

Description

SurgeSwitch™ are designed to provide high energy EOS protection with superior clamping and temperature characteristics when compared to standard TVS devices. The device uses a surge rated FET as the main protection element. During an EOS event, transient voltage increases beyond the rated breakdown voltage of the device. The FET in turn switches on and conducts transient current to ground. The TDS clamping voltage is nearly constant across the rated peak pulse current range due to the extremely low ON Resistance of the FET. Lower clamping voltage at maximum peak pulse current makes them more suitable for protecting today's sensitive IC's, when compared to standard TVS diodes.

TDS5311P is designed to protect voltage bus or data lines with an operating voltage as high as 53V. It is rated for a high-energy transient current up to 24A ($t_p = 8/20\mu s$) and may be used to meet the common industrial voltage surge standard of $\pm 1kV$ per IEC 61000-4-5 ($R_s = 42\Omega$, $C_s = 0.5\mu F$).

TDS5311P is in a small 2.0 x 2.0mm, 6-pin DFN package and represents significant board space savings over traditional SMAJ and SMBJ packaged devices.

Applications

- IoT Devices
- Notebook and Tablet PC
- USB PD
- Appliances
- VBUS Lines
- Solid-State Switches
- USB Type-C

Dimensions

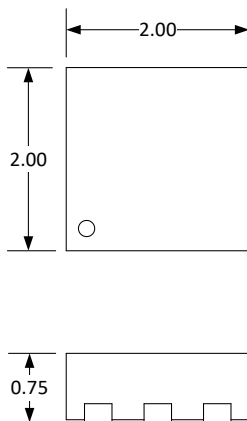


Figure (1) Nominal Dimensions Drawing

Features

- High ESD withstand Voltage: $\pm 20kV$ (Contact) and $\pm 25kV$ (Air) per IEC 61000-4-2
- High peak pulse current capability: 24A ($t_p = 8/20\mu s$), 1kV ($t_p = 1.2/50\mu s$, $R_s = 42\Omega$) per IEC 61000-4-5
- High EFT Withstand Voltage: $\pm 4kV$ (100kHz and 5kHz, 5/50ns) IEC 61000-4-4
- Protects one I/O or power line
- Low ESD and clamping voltage
- Working voltage: 53V
- Solid-state technology

Mechanical Characteristics

- Package: DFN 2.0 x 2.0 x 0.75mm 6-Lead
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Molding compound flammability rating: UL 94V-0
- Lead Finish: Lead Free
- Marking: Marking code and Date Code
- Packaging: Tape and Reel

Functional Diagram

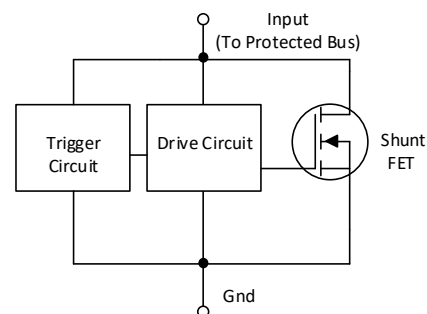


Figure (2) Functional diagram

Absolute Maximum ESD Rating

RATING	SYMBOL	VALUE	UNITS
Peak Pulse Power ($t_p = 8/20\mu s$)	P_{PK}	1512	W
Peak Pulse Current ($t_p = 8/20\mu s$)	I_{PP}	24	A
Peak Pulse Current ($t_p = 10/1000\mu s$)	I_{PP}	1.5	A
Forward Current	I_F	150	A
ESD per IEC 61000-4-2 (Air) ⁽¹⁾ ESD per IEC 61000-4-2 (Contact) ⁽¹⁾	V_{ESD}	± 25 ± 20	kV kV
Operating Temperature	T_{OP}	-40 to +125	°C
Junction and Storage Temperature	T_J and T_{STG}	-55 to +150	°C

Exceeding the above specifications may result in permanent damage to the device or device malfunction. Operation outside of the parameters specified in the Electrical Characteristics section is not recommended.

Electrical Characteristics

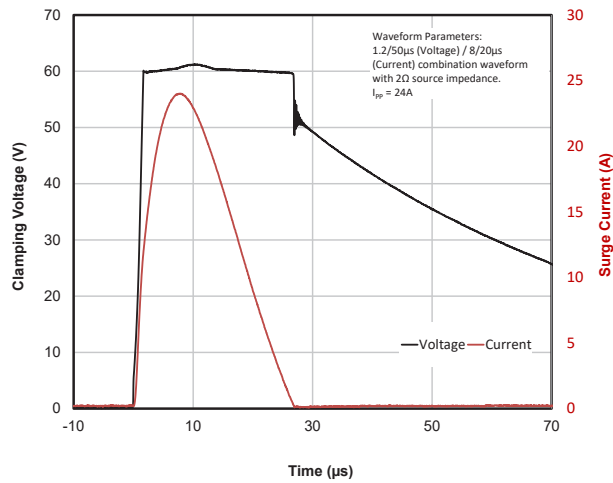
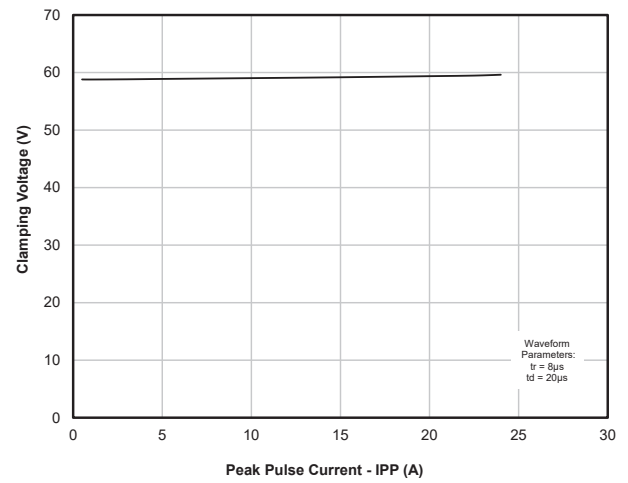
$T_A = 25^\circ\text{C}$ unless otherwise specified. All data taken from Pin 1, 2, 3 to Pin 4, 5, 6 unless otherwise specified.

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse Stand-Off Voltage	V_{RWM}				53	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1\text{mA}$	57	59	61	V
Forward Voltage	V_F	$I_t = 1\text{mA}$, Pin 4, 5, 6 to Pin 1, 2, 3		0.6		V
Leakage Current	I_R	$V_{RWM} = 53\text{V}$		9	50	nA
Clamping Voltage ⁽²⁾	V_C	$I_{PP} = 24\text{A}$, $t_p = 8/20\mu s$		60	63	V
Dynamic Resistance ^{(2),(3)}	R_{DYN}	$t_p = 8/20\mu s$		31		mΩ
Junction Capacitance	C_J	$V_R = 53\text{V}$, $f = 1\text{MHz}$		82		pF

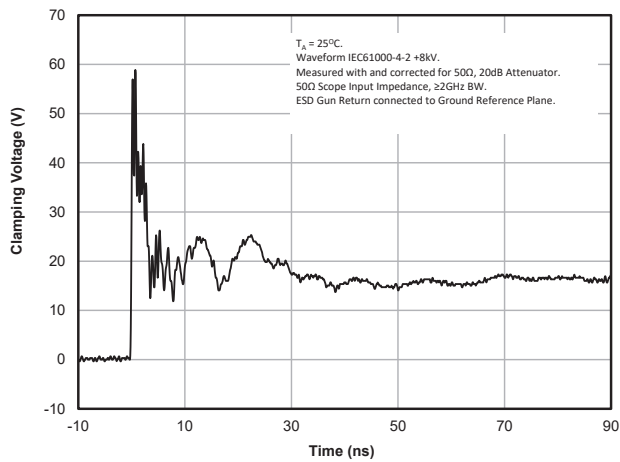
Notes:

- 1) ESD gun return path connected to ESD ground plane.
- 2) Parameter guaranteed by design.
- 3) Dynamic resistance measured between 1A and IPP ($t_p = 8/20\mu s$)

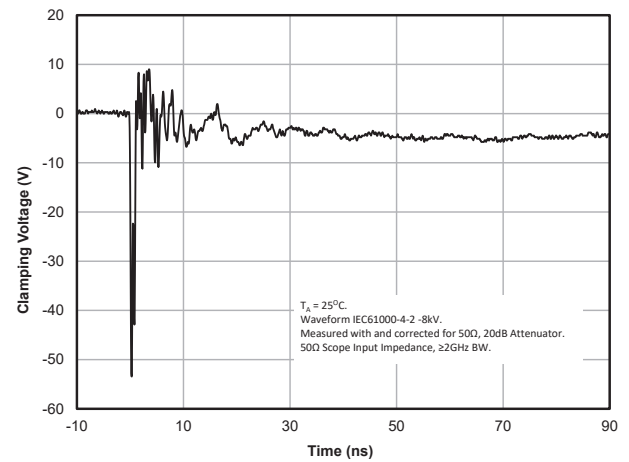
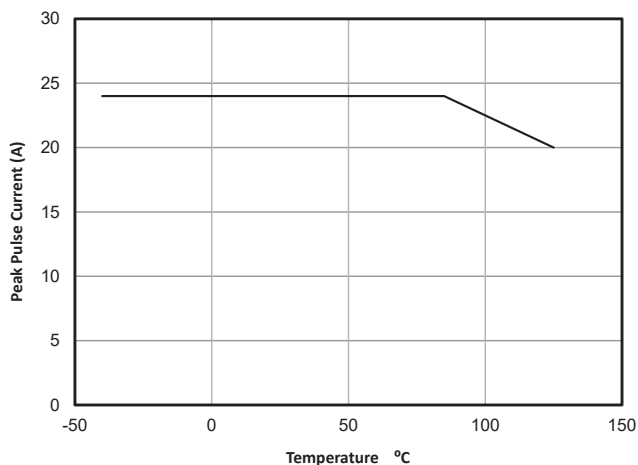
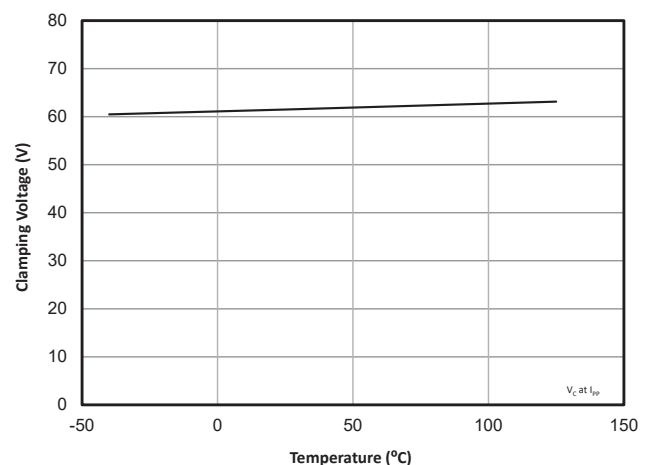
Typical Characteristics

Clamping Voltage ($t_p=1.2/50\mu s$, $I_{pp}=24A$)Clamping Voltage vs. Peak Pulse Current ($t_p=8/20\mu s$)

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

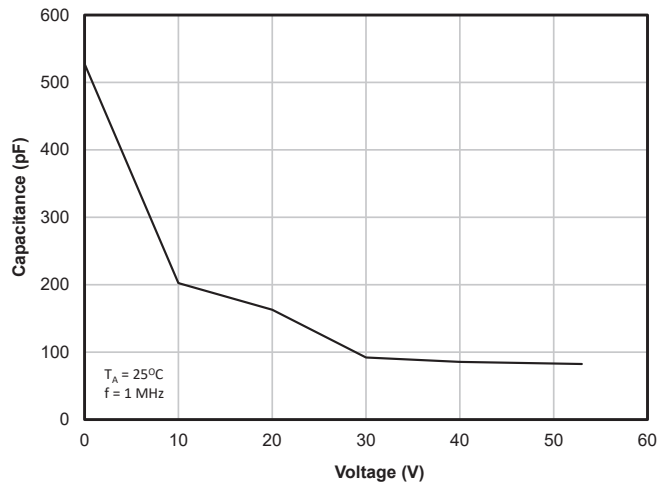


ESD Clamping (-8kV Contact per IEC 61000-4-2)

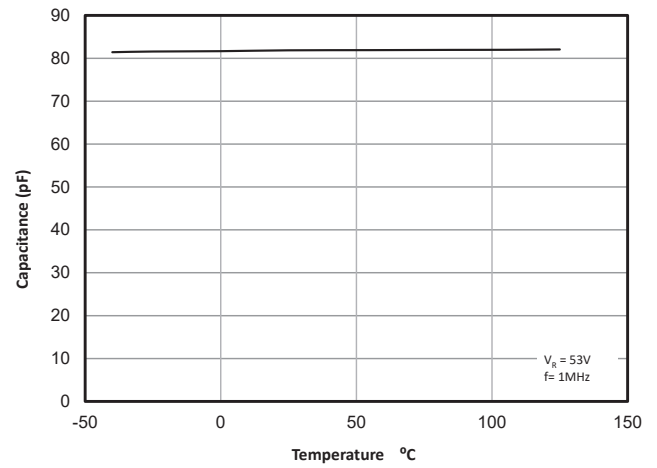
Peak Pulse Current vs. Temperature ($t_p=8/20\mu s$)Clamping Voltage vs. Temperature ($t_p=8/20\mu s$)

Typical Characteristics

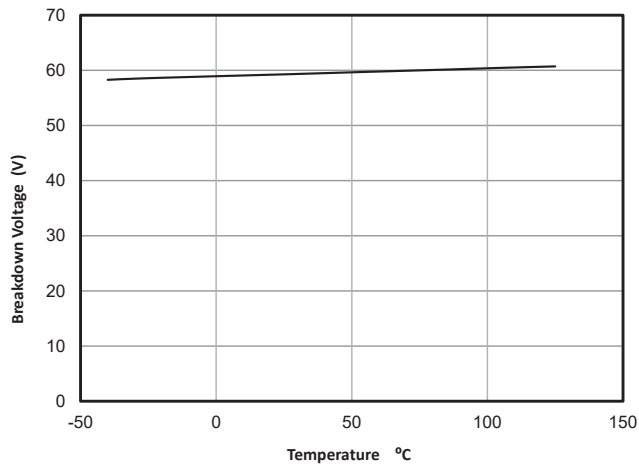
Capacitance vs. Reverse Voltage



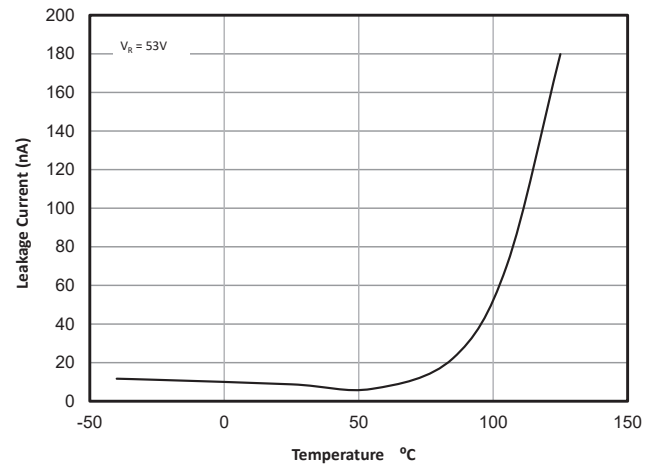
Capacitance vs. Temperature



Breakdown Voltage vs. Temperature



Reverse Leakage vs. Temperature

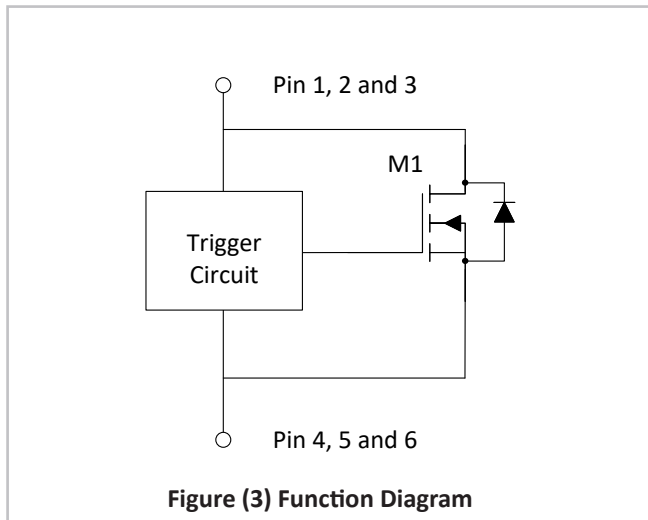


Application Information

DESCRIPTION

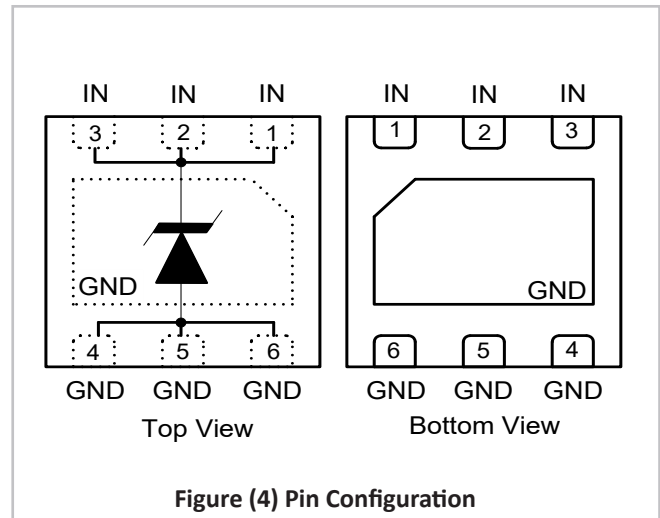
SurgeSwitch™ are designed to provide high energy EOS protection with superior clamping and temperature characteristics when compared to standard TVS devices.

This design uses a surge rated FET as the main protection element. During an EOS event, transient voltage increases beyond the breakdown voltage of the trigger circuit. This in turn activates the drive circuit and turns on the shunt FET which conducts transient current to ground. The SurgeSwitch™ has an extremely low dynamic resistance and exhibits a nearly constant clamping voltage across the rated peak pulse current range.



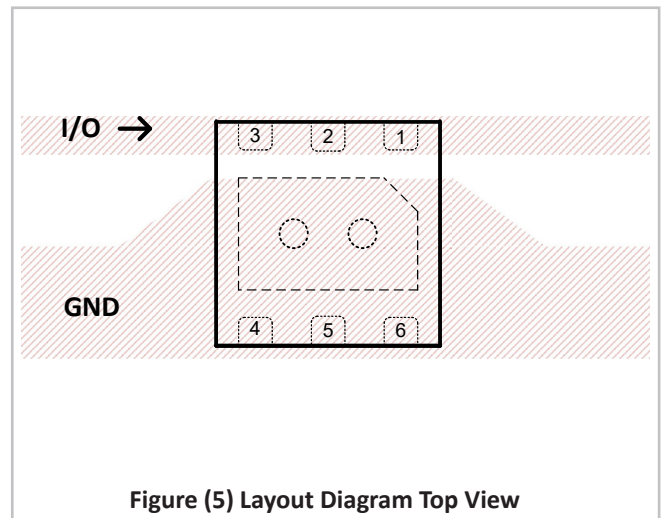
PIN CONFIGURATION

TDS5311P is in a 2 x 2mm, 6-pin DFN package. The input or connection to the protected bus is made at pins 1, 2, and 3. Ground connection is made at pins 4, 5, and 6. The exposed center pad may be connected to GND. The pin configuration is shown in Figure (4).

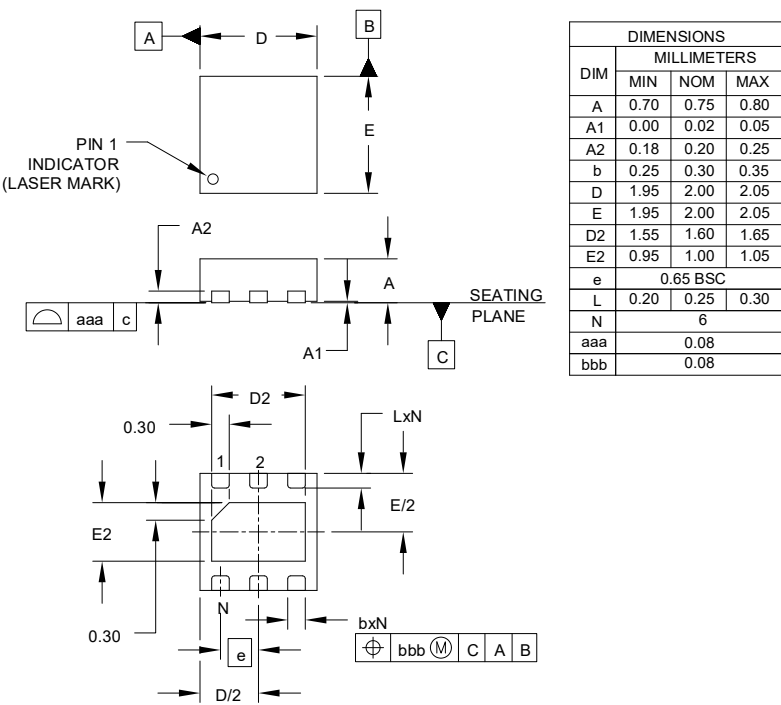


LAYOUT GUIDELINES

Figure 5 shows a recommended layout. Multiple vias are recommended for the ground connection.

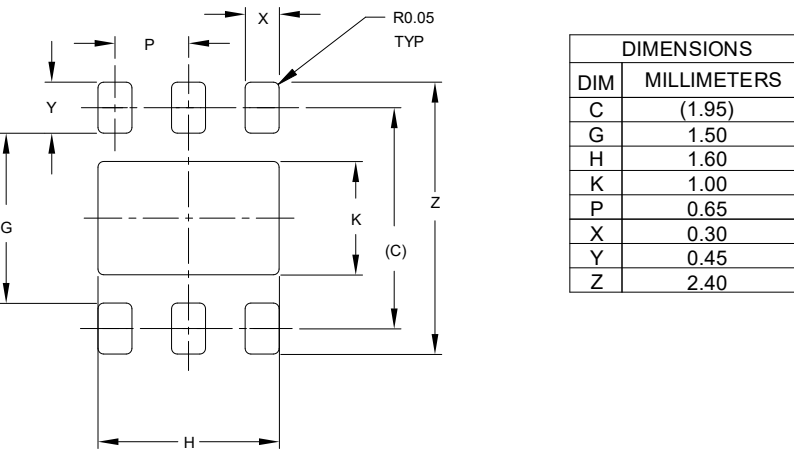


Outline Drawing - DFN 2.0 x 2.0 x 0.75 mm, 6 Lead



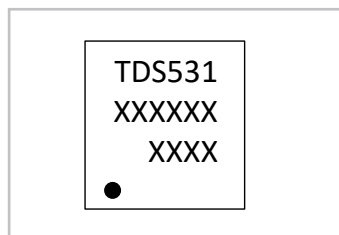
- NOTES:
- 1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
 - 2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

Landing Pattern - DFN 2.0 x 2.0 x 0.75 mm, 6 Lead



- NOTES:
- 1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
 - 2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

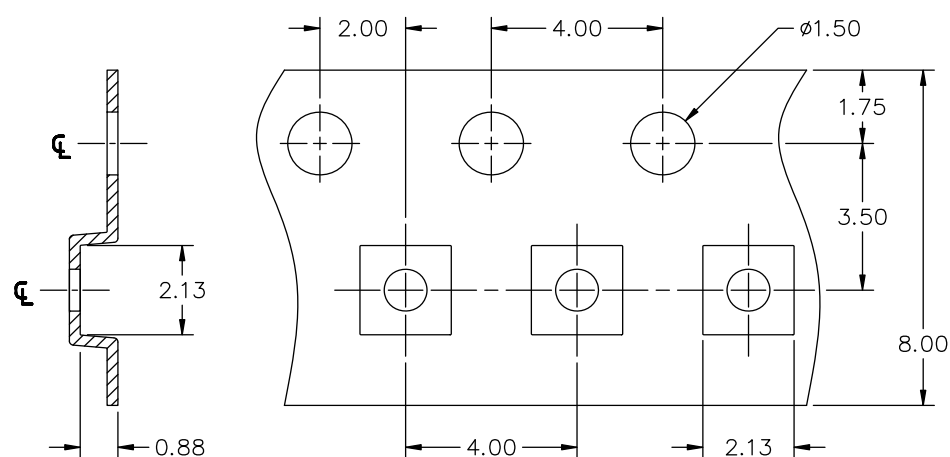
Marking Code



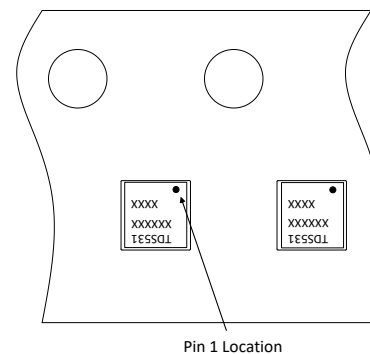
Note:

1. Dot indicates Pin 1 location.
2. XXXXXX Lot Number
3. XXXX Date Code

Tape and Reel Specification



Note: All dimensions are nominal dimensions in mm.



Pin 1 Location

Order Information

PART NUMBER	QTY PER REEL	DESCRIPTION
TDS5311P.C	3,000	7" Reel



SEMTECH®

Datasheet Identification Table

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