

## Features

- ❑ Transient protection for high-speed data lines
  - IEC 61000-4-2 (ESD) ±25kV (Air)
  - ±20kV (Contact)
  - IEC 61000-4-4 (EFT) 40A (5/50 ns)
  - 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: 1.0pF (Typical)
- ❑ Low leakage current: 10nA @ V<sub>RWM</sub> (Typical)
- ❑ Low clamping voltage
- ❑ Each I/O pin can withstand over 1000 ESD strikes for ±8kV contact discharge
- ❑ ROHS compliant

## Description

TT0301TBX is a low-capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 1.0pF only, TT0301TBX 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), IEC 61000-4-4 (electrical fast transient - EFT) (40A, 5/50 ns), very fast charged device model (CDM) ESD and cable discharge event (CDE), etc.

TT0301TBX uses ultra-small uDFN-2L package. Each TT0301TBX 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 TT0301TBX 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

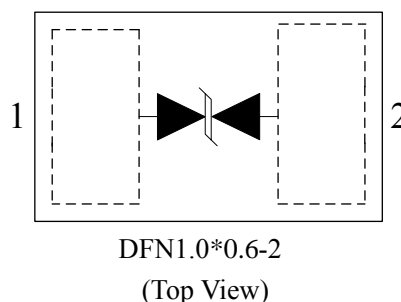
## Mechanical Characteristics

- ❑ DFN1.0\*0.6-2L package
- ❑ Flammability Rating: UL 94V-0
- ❑ Marking: Part number
- ❑ Packaging: Tape and Reel

## Circuit Diagram



## Pin Configuration

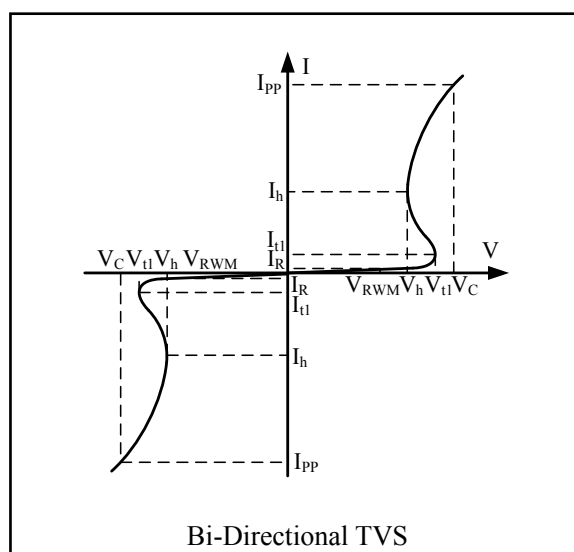


### Absolute Maximum Rating

| Symbol    | Parameter   | Value                | Units |
|-----------|---|----------------------|-------|
| $I_{PP}$  | Peak Pulse Current( $t_p=8/20\mu s$ )                         | 3                    | A     |
| $V_{ESD}$ | ESD per IEC 61000-4-2(Air)<br>ESD per IEC 61000-4-2 (Contact) | $\pm 25$<br>$\pm 20$ | kV    |
| $T_{OPT}$ | Operating Temperature   | -55/+125             | °C    |
| $T_{STG}$ | Storage Temperature   | -55/+150             | °C    |

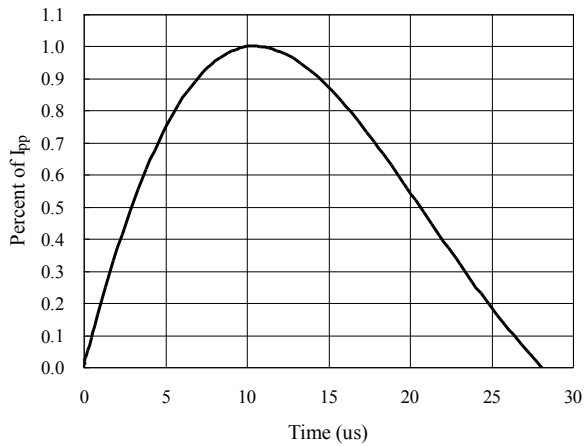
### Electrical Characteristics (T = 25°C)

| Symbol       | Parameter                                |
|--------------|--|
| $V_{RWM}$    | Nominal Reverse Working Voltage          |
| $I_R$        | Reverse Leakage Current @ $V_{RWM}$      |
| $V_{t1}$     | Trigger Voltage                          |
| $I_{t1}$     | Trigger Current @ $V_{t1}$               |
| $V_h$        | Holding Voltage                          |
| $I_h$        | Holding Current @ $V_h$                  |
| $V_C$        | Clamping Voltage @ $I_{PP}$              |
| $I_{PP}$     | Maximum Peak Pulse Current               |
| $C_{ESD}$    | Parasitic Capacitance                    |
| $C_{\Delta}$ | Variation in $C_{ESD}$ with Reverse Bias |

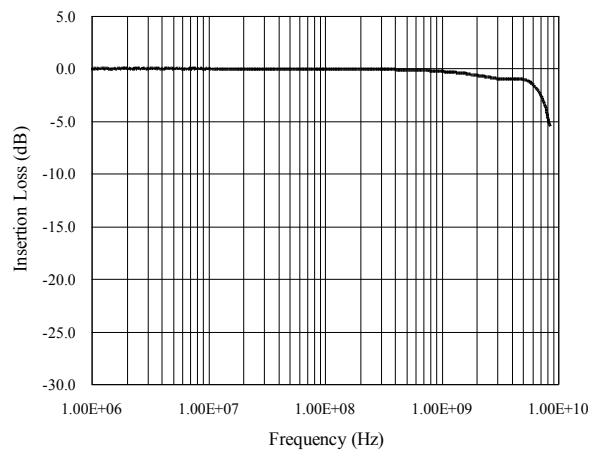


| Symbol    | Test Condition                    | Minimum | Typical | Maximum | Units |
|-----------|-----------------------------------|---------|---------|---------|-------|
| $V_{RWM}$ |                                   |         |         | 3.3     | V     |
| $I_R$     | $V_{RWM} = 3.3V, T = 25^{\circ}C$ |         | 10      | 100     | nA    |
| $V_{t1}$  | $I_{t1} = 1\mu A$                 |         | 6.0     |         | V     |
| $V_h$     | $I_h = 10mA$                      |         | 4.0     |         | V     |
| $V_C$     | $I_{PP} = 1A, t_p = 8/20\mu s$    |         | 6.0     |         | V     |
| $V_C$     | $I_{PP} = 3A, t_p = 8/20\mu s$    |         | 8.0     |         | V     |
| $C_{ESD}$ | $V_R = 0V, f = 1MHz$              |         | 1.0     |         | pF    |

**8/20 $\mu$ s Pulse Waveform**

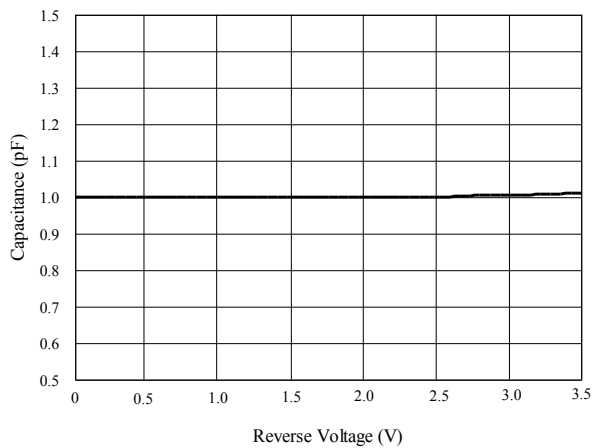


**Insertion Loss S21 of I/O to I/O**

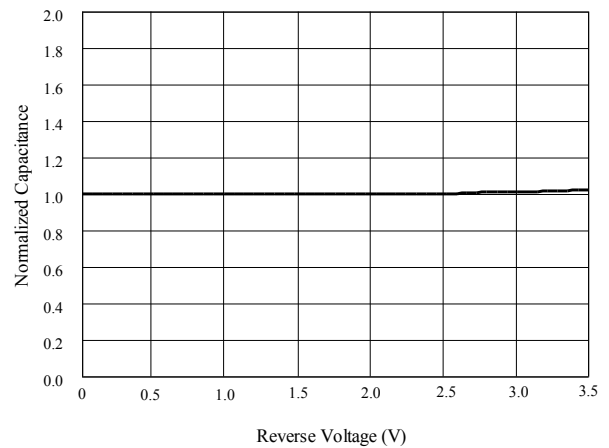


**Capacitance vs. Voltage of I/O to I/O (f = 1MHz)**

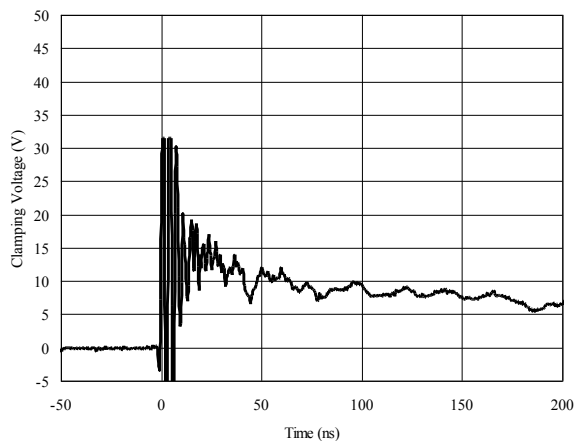
Capacitance vs. Reverse Voltage



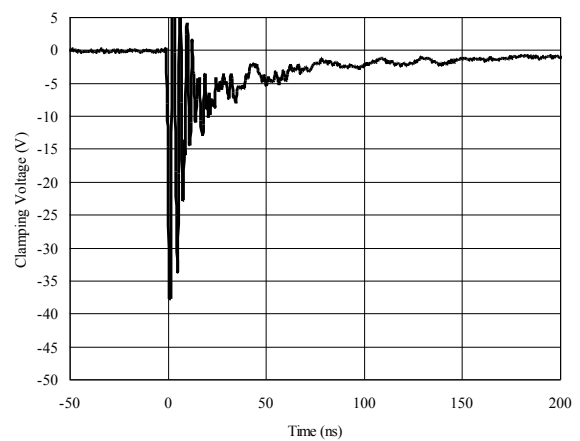
Normalized Capacitance vs. Reverse Voltage



**ESD Clamping of I/O to GND  
(+8kV Contact per IEC 61000-4-2)**

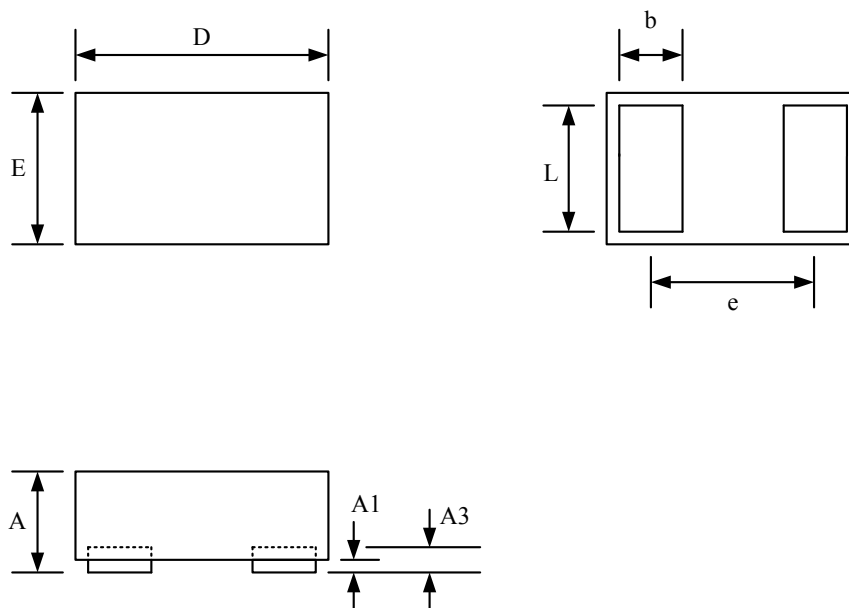


**ESD Clamping of I/O to GND  
(-8kV Contact per IEC 61000-4-2)**



## Package Outline

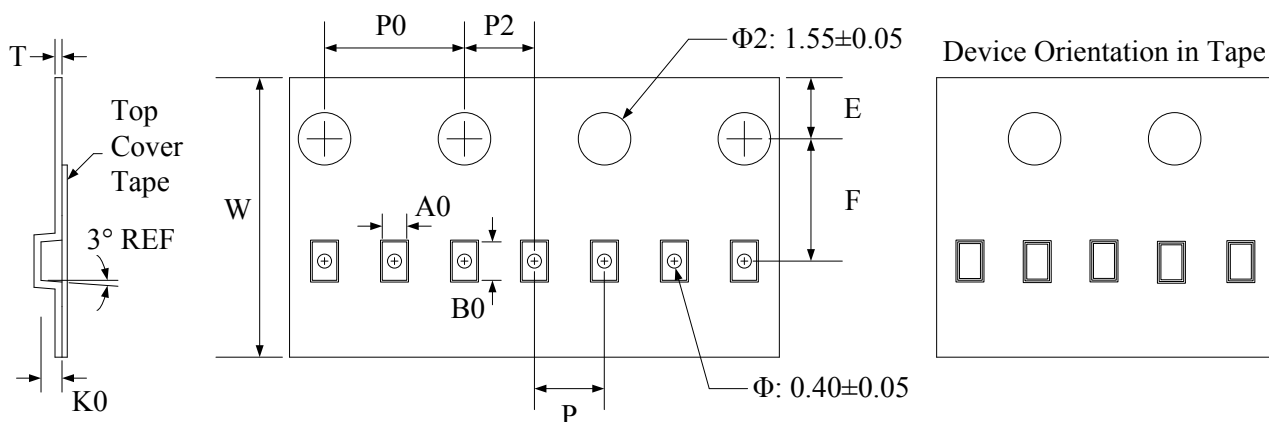
- ❑ DFN1.0\*0.6-2L package
- ❑ 2 leads, very small package
- ❑ MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

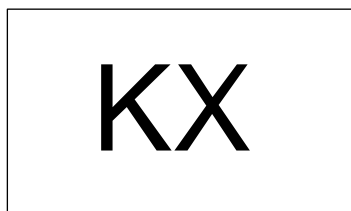
| Symbol | Dimensions In Millimeters |         | Dimensions In Inches |         |
|--------|---------------------------|---------|----------------------|---------|
|        | Minimum                   | Maximum | Minimum              | Maximum |
| A      | 0.400                     | 0.550   | 0.016                | 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



### Ordering Information

| Part Number | Working Voltage | Quantity Per Reel | Reel Size |
|-------------|-----------------|-------------------|-----------|
| TT0301TBX   | 3.3V            | 10,000            | 7 Inch    |

Note:

- (1) "K" is part number, fixed
- (2) "X" is date code, which is the assembly month in three years, changing as (1~9, 0, A~Z)

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