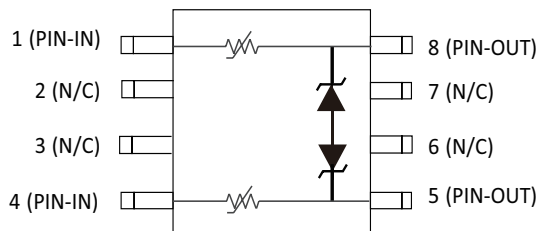


**Functional Block Diagram**



**Features**

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 35A (8/20 as defined in IEC 61000-4-5 2nd edition)
- Low capacitance of 2.5pF (@V<sub>R</sub>=0V)
- Moisture Sensitivity Level (MSL -1)
- Lead free and RoHS compliant
- This SP4031 hybrid component provides a tested and proved protection solution for high-speed interfaces such as 10/100/1000 BaseT applications
- Low parasitic capacitance
- Low operating voltage (<3.3 V)
- Low breakdown voltage (>3.5V)

**Description**

The SP4031 hybrid protector offers both overcurrent and differential only overvoltage protection for applications such as 10/100/1000 BaseT ports. Compliant with the newest standards of overvoltage per industry standard ITU-T K.21. Tested to basic tests levels 2.5kV overvoltage. Flow-through package layout allows PCB trace routing directly through the SP4031 without changing pitch dimensions, thus having less impact on normal signal high frequency components.

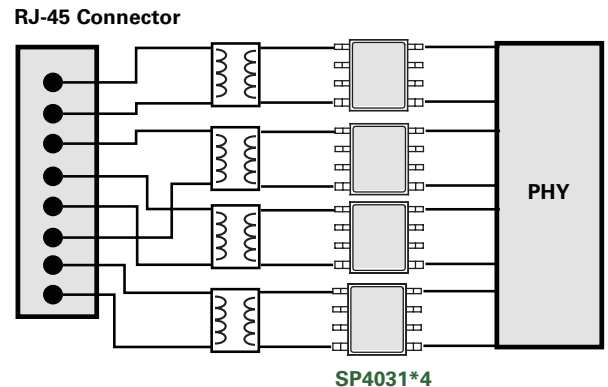
During a prolonged overvoltage event such as a power fault, this component will present a high impedance. The high impedance state will reset once the power fault event has ended. During a fast transient event, the component will clamp, thus protecting any downstream chipsets.

These components can safely absorb up to 35A per IEC 61000-4-5 2<sup>nd</sup> edition (t<sub>p</sub>=8/20µs) without performance degradation and a minimum ±30kV ESD per IEC 61000-4-2 International Standard. The low loading capacitance and high surge capability makes the SP4031 ideal for protecting telecommunication ports such as Ethernet and other high speed data interfaces.

**Applications**

- 10/100/1000 BaseT Ethernet
- ITU K.21 Basic level compliance
- ADSL/VDSL/G.fast modem
- Industrial Ethernet

**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
$T_{OP}$	Operating Temperature	-40 to 85	°C
$I_{PP}$	Peak Current (tp=8/20µs)	35	A
$T_{STOR}$	Storage Temperature	-55 to 85	°C

Notes:

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.

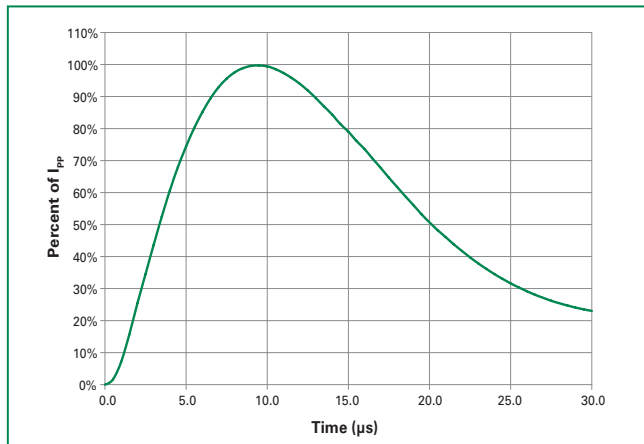
### Electrical Characteristics, Pin1 to Pin5 ( $T_{OP} = 25^{\circ}C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R = 1\mu A$			3.3	V
Breakdown Voltage	$V_{BR}$	$I_R = 1mA$	3.5	4.5		V
Reverse Leakage Current	$I_{LEAK}$	$V_R = 3.3V$			0.5	µA
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s, \text{Pin5 to Pin8}$		6	7.5	V
		$I_{PP} = 35A, t_p = 8/20\mu s, \text{Pin5 to Pin8}$		29.5	35	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns, \text{Pin5 to Pin8}$		0.45		Ω
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	±30			kV
		IEC 61000-4-2 (Air Discharge)	±30			kV
Diode Capacitance <sup>1</sup>	$C_{VO-VO}$	Reverse Bias=0V, f=1MHz		2	2.5	pF

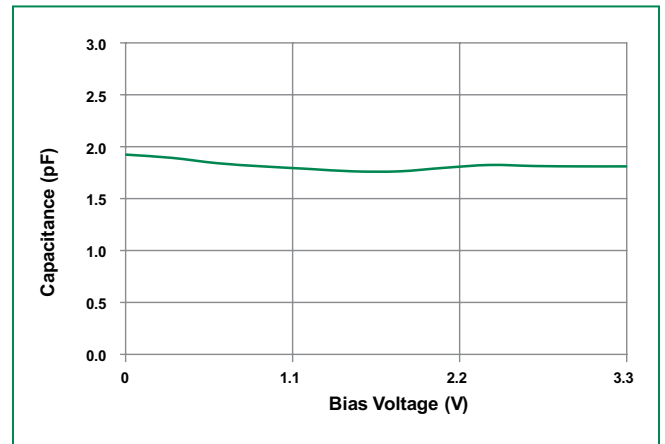
Notes: 1 Parameter is guaranteed by design and/or component characterization.

2. Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window  $t_1 = 70ns$  to  $t_2 = 90ns$

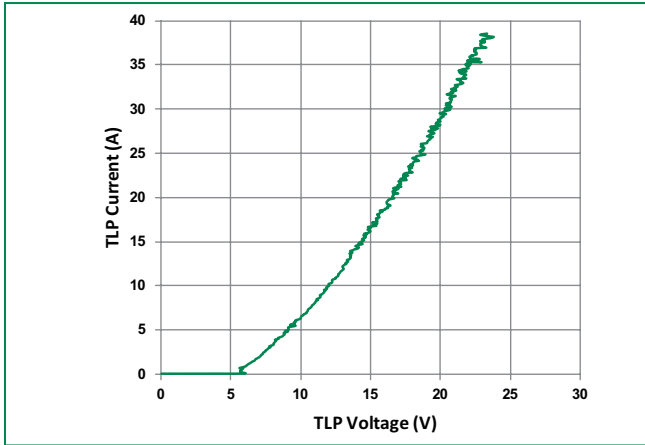
### 8/20 Pulse Waveform



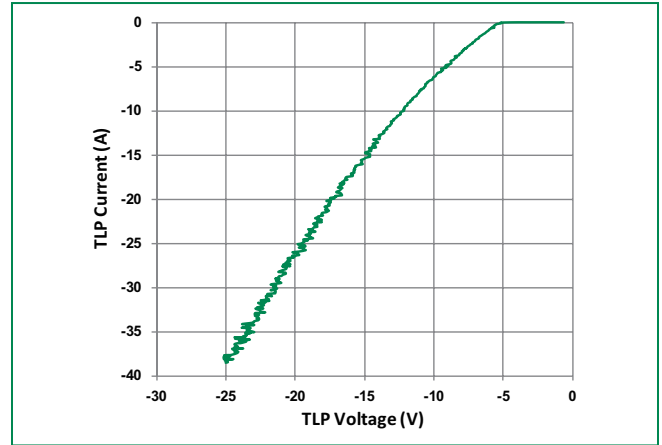
### Capacitance vs. Reverse Bias



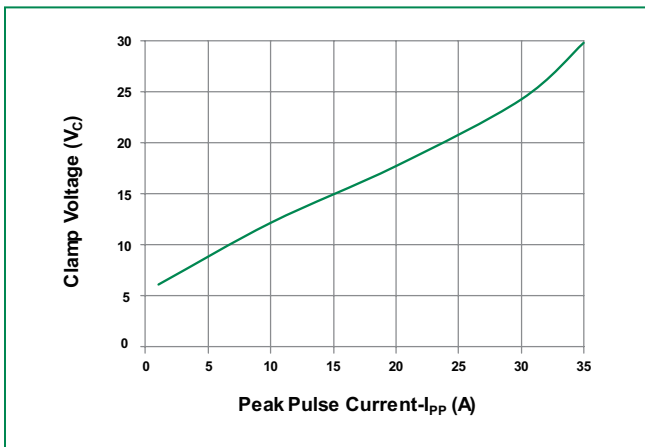
**Positive Transmission Line Pulsing (TLP) Plot**



**Negative Transmission Line Pulsing (TLP) Plot**

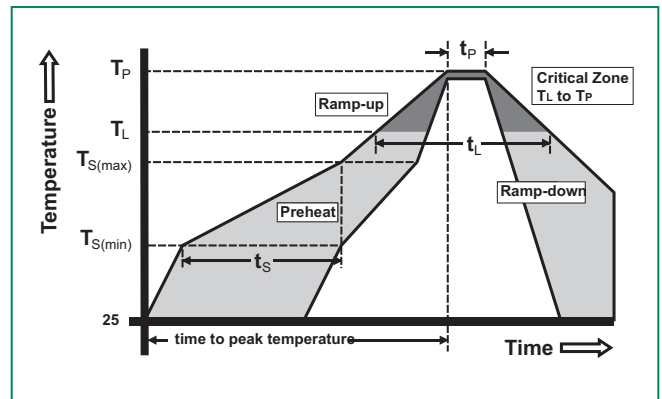


**Clamping voltage vs.  $I_{pp}$  for 8/20 $\mu$ S waveshape**



**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



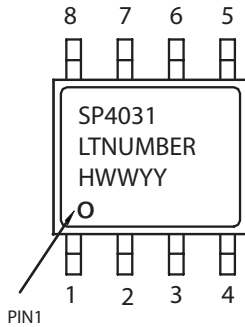
**Product Characteristics**

<b>Lead Plating</b>	Tin
<b>Lead Material</b>	Copper Alloy
<b>Lead Coplanarity</b>	0.004 inches(0.102mm)
<b>Substrate Material</b>	Silicon
<b>Body Material</b>	Molded Compound
<b>Flammability</b>	UL Recognized compound meeting flammability rating V-0

**Ordering Information**

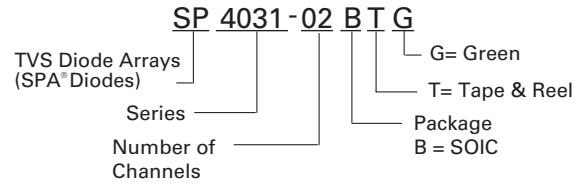
Part Number	Package	Min. Order Qty.
SP4031-02BTG	SOIC Tape & Reel	2500

**Part Marking System**

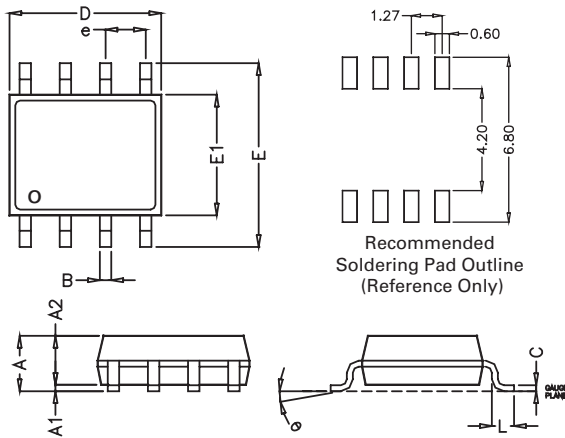


SP4031=Part code  
LTNUMBER = Lot Number  
H = Assembly Code  
WW=Week code  
YY=Year code

**Part Numbering System**

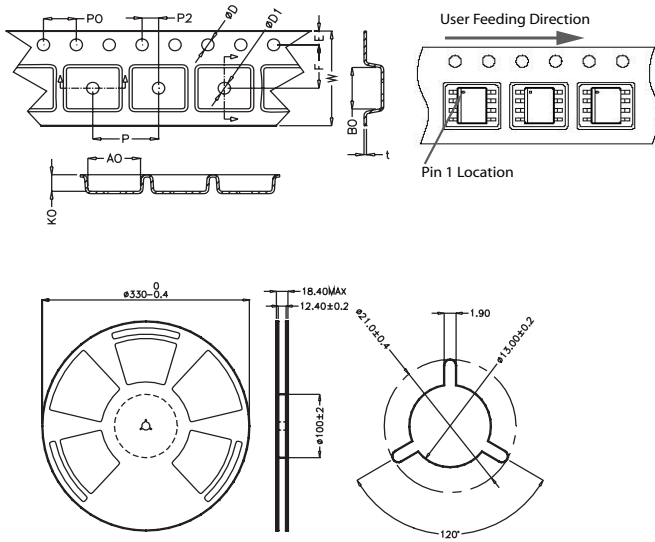


**Package Dimensions of SOIC-8**



Package	SOIC			
Pins	8			
JEDEC	MS-012			
	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	1.35	1.75	0.053	0.069
<b>A1</b>	0.10	0.25	0.004	0.010
<b>A2</b>	1.25	1.65	0.050	0.065
<b>B</b>	0.31	0.51	0.012	0.020
<b>c</b>	0.17	0.25	0.007	0.010
<b>D</b>	4.80	5.00	0.189	0.197
<b>E</b>	5.80	6.20	0.228	0.244
<b>E1</b>	3.80	4.00	0.150	0.157
<b>e</b>	1.27 BSC		0.050 BSC	
<b>L</b>	0.40	1.27	0.016	0.050

**Embossed Carrier Tape & Reel Specification – SOIC Package**



	Millimeters		Inches	
	Min	Max	Min	Max
<b>E</b>	1.65	1.85	0.065	0.073
<b>F</b>	5.4	5.6	0.213	0.22
<b>P2</b>	1.95	2.05	0.077	0.081
<b>D</b>	1.5	1.6	0.059	0.063
<b>D1</b>	1.50 Min		0.059 Min	
<b>P0</b>	3.9	4.1	0.154	0.161
<b>10P0</b>	40.0 +/- 0.20		1.574 +/- 0.008	
<b>W</b>	11.9	12.1	0.468	0.476
<b>P</b>	7.9	8.1	0.311	0.319
<b>A0</b>	6.3	6.5	0.248	0.256
<b>B0</b>	5.1	5.3	0.2	0.209
<b>K0</b>	2	2.2	0.079	0.087
<b>t</b>	0.30 +/- 0.05		0.012 +/- 0.002	

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