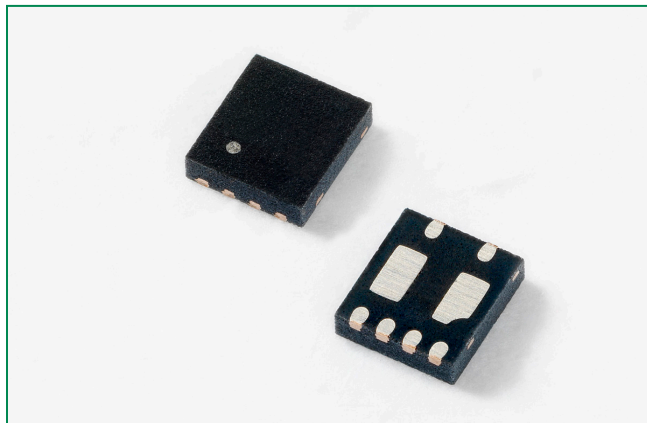


SP1555 Series 120A for  $V_{BUS}$

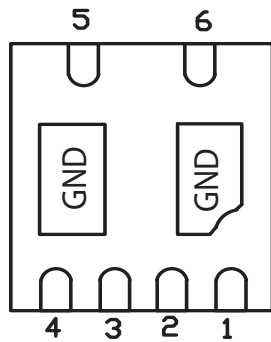


**Description**

The SP1555 integrates a 15V TVS diode to provide lightning surge protection for the USB  $V_{BUS}$  pin up to 120A ( $t_p=8/20\mu s$ ) per the IEC61000-4-5 2nd edition standard. The SP1555 provides superior protection for current intensive applications such as fast charging peripherals.

The SP1555 comes in a space saving 2.0x1.8mm  $\mu$ DFN package with a typical height of 0.55mm making it an ideal solution for smart phones, tablets, and other portable electronics.

**Pinout**

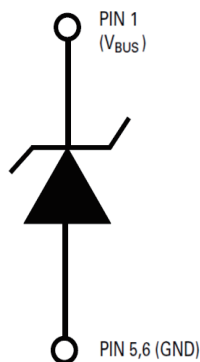


Bottom View

**Features**

- ESD, IEC 61000-4-2,  $\pm 30kV$  contact,  $\pm 30kV$  air
- EFT, IEC 61000-4-4, 80A ( $t_p=5/50ns$ )
- Surge, IEC 61000-4-5 2nd edition, 120A ( $t_p=8/20\mu s$ )
- Protection for  $V_{BUS}$  operating up to 15V
- Benchmark setting protection
- High current handling capability for fast charging applications
- Moisture Sensitivity Level (MSL:1)
- Lead-free and RoHS compliant

**Functional Block Diagram**



**Applications**

- Protection for the  $V_{BUS}$  circuit on USB2.0 Fast Charging

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 ( $t_p=8/20\mu s$ ) | 120        | A     |
| $T_{OP}$         | Operating Temperature            | -40 to 125 | °C    |
| $T_{STOR}$       | Storage Temperature              | -55 to 150 | °C    |

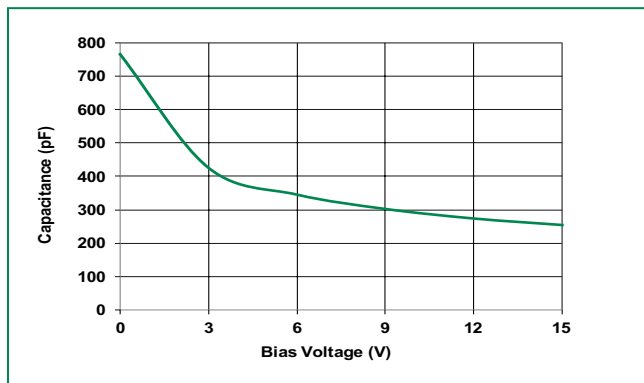
CAUTION: Stresses at or above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Also due to variations in test equipment stresses shown above are averages.

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

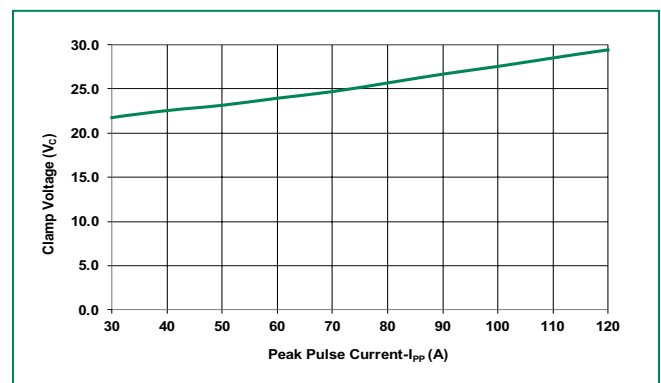
| Parameter                          | Symbol     | Test Conditions                       | Min      | Typ  | Max  | Units   |
|------------------------------------|------------|---------------------------------------|----------|------|------|---------|
| USB $V_{BUS}$ (Pin 1)              |            |                                       |          |      |      |         |
| Reverse Standoff Voltage           | $V_{RWM}$  | Pin 1 to GND                          |          |      | 15   | V       |
| Reverse Breakdown Voltage          | $V_{BR}$   | $I_T=1mA$ , Pin 1 to GND              | 17.5     | 18.8 | 20.1 | V       |
| Reverse Leakage Current            | $I_{LEAK}$ | $V_R=15V$ , Pin 1 to GND              |          | 0.05 | 1    | $\mu A$ |
| Forward Voltage                    | $V_F$      | $I_F=10mA$ , GND to Pin 1             | 0.6      | 0.7  | 1.0  | V       |
| Clamp Voltage <sup>1</sup>         | $V_C$      | $I_{PP}=30A$ , $t_p=8/20\mu s$ , Fwd  |          | 21.5 |      | V       |
|                                    |            | $I_{PP}=100A$ , $t_p=8/20\mu s$ , Fwd |          | 27.5 |      | V       |
|                                    |            | $I_{PP}=120A$ , $t_p=8/20\mu s$ , Fwd |          | 29.5 |      | V       |
| 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>     | $C_D$      | Reverse Bias=0V, $f=1MHz$             |          | 800  |      | pF      |

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

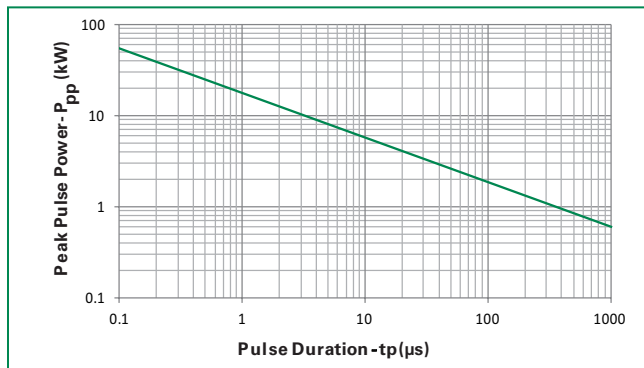
### Capacitance vs. Reverse Bias (Pin1 to GND)



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

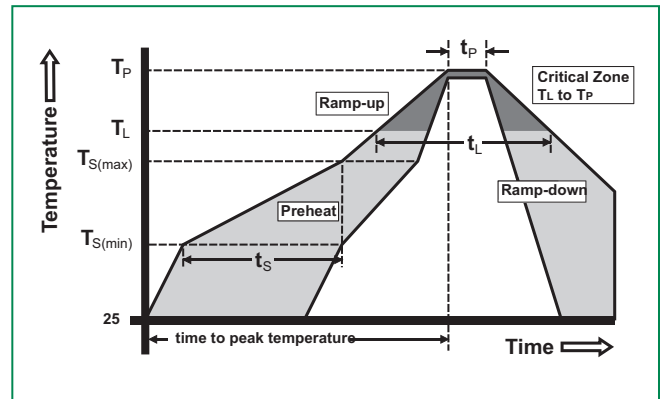


### Non-Repetitive Peak Pulse Power vs. Pulse Duration (Pin1 to GND)

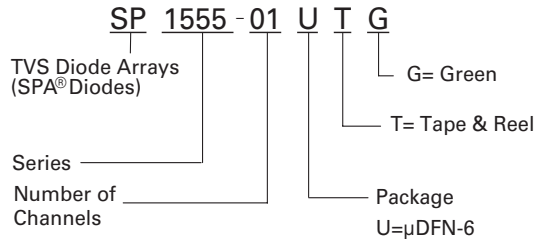


### Soldering Parameters

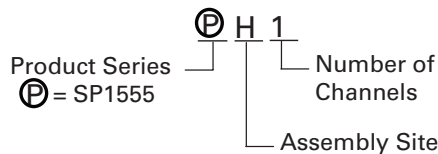
|  |                                    |                  |
|--|------------------------------------|------------------|
| Reflow Condition                                       | Pb – Free assembly                 |                  |
| Pre Heat   | - Temperature Min ( $T_{s(min)}$ ) | 150°C            |
|  | - 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                              |                  |



### Part Numbering System



### Part Marking System



### Product Characteristics

|                           |                       |
|---------------------------|-----------------------|
| <b>Lead Plating</b>       | Pre-Plated Frame      |
| <b>Lead Material</b>      | Copper Alloy          |
| <b>Lead Coplanarity</b>   | 0.004 inches(0.102mm) |
| <b>Substrate material</b> | Silicon               |
| <b>Body Material</b>      | Molded Epoxy          |
| <b>Flammability</b>       | UL 94 V-0             |

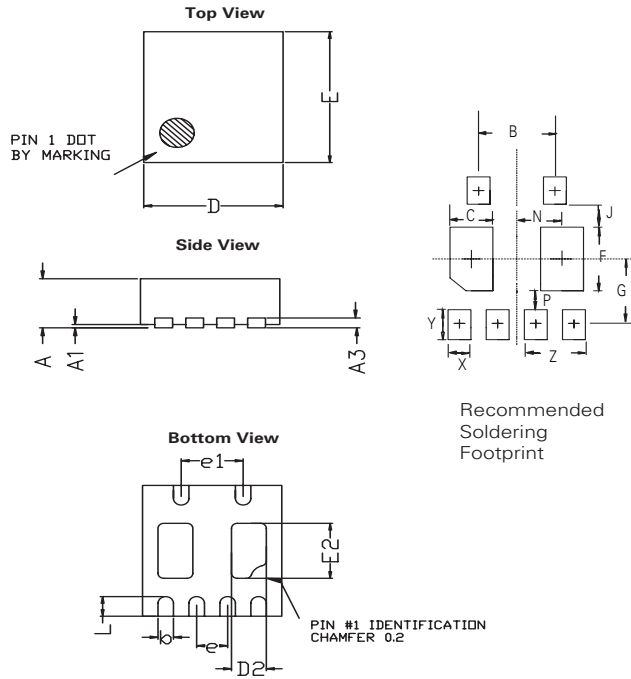
Notes :

1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.

### Ordering Information

| Part Number  | Package | Min. Order Qty. | Packaging Option               | P0/P1   | Packaging Specification |
|--------------|---------|-----------------|--------------------------------|---------|-------------------------|
| SP1555-01UTG | μDFN-6  | 3000            | Tape & Reel – 8mm tape/7" reel | 4mm/4mm | EIA RS-481              |

**Package Dimensions —  $\mu$ DFN-6 (1.8x2.0x0.55mm)**

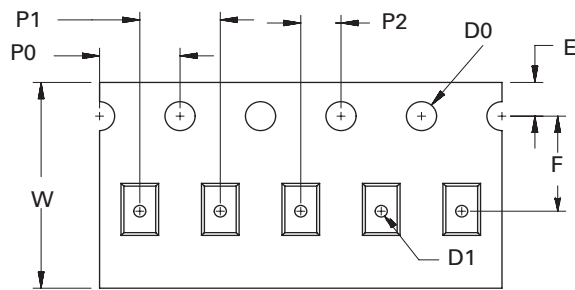


| JEDEC MO-229 |             |      |      |           |       |       |
|--------------|-------------|------|------|-----------|-------|-------|
| Symbol       | Millimeters |      |      | Inches    |       |       |
|              | Min         | Nom  | Max  | Min       | Nom   | Max   |
| <b>A</b>     | 0.50        | 0.55 | 0.60 | 0.020     | 0.022 | 0.024 |
| <b>A1</b>    | 0.00        | -    | 0.05 | 0.000     | -     | 0.002 |
| <b>A3</b>    | 0.15 Ref    |      |      | 0.006 Ref |       |       |
| <b>D</b>     | 1.75        | 1.80 | 1.85 | 0.069     | 0.071 | 0.073 |
| <b>E</b>     | 1.95        | 2.00 | 2.05 | 0.077     | 0.079 | 0.081 |
| <b>b</b>     | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| <b>L</b>     | 0.20        | 0.30 | 0.40 | 0.008     | 0.012 | 0.016 |
| <b>D2</b>    | 0.35        | 0.45 | 0.55 | 0.014     | 0.018 | 0.022 |
| <b>E2</b>    | 0.74        | 0.84 | 0.94 | 0.029     | 0.033 | 0.037 |
| <b>e</b>     | 0.40 BSC    |      |      | 0.016 BSC |       |       |
| <b>e1</b>    | 0.80 BSC    |      |      | 0.031 BSC |       |       |
| <b>B</b>     | 0.80 BSC    |      |      | 0.031 BSC |       |       |
| <b>C</b>     | 0.35        | 0.45 | 0.55 | 0.014     | 0.018 | 0.022 |
| <b>F</b>     | 0.81        | 0.84 | 0.87 | 0.032     | 0.033 | 0.034 |
| <b>G</b>     | 0.82        | 0.85 | 0.88 | 0.032     | 0.033 | 0.034 |
| <b>J</b>     | 0.24        | 0.25 | 0.26 | 0.010     | 0.010 | 0.010 |
| <b>N</b>     | 0.47        | 0.48 | 0.49 | 0.018     | 0.019 | 0.020 |
| <b>P</b>     | 0.24        | 0.25 | 0.26 | 0.010     | 0.010 | 0.010 |
| <b>X</b>     | 0.23        | 0.24 | 0.25 | 0.009     | 0.009 | 0.009 |
| <b>Y</b>     | 0.35        | 0.36 | 0.37 | 0.014     | 0.014 | 0.014 |
| <b>Z</b>     | 0.62        | 0.64 | 0.66 | 0.024     | 0.025 | 0.026 |

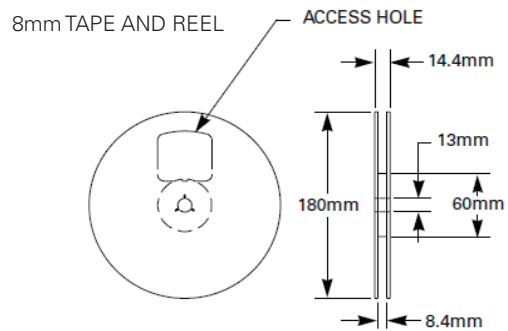
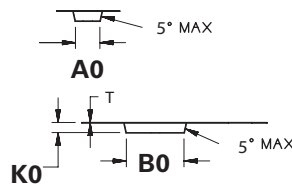
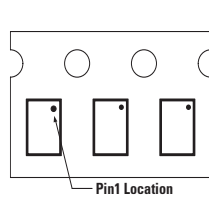
Notes:

1. Dimension and tolerancing conform to ASME Y14.5M-1994.
2. Controlling dimensions: Millimeter. Converted Inch dimensions are not necessarily exact.

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



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



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