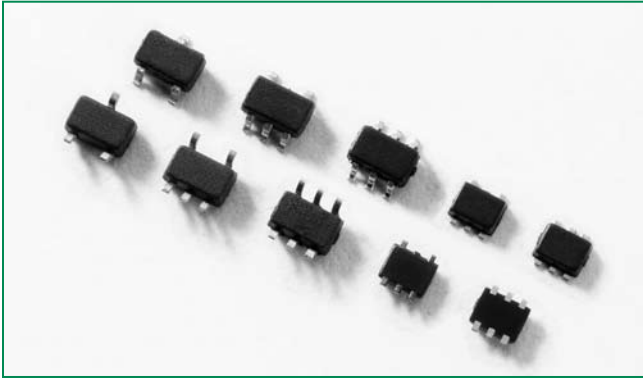




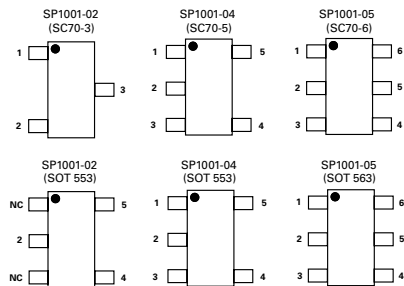
## SP1001 Lead-Free/Green Series



### Description

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.

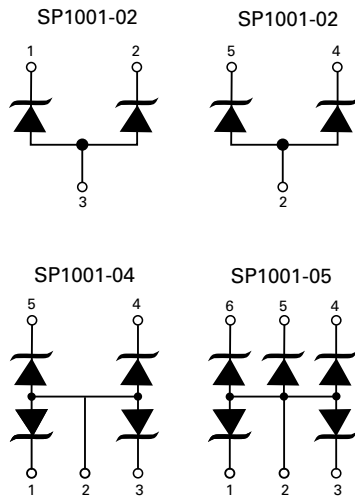
### Pinout



### Features

- Low capacitance of 8pF (TYP) per I/O
- ESD protection of 8kV contact discharge, 15kV air discharge, (Level 4, IEC61000-4-2)
- EFT protection, IEC61000-4-4, 40A (5/50 ns)
- Low leakage current of 0.5μA (MAX) at 5V
- Small package saves board space
- Lightning Protection, IEC61000-4-5, 2.5A (8/μs)

### Functional Block Diagram



### Applications

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

### Absolute Maximum Ratings

| Symbol     | Parameter                        | Value      | Units |
|------------|----------------------------------|------------|-------|
| $I_P$      | Peak Current ( $t_p=8/20\mu s$ ) | 2          | 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 10s) | 300        | °C    |

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

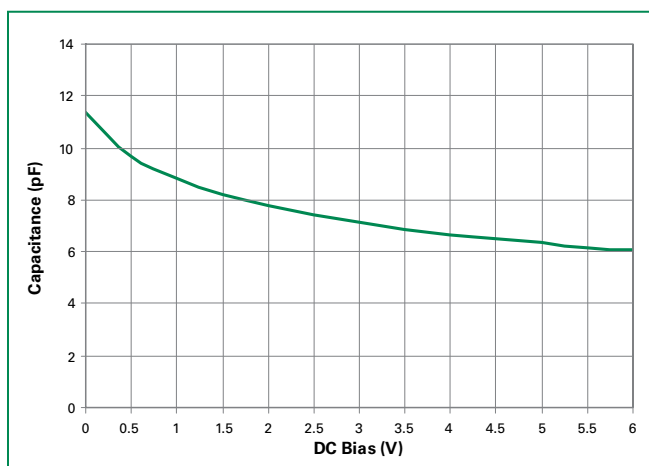
| Parameter                            | Symbol     | Test Conditions                            | Min      | Typ | Max  | Units         |
|--------------------------------------|------------|--------------------------------------------|----------|-----|------|---------------|
| Forward Voltage Drop                 | $V_F$      | $I_F=10\text{mA}$                          | 0.7      | 0.9 | 1.2  | V             |
| Reverse Voltage Drop                 | $V_R$      | $I_R=10\text{mA}$                          | 6.0      | 6.7 | 8.0  | V             |
| Reverse Standoff                     | $V_{RWM}$  | $I_R \leq 1\mu\text{A}$                    |          |     | 5.5  | V             |
| Reverse Leakage Current              | $I_{LEAK}$ | $V_R=5\text{V}$                            |          |     | 0.5  | $\mu\text{A}$ |
| Clamp Voltage <sup>1</sup>           | $V_C$      | $I_{PP}=1\text{A}$ , $t_p=8/20\mu s$ , Fwd |          | 8.0 | 11.0 | V             |
|                                      |            | $I_{PP}=2\text{A}$ , $t_p=8/20\mu s$ , Fwd |          | 9.7 | 13.0 | V             |
| ESD Withstand Voltage <sup>1,2</sup> | $V_{ESD}$  | IEC61000-4-2 (Contact)                     | $\pm 8$  |     |      | kV            |
|                                      |            | IEC61000-4-2 (Air)                         | $\pm 15$ |     |      | kV            |
| Diode Capacitance <sup>1</sup>       | $C_D$      | Reverse Bias=0V                            |          | 12  |      | pF            |
|                                      |            | Reverse Bias=2.5V                          |          | 8   |      | pF            |
|                                      |            | Reverse Bias=5V                            |          | 7   |      | pF            |

Notes:

<sup>1</sup> Parameter is guaranteed by device characterization

<sup>2</sup> 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

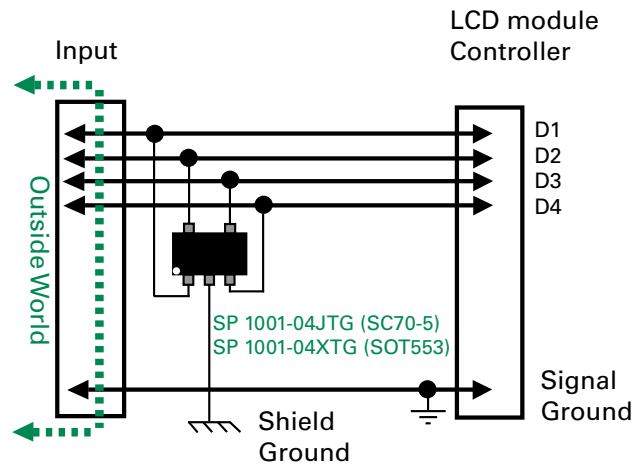


## Design Consideration

Because of the fast rise-time of the ESD transient, placement of ESD devices is a key design consideration. To achieve optimal ESD suppression, the devices should be placed on the circuit board as close to the source of the ESD transient as possible. Install the ESD suppressors

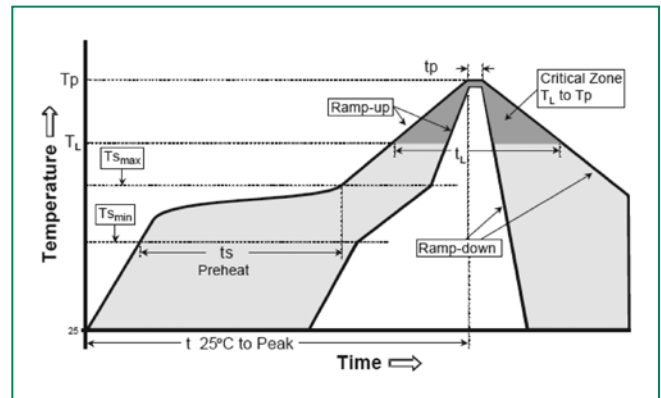
directly behind the connector so that they are the first board-level circuit component encountered by the ESD transient. They are connected from signal/data line to ground.

## Application Example

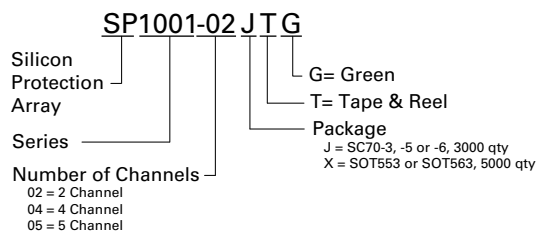


## Soldering Parameters

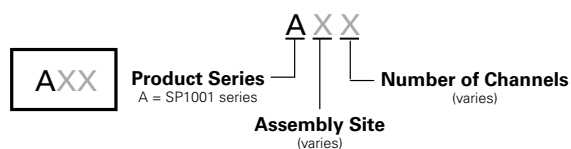
|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | 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 ( $T_p$ )                             |                                    | 250 <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>        | Matte Tin               |
| <b>Lead Material</b>       | Copper Alloy            |
| <b>Lead Coplanarity</b>    | 0.0004 inches (0.102mm) |
| <b>Substitute Material</b> | Silicon                 |
| <b>Body Material</b>       | Molded Epoxy            |
| <b>Flammability</b>        | UL94-V-0                |

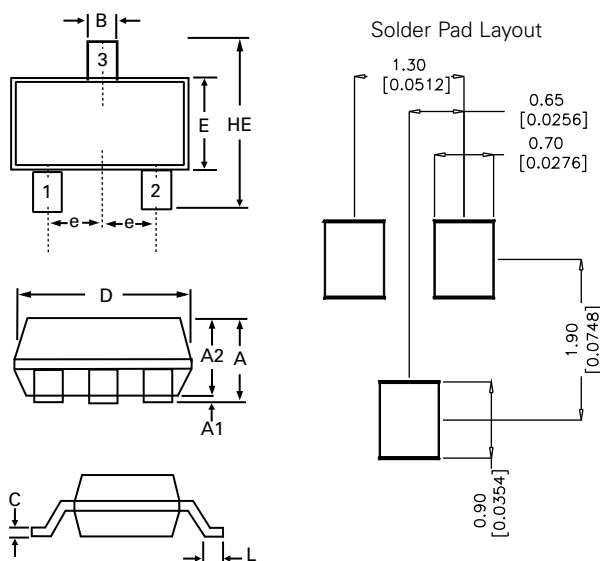
#### Notes :

1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. All specifications comply to JEDEC SPEC MO-203 Issue A
5. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
6. Package surface matte finish VDI 11-13.

### Ordering Information

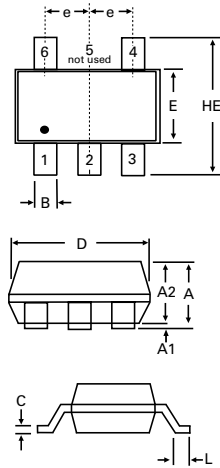
| Part Number  | Package | Marking | Min. Order Qty. |
|--------------|---------|---------|-----------------|
| SP1001-02JTG | SC70-3  | AX2     | 3000            |
| SP1001-02XTG | SOT553  | AX2     | 5000            |
| SP1001-04JTG | SC70-5  | AX4     | 3000            |
| SP1001-04XTG | SOT553  | AX4     | 5000            |
| SP1001-05JTG | SC70-6  | AX5     | 3000            |
| SP1001-05XTG | SOT563  | AX5     | 5000            |

### Package Dimensions - SC70-3

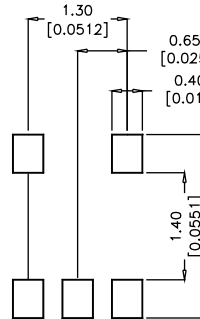


| Package      | SC70-3         |      |           |       |
|--------------|----------------|------|-----------|-------|
| <b>Pins</b>  | 3              |      |           |       |
| <b>JEDEC</b> | MO-203 Issue A |      |           |       |
|              | Millimeters    |      | Inches    |       |
|              | Min            | Max  | Min       | Max   |
| <b>A</b>     | 0.80           | 1.10 | 0.031     | 0.043 |
| <b>A1</b>    | 0.00           | 0.10 | 0.000     | 0.004 |
| <b>A2</b>    | 0.70           | 1.00 | 0.028     | 0.039 |
| <b>B</b>     | 0.15           | 0.30 | 0.006     | 0.012 |
| <b>c</b>     | 0.08           | 0.25 | 0.003     | 0.010 |
| <b>D</b>     | 1.85           | 2.25 | 0.073     | 0.089 |
| <b>E</b>     | 1.15           | 1.35 | 0.045     | 0.053 |
| <b>e</b>     | 0.66 BSC       |      | 0.026 BSC |       |
| <b>HE</b>    | 2.00           | 2.40 | 0.079     | 0.094 |
| <b>L</b>     | 0.26           | 0.46 | 0.010     | 0.018 |

### Package Dimensions - SC70-5

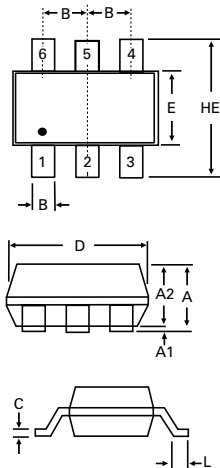


Solder Pad Layout

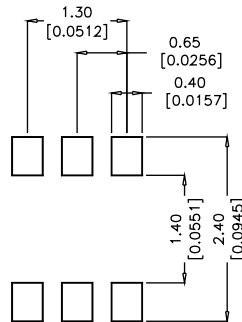


| Package   | SC70-5         |      |           |       |
|-----------|----------------|------|-----------|-------|
| Pins      | 5              |      |           |       |
| JEDEC     | MO-203 Issue A |      |           |       |
|           | Millimeters    |      | Inches    |       |
|           | Min            | Max  | Min       | Max   |
| <b>A</b>  | 0.80           | 1.10 | 0.031     | 0.043 |
| <b>A1</b> | 0.00           | 0.10 | 0.000     | 0.004 |
| <b>A2</b> | 0.70           | 1.00 | 0.028     | 0.039 |
| <b>B</b>  | 0.15           | 0.30 | 0.006     | 0.012 |
| <b>c</b>  | 0.08           | 0.25 | 0.003     | 0.010 |
| <b>D</b>  | 1.85           | 2.25 | 0.073     | 0.089 |
| <b>E</b>  | 1.15           | 1.35 | 0.045     | 0.053 |
| <b>e</b>  | 0.65 BSC       |      | 0.026 BSC |       |
| <b>HE</b> | 2.00           | 2.40 | 0.079     | 0.094 |
| <b>L</b>  | 0.26           | 0.46 | 0.010     | 0.018 |

### Package Dimensions - SC70-6

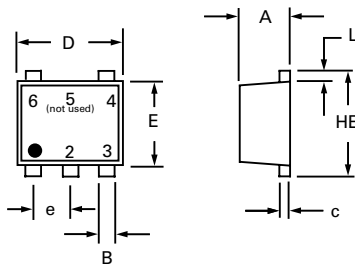


Solder Pad Layout

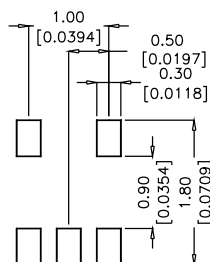


| Package   | SC70-6         |      |           |       |
|-----------|----------------|------|-----------|-------|
| Pins      | 6              |      |           |       |
| JEDEC     | MO-203 Issue A |      |           |       |
|           | Millimeters    |      | Inches    |       |
|         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

### Package Dimensions - SOT553

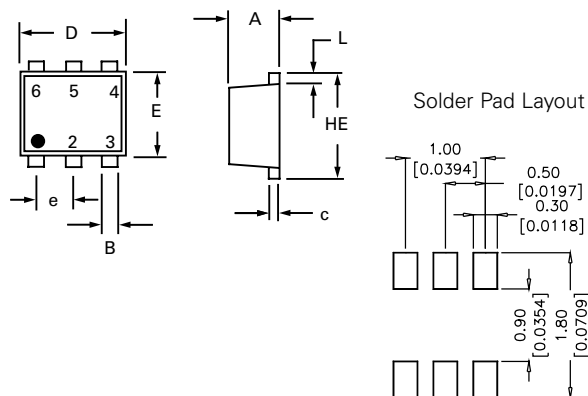


Solder Pad Layout



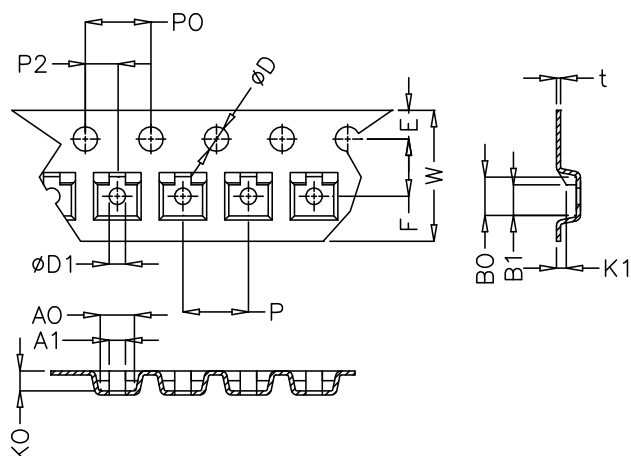
| Package   | SOT 553     |       |           |       |
|-----------|-------------|-------|-----------|-------|
| Pins      | 5           |       |           |       |
|           | Millimeters |       | Inches    |       |
|           | Min         | Max   | Min       | Max   |
| <b>A</b>  | 0.50        | 0.60  | 0.020     | 0.024 |
| <b>B</b>  | 0.17        | 0.27  | 0.007     | 0.011 |
| <b>c</b>  | 0.08        | 0.018 | 0.003     | 0.007 |
| <b>D</b>  | 1.50        | 1.70  | 0.059     | 0.067 |
| <b>E</b>  | 1.10        | 1.30  | 0.043     | 0.051 |
| <b>e</b>  | 0.50 BSC    |       | 0.014 BSC |       |
| <b>L</b>  | 0.10        | 0.30  | 0.004     | 0.012 |
| <b>HE</b> | 1.50        | 1.70  | 0.059     | 0.067 |

### Package Dimensions - SOT563



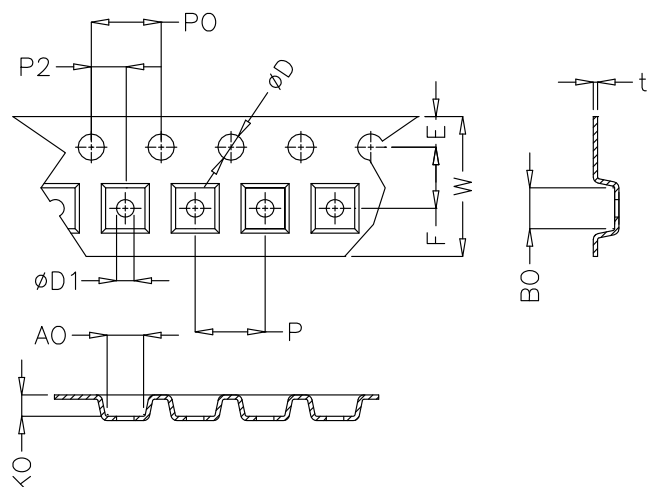
| Package   | SOT 563     |      |           |       |
|-----------|-------------|------|-----------|-------|
| Pins      | 6           |      |           |       |
|           | Millimeters |      | Inches    |       |
|           | Min         | Max  | Min       | Max   |
| <b>A</b>  | 0.50       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

### Embossed Carrier Tape & Reel Specification - SC70-3



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

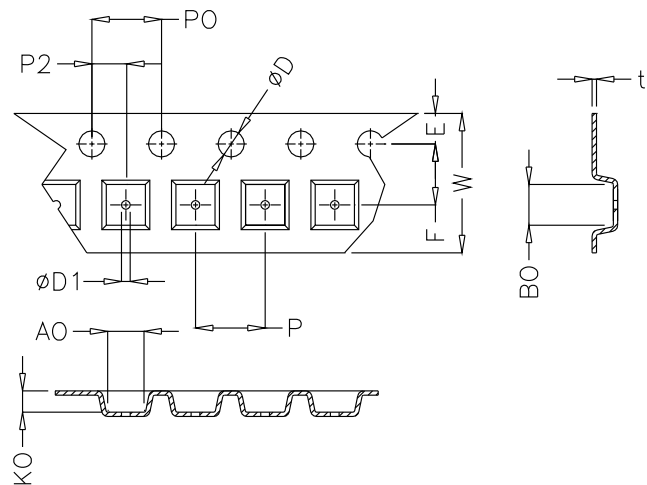
**Embossed Carrier Tape & Reel Specification - SC70-5 and SC70-6**



**Dimensions**

|             | Millimetres   |      | Inches          |       |
|-------------|---------------|------|-----------------|-------|
|             | Min           | Max  | Min             | Max   |
| <b>E</b>    | 1.65          | 1.85 | 0.065           | 0.073 |
| <b>F</b>    | 3.45          | 3.55 | 0.135           | 0.139 |
| <b>P2</b>   | 1.95          | 2.05 | 0.077           | 0.081 |
| <b>D</b>    | 1.40          | 1.60 | 0.055           | 0.063 |
| <b>D1</b>   | 1.00          | 1.25 | 0.039           | 0.049 |
| <b>P0</b>   | 3.90          | 4.10 | 0.154           | 0.161 |
| <b>10P0</b> | 40.0 +/- 0.20 |      | 1.574 +/- 0.008 |       |
| <b>W</b>    | 7.70          | 8.10 | 0.303           | 0.318 |
| <b>P</b>    | 3.90          | 4.10 | 0.153           | 0.161 |
| <b>A0</b>   | 2.14          | 2.34 | 0.084           | 0.092 |
| <b>B0</b>   | 2.24          | 2.44 | 0.088           | 0.096 |
| <b>K0</b>   | 1.12          | 1.32 | 0.044           | 0.051 |
| <b>t</b>    | 0.27 max      |      | 0.010 max       |       |

**Embossed Carrier Tape & Reel Specification - SOT553 and SOT563**



**Dimensions**

|             | Millimetres   |      | Inches          |       |
|-------------|---------------|------|-----------------|-------|
|             | Min           | Max  | Min             | Max   |
| <b>E</b>    | 1.65          | 1.85 | 0.065           | 0.073 |
| <b>F</b>    | 3.45          | 3.55 | 0.135           | 0.139 |
| <b>P2</b>   | 1.95          | 2.05 | 0.077           | 0.081 |
| <b>D</b>    | 1.40          | 1.60 | 0.055           | 0.063 |
| <b>D1</b>   | 0.45          | 0.55 | 0.017           | 0.021 |
| <b>P0</b>   | 3.90          | 4.1  | 0.154           | 0.161 |
| <b>10P0</b> | 40.0 +/- 0.20 |      | 1.574 +/- 0.008 |       |
| <b>W</b>    | 7.70          | 8.10 | 0.303           | 0.318 |
| <b>P</b>    | 3.90          | 4.10 | 0.153           | 0.161 |
| <b>A0</b>   | 1.73          | 1.83 | 0.068           | 0.072 |
| <b>B0</b>   | 1.73          | 1.83 | 0.068           | 0.072 |
| <b>K0</b>   | 0.64          | 0.74 | 0.025           | 0.029 |
| <b>t</b>    | 0.22 max      |      | 0.010 max       |       |

Lead-Free/Green SP1001