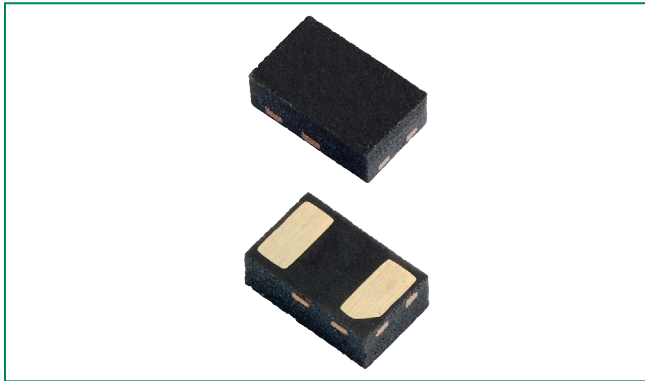


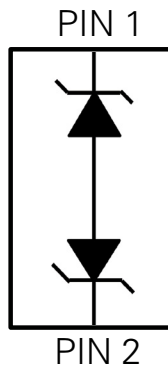
## SP1233 20A Discrete Bidirectional TVS Diode



### Description

The SP1233 includes TVS diodes fabricated in a proprietary silicon avalanche technology to protect each I/O pin and provide a high level of protection for electronic equipment that may experience destructive electrostatic discharges (ESD). These robust diodes can safely absorb repetitive ESD strikes at  $\pm 30\text{kV}$  (contact discharge, IEC61000-4-2) without performance degradation. Additionally, the SP1233 offers up to 20A 8/20 surge rating with low clamping voltages

### Pinout and Functional Block Diagram



### Features

- ESD, IEC 61000-4-2,  $\pm 30\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 20A (8/20 as defined in IEC 61000-4-5 2<sup>nd</sup> edition)
- Low clamping voltage
- Low leakage current
- AEC-Q101 qualified
- Moisture Sensitivity Level (MSL -1)
- Halogen free, lead free and RoHS compliant

### Applications

- Switches / Buttons
- Test Equipment / Instrumentation
- Point-of-Sale Terminals
- Medical Equipment
- Notebooks / Desktops / Servers
- Computer Peripherals

Life Support Note:

**Not Intended for Use in Life Support or Life Saving Applications**

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

### Absolute Maximum Ratings

| Symbol     | Parameter                              | Value      | Units |
|------------|--|------------|-------|
| $I_{pp}$   | Peak Pulse Current ( $t_p=8/20\mu s$ ) | 20         | A     |
| $P_{pk}$   | Peak Pulse Power ( $t_p=8/20\mu s$ )   | 180        | W     |
| $T_{OP}$   | Operating Temperature                  | -40 to 125 | °C    |
| $T_{STOR}$ | Storage Temperature                    | -55 to 150 | °C    |

Notes:

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

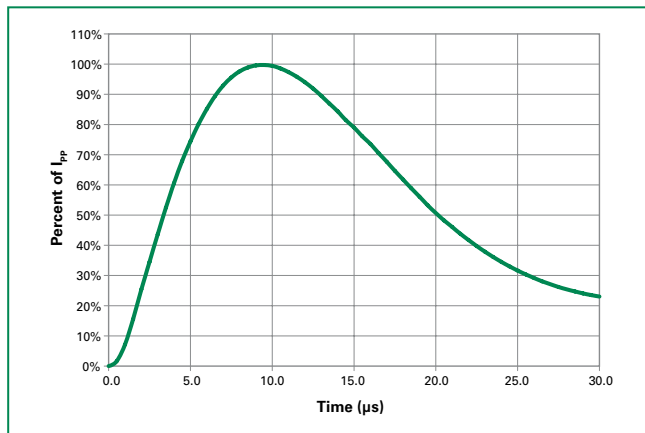
### Electrical Characteristics ( $T_{OP}=25^\circ C$ )

| Parameter                          | Symbol     | Test Conditions                      | Min      | Typ  | Max | Units    |
|------------------------------------|------------|--------------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$  | $I_R \leq 1\mu A$                    |          |      | 3.3 | V        |
| Breakdown Voltage                  | $V_{BR}$   | $I_R = 1mA$                          |          | 4.2  |     | V        |
| Leakage Current                    | $I_{LEAK}$ | $V_R = 3.3V$                         |          | 0.02 | 0.5 | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$      | $I_{PP} = 10A, t_p = 8/20\mu s, Fwd$ |          | 6.1  |     | V        |
|                                    |            | $I_{PP} = 20A, t_p = 8/20\mu s, Fwd$ |          | 8.5  |     | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$  | TLP, $t_p = 100ns, I/O$ to GND       |          | 0.07 |     | $\Omega$ |
| Peak Pulse Current                 | $I_{pp}$   | $t_p = 8/20\mu s$                    |          |      | 20  | A        |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$  | IEC 61000-4-2 (Contact Discharge)    | $\pm 30$ |      |     | kV       |
|                                    |            | IEC 61000-4-2 (Air Discharge)        | $\pm 30$ |      |     | kV       |
| Diode Capacitance <sup>1</sup>     | $C_D$      | Reverse Bias=0V, $f=1MHz$            |          | 35   |     | pF       |

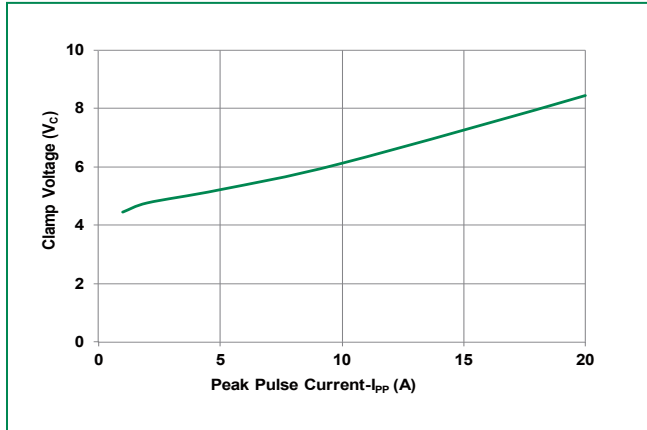
Note:

- Parameter is guaranteed by design and/or component characterization.
- Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window  $t_1=70ns$  to  $t_2=90ns$

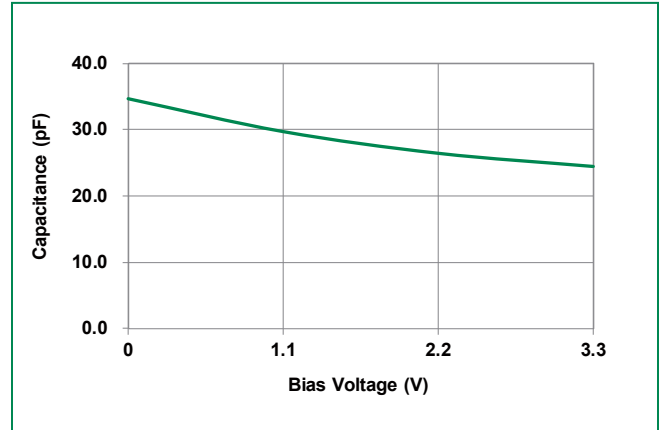
### 8/20 $\mu s$ Pulse Waveform



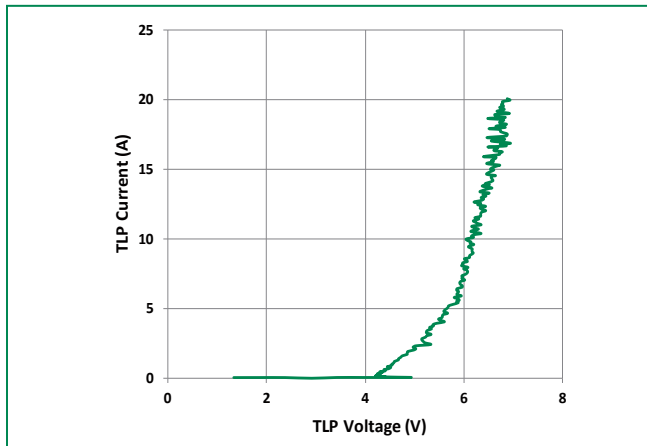
**Clamping voltage vs.  $I_{pp}$  for 8/20 $\mu$ S waveshape**



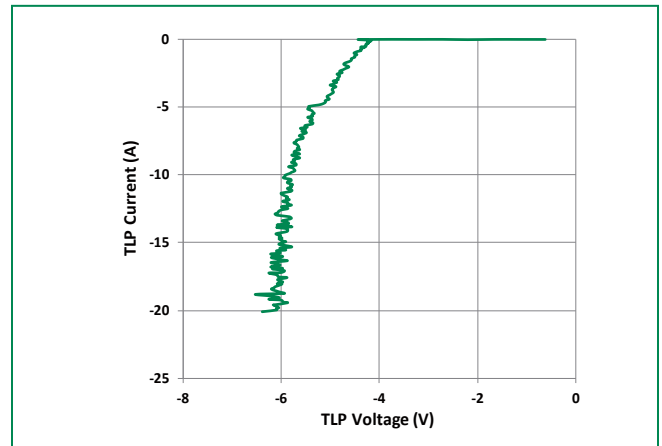
**Capacitance vs. Reverse Bias**



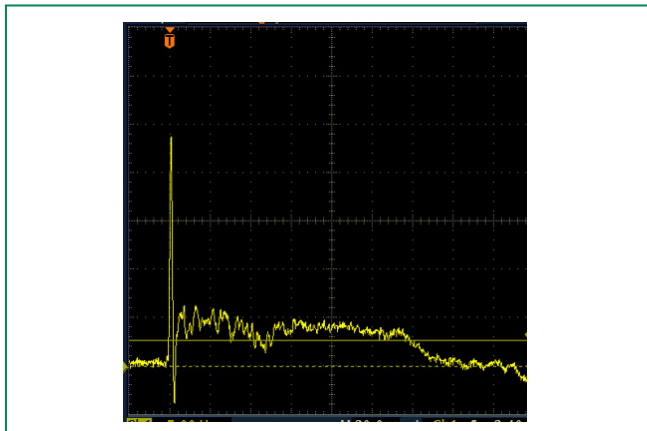
**Positive Transmission Line Pulsing (TLP) Plot**



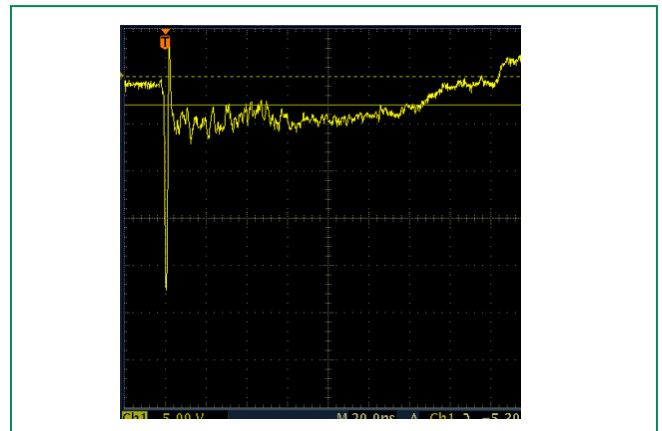
**Negative Transmission Line Pulsing (TLP) Plot**



**IEC 61000-4-2 +8 kV Contact ESD Clamping Voltage**

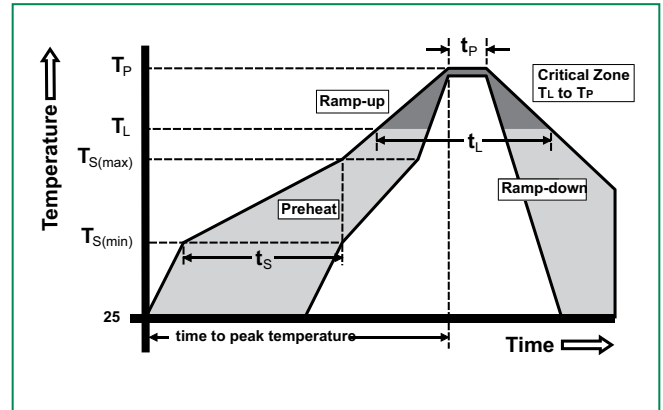


**IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage**

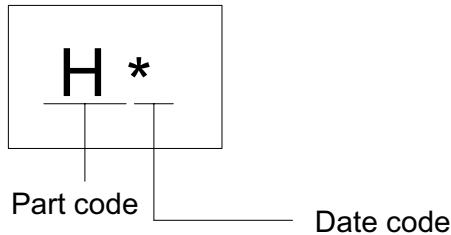


### Soldering Parameters

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Pb – Free assembly      |
| Pre Heat   | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|  | - Time (min to max) ( $t_s$ )      | 60 – 180 secs           |
| Average ramp up rate (Liquidus) Temp ( $T_L$ ) to peak |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow   | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|  | - Temperature ( $t_L$ )            | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds         |
| Ramp-down Rate   |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed  |                                    | 260°C                   |



### Part Marking System

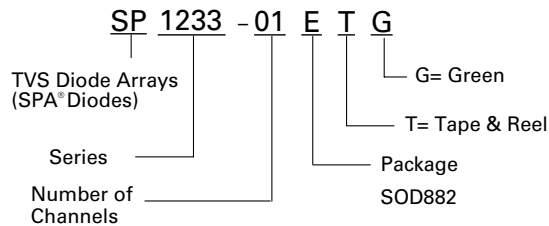


### Product Characteristics

|                           |   |
|---------------------------|---|
| <b>Lead Plating</b>       | Pre-Plated Frame  |
| <b>Lead Material</b>      | Copper Alloy  |
| <b>Substrate material</b> | Silicon   |
| <b>Body Material</b>      | Molded Compound   |
| <b>Flammability</b>       | UL Recognized compound meeting flammability rating V-0. |

- Notes :
1. All dimensions are in millimeters
  2. Dimensions include solder plating.
  3. Dimensions are exclusive of mold flash & metal burr.

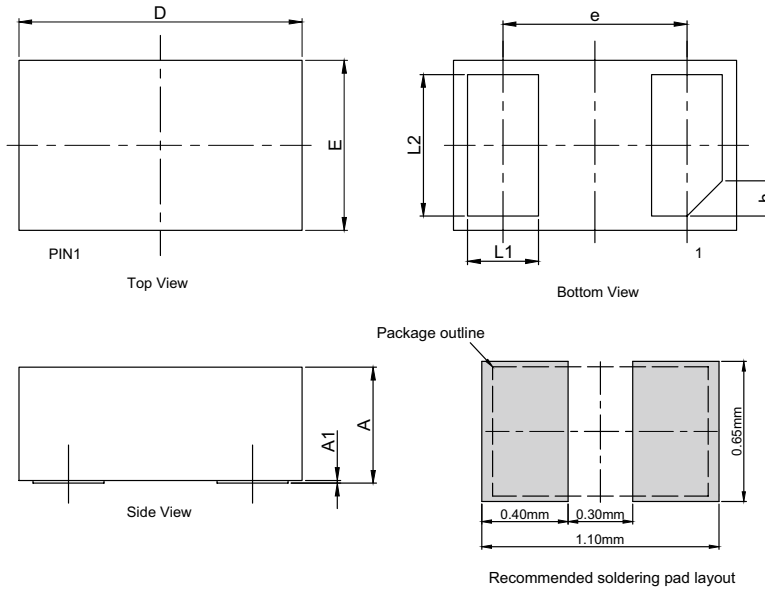
### Part Numbering System



### Ordering Information

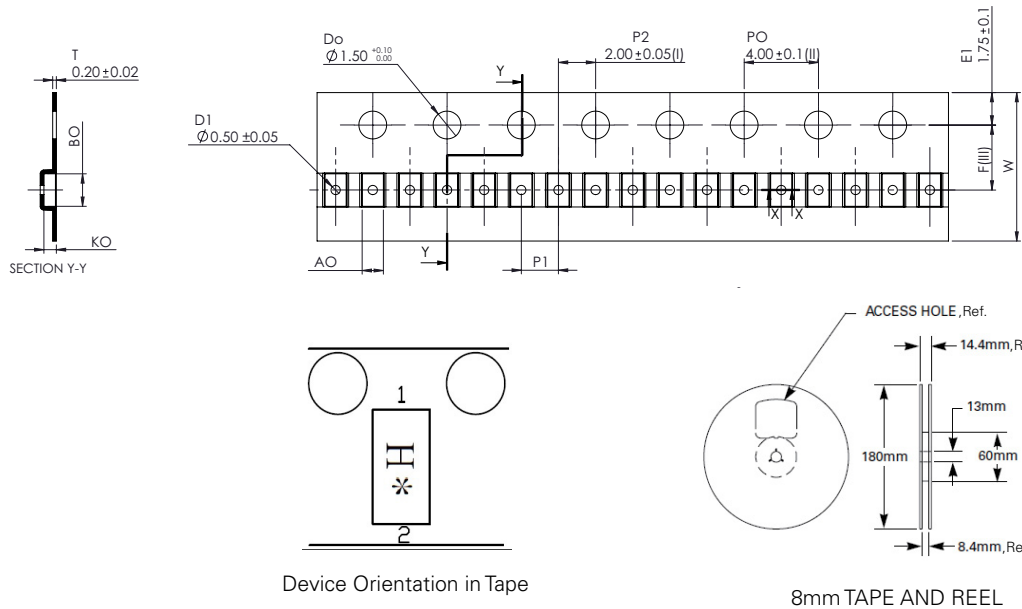
| Part Number  | Package | Marking | Min. Order Qty. |
|--------------|---------|---------|-----------------|
| SP1233-01ETG | SOD882  | H*      | 10,000          |

**Package Dimensions**



| Symbol    | SOD882        |      |      |
|-----------|---------------|------|------|
|           | Millimeters   |      |      |
|           | Min           | Nor  | Max  |
| <b>A</b>  | 0.40          | 0.45 | 0.55 |
| <b>A1</b> | -             | 0.02 | 0.05 |
| <b>L1</b> | 0.20          | 0.25 | 0.30 |
| <b>L2</b> | 0.45          | 0.50 | 0.55 |
| <b>D</b>  | 0.90          | 1.00 | 1.10 |
| <b>E</b>  | 0.50          | 0.60 | 0.70 |
| <b>e</b>  | 0.65 BSC      |      |      |
| <b>h</b>  | 0.125 (x 45°) |      |      |

**Embossed Carrier Tape & Reel Specification**



| Symbol    | Millimeters   |
|-----------|---------------|
| <b>A0</b> | 1.14 +/- 0.03 |
| <b>B0</b> | 1.75 +/- 0.03 |
| <b>K0</b> | 0.67 +/- 0.05 |
| <b>F</b>  | 3.50 +/- 0.05 |
| <b>P1</b> | 2.00 +/- 0.10 |
| <b>W</b>  | 8.00 +/- 0.10 |

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