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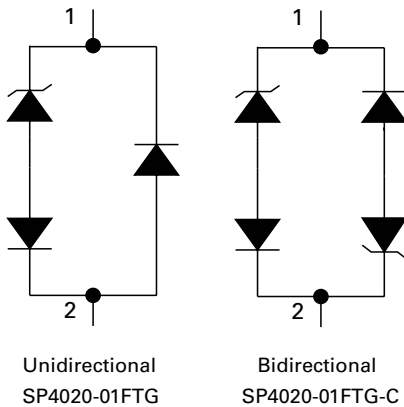
## SP4020 Series 2.5pF, 30A Discrete TVS Diode



### Pinout



### Functional Block Diagram



### Description

The SP4020 devices integrate low capacitance steering diodes with one or two zener diodes for unidirectional or bidirectional protection, respectively, to protect against ESD and lightning induced surge events. These devices can safely absorb up to 30A per IEC61000-4-5 ( $t_p=8/20\mu s$ ) without performance degradation and a minimum  $\pm 30kV$  ESD per IEC61000-4-2 International Standard. The low loading capacitance and high surge capability make it ideal for protecting telecommunication ports such as Ethernet and other high speed data interfaces.

### Features

- ESD, IEC61000-4-2,  $\pm 30kV$  contact,  $\pm 30kV$  air
- EFT, IEC61000-4-4, 40A (5/50ns)
- Lightning, IEC61000-4-5, 30A ( $t_p=8/20\mu s$ )
- Low capacitance of 2.5pF (@  $V_R=0V$ )
- Low leakage current of 0.1 $\mu A$  at 3.3V
- Unidirectional and Bidirectional configuration
- Small SOD323 package fits 0805 footprints

### Applications

- 10/100/1000 Ethernet
- T1/E1/T3/E3
- USB 1.1/2.0
- Power Ports
- Computers and Peripherals
- Instrumentation
- Medical Equipment

SP4020

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 Current ( $t_p=8/20\mu s$ )     | 30         | A     |
| $P_{PK}$   | Peak Pulse Power ( $t_p=8/20\mu s$ ) | 750        | 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 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    |

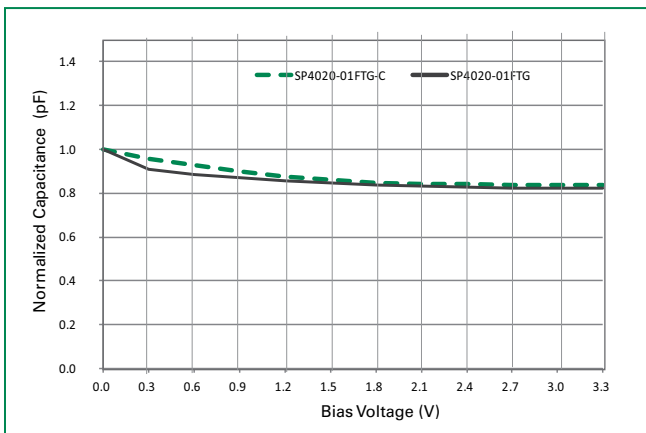
**Electrical Characteristics ( $T_{OP}=25^\circ C$ )**

| Parameter                          | Symbol     | Test Conditions                           | Min      | Typ  | Max | Units    |
|------------------------------------|------------|---|----------|------|-----|----------|
| Breakdown Voltage                  | $V_{BD}$   | $I_R=2\mu A$                              | 3.5      |      |     | V        |
| Reverse Standoff Voltage           | $V_{RWM}$  | $I_R \leq 1\mu A$                         |          |      | 3.3 | V        |
| Leakage Current                    | $I_{LEAK}$ | $V_R=3.3V$                                |          | 0.1  | 0.5 | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$      | $I_{PP}=1A, t_p=8/20\mu s, Fwd$           |          | 6.6  |     | V        |
|                                    |            | $I_{PP}=10A, t_p=8/20\mu s, Fwd$          |          | 14.2 |     | V        |
|                                    |            | $I_{PP}=24A, t_p=8/20\mu s, Fwd$          |          | 21.8 |     | V        |
| Dynamic Resistance                 | $R_{DYN}$  | $(V_{C2} - V_{C1}) / (I_{PP2} - I_{PP1})$ |          | 0.7  |     | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$  | IEC61000-4-2 (Contact Discharge)          | $\pm 30$ |      |     | kV       |
|                                    |            | IEC61000-4-2 (Air Discharge)              | $\pm 30$ |      |     | kV       |
| Diode Capacitance <sup>1</sup>     | $C_D$      | Reverse Bias=0V, f=1MHz                   |          | 2.5  |     | pF       |

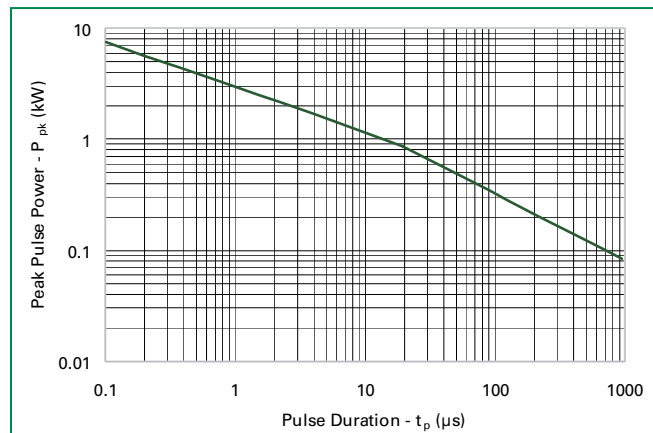
Note:

<sup>1</sup>Parameter is guaranteed by design and/or device characterization.

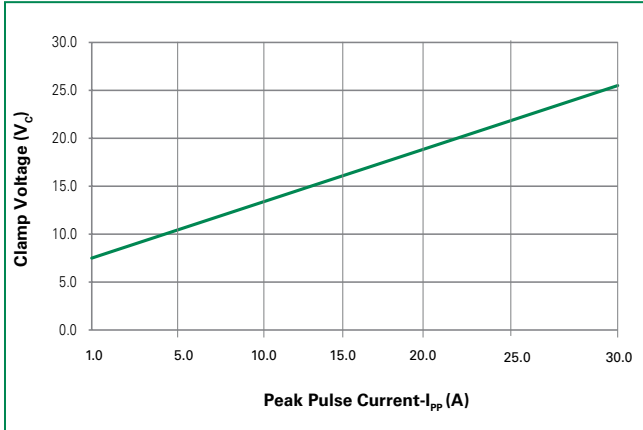
**Normalized Capacitance vs. Bias Voltage**



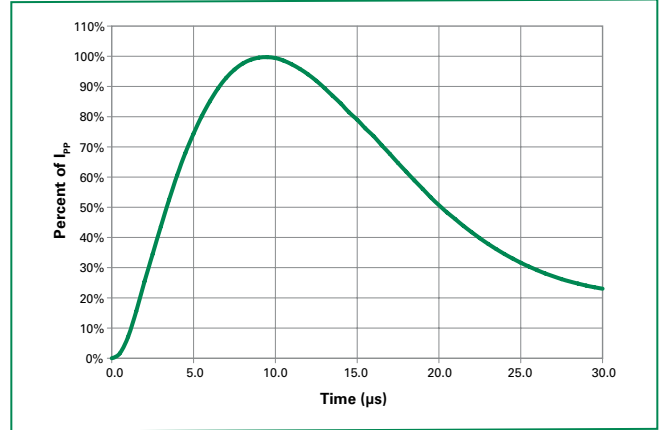
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



**Clamping Voltage vs.  $I_{pp}$**

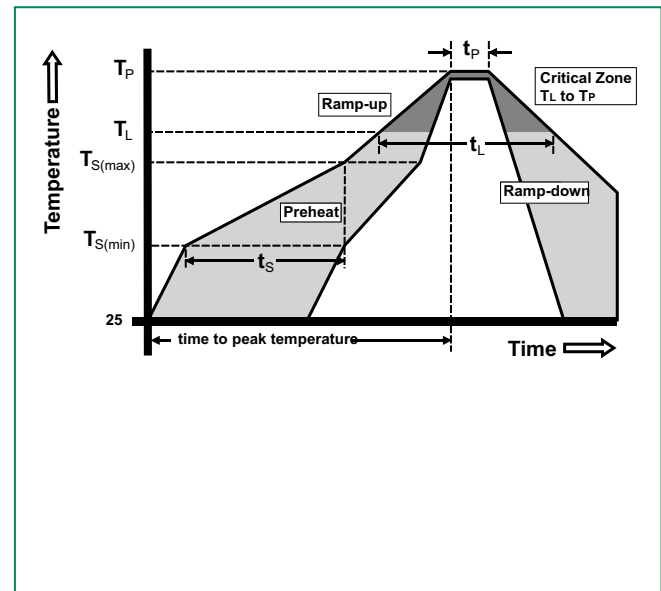


**Pulse Waveform**



**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                              |                  |

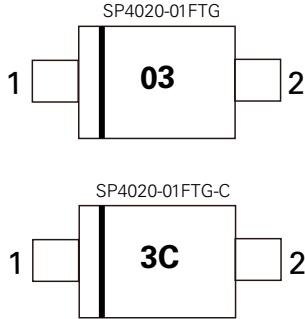


**Product Characteristics**

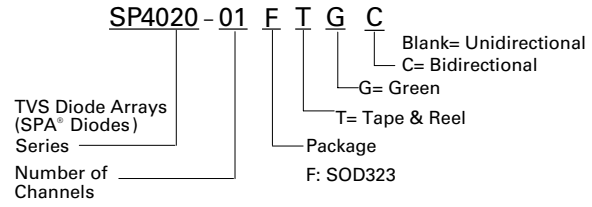
|                            |                         |
|----------------------------|-------------------------|
| <b>Lead Plating</b>        | Matte Tin               |
| <b>Lead Material</b>       | Iron Alloy              |
| <b>Lead Coplanarity</b>    | 0.0004 inches (0.102mm) |
| <b>Substitute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

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

**Part Marking System**



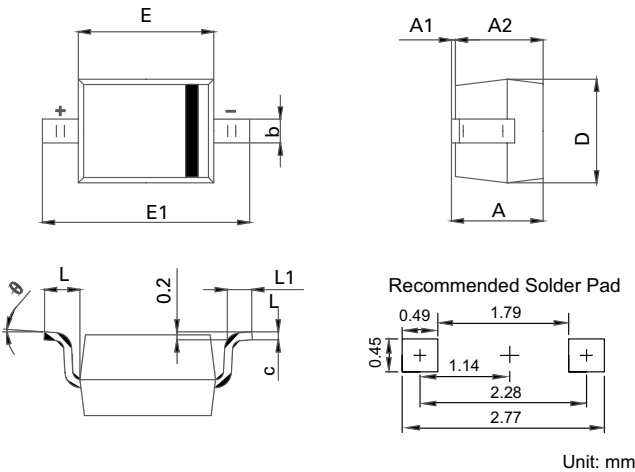
**Part Numbering System**



**Ordering Information**

| Part Number    | Package | Marking | Min. Order Qty. |
|----------------|---------|---------|-----------------|
| SP4020-01FTG   | SOD323  | 03      | 3000            |
| SP4020-01FTG-C | SOD323  | 3C      | 3000            |

**Package Dimensions -SOD323**



| Symbol | SOD323      |      |        |       |
|--------|-------------|------|--------|-------|
|        | Millimeters |      | Inches |       |
|        | Min         | Max  | Min    | Max   |
| A      | 0.8         | 1.14 | 0.031  | 0.045 |
| A1     | 0.00        | 0.10 | 0.000  | 0.004 |
| A2     | 0.80        | 1.04 | 0.031  | 0.014 |
| b      | 0.25        | 0.35 | 0.010  | 0.014 |
| c      | 0.08        | 0.15 | 0.003  | 0.006 |
| D      | 1.15        | 1.45 | 0.045  | 0.057 |
| E      | 1.60        | 1.90 | 0.063  | 0.075 |
| E1     | 2.44        | 2.70 | 0.096  | 0.106 |
| L1     | 0.25        | 0.45 | 0.010  | 0.018 |

**Embossed Carrier Tape & Reel Specification – SOD323**

