

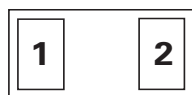
# SP00R6

## 0.2pF, 12KV Diode, Low Voltage Low Capacitance ESD Protection

HF **RoHS** **Pb**

Note: This package image is for example and reference only. For detail package drawing, please refer to the package section in this datasheet.

### Pinout



### Functional Block Diagram



### Description

The SP00R6 features extremely low breakdown/turn on voltages, making them more ideal protectors of low voltage -0.3 to +0.3V data lines. These robust diodes can safely absorb repetitive ESD strikes above the maximum level specified in IEC 61000-4-2 international standard (Level 4, ±8kV contact discharge) without performance degradation.

### Features

- ESD, IEC 61000-4-2, ±12 contact, ±15kV air
- EFT, IEC 61000-4-4, 30A (5/50ns)
- Surge Tolerance, IEC 61000-4-5 2nd Edition, 3A (8/20us)
- Low capacitance of 0.2pF (TYP)
- Space efficient 0201 package
- Halogen-free, lead-free and RoHS-compliant

### Applications

- USB 3.x
- Thunderbolt 4 or 3
- USB4(TM)
- USB 3.2 Gen 2x2
- USB 3.2 Gen 2
- PCI Express 6.0

#### 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.

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### Absolute Maximum Ratings

| Symbol     | Parameter                        | Value      | Units |
|------------|----------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ ) | 3          | 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 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 ( $T_{OP}=25^\circ C$ )

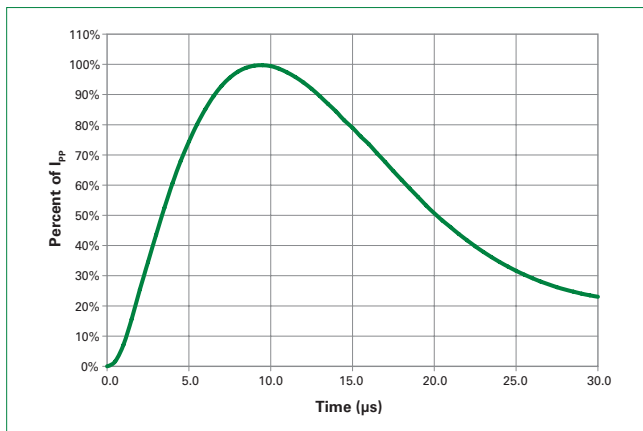
| Parameter                          | Symbol     | Test Conditions                   | Min      | Typ | Max | Units    |
|------------------------------------|------------|-----------------------------------|----------|-----|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$  |                                   |          |     | 0.3 | V        |
| Breakdown Voltage                  | $V_{BR}$   | $I_R=1mA$                         | 0.7      |     | 0.9 | V        |
| Reverse Leakage Current            | $I_{LEAK}$ | $V_R=0.3V$ , Any I/O to GND       |          |     | 100 | nA       |
| Clamp Voltage <sup>1</sup>         | $V_C$      | $I_{PP}=1A$ , $t_p=8/20\mu s$     |          | 2.0 |     | V        |
|                                    |            | $I_{PP}=2A$ , $t_p=8/20\mu s$     |          | 2.5 |     |          |
| Dynamic Resistance <sup>3</sup>    | $R_{DYN}$  | TLP, $t_p=100ns$                  |          | 0.3 |     | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$  | IEC 61000-4-2 (Contact Discharge) | $\pm 12$ |     |     | kV       |
|                                    |            | IEC 61000-4-2 (Air Discharge)     | $\pm 15$ |     |     | kV       |
| Line Capacitance <sup>1,2</sup>    | $C_L$      | Reverse Bias=0V, $f=3GHz$         |          | 0.2 |     | pF       |

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

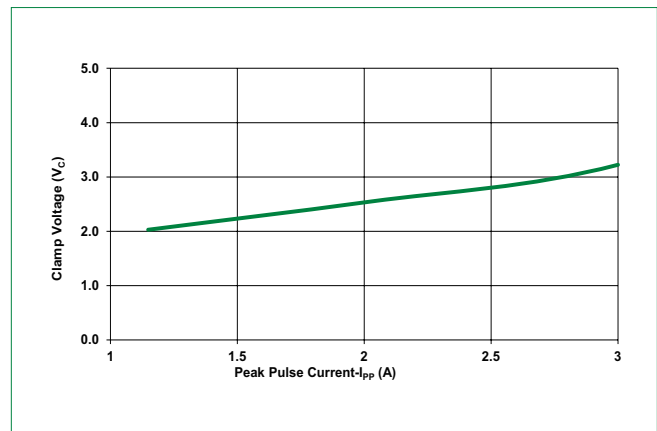
Note 2: Test equipment accuracy  $\pm 50fF$ .

Note 3: Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window  $t1=70ns$  to  $t2=90ns$

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



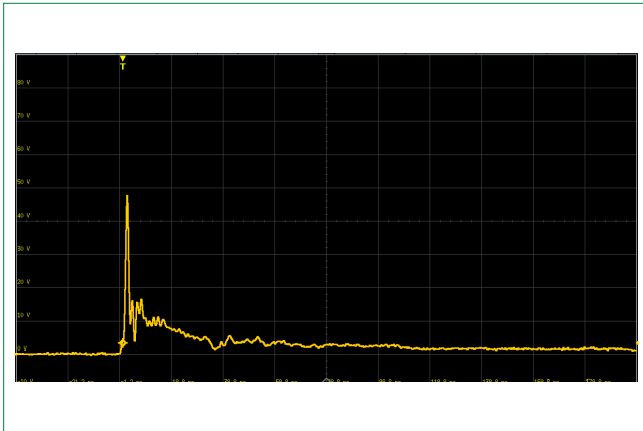
#### Clamping Voltage vs $I_{PP}$



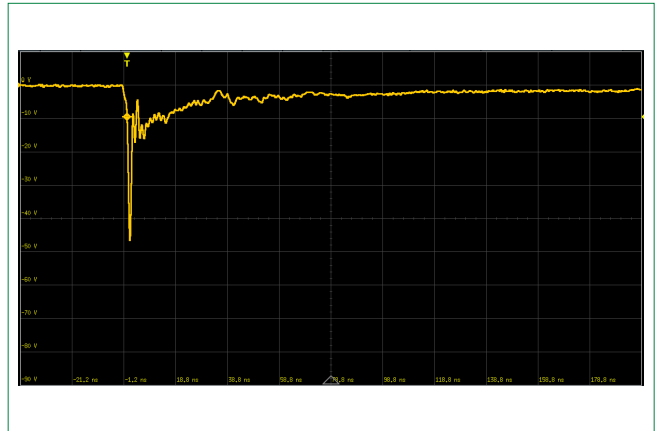
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## 0.2pF, 12KV Diode, Low Voltage Low Capacitance ESD Protection

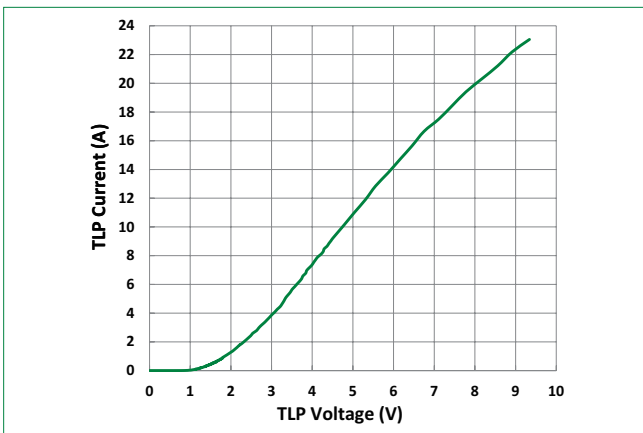
IEC 61000-4-2 +8 kV Contact ESD Clamping Voltage



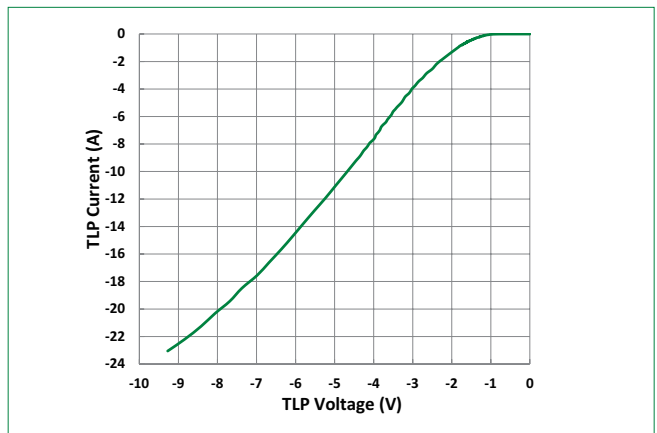
IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage



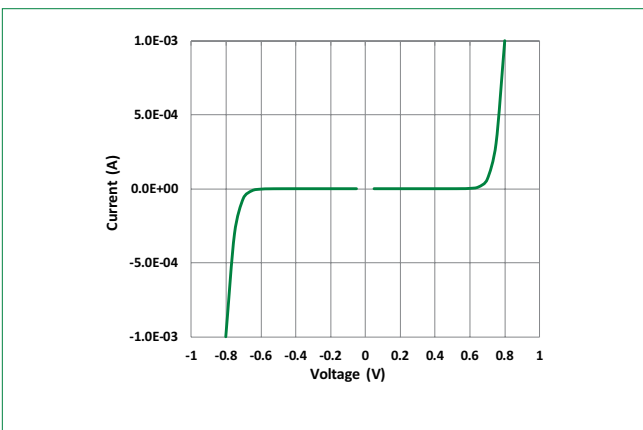
Positive Transmission Line Pulsing (TLP) Plot



Negative Transmission Line Pulsing (TLP) Plot



IV curve

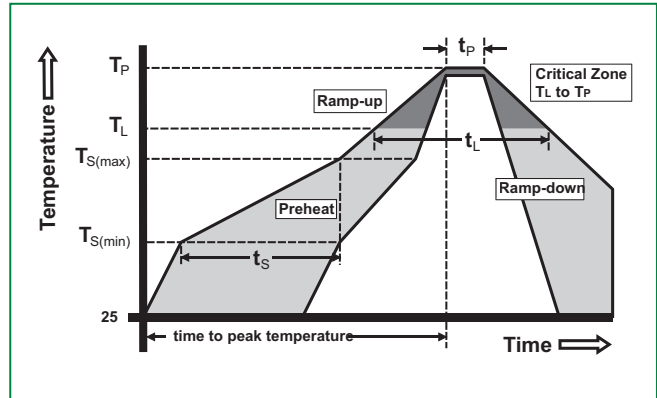


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### Soldering Parameters

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| <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 – 120 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>   |                                    | 30 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                   |



### Ordering Information

| Part Number  | Package  | Min. Order Qty. |
|--------------|----------|-----------------|
| SP00R6-01WTG | Flipchip | 10000           |

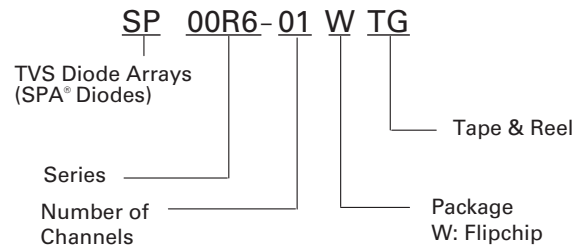
### Part Marking System



### Product Characteristics

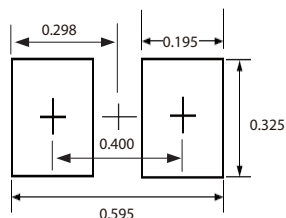
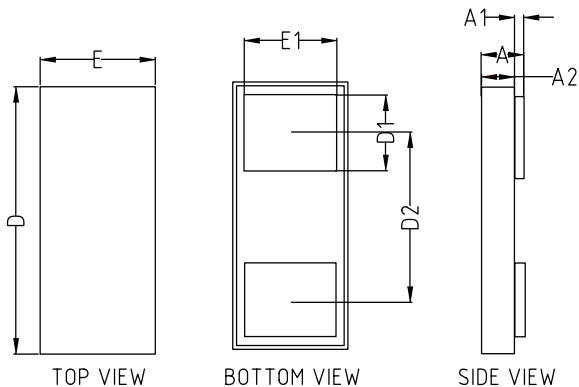
|                           |  |
|---------------------------|--|
| <b>Lead Plating</b>       | Tin plating  |
| <b>Lead material</b>      | Copper bump  |
| <b>Substrate Material</b> | Silicon  |
| <b>Flammability</b>       | UL Recognized compound meeting flammability rating V-0 |

### Part Numbering System



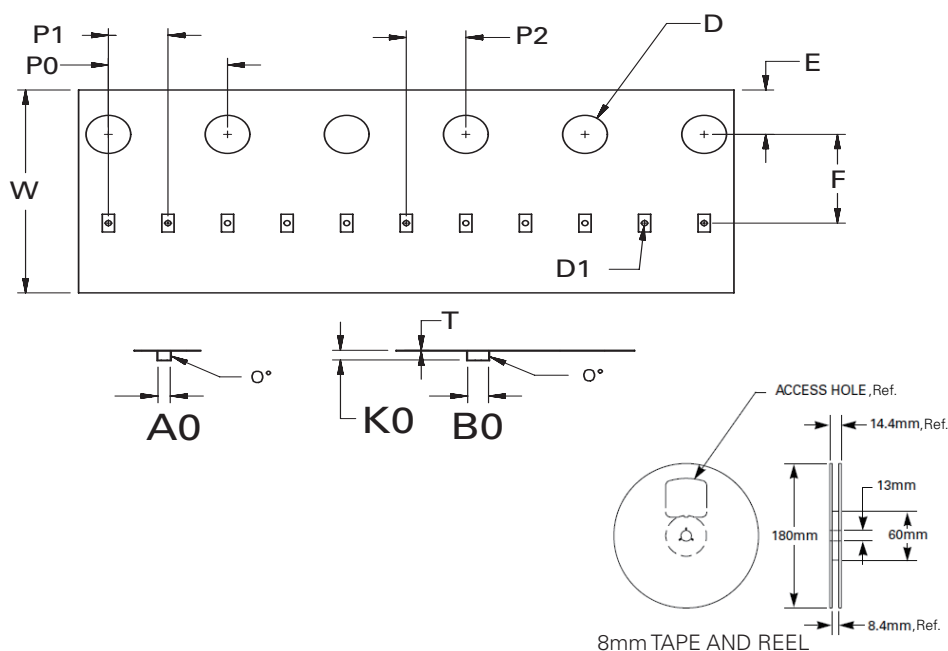
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**Package Dimensions – FLIPCHIP**

Recommended Soldering Pad Layout (mm)

| Symbol    | 0201 Flipchip |       |            |        |
|-----------|---------------|-------|------------|--------|
|           | Millimeters   |       | Inches     |        |
|           | Min           | Max   | Min        | Max    |
| <b>D</b>  | 0.605         | 0.655 | 0.0238     | 0.0258 |
| <b>E</b>  | 0.305         | 0.355 | 0.0120     | 0.0140 |
| <b>D1</b> | 0.145         | 0.155 | 0.0057     | 0.0061 |
| <b>E1</b> | 0.245         | 0.255 | 0.0096     | 0.0100 |
| <b>D2</b> | 0.400 BSC     |       | 0.0157 BSC |        |
| <b>A</b>  | 0.273         | 0.329 | 0.0107     | 0.0130 |
| <b>A2</b> | 0.265         | 0.315 | 0.0104     | 0.0124 |
| <b>A1</b> | 0.008         | 0.014 | 0.0003     | 0.0006 |

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

| Symbol    | Millimeters     |
|-----------|-----------------|
| <b>A0</b> | 0.41+/-0.03     |
| <b>B0</b> | 0.70+/-0.03     |
| <b>D</b>  | ø 1.50 + 0.10   |
| <b>D1</b> | ø 0.20 +/- 0.05 |
| <b>E</b>  | 1.75+/-0.10     |
| <b>F</b>  | 3.50+/-0.05     |
| <b>K0</b> | 0.38+/-0.03     |
| <b>P0</b> | 4.00+/-0.10     |
| <b>P1</b> | 2.00+/-0.05     |
| <b>P2</b> | 2.00+/-0.05     |
| <b>W</b>  | 8.00+0.30/-0.10 |
| <b>T</b>  | 0.23+/-0.02     |

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