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Semtech
UCLAMP3301H.TCT

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uClamp3301H
Low Voltage µClamp™ for ESD and CDE Protection

PROTECTION PRODUCTS -MicroClamp®

Description

The µClamp® series of Transient Voltage Suppressors (TVS) are designed to replace multilayer varistors (MLVs) in portable applications such as cell phones, notebook computers, and PDAs. They offer superior electrical characteristics such as lower clamping voltage and no device degradation when compared to MLVs. They are designed to protect sensitive semiconductor components from damage or upset due to electrostatic discharge (ESD), lightning, electrical fast transients (EFT), and cable discharge events (CDE).

The µClamp®3301H is constructed using Semtech's proprietary EPD process technology. The EPD process provides low standoff voltages with significant reductions in leakage currents and capacitance over silicon-avalanche diode processes. They feature a true operating voltage of 3.3 volts for superior protection when compared to traditional pn junction devices.

The µClamp3301H is in a 2-pin SOD-523 package. Each device will protect one unidirectional line operating at 3.3 volts. They give the designer the flexibility to protect one line in applications where arrays are not practical. They may be used to meet the ESD immunity requirements of IEC 61000-4-2.

Features

- Transient protection for data lines to
  IEC 61000-4-2 (ESD) ±30kV (air), ±30kV (contact)
  IEC 61000-4-4 (EFT) 40A (tp = 5/50ns)
  Cable Discharge Event (CDE)
- Small SOD-523 package
- Protects one data line
- Low clamping voltage
- Working voltage: 3.3V
- Low leakage current
- Solid-state silicon-avalanche technology

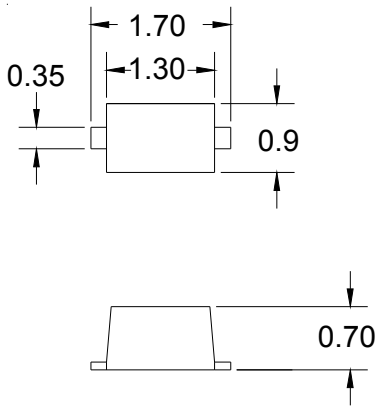
Mechanical Characteristics

- EIAJ SOD-523 package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Molding compound flammability rating: UL 94V-0
- Nominal Dimensions: 1.7 x 0.9 x 0.7mm
- Marking : Marking code, cathode band
- Packaging: Tape and Reel
- Lead Finish: Matte tin

Applications

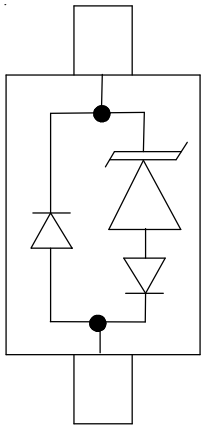
- Cellular Handsets & Accessories
- Notebooks & Handhelds
- Portable Instrumentation
- Keypads, Side Keys, LCD Displays
- Notebooks & Desktop Computers
- Digital Cameras
- MP3 Players

Dimensions



Nominal Dimensions (mm)

Schematic & Pin Configuration



SOD-523 (Top View)

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20µs)	P_{pk}	40	Watts
Maximum Peak Pulse Current (tp = 8/20µs)	I_{pp}	5	Amps
ESD per IEC 61000-4-2 (Air)[1] ESD per IEC 61000-4-2 (Contact)[1]	V_{ESD}	+/- 30 +/- 30	kV
Operating Temperature	T_J	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

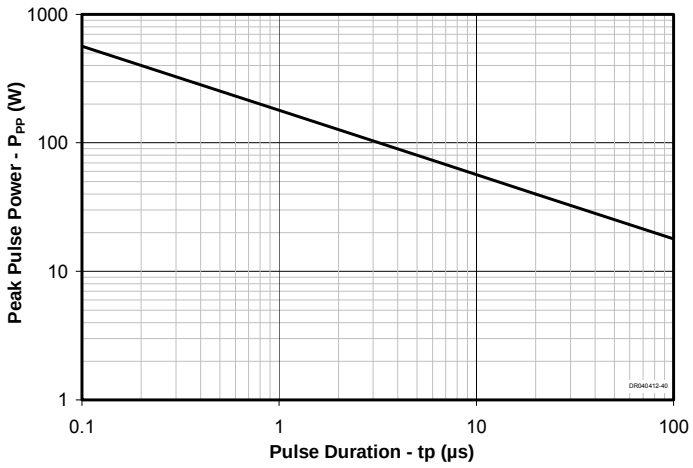
Electrical Characteristics (T=25°C)

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}				3.3	V
Punch-Through Voltage	V_{PT}	I_{PT} = 2µA	3.5	3.9	4.6	V
Snap-Back Voltage	V_{SB}	I_{SB} = 50mA	2.8			V
Reverse Leakage Current	I_R	V_{RWM} = 3.3V		0.05	0.5	µA
Clamping Voltage	V_C	I_{PP} = 1A, tp = 8/20µs			5.5	V
Clamping Voltage	V_C	I_{PP} = 5A, tp = 8/20µs			8	V
Forward Voltage	V_F	I_{PP} = 1A, tp = 8/20µs			2.4	V
Junction Capacitance	C_j	I/O pin to Gnd V_R = 0V, f = 1MHz		25	30	pF
		I/O pin to Gnd V_R = 3.3V, f = 1MHz		14		pF

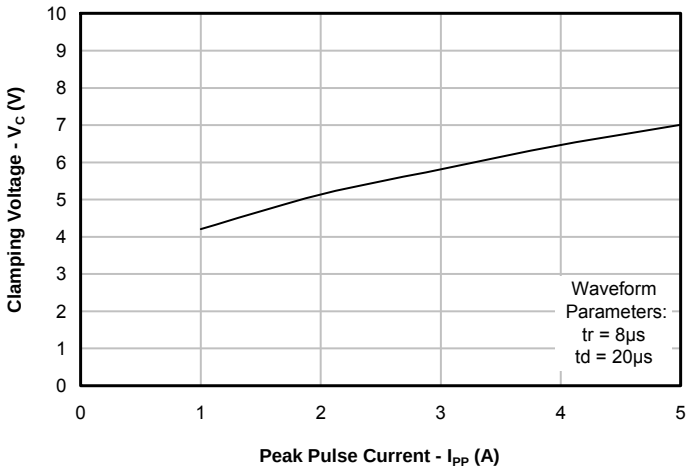
Notes
1)ESD gun return path connected to ESD ground reference plane.

Typical Characteristics

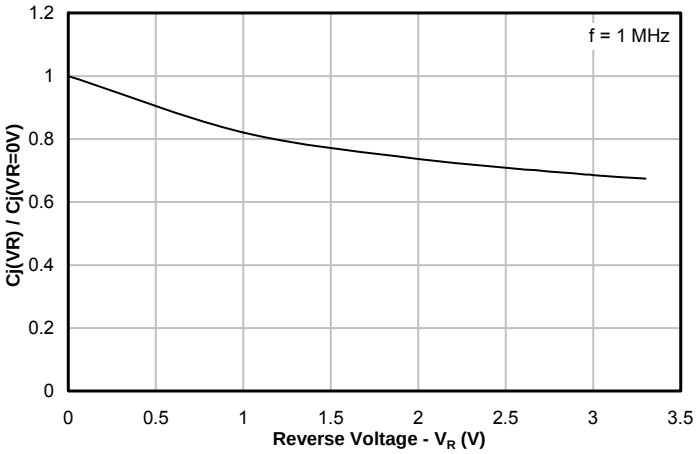
Non-Repetitive Peak Pulse Power vs. Pulse Time



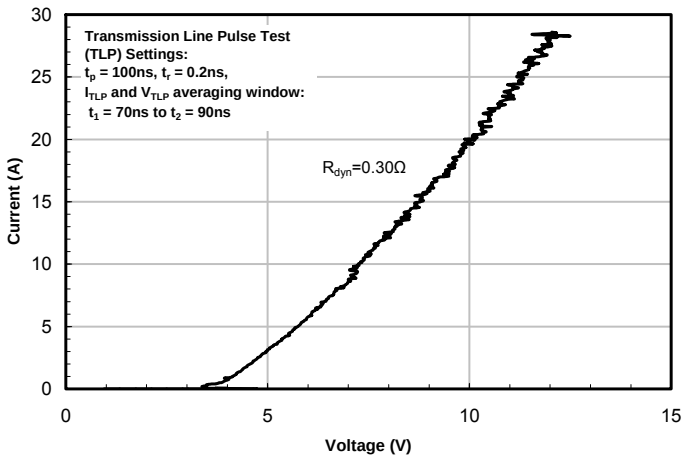
Clamping Voltage vs. Peak Pulse Current



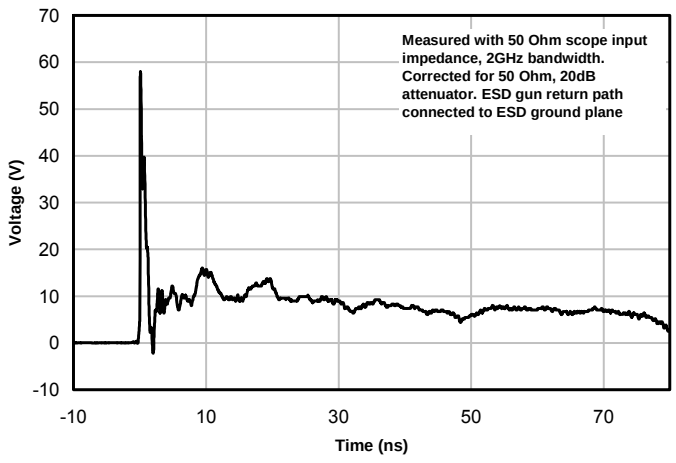
Normalized Capacitance vs. Reverse Voltage



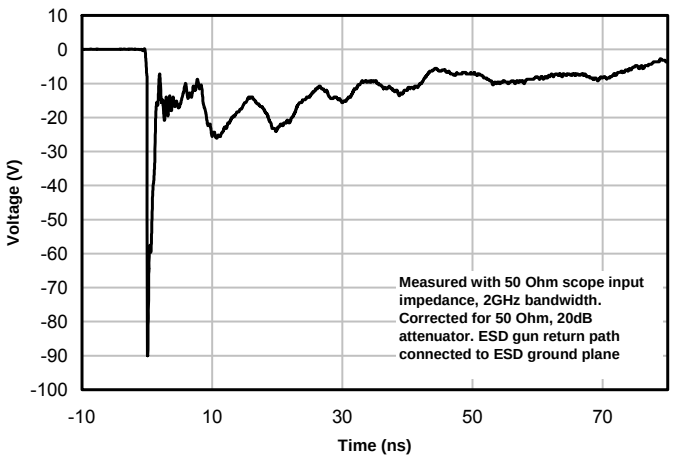
TLP Characteristic



ESD Clamping (+8kV Contact per IEC 61000-4-2)



ESD Clamping (-8kV Contact per IEC 61000-4-2)



Applications Information

Semtech Low Voltage TVS

Conventional TVS diodes are silicon avalanche, p-n junction devices designed to operate at voltages as low as 5 volts. However, many of today's semiconductor devices operate at voltages below 5 volts, and thus require lower voltage protection devices. Unfortunately, for operating voltages below 5 volts, conventional TVS diode technology becomes impractical. This is due to the adverse effects of high leakage current and high capacitance caused by the high impurity concentrations that are needed to lower the device voltage below 5 volts. Semtech's proprietary low voltage EPD device technology was developed to provide protection for today's circuits operating at voltages below 5 volts. Unlike conventional TVS diodes, the EPD device utilizes a complex four layer (n-p-p-n) structure. The construction of these devices results in very low operating voltage without the adverse effects mentioned above.

Device Operation

Since the EPD TVS devices use a 4-layer structure, they exhibit a slightly different IV characteristic curve when compared to conventional devices. Figure 1 compares the IV characteristic curves of a low voltage TVS with a working voltage (V_{RWM}) of 3.3 volts to a conventional device with a working voltage of 5 volts. During normal operation, each device represents a high-impedance to the circuit up to its working voltage. During an ESD event, they will begin to conduct and will enter a low impedance state. For the 3.3 volt device, this happens when the punch-through voltage (V_{PT}) is exceeded. Unlike a conventional 5 volt device, the low voltage TVS will exhibit a slight negative resistance characteristic as it conducts current. This characteristic aids in lowering the clamping voltage of the device. However, the device can latch up if a DC bias voltage is present. The reason being that in order for the device to turn off, the voltage must fall below the snap-back voltage (V_{SB}). This value is normally a minimum of 2.8 volts. If the device is biased above the 2.8 volts, it will never fall below the snap-back voltage and will therefore stay in a conducting state.

Low Voltage TVS

- **Working Voltage** (V_{RWM}): Maximum rated operating voltage at which the device will appear as a high impedance to the protected circuit.
- **Punch-Through Voltage** (V_{PT}): Minimum rated voltage at which the device will become a low impedance (i.e. Minimum Turn-On Voltage). When V_{PT} is exceeded, the device will conduct.
- **Snap-Back Voltage** (V_{SB}): Minimum rated voltage when the device is in a conducting state measured at I_{SB} = 50mA. This voltage is less than the working voltage. The voltage must fall below V_{SB} for the device to turn off.
- **Clamping Voltage** (V_C): Maximum voltage drop across the device at a defined peak pulse current (I_{PP}). This is the voltage seen by the protected circuit during a transient event.

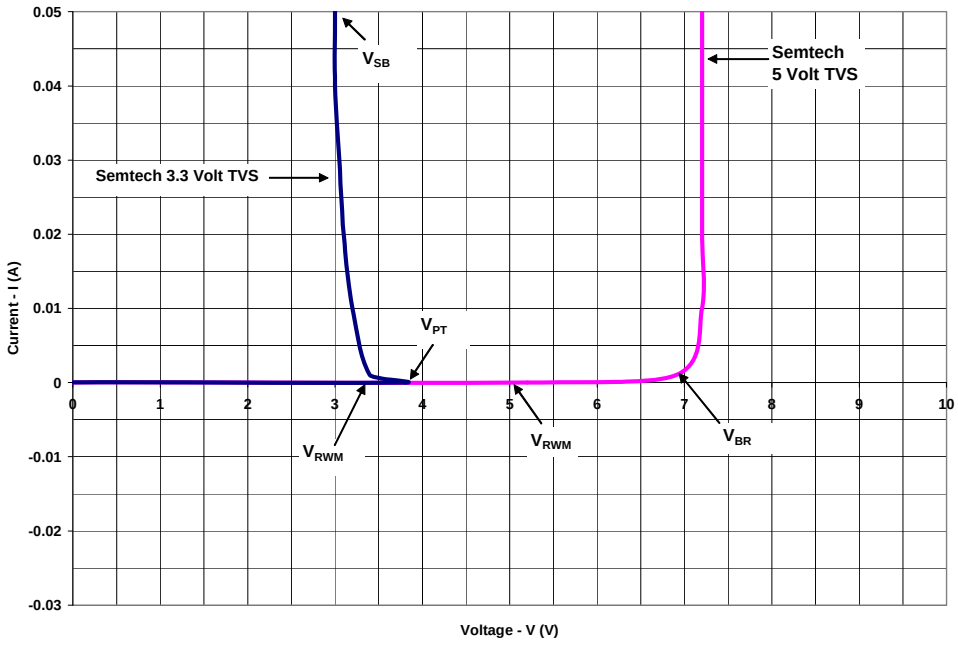
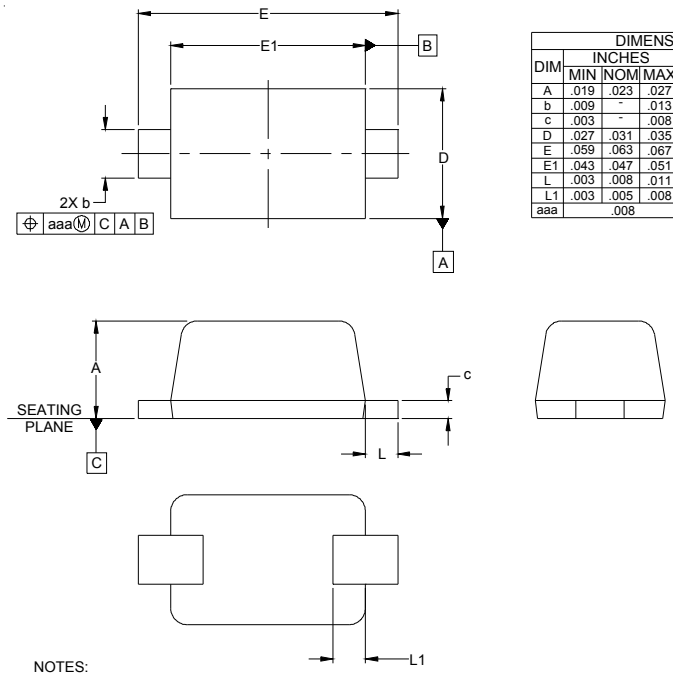


Figure 1 - 3.3 volt vs. 5 volt TVS IV Curve

Outline Drawing - SOD-523

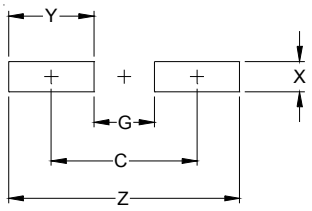


DIM	DIMENSIONS					
	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.019	.023	.027	0.50	0.60	0.70
b	.009	-	.013	0.25	-	0.35
c	.003	-	.008	0.10	-	0.20
D	.027	.031	.035	0.70	0.80	0.90
E	.059	.063	.067	1.50	1.60	1.70
E1	.043	.047	.051	1.10	1.20	1.30
L	.003	.008	.011	0.10	0.20	0.30
L1	.003	.005	.008	0.10	0.15	0.20
aaa	.008			0.20		

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

Land Pattern - SOD-523

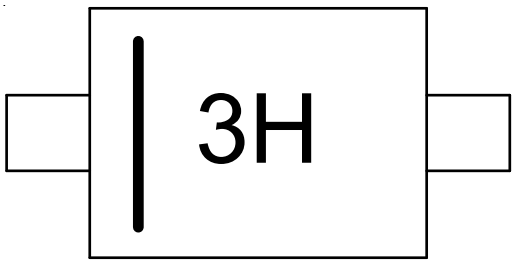


DIMENSIONS		
DIM	INCHES	MILLIMETERS
C	(.057)	(1.45)
G	.024	0.60
X	.018	0.45
Y	.033	0.85
Z	.090	2.30

NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET

Marking Codes



Ordering Information

Part Number	Qty per Reel	Reel Size
uClamp3301H.TCT	3,000	7 Inch
uClamp3301H.THT	6,000	7 Inch

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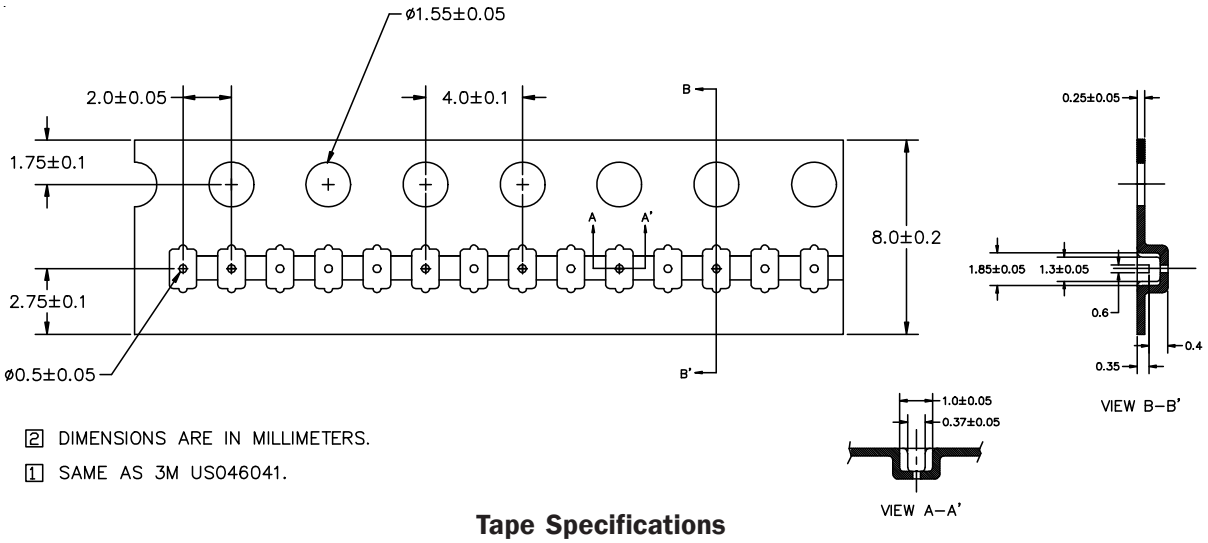
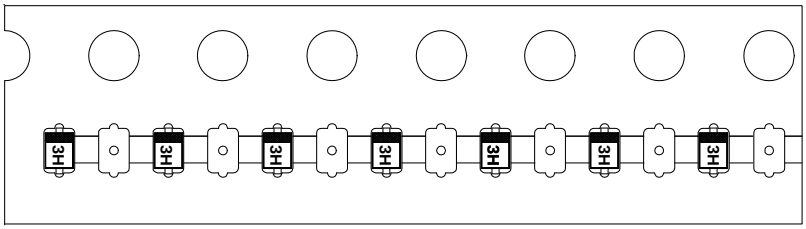
Carrier Tape Specification

3,000 piece Reel, 4mm Pitch Between Devices

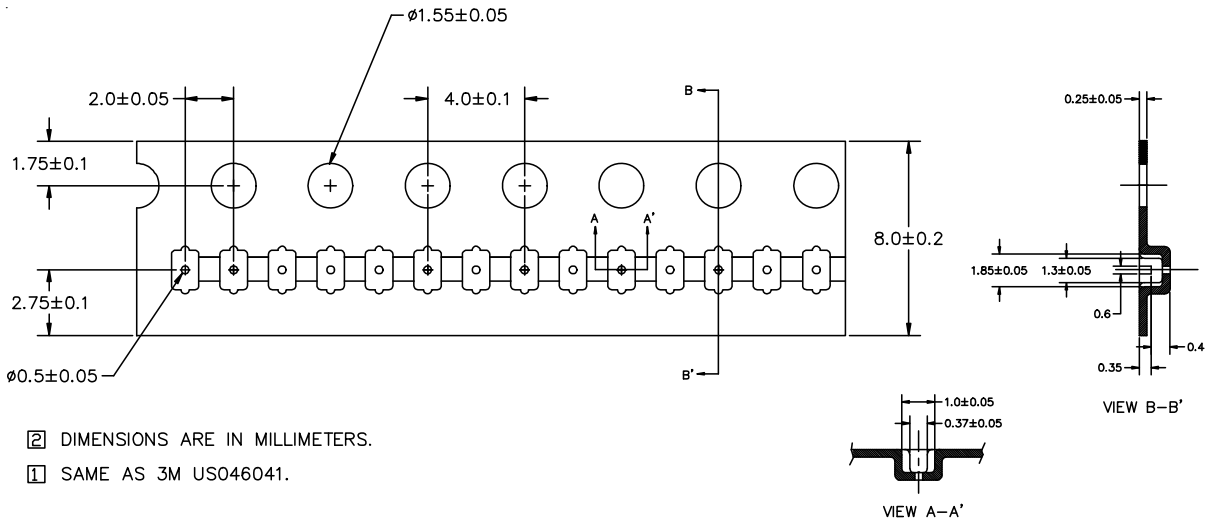


Tape Specifications

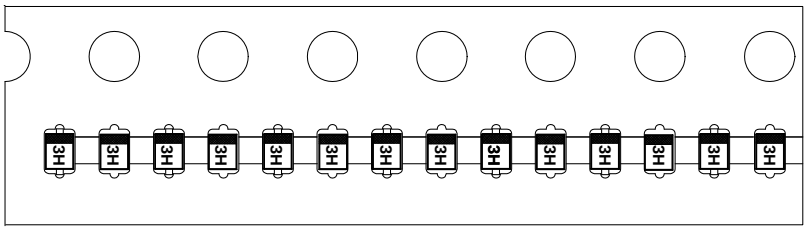


Device Orientation in Tape (Every Other Pocket Populated)

6,000 piece Reel, 2mm Pitch Between Devices



Tape Specifications



Device Orientation in Tape (Every Pocket Populated)

Contact Information

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