

## Features

- Transient protection for high-speed data lines  
IEC61000-4-2 (ESD)  $\pm 10\text{kV}$  (Air)  
 $\pm 10\text{kV}$  (Contact)  
IEC61000-4-5 (Lightning) 3.0A (8/20 $\mu\text{s}$ )
- Small package saves board space
- Protects one I/O line (bidirectional)
- Low capacitance: 0.15pF@0V (Typical) (I/O-I/O)
- Low leakage current: 0.1 $\mu\text{A}$  @  $V_{\text{RWM}}$ (Maximum)
- Low clamping voltage
- Each I/O pin can withstand over 1000 ESD strikes for  $\pm 10\text{kV}$  contact discharge

## Description

TT0521SAX is an ultra-low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 0.15pF only, it is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events.

The TT0521SAX comes in a RoHS compliant and Halogen Free 0.6mm x 0.3mm x 0.3mm DFN0603-2L package.

## Applications

- Portable applications
- Communication systems
- Computers and peripherals
- High speed data lines:
  - USB 2.0/3.0/3.1
  - HDMI 1.4/2.0

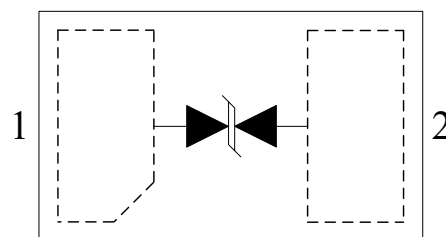
## Mechanical Characteristics

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

## Circuit Diagram



## Pin Configuration

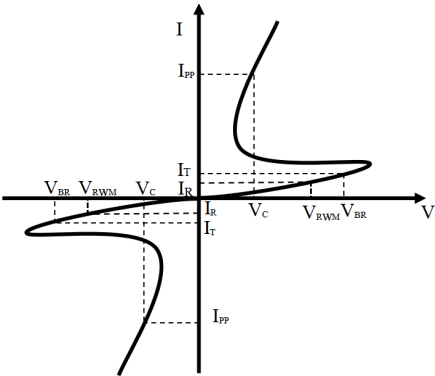


DFN0603-2L  
(Top View)

## Absolute Maximum Rating

| Symbol    | Parameter                                                    | Value                | Units |
|-----------|--------------------------------------------------------------|----------------------|-------|
| $I_{PP}$  | Peak Pulse Current (8/20 $\mu$ s)                            | 3                    | A     |
| $V_{ESD}$ | ESD per IEC61000-4-2 (Air)<br>ESD per IEC61000-4-2 (Contact) | $\pm 10$<br>$\pm 10$ | kV    |
| $T_{OPT}$ | Operating Temperature                                        | -55/+125             | °C    |
| $T_{STG}$ | Storage Temperature                                          | -55/+150             | °C    |

## Electrical Characteristics (T = 25°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               |                                                                                     |
| $R_{dyn}$     | Dynamic Resistance                  |                                                                                     |
| $\alpha_{IL}$ | Insertion Loss                      |                                                                                     |

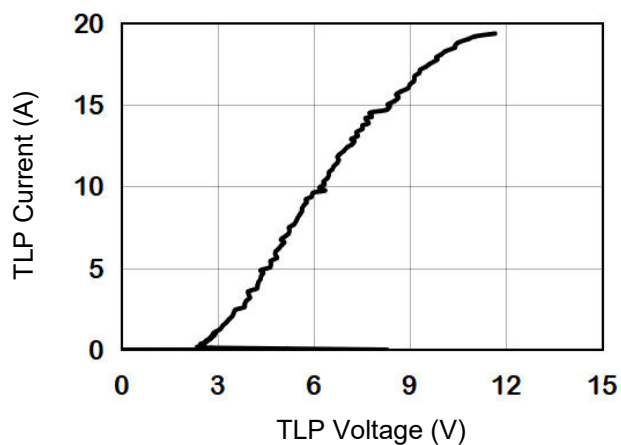
| Symbol    | Test Condition                         | Minimum | Typical | Maximum | Units    |
|-----------|----------------------------------------|---------|---------|---------|----------|
| $V_{RWM}$ | —                                      | —       | —       | 5.0     | V        |
| $I_R$     | $V_{RWM} = 5.0V$ , $T = 25^\circ C$    | —       | —       | 100     | nA       |
| $V_{BR}$  | $I_T = 100\mu A$                       | 5.5     | —       | 9.0     | V        |
| $V_C$     | $I_{PP} = 3A$ , $t_p = 8/20\mu s$      | —       | 4.5     | —       | V        |
| $V_C$     | $I_{PP} = 8.0A$ , $t_p = 100ns^{(1)}$  | —       | 5.2     | —       | V        |
|           | $I_{PP} = 16.0A$ , $t_p = 100ns^{(1)}$ | —       | 8.3     | —       | V        |
| $R_{dyn}$ | $I_{PP} = 12.0A$ , $t_p = 100ns^{(1)}$ | —       | 0.39    | —       | $\Omega$ |

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

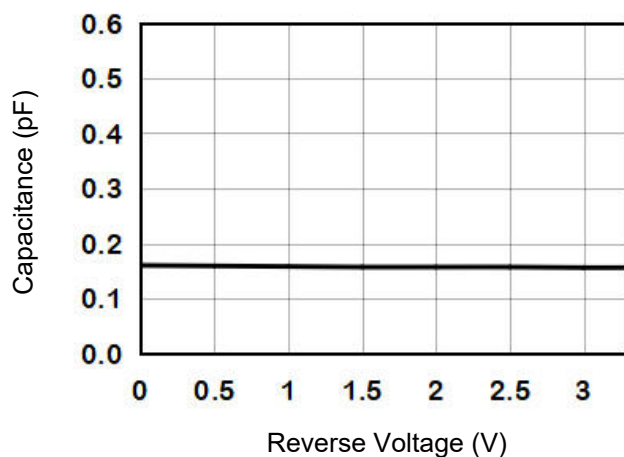
| Symbol        | Test Condition       | Minimum | Typical | Maximum | Units |
|---------------|----------------------|---------|---------|---------|-------|
| $C_{ESD}$     | $V_R = 0V, f = 1MHz$ |         | 0.15    |         | pF    |
|               | $V_R = 1V, f = 1GHz$ |         | 0.12    |         | pF    |
| $\alpha_{IL}$ | $f = 5GHz$           |         | -0.04   |         | dB    |
|               | $f = 10GHz$          |         | -0.63   |         | dB    |

## Typical Performance Characteristics

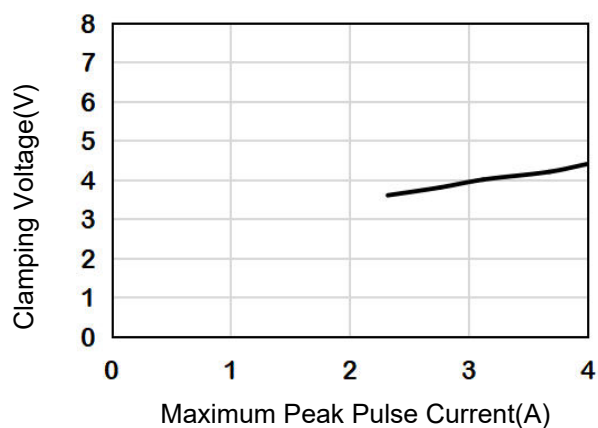
**TLP Measurement of I/O to I/O**



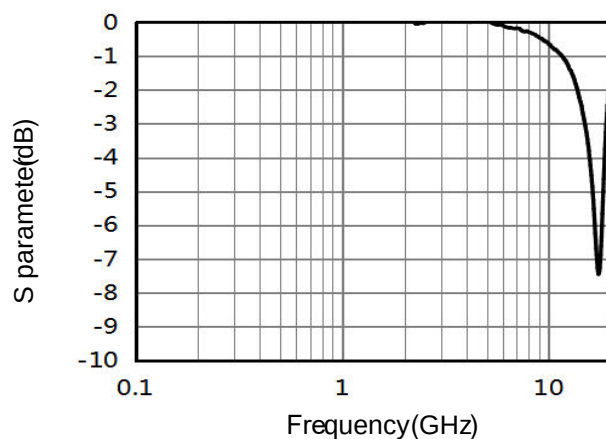
**Capacitance vs Reverse Voltage IO to IO**



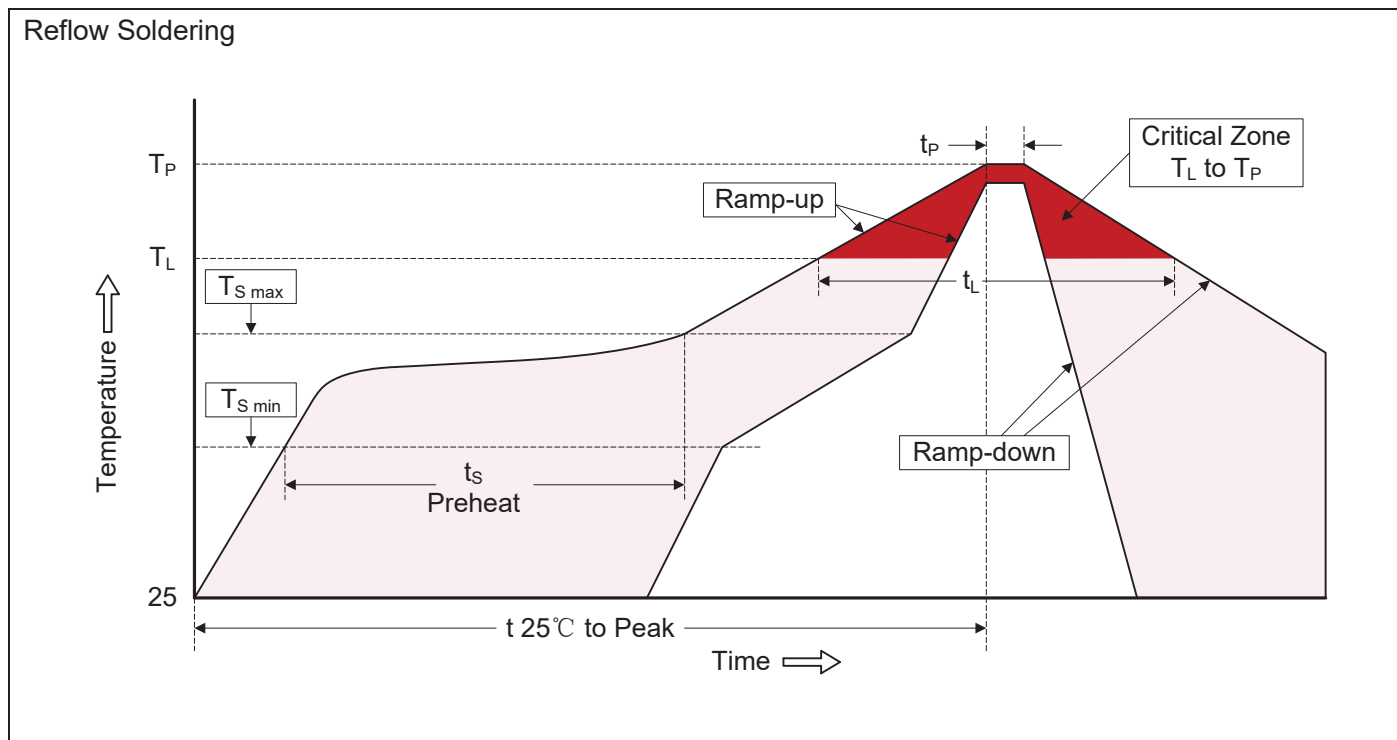
**8/20us Current IO to IO**



**Insertion loss**



## Recommended Soldering Conditions

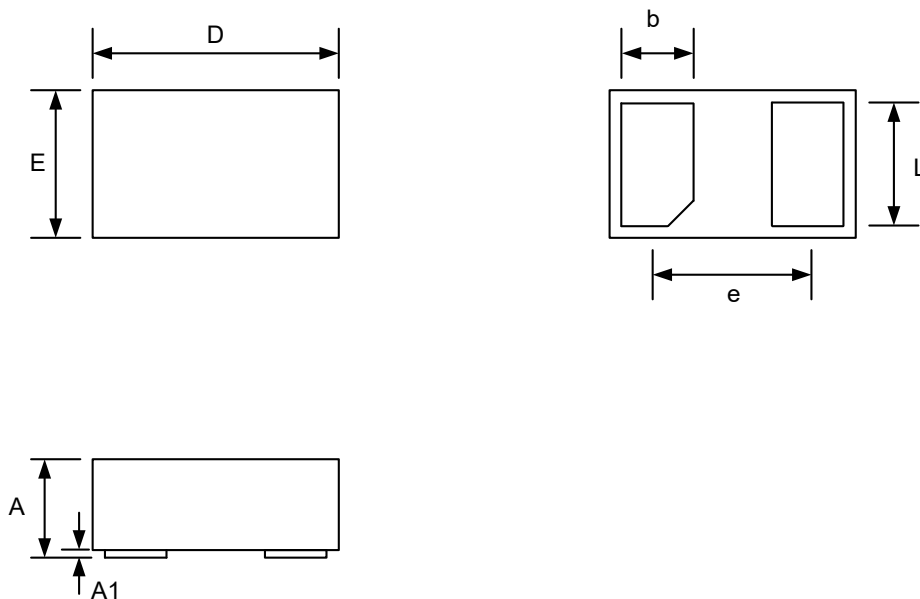


### Recommended Conditions

| Profile Feature                                                                                                                                                                                         | Pb-Free Assembly                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )                                                                                                                                                                 | 3°C/second max.                  |
| Preheat <ul style="list-style-type: none"> <li>-Temperature Min (<math>T_{S\ min}</math>)</li> <li>-Temperature Max (<math>T_{S\ max}</math>)</li> <li>-Time (min to max) (<math>t_s</math>)</li> </ul> | 150°C<br>200°C<br>60-180 seconds |
| $T_{S\ max}$ to $T_L$ <ul style="list-style-type: none"> <li>-Ramp-up Rate</li> </ul>                                                                                                                   | 3°C/second max.                  |
| Time maintained above: <ul style="list-style-type: none"> <li>-Temperature (<math>T_L</math>)</li> <li>-Time (<math>t_L</math>)</li> </ul>                                                              | 217°C<br>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

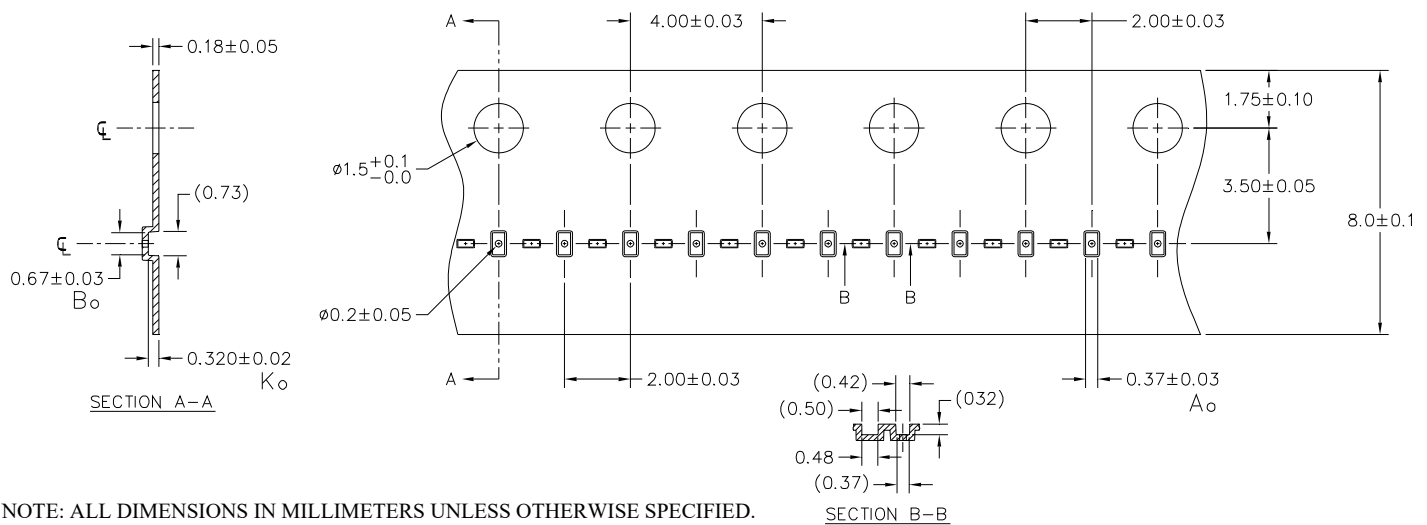
- DFN0603-2L package
- 2 leads, very small package
- MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

| Symbol | Dimensions In Millimeters |         | Dimensions In Inches |         |
|--------|---------------------------|---------|----------------------|---------|
|        | Minimum                   | Maximum | Minimum              | Maximum |
| A      | 0.250                     | 0.350   | 0.010                | 0.014   |
| A1     | 0.000                     | 0.020   | 0.000                | 0.001   |
| D      | 0.550                     | 0.650   | 0.022                | 0.026   |
| E      | 0.250                     | 0.350   | 0.010                | 0.014   |
| b      | 0.150                     | 0.250   | 0.006                | 0.010   |
| e      | 0.350 BSC                 |         | 0.014 BSC            |         |
| L      | 0.180                     | 0.280   | 0.007                | 0.011   |

## Carries Tape Specification



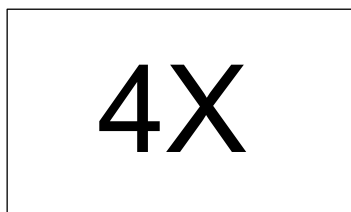
NOTE: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

### Device Orientation in Tape

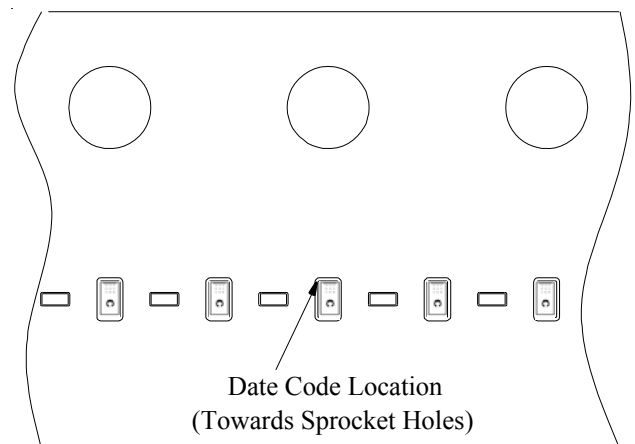
| A0           | B0           | K0              |
|--------------|--------------|-----------------|
| 0.37 +/-0.03 | 0.67 +/-0.03 | 0.32 +/-0.02 mm |

Note: All dimensions in mm unless otherwise specified

## Marking Codes



**OR**



## Ordering Information

| Part Number | Working Voltage | Quantity Per Reel | Reel Size |
|-------------|-----------------|-------------------|-----------|
| TT0521SAX   | 5.0V            | 10,000            | 7 Inch    |

**Note:**

- (1)“4” and “A” is part number.  
(2)“X” is the internal code.