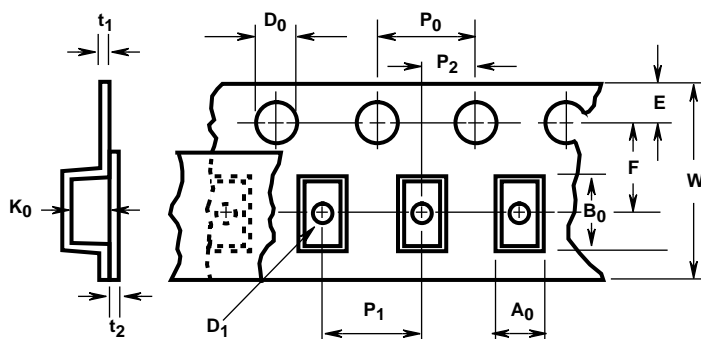
SYMBOL	DEVICE DIMENSIONS					
	1206 SIZE		0805 SIZE		0603 SIZE	
	INCH	MM	INCH	MM	INCH	MM
D Max.	0.071	1.80	0.043	1.1	0.035	0.9
E	0.02 ±0.01	0.50 ±0.25	0.02 to ±0.01	0.50 to ±0.25	0.015 ±0.008	0.4 ±0.2
L	0.125 ±0.012	3.20 ±0.03	0.079 ±0.008	2.01 ±0.2	0.063 ±0.006	1.6 ±0.15
W	0.06 ±0.011	1.60 ±0.28	0.049 ±0.008	1.25 ±0.2	0.032 ±0.006	0.8 ±0.15

Tape and Reel Specifications

- Conforms to EIA - 481, Revision A
- Can be Supplied to IEC Publication 286 - 3

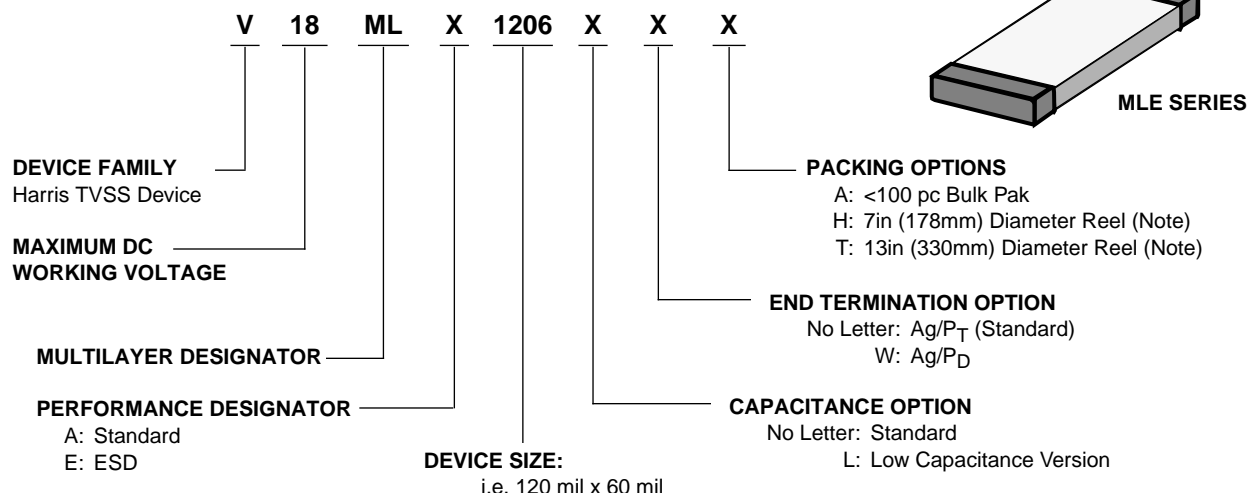
SYMBOL	DESCRIPTION	MILLIMETERS
A ₀	Width of Cavity	Dependent on Chip Size to Minimize Rotation.
B ₀	Length of Cavity	Dependent on Chip Size to Minimize Rotation.
K ₀	Depth of Cavity	Dependent on Chip Size to Minimize Rotation.
W	Width of Tape	8 ± 0.2
F	Distance Between Drive Hole Centers and Cavity Centers	3.5 ± 0.5
E	Distance Between Drive Hole Centers and Tape Edge	1.75 ± 0.1
P ₁	Distance Between Cavity Center	4 ± 0.1
P ₂	Axial Distance Between Drive Hole Centers and Cavity Centers	2 ± 0.1
P ₀	Axial Distance Between Drive Hole Centers	4 ± 0.1
D ₀	Drive Hole Diameter	1.55 ± 0.05
D ₁	Diameter of Cavity Piercing	1.05 ± 0.05
t ₁	Embossed Tape Thickness	0.3 max
t ₂	Top Tape Thickness	0.1 max

NOTE: Dimensions in millimeters.



Ordering Information

VXXMLE TYPES



NOTE: Quantity per reel depending upon device size.

End - Termination Options

For reflow soldering operations, the standard silver platinum (Ag/Pt) termination finish is recommended. To order, maintain the standard model number, e.g., V18MLE0603.

For wave soldering operations, the optional silver palladium (Ag/Pd) termination finish is recommended. To order, append "W" to the standard model number, e.g., V18MLE0603W.

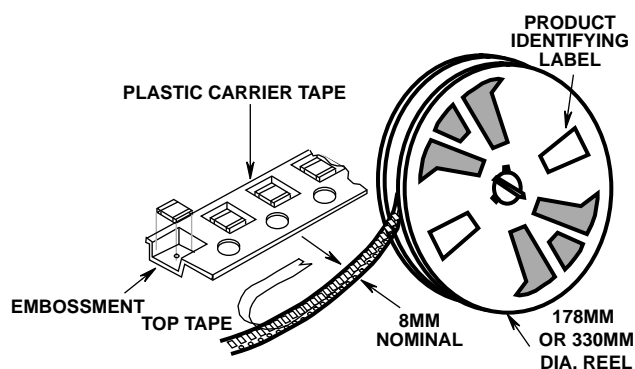
Tape and Reel

The MLE Series of transient suppressors are packaged in tape and reel. The standard 330 millimeter (13 inch) reel utilized contains 10000 pieces for the 1206, 0805 and 0603 chips. To order add "T" to the part number, e.g. V18MLE1206T or V18MLE1206WT.

Other Packaging

Option 1: 178 millimeter (7 inch) reels containing 2500, pieces are available. To order add "H" to the part number, e.g., V18MLE1206H.

Option 2: For small sample quantities (less than 100 pieces) the units are shipped bulk pack. To order add "A" to the part number, e.g., V18MLE1206A.



Explanation of Terms

Rated DC Voltage ($V_{M(DC)}$)

This is the maximum continuous DC voltage which may be applied up to the maximum operating temperature of the device. The rated DC operating voltage (working voltage) is also used as the reference point for leakage current. This voltage is always less than the breakdown voltage of the device.

Leakage (I_L) at Rated DC Voltage

In the nonconducting mode, the device is at a very high impedance ($10^6\Omega$) and appears as an almost open circuit in the system. The leakage current drawn at this level is very low. See Device Ratings.

Nominal Voltage ($V_{N(DC)}$)

This is the voltage at which the device changes from the off state to the on state and enters its conduction mode of operation. The voltage is usually characterized at the 1mA point and has a specified minimum and maximum voltage listed.

Clamping Voltage (V_C)

This is the peak voltage appearing across the suppressor when measured at conditions of specified pulse current and specified waveform. See Device Ratings.

Capacitance (C)

This is the capacitance of the device at a specified frequency (1MHz) and bias ($1V_{P-P}$). See Device Ratings.

IEC 1000-4-2

The electrostatic discharge requirements portion of the electromagnetic compatibility standard written by the International Electrotechnical Commission. The specification describes a specific human body model test conditions and methods.

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