# MLN SurgeArray™ Suppressor

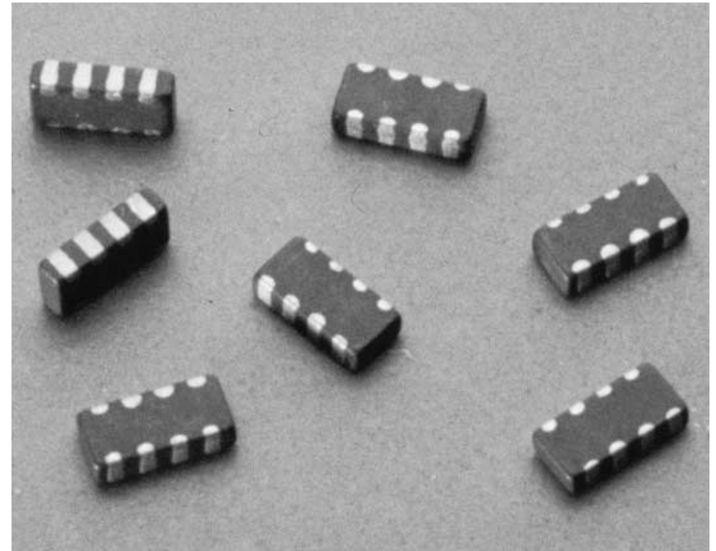
The MLN SurgeArray™ Suppressor is designed to help protect components from transient voltages that exist at the circuit board level. This device provides four independent suppressors in a single “1206” leadless chip in order to reduce part count and placement time as well as save space on printed circuit boards.

SurgeArray™ devices are intended to suppress ESD, EFT and other transients in order to protect integrated circuits or other sensitive components operating at any voltage up to $18V_{DC}$. SurgeArray devices are rated to the IEC 61000-4-2 human body model ESD to help products attain EMC compliance. The array offers excellent isolation and low crosstalk between sections.

The inherent capacitance of the SurgeArray Suppressor permits it to function as a filter/suppressor, thereby replacing separate zener/ capacitor combinations.

The MLN array is manufactured using the Littelfuse Multilayer technology process and is similar to the Littelfuse ML and MLE Series of discrete leadless chips.

The MLN can also be provided in a Dual version. Contact Littelfuse for information.



## Features

- Four Individual Devices in One 1206 Chip
- ESD Rated to IEC 61000-4-2 (Level 4)
- AC Characterized for Impedance and Capacitance
- Low Adjacent Channel Crosstalk, -55dB at 10MHz (Typ)
- Low Leakage (6nA at 5.5V, 30nA at 15V)
- Operating Voltage up to $18V_{M(DC)}$
- -55°C to 125°C Operating Temperature Range
- Low-Profile, PCMCIA Compatible

## Applications

- Data, Diagnostic I/O Ports
- Analog Signal/Sensor Lines
- Portable/Hand-Held Products
- Mobile Communications/Cellular Phones
- Computer/DSP Products
- Industrial Instruments Including Medical

# MLN SurgeArray™ Suppressor

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

| | MLN ARRAY | 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 Any Single Section

| PART NUMBER | MAX RATINGS (125°C) | | PERFORMANCE SPECIFICATIONS (25°C) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MAXIMUM CONTINUOUS WORKING VOLTAGE | MAXIMUM NON-REPETITIVE SURGE CURRENT (8/20µs) | MAXIMUM CLAMPING VOLTAGE (AT NOTED 8/20µs) CURRENT | MAXIMUM NON-REPETITIVE SURGE ENERGY (10/1000µs) | TYPICAL ESD SUPPRESSION VOLTAGE (NOTE 1) | | | NOMINAL VOLTAGE AT 1mA DC CURRENT | | CAPACITANCE AT 1MHz (1V p-p) | |
| | $V_{M(DC)}$ | $I_{TM}$ | $V_C$ (See Fig. 3) | $W_{TM}$ | (NOTE 2) 8kV CONTACT | | (NOTE 3) 15kV AIR | $V_{N(DC)}$ MIN | $V_{N(DC)}$ MAX | (NOTE 4) C | |
| | | | | | Peak | Clamp | Peak | | | TYP | MAX |
| | (V) | (A) | (V) | (J) | (V) | (V) | (V) | (V) | (V) | (pF) | (pF) |
| V5.5MLN41206 | 5.5 | 30 | 15.5 at 2A | 0.1 | 60 | 35 | 45 | 7.1 | 9.3 | 430 | 520 |
| V9MLN41206 | 9 | 30 | 23 at 2A | 0.1 | 95 | 50 | 75 | 11.0 | 16.0 | 250 | 300 |
| V14MLN41206 | 14 | 30 | 30 at 2A | 0.1 | 110 | 55 | 85 | 15.9 | 20.3 | 140 | 175 |
| V18MLN41206 | 18 | 30 | 40 at 2A | 0.1 | 165 | 60 | 100 | 22.0 | 28.0 | 100 | 125 |
| V18MLN41206L | 18 | 20 | 50 at 1A | 0.05 | 200 | 95 | 130 | 25.0 | 35.0 | 45 | 75 |

NOTES:

1. Tested to IEC61000-4-2 Human Body Model (HBM) discharge test circuit. See explanation of Terms on page 7.
2. Direct discharge to device terminals (IEC preffered test method). See figure 2.
3. Corona discharge through air (represents actual ESD event)
4. Capacitance may be customized, contact Sales.

## Temperature Derating

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

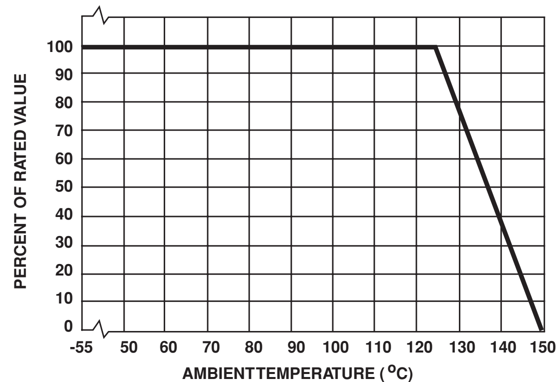
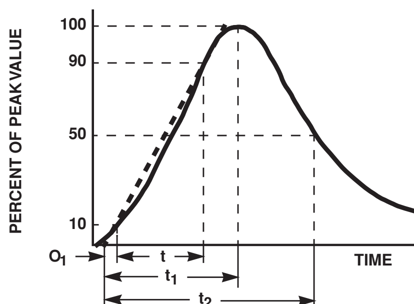



FIGURE 1. PEAK CURRENT AND ENERGY DERATING CURVE



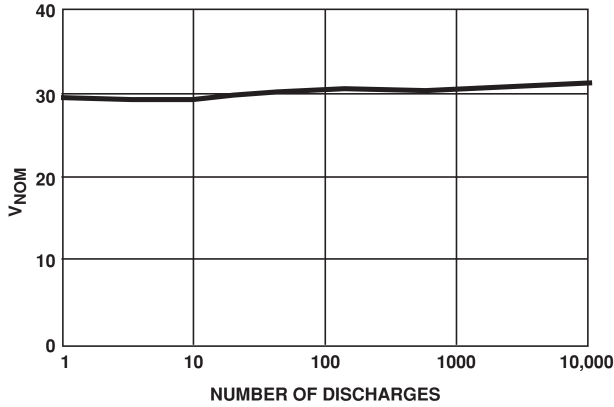

$O_1$ = VIRTUAL ORIGIN OF WAVE
t = TIME FROM 10% TO 90% OF PEAK
$t_1$ = VIRTUAL FRONT TIME = 1.25 x t
$t_2$ = VIRTUAL TIME TO HALF VALUE (IMPULSE DURATION)

EXAMPLE:
FOR AN 8/20µs CURRENT WAVEFORM:
8µs = $t_1$ = VIRTUAL FRONT TIME
20µs = $t_2$ = VIRTUAL TIME TO HALF VALUE

FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM FOR CLAMPING VOLTAGE

# MLN SurgeArray™ Suppressor

## *Typical Performance Curves* Any Single Section



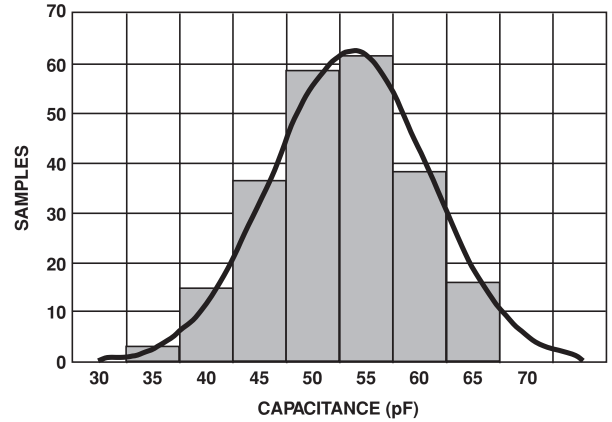




FIGURE 4. PRODUCT DISTRIBUTION OF CAPACITANCE (1MHz)



## *Typical Performance Curves* Any Single Section

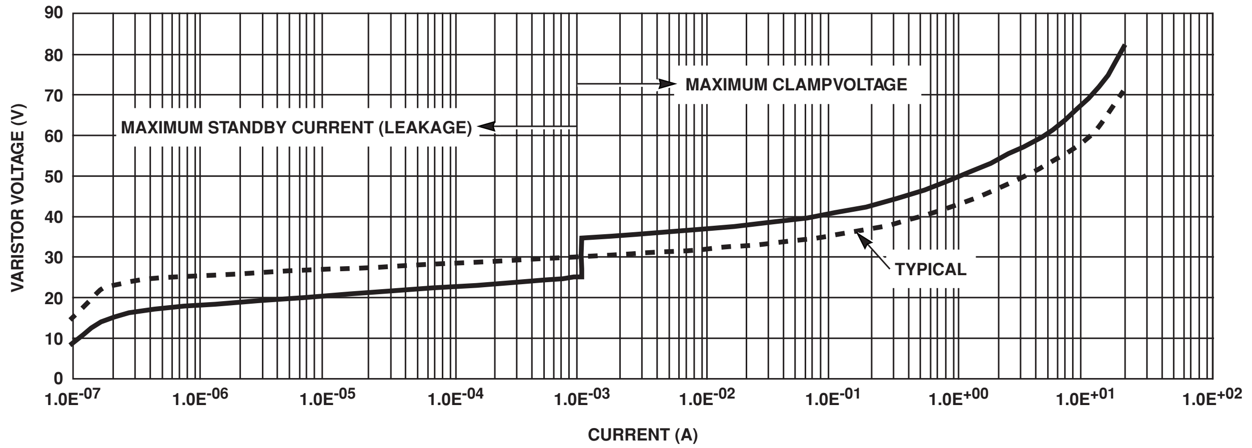



FIGURE 5. V-I CHARACTERISTICS

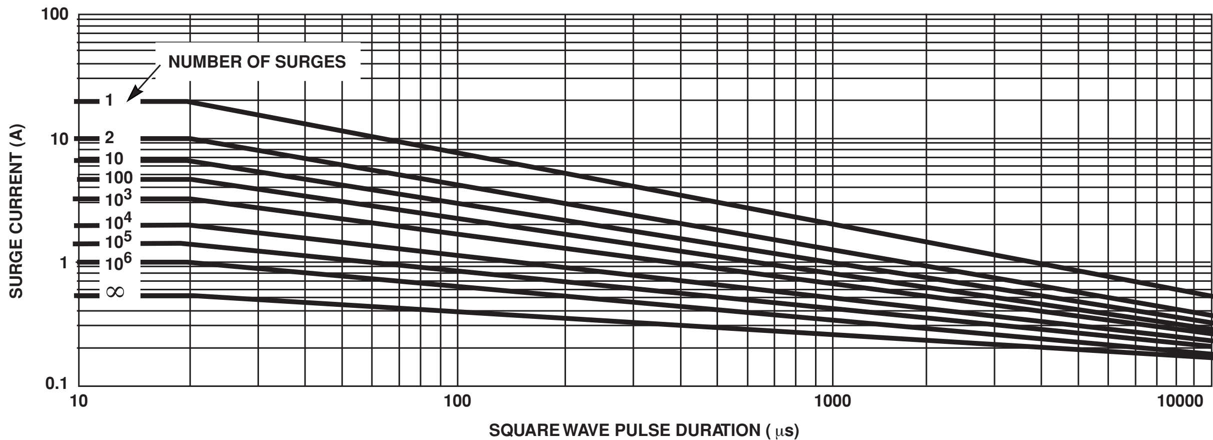



FIGURE 6. PULSE RATING FOR LONG DURATION SURGES (ANY SINGLE SECTION)

# MLN SurgeArray™ Suppressor

## *Typical Performance Curves* Any Single Section (Continued)

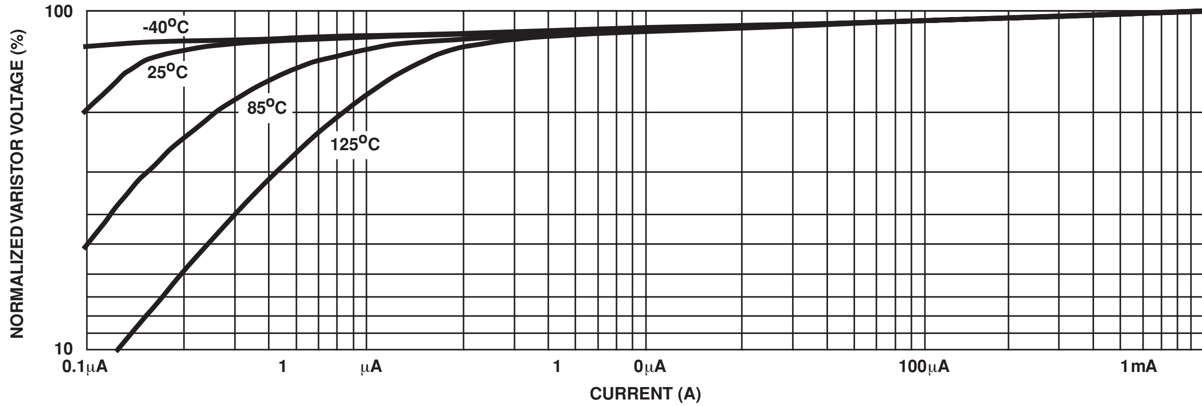



FIGURE 7. STANDBY CURRENT AT NORMALIZED VARISTOR VOLTAGE AND TEMPERATURE (ANY SINGLE SECTION)

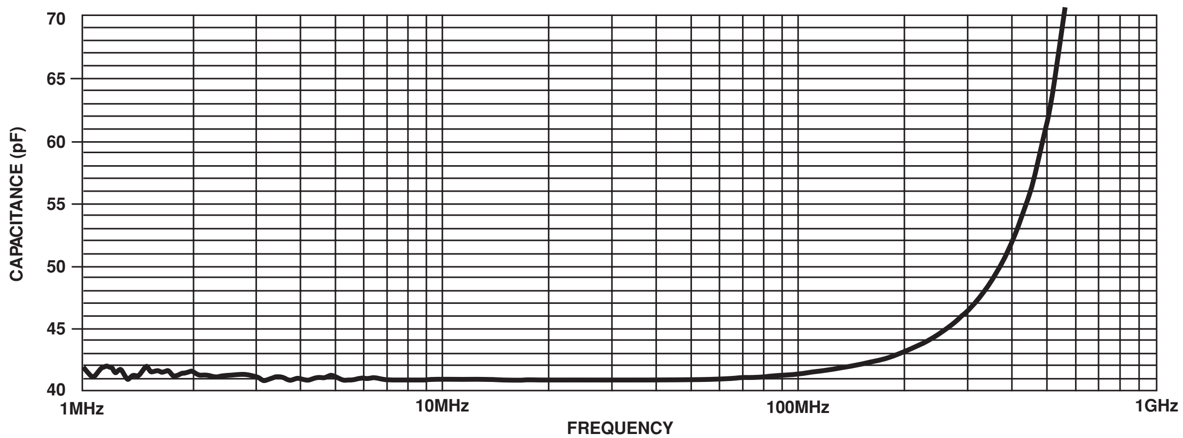



FIGURE 8. CAPACITANCE vs FREQUENCY

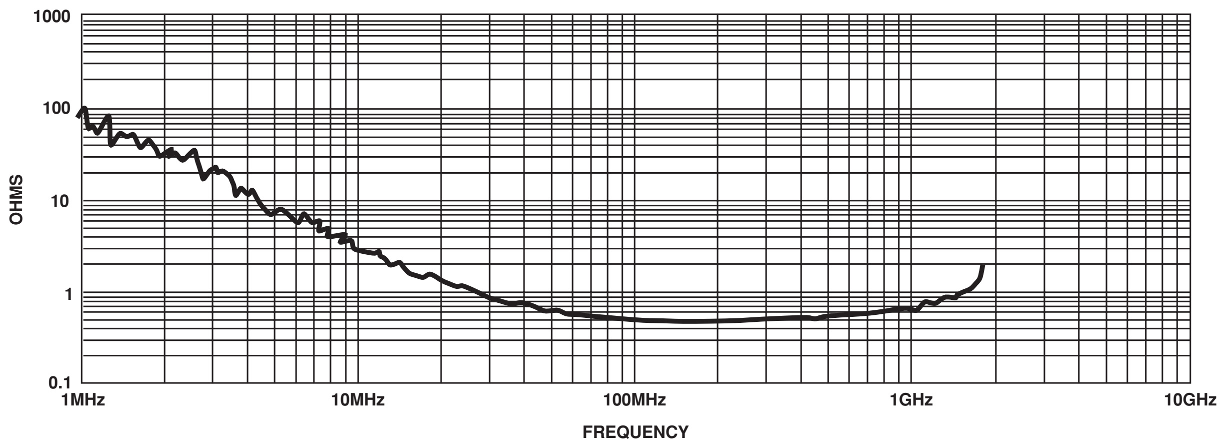



FIGURE 9. EQUIVALENT SERIES RESISTANCE

# MLN SurgeArray™ Suppressor

## Typical Performance Curves Any Single Section (Continued)

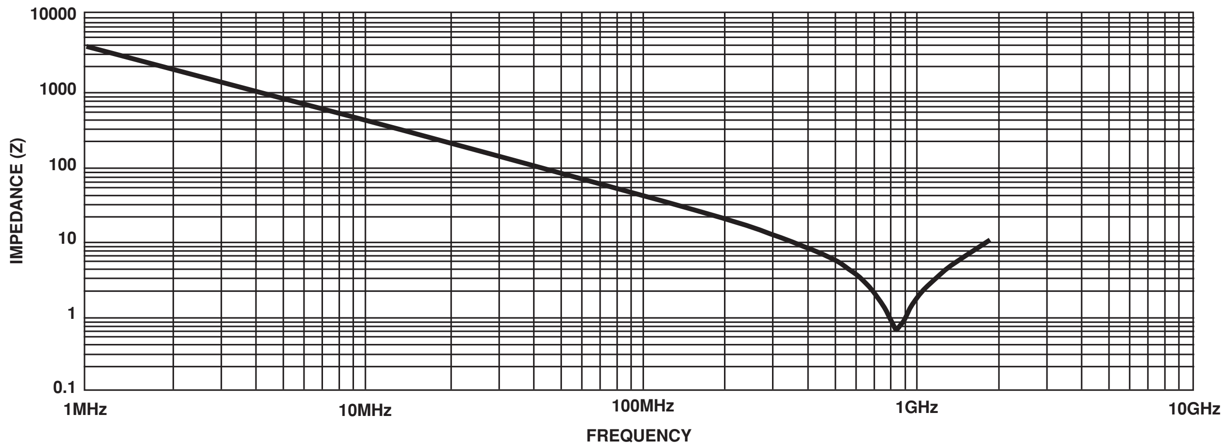



FIGURE 10. IMPEDANCE vs FREQUENCY

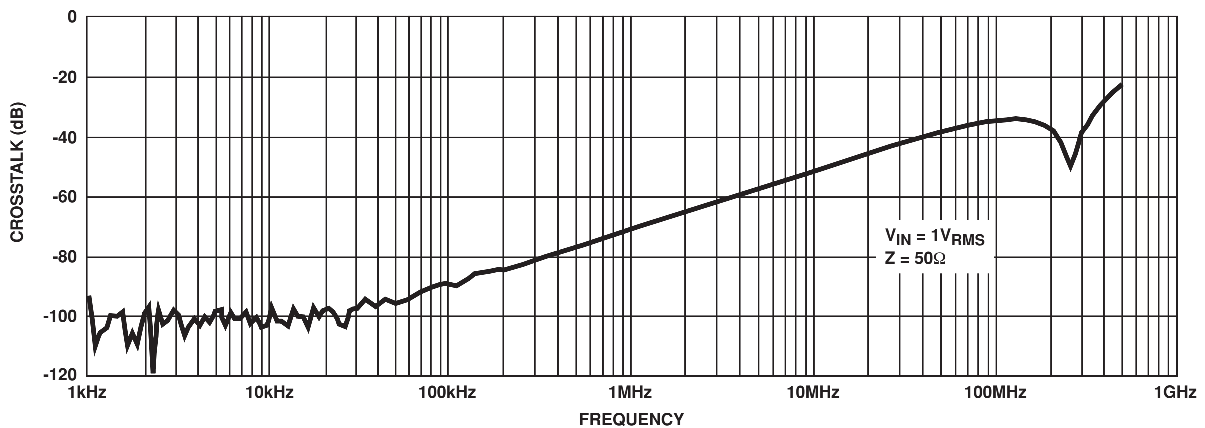



FIGURE 11. ADJACENT CHANNEL CROSSTALK



## Soldering Recommendations

The principal techniques used for the soldering of components in surface mount technology are Infrared (IR) Reflow, Vapour Phase Reflow, and Wave Soldering. Typical profiles are shown in Figures 12, 13 and 14. When wave soldering, the MLN 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.

The recommended solder for the MLN 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 MLN 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 MLN array 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.

# MLN SurgeArray™ Suppressor

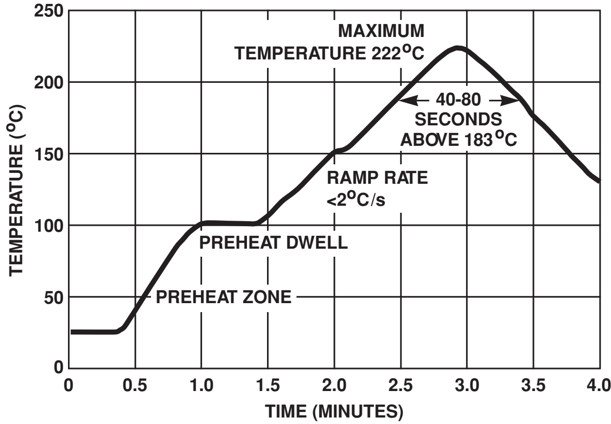



FIGURE 12. IR REFLOW SOLDER PROFILE

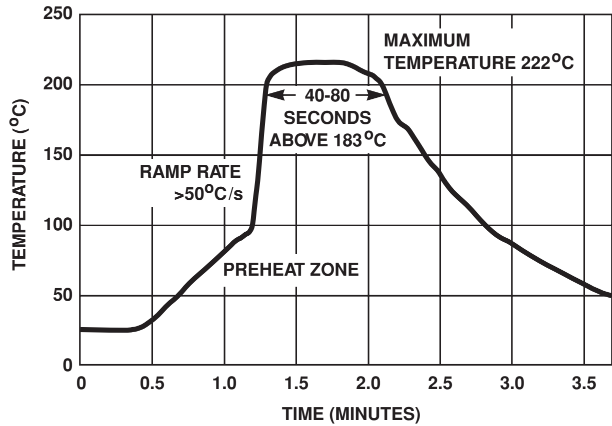



FIGURE 14. VAPOR PHASE SOLDER PROFILE

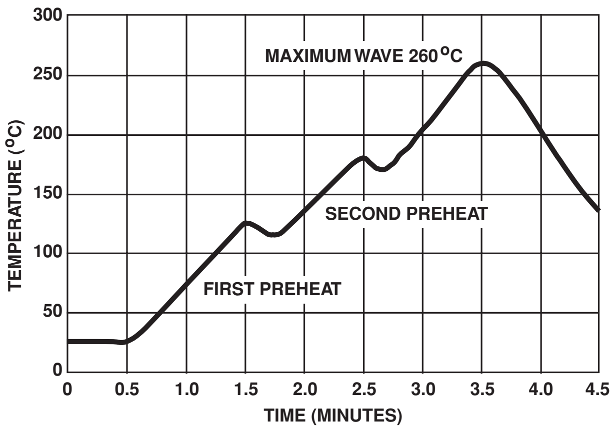



FIGURE 13. WAVE SOLDER PROFILE

## Recommended Pad Outline

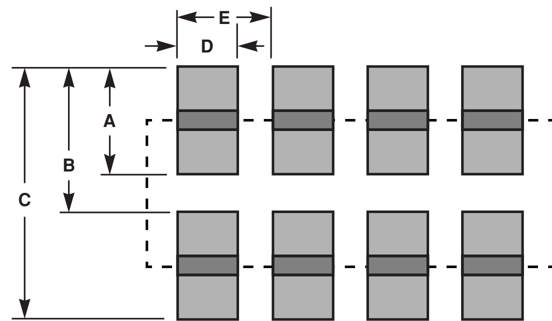
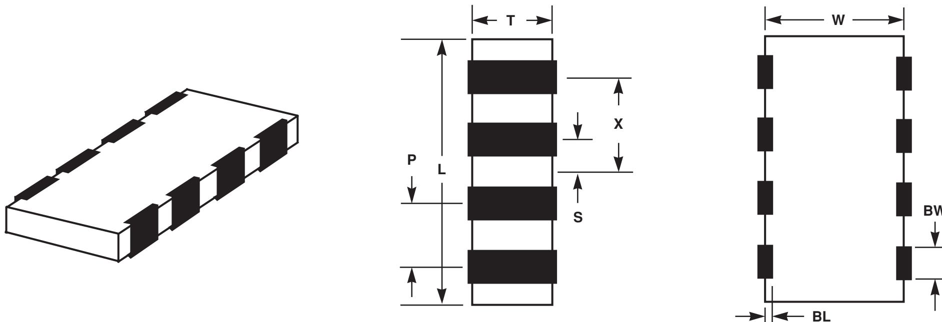



TABLE 1. PAD LAYOUT DIMENSIONS

| DIMENSION | A | B | C | D | E |
|---|---|---|---|---|---|
| Millimeters | 0.89 | 1.65 | 2.54 | 0.46 | 0.79 |
| Inches | 0.035 | 0.065 | 0.100 | 0.018 | 0.030 |

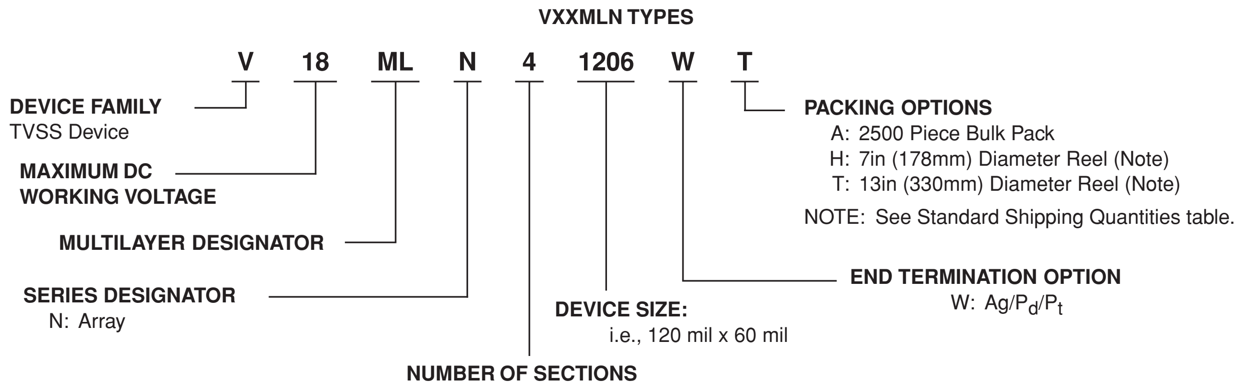
## Mechanical Dimensions




| | L | W | T | BW | BL | P | X | S |
|---|---|---|---|---|---|---|---|---|
| Inch | 0.126 ±0.008 | 0.063 ±0.008 | 0.053 Max | 0.016 ±0.004 | 0.007 +0.01/- 0.002 | 0.030 Ref | 0.045 ±0.004 | 0.015 ±0.004 |
| Millimeter | 3.2 ±0.2 | 1.6 ±0.2 | 1.35 Max | 0.41 ±0.1 | 0.18 +0.25/-0.05 | 0.76 Ref | 1.14 ±0.1 | 0.38 ±0.1 |

# MLN SurgeArray™ Suppressor

## Ordering Information



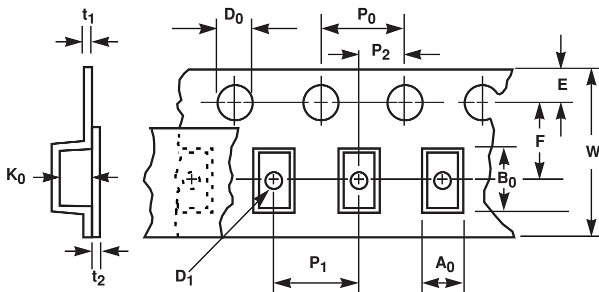


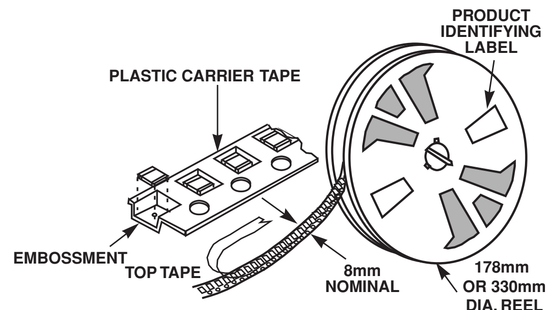

## Tape and Reel Specifications

- 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.




## Standard Shipping Quantities

| DEVICE SIZE | "13" INCH REEL ("T" OPTION) | "7" INCH REEL ("H" OPTION) | BULK PACK ("A" OPTION) |
|---|---|---|---|
| 1206 | 10,000 | 2,500 | 2,500 |