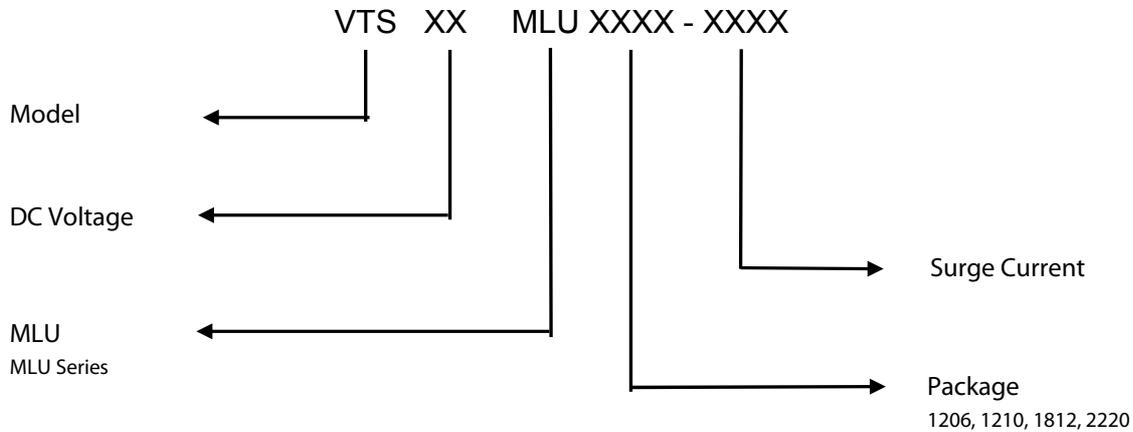


### 1. Part Number Identification

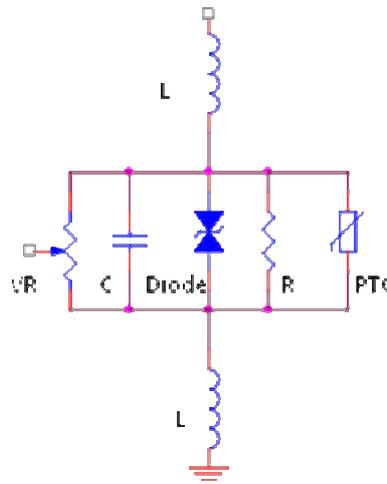


### 1.1 Features of MLU Series

1. RoHS compliant
2. SMD type Body size 1206 ~2220
3. Meet IEC61000-4-5 / K21 Standard
4. Bidirectional and symmetrical V/I characteristics
5. Large withstanding surge current capability: 500A~3000A (@8/20μs)
6. Excellent low leakage current <15μA
7. Operating temperature range: -55 ~ +125 °C
8. Multi-Layers construction provides higher power dissipation

### Equivalent Circuit

- L Body Inductance
- C Device Capacitance
- VR Voltage Variable Resistor
- R Insulation Resistor
- Diode Voltage clamped
- PTC For low leakage current





# SMD Transient Voltage Suppressors

## Ultra High Current (MLU) Series

### 1.2 Performance Characteristics

Part Number	Working Voltage		Breakdown Voltage at (1mA)	Clamping Voltage (*)	Surge Current tested at (8/20 $\mu$ s) waveform
	AC	DC			
Symbol	AC	DC	V	V	A
VTS09MLU1206-500	6	9	12(12~20)	<25	500
VTS18MLU1206-500	14	18	24( $\pm$ 10%)	<45	500
VTS38MLU1206-500	30	38	47( $\pm$ 10%)	<85	500
VTS60MLU1206-500	48	60	75( $\pm$ 10%)	<100	500
VTS09MLU1210-1000	6	9	12(12~20)	<25	1000
VTS18MLU1210-1000	14	18	24( $\pm$ 10%)	<45	1000
VTS38MLU1210-1000	30	38	47( $\pm$ 10%)	<85	1000
VTS60MLU1210-1000	48	60	75( $\pm$ 10%)	<100	1000
VTS18MLU1812-2000	14	18	24( $\pm$ 10%)	<45	2000
VTS38MLU1812-2000	30	38	47( $\pm$ 10%)	<85	2000
VTS60MLU1812-2000	48	60	75( $\pm$ 10%)	<100	2000
VTS18MLU2220-3000	14	18	24( $\pm$ 10%)	<45	3000
VTS38MLU2220-3000	30	38	47( $\pm$ 10%)	<85	3000
VTS45MLU2220-3000	35	45	56( $\pm$ 10%)	<90	3000
VTS60MLU2220-3000	48	60	75( $\pm$ 10%)	<100	3000
VTS65MLU2220-3000	50	65	82( $\pm$ 10%)	<135	3000

\* The clamping voltage was measured at standard current, 1206(1A), 1210(2.5A), 1812(5A) and 2220(10A) .



# SMD Transient Voltage Suppressors

## Ultra High Current (MLU) Series

### 1.3 Reference Data

Part Number	Non-linear Coefficient	Leakage current		Capacitance (*1)	Response Time	Operation Ambient Temperature	Storage Temperature
		Before Surge Test	After Surge Test				
Symbol	$\alpha$	$\mu\text{A}$	$\mu\text{A}$	PF(at 1 KHz)	$T_{\text{rise}}$	$^{\circ}\text{C}$	$^{\circ}\text{C}$
VTS09MLU1206-500	20	10	80	4200	<1ns	-55~+125	-55~+150
VTS18MLU1206-500	20	10	80	1000			
VTS38MLU1206-500	30	10	80	800			
VTS60MLU1206-500	.30	10	80	800			
VTS09MLU1210-1000	20	15	80	7000			
VTS18MLU1210-1000	20	15	80	3800			
VTS38MLU1210-1000	30	10	80	2000			
VTS60MLU1210-1000	30	10	80	2000			
VTS18MLU1812-2000	20	15	80	2800			
VTS38MLU1812-2000	30	15	80	1400			
VTS60MLU1812-2000	30	15	80	2100			
VTS18MLU2220-3000	20	15	80	8400			
VTS38MLU2220-3000	35	15	80	4900			
VTS45MLU2220-3000	35	15	80	3500			
VTS60MLU2220-3000	40	15	80	3400			
VTS65MLU2220-3000	40	15	80	2000			

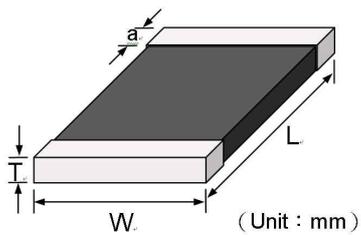
\* 1 The capacitance value only for customer reference, it's not formal specification.

\* The components shall be employed within 1 year, in the nitrogen condition.

### 1.4 Other Data

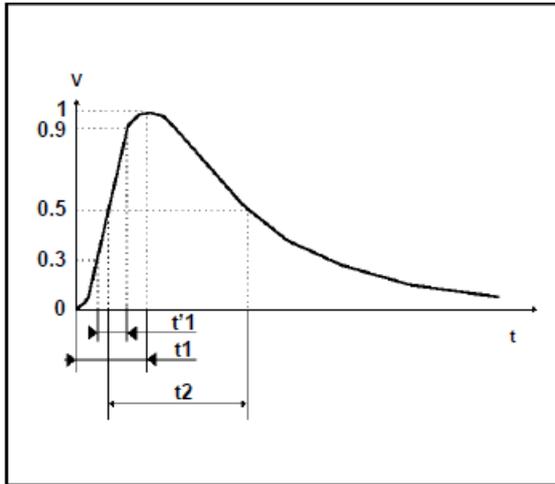
Parameter	Symbol	Value	Unit
Body		Nano Special Ceramic	
End Termination		Ag/Sn(1206~2220)	
Packaging		Reel	
Marking		None	
Lead Content		<1000	ppm

### 2. Mechanical Characteristics



Model	1206 Series	1210 Series	1812 Series	2220 Series
Length(L)	3.2 ±0.2mm	3.2 ±0.3mm	4.7 ±0.35mm	6.1 ±0.40mm
Width(W)	1.67 ±0.15mm	2.5 ±0.2mm	3.3 ±0.30mm	5.2 ±0.30mm
Thickness(T)	1.70 mm Max	2.50 mm Max	3.00 mm Max	3.50 mm Max
Termination(a)	0.50±0.2mm	0.5±0.25mm	0.5+0.35/-0.1mm	0.5+0.35/-0.1mm

### 3. Surge Wave Form



8/20µs waveform current

### IEC61000 -4-5 Standards

SEVERITY LEVEL	t1 (=1.67t'1)	t2
1	8 µs	20 µs

### 4. Environmental Reliability Test

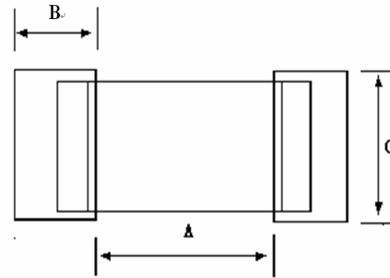
Item	Requirement	Test condition
High Temperature Storage	1. Breakdown voltage change : within $\pm 10\%$ 2. No mechanical damage	1. Temperature : $150 \pm 2^\circ\text{C}$ 2. Time : $1000 \pm 2$ hours 3. Test after placing in ambient temperature for 24 hours.
Low Temperature Storage	1. Breakdown voltage change : within $\pm 10\%$ 2. No mechanical damage	1. Temperature : $-40 \pm 2^\circ\text{C}$ 2. Time : $1000 \pm 2$ hours 3. Test after placing in ambient temperature for 24 hours.
Temperature Cycle	1. Breakdown voltage change : within $\pm 10\%$ 2. No mechanical damage	1. Step 1 : $-40 \pm 3^\circ\text{C}$ ; time : $30 \pm 3$ min 2. Step 2 : $25^\circ\text{C}$ ; time : 1 hour 3. Step 3 : $125 \pm 3^\circ\text{C}$ ; time : $30 \pm 3$ min 4. Step 4 : $25^\circ\text{C}$ ; time : 1 hour 5. Number of cycle : 5 times 6. Test after placing in ambient temperature for 24 hours.
High Temperature Load	1. Breakdown voltage change : within $\pm 10\%$ 2. No mechanical damage	1. Temperature : $125 \pm 2^\circ\text{C}$ 2. Rated working voltage applied 3. Time : $1000 \pm 2$ hours 4. Test after placing in ambient temperature for 24 hours.
Damp Heat Load/ Humidity Load	1. Breakdown voltage change : within $\pm 10\%$ 2. No mechanical damage	1. Temperature : $40 \pm 2^\circ\text{C}$ 2. Humidity : 90~95% RH 3. Rated working voltage applied 4. Time : $500 \pm 2$ hours 5. Test after placing in ambient temperature for 24 hours.

### 5. Soldering Recommendations

#### 5.1 Recommended solder pad layout

(Unit : mm)

	A	B	C
1206	1.8~2.5	1.2~1.8	1.5~2.0
1210	1.8~2.5	1.3~2.0	2.2~3.0
1812	2.5~3.3	1.3~2.2	2.8~3.6
2220	3.8~4.6	1.3~2.2	4.8~5.5

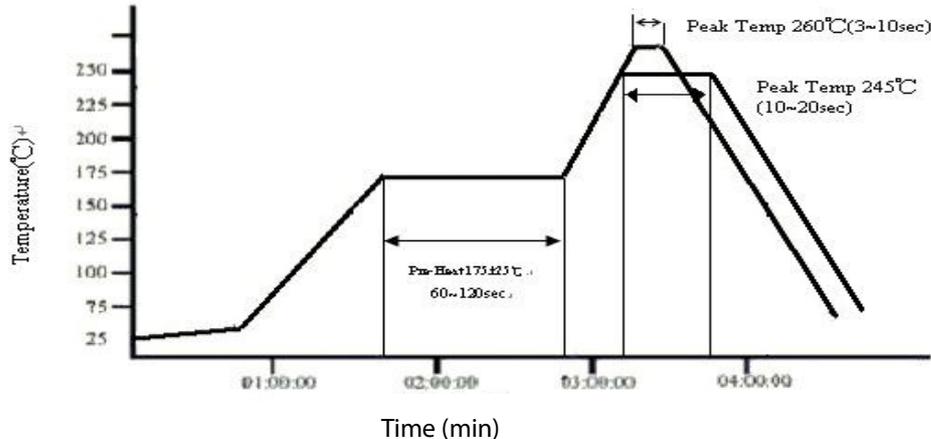


#### 5.2 The SIR test of the solder paste shall be done (Based on JIS-Z-3284)

#### 5.3 Steel plate and foot distance printing

Foot distance printing (mm)	Steel Plate thickness (mm)
> 0.65mm	0.18mm
0.65mm~0.5mm	0.15mm
0.50mm~0.40mm	0.12mm
<=0.40 mm	0.10mm

#### 5.4 The IR Reflow and Temperature of Soldering for Pb Free



IR reflow Pb Free Process suggestion profile

- (1) The solder recommend is Sn96.5/Ag 3.5 of 120 to 150 $\mu$ m
- (2) Ramp-up rate (217°C to Peak) + 3°C/second max
- (3) Temp. maintain at 175 +/-25°C 180 seconds max
- (4) Temp. maintain above 217°C 60-150 seconds
- (5) Peak temperature range 245°C +20°C / -10°C time within 5°C of actually peak temperature 10~20 seconds
- (6) Ramp down rate +6°C/second max.

※Perform adequate test in advance as the reflow temperature profile will vary according to the conditions of the manufacturing process, and the specification of the reflow furnace.

### 5.5 Resistance to Soldering Heat-High Temperature Resistance:260,10sec- 3 times.

### 5.6 Hand Soldering

In hand soldering of the MLU devices. Large temperature gradient between preheated the MLU devices and the tip of soldering iron may cause electrical failures and mechanical damages such as crackings or breakings of the devices. The soldering shall be carefully controlled and carried out so that the temperature gradient is kept minimum with following recommended conditions for hand soldering.

#### 5.6.1 Recommended Soldering Condition 1

- (1) Solder :  
0.12~0.18mm Thread solder (Sn96.5:Ag3.5) with soldering flux in the core.  
Rosin-based and non-activated flux is recommended.
- (2) Preheating  
The MLU devices shall be preheated so that Temperature Gradient between the devices and the tip of soldering iron is 150°C or below.
- (3) Soldering Iron  
Rated Power of 20w max with 3mm soldering tip in diameter.  
Temperature of soldering iron tip 380°C max, 3-5sec ( The required amount of solder shall be melted in advance on the soldering tip.)
- (4) Cooling  
After soldering. The MLU devices shall be cooled gradually at room ambient temperature.

#### 5.6.2 Recommended Soldering Condition 2 ( Without preheating )

- (1) Solder iron tip shall not directly touch to ceramic dielectrics.
- (2) Solder iron tip shall be fully preheated before soldering while soldering iron tip to the external electrode of the MLU devices.

### 5.7 Recommended using IR Reflow Process. The Wave Soldering Process and Immersion Tin Process can't to be Adopted for this Product.

### 5.8 Post Soldering Cleaning

5.8.1 Residues of corrosive soldering fluxes on the PC board after cleaning may greatly have influences on the electrical characteristic and the reliability (such as humidity resistance)of the MLU devices which have been mounted on the board. It shall be confirmed that the characteristic and the reliability of the devices are not affected by the applied cleaning conditions.

5.8.2. When an ultrasonic cleaning is applied to the mounted MLU devices on PC Boards.

Following conditions are recommended for preventing failures or damages of the devices due to the large vibration energy and the resonance caused by the ultrasonic waves.

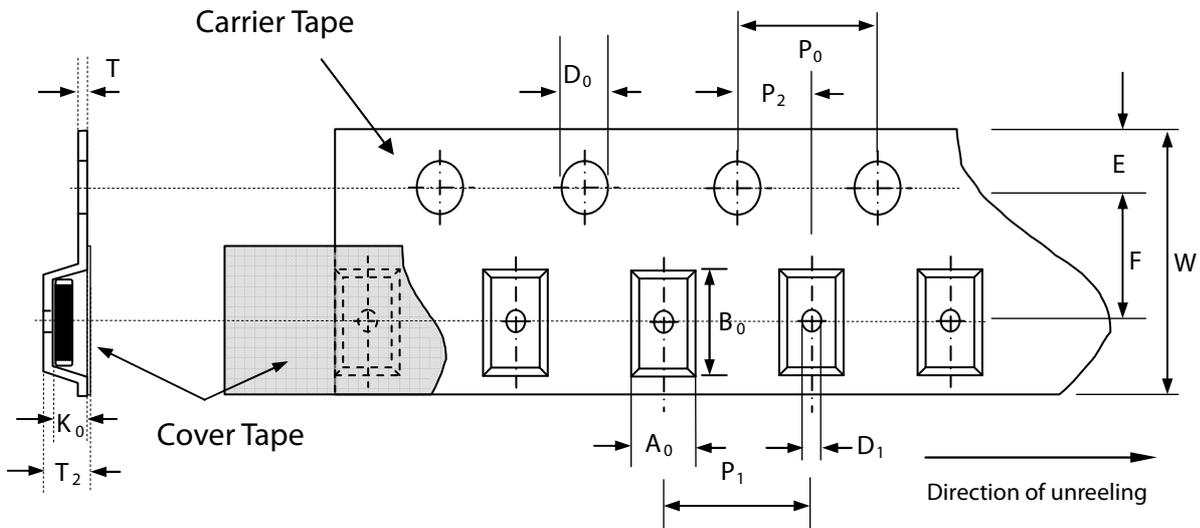
- (1) Frequency 29MHz max
- (2) Radiated Power 20w/lithr max
- (3) Period 5minuets max

### 6. Packaging Specification

6.1 Carrier tape and transparent cover tape should be heat-sealed to carry the products, and the reel should be used to reel the carrier tape.

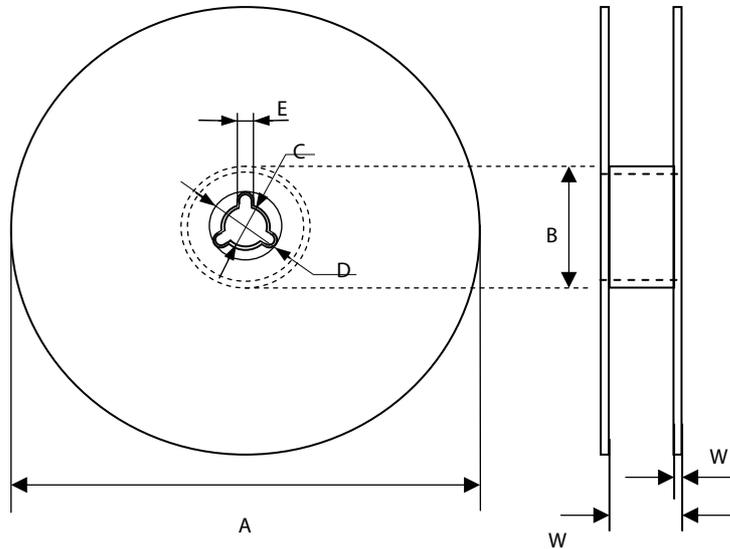
6.2 The adhesion of the heat-sealed cover tape shall be  $40 +20/-15$  grams.

6.3 Both the head and the end portion of the taping shall be empty for reel package and SMD auto-pickup machine. And a normal paper tape shall be connected in the head of taping for the operator to handle.



Symbol	$A_0$ $\pm 0.10$	$B_0$ $\pm 0.10$	$K_0$ $\pm 0.10$	$T$ $\pm 0.05$	$T_2$ $\pm 0.05$	$D_0$ $+0.10$ $-0.00$	$D_1$ $\pm 0.05$	$P_1$ $\pm 0.10$	$P_2$ $\pm 0.05$	$P_0$ $\pm 0.05$	$W$ $\pm 0.20$	$E$ $\pm 0.10$	$F$ $\pm 0.05$
1206	1.99	3.55	2.10	0.22	2.32	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
1210	2.85	3.65	2.65	0.22	2.87	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
1812	3.79	5.25	3.15	0.25	3.40	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50
2220	5.65	6.65	3.65	0.25	3.90	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50

### 7.Reel Dimension



Symbol	A	B	C	D	E	W	W <sub>1</sub>
1206	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
1210	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
1812	178.0±1.0	60.2±0.5	13.0±0.5	21.0±0.2	2.5±0.5	13.6±0.2	1.5±0.15
2220	178.0±1.0	60.2±0.5	13.0±0.5	21.0±0.2	2.5±0.5	13.6±0.2	1.5±0.15

### 8.Standard Packaging

Size	1206	1210	1812	2220
Pcs	2000	1500	500	500