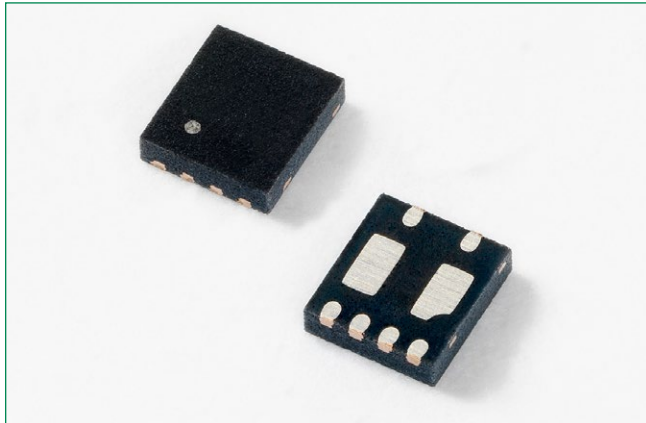


## SP1224 (100A) for USB $V_{BUS}$

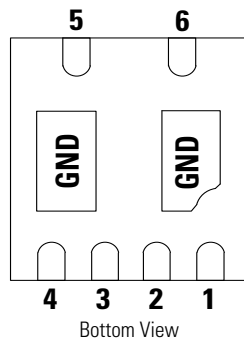


### Description

This SP1224 TVS diode has a lightning surge rating of 100A (8/20 as defined in IEC 61000-4-5 2<sup>nd</sup> edition) and is intended for USB  $V_{BUS}$  protection. It provides superior protection for current intensive applications such as the USB fast charging circuits.

The SP1224 TVS is offered in a space saving 2.0 x 1.8 mm  $\mu$ DFN package with a typical height of 0.55 mm. This small form factor makes this component ideal for smart phones, tablets, and other portable electronics that are footprint challenged.

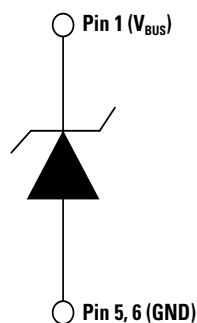
### Pinout



### Features

- ESD, IEC 61000-4-2,  $\pm 30\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC 61000-4-4, 80A ( $t_r=5/50\text{ns}$ )
- Lightning, 100A (8/20 as defined in IEC 61000-4-5 2<sup>nd</sup> edition)
- Protection for  $V_{BUS}$  operating up to 24V
- High current handling capability for fast charging applications
- Halogen free, lead free and RoHS compliant
- Moisture Sensitivity Level (MSL -1)

### Functional Block Diagram



### Applications

- $V_{BUS}$  protection for fast charging USB circuits

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 |
|------------------|--------------------------------------|------------|-------|
| $I_{PP}$ (Pin 1) | Peak Current ( $t_p=8/20\mu s$ )     | 100        | A     |
| $P_{PK}$ (Pin1)  | Peak Pulse Power ( $t_p=8/20\mu s$ ) | 3700       | W     |
| $T_{OP}$         | Operating Temperature                | -40 to 125 | °C    |
| $T_{STOR}$       | Storage Temperature                  | -55 to 150 | °C    |

**CAUTION:** Stresses at or 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. Also due to variations in test equipment stresses shown above are averages.

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

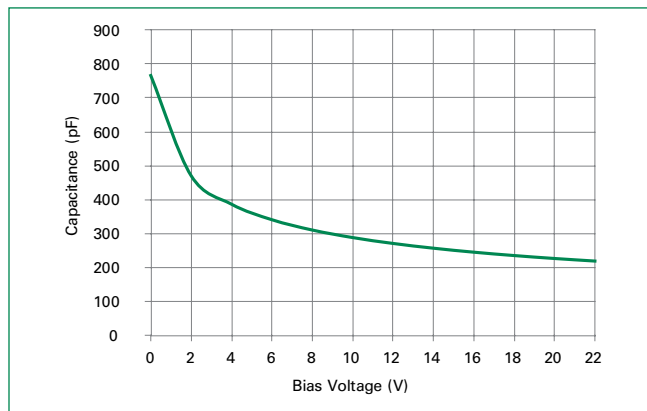
| Parameter                          | Symbol        | Test Conditions                       | Min      | Typ  | Max | Units    |
|------------------------------------|---------------|---------------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$     | $I_R=1\mu A$ , Pin 1 to GND           |          |      | 22  | V        |
| Breakdown Voltage                  | $V_{BR}$      | $I_R=1mA$ , Pin 1 to GND              | 24       |      | 27  | V        |
| Reverse Leakage Current            | $I_{LEAK}$    | $V_R=22V$ , Pin 1 to GND              |          | 0.02 | 0.5 | $\mu A$  |
| Forward Voltage                    | $V_F$         | $I_F=10mA$ , GND to Pin 1             | 0.6      | 0.7  | 1.0 | V        |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP}=100A$ , $t_p=8/20\mu s$ , Fwd |          | 35   | 37  | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP, $t_p=100ns$ , Pin1 to GND        |          | 0.15 |     | $\Omega$ |
| 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>1</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, $f=1MHz$             |          | 770  | 850 | pF       |

**Notes:**

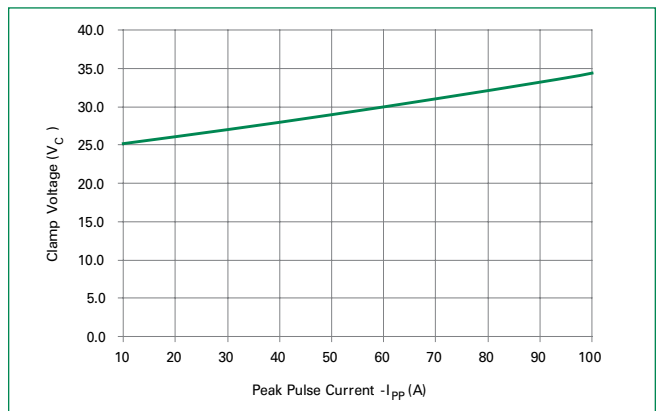
<sup>1</sup> Parameter is guaranteed by design and/or component characterization.

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

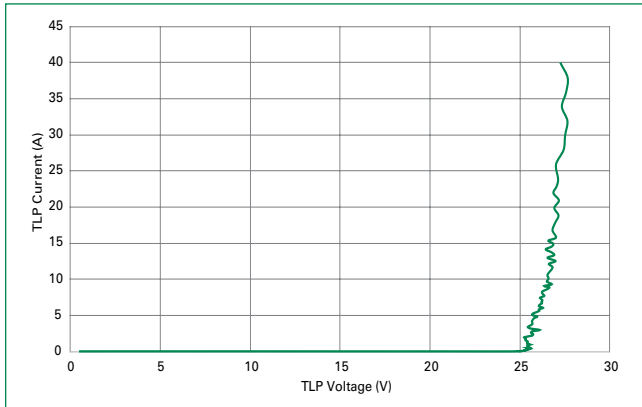
### Capacitance vs. Reverse Bias (Pin1 to GND)



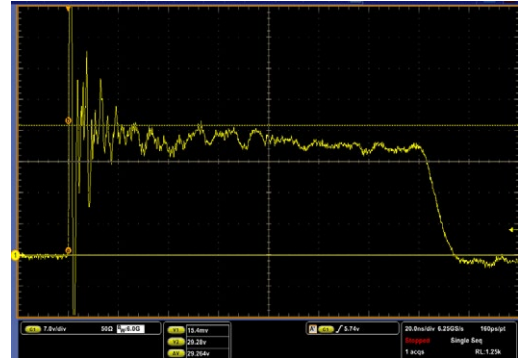
### Clamping Voltage vs. Peak Pulse Current (Pin1 to GND)



### Transmission Line Pulsing (TLP) Plot

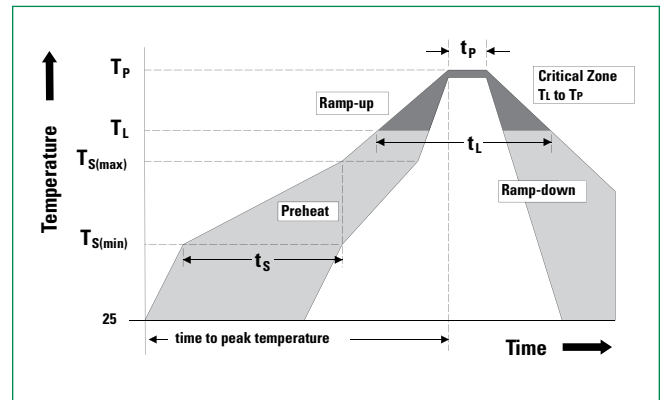


### IEC 61000-4-2 +8kV Contact ESD Clamping Voltage

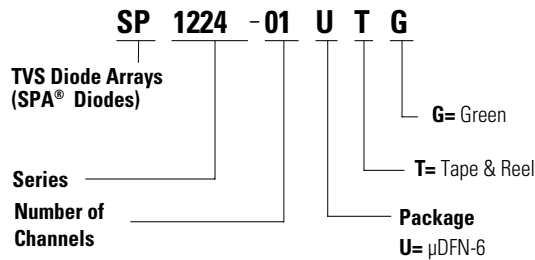


### Soldering Parameters

|                                                                        |                                    |                    |
|------------------------------------------------------------------------|------------------------------------|--------------------|
| <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 – 180 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 $^{+0/-5}$ °C  |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 20 – 40 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              |



### Part Numbering System



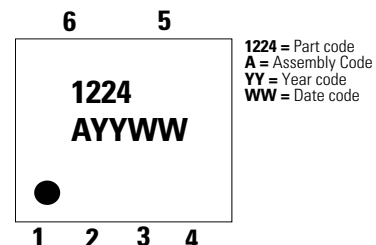
### Ordering Information

| Part Number  | Package     | Min. Order Qty. |
|--------------|-------------|-----------------|
| SP1224-01UTG | $\mu$ DFN-6 | 3000            |

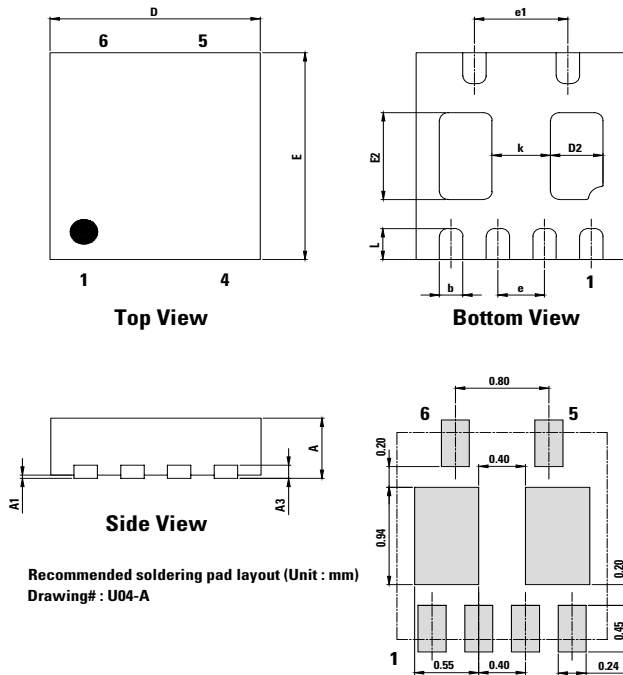
### Product Characteristics

|                           |                                                        |
|---------------------------|--------------------------------------------------------|
| <b>Lead Plating</b>       | Pre-Plated Frame                                       |
| <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 Marking System

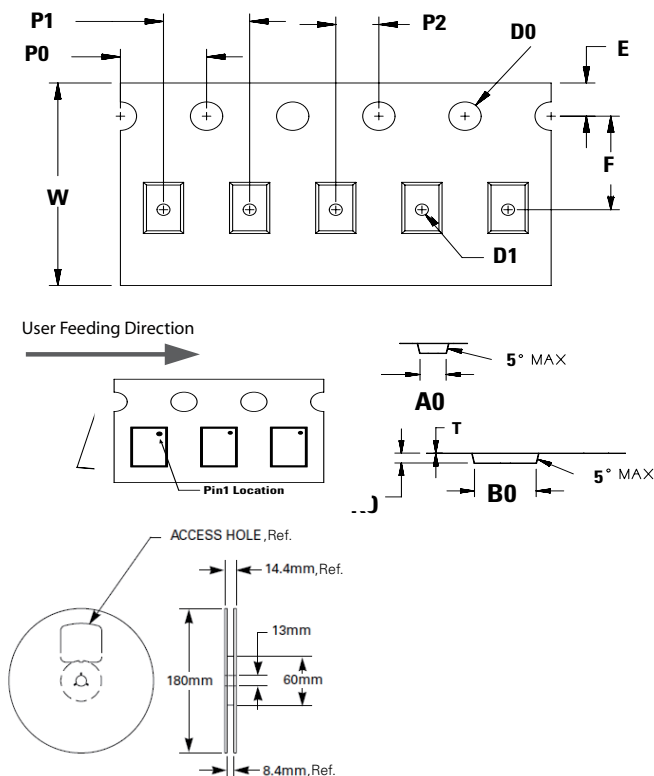


### Package Dimensions — $\mu$ DFN-6



| $\mu$ DFN6 (1.8x2.0x0.5mm) |             |      |      |           |       |       |
|----------------------------|-------------|------|------|-----------|-------|-------|
| JEDEC MO-229               |             |      |      |           |       |       |
| Symbol                     | Millimeters |      |      | Inches    |       |       |
|                            | Min         | Nom  | Max  | Min       | Nom   | Max   |
| A                          | 0.50        | 0.55 | 0.60 | 0.020     | 0.022 | 0.024 |
| A1                         | 0.00        | 0.02 | 0.05 | 0.000     | 0.001 | 0.002 |
| A3                         | 0.125 REF   |      |      | 0.005 REF |       |       |
| b                          | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D                          | 1.75        | 1.80 | 1.85 | 0.069     | 0.071 | 0.073 |
| E                          | 1.95        | 2.00 | 2.05 | 0.077     | 0.079 | 0.081 |
| D2                         | 0.35        | 0.45 | 0.55 | 0.014     | 0.018 | 0.022 |
| E2                         | 0.74        | 0.84 | 0.94 | 0.029     | 0.033 | 0.037 |
| e                          | 0.40 BSC    |      |      | 0.016 BSC |       |       |
| e1                         | 0.80 BSC    |      |      | 0.031 BSC |       |       |
| L                          | 0.20        | 0.30 | 0.40 | 0.008     | 0.012 | 0.016 |
| K                          | 0.50 REF    |      |      | 0.020 REF |       |       |

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



| Symbol | Millimeters         |
|--------|---------------------|
| A0     | 1.95 +/- 0.05       |
| B0     | 2.30 +/- 0.05       |
| D0     | 1.50 + 0.10         |
| D1     | Ø 0.60 + 0.05       |
| E      | 1.75 +/- 0.10       |
| F      | 3.50 +/- 0.05       |
| K0     | 0.75 +/- 0.05       |
| P0     | 4.00 +/- 0.10       |
| P1     | 4.00 +/- 0.10       |
| P2     | 2.00 +/- 0.05       |
| T      | 0.25 +/- 0.02       |
| W      | 8.00 + 0.30 /- 0.10 |