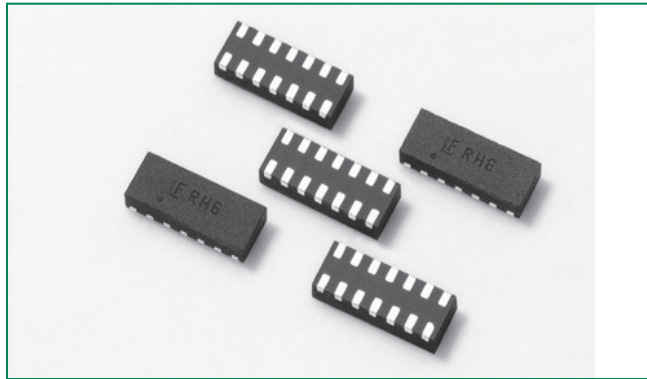


### SP3011 Series 0.40pF Rail Clamp Array for USB 3.0

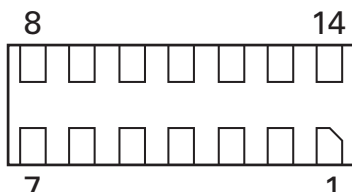


#### Description

The SP3011 integrates six channels of ultra-low capacitance rail-to-rail diodes and an additional zener diode to provide protection for USB 3.0 ports that may experience destructive electrostatic discharges (ESD). This high density array can safely absorb repetitive ESD strikes at the maximum level specified in the IEC61000-4-2 international standard (Level 4, ±8kV contact discharge) without performance degradation. It's extremely low loading capacitance makes it ideal for protecting any high-speed signal pins.

SP3011

#### Pinout

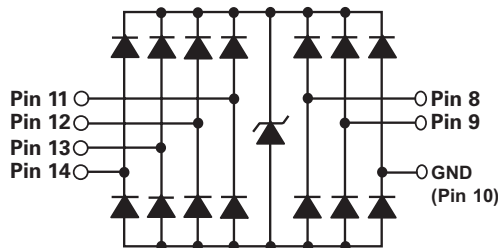


\*Pins 1, 2, 3, 4, 5, 6, 7 are not internally connected but should be connected to the opposite pin with the PCB trace.

#### Features

- ESD, IEC61000-4-2, ±8kV contact, ±15kV air
- EFT, IEC61000-4-4, 40A (5/50ns)
- Lightning, IEC61000-4-5, 3A (8/20µs)
- Low capacitance of 0.4pF (TYP) per I/O
- Low leakage current of 0.1µA (TYP) at 5V
- Small form factor uDFN package saves board space

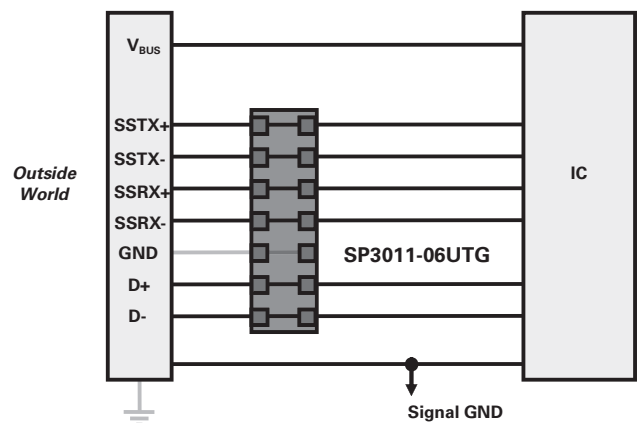
#### Functional Block Diagram



#### Applications

- Notebooks
- External Storage
- Digital Camcorder
- MP3/PMP Player
- Desktops
- Ultramobile PC
- Smartphone
- Set Top Box (DVR/PVR)

#### 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 Current ( $t_p=8/20\mu s$ )	3.0	A
$T_{OP}$	Operating Temperature	-40 to 85	°C
$T_{STOR}$	Storage Temperature	-60 to 150	°C

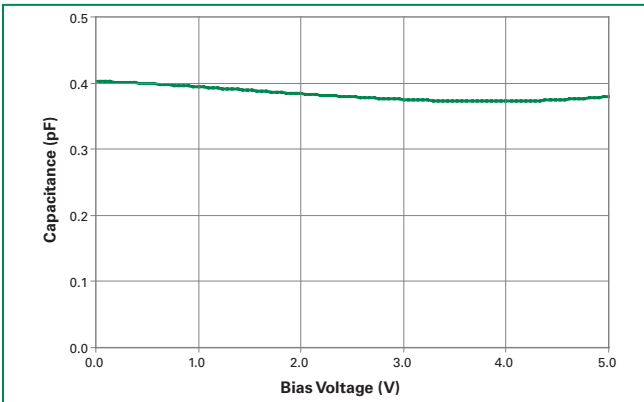
CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

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

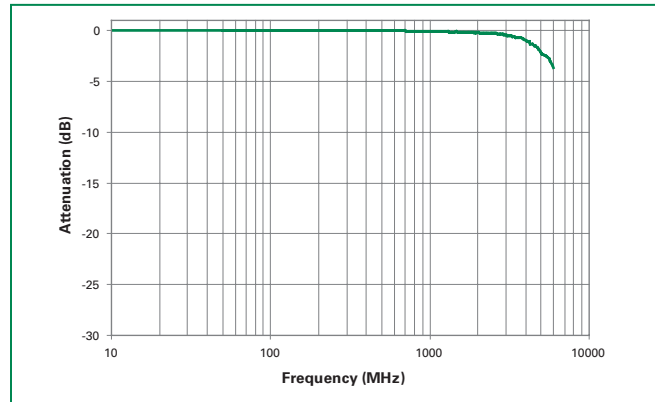
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$			6.0	V
Reverse Leakage Current	$I_{LEAK}$	$V_R=5V$ , Any I/O to GND		0.1	0.5	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A$ , $t_p=8/20\mu s$ , Fwd		11.0		V
		$I_{PP}=2A$ , $t_p=8/20\mu s$ , Fwd		12.5		V
Dynamic Resistance	$R_{DYN}$	$(V_{C2}-V_{C1}) / (I_{PP2}-I_{PP1})$		1.5		$\Omega$
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC61000-4-2 (Contact)	$\pm 8$			kV
		IEC61000-4-2 (Air)	$\pm 15$			kV
Diode Capacitance <sup>1</sup>	$C_{I/O-GND}$	Reverse Bias=0V		0.4		pF

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

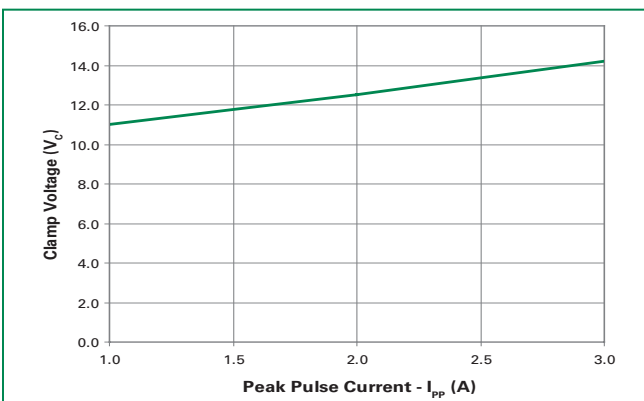
**Capacitance vs. Bias Voltage**



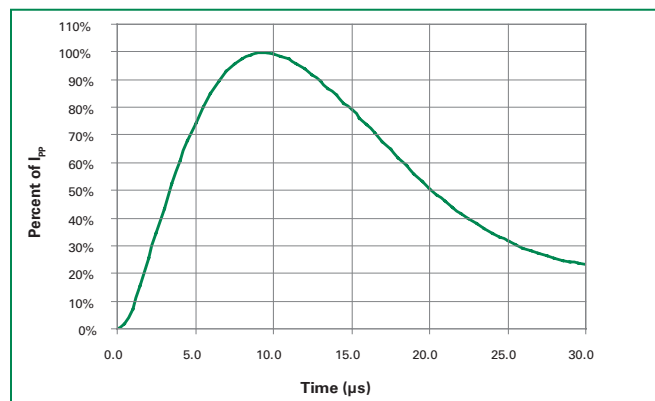
**Insertion Loss (S21) I/O to GND**



**Clamping Voltage vs.  $I_{PP}$**

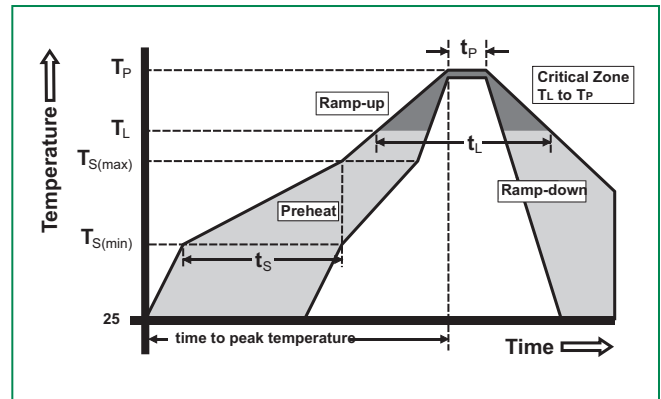


**Pulse Waveform**

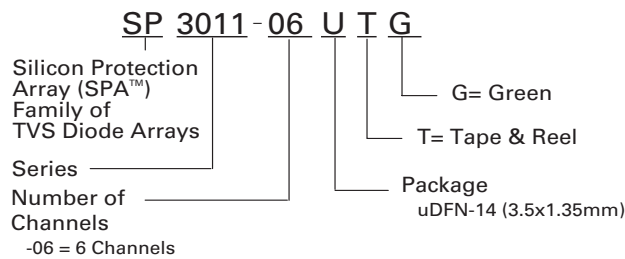


**Soldering Parameters**

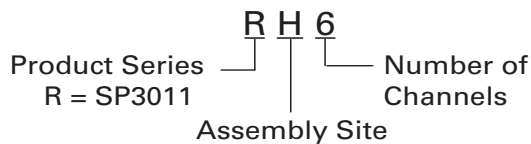
Reflow Condition		Pb – Free assembly
Pre Heat	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
Average ramp up rate (Liquidus) Temp ( $T_L$ ) to peak		3°C/second max
$T_{s(max)}$ to $T_L$ - Ramp-up Rate		3°C/second max
Reflow	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_l$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <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>	Pre-Plated Frame
<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

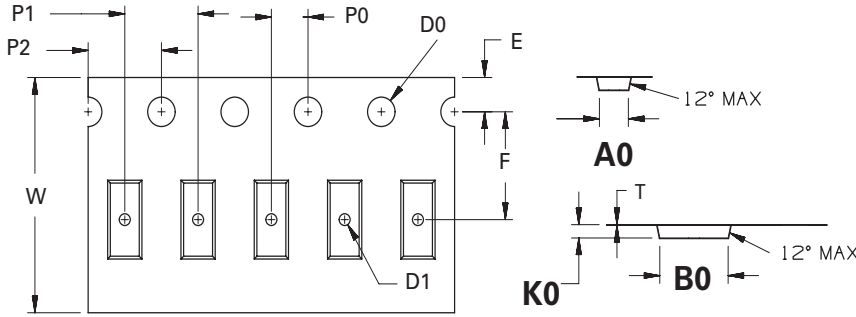
Notes :

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-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**

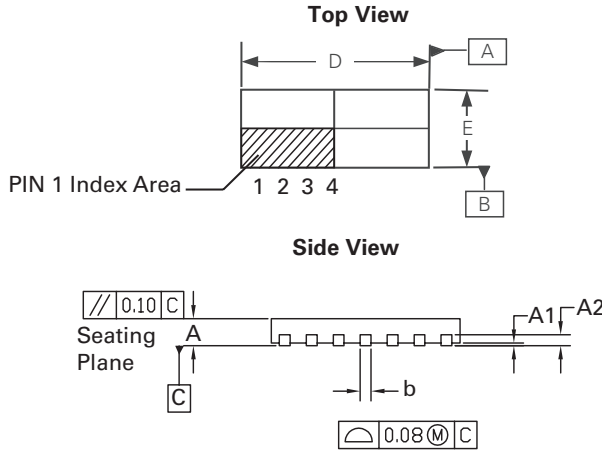
Part Number	Package	Marking	Min. Order Qty.
SP3011-06UTG	uDFN-14	RH6	3000

**Embossed Carrier Tape & Reel Specification – uDFN-14**



Symbol	Millimeters
<b>A0</b>	1.58 +/- 0.10
<b>B0</b>	3.73 +/- 0.10
<b>D0</b>	0.60 + 0.05
<b>D1</b>	Ø 0.60 + 0.05
<b>E</b>	1.75 +/- 0.10
<b>F</b>	5.50 +/- 0.05
<b>K0</b>	0.68 +/- 0.10
<b>P0</b>	2.00 +/- 0.05
<b>P1</b>	4.00 +/- 0.10
<b>P2</b>	4.00 +/- 0.10
<b>T</b>	0.28 +/- 0.02
<b>W</b>	12.00 + 0.30 /- 0.10

**Package Dimensions – uDFN-14 (3.5x1.35x0.5mm)**

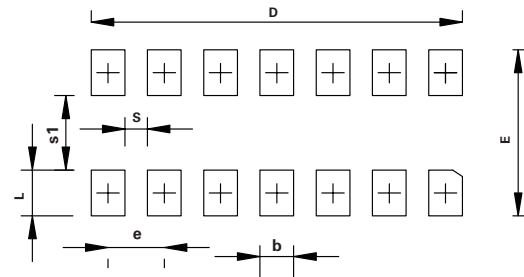


uDFN-14 (3.5x1.35x0.5mm)						
Symbol	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
<b>A</b>	0.45	0.50	0.55	0.018	0.020	0.022
<b>A1</b>	0.00	0.02	0.05	0.000	0.001	0.002
<b>A2</b>	0.203 Ref			0.008 Ref		
<b>b</b>	0.15	0.20	0.25	0.006	0.008	0.012
<b>D</b>	3.40	3.50	3.60	0.134	0.138	0.142
<b>D2</b>	-	-	-	-	-	-
<b>E</b>	1.25	1.35	1.45	0.050	0.054	0.058
<b>E1</b>	-	-	-	-	-	-
<b>e</b>	0.500 BSC			0.020 BSC		
<b>L</b>	0.25	0.30	0.35	0.010	0.012	0.014

Notes:

1. Dimension and tolerancing conform to ASME Y14.5M-1994.
2. Controlling dimensions: Millimeter. Converted Inch dimensions are not necessarily exact.

**Recommended Soldering Pad Layout**



Symbol	Millimeter			Inches		
<b>D</b>	3.29	3.30	3.31	0.1295	0.1299	0.1303
<b>E</b>	1.44	1.45	1.46	0.0567	0.0571	0.0575
<b>b</b>	0.29	0.30	0.31	0.0114	0.0118	0.0122
<b>L</b>	0.39	0.40	0.41	0.0154	0.0158	0.0161
<b>e</b>	0.50typ			0.020typ		
<b>s</b>	0.19	0.20	0.21	0.0075	0.0078	0.0083
<b>s1</b>	0.64	0.65	0.66	0.0252	0.0256	0.0260