

## Features

- ❑ Transient protection for high-speed data lines  
IEC 61000-4-2 (ESD)  $\pm 25\text{kV}$  (Air)  
 $\pm 17\text{kV}$  (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: 3 pF (Typical)
- ❑ Low leakage current: 10nA @  $V_{\text{RWM}}$  (Typical)
- ❑ Low clamping voltage
- ❑ Each I/O pin can withstand over 1000 ESD strikes for  $\pm 8\text{kV}$  contact discharge
- ❑ ROHS compliant

## Description

TT2401PBX is a low-capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of 3.0pF only, TT2401PBX 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 ( $\pm 15\text{kV}$  air,  $\pm 8\text{kV}$  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.

TT2401PBX uses ultra-small uDFN-2L package. Each TT2401PBX device can protect one high-speed data line. It offers system designers flexibility to protect single data line where space is a premium concern.

## Applications

- ❑ Serial ATA
- ❑ PCI Express
- ❑ Desktops, Servers and Notebooks
- ❑ Cellular Phones
- ❑ MDDI Ports
- ❑ Display Ports
- ❑ Digital Visual Interfaces (DVI)

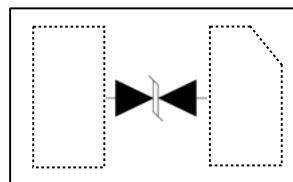
## Mechanical Characteristics

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

## Circuit Diagram



## Pin Configuration



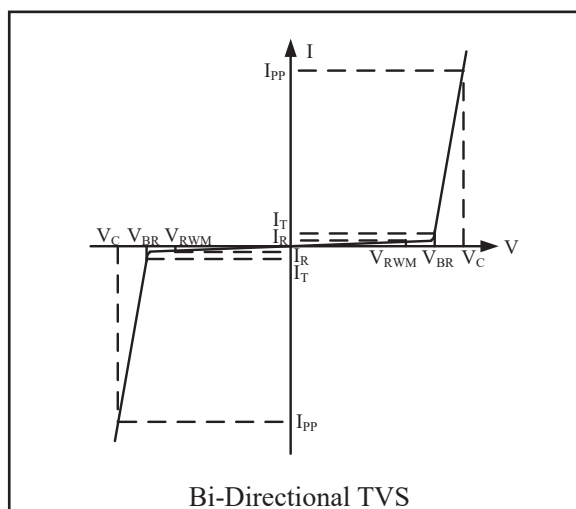
DFN1006-2L  
(Top View)

## Absolute Maximum Rating

| Symbol    | Parameter                       | Value    | Units |
|-----------|---------------------------------|----------|-------|
| $V_{ESD}$ | ESD per IEC 61000-4-2 (Air)     | $\pm 25$ | kV    |
|           | ESD per IEC 61000-4-2 (Contact) | $\pm 17$ |       |
| $T_{OPT}$ | Operating Temperature           | -55/+125 | °C    |
| $T_{STG}$ | Storage Temperature             | -55/+150 | °C    |

## Electrical Characteristics (T = 25°C)

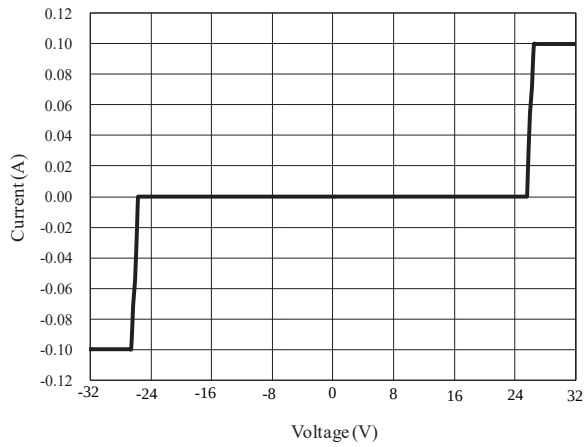
| Symbol    | Parameter                           |
|-----------|-------------------------------------|
| $V_{RWM}$ | Nominal Reverse Working Voltage     |
| $I_R$     | Reverse Leakage Current @ $V_{RWM}$ |
| $V_{BR}$  | Reverse Breakdown Voltage @ $I_T$   |
| $I_T$     | Test Current for Reverse Breakdown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



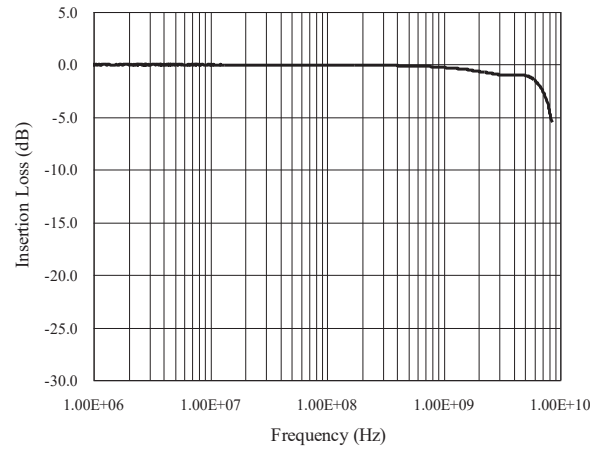
| Symbol    | Test Condition                                           | Minimum | Typical | Maximum | Units |
|-----------|----------------------------------------------------------|---------|---------|---------|-------|
| $V_{RWM}$ |                                                          |         |         | 24.0    | V     |
| $I_R$     | $V_{RWM} = 24V$ , T = 25°C<br>Between I/O and I/O        |         | 0.01    | 0.1     | μA    |
| $V_{BR}$  | $I_T = 1mA$<br>Between I/O and I/O                       | 26      |         |         | V     |
| $V_C$     | $I_{PP} = 1A$ , $t_p = 8/20\mu s$<br>Between I/O and I/O |         | 40      |         | V     |
| $C_{ESD}$ | $V_R = 0V$ , f = 1MHz<br>Between I/O and I/O             |         | 3       | 5       | pF    |



### Voltage Sweeping of I/O to I/O

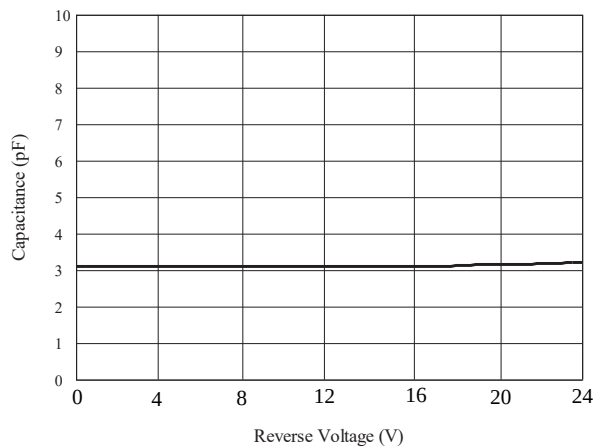


### Insertion Loss S21 of I/O to I/O

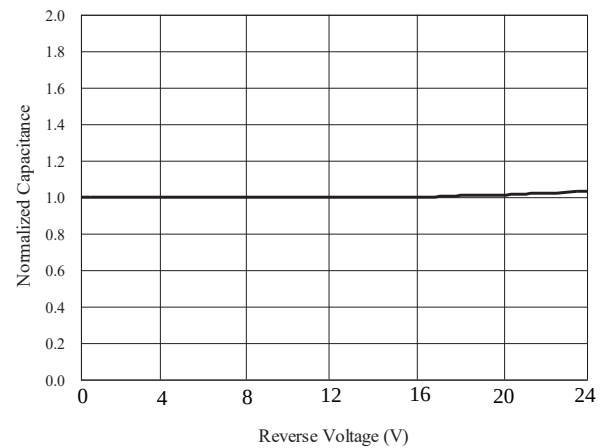


### Capacitance vs. Voltage of I/O to I/O (f = 1MHz)

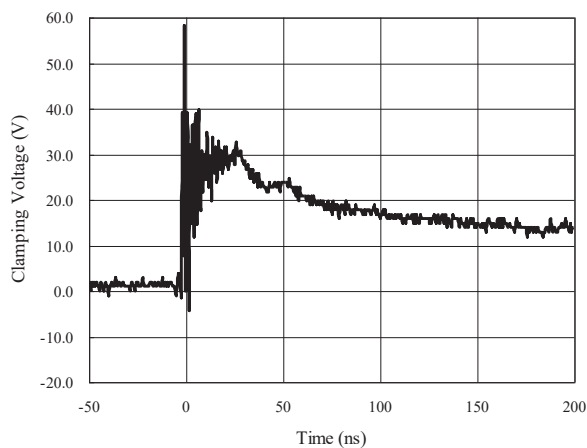
Capacitance vs. Reverse Voltage



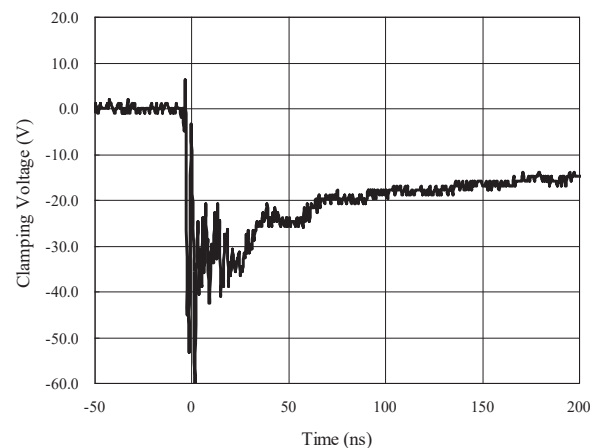
Normalized Capacitance vs. Reverse Voltage



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

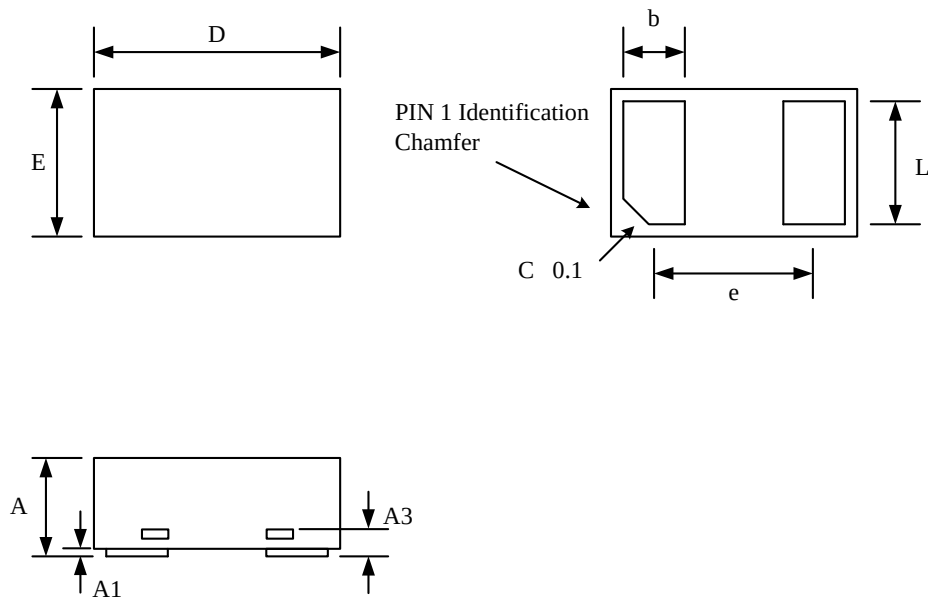


### ESD Clamping of I/O to I/O (-8kV Contact per IEC 61000-4-2)



## Package Outline

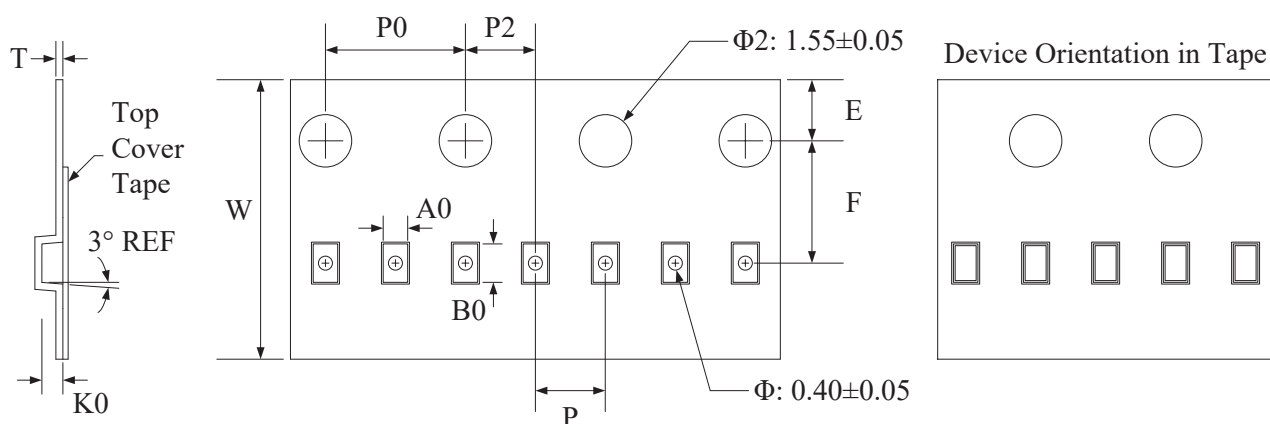
- ❑ DFN1006-2L package
- ❑ 2 leads, very small package
- ❑ MSL-1



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 |
|-------------|-----------------|-------------------|-----------|
| TT2401PBX   | 24V             | 10,000            | 7 Inch    |

### Note:

(1) "EB" is part number.