

# SP0502B Series

## Low Capacitance ESD Protection

**OBSOLETE** DATE: 12/31/2022 PCN/ECN# ESU270-77  
REPLACED BY: AQ3102-02JTG (Functional)

HF RoHS Pb



### Description

The SP0502B is a low capacitance TVS diode array designed to protect high-speed data interfaces from over-voltage caused by ESD (electrostatic discharge), CDE (Cable Discharge Events), and EFT (electrical fast transients). It has a typical capacitance of only 0.3pF (pin 1 to 2) making it suitable for use on circuits operating in excess of 3GHz without signal attenuation.

The SP0502BXTG is in a small SOT-523 package and each device can be configured to protect 1 bidirectional line or two unidirectional lines. The combination of small size, ultra-low capacitance, and high level of ESD protection makes it an ideal solution for applications such as HDMI, USB, MDDI, antennas, and DisplayPort.

### Additional Information



Resources

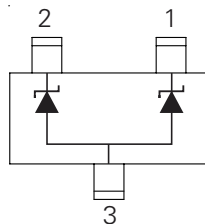


Accessories



Samples

### Functional Block Diagram and Pinout



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.

### Features & Benefits

- RoHS compliant and lead-free
- ESD protection of  $\pm 15\text{kV}$  contact discharge,  $\pm 20\text{kV}$  air discharge, (IEC 61000-4-2)
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Surge tolerance, IEC 61000-4-5 2nd edition, 2A ( $t_p=8/20\mu\text{s}$ )
- Stand-off voltage of 5V
- Low capacitance of 1pF @  $V_R=0\text{V}$  (MAX)
- Low leakage current of 0.5 $\mu\text{A}$  at 5V (MAX)
- Small form factor (SOT523) and low profile (<1mm)
- AEC-Q101 qualified
- Halogen free, lead free and RoHS compliant
- Moisture Sensitivity Level (MSL -1)

### Applications

- High-Definition Multimedia Interface (HDMI)
- Mobile Display Digital Interface (MDDI)
- RF/Antenna Circuits
- USB 2.0
- DisplayPort
- Mobile - Smartphone, Tablet, Notebook

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### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$P_{PK}$	Peak Pulse Power ( $t_p=8/20\mu s$ )	25	W
$I_{PP}$	Peak Pulse Current ( $t_p=8/20\mu s$ )	2	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 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	-55 to 150	°C
Maximum Junction Temperature	150	°C
Maximum Lead Temperature (Soldering 30s)	260	°C

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R \leq 1\mu A$ , Pin1 or Pin2 to Pin3 and Pin1 to Pin2			5.0	V
Reverse Breakdown Voltage	$V_{BR}$	$I_t = 1mA$ , Pin1 or Pin2 to Pin3	6			V
Leakage Current	$I_{LEAK}$	$V_R = 5V$			0.5	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP} = 1A$ , $t_p = 8/20\mu s$ , Pin 1 to Pin 2			12	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p = 100ns$ , I/O to GND		0.45		$\Omega$
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 15$			kV
		IEC 61000-4-2 (Air Discharge)	$\pm 20$			kV
Diode Capacitance <sup>1</sup>	$C_{I/O-I/O}$	Reverse Bias=0V, $f=1MHz$ ; Pin 1 to Pin2		0.25	0.5	pF
	$C_{I/O-GND}$	Reverse Bias=0V, $f=1MHz$ ; Pin 1 or Pin2 to Pin 3			1.0	pF

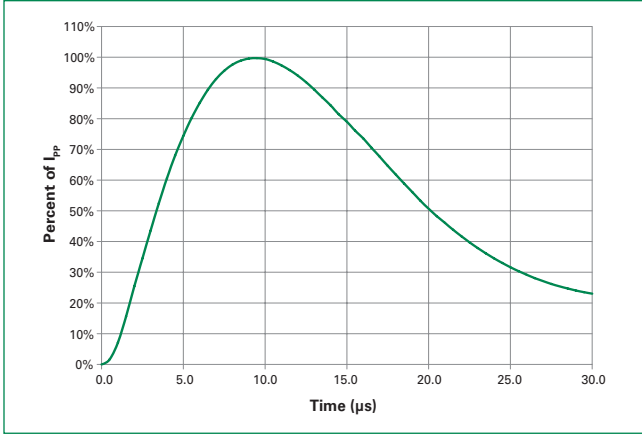
**Note:**

- Parameter is guaranteed by design and/or device characterization.
- Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

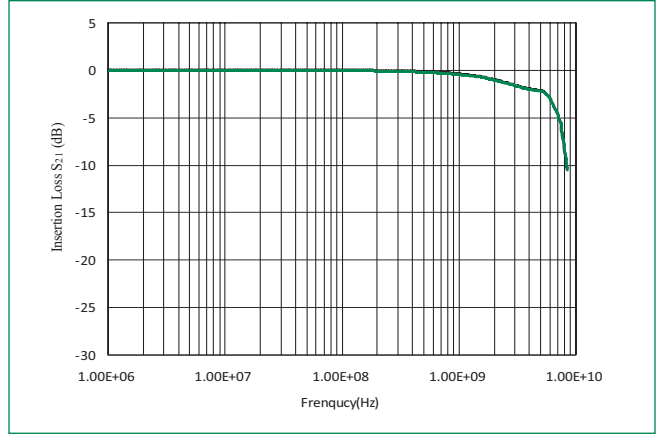
# SP0502B Series

## Low Capacitance ESD Protection

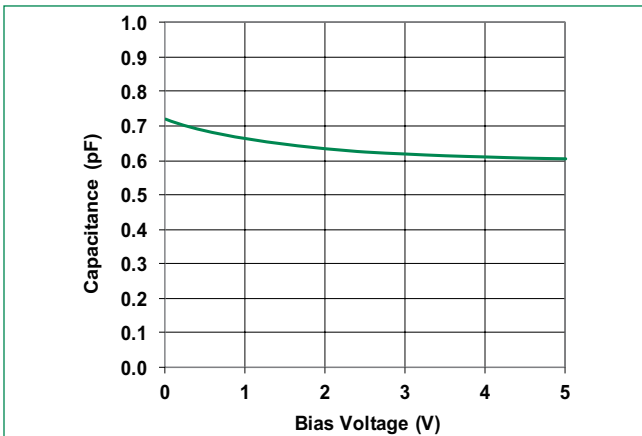
**Pulse Waveform**



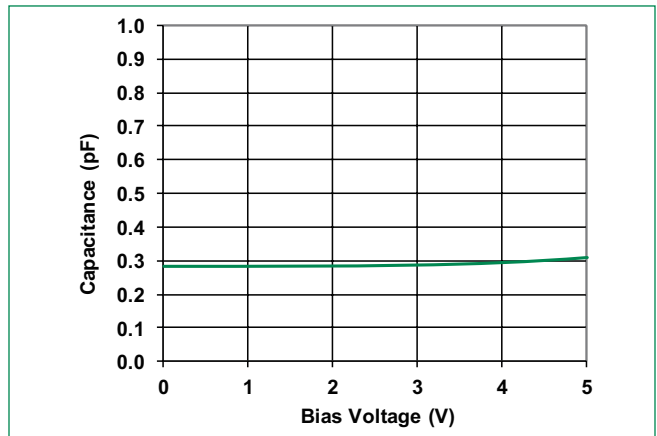
**Insertion Loss of Pin 1 to Pin 2 (I/O to I/O)**



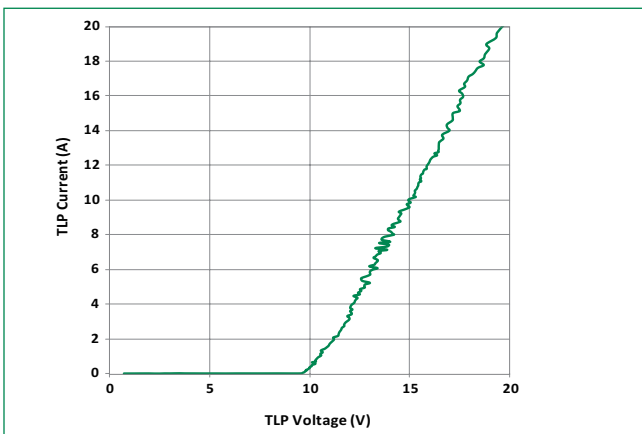
**Capacitance vs. Reverse Bias (Pin 1 or Pin 2 to Pin 3)**



**Capacitance vs. Reverse Bias (I/O-I/O) (Pin 1 to Pin 2)**



**Transmission Line Pulse (TLP)**



# SP0502B Series

## Low Capacitance ESD Protection

### Soldering Parameters

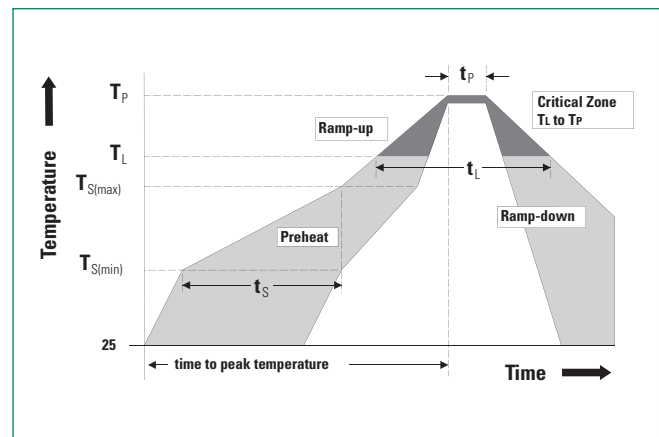
<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 120 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_l$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		30 seconds
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C

### Product Characteristics

<b>Lead Plating</b>	Tin
<b>Lead Material</b>	Copper Alloy
<b>Lead Coplanarity</b>	0.0004 inches (0.102mm)
<b>Substrate material</b>	Silicon
<b>Body Material</b>	Molded 'Compound
<b>Flammability</b>	UL 94 V-0

#### Notes :

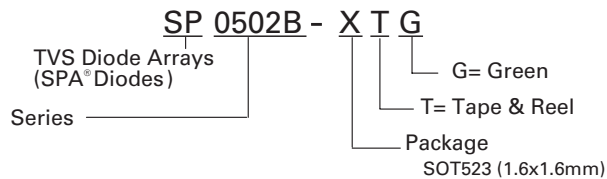
1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.



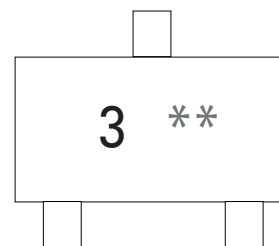
### Ordering Information

Part Number	Package	Size	Marking	Min. Order Qty.
SP0502BXTG	SOT523	1.6x1.6mm	3**	3000

### Part Numbering System



### Part Marking System



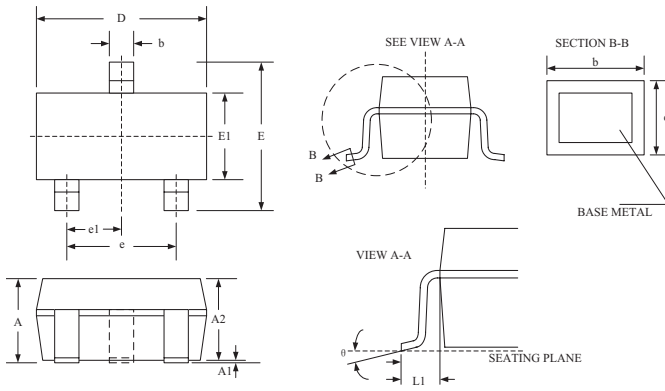
3 = Part code

\* = Date code

# SP0502B Series

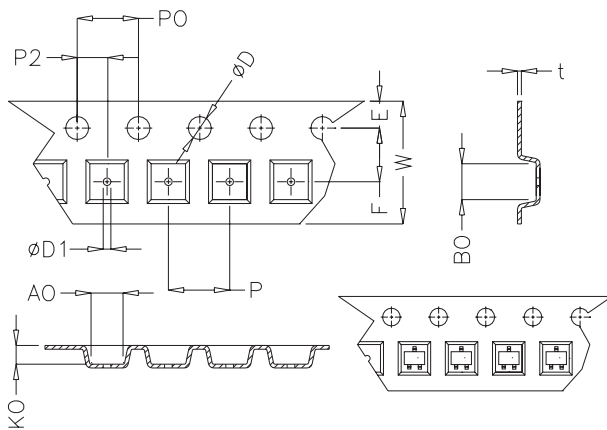
## Low Capacitance ESD Protection

### Package Dimensions — SOT523



	Millimetres			Inches		
	Min	Typ	Max	Min	Typ	Max
<b>A</b>	0.60	-	0.90	0.023	-	0.035
<b>A1</b>	0.00	-	0.10	0.000	-	0.004
<b>A2</b>	0.60	0.75	0.80	0.023	0.030	0.031
<b>b</b>	0.15	-	0.30	0.005	-	0.012
<b>c</b>	0.10	-	0.20	0.003	-	0.008
<b>D</b>	1.50	1.60	1.70	0.059	0.063	0.067
<b>e</b>	1.00 BSC			0.039 BSC		
<b>e1</b>	0.50 BSC			0.020 BSC		
<b>E</b>	1.45	1.60	1.75	0.057	0.063	0.069
<b>E1</b>	0.75	0.80	0.85	0.029	0.031	0.033
<b>L1</b>	0.22 REF			0.009 RFE		
$\theta$	0°	-	8°	0°	-	8°

### Embossed Carrier Tape & Reel Specification — SOT523



	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	4.10	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>	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		0.009 max	

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