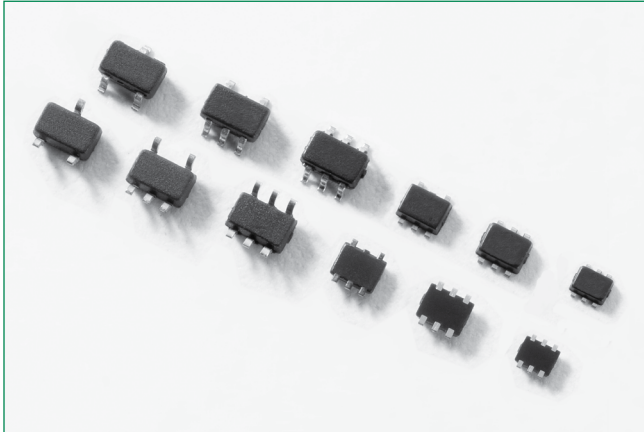


SP1001 Series

8pF 15kV Unidirectional TVS Array



Web Resources



Download ECAD models, order samples, and find technical resources at www.littelfuse.com

Description

Avalanche breakdown 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 above the maximum level specified in IEC 61000-4-2 international standard (Level 4, $\pm 8\text{kV}$ contact discharge) without performance degradation. Their very low loading capacitance also makes them ideal for protecting high-speed signal pins.

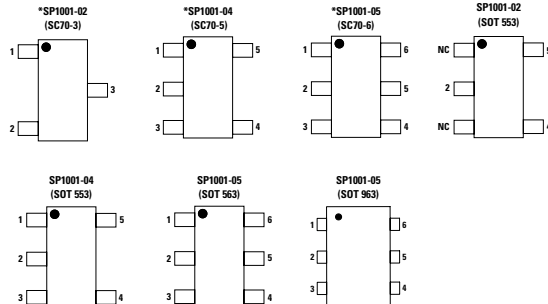
Features & Benefits

- Low capacitance of 8pF (TYP) per I/O
- ESD protection of $\pm 15\text{kV}$ contact discharge, $\pm 30\text{kV}$ air discharge, (Level 4, IEC 61000-4-2)
- EFT protection, IEC 61000-4-4, 40A (5/50ns)
- Low leakage current of $0.5\mu\text{A}$ (MAX) at 5V
- Small package saves board space
- Lightning Protection, IEC 61000-4-5, 2A (8/20 μs)
- AEC-Q101 Qualified

Applications

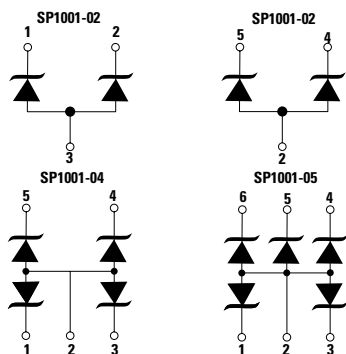
- Computer Peripherals
- Mobile Phones
- Digital Cameras
- Desktops/Notebooks
- LCD/PDPTVs
- Set Top Boxes
- DVD Players
- MP3/PMP

Pinout

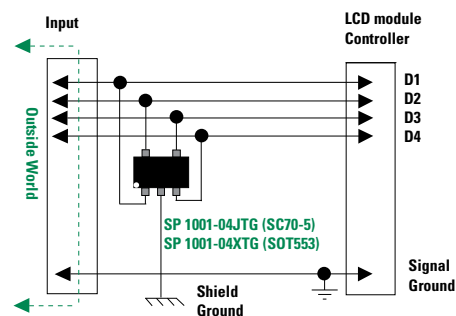


Note: * AEC-Q101 Qualified

Functional Block Diagram



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.

SP1001 Series

8pF 15kV Unidirectional TVS Array

Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|------------|----------------------------------|-------------|-------|
| I_{PP} | Peak Current ($t_p=8/20\mu s$) | 2 | A |
| T_{OP} | Operating Temperature | -40 to 125 | °C |
| T_{STOR} | Storage Temperature | -505 to 150 | °C |

Caution: Stresses 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.

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 |
| Thermal resistance junction to ambient | 124.21 | °C/W |
| Thermal resistance junction to case | 190.54 | °C/W |
| Power dissipation | 1 | W |

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

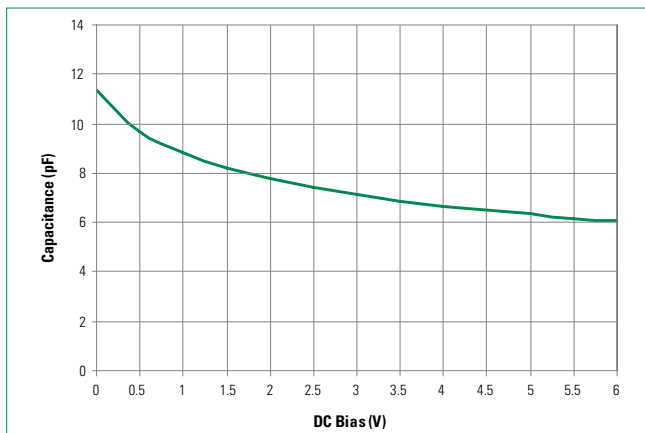
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|--------------------------------------|------------|---|----------|-----|------|----------|
| Forward Voltage Drop | V_F | $I_F=10mA$ | 0.7 | 0.9 | 1.2 | V |
| Reverse Voltage Drop | V_R | $I_R=1mA$ | 7.0 | 7.8 | 8.5 | V |
| Reverse Standoff Voltage | V_{RWM} | $I_R \leq 1\mu A$ | - | - | 5.5 | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=5V$ | - | - | 0.1 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A, t_p=8/20\mu s, Fwd$ | - | 8.0 | 11.0 | V |
| | | $I_{PP}=2A, t_p=8/20\mu s, Fwd$ | - | 9.7 | 13.0 | V |
| Dynamic Resistance | R_{DYN} | $(V_{C2} - V_{C1}) / (I_{PP2} - I_{PP1})$ | - | 1.7 | - | Ω |
| ESD Withstand Voltage ^{1,2} | V_{ESD} | IEC 61000-4-2 (Contact) | ± 15 | - | - | kV |
| | | IEC 61000-4-2 (Air) | ± 30 | - | - | kV |
| Diode Capacitance ¹ | C_D | Reverse Bias=0V | - | 12 | - | pF |
| | | Reverse Bias=2.5V | - | 8 | - | pF |
| | | Reverse Bias=5V | - | 7 | - | pF |

Notes:

¹ Parameter is guaranteed by component characterization

² A minimum of 1,000 ESD pulses are applied at 1s intervals between the anode and common cathode of each diode

Capacitance vs. Reverse Bias



Design Consideration

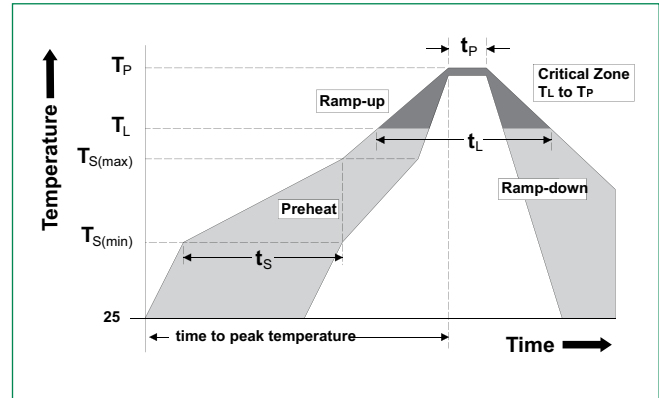
Because of the fast rise-time of the ESD transient, placement of ESD components is a key design consideration. To achieve optimal ESD suppression, the components should be placed on the circuit board as close to the source of the ESD transient as possible. Install the ESD suppressors directly behind the connector so that they are the first board-level circuit component encountered by the ESD transient. They are connected from signal/data line to ground.

SP1001 Series

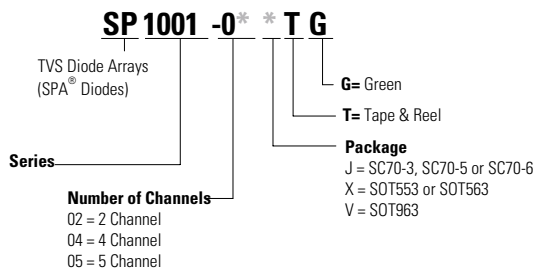
8pF 15kV Unidirectional TVS Array

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



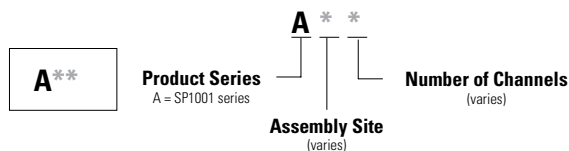
Product Characteristics

| | |
|---------------------------|--|
| Lead Plating | Matte Tin (SC70-x) Pre-Plated Frame (SOT5x3, SOT963) |
| Lead Material | Copper Alloy |
| Lead Coplanarity | 0.004 inches(0.102mm) |
| Substrate material | Silicon |
| Body Material | Molded Compound |
| Flammability | UL Recognized compound meeting flammability rating V-0 |

Notes :

- All dimensions are in millimeters
- Dimensions include solder plating.
- Dimensions are exclusive of mold flash & metal burr.

Part Marking System



Ordering Information

| Part Number | Package | Marking | Min. Order Qty. |
|--------------|---------|---------|-----------------|
| SP1001-02JTG | SC70-3 | A*2 | 3000 |
| SP1001-02XTG | SOT553 | A*2 | 3000 |
| SP1001-04JTG | SC70-5 | A*4 | 3000 |
| SP1001-04XTG | SOT553 | A*4 | 3000 |
| SP1001-05JTG | SC70-6 | A*5 | 3000 |
| SP1001-05VTG | SOT963 | A5 | 8000 |
| SP1001-05XTG | SOT563 | A*5 | 3000 |

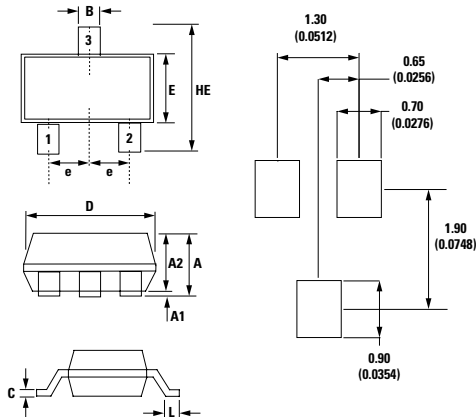
SP1001 Series

8pF 15kV Unidirectional TVS Array

Package Dimensions — SC70

SC70-3

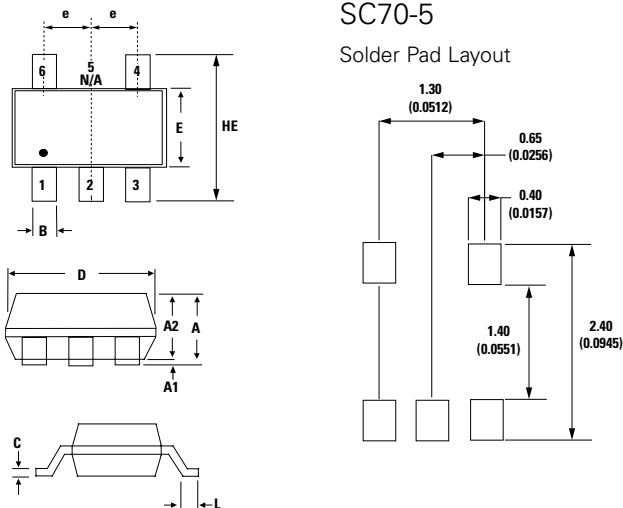
Solder Pad Layout



| Package | SC70-3 | | | |
|---------|-------------|------|-----------|-------|
| Pins | 3 | | | |
| JEDEC | MO-203 | | | |
| | 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 | 0.40 | 0.006 | 0.016 |
| 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 | 0.66 BSC | | 0.026 BSC | |
| HE | 2.00 | 2.45 | 0.079 | 0.096 |
| L | 0.26 | 0.46 | 0.010 | 0.018 |

SC70-5

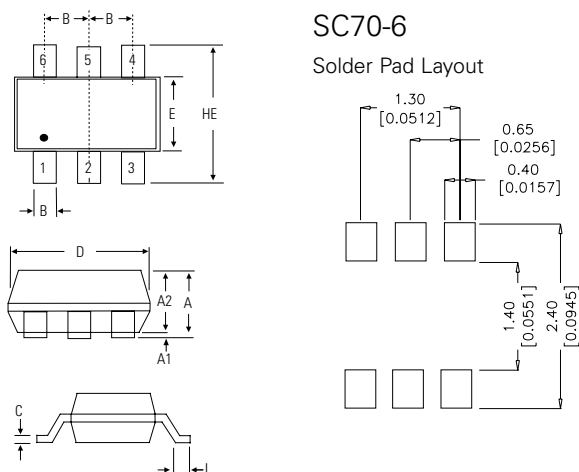
Solder Pad Layout



| Package | SC70-5 | | | |
|---------|-------------|------|-----------|-------|
| Pins | 5 | | | |
| JEDEC | MO-203 | | | |
| | 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 |

SC70-6

Solder Pad Layout

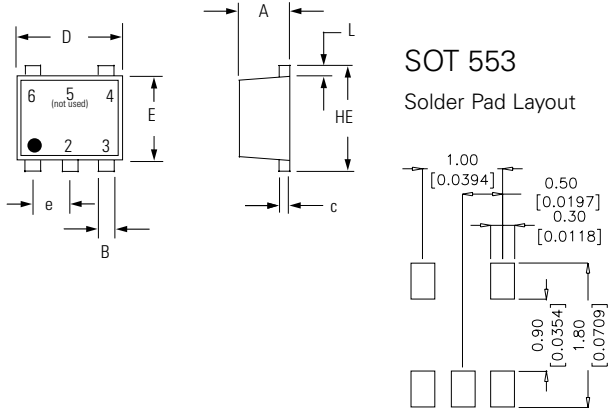


| Package | SC70-6 | | | |
|---------|-------------|------|-----------|-------|
| Pins | 6 | | | |
| JEDEC | MO-203 | | | |
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | 0.80 | 1.10 | 0.031 | 0.043 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.70 | 1.00 | 0.028 | 0.039 |
| B | 0.15 | 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 |

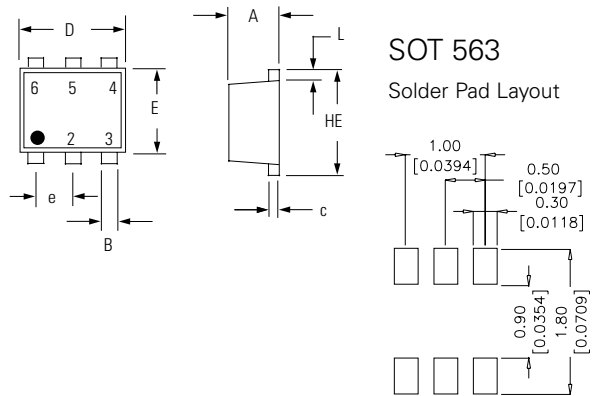
SP1001 Series

8pF 15kV Unidirectional TVS Array

Package Dimensions – SOT553 and SOT563

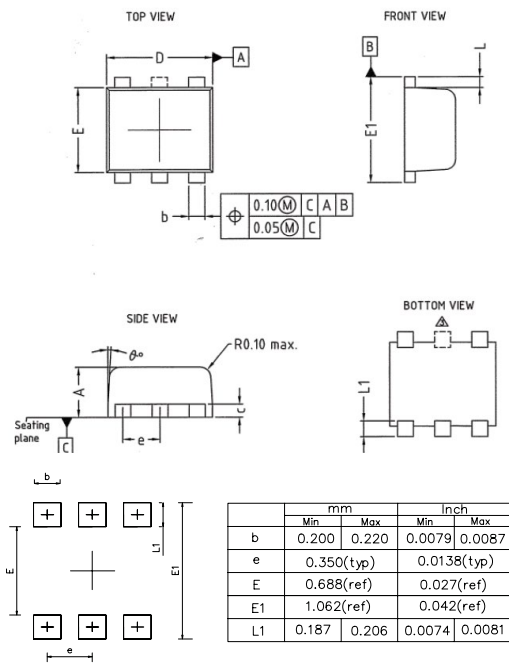


| Package | SOT 553 | | | |
|-----------|-------------|------|-----------|-------|
| Pins | 5 | | | |
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | 0.50 | 0.60 | 0.020 | 0.024 |
| B | 0.17 | 0.27 | 0.007 | 0.011 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.50 | 1.70 | 0.059 | 0.067 |
| E | 1.10 | 1.30 | 0.043 | 0.051 |
| e | 0.50 BSC | | 0.020 BSC | |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| HE | 1.50 | 1.70 | 0.059 | 0.067 |



| Package | SOT 563 | | | |
|-----------|-------------|------|-----------|-------|
| Pins | 6 | | | |
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | 0.50 | 0.60 | 0.020 | 0.024 |
| B | 0.17 | 0.27 | 0.007 | 0.011 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.50 | 1.70 | 0.059 | 0.067 |
| E | 1.10 | 1.30 | 0.043 | 0.051 |
| e | 0.50 BSC | | 0.020 BSC | |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| HE | 1.50 | 1.70 | 0.059 | 0.067 |

Package Dimensions – SOT963

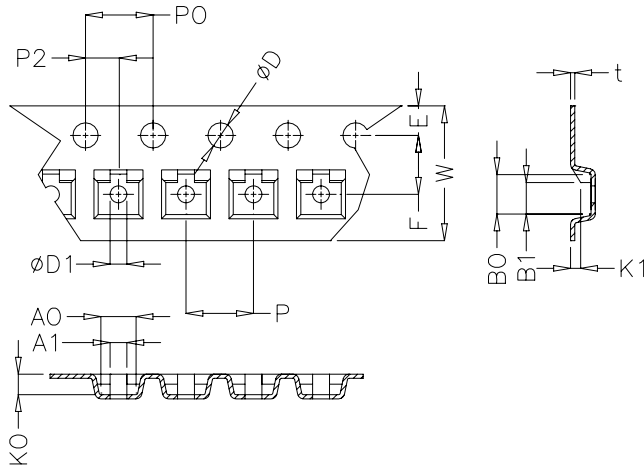


| Package | SOT 963 | | | | | |
|-----------|-------------|------|-------|-----------|--------|--------|
| Pins | 6 | | | | | |
| | Millimeters | | | Inches | | |
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.44 | 0.48 | 0.50 | 0.0173 | 0.0189 | 0.0197 |
| B | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| c | 0.05 | 0.10 | 0.15 | 0.002 | 0.004 | 0.006 |
| D | 0.95 | 1.00 | 1.05 | 0.037 | 0.039 | 0.041 |
| E | 0.75 | 0.80 | 0.85 | 0.029 | 0.031 | 0.033 |
| E1 | 0.95 | 1.00 | 1.05 | 0.037 | 0.039 | 0.041 |
| e | 0.35 BSC | | | 0.014 BSC | | |
| L | 0.05 | 0.10 | 0.15 | 0.002 | 0.004 | 0.006 |
| L1 | 0.125 | 0.15 | 0.175 | 0.005 | 0.006 | 0.007 |
| ø | 3° | 5° | 7° | 3° | 5° | 7° |

SP1001 Series

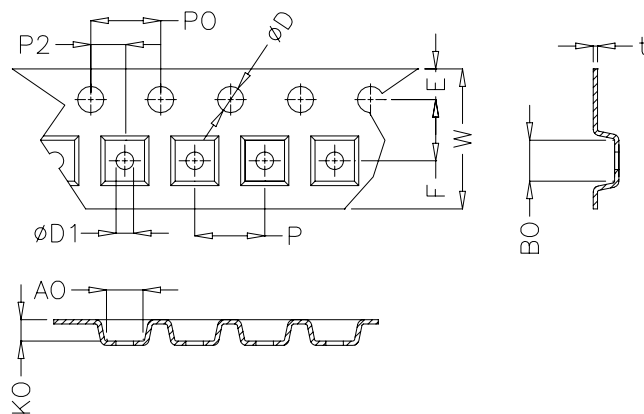
8pF 15kV Unidirectional TVS Array

Embossed Carrier Tape & Reel Specification – SC70-3



| Symbol | Millimetres | | Inches | |
|-------------|---------------|------|-----------------|-------|
| | Min | Max | Min | Max |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 3.45 | 3.55 | 0.135 | 0.139 |
| P2 | 1.95 | 2.05 | 0.077 | 0.081 |
| D | 1.40 | 1.60 | 0.055 | 0.063 |
| D1 | 1.00 | 1.25 | 0.039 | 0.049 |
| P0 | 3.90 | 4.10 | 0.154 | 0.161 |
| 10P0 | 40.0 +/- 0.20 | | 1.574 +/- 0.008 | |
| W | 7.70 | 8.10 | 0.303 | 0.318 |
| P | 3.90 | 4.10 | 0.153 | 0.161 |
| A0 | 2.30 | 2.50 | 0.090 | 0.098 |
| A1 | 1.00 Ref | | 0.039 Ref | |
| B0 | 2.30 | 2.50 | 0.090 | 0.098 |
| B1 | 1.90 Ref | | 0.074 | |
| K0 | 1.10 | 1.30 | 0.043 | 0.051 |
| K1 | 0.60 Ref | | 0.023 Ref | |
| t | 0.27 max | | 0.010 | |

Embossed Carrier Tape & Reel Specification – SC70-5 and SC70-6

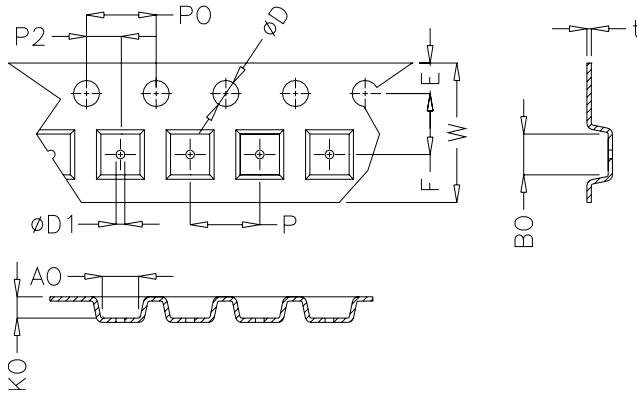


| Symbol | Millimetres | | Inches | |
|-------------|---------------|------|-----------------|-------|
| | Min | Max | Min | Max |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 3.45 | 3.55 | 0.135 | 0.139 |
| P2 | 1.95 | 2.05 | 0.077 | 0.081 |
| D | 1.40 | 1.60 | 0.055 | 0.063 |
| D1 | 1.00 | 1.25 | 0.039 | 0.049 |
| P0 | 3.90 | 4.10 | 0.154 | 0.161 |
| 10P0 | 40.0 +/- 0.20 | | 1.574 +/- 0.008 | |
| 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 | 0.096 |
| K0 | 1.12 | 1.32 | 0.044 | 0.052 |
| t | 0.27 max | | 0.010 max | |

SP1001 Series

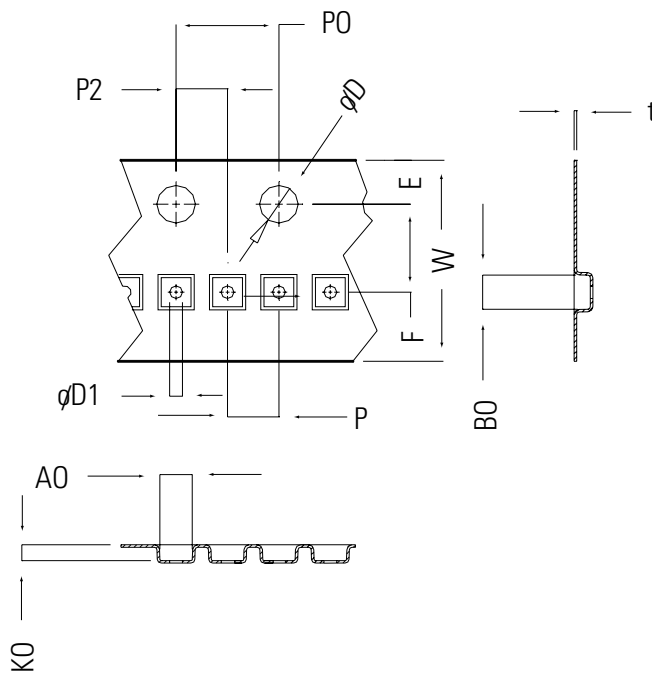
8pF 15kV Unidirectional TVS Array

Embossed Carrier Tape & Reel Specification – SOT553 and SOT563



| Symbol | Millimetres | | Inches | |
|-------------|---------------|------|-----------------|-------|
| | Min | Max | Min | Max |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 3.45 | 3.55 | 0.135 | 0.139 |
| P2 | 1.95 | 2.05 | 0.077 | 0.081 |
| D | 1.40 | 1.60 | 0.055 | 0.063 |
| D1 | 0.45 | 0.55 | 0.017 | 0.021 |
| P0 | 3.90 | 4.1 | 0.154 | 0.161 |
| 10P0 | 40.0 +/- 0.20 | | 1.574 +/- 0.008 | |
| W | 7.70 | 8.10 | 0.303 | 0.318 |
| P | 3.90 | 4.10 | 0.153 | 0.161 |
| A0 | 1.73 | 1.83 | 0.068 | 0.072 |
| B0 | 1.73 | 1.83 | 0.068 | 0.072 |
| K0 | 0.64 | 0.74 | 0.025 | 0.029 |
| t | 0.22 max | | .009 max | |

Embossed Carrier Tape & Reel Specification – SOT963



| 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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