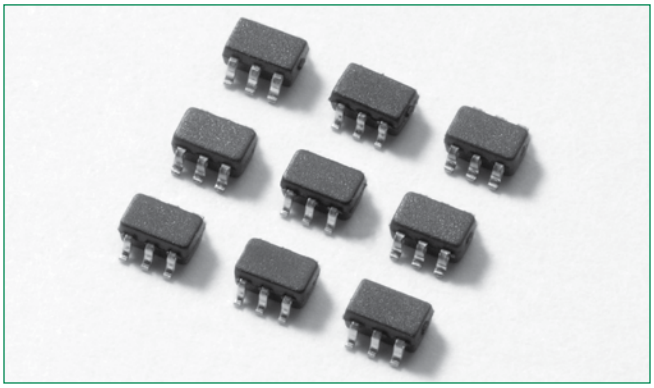
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# TVS Diode Array (SPA® Diodes)

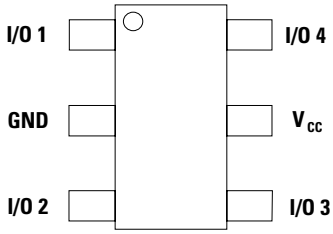
## Low Capacitance ESD Protection - SP3001 Series

## SP3001 Series 0.65pF Diode Array

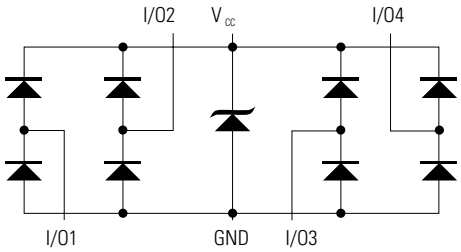
RoHS Pb GREEN



## Pinout




## Functional Block Diagram




## Additional Information

Datasheet | Resources | Samples

## Description

The SP3001 has ultra low capacitance rail-to rail diodes with an additional zener diode fabricated in a proprietary silicon avalanche technology to protect each I/O pin providing a high level of protection for electronic equipment 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 (Level 4, ±8kV contact discharge) without performance degradation. Their very low loading capacitance also makes them ideal for protecting high speed signal pins such as HDMI, DVI, USB2.0, and IEEE 1394.

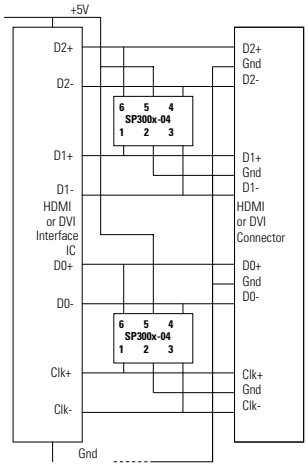
## Features

- Low capacitance of 0.65pF (TYP) per I/O
- ESD protection of ±8kV contact discharge, ±15kV air discharge, (IEC 61000-4-2)
- EFT protection, IEC 61000-4-4, 40A (5/50ns)
- Low leakage current of 0.5µA (MAX) at 5V
- Small SC70 ( JEDEC MO-203) package saves board space
- Lightning Protection, IEC 61000-4-5, 2nd edition 2.5A (8/20µs)
- RoHS compliant and lead-free
- AEC-Q101 qualified

## Applications

- Computer Peripherals
- Mobile Phones
- PDA's
- Digital Cameras
- Network Hardware/Ports
- Test Equipment
- Medical Equipment

## Application Example




A single 4 channel SP300x-04 device can be used to protect four of the data lines in a HDMI/DVI interface. Two (2) SP300x-04 devices provide protection for the main data lines. Low voltage ASIC HDMI/DVI drivers can also be protected with the SP300x-04, the $+V_{CC}$ pins on the SP300x-04 can be substituted with a suitable bypass capacitor or in some backdrive applications the $+V_{CC}$ of the SP300x-04 can be floated or NC.

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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# TVS Diode Array (SPA® Diodes)

## Low Capacitance ESD Protection - SP3001 Series

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $I_{PP}$ | Peak Current ($t_p$=8/20µs) | 2.5 | 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

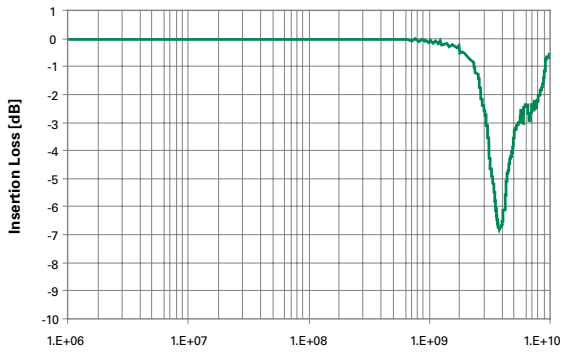
| Parameter | Rating | Units |
|---|---|---|
| Storage Temperature Range | –55 to 150 | °C |
| Maximum Junction Temperature | 150 | °C |
| Maximum Lead Temperature (Soldering 20-40s) | 260 | °C |

## Electrical Characteristics ($T_{OP}$=25°C)

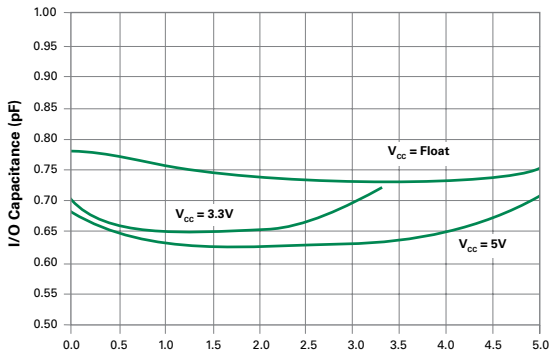
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R \leq 1\mu A$ | | | 6 | V |
| Reverse Leakage Current | $I_{LEAK}$ | $V_R$=5V | | | 0.5 | µA |
| Clamp Voltage[1] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20µs, Fwd | | 9.5 | 11.0 | V |
| | | $I_{PP}$=2A, $t_p$=8/20µs, Fwd | | 10.6 | 13.0 | V |
| ESD Withstand Voltage[1] | $V_{ESD}$ | IEC61000-4-2 (Contact) | ±8 | | | kV |
| | | IEC61000-4-2 (Air) | ±15 | | | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V | 0.7 | 0.8 | 0.9 | pF |
| | | Reverse Bias=1.65V | 0.55 | 0.65 | 0.75 | pF |
| Diode Capacitance[1] | $C_{I/O-I/O}$ | Reverse Bias=0V | | 0.35 | | pF |

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

## Insertion Loss (S21) I/O to GND




## Capacitance vs. Bias Voltage

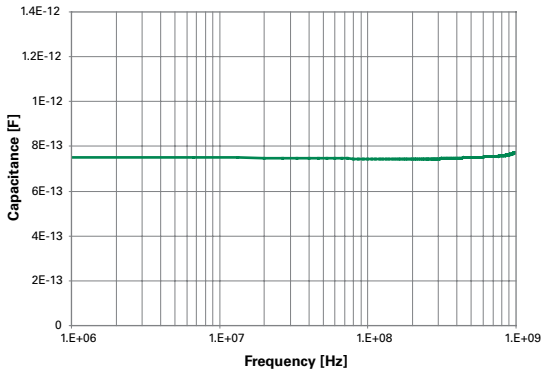



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# TVS Diode Array (SPA® Diodes)

## Low Capacitance ESD Protection - SP3001 Series

## Capacitance vs. Frequency



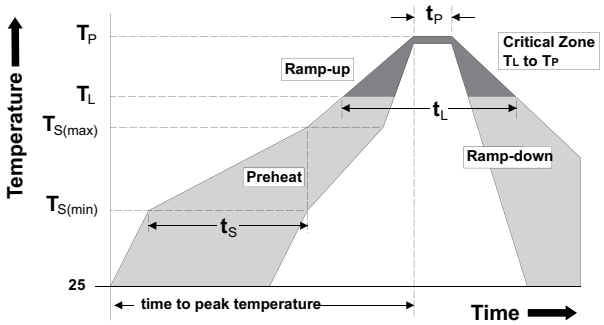

## Product Characteristics

| | |
|---|---|
| **Lead Plating** | Matte Tin |
| **Lead Material** | Copper Alloy |
| **Lead Coplanarity** | 0.0004 inches (0.102mm) |
| **Substitute Material** | Silicon |
| **Body Material** | Molded Epoxy |
| **Flammability** | 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.

## 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 |

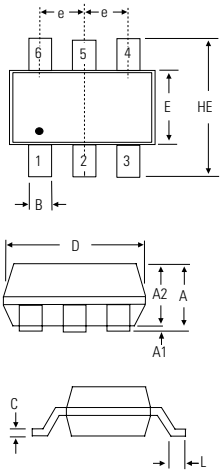


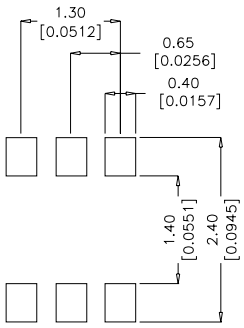

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# TVS Diode Array (SPA® Diodes)

## Low Capacitance ESD Protection - SP3001 Series

## Package Dimensions — SC70-6

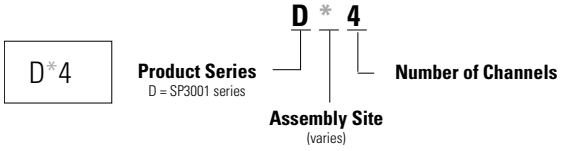


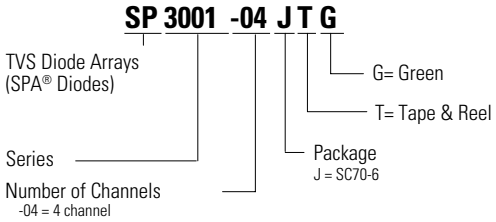

Solder Pad Layout

| Package | SC70-6 | | | |
|---|---|---|---|---|
| Pins | 6 | | | |
| JEDEC | MO-203 | | | |
| Symbol | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | 0.80 | 1.10 | 0.031 | 0.043 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.70 | 1.00 | 0.028 | 0.039 |
| B | 0.15 | 0.30 | 0.006 | 0.012 |
| c | 0.08 | 0.25 | 0.003 | 0.010 |
| D | 1.85 | 2.25 | 0.073 | 0.089 |
| E | 1.15 | 1.35 | 0.045 | 0.053 |
| e | 0.65 BSC | | 0.026 BSC | |
| HE | 2.00 | 2.40 | 0.079 | 0.094 |
| L | 0.26 | 0.46 | 0.010 | 0.018 |

## Part Marking System



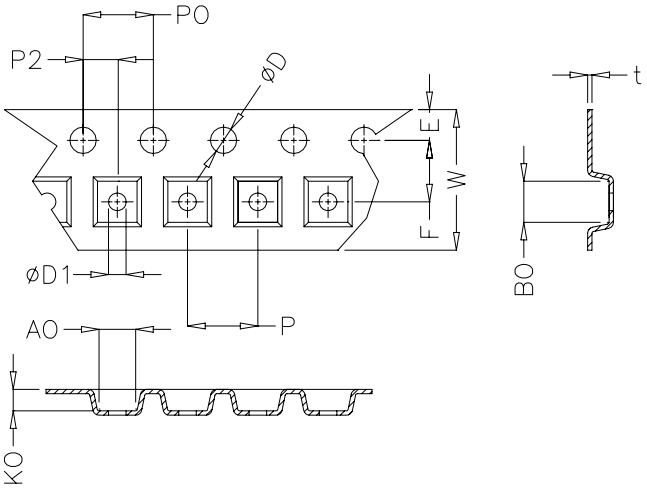

## Part Numbering System




## Ordering Information

| Part Number | Package | Marking | Min. Order Qty. |
|---|---|---|---|
| SP3001-04JTG | SC70-6 | D*4 | 3000 |

## Embossed Carrier Tape & Reel Specification — SC70-6




| Symbol | Millimetres | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| E | 1.65 | 1.85 | 0.064 | 0.072 |
| F | 3.45 | 3.55 | 0.135 | 0.139 |
| P2 | 1.95 | 2.05 | 0.076 | 0.081 |
| D | 1.40 | 1.60 | 0.055 | 0.062 |
| D1 | 1.00 | 1.25 | 0.039 | 0.049 |
| P0 | 3.90 | 4.10 | 0.153 | 0.161 |
| 10P0 | 40.0± 0.20 | | 1.574±0.007 | |
| W | 7.70 | 8.10 | 0.303 | 0.318 |
| P | 3.90 | 4.10 | 0.153 | 0.161 |
| A0 | 2.14 | 2.34 | 0.084 | 0.092 |
| B0 | 2.24 | 2.44 | 0.088 | 0.960 |
| K0 | 1.12 | 1.32 | 0.044 | 0.052 |
| t | 0.27 max | | 0.010 max | |

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