

## Features

- Transient protection for high-speed data lines
  - IEC61000-4-2 (ESD)  $\pm 20\text{kV}$  (Air)
  - $\pm 20\text{kV}$  (Contact)
  - IEC61000-4-5 (Lightning) 4.0A (8/20 $\mu\text{s}$ )
- Protects one high-speed data line
- Low reverse current: <10nA typical (VR=5V)
- Working voltage: 5V
- Low capacitance: 0.25pF typical
- Dynamic resistance: 0.47 Ohms (Typ)
- Solid-state silicon-avalanche technology

## Description

TT0501SAX are ultra low capacitance ESD protection devices designed to protect high speed data interfaces. They are designed to replace 0201 size mul-tilayer varistors (MLVs) in portable applications such as cell phones, notebook computers, and other portable electronics. This device offers desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation. TT0501SAX has a typical capacitance of only 0.25pF. This allows it to be used on circuits operating.

TT0501SAX is in a 2-pin DFN0603 package. It measures 0.6 x 0.3 mm with a nominal height of only 0.27mm. Leads are finished with lead-free NiAu. Each device will protect one line operating at 5 volts. It gives the designer the flexibility to protect single lines in applications where arrays are not practical. The combination of small size and high ESD surge capability makes them ideal for use in portable applications such as cellular phones, digital cameras, and MP3 players.

## Applications

- HDMI 1.3/1.4 and HDMI 2.0
- USB 2.0 and USB 3.0
- MHL
- LVDS Interfaces
- FM Antenna
- PCI Express
- eSATA Interfaces

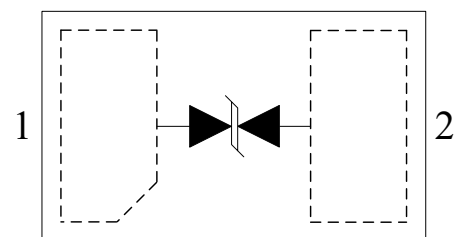
## Mechanical Characteristics

- Package: DFN0603-2L
- Marking: Part number
- Packaging: Tape and Reel
- ROHS compliant

## Circuit Diagram



## Pin Configuration

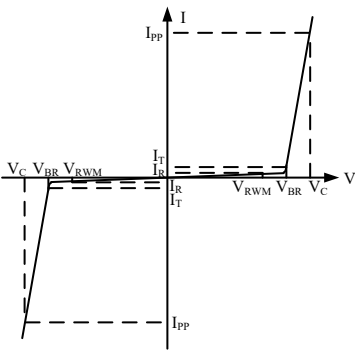


DFN0603-2L  
(Top View)

## Absolute Maximum Rating

Symbol	Parameter	Value	Units
$I_{PP}$	Peak Pulse Current (8/20 $\mu$ s)	4	A
$P_{PK}$	Peak Pulse Power (8/20 $\mu$ s)	60	W
$V_{ESD}$	ESD per IEC61000-4-2 (Air) ESD per IEC61000-4-2 (Contact)	$\pm 20$ $\pm 20$	kV
$T_{OPT}$	Operating Temperature	-55/+125	$^{\circ}$ C
$T_{STG}$	Storage Temperature	-55/+150	$^{\circ}$ C

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

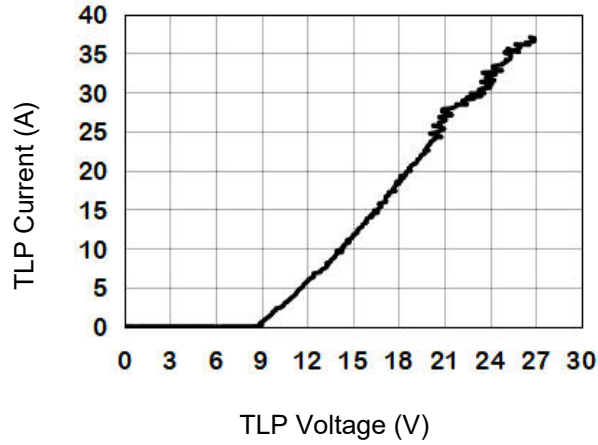
Symbol	Parameter	Diagram
$V_{RWM}$	Nominal Reverse Working Voltage	
$I_R$	Reverse Leakage Current @ $V_{RWM}$	
$V_{BR}$	Reverse Breakdown Voltage @ $I_T$	
$I_T$	Test Current for Reverse Breakdown	
$V_C$	Clamping Voltage @ $I_{PP}$	
$I_{PP}$	Maximum Peak Pulse Current	
$C_{ESD}$	Parasitic Capacitance	

Symbol	Test Condition	Minimum	Typical	Maximum	Units
$V_{RWM}$				5.0	V
$I_R$	$V_{RWM} = 5.0V, T = 25^{\circ}C$		10	100	nA
$V_{BR}$	$I_T = 1mA$	7.0	8.5	10	V
$V_C$	$I_{PP} = 4A, t_p = 8/20\mu s$		13	16	V
$V_C$	$I_{PP} = 8.0A, t_p = 100ns^{(1)}$		13.2		V
	$I_{PP} = 16.0A, t_p = 100ns^{(1)}$		17.2		V
$R_{dyn}$	$I_{PP} = 12.0A, t_p = 100ns^{(1)}$		0.47		$\Omega$
$C_{ESD}$	$V_R = 0V, f = 1MHz$		0.25		pF

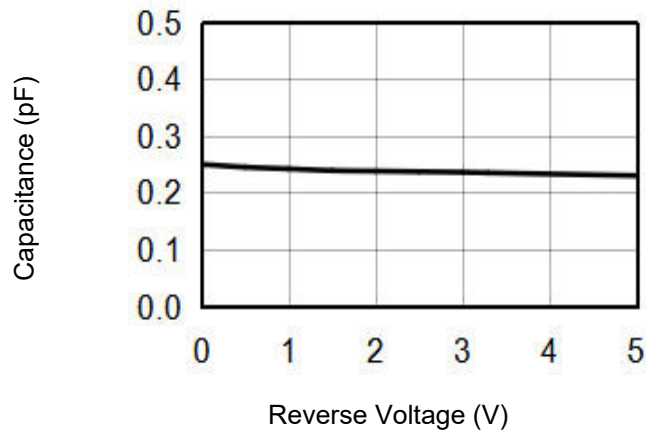
Notes:(1)Measurements performed using a 100ns Transmission Line Pulse(TLP) system.

## Typical Performance Characteristics

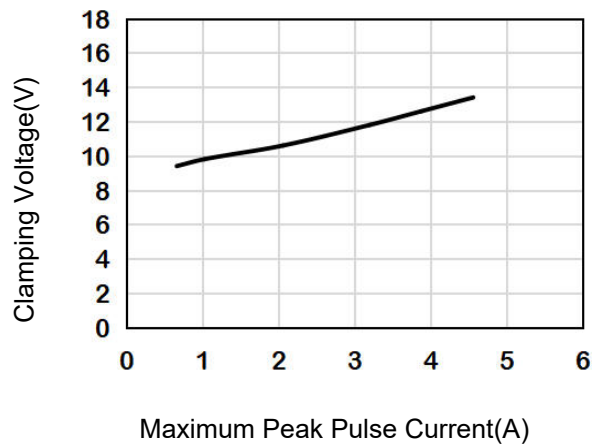
**TLP Measurement of I/O to I/O**



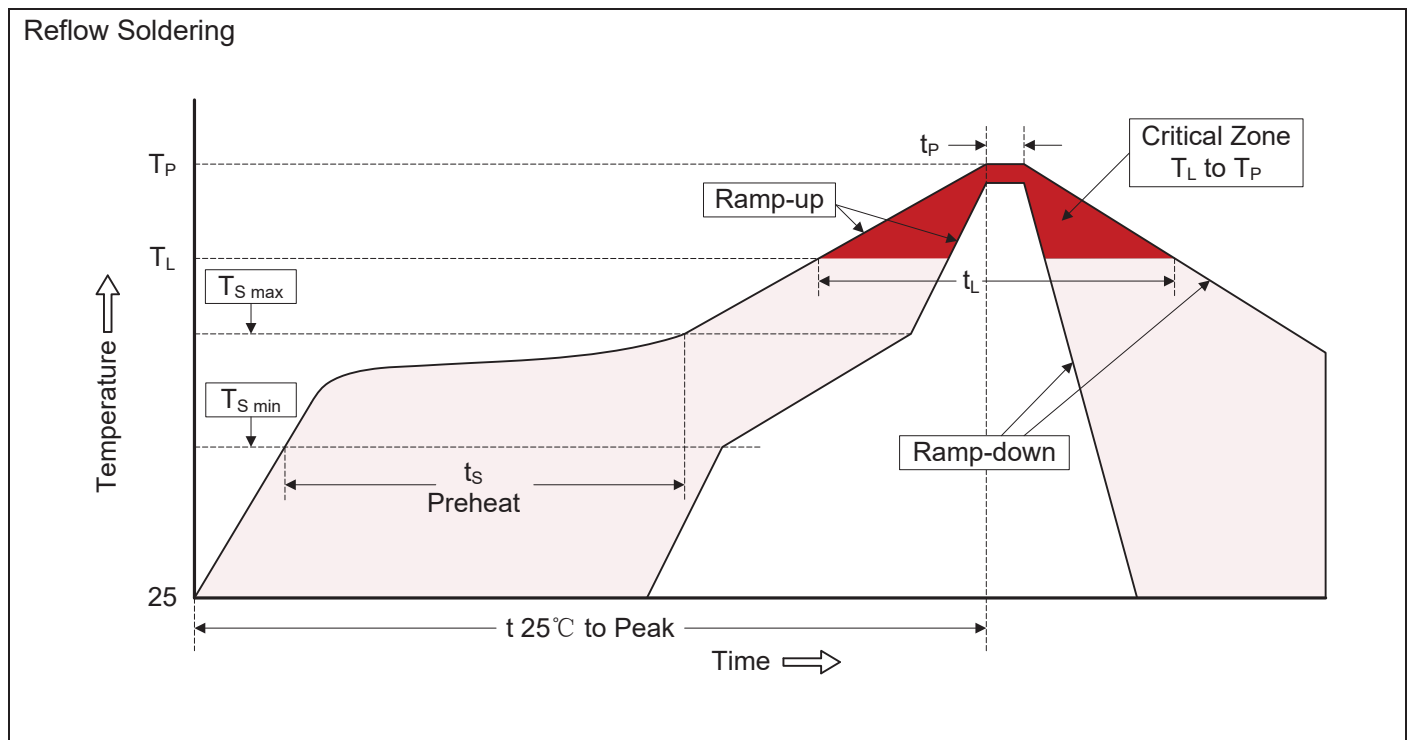
**Capacitance vs Reverse Voltage IO to IO**



**8/20us Current IO to IO**



## Recommended Soldering Conditions

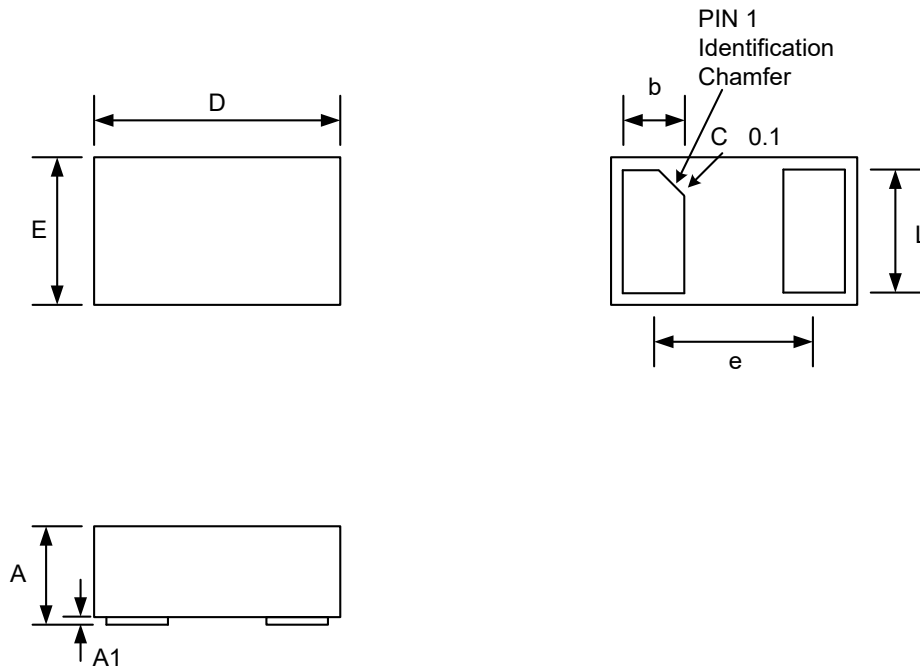


### Recommended Conditions

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

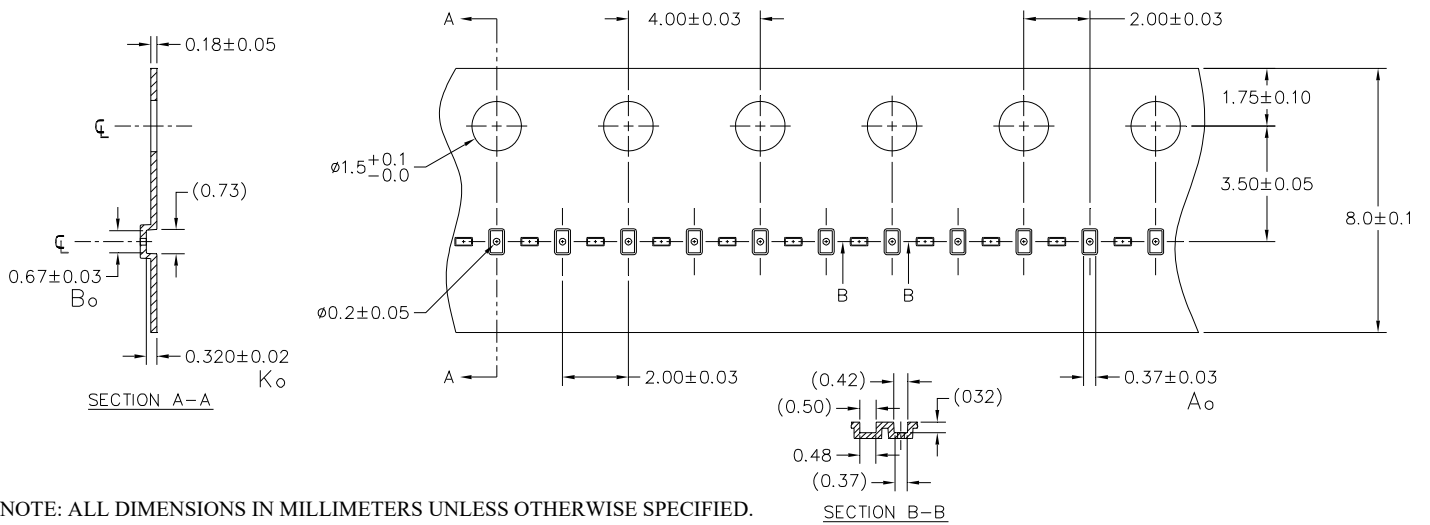
- ❑ DFN0603-2L package
- ❑ 2 leads, very small package
- ❑ MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Minimum	Maximum	Minimum	Maximum
A	0.270	0.330	0.011	0.013
A1	0.000	0.050	0.000	0.002
D	0.600	0.640	0.023	0.025
E	0.300	0.340	0.011	0.013
b	0.115	0.175	0.005	0.007
e	0.400 BSC		0.016 BSC	
L	0.215	0.275	0.008	0.011

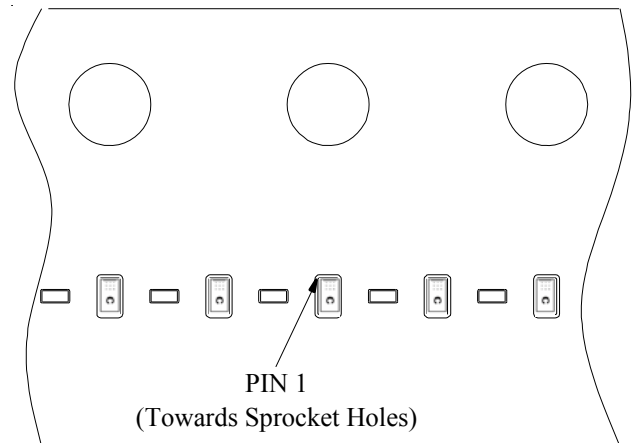
## Carries Tape Specification



### Device Orientation in Tape

A0	B0	K0
0.37 +/-0.03	0.67 +/-0.03	0.32 +/-0.02 mm

Note: All dimensions in mm unless otherwise specified



## Marking Codes



### Note:

- (1) "S" is part number.
- (2) "X" is the internal code.

## Ordering Information

Part Number	Working Voltage	Quantity Per Reel	Reel Size
TT0501SAX	5.0V	10,000	7 Inch

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