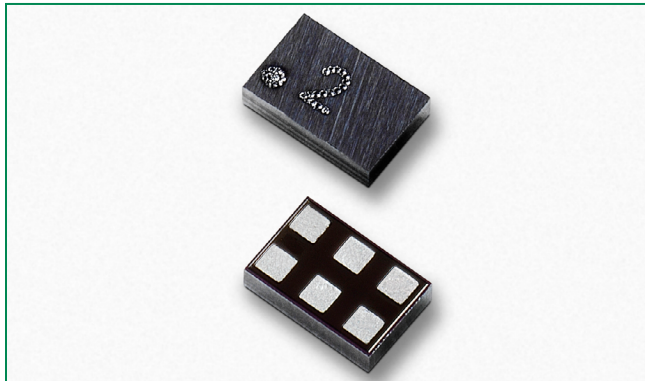


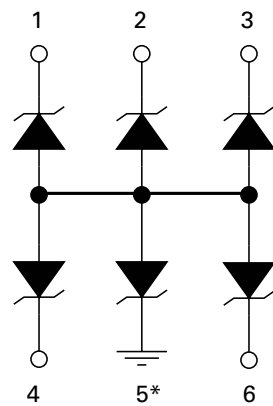
## SP1012 Series 6.5pF, 15kV Bidirectional TVS Array



### Description

The miniature 5 channel bidirectional TVS array provides protection for data lines that may experience destructive electrostatic discharges (ESD). These robust diodes can safely absorb repetitive ESD strikes at the maximum level specified in the IEC 61000-4-2 international standard without performance degradation. The bidirectional configuration provides symmetrical ESD protection for data lines when AC signals are present.

### Functional Block Diagram

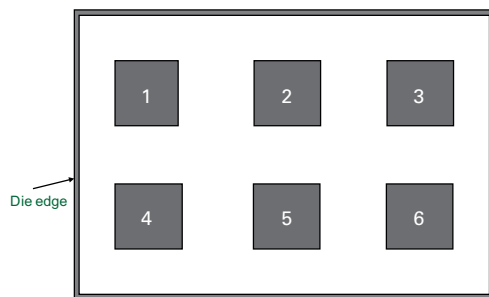


\*Any pin can be used as GND.

### Features

- RoHS compliant, Halogen-free and lead-free
- ESD, IEC 61000-4-2,  $\pm 15\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning protection, IEC 61000-4-5 2nd Edition, 3.0A ( $t_p = 8/20\mu\text{s}$ )
- Highest density TVS array available today
- 5 channels of protection in a 0.94x0.61mm footprint (i.e. a discrete 0402)

### Pinout



### Applications

- Smart Phones
- Mobile Phones
- Wearable Technology

### Additional Information



Datasheet



Resources



Samples

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 |
|------------|----------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ ) | 3.0        | 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 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.

### Thermal Information

| Parameter                                   | Rating     | Units |
|---------------------------------------------|------------|-------|
| Storage Temperature Range                   | -55 to 150 | °C    |
| Maximum Junction Temperature                | 150        | °C    |
| Maximum Lead Temperature (Soldering 20-40s) | 260        | °C    |

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

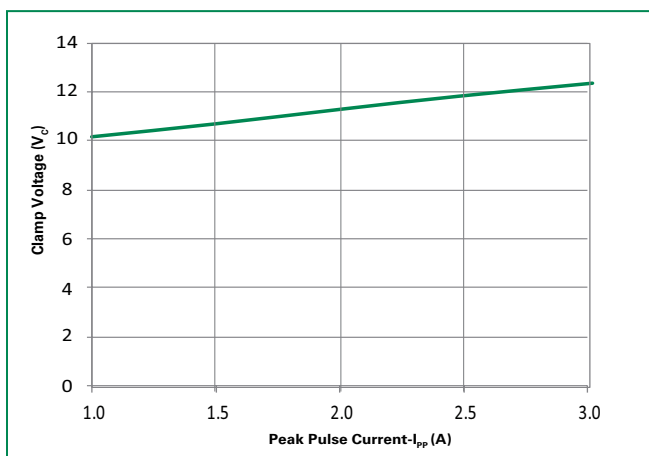
| Parameter                          | Symbol    | Test Conditions                   | Min      | Typ  | Max | Units    |
|------------------------------------|-----------|-----------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$ |                                   |          |      | 5.0 | V        |
| Reverse Breakdown Voltage          | $V_{BD}$  | $I_R=1mA$                         | 6.0      |      |     | V        |
| Leakage Current                    | $I_R$     | $V_R=5V$                          |          |      | 1.0 | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$     | $I_{PP}=1A, t_p=8/20\mu s, Fwd$   |          | 10.2 |     | V        |
|                                    |           | $I_{PP}=3A, t_p=8/20\mu s, Fwd$   |          | 12.3 |     | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$ | TLP, $t_p=100ns$ , I/O to GND     |          | 0.48 |     | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$ | IEC 61000-4-2 (Contact Discharge) | $\pm 15$ |      |     | kV       |
|                                    |           | IEC 61000-4-2 (Air Discharge)     | $\pm 30$ |      |     | kV       |
| Diode Capacitance <sup>1</sup>     | $C_D$     | Reverse Bias=0V (I/O to GND)      |          | 6.5  |     | pF       |

Note:

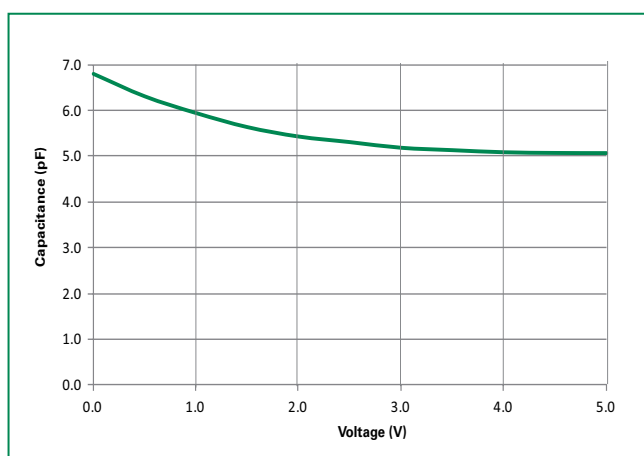
<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

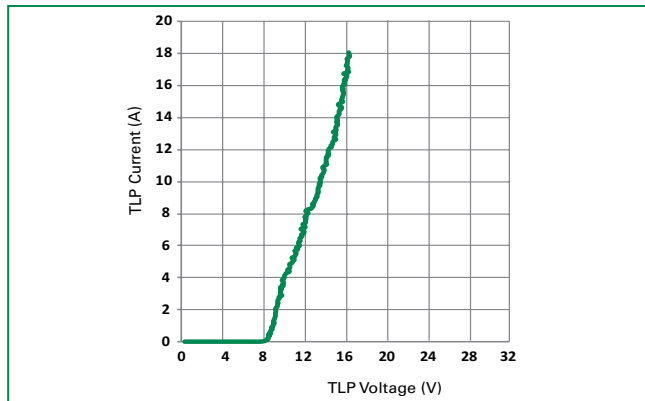
### Clamping Voltage vs. $I_{PP}$



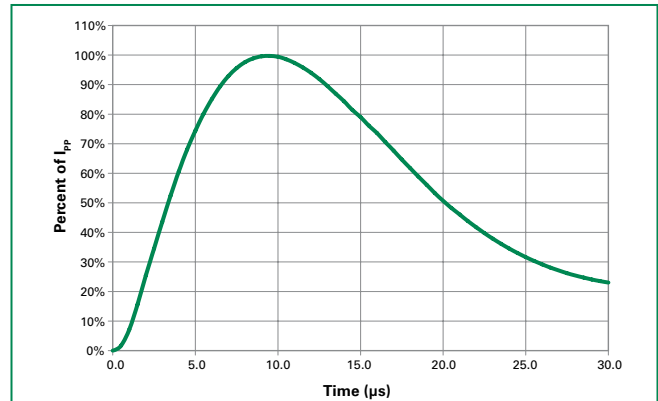
### Capacitance vs. Reverse Bias



### Transmission Line Pulsing (TLP) Plot

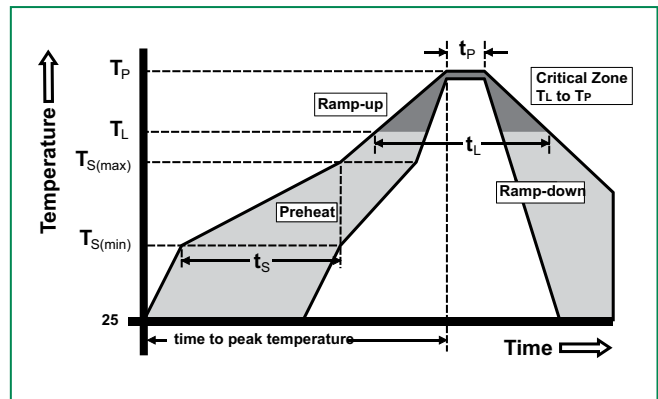


### Pulse Waveform

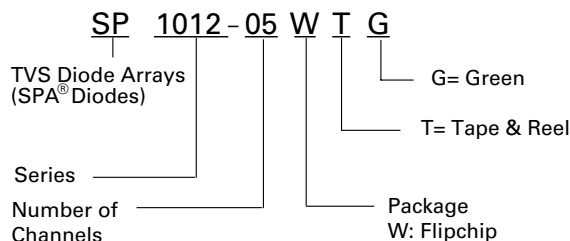


### Soldering Parameters

|                                                        |                                    |                    |
|--------------------------------------------------------|------------------------------------|--------------------|
| 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 $^{+0/-5}$ °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              |



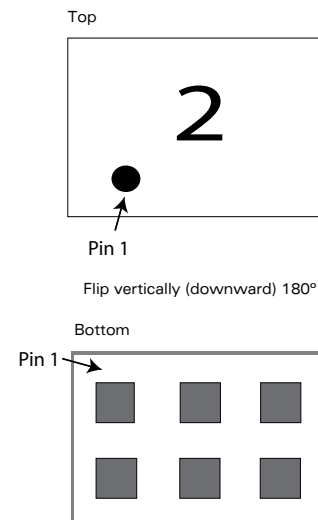
### Part Numbering System



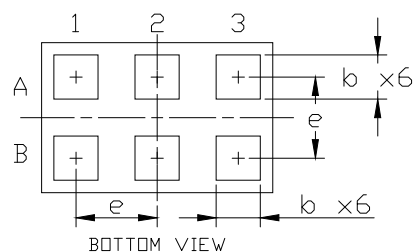
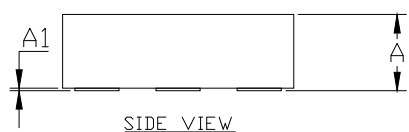
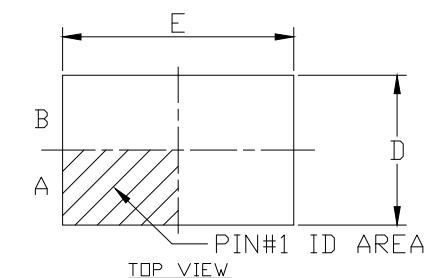
### Ordering Information

| Part Number  | Package               | Marking | Min. Order Qty. |
|--------------|-----------------------|---------|-----------------|
| SP1012-05WTG | 0.94x0.61mm Flip Chip | 2       | 5000            |

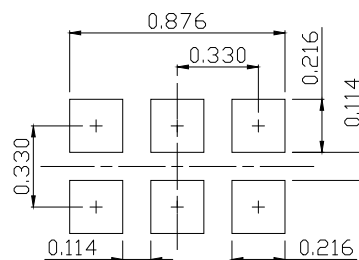
### Part Marking System



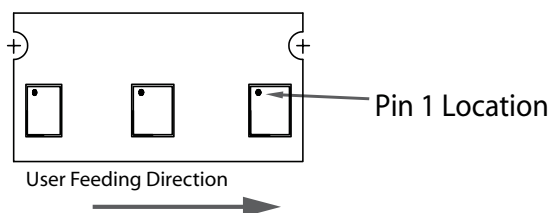
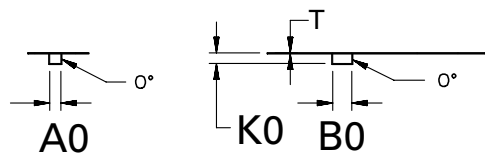
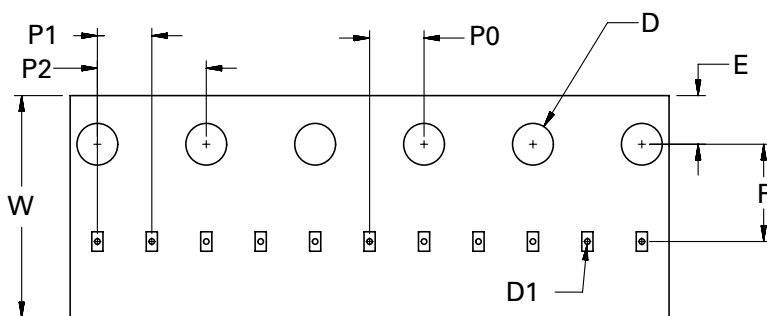
## Package Dimensions



| Symbol    | 0.94x0.61mm Flip Chip |       |       |        |        |        |
|-----------|-----------------------|-------|-------|--------|--------|--------|
|           | Millimeters           |       |       | Inches |        |        |
|           | Min                   | Typ   | Max   | Min    | Typ    | Max    |
| <b>A</b>  | 0.280                 | 0.310 | 0.340 | 0.0110 | 0.0122 | 0.0134 |
| <b>A1</b> | 0.005                 | 0.010 | 0.015 | 0.0002 | 0.0004 | 0.0006 |
| <b>b</b>  | 0.175                 | 0.180 | 0.185 | 0.0069 | 0.0071 | 0.0073 |
| <b>D</b>  | 0.585                 | 0.610 | 0.635 | 0.0230 | 0.0240 | 0.0250 |
| <b>E</b>  | 0.915                 | 0.940 | 0.965 | 0.0360 | 0.0370 | 0.0380 |
| <b>e</b>  | 0.330                 |       |       | 0.0130 |        |        |



## Embossed Carrier Tape & Reel Specification — Flipchip



| Symbol    | Millimeters       |
|-----------|-------------------|
| <b>A0</b> | 0.68+/-0.03       |
| <b>B0</b> | 1.12+/-0.03       |
| <b>D</b>  | ø 1.50 + 0.10     |
| <b>D1</b> | ø 0.40 +/- 0.05   |
| <b>E</b>  | 1.75+/-0.10       |
| <b>F</b>  | 3.50+/-0.05       |
| <b>K0</b> | 0.36+/-0.03       |
| <b>P0</b> | 2.00+/-0.05       |
| <b>P1</b> | 2.00+/-0.05       |
| <b>P2</b> | 4.00+/-0.10       |
| <b>W</b>  | 8.00 + 0.30 -0.10 |
| <b>T</b>  | 0.20+/-0.02       |