

## Features

- ❑ Transient protection for high-speed data lines
  - IEC 61000-4-2 (ESD) ±25kV (Air)
  - ±20kV (Contact)
  - Cable Discharge Event (CDE)
- ❑ Package optimized for high-speed lines
- ❑ Ultra-small package (1.0mm×0.6mm×0.55mm)
- ❑ Protects one data, control or power line
- ❑ Low capacitance: 0.35pF (Typical)
- ❑ Low leakage current: 10nA @  $V_{RWM}$  (Typical)
- ❑ Low clamping voltage
- ❑ Each I/O pin can withstand over 1000 ESD strikes for ±8kV contact discharge
- ❑ ROHS compliant

## Description

TT0501SBX is a low-capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 0.35pF only, TT0501SBX is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC 61000-4-2 (ESD), Level 4 (±15kV air, ±8kV contact discharge), very fast charged device model (CDM) ESD and cable discharge event (CDE), etc.

TT0501SBX uses ultra-small DFN1006-2L package. Each TT0501SBX device can protect one high-speed data line. It offers system designers flexibility to protect single data line where space is a premium concern. The combined features of low capacitance, ultra-small size and high ESD robustness make TT0501SBX ideal for high-speed data port and high-frequency line (e.g., USB 2.0 & antenna line) applications, such as cellular phones and HD visual devices.

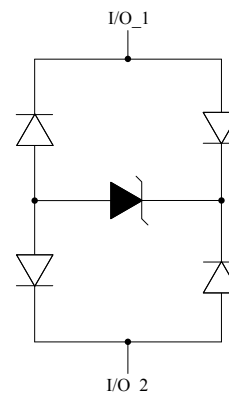
## Applications

- ❑ Serial ATA
- ❑ PCI Express
- ❑ Desktops, Servers and Notebooks
- ❑ Cellular Phones
- ❑ MDDI Ports
- ❑ USB2.0/3.0 Power and Data Line Protection
- ❑ Display Ports
- ❑ Digital Visual Interfaces (DVI)
- ❑ HDMI 1.4/2.0

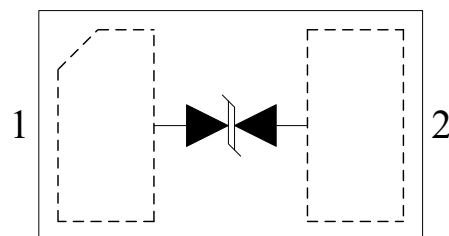
## Mechanical Characteristics

- ❑ DFN1006-2L package
- ❑ Flammability Rating: UL 94V-0
- ❑ Packaging: Tape and Reel

## Circuit Diagram



## Pin Configuration



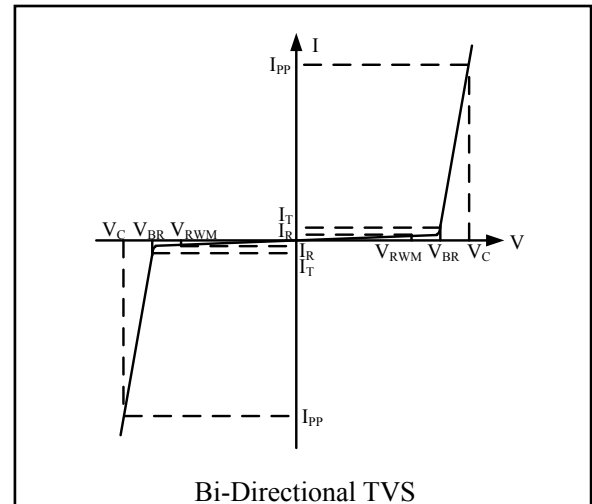
DFN1006-2L  
(Top View)

### Absolute Maximum Rating

Symbol	Parameter	Value	Units
$P_{PK}$	Peak Pulse Power (8/20 $\mu$ s)	40	W
$I_{PP}$	Peak Pulse Current( $t_p=8/20\mu s$ )	4	A
$V_{ESD}$	ESD per IEC 61000-4-2(Air) ESD per IEC 61000-4-2 (Contact)	$\pm 25$ $\pm 20$	kV
$T_{OPT}$	Operating Temperature	-55/+125	$^{\circ}C$
$T_{STG}$	Storage Temperature	-55/+150	$^{\circ}C$

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

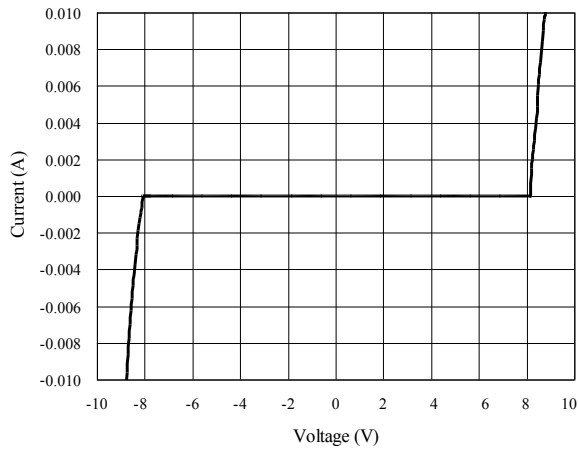
Symbol	Parameter
$V_{RWM}$	Nominal Reverse Working Voltage
$I_R$	Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Reverse Breakdown Voltage @ $I_T$
$I_T$	Test Current for Reverse Breakdown
$V_C$	Clamping Voltage @ $I_{PP}$
$I_{PP}$	Peak Pulse Current
$C_{ESD}$	Parasitic Capacitance
$V_R$	Reverse Voltage
f	Small Signal Frequency



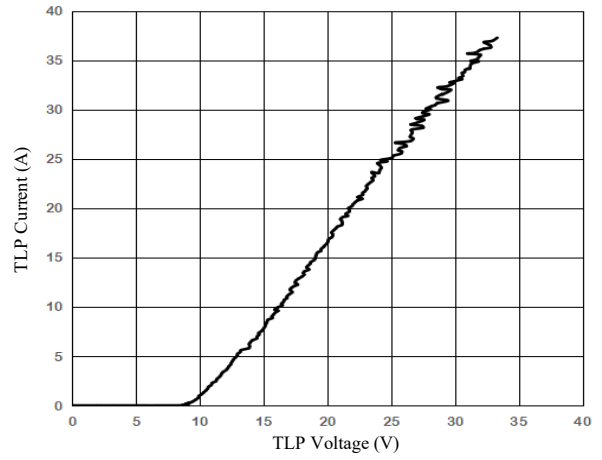
Symbol	Test Condition	Minimum	Typical	Maximum	Units
$V_{RWM}$				5.0	V
$I_R$	$V_{RWM} = 5V, T = 25^{\circ}C$ Between I/O and I/O		0.01	0.1	$\mu A$
$V_{BR}$	$I_T = 1mA$ Between I/O and I/O	6.0	8.0		V
$V_C$	$I_{PP} = 1A, t_p = 8/20\mu s$ Between I/O and I/O		9.6	12.0	V
	$I_{PP} = 4A, t_p = 8/20\mu s$ Between I/O and I/O		13.0	15.0	V
$V_C$	$I_{PP} = 8.0A, t_p = 100ns^{(1)}$		14.5		V
	$I_{PP} = 16.0A, t_p = 100ns^{(1)}$		18.5		V
$R_{dyn}$	$I_{PP} = 34.0A, t_p = 322\mu s^{(1)}$		0.7		$\Omega$
$C_{ESD}$	$V_R = 0V, f = 1MHz$ Between I/O and I/O		0.35		pF

Notes:(1) Measurements performed using a 100ns Transmission Line Pulse(TLP) system.

**Voltage Sweeping of I/O to I/O**

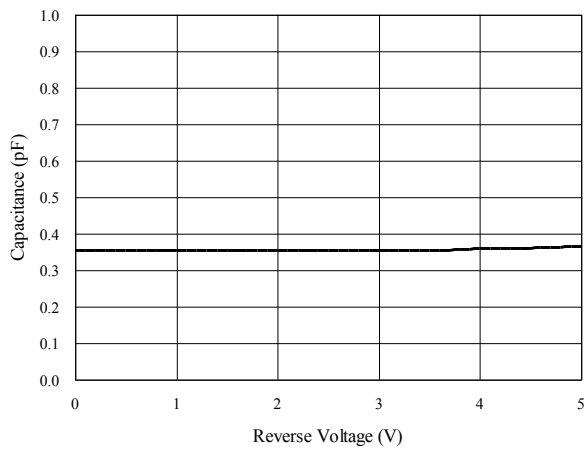


**TLP Measurement of I/O to I/O**

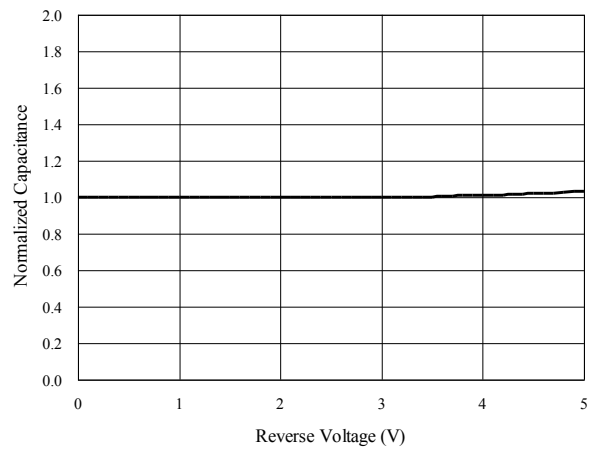


**Capacitance vs. Voltage of I/O to I/O (f = 1MHz)**

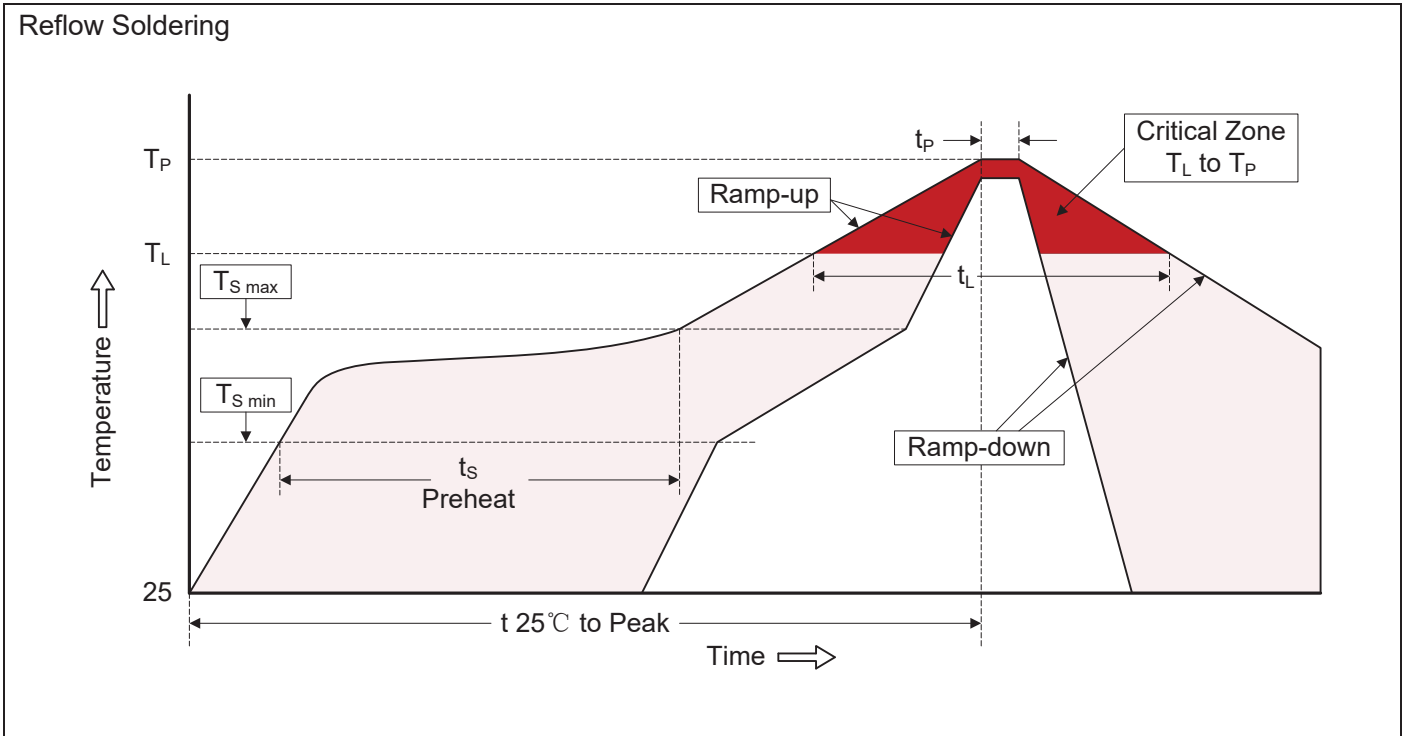
Capacitance vs. Reverse Voltage



Normalized Capacitance vs. Reverse Voltage



## Recommended Soldering Conditions

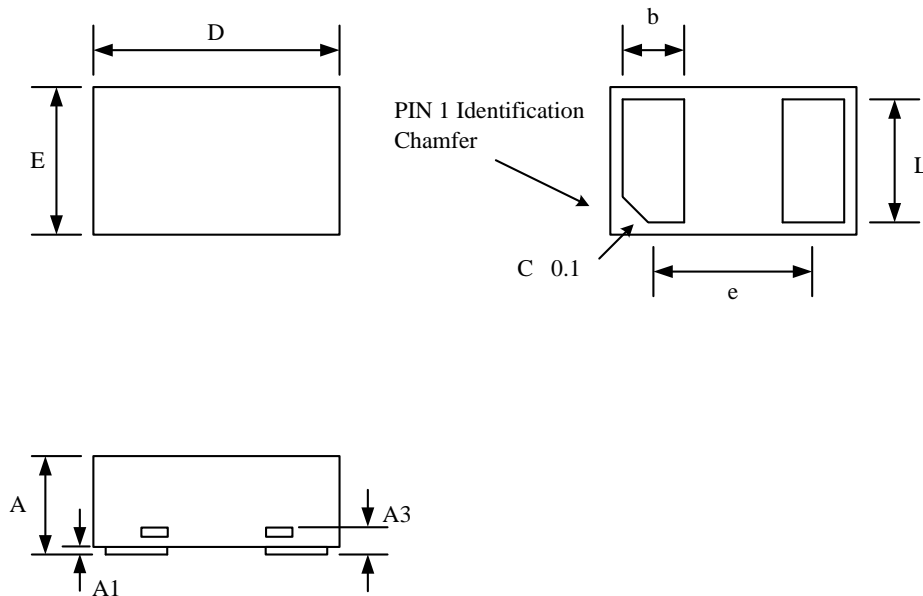


### Recommended Conditions

Profile Feature	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/second max.
Preheat -Temperature Min ( $T_{S\ min}$ ) -Temperature Max ( $T_{S\ max}$ ) -Time (min to max) ( $t_s$ )	150°C 200°C 60-180 seconds
$T_{S\ max}$ to $T_L$ -Ramp-up Rate	3°C/second max.
Time maintained above: -Temperature ( $T_L$ ) -Time ( $t_L$ )	217°C 60-150 seconds
Peak Temperature ( $T_P$ )	260°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	8 minutes max.

## Package Outline

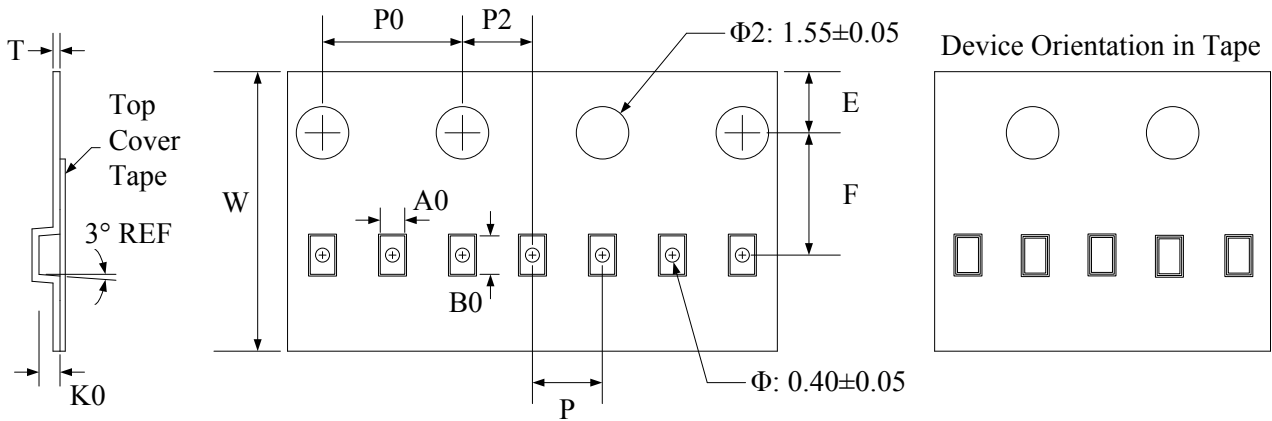
- DFN1006-2L Package
- MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

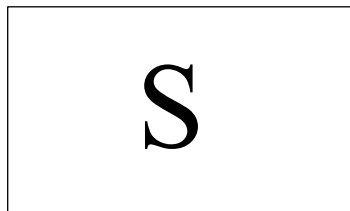
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Minimum	Maximum	Minimum	Maximum
A	0.400	0.550	0.016	0.022
A1	0.000	0.050	0.000	0.002
A3	0.125 REF		0.005 REF	
D	0.950	1.050	0.037	0.041
E	0.550	0.650	0.022	0.026
b	0.200	0.300	0.008	0.012
e	0.650 BSC		0.026 BSC	
L	0.450	0.550	0.018	0.022

### Tape and Reel Specification



Symbol	W	A0	B0	K0	E	F	P	P0	P2	T
Dimensions (mm)	8.00±0.1	0.7±0.05	1.15±0.05	0.55±0.05	1.75±0.1	3.5±0.05	2.0±0.1	4.0±0.1	2.0±0.05	0.2±0.05

### Marking Codes



Or



**Note:**

(1) "S" is part number, fixed.

**Note:**

(1) "2B" is part number, fixed.

### Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
TT0501SBX	5V	10,000	7 Inch

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