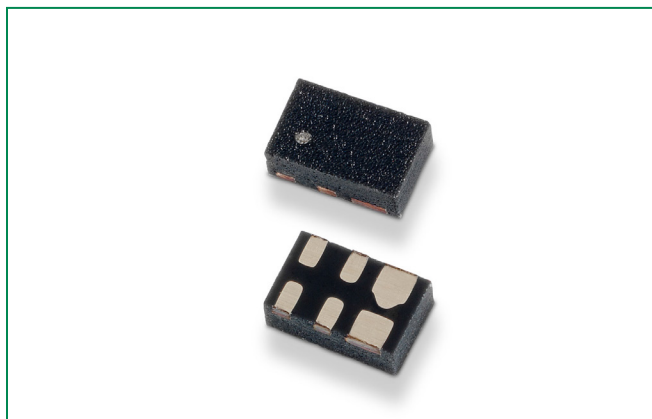


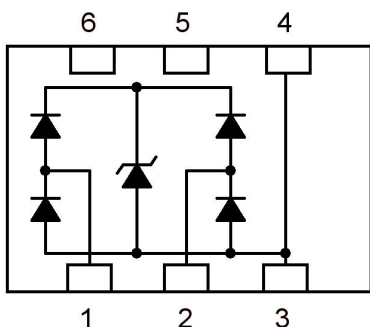
## SP3400, 1pF, ±30kV Diode Array



### Pinout

|      |   |   |     |
|------|---|---|-----|
| I/O1 | 1 | 6 | NC  |
| I/O2 | 2 | 5 | NC  |
| GND  | 3 | 4 | GND |

### Functional Block Diagram



### Description

The SP3400 integrates 2 channels of low capacitance steering diodes and an additional zener diode to provide protection for electronic equipment that may experience destructive electrostatic discharges (ESD). The SP3400 can safely absorb repetitive ESD strikes above the maximum contact level specified in IEC 61000-4-2 international standard (Level 4, ±8kV contact discharge) without performance degradation.

The low off-state capacitance makes it ideal for protecting high-speed signal lines such as USB2.0 or USB 3.0 and 1Gb Ethernet with an extremely low dynamic resistance to protect the most sensitive, state of the art chipsets against ESD transients.

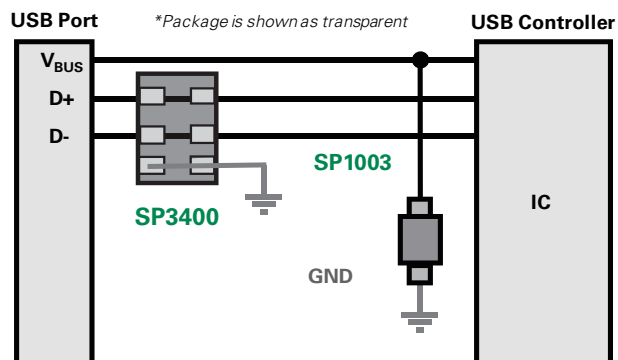
### Features

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 80A ( $t_p=5/50ns$ )
- Lightning, 8A (8/20 as defined in IEC 61000-4-5 2<sup>nd</sup> edition)
- Low capacitance of 1pF (TYP) per I/O
- Low leakage current of 0.01μA (TYP) at 5V
- Small form factor μDFN (JEDEC MO-229) package provides flow through routing to simplify PCB layout
- 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 Protection Application Example



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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Specifications are subject to change without notice.  
Revision: 09/11/18

### Absolute Maximum Ratings

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

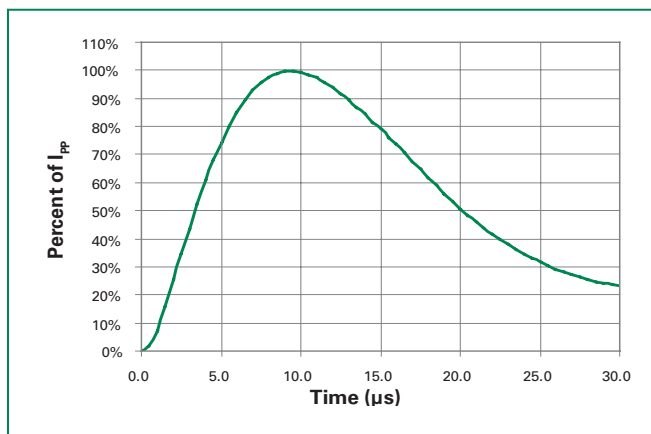
| Parameter                          | Symbol        | Test Conditions                     | Min      | Typ  | Max | Units    |
|------------------------------------|---------------|-------------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$     | $I_R = 1\mu A$                      |          |      | 5.0 | V        |
| Breakdown Voltage                  | $V_{BR}$      | $I_R = 1mA$                         | 6.5      | 7.8  |     | V        |
| Reverse Leakage Current            | $I_{LEAK}$    | $V_R=5V$ , Any I/O to GND           |          | 0.01 | 0.5 | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP}=1A$ , $t_p=8/20\mu s$ , Fwd |          | 9.2  | 12  | V        |
|                                    |               | $I_{PP}=8A$ , $t_p=8/20\mu s$ , Fwd |          | 13   | 16  | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP, $t_p=100ns$ , I/O to GND       |          | 0.24 |     | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC 61000-4-2 (Contact)             | $\pm 30$ |      |     | kV       |
|                                    |               | IEC 61000-4-2 (Air)                 | $\pm 30$ |      |     | kV       |
| Diode Capacitance <sup>3</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, $f=3GHz$           |          | 1    |     | pF       |
|                                    | $C_{I/O-I/O}$ |                                     |          | 0.5  |     |          |

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

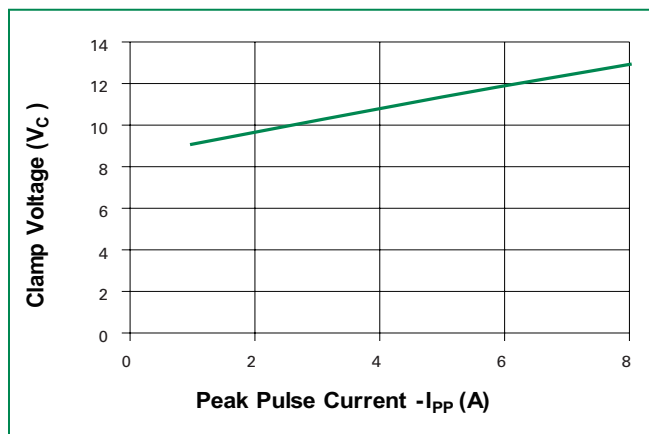
2. Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window  $t_1=70ns$  to  $t_2=90ns$ .

3. Package sizes larger than 0201 can add parasitic capacitance, inductance and resistance.

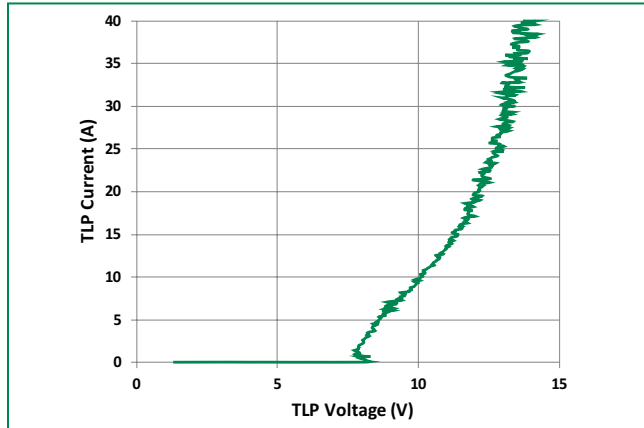
### 8/20 $\mu s$ Pulse Waveform



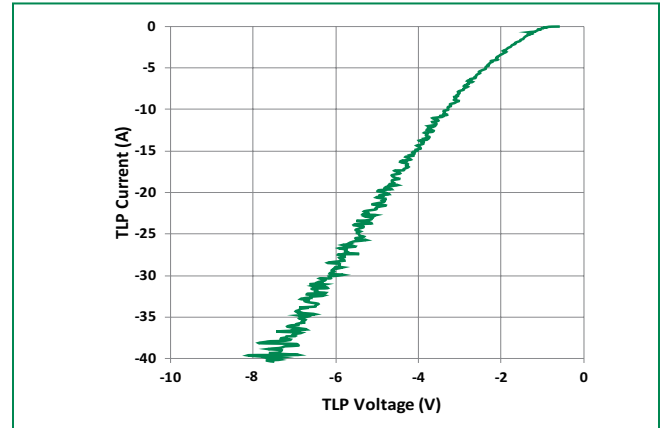
### Clamping voltage vs. $I_{PP}$ for 8/20 $\mu s$ waveshape



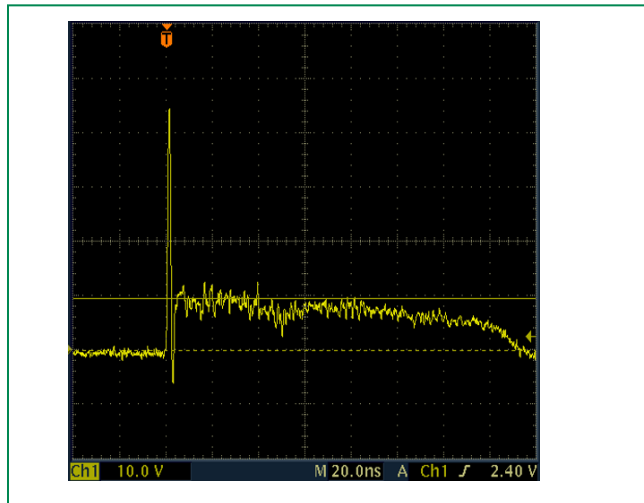
**Positive Transmission Line Pulsing (TLP) Plot**



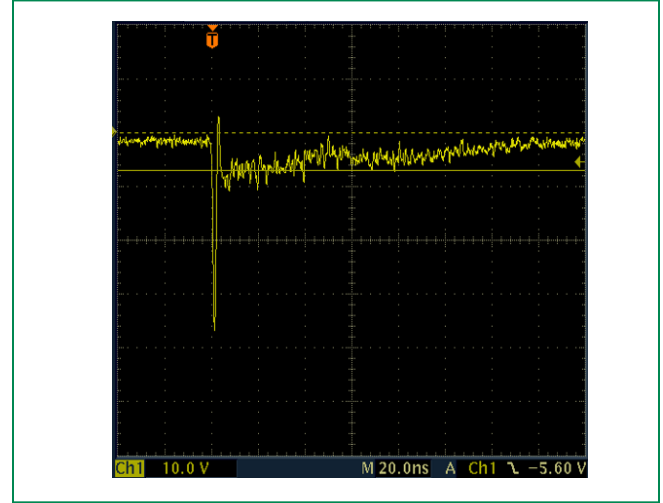
**Negative Transmission Line Pulsing (TLP) Plot**



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

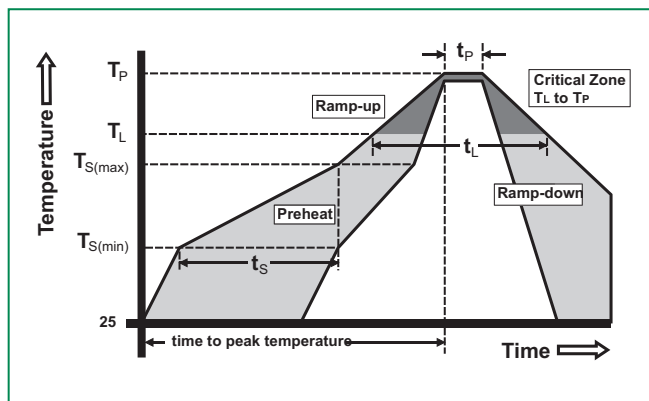


**IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage**



### Soldering Parameters

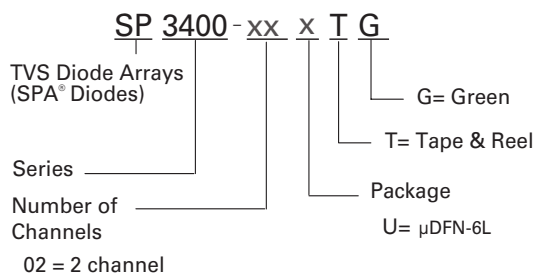
|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | 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                   |



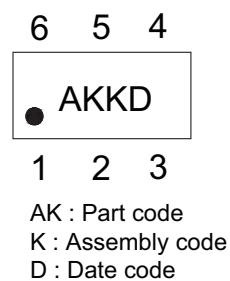
### Product Characteristics

|                           |                                                        |
|---------------------------|--------------------------------------------------------|
| <b>Lead Plating</b>       | Pre-Plated Frame (μDFN)                                |
| <b>Lead Material</b>      | Copper Alloy                                           |
| <b>Substrate Material</b> | Silicon                                                |
| <b>Body Material</b>      | Molded Compound                                        |
| <b>Flammability</b>       | UL Recognized compound meeting flammability rating V-0 |

### Part Numbering System



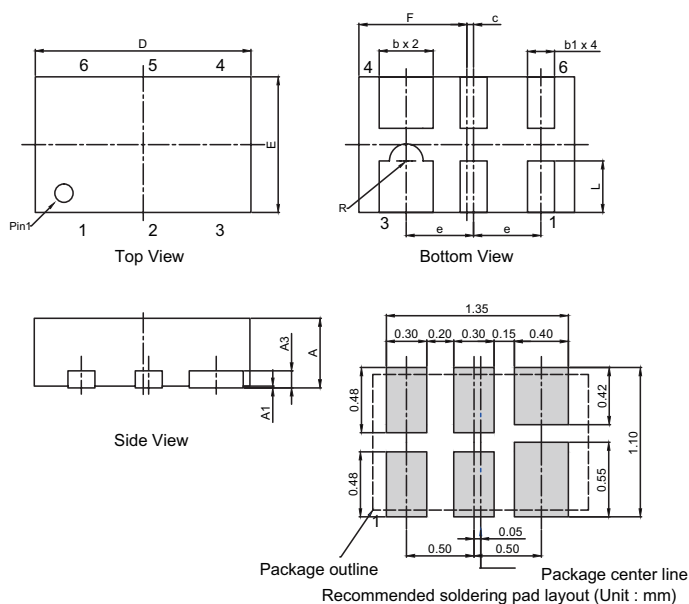
### Part Marking System



### Ordering Information

| Part Number  | Package | Min. Order Qty. |
|--------------|---------|-----------------|
| SP3400-02UTG | μDFN-6L | 3000            |

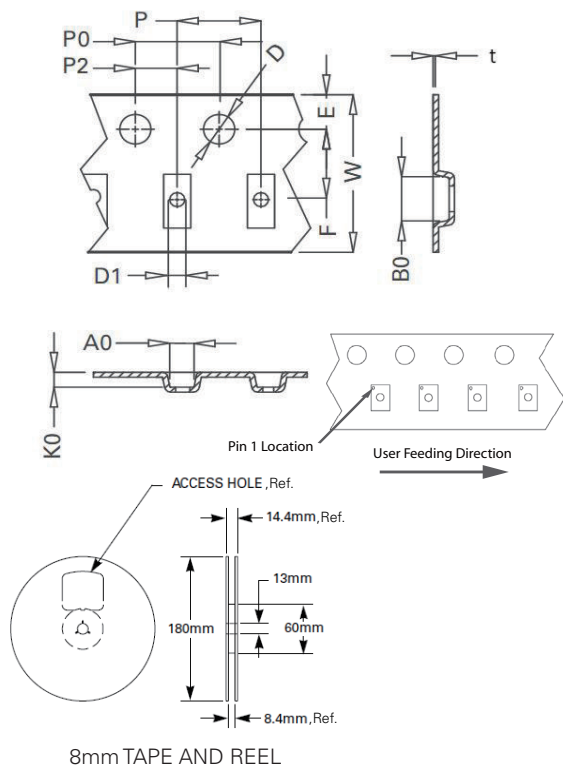
### Package Dimensions — $\mu$ DFN-6L



Drawing# : U03-A

| Package   | $\mu$ DFN-6L |      |           |       |
|-----------|--------------|------|-----------|-------|
| JEDEC     | MO-229       |      |           |       |
| Pins      | 6            |      |           |       |
|           | Millimeters  |      | Inches    |       |
|           | Min          | Max  | Min       | Max   |
| <b>A</b>  | 0.45         | 0.55 | 0.018     | 0.022 |
| <b>A1</b> | 0.00         | 0.05 | 0.000     | 0.002 |
| <b>A3</b> | 0.125 REF    |      | 0.005 REF |       |
| <b>b</b>  | 0.35         | 0.45 | 0.014     | 0.018 |
| <b>b1</b> | 0.15         | 0.25 | 0.006     | 0.010 |
| <b>c</b>  | 0.05 REF     |      | 0.002 REF |       |
| <b>D</b>  | 1.55         | 1.65 | 0.062     | 0.065 |
| <b>E</b>  | 0.95         | 1.05 | 0.038     | 0.042 |
| <b>F</b>  | 0.80 REF     |      | 0.031 REF |       |
| <b>e</b>  | 0.50 REF     |      | 0.020 REF |       |
| <b>R</b>  | 0.125 REF    |      | 0.005 REF |       |
| <b>L</b>  | 0.33         | 0.43 | 0.013     | 0.017 |

### Embossed Carrier Tape & Reel Specification — $\mu$ DFN-6L



| Symbol      | Millimeters |      | Inches        |       |
|-------------|-------------|------|---------------|-------|
|             | Min         | Max  | Min           | Max   |
| <b>E</b>    | 1.65        | 1.85 | 0.064         | 0.073 |
| <b>F</b>    | 3.45        | 3.55 | 0.135         | 0.139 |
| <b>P2</b>   | 1.95        | 2.05 | 0.076         | 0.081 |
| <b>D</b>    | 1.40        | 1.60 | 0.055         | 0.063 |
| <b>D1</b>   | 0.45        | 0.55 | 0.017         | 0.021 |
| <b>P</b>    | 3.90        | 4.10 | 0.154         | 0.161 |
| <b>10P0</b> | 40.0+/-0.20 |      | 1.574+/-0.008 |       |
| <b>W</b>    | 7.90        | 8.30 | 0.311         | 0.319 |
| <b>P0</b>   | 3.90        | 4.10 | 0.154         | 0.161 |
| <b>A0</b>   | 1.15        | 1.25 | 0.045         | 0.049 |
| <b>B0</b>   | 1.75        | 1.85 | 0.069         | 0.073 |
| <b>K0</b>   | 0.65        | 0.75 | 0.026         | 0.03  |
| <b>t</b>    | 0.22 max    |      | 0.009 max     |       |

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