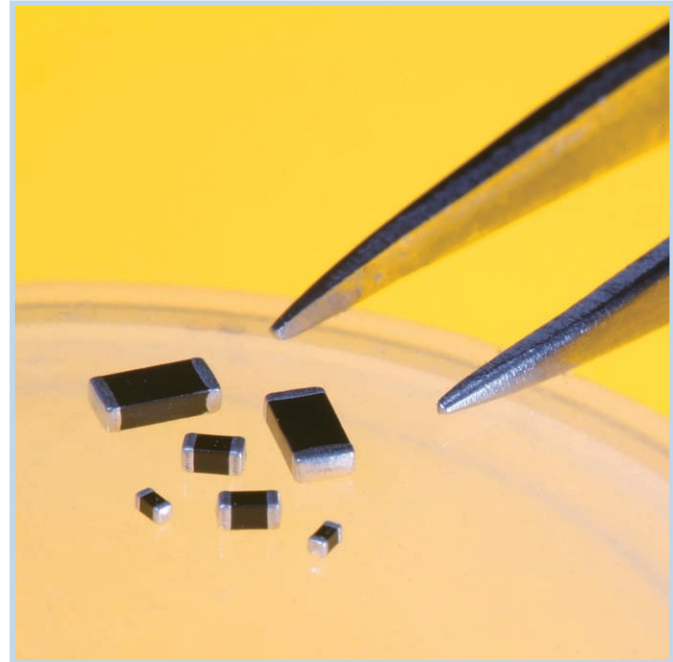




# Multi Layer Varistors

Multi Layer Varistors (MLVs) are small, leadless, surface mount components made of multiple layers of Zinc Oxide with electrodes between them. They are used to help protect integrated circuits and other sensitive equipment. Their small size is suitable for high density printed circuit boards.

Tyco Electronics also offers the “E” series, which is a family of low capacitance MLVs. They provide ESD protection in high data rate applications.



## Benefits

- Standard series helps protect sensitive equipment against damage caused by transients and other events such as, ESD (electrostatic discharge), EMC (electromagnetic compatibility), and EOS (electrical over stress)
- “E” series helps protect sensitive equipment against damage caused by typical ESD events
- Cost efficient assembly and protection
- Resistance to standard wave solder fluxes and provides excellent solderability
- Space savings
- Longer battery life due to low leakage current

## Features

- RoHS compliant
- Halogen free (refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm)
- Bi-directional clamping
- Compatible with standard surface-mount methods
- Low and stable leakage current
- Low-clamping voltage
- Quick response time (<1ns)
- High transient current capability
- “E” series low capacitance

## Applications

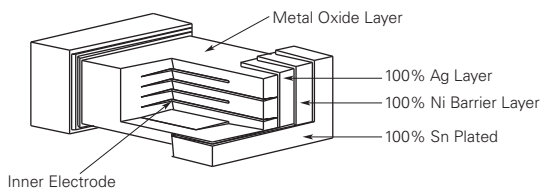
**Standard series: ESD, EMC and EOS protection of:**

- Computer I/O ports and interfaces (USB, IEEE 1394, etc...)
- Portable devices
- Automotive electronic circuits
- Telecom equipment
- Medical instruments

**“E” series: ESD protection of:**

- High-speed computer I/O ports and interfaces (USB, IEEE 1394, etc...)
- Portable devices
- Telecom equipment

**Figure VM1 Construction for Multi Layer Varistors**



**Table VM1 Dimensions for Multi Layer Varistors in Millimeters (Inches)**

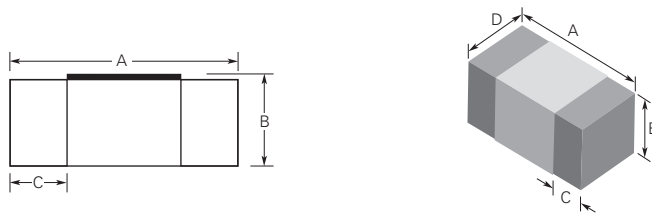
**Multi Layer Varistors Standard Series**

Part Number	Length A		Height B		Terminal Width C		Width D	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<b>Size 0402 (1005mm)</b>								
MLV0402-080M-C221	0.85 (0.033)	1.15 (0.045)	0.4 (0.016)	0.6 (0.024)	0.1 (0.004)	0.4 (0.016)	0.4 (0.016)	0.6 (0.024)
MLV0402-250K-C400	0.85 (0.033)	1.15 (0.045)	0.4 (0.016)	0.6 (0.024)	0.1 (0.004)	0.4 (0.016)	0.4 (0.016)	0.6 (0.024)
<b>Size 0603 (1608mm)</b>								
MLV0603-130M-C201	1.4 (0.060)	1.8 (0.070)	0.6 (0.024)	1.0 (0.040)	0.1 (0.004)	0.5 (0.020)	0.6 (0.024)	1.0 (0.040)
<b>Size 1206 (3216mm)</b>								
MLV1206-700K	3.0 (0.118)	3.4 (0.134)	– –	1.7 (0.067)	0.25 (0.010)	0.75 (0.030)	1.4 (0.060)	1.8 (0.070)

**Multi Layer Varistors "E" Series**

Part Number	Length A		Height B		Terminal Width C		Width D	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<b>Size 0402 (1005mm)</b>								
MLV0402-180-E030	0.85 (0.033)	1.15 (0.045)	0.4 (0.016)	0.6 (0.024)	0.1 (0.004)	0.4 (0.016)	0.4 (0.016)	0.6 (0.024)
MLV0402-120-E120	0.85 (0.033)	1.15 (0.045)	0.4 (0.016)	0.6 (0.024)	0.1 (0.004)	0.4 (0.016)	0.4 (0.016)	0.6 (0.024)

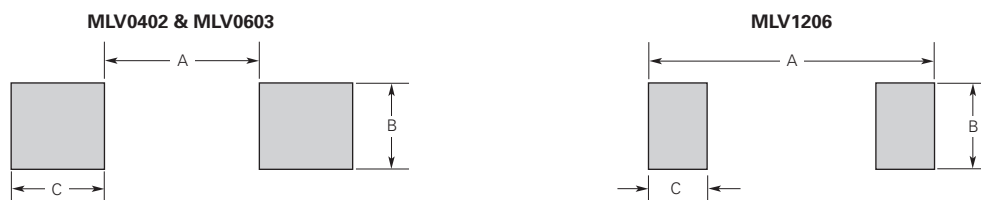
**Figure VM2 Dimension Figures for Multi Layer Varistors**



**Table VM2 Recommended Pad Layout for Multi Layer Varistors in Millimeters (Inches)**

Part Number	Chip Size	A	B	C
MLV0402 & MLV0603	0402 (1005)	0.35 (0.014)	0.75 (0.030)	0.85 (0.033)
	0603 (1608)	0.50 (0.020)	0.76 (0.030)	1.02 (0.040)
MLV1206	1206 (3216)	4.06 (0.160)	1.65 (0.065)	1.02 (0.040)

**Figure VM3 Pad Layout Figures for Multi Layer Varistors**



**Table VM3 Electrical Characteristics for Multi Layer Varistors @ (25 ± 5°C)**
**Multi Layer Varistors Standard Series**

	Varistor Voltage	Maximum Working Voltage		Clamping Voltage	Peak Current	Max Transient Energy	Typical Capacitance <sup>†</sup>
Symbol	V <sub>v</sub>	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>c</sub>	I <sub>MAX</sub>	W <sub>MAX</sub>	C <sub>p</sub>
Units	V	V	V (Max)	V	A (Min)	J (Max)	pF
Test Conditions	@ 1mA DC	<10μA	<10μA	@ 1A 8/20μs	8/20μs	10/1000μs	@ 1MHz
MLV0402-080M-C221	8 ± 20%	4	5.5	20	20	0.05	220
MLV0402-250K-C400	25 ± 10%	14	18	50	20	0.05	40
MLV0603-130M-C201	13.5 ± 20 %	7	9	30	30	0.1	200
MLV1206-700K	70 ± 10 %	40*	56*	120	200	1	180

\* Test Conditions &lt; 50μA

 † Cp - Device capacitance measured with zero volt bias and 1V<sub>RMS</sub> signal.

**Multi Layer Varistors "E" Series**

	Maximum Working Voltage	Typical Clamping Voltage‡	Leakage Current	Typical Capacitance
Symbol	V <sub>DC</sub>	V <sub>c</sub>	I <sub>L</sub>	C <sub>p</sub>
Units	V (Max)	V	μA (Max)	pF
Test Conditions	< 10μA	IEC Pulse	@12V	@ 1MHz
MLV0402-180-E030	18	350	<1	3
MLV0402-120-E120	12	100	<1	12

‡ Measure per IEC61000-4-2, 8kV contact discharge, 30 ns after initiation of the ESD pulse.

**Table VM4 General Characteristics and Environmental Specifications for Multi Layer Varistors**
**MLV0402 & MLV0603**
**General Characteristics**

Operating temperature	-40 to +85°C
Storage temperature	-40 to +85°C

**Environmental Specifications**

Characteristics	Specifications	Test Conditions
Bias humidity	$\Delta V_v / V_v \leq \pm 10\%$	90% RH, 40°C, maximum working Voltage V <sub>DC</sub> , 1000 hours
Thermal shock	$\Delta V_v / V_v \leq \pm 10\%$	-40°C to +85°C, 30 min. cycle, 5 cycles
Full load voltage	$\Delta V_v / V_v \leq \pm 10\%$	Maximum working Voltage V <sub>DC</sub> , 85°C, 1000 hours
Solderability	95% Coverage	230°C, 3s
Solder heat resistance	90% Coverage	260°C, 10s

**MLV1206**
**General Characteristics**

Operating temperature	-55 to +125°C
Storage temperature	-55 to +150°C

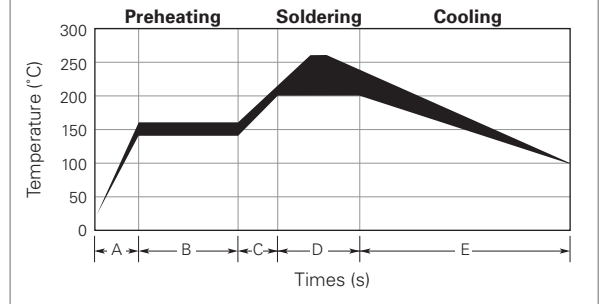
**Environmental Specifications**

Characteristics	Specifications	Test Conditions
Bias humidity	$\Delta V_v / V_v \leq \pm 10\%$	90% RH, 40°C, maximum working Voltage V <sub>DC</sub> , 1000 hours
Thermal shock	$\Delta V_v / V_v \leq \pm 10\%$	-55°C to +125°C, 30 min. cycle, 5 cycles
Full load voltage	$\Delta V_v / V_v \leq \pm 10\%$	Maximum working Voltage V <sub>DC</sub> , 125°C, 1000 hours
Solderability	95% Coverage	230°C, 3s
Solder heat resistance	90% Coverage	260°C, 10s

**Table VM5 Solder Reflow Recommendations for Multi Layer Varistors**

A	Temperature ramp up 1	From ambient to preheating temperature	30s to 60s
B	Preheating	140°C - 160°C	60s to 120s
C	Temperature ramp up 2	From preheating to main heating temperature	20s to 40s
D	Main heating	at 200°C at 220°C at 240°C at 260°C	60s to 70s 50s to 60s 30s to 40s 5s to 10s
E	Cooling	From main heating temperature to 100°C	max 4°C/s

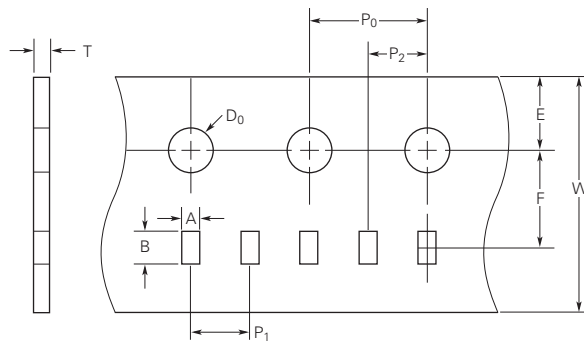
**Figure VM4**



**Table VM6 Tape and Reel Specifications for Multi Layer Varistors**

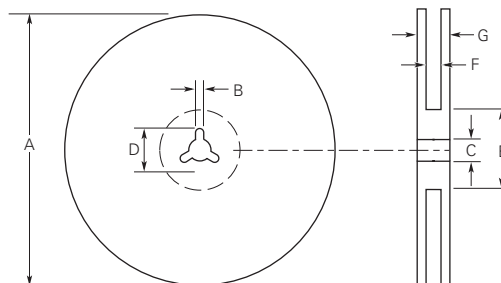
Description	MLV0402		MLV0603		MLV1206	
	Dimensions (mm)	Tolerance (mm)	Dimensions (mm)	Tolerance (mm)	Dimensions (mm)	Tolerance (mm)
A	0.62	±0.03	0.90	±0.20	1.90	±0.20
B	1.12	±0.03	1.80	±0.20	3.50	±0.20
W	8.00	±0.30	8.00	±0.30	8.00	±0.30
E	1.75	±0.05	1.75	±0.10	1.75	±0.10
F	3.50	±0.05	3.50	±0.05	3.50	±0.05
P <sub>0</sub>	4.00	±0.10	4.00	±0.10	4.00	±0.10
P <sub>1</sub>	2.00	±0.05	4.00	±0.10	4.00	±0.10
P <sub>2</sub>	2.00	±0.05	2.00	±0.05	2.00	±0.05
D <sub>0</sub>	1.50	±0.10	1.50	±0.10	1.50	±0.10
T	0.60	±0.05	0.95	±0.05	0.95	±0.05

**Figure VM5 Referenced Taped Component Dimensions for Multi Layer Varistors**



**Figure VM6 Reel Dimensions for Multi Layer Varistors**

Reel Dimension	
A	178.0 ± 2.0
B	2.0 ± 0.5
C	13.0 ± 0.5
D	21.0 ± 0.8
E	62.0 ± 1.5
F	9.0 ± 0.5
G	13.0 ± 1.0



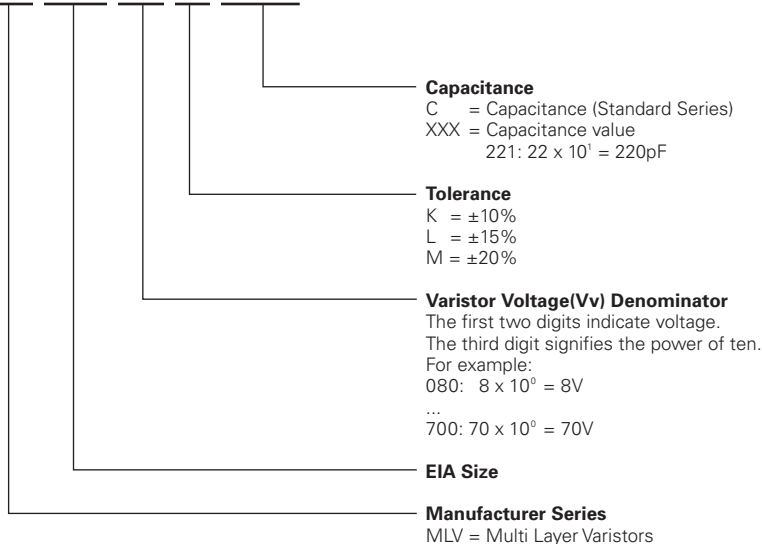
**Table VM7 Packaging Specifications for Multi Layer Varistors**

Chip Size	Parts Quantity per reel
0402 (1005)	10,000
0603 (1608)	4,000
1206 (3216)	4,000

**Part Numbering System for Multi Layer Varistors**

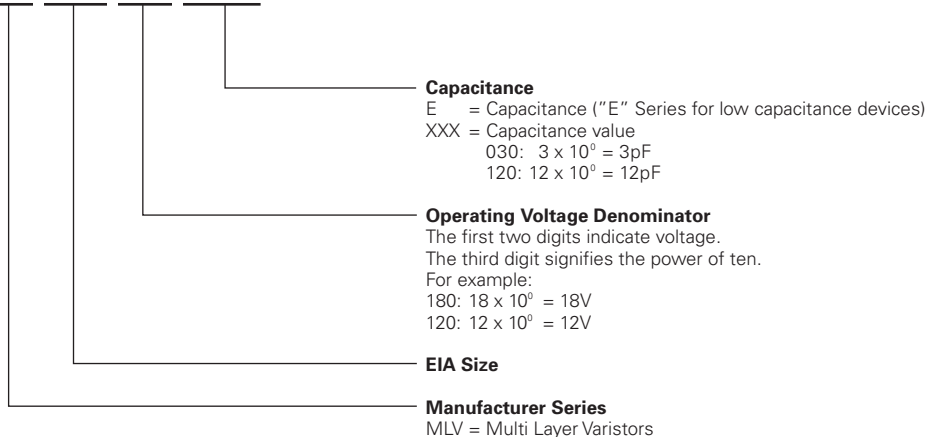
**Multi Layer Varistors Standard Series**

MLV 0402 - 080 M - CXXX



**Multi Layer Varistors "E" Series**

MLV 0402 - 120 - EXXX



 **Warning :**

- Operation beyond the maximum ratings or improper use may result in device damage and possible electrical arcing and flame.
- The devices are intended for protection against damage caused by occasional overvoltage fault conditions and should not be used when repeated fault conditions or prolonged trip events are anticipated.
- Device performance can be impacted negatively if devices are handled in a manner inconsistent with recommended electronic, thermal, and mechanical procedures for electronic components.

