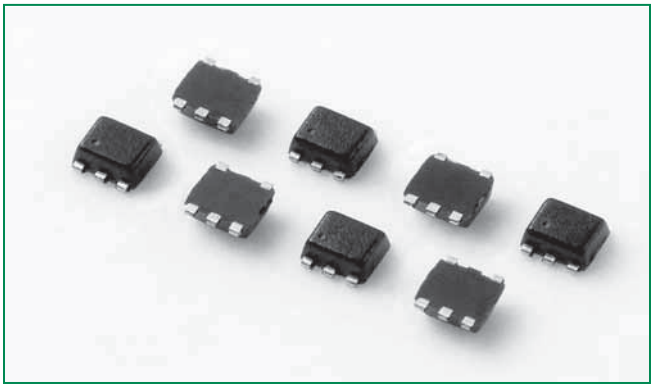
# SP1004 Series 5pF 8kV Bidirectional TVS Array

RoHS GREEN

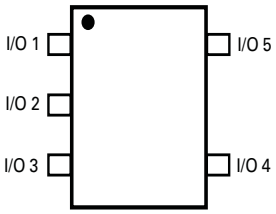




## Description

Back-to-back zener diodes fabricated in a proprietary silicon avalanche technology protect each I/O pin to provide 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.

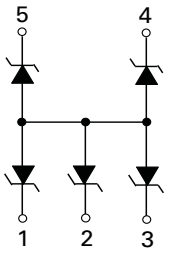
## Pinout




SOT953

Notes:
[1]Any of the 5 I/O pins can be tied to GND to provide 4 channels of bidirectional protection

## Functional Block Diagram



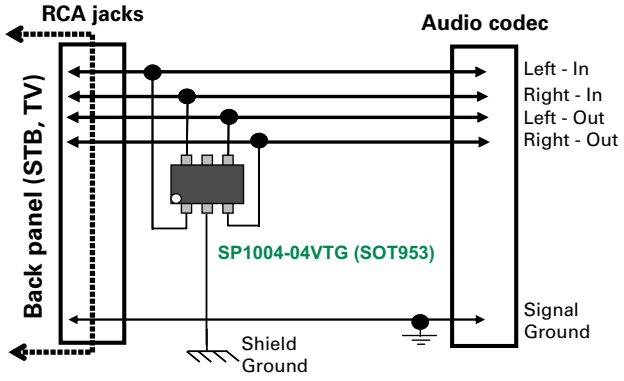

## Features

- ESD, IEC61000-4-2, ±8kV contact, ±15kV air
- Capable of withstanding >1,000 ±8kV ESD strikes
- Lightning, IEC61000-4-5, 2A ($t_p$=8/20µs)
- Low capacitance of 5pF (TYP) per I/O
- Low leakage current of 1µA (MAX) at 5V
- Small SOT953 package

## Applications

- MP3-PMPs
- DVD players
- Desktops
- Mobile phones
- Digital cameras
- Set top boxes
- Notebooks

## 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.

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $I_{PP}$ | Peak Pulse Current ($t_p$=8/20μs) | 2.0 | A |
| $T_{OP}$ | Operating Temperature | -40 to 85 | °C |
| $T_{STOR}$ | Storage Temperature | -60 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

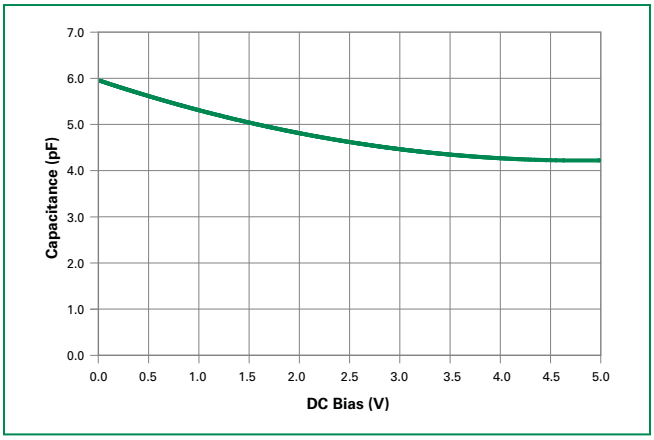
| Parameter | Rating | Units |
|---|---|---|
| Storage Temperature Range | -65 to 150 | °C |
| Maximum Junction Temperature | 150 | °C |
| Maximum Lead Temperature (Soldering 20-40s) | 260 | °C |

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

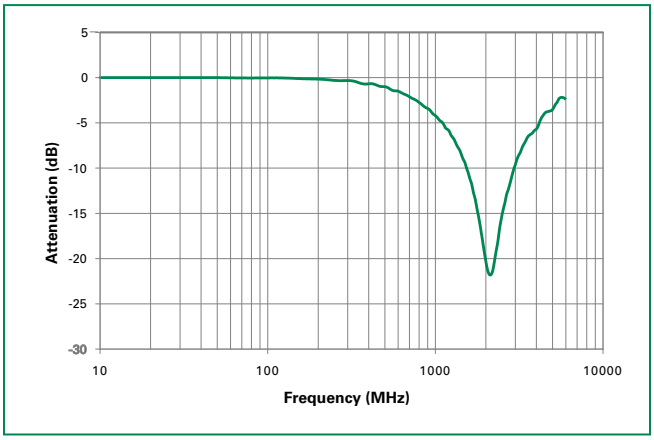
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Voltage Drop[1] | $V_R$ | $I_R$=1mA | 8.0 | 8.8 | 9.5 | V |
| Reverse Standoff Voltage[1] | $V_{RWM}$ | $I_R$≤1μA | | | 6.0 | V |
| Reverse Leakage Current[1] | $I_{LEAK}$ | $V_R$=5V | | | 0.1 | μA |
| Clamp Voltage[2] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20μs | | 10 | | V |
| | | $I_{PP}$=2A, $t_p$=8/20μs | | 12 | | V |
| Dynamic Resistance | $R_{DYN}$ | $(V_{C2} - V_{C1}) / (I_{PP2} - I_{PP1})$ | | 2.0 | | Ω |
| ESD Withstand Voltage[1,2] | $V_{ESD}$ | IEC61000-4-2 (Contact Discharge)[3] | ±8 | | | kV |
| | | IEC61000-4-2 (Air Discharge) | ±15 | | | kV |
| Diode Capacitance[1,2] | $C_D$ | Reverse Bias=0V | | 6 | 7 | pF |
| | | Reverse Bias=1.5V | | 5 | 6 | pF |

Note: [1] Parameter specified with pin 2 grounded externally.
[2] Parameter is guaranteed by design and/or device characterization.
[3] Capable of withstanding >1,000 pulses at 1s intervals.

## Capacitance vs. Reverse Bias

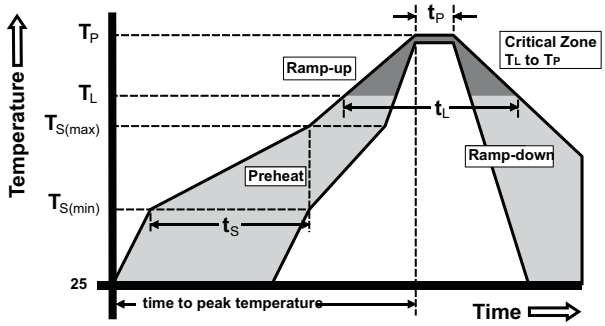



## Insertion Loss (S21)

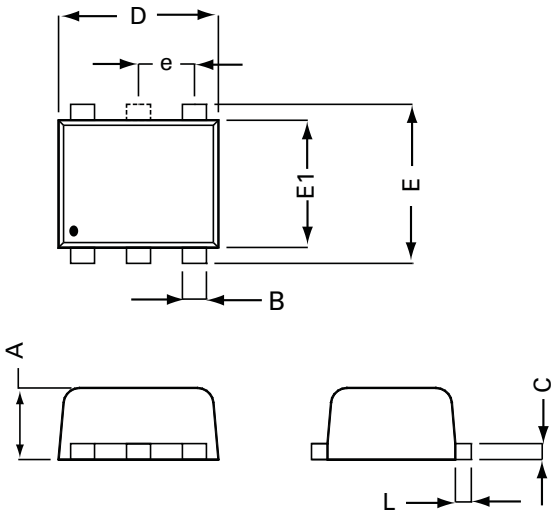


## Soldering Parameters

| | | |
|---|---|---|
| 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 |

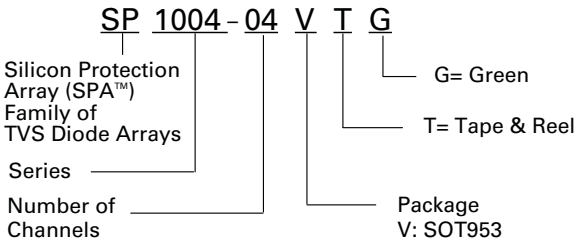



## Package Dimensions — SOT953

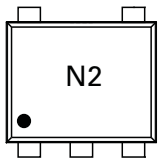



| Symbol | SOT953 | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| **A** | 0.44 | 0.5 | 0.170 | 0.020 |
| **B** | 0.10 | 0.20 | 0.004 | 0.008 |
| **c** | 0.05 | 0.15 | 0.002 | 0.006 |
| **D** | 0.95 | 1.05 | 0.037 | 0.041 |
| **E** | 0.95 | 1.05 | 0.037 | 0.041 |
| **E1** | 0.75 | 0.85 | 0.029 | 0.033 |
| **e** | 0.35 BSC | | 0.014 BSC | |
| **L** | 0.05 | 0.15 | 0.002 | 0.006 |

## Part Numbering System




## Part Marking System




## Product Characteristics

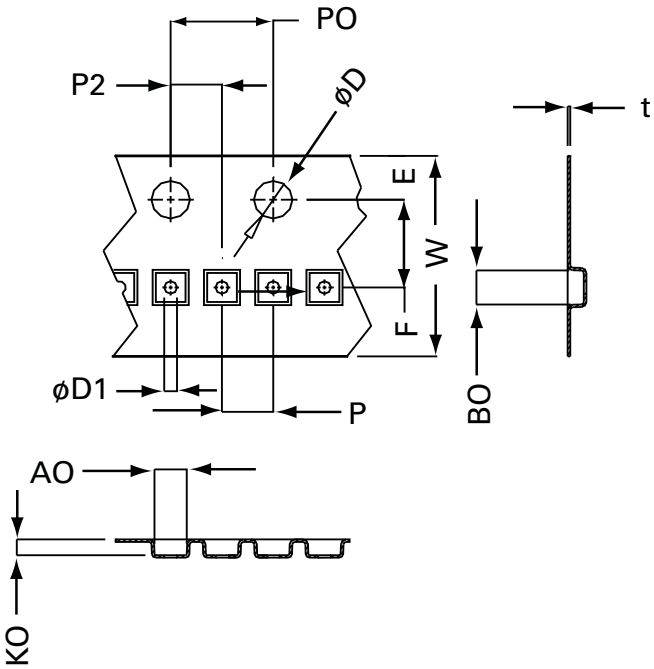
| | |
|---|---|
| **Lead Plating** | Pre-Plated Frame |
| **Lead Material** | Copper Alloy |
| **Lead Coplanarity** | 0.0004 inches (0.102mm) |
| **Substitute Material** | Silicon |
| **Body Material** | Molded Epoxy |
| **Flammability** | UL 94 V-0 |

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.

## Ordering Information

| Part Number | Package | Marking | Min. Order Qty. |
|---|---|---|---|
| SP1004-04VTG | SOT953 | N2 | 8000 |

## Embossed Carrier Tape & Reel Specification – SOT953




| Symbol | Millimetres | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| **E** | 1.65 | 1.85 | 0.065 | 0.073 |
| **F** | 3.45 | 3.55 | 0.136 | 0.140 |
| **D1** | 0.45 | 0.55 | 0.018 | 0.022 |
| **D** | 1.50 min | | 0.059 min | |
| **P0** | 3.90 | 4.10 | 0.154 | 0.161 |
| **10P0** | 40.0 +/- 0.20 | | 1.575 +/- 0.008 | |
| **P** | 1.95 | 2.05 | 0.077 | 0.081 |
| **P2** | 1.95 | 2.05 | 0.077 | 0.081 |
| **W** | 7.90 | 8.20 | 0.311 | 0.323 |
| **A0** | 1.11 | 1.21 | 0.044 | 0.048 |
| **B0** | 1.11 | 1.21 | 0.044 | 0.048 |
| **K0** | 0.58 | 0.68 | 0.023 | 0.027 |
| **t** | 0.22 max | | 0.009 max | |

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