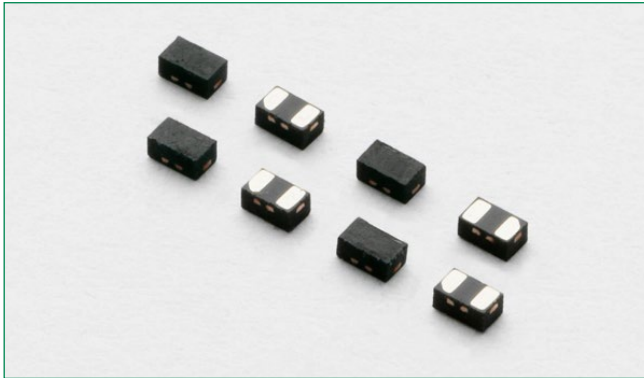
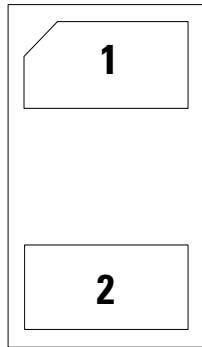


SP3021 Series 0.5pF 8kV Bidirectional Discrete TVS



**Pinout**



**Functional Block Diagram**



**Additional Information**



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.

**Description**

The SP3021 includes back-to-back TVS diodes fabricated in a proprietary silicon avalanche technology to provide protection for electronic equipment that may experience destructive electrostatic discharges (ESD). These robust diodes can safely absorb repetitive ESD strikes up to the maximum level specified in the IEC 61000-4-2 international standard without performance degradation. The back-to-back configuration provides symmetrical ESD protection for data lines when AC signals are present.

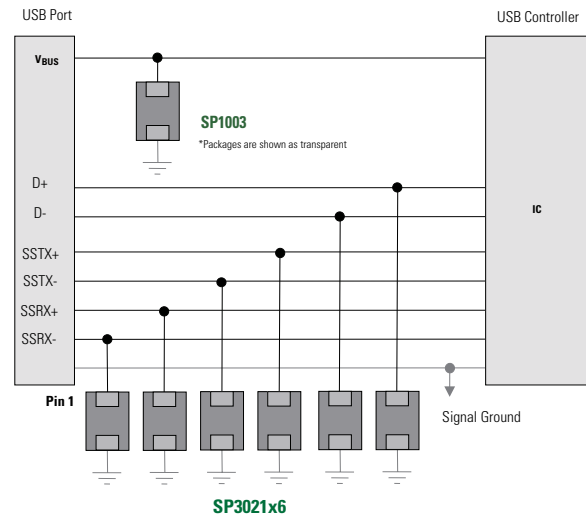
**Features**

- ESD protection of  $\pm 8\text{kV}$  contact discharge,  $\pm 15\text{kV}$  air discharge, (IEC 61000-4-2)
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning protection, IEC 61000-4-5 2nd edition ( $t_p = 8/20\mu\text{s}$ )
- Low capacitance of  $0.5\text{pF}$  @  $V_R = 0\text{V}$
- Low leakage current of  $1\mu\text{A}$  at  $5\text{V}$
- 0402 small footprint available
- RoHS compliant, lead-free and halogen free
- AEC-Q101 qualified

**Applications**

- USB 3.0/USB 2.0
- MHL/MIPI/MDDI
- HDMI, Display Port, eSATA
- Set Top Boxes, Game Consoles
- Smart Phones
- External Storage
- Ultrabooks, Notebooks
- Tablets, eReaders

**USB3.0 Application Example**



### Absolute Maximum Ratings

| Symbol     | Parameter                        | Value      | Units |
|------------|----------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ ) | 2.0        | A     |
| $T_{OP}$   | Operating Temperature            | -40 to 125 | °C    |
| $T_{STOR}$ | Storage Temperature              | -55 to 150 | °C    |

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

### Thermal Information

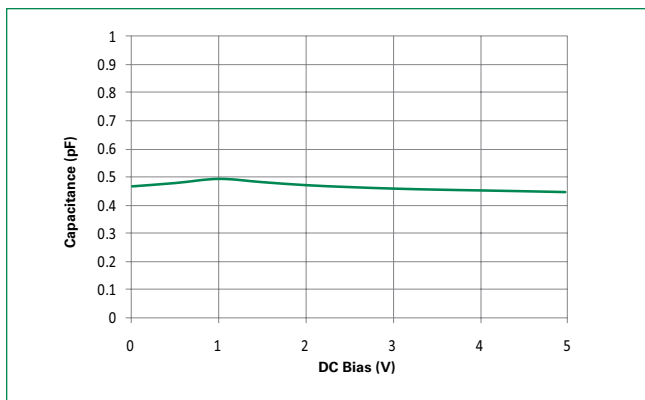
| Parameter                                   | Rating     | Units |
|---------------------------------------------|------------|-------|
| Storage Temperature Range                   | -55 to 150 | °C    |
| Maximum Junction Temperature                | 150        | °C    |
| Maximum Lead Temperature (Soldering 20-40s) | 260        | °C    |

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

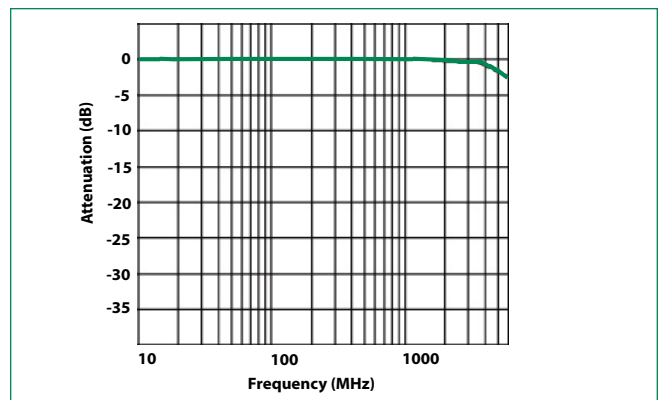
| Parameter                          | Symbol     | Test Conditions                     | Min      | Typ  | Max | Units    |
|------------------------------------|------------|-------------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$  |                                     |          |      | 5.0 | V        |
| Reverse Breakdown Voltage          | $V_{BR}$   | $I_R=1mA$                           | 7.0      |      |     | V        |
| Reverse Leakage Current            | $I_{LEAK}$ | $V_R=5V$                            |          |      | 1   | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$      | $I_{PP}=1A, t_p=8/20\mu s, Fwd$     |          | 13.1 |     | V        |
|                                    |            | $I_{PP}=2A, t_p=8/20\mu s, Fwd$     |          | 14.7 |     | V        |
| Dynamic Resistance                 | $R_{DYN}$  | $(V_{C2}-V_{C1})/(I_{PP2}-I_{PP1})$ |          | 1.6  |     | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$  | IEC61000-4-2 (Contact)              | $\pm 8$  |      |     | kV       |
|                                    |            | IEC61000-4-2 (Air)                  | $\pm 15$ |      |     | kV       |
| Diode Capacitance <sup>1</sup>     | $C_D$      | Reverse Bias=0V                     |          | 0.5  |     | pF       |

**Note: 1.** Parameter is guaranteed by design and/or device characterization.

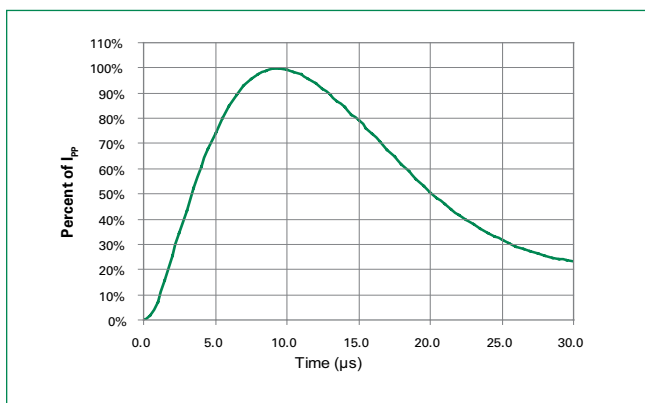
### Capacitance vs. Bias Voltage



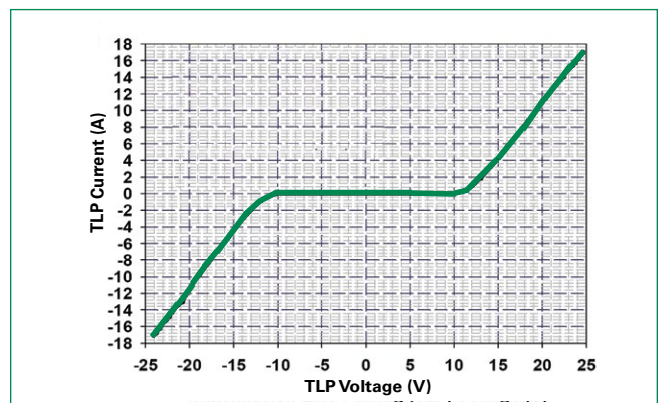
### Insertion Loss (S21) I/O to GND



### Pulse Waveform



### Transmission Line Pulsing (TLP) Plot



**Product Characteristics**

|                            |                               |
|----------------------------|-------------------------------|
| <b>Lead Plating</b>        | Pre-Plated Frame or Matte Tin |
| <b>Lead Material</b>       | Copper Alloy                  |
| <b>Lead Coplanarity</b>    | 0.0004 inches (0.102mm)       |
| <b>Substitute Material</b> | Silicon                       |
| <b>Body Material</b>       | Molded Epoxy                  |
| <b>Flammability</b>        | UL 94 V-0                     |

**Notes :**

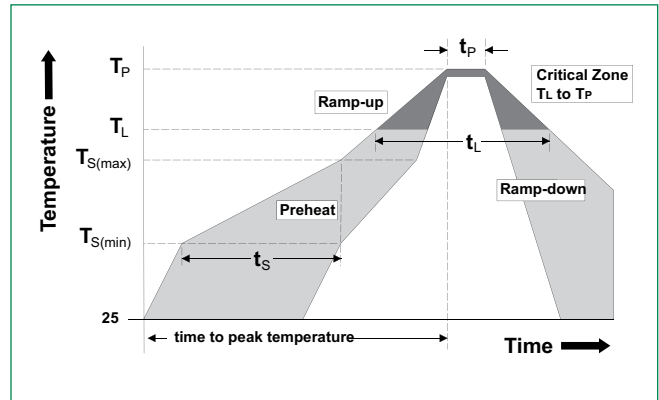
- All dimensions are in millimeters
- Dimensions include solder plating.
- Dimensions are exclusive of mold flash & metal burr.
- Bto is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
- Package surface matte finish VDI 11-13.

**Ordering Information**

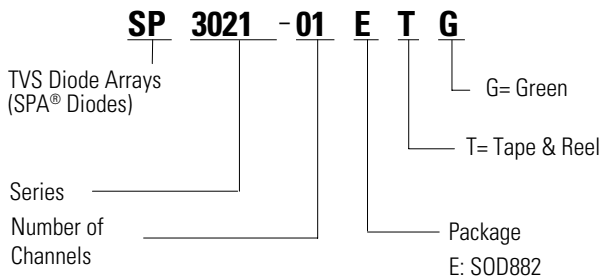
| Part Number  | Package | Min. Order Qty. |
|--------------|---------|-----------------|
| SP3021-01ETG | SOD882  | 12000           |

**Soldering Parameters**

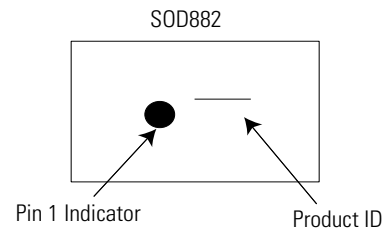
|                                                                        |                                    |                  |
|------------------------------------------------------------------------|------------------------------------|------------------|
| <b>Reflow Condition</b>             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



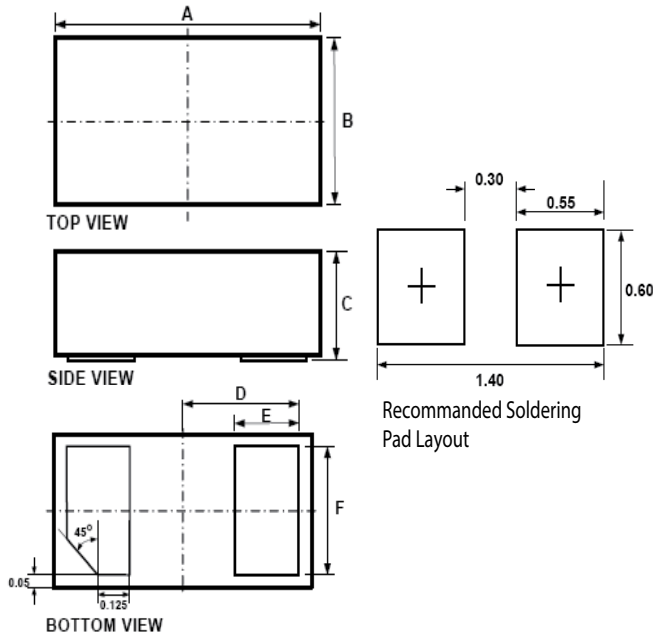
**Part Numbering System**



**Part Marking System**

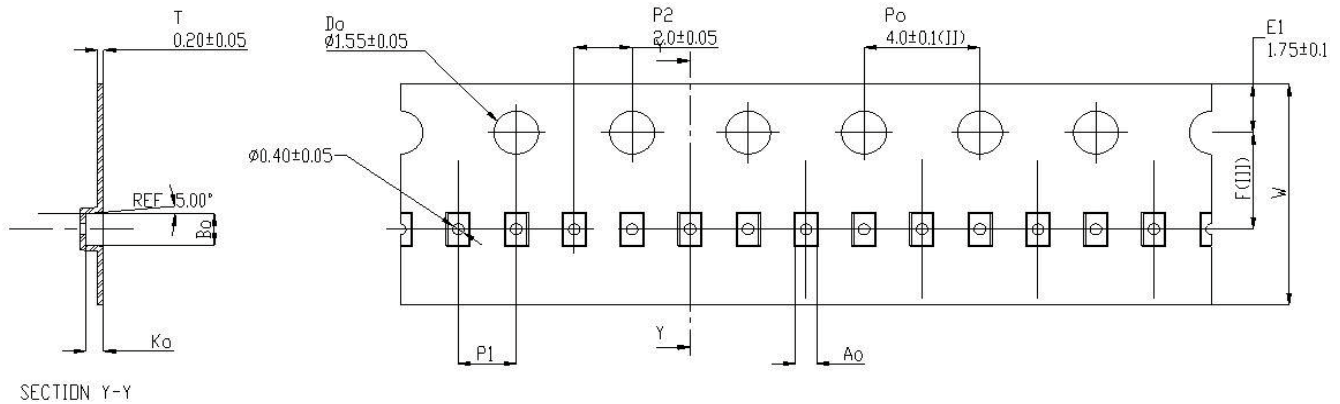


**Package Dimensions – SOD882**



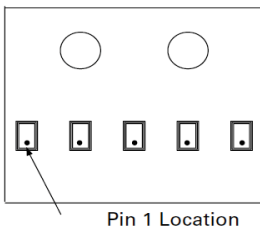
| Symbol | Package     | SOD882 |      |        |       |       |
|--------|-------------|--------|------|--------|-------|-------|
|        | JEDEC       | MO-236 |      |        |       |       |
|        | Millimeters |        |      | Inches |       |       |
|        | Min         | Typ    | Max  | Min    | Typ   | Max   |
| A      | 0.90        | 1.00   | 1.10 | 0.035  | 0.039 | 0.043 |
| B      | 0.50        | 0.60   | 0.70 | 0.020  | 0.024 | 0.028 |
| C      | 0.40        | 0.50   | 0.60 | 0.016  | 0.020 | 0.024 |
| D      |             | 0.45   |      |        | 0.018 |       |
| E      | 0.20        | 0.25   | 0.35 | 0.008  | 0.010 | 0.012 |
| F      | 0.45        | 0.50   | 0.55 | 0.018  | 0.020 | 0.022 |

**Embossed Carrier Tape & Reel Specification – SOD882**



Notes:  
1. All dimensions are in millimeters

Device Orientation in Tape



| Symbol | Millimeters       |
|--------|-------------------|
| A0     | 0.70±0.045        |
| B0     | 1.10±0.045        |
| K0     | 0.65±0.045        |
| F      | 3.50±0.05         |
| P1     | 2.00±0.10         |
| W      | 8.00 + 0.30 -0.10 |

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