SP3423, 0.2pF, +20kV/-10kV Diode Array

Description

The SP3423 integrates 2 channels of low capacitance steering diodes and an avalanche breakdown diode to provide protection for electronic equipment that may experience destructive electrostatic discharges (ESD). The SP3423 can safely absorb repetitive ESD strikes above the maximum contact level specified in IEC 61000-4-2 international standard (±8kV contact discharge) without performance degradation.

The low off-state capacitance makes it ideal for protecting high-speed signal lines such as USB2.0/3.0 and 10GbE interfaces with an extremely low dynamic resistance to protect the most sensitive, state of the art chipsets against ESD transients.

Its flow-through capability makes this SP3423 TVS a PCB layout friendly component and helps reduce stray PCB capacitances.

Features

• ESD, IEC 61000-4-2, ±10kV contact, ±15kV air
• EFT, IEC 61000-4-4, 80A (tₚ=5/50ns)
• Lightning, 2A (8/20 as defined in IEC 61000-4-5 2nd edition)
• Low capacitance of 0.2pF (TYP) per I/O
• Low leakage current of 0.01μA (TYP) at 5V
• Small μDFN-6 footprint (1.2 mm x 1.0 mm x 0.5 mm)
• AEC-Q101 qualified
• Moisture Sensitivity Level (MSL -1)
• Halogen free, lead free and RoHS compliant

Applications

- LCD/PDP TVs
- External Storages
- DVD/Blu-ray Players
- Set Top Boxes
- Smartphones
- Ultrabooks/Notebooks
- Digital Cameras
- Portable Medical
- Automotive Electronics
- Wearable Technology
- USB 2.0/3.0
- Ethernet up to 10GbE

USB 2.0/3.0 Protection Application Example

*Package is shown as transparent

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.

©2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/03/18
### 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 Current ($t_p=8/20\mu$s)</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 ($T_{OP}=25^\circ$ 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>$V_{RWM}$</td>
<td>$I_R = 1\mu$A</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td>$V_{BR}$</td>
<td>$I_R = 1$mA</td>
<td>7</td>
<td>8.4</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Reverse Leakage Current</td>
<td>$I_{LEAK}$</td>
<td>$V_R=5$V, Any I/O to GND</td>
<td>0.01</td>
<td>0.5</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Clamp Voltage¹</td>
<td>$V_C$</td>
<td>$I_{PP}=1$A, $t_p=8/20\mu$s, Fwd</td>
<td>10.4</td>
<td>13</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Dynamic Resistance²</td>
<td>$R_{DYN}$</td>
<td>TLP, $t_p=100$ns, I/O to GND</td>
<td>0.65</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)</td>
<td>±10</td>
<td></td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2 (Air)</td>
<td>±15</td>
<td></td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td>Diode Capacitance</td>
<td>$C_{I/O,GND}$</td>
<td>Reverse Bias=0V, f=3 GHz</td>
<td>0.2</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td>$C_{I/O-I/O}$</td>
<td></td>
<td>0.1</td>
<td></td>
<td></td>
<td></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 $t_1=70$ns to $t_2=90$ns

### 8/20μs Pulse Waveform

![8/20μs Pulse Waveform](image)

### Clamping voltage vs. $I_{PP}$ for 8/20μS waveshape

![Clamping voltage vs. $I_{PP}$ for 8/20μS waveshape](image)
Low Capacitance ESD Protection - SP3423

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

![Positive TLP Plot]

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

![Negative TLP Plot]

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

![Positive ESD Clamping Voltage]

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

![Negative ESD Clamping Voltage]
Soldering Parameters

<table>
<thead>
<tr>
<th>Reflow Condition</th>
<th>Pb – Free assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Heat</td>
<td></td>
</tr>
<tr>
<td>- Temperature Min (T_s(min))</td>
<td>150°C</td>
</tr>
<tr>
<td>- Temperature Max (T_s(max))</td>
<td>200°C</td>
</tr>
<tr>
<td>- Time (min to max) (t_s)</td>
<td>60 – 180 secs</td>
</tr>
<tr>
<td>Average ramp up rate (Liquidus) Temp (T_L) to peak</td>
<td>3°C/second max</td>
</tr>
<tr>
<td>T_s(max) to T_L - Ramp-up Rate</td>
<td>3°C/second max</td>
</tr>
<tr>
<td>Reflow</td>
<td></td>
</tr>
<tr>
<td>- Temperature (T_L) (Liquidus)</td>
<td>217°C</td>
</tr>
<tr>
<td>- Temperature (T_L)</td>
<td>60 – 150 seconds</td>
</tr>
<tr>
<td>Peak Temperature (T_P)</td>
<td>260°C</td>
</tr>
<tr>
<td>Time within 5°C of actual peak Temperature (t_p)</td>
<td>20 – 40 seconds</td>
</tr>
<tr>
<td>Ramp-down Rate</td>
<td>6°C/second max</td>
</tr>
<tr>
<td>Time 25°C to peak Temperature (T_L)</td>
<td>8 minutes Max.</td>
</tr>
<tr>
<td>Do not exceed</td>
<td>260°C</td>
</tr>
</tbody>
</table>

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Min. Order Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP3423-02UTG</td>
<td>µDFN-6L</td>
<td>3000</td>
</tr>
</tbody>
</table>

Part Numbering System

SP 3423-xx - T G

- TVS Diode Arrays (SPA® Diodes)
- Series
- Number of Channels: 02 = 2 channel
- T = Tape & Reel
- G = Green
- Package: U = µDFN-6L

Part Marking System

6 5 4

TKD

- T : Part code
- K : Assembly code
- D : Date code

Product Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Plating</td>
<td>Pre-Plated Frame (µDFN)</td>
</tr>
<tr>
<td>Lead Material</td>
<td>Copper Alloy</td>
</tr>
<tr>
<td>Substrate Material</td>
<td>Silicon</td>
</tr>
<tr>
<td>Body Material</td>
<td>Molded Compound</td>
</tr>
<tr>
<td>Flammability</td>
<td>UL Recognized compound meeting flammability rating V-0</td>
</tr>
</tbody>
</table>
Package Dimensions — µDFN-6L

Recommended Soldering Pad Layout

Drawing# : U02-A

Embossed Carrier Tape & Reel Specification — µDFN-6L

Symbol | Millimeters | Inches
--- | --- | ---
E | 1.65 | 0.64
F | 3.45 | 1.35
P2 | 1.95 | 0.76
D | 1.40 | 0.55
D1 | 0.45 | 0.17
P | 3.90 | 1.54
10P0 | 40.0+/-0.20 | 1.57+/-0.008
W | 7.90 | 0.31
P0 | 3.90 | 1.54
A0 | 1.15 | 0.04
B0 | 1.75 | 0.07
K0 | 0.65 | 0.03
t | 0.22 max | 0.009 max

Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications.


©2018 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/03/18