**Description**

The SP3213 is a bidirectional TVS Diode that provides ultra low capacitance and a high level of protection for electronic equipment that may experience destructive electrostatic discharges (ESD). The typical capacitance of 0.09pF helps ensure signal integrity on the most challenging consumer electronics interfaces such as USB 3.2, 3.1, HDMI 2.1, 2.0, DisplayPort, Thunderbolt, and V-by-One®.

It can safely absorb repetitive ESD strikes at ±12kV (contact discharge, IEC 61000-4-2) without performance degradation and safely dissipate 2A of 8/20μs surge current (IEC 61000-4-5 2nd edition).

**Features**

- ESD, IEC 61000-4-2, ±12kV contact, ±18kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 2A (8/20 as defined in IEC 61000-4-5 2nd Edition)
- Low leakage current of 0.02μA(TYP) at 5V
- Space efficient 0201 footprint
- AEC-Q101 qualified and PPAP capable
- Halogen free, lead free and RoHS compliant
- Moisture Sensitivity Level(MSL -1)

**Applications**

- Ultra-high speed data lines
- USB 3.2, 3.1, 3.0, and 2.0
- HDMI 2.1, 2.0, 1.4a, 1.3
- DisplayPort(TM)
- Thunderbolt (Light Peak)
- V-by-One®
- LVDS interfaces
- Consumer, mobile and portable electronics
- Tablet PC and external storage with high speed interfaces

**Pinout**

![Pinout Diagram]

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**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{PP}</td>
<td>Peak Pulse Current (t_p=8/20μs)</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>T_{OP}</td>
<td>Operating Temperature</td>
<td>-40 to 125</td>
<td>°C</td>
</tr>
<tr>
<td>T_{STOR}</td>
<td>Storage Temperature</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

**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°C)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Standoff Voltage</td>
<td>V_{RMS}</td>
<td>I_R=1μA, I/O to I/O</td>
<td>5</td>
<td>6.2</td>
<td>7.5</td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td>V_{BR}</td>
<td>I_I=1mA, I/O to I/O</td>
<td>6.2</td>
<td>7.5</td>
<td>7.5</td>
<td>V</td>
</tr>
<tr>
<td>Reverse Leakage Current</td>
<td>I_{LEAK}</td>
<td>V_I=5V</td>
<td>0.02</td>
<td>0.1</td>
<td>0.1</td>
<td>μA</td>
</tr>
<tr>
<td>Clamp Voltage¹</td>
<td>V_C</td>
<td>I_{IP}=1A, t_p=8/20μs, I/O to I/O</td>
<td>12</td>
<td>15</td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_{IP}=2A, t_p=8/20μs, I/O to I/O</td>
<td>14.5</td>
<td>18</td>
<td>18</td>
<td>V</td>
</tr>
<tr>
<td>Dynamic Resistance²</td>
<td>R_{DYN}</td>
<td>TLP, t_p=100ns, I/O to I/O</td>
<td>1.2</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>ESD Withstand Voltage¹</td>
<td>V_{ESD}</td>
<td>IEC 61000-4-2 (Contact Discharge)</td>
<td>±12</td>
<td></td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2 (Air Discharge)</td>
<td>±18</td>
<td></td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td>Diode Capacitance¹</td>
<td>C_{I/O-I/O}</td>
<td>Reverse Bias=0V, f=1MHz, I/O to I/O</td>
<td>0.09</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
</tbody>
</table>

Note: 1. Parameter is guaranteed by design and/or component characterization.
2. Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2=90ns

**Capacitance vs. Reverse Bias**

**Clamping Voltage vs. I_{PP}**

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Revised: JC.01/12/21
TVS Diode Arrays (SPA® Diodes)
Ultra Low Capacitance ESD Protection - SP3213

Positive Transmission Line Pulsing (TLP) Plot

Negative Transmission Line Pulsing (TLP) Plot

Insertion Loss (S21) I/O to GND

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

IEC 61000-4-2 -8kV Contact ESD Clamping Voltage
3.4 Gbps, High Speed Display interfaces

6 Gbps, SATA, HDMI 2.x interfaces

10 Gbps, USB 3.1 Gen 2, Thunderbolt
Soldering Parameters

Reflow Condition
- Lead Material: Copper Alloy
- Substrate Material: Silicon
- Body Material: Molded Compound
- Lead Plating: Pre-Plated Frame
- Flammability: UL Recognized compound meeting flammability rating V-0

Pre Heat
- Temperature Min ($T_{min}$): 150°C
- Temperature Max ($T_{max}$): 200°C
- Time (min to max) ($t_{r}$): 60 – 180 secs

Average ramp up rate (Liquids) $T_{L}$ to peak
3°C/second max

$T_{max}$ to $T_{L}$ - Ramp-up Rate
3°C/second max

Reflow
- Temperature ($T_{L}$) (Liquids): 217°C
- Temperature ($T_{r}$): 60 – 150 seconds

Peak Temperature ($T_{p}$)
260°C to 265°C

Time within 5°C of actual peak Temperature ($t_{r}$)
20 – 40 seconds

Ramp-down Rate
6°C/second max

Time 25°C to peak Temperature ($t_{p}$)
8 minutes Max.

Part Numbering System

SP 3213 - 01 U T G

- TVS Diode Arrays (SPA® Diodes)
- Series
- Number of Channels
- Package: μDFN-2
- G: Green
- T: Tape & Reel

Part Marking System

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Min. Order Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP3213-01UTG</td>
<td>μDFN-2</td>
<td>15000</td>
</tr>
</tbody>
</table>

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Revised: JC.01/12/21
## Package Dimensions — μDFN-2 (0201)

### Upper View
- **A**: 0.25 to 0.33
- **b**: 0.12 to 0.28
- **L1**: 0.12 to 0.22
- **L2**: 0.13 to 0.23
- **D**: 0.60 BSC to 0.024 BSC
- **E**: 0.30 BSC to 0.012 BSC
- **e**: 0.35 REF to 0.014 REF

### Lower View
- **A0**: 0.25 to 0.33
- **b**: 0.12 to 0.28
- **L1**: 0.12 to 0.22
- **L2**: 0.13 to 0.23
- **D**: 0.60 BSC to 0.024 BSC
- **E**: 0.30 BSC to 0.012 BSC
- **e**: 0.35 REF to 0.014 REF

### Recommended soldering pad layout

## Embossed Carrier Tape & Reel Specification — μDFN-2

### Upper View
- **A0**: 0.53 to 0.63
- **B0**: 0.63 to 0.70
- **D0**: 1.40 to 1.60
- **E**: 3.45 to 3.65
- **K0**: 0.30 to 0.39
- **P0**: 1.90 to 2.10
- **P1**: 1.95 to 2.05
- **P2**: 3.90 to 4.10
- **T**: 0.13 to 0.25
- **W**: 7.90 to 8.30

### Lower View
- **A0**: 0.53 to 0.63
- **B0**: 0.63 to 0.70
- **D0**: 1.40 to 1.60
- **E**: 3.45 to 3.65
- **K0**: 0.30 to 0.39
- **P0**: 1.90 to 2.10
- **P1**: 1.95 to 2.05
- **P2**: 3.90 to 4.10
- **T**: 0.13 to 0.25
- **W**: 7.90 to 8.30

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