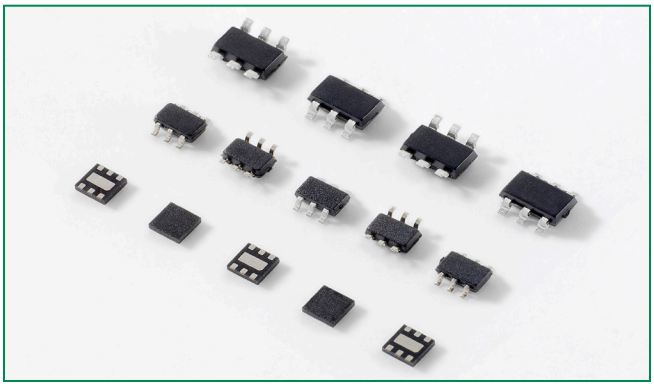
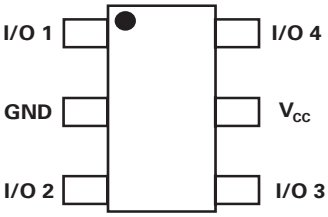
# HF RoHS Pb GREEN SP3002 Lead-Free/Green Series



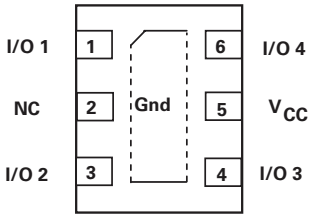
## Description

The SP3002 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 (Level 4) specified in the IEC 61000-4-2 international standard 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.

## Pinout




SC70-6 and SOT23-6

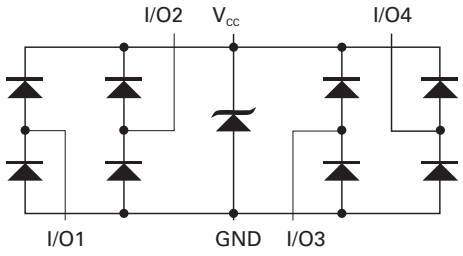



uDFN-6
(1.6x1.6x0.5mm)

## Features

- Low capacitance of 0.85 pF (TYP) per I/O
- ESD protection of ±12kV contact discharge, ±15kV air discharge, (IEC61000-4-2)
- EFT protection, IEC61000-4-4, 40A (5/50ns)
- Low leakage current of 0.5µA (MAX) at 5V
- Small packaging options saves board space
- Lightning Protection, IEC61000-4-5, 4.5A (8/20µs)

## Functional Block Diagram




## Applications

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



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## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $I_{PP}$ | Peak Current ($t_p$=8/20µs) | 4.5 | A |
| $T_{OP}$ | Operating Temperature | -40 to 85 | °C |
| $T_{STOR}$ | Storage Temperature | -50 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) | 260 | °C |

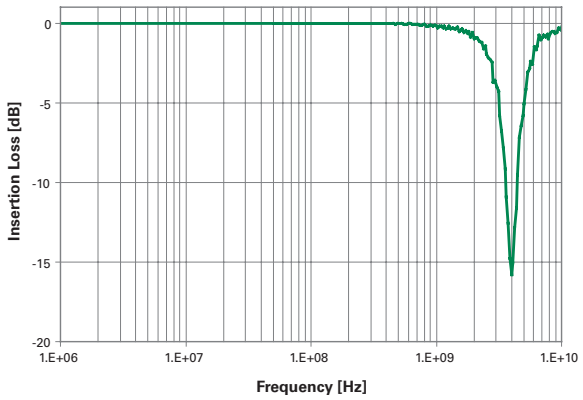
## Electrical Characteristics ($T_{OP}$=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R \leq 1\mu A$ | | | 6.0 | 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) | ±12 | | | kV |
| | | IEC61000-4-2 (Air) | ±15 | | | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V | 0.95 | 1.1 | 1.25 | pF |
| | | Reverse Bias=1.65V | 0.7 | 0.85 | 1.0 | pF |
| Diode Capacitance[1] | $C_{I/O-I/O}$ | Reverse Bias=0V | | 0.5 | | pF |

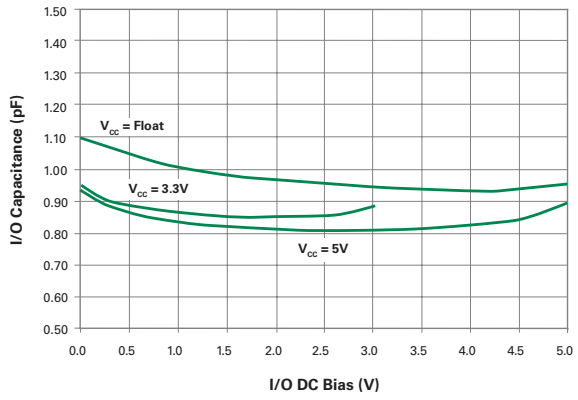
Note 1: Parameter is guaranteed by design and/or device characterization.


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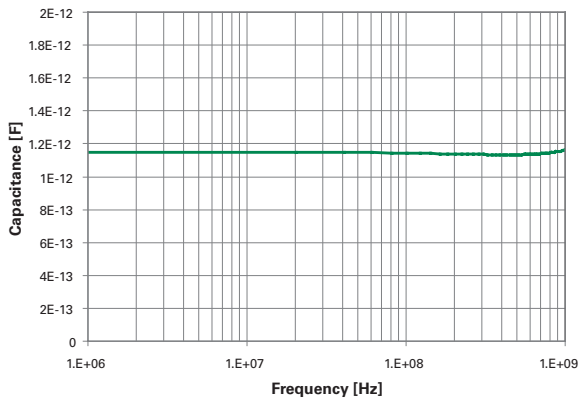
## Insertion Loss (S21) I/O to GND




## Capacitance vs. Bias Voltage



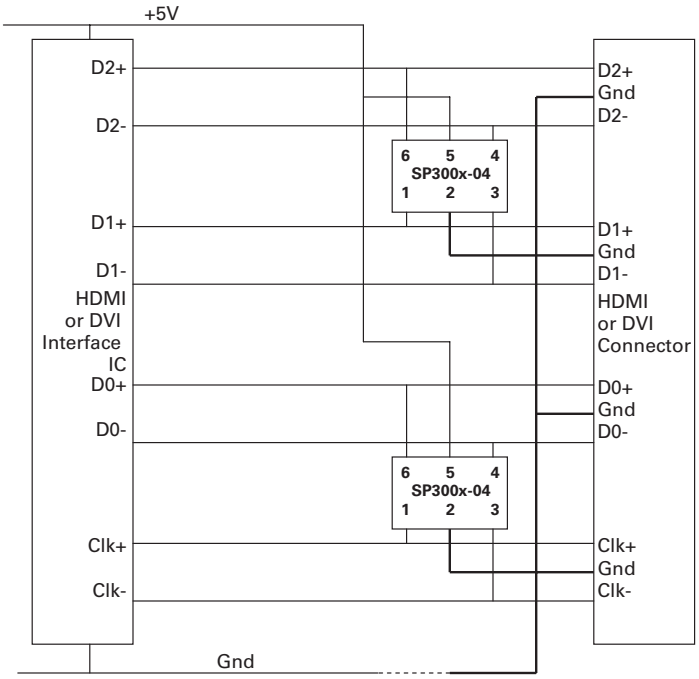

## Capacitance vs. Frequency




Lead-Free/Green SP3002

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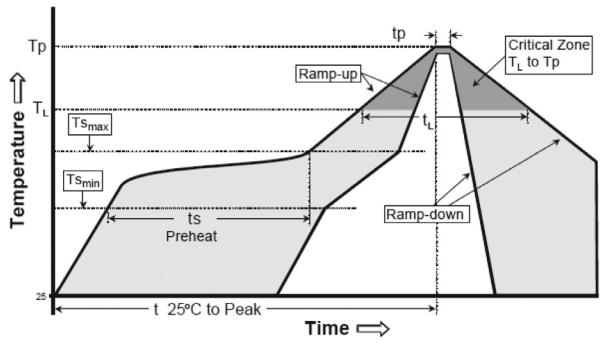
## Application Example




HDMI or DVI application example for the Littelfuse SP300x-04 protection devices. 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.

## Soldering Parameters

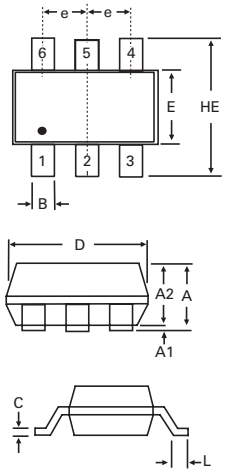
| | | |
|---|---|---|
| Reflow Condition | | Pb – Free assembly |
| Pre Heat | -Temperature Min ($T_{s(min)}$) | 150°C |
| | -Temperature Max ($T_{s(max)}$) | 200°C |
| | -Time (min to max) ($t_s$) | 60 – 180 secs |
| Average ramp up rate (Liquidus) Temp ($T_L$) to peak | | 3°C/second max |
| $T_{S(max)}$ 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 ($T_P$) | | $250^{+0/-5}$ °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 |

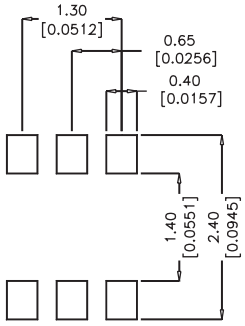




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## Package Dimensions - SC70-6

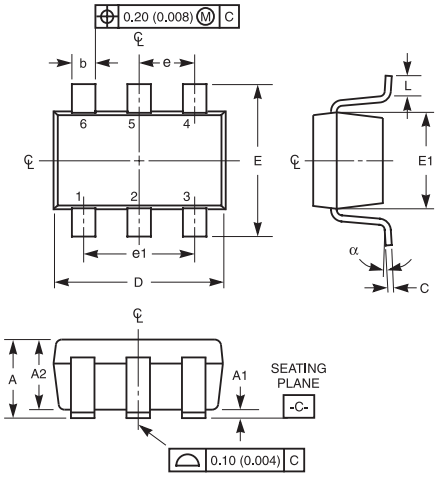


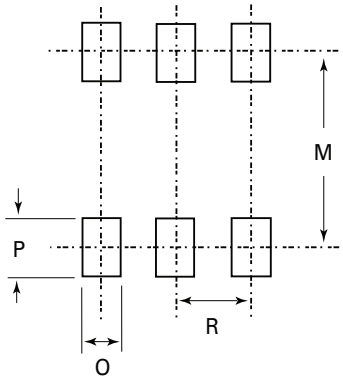

Solder Pad Layout

| Package | SC70-6 | | | |
|---|---|---|---|---|
| Pins | 6 | | | |
| JEDEC | MO-203 Issue A | | | |
| | 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 |

## Package Dimensions - SOT23-6




Recommended Solder Pad Layout




| Package | SOT23-6 | | | | |
|---|---|---|---|---|---|
| Pins | 6 | | | | |
| JEDEC | MO-203 Issue A | | | | |
| | Millimeters | | Inches | | Notes |
| | Min | Max | Min | Max | |
| **A** | 0.900 | 1.450 | 0.035 | 0.057 | - |
| **A1** | 0.000 | 0.150 | 0.000 | 0.006 | - |
| **A2** | 0.900 | 1.300 | 0.035 | 0.051 | - |
| **b** | 0.350 | 0.500 | 0.0138 | 0.0196 | - |
| **C** | 0.080 | 0.220 | 0.0031 | 0.009 | - |
| **D** | 2.800 | 3.000 | 0.11 | 0.118 | 3 |
| **E** | 2.600 | 3.000 | 0.102 | 0.118 | - |
| **E1** | 1.500 | 1.750 | 0.06 | 0.069 | 3 |
| **e** | 0.95 Ref | | 0.0374 Ref | | - |
| **e1** | 1.9 Ref | | 0.0748 Ref | | - |
| **L** | 0.100 | 0.600 | 0.004 | 0.023 | 4,5 |
| **N** | 6 | | 6 | | 6 |
| **a** | 0° | 10° | 0° | 10° | - |
| **M** | | 2.590 | | 0.102 | - |
| **O** | | 0.690 | | .027 TYP | - |
| **P** | | 0.990 | | .039 TYP | - |
| **R** | | 0.950 | | 0.038 | - |

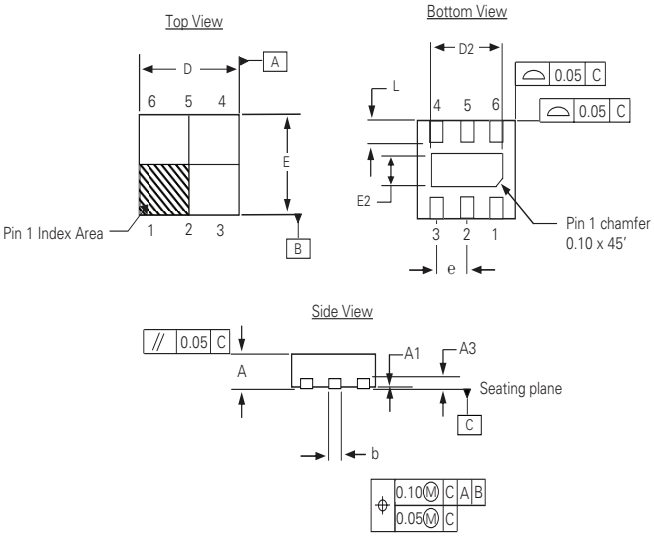
Notes:

1. Dimensioning and tolerances per ANSI 14.5M-1982.
2. Package conforms to EIAJ SC-74 (1992).
3. Dimensions D and E1 are exclusive of mold flash, protrusions, or gate burrs.
4. Footlenth L measured at reference to seating plane.
5. "L" is the length of flat foot surface for soldering to substrate.
6. "N" is the number of terminal positions.
7. Controling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact.



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## Package Dimensions - uDFN (1.6x1.6x0.5mm)



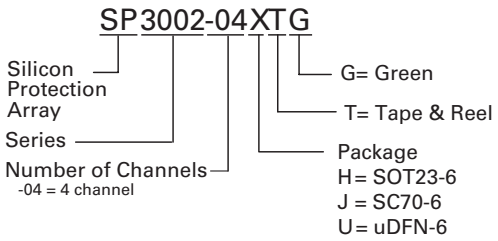




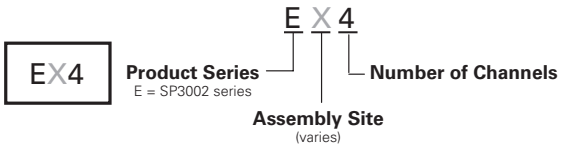
| uDFN (1.6x1.6x0.5mm) | | | | |
|---|---|---|---|---|
| Symbol | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| **A** | 0.45 | 0.55 | 0.018 | 0.022 |
| **A1** | 0.00 | 0.05 | 0.000 | 0.002 |
| **A3** | 0.127 Ref | | 0.005 Ref | |
| **b** | 0.20 | 0.30 | 0.008 | 0.012 |
| **D** | 1.50 | 1.70 | 0.060 | 0.067 |
| **D2** | 1.05 | 1.30 | 0.042 | 0.052 |
| **E** | 1.50 | 1.70 | 0.060 | 0.067 |
| **E2** | 0.40 | 0.65 | 0.016 | 0.026 |
| **e** | 0.50 Ref | | 0.020 Ref | |
| **L** | 0.100 | 0.600 | 0.004 | 0.023 |


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## Part Numbering System




## Part Marking System




## Product Characteristics

| | |
|---|---|
| **Lead Plating** | SC70 & SOT23: Matte Tin<br>uDFN: Pre-Plated Frame |
| **Lead Material** | Copper Alloy |
| **Lead Coplanarity** | 0.0004 inches (0.102mm) |
| **Subsitute Material** | Silicon |
| **Body Material** | Molded Epoxy |
| **Flammability** | UL94-V-0 |

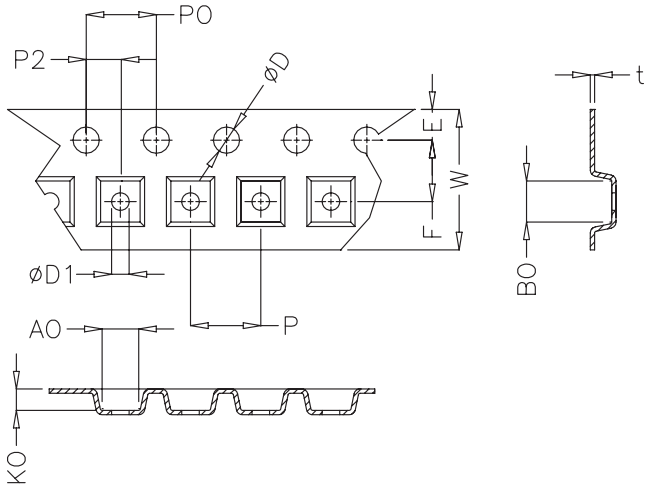
Notes :

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-223 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. |
|---|---|---|---|
| SP3002-04HTG | SOT23-6 | EX4 | 3000 |
| SP3002-04JTG | SC70-6 | EX4 | 3000 |
| SP3002-04UTG | uDFN-6 (1.6x1.6x0.5mm) | EX4 | 3000 |

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



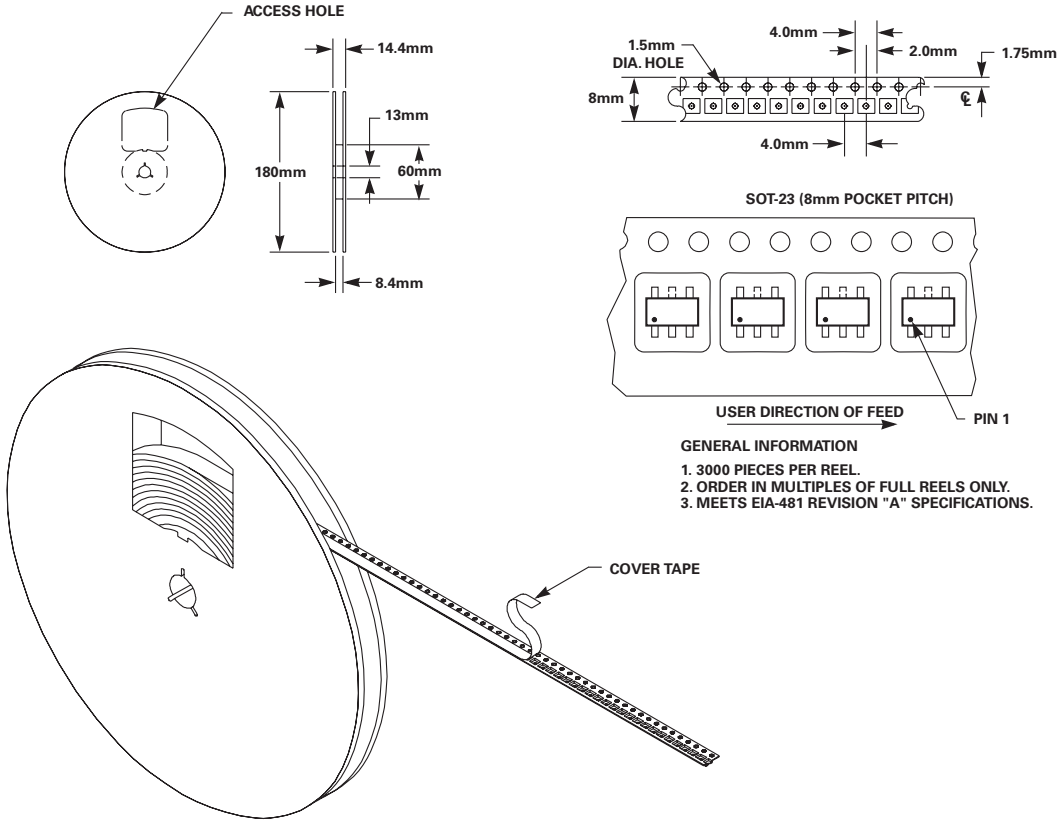

| Symbol | Millimetres | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| **E** | 1.65 | 1.85 | 0.064 | 0.073 |
| **F** | 3.45 | 3.55 | 0.135 | 0.139 |
| **P2** | 1.95 | 2.05 | 0.077 | 0.081 |
| **D** | 1.40 | 1.60 | 0.055 | 0.063 |
| **D1** | 1.00 | 1.25 | 0.039 | 0.049 |
| **P0** | 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 | |



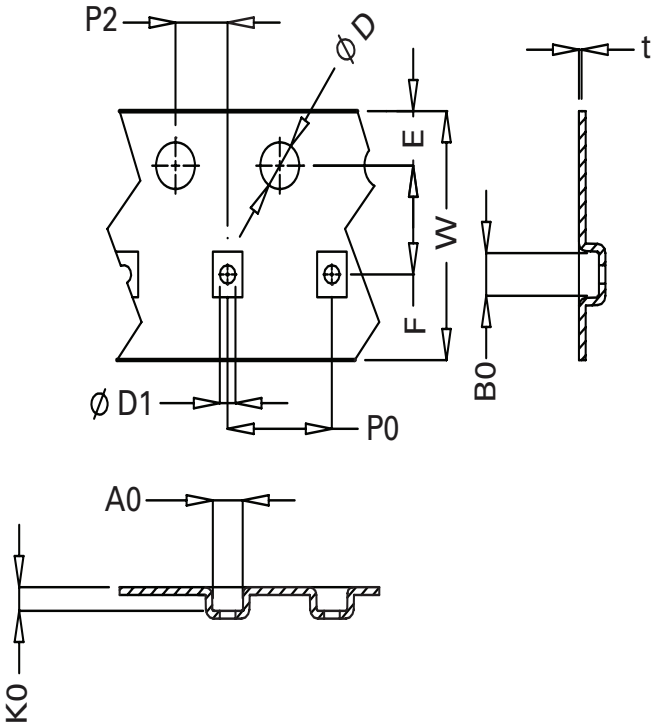
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## Embossed Carrier Tape & Reel Specification -- SOT23-6

8mm TAPE AND REEL




## Embossed Carrier Tape & Reel Specification -- uDFN-6 (1.6x1.6x0.5mm)




| Symbol | Millimetres | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| **E** | 1.65 | 1.85 | 0.06 | 0.07 |
| **F** | 3.45 | 3.55 | 0.14 | 0.14 |
| **D1** | 1.00 | 1.25 | 0.04 | 0.05 |
| **D** | 1.50 MIN | | 0.06 MIN | |
| **P0** | 3.90 | 4.10 | 0.15 | 0.16 |
| **10P0** | 40.0+/- 0.20 | | 1.57+/-0.01 | |
| **W** | 7.90 | 8.30 | 0.31 | 0.33 |
| **P2** | 1.95 | 2.05 | 0.08 | 0.08 |
| **A0** | 1.78 | 1.88 | 0.07 | 0.07 |
| **B0** | 1.78 | 1.88 | 0.07 | 0.07 |
| **K0** | 0.84 | 0.94 | 0.03 | 0.04 |
| **t** | 0.25 TYP | | 0.01 TYP | |


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