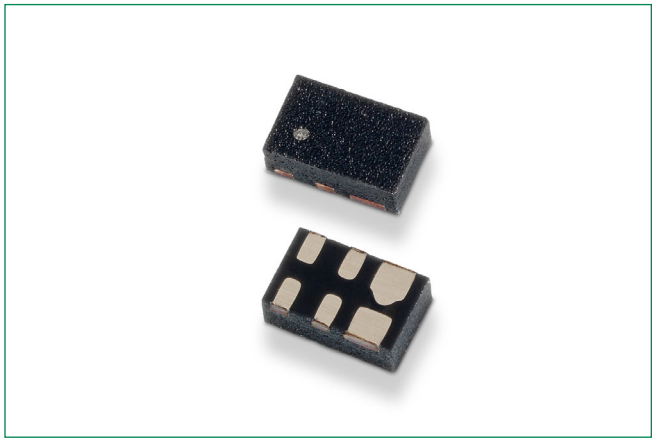
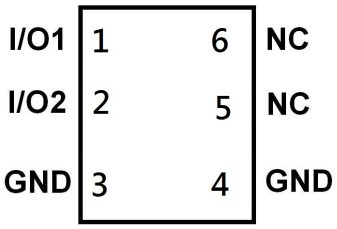
SP3401 Series

Low Capacitance ESD Protection

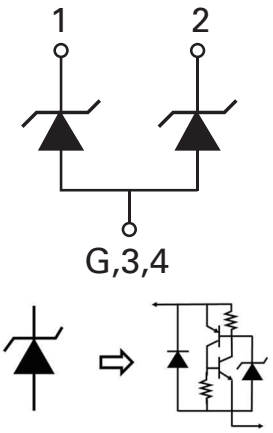
GREEN | AUTOMOTIVE GRADE | HF | RoHS | Pb



Pinout



Functional Block Diagram



Description

SP3401 is specifically designed to protect high-speed interfaces against ElectroStatic Discharge (ESD), such as DisplayPort interfaces and USB 3.1 Gen 1.

The signal line is protected by a TVS diode offering low line capacitance of 0.35 pF typical. SP3401 can safely absorb repetitive ESD strikes up to ±18 kV contact exceeding IEC 61000-4-2, level 4 (±8kV contact discharge).

Excellent low capacitance, clamping capability, low leakage, and fast response time make this parts an ideal solution for protecting high speed data lines.

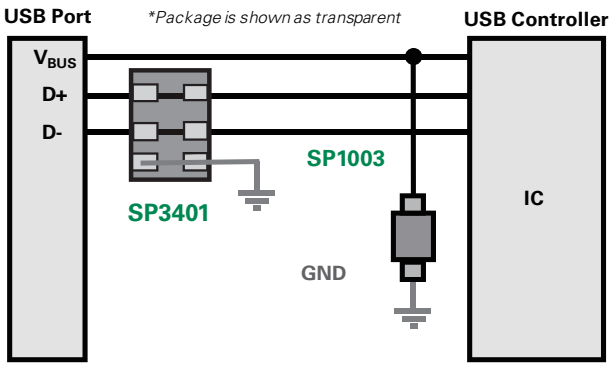
Features

- ESD, IEC 61000-4-2, ±18kV contact, ±30kV air
- EFT, IEC 61000-4-4, 80A (tP=5/50ns)
- Lightning, IEC 61000-4-5 2nd edition, 10A (tP=8/20µs)
- Low capacitance of 0.35pF (TYP) per I/O
- Low leakage current of 1nA (TYP) at 3.3V
- Small form factor µDFN (JEDEC MO-229) package provides flow through routing to simplify PCB layout
- AEC-Q101 qualified
- Moisture Sensitivity Level(MSL -1)
- Halogen free, lead free and RoHS compliant

Applications

- USB 3.1 Gen1
- DisplayPort
- S-ATA
- NFC
- 1G/2.5G/10G Ethernet
- HDBaseT

USB Protection 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.

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Absolute Maximum Ratings

Symbol	Parameter	Value	Units
I_{PP}	Peak Current (t_p=8/20µs)	10	A
T_{OP}	Operating Temperature	-40 to 125	°C
T_{STOR}	Storage Temperature	-55 to 150	°C

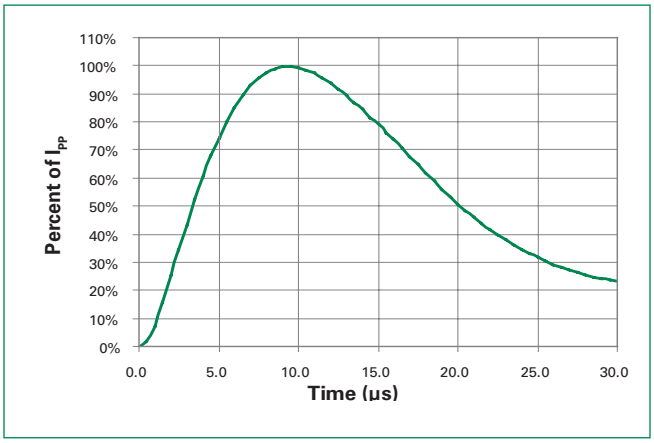
Caution: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

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

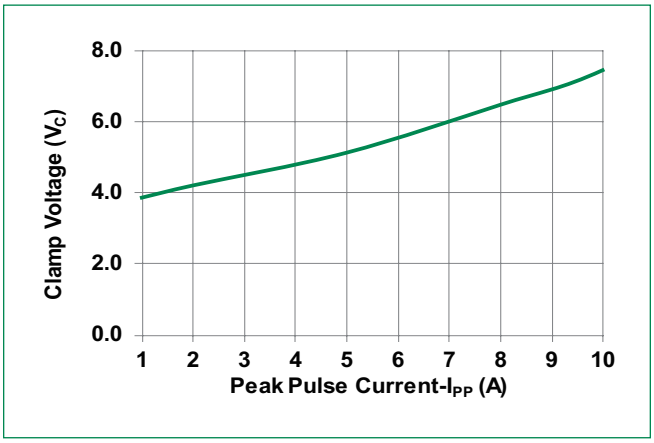
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R = 1µA			3.3	V
Breakdown Voltage	V_{BR}	I_R = 1mA, I/O to I/O	6.5	8.2	11.5	V
Reverse Leakage Current	I_{LEAK}	V_R=3.3V		1	100	nA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, I/O to I/O		4	5	V
		I_{PP}=10A, t_p=8/20µs, I/O to I/O		7.5	9	V
Dynamic Resistance[2]	R_{DYN}	TLP, t_p=100ns, I/O to I/O		0.28		Ω
ESD Withstand Voltage[1]	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	±18			kV
		IEC 61000-4-2 (Air Discharge)	±30			kV
Diode Capacitance[1]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		0.8	1	pF
	$C_{I/O-I/O}$			0.35	0.55	

Note: 1 Parameter is guaranteed by design and/or component characterization.
2. Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2= 90ns.

8/20µs Pulse Waveform



Clamping voltage vs. IPP for 8/20µs waveshape



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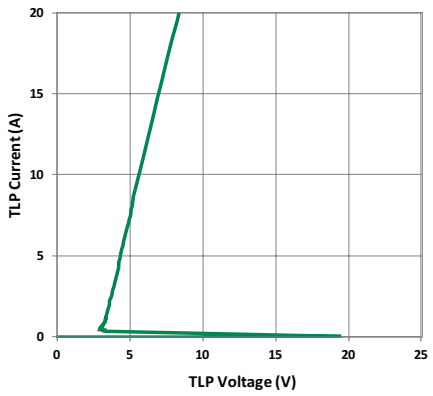
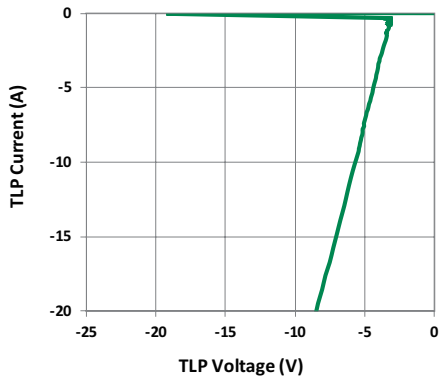
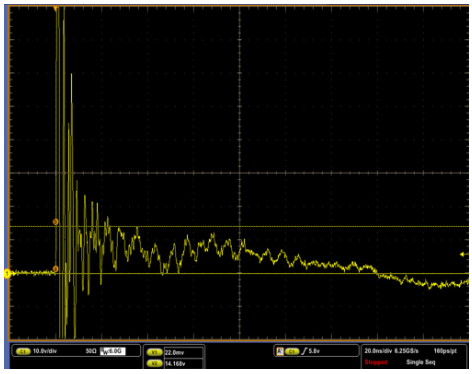
Positive Transmission Line Pulsing (TLP) Plot



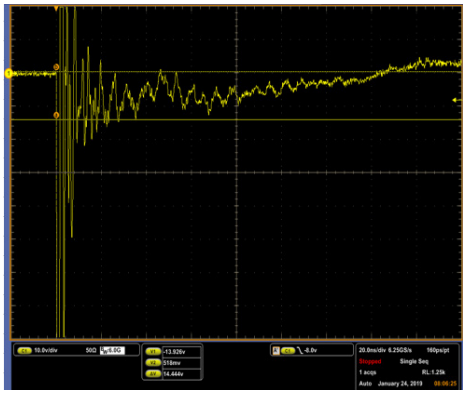
Negative Transmission Line Pulsing (TLP) Plot



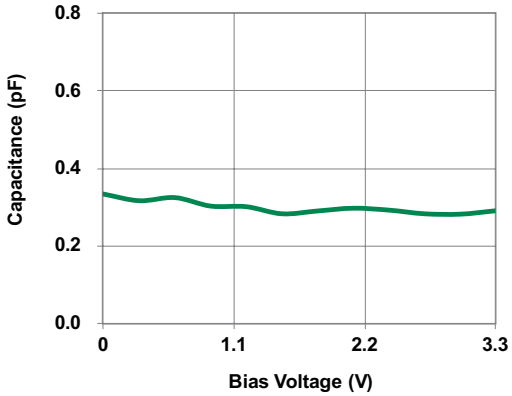
IEC 61000-4-2 +8 kV Contact ESD Clamping Voltage



IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage



Capacitance vs. Reverse Bias



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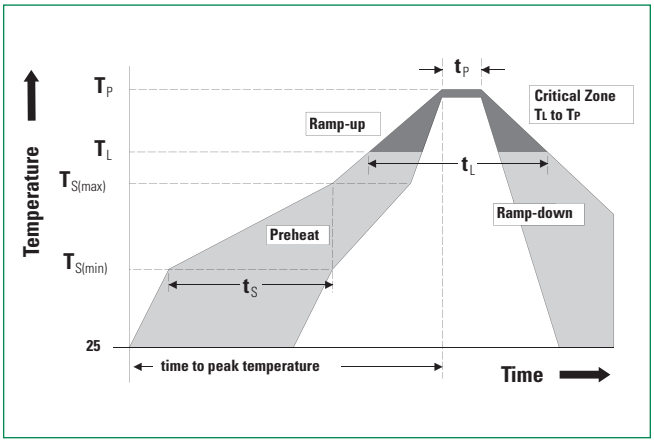
Soldering Parameters

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 – 120 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)		30 seconds
Ramp-down Rate		6°C/second max
Time 25°C to peak Temperature (T_P)		8 minutes Max.
Do not exceed		260°C



Product Characteristics

Lead Plating	Pre-Plated Frame
Lead Material	Copper Alloy
Substrate Material	Silicon
Body Material	Molded Compound
Flammability	UL Recognized compound meeting flammability rating V-0

Ordering Information

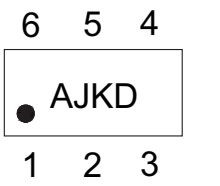
Part Number	Package	Min. Order Qty.
SP3401-02UTG	µDFN-6L	3000

Part Numbering System

SP 3401- xx x T G

- SP 3401: TVS Diode Arrays (SPA® Diodes) — Series
- xx: Number of Channels — 02 = 2 channel
- x: Package — U= µDFN-6L
- T: T= Tape & Reel
- G: G= Green

Part Marking System



AJ : Part code
K : Assembly code
D : Date code

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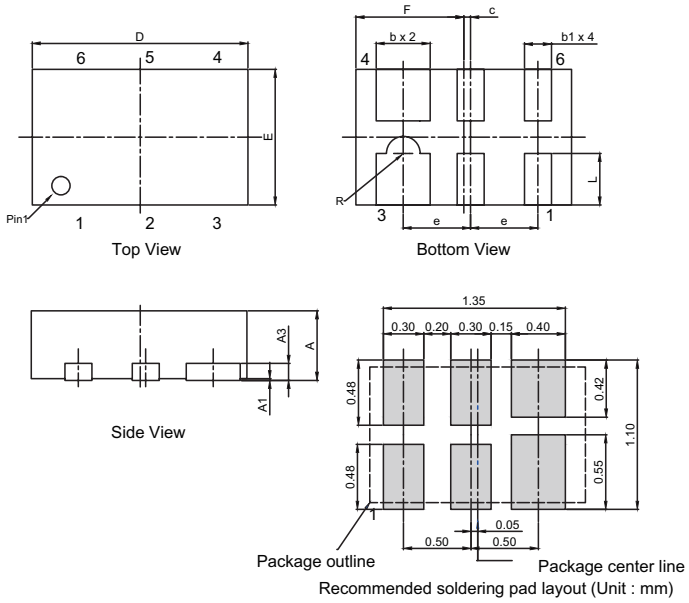
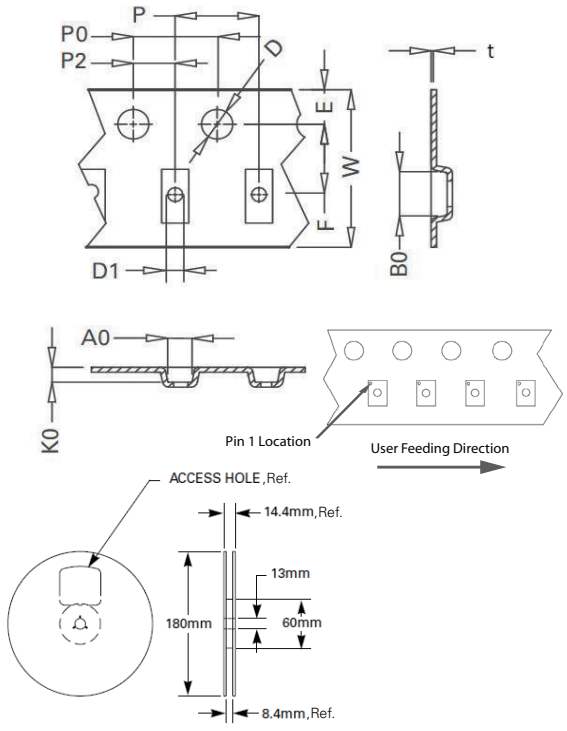
Package Dimensions —µDFN-6L



Drawing# : U03-A

Package	µDFN-6L			
JEDEC	MO-229			
Pins	6			
	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	0.125 REF		0.005 REF	
b	0.35	0.45	0.014	0.018
b1	0.15	0.25	0.006	0.010
c	0.05 REF		0.002 REF	
D	1.55	1.65	0.062	0.065
E	0.95	1.05	0.038	0.042
F	0.80 REF		0.031 REF	
e	0.50 REF		0.020 REF	
R	0.125 REF		0.005 REF	
L	0.33	0.43	0.013	0.017

Embossed Carrier Tape & Reel Specification — µDFN-6L



8mm TAPE AND REEL

Symbol	Millimeters		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	0.076	0.081
D	1.40	1.60	0.055	0.063
D1	0.45	0.55	0.017	0.021
P	3.90	4.10	0.154	0.161
10P0	40.0+/-0.20		1.574+/-0.008	
W	7.90	8.30	0.311	0.319
P0	3.90	4.10	0.154	0.161
A0	1.15	1.25	0.045	0.049
B0	1.75	1.85	0.069	0.073
K0	0.65	0.75	0.026	0.03
t	0.22 max		0.009 max	

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