

## Features

- Transient protection for high-speed data lines
- IEC61000-4-2 (ESD)  $\pm 14\text{kV}$  (Air)  
 $\pm 12\text{kV}$  (Contact)
- IEC61000-4-5 (Lightning)  $5.5\text{A}$  (8/20 $\mu\text{s}$ )
- Small package saves board space
- Protects one I/O line (bidirectional)
- Low capacitance:  $0.25\text{pF}$  @  $0\text{V}$  (Typical)
- Low leakage current:  $10\text{nA}$  @  $V_{\text{RWM}}$  (Maximum)
- Low clamping voltage
- Each I/O pin can withstand over 1000 ESD strikes for  $\pm 12\text{kV}$  contact discharge

## Description

TT0361SBX is a low capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for high-speed data interfaces. With typical capacitance of  $0.25\text{pF}$  only, it is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events.

The TT0361SBX comes in a ROHS compliant and Halogen Free  $1.0\text{mm} \times 0.6\text{mm} \times 0.5\text{mm}$  DFN1006-2L package.

## Applications

- Portable applications
- Communication systems
- Computers and peripherals
- High speed data lines:
  - USB 2.0/3.X
  - Thunderbolt
  - eSATA
  - DisplayPort
  - PCI-e

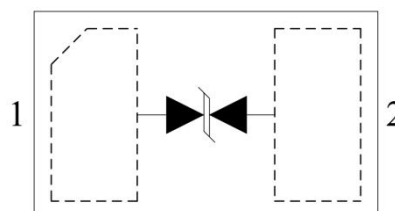
## Mechanical Characteristics

- Package: DFN1006-2L
- Marking: Part number
- Packaging: Tape and Reel
- ROHS compliant
- Moisture Sensitivity Level (MSL Level-1)

## Circuit Diagram



## Pin Configuration

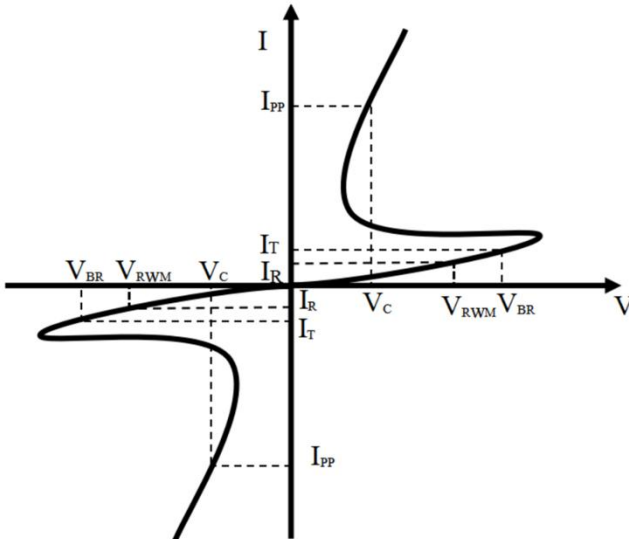


DFN1006-2L  
(Top View)

## Absolute Maximum Rating

| Symbol    | Parameter                                                    | Value                | Units |
|-----------|--------------------------------------------------------------|----------------------|-------|
| $I_{PP}$  | Peak Pulse Current (8/20 $\mu$ s)                            | 5.5                  | A     |
| $P_{PK}$  | Peak Pulse Power (8/20 $\mu$ s)                              | 30                   | W     |
| $V_{ESD}$ | ESD per IEC61000-4-2 (Air)<br>ESD per IEC61000-4-2 (Contact) | $\pm 14$<br>$\pm 12$ | 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                      |                                                                                     |
| $f_{-3db}$    | Cut-off frequency at -3dB           |                                                                                     |
|               |                                     |                                                                                     |
|               |                                     |                                                                                     |

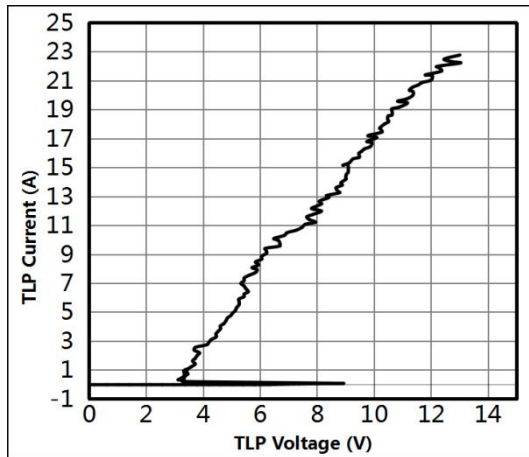
| Symbol    | Test Condition                    | Minimum | Typical | Maximum | Units    |
|-----------|-----------------------------------|---------|---------|---------|----------|
| $V_{RWM}$ |                                   |         |         | 3.3     | V        |
| $I_R$     | $V_{RWM} = 3.3V, T = 25^\circ C$  |         | 1       | 10      | nA       |
| $V_{BR}$  | $I_T = 0.01mA$                    | 5.5     | 6.5     |         | V        |
| $V_C$     | $I_{PP} = 5.5A, t_p = 8/20\mu s$  |         | 6.2     |         | V        |
| $V_C$     | $I_{PP} = 8A, t_p = 100ns^{(1)}$  |         | 6.0     |         | V        |
|           | $I_{PP} = 16A, t_p = 100ns^{(1)}$ |         | 9.5     |         | V        |
| $R_{dyn}$ | $I_{PP} = 12A, t_p = 100ns^{(1)}$ |         | 0.43    |         | $\Omega$ |

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

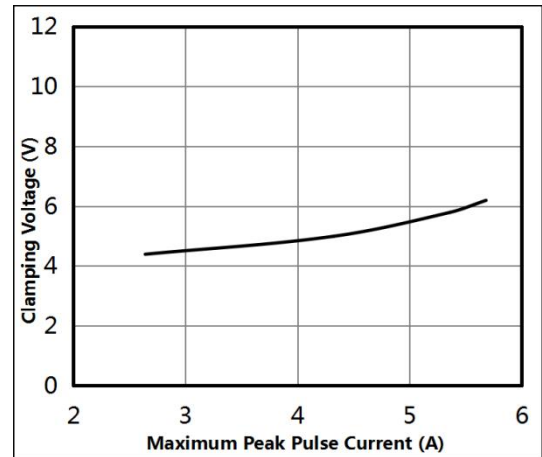
| Symbol        | Test Condition       | Minimum | Typical | Maximum | Units |
|---------------|----------------------|---------|---------|---------|-------|
| $C_{ESD}$     | $V_R = 0V, f = 1MHz$ |         | 0.25    |         | pF    |
|               | $V_R = 0V, f = 5GHz$ |         | 0.20    |         | pF    |
| $\alpha_{IL}$ | $f = 10GHz$          |         | -1.59   |         | dB    |

## Typical Performance Characteristics

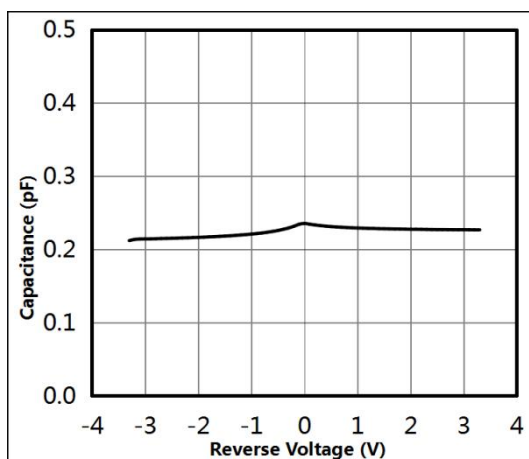
**TLP Measurement of I/O to I/O**



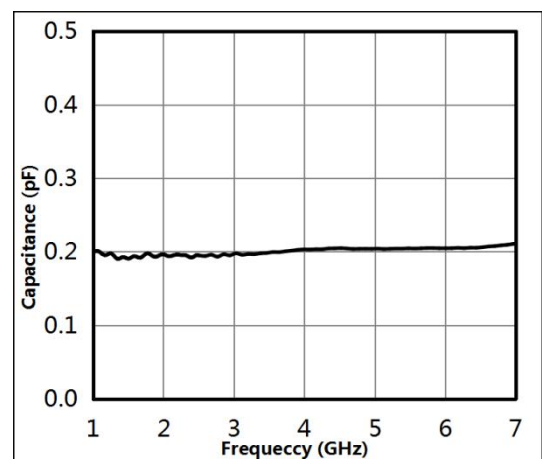
**8/20us Current I/O to I/O**



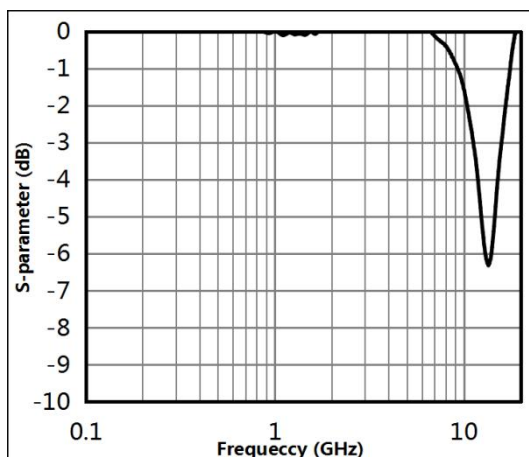
**Capacitance vs Reverse Voltage of I/O to I/O**



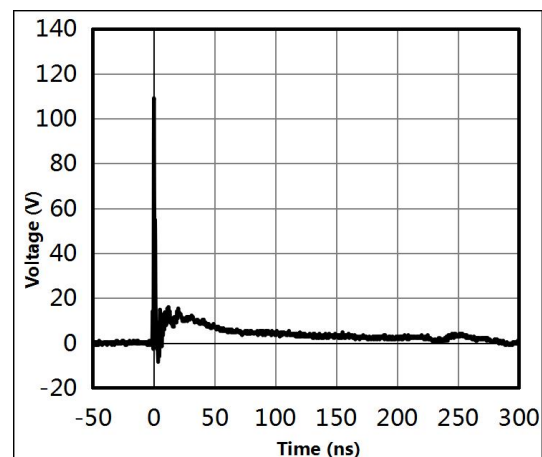
**Capacitance vs Frequency of I/O to I/O**



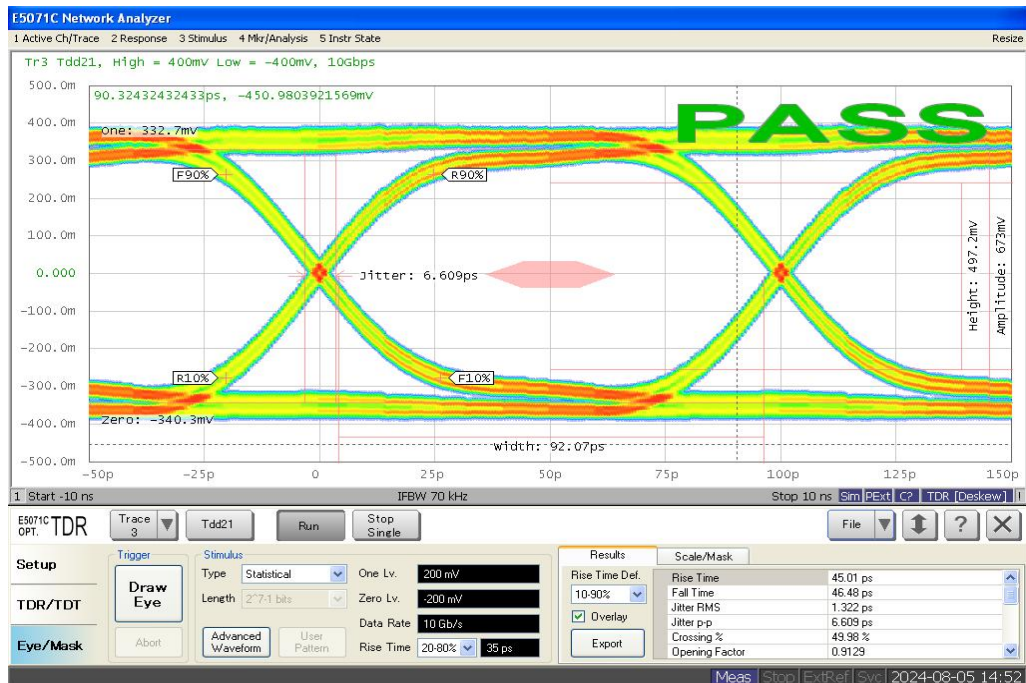
**Insertion loss of I/O to I/O**



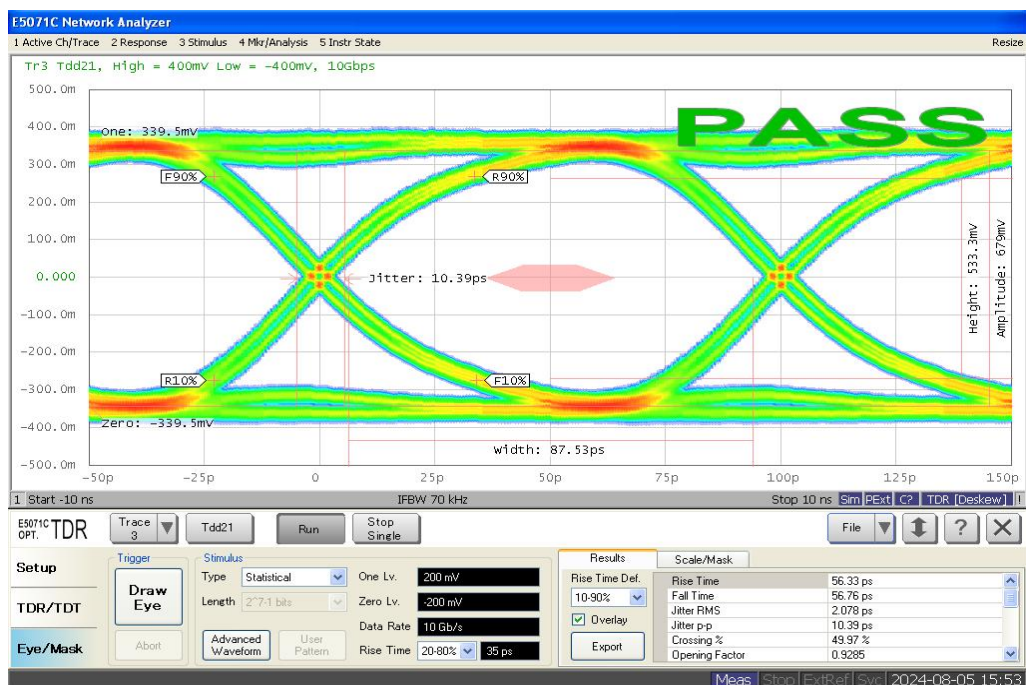
**+8kV Contact IEC Waveform of I/O to I/O**



## Application Curves

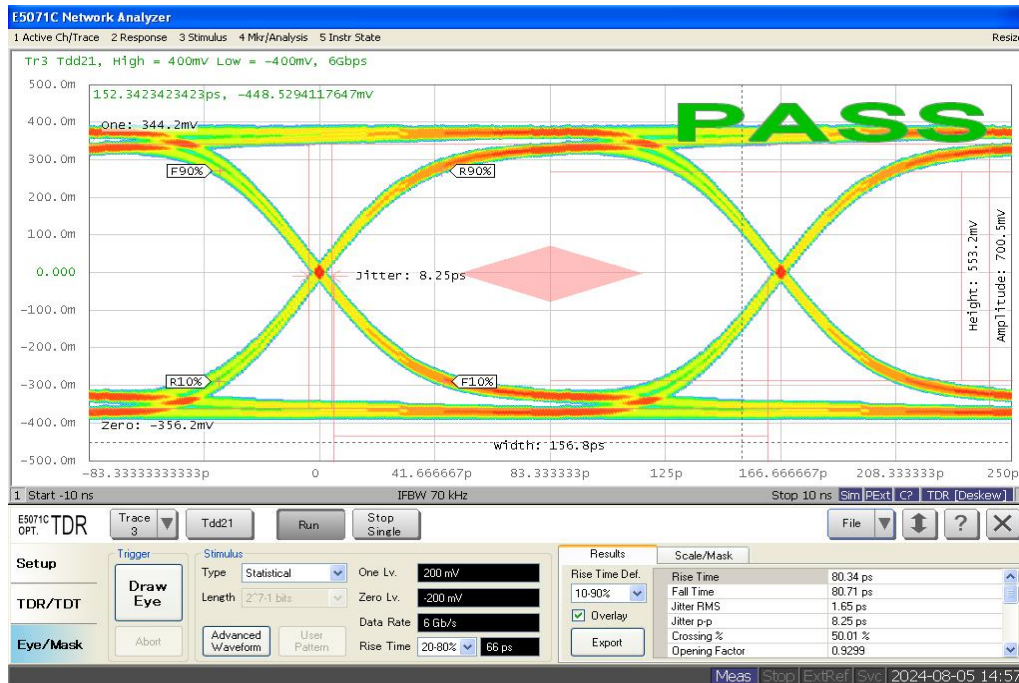


USB3.2 Gen2 Eye Diagram W/O Device (10Gbps)

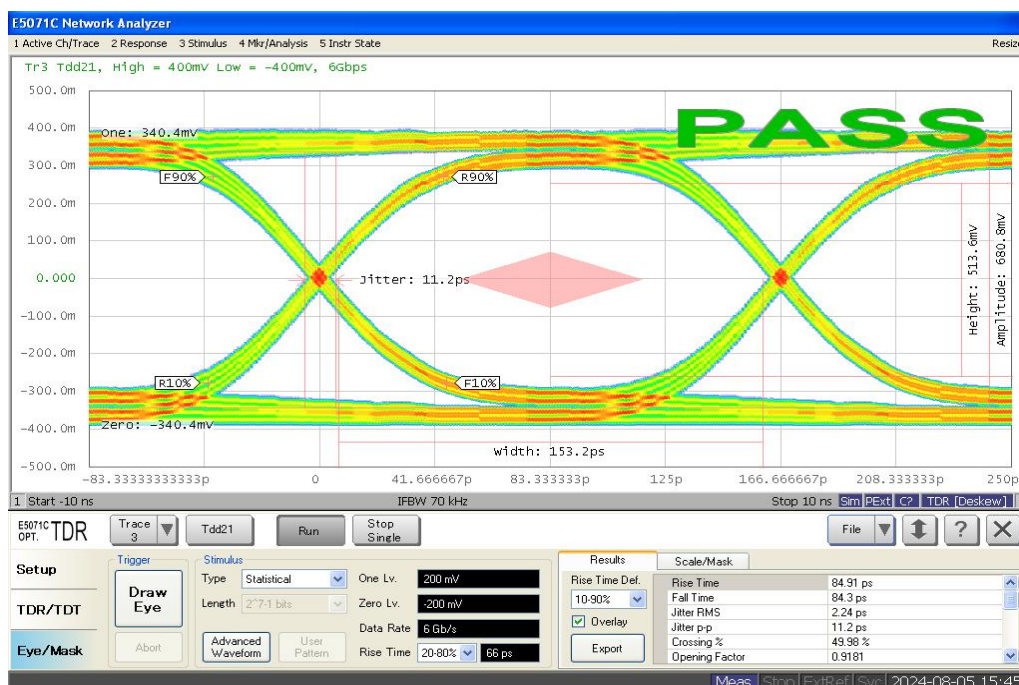


USB3.2 Gen2 Eye Diagram W/I Device (10Gbps)

## Application Curves

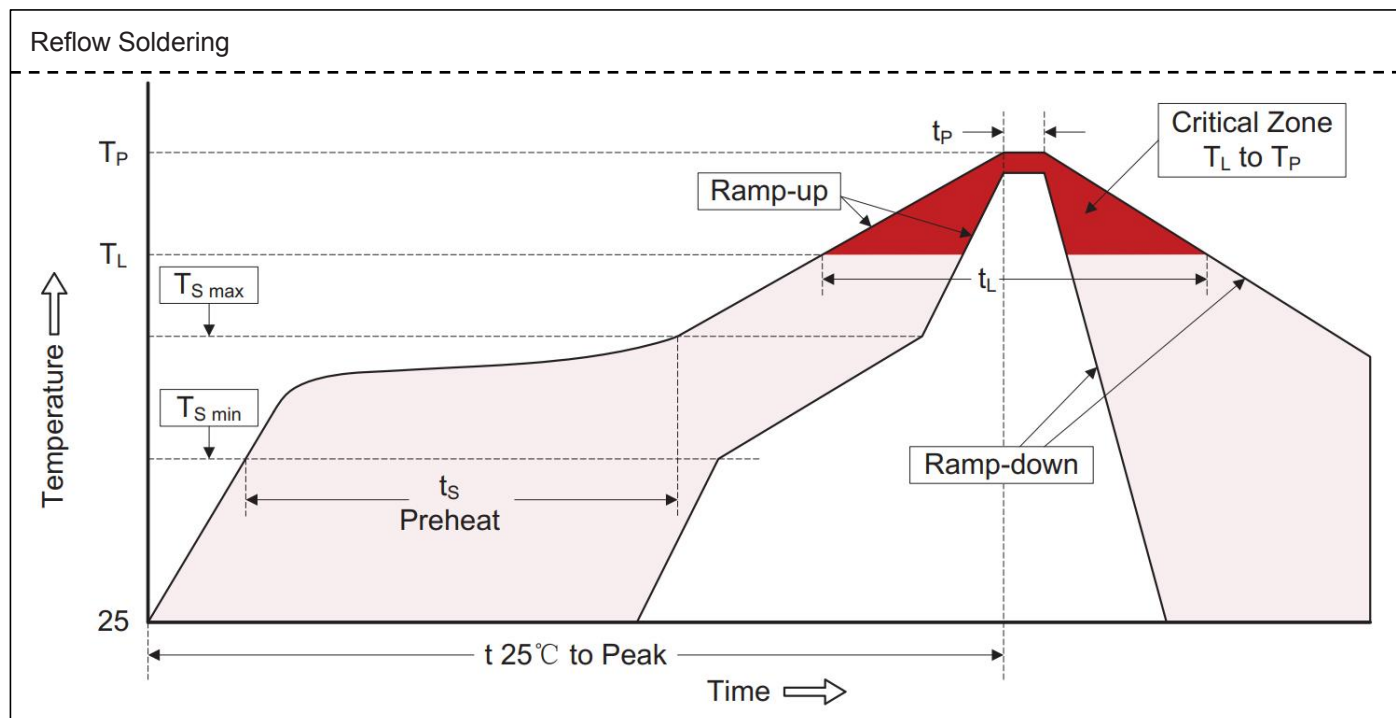


**HDMI2.0 Eye Diagram W/O Device (6Gbps)**



**HDMI2.0 Eye Diagram W/I Device (6Gbps)**

## Recommended Soldering Conditions

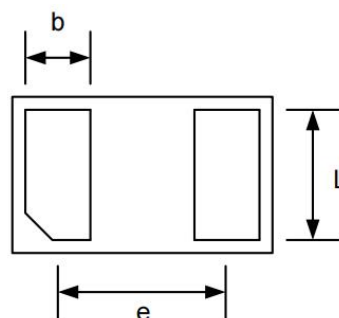
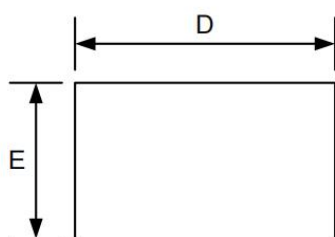


### Recommended Conditions

| 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

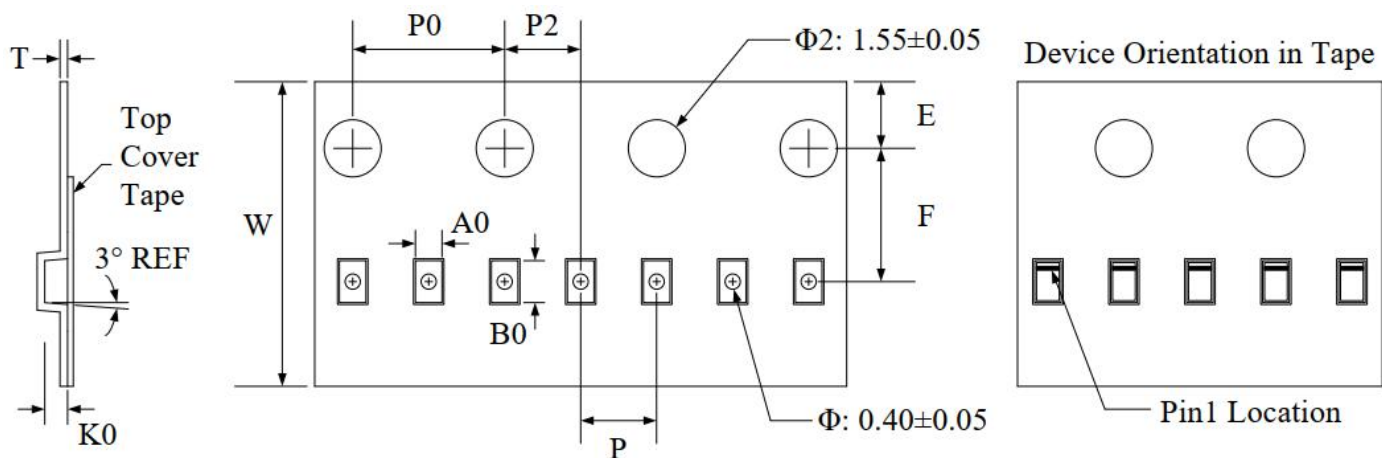
- DFN1006-2L package
- 2 leads, very small package
- MSL-1



Package Dimensions (Controlling dimensions are in millimeters)

| Symbol | Dimensions In Millimeters |         | Dimensions In Inches |         |
|--------|---------------------------|---------|----------------------|---------|
|        | Minimum                   | Maximum | Minimum              | Maximum |
| A      | 0.450                     | 0.550   | 0.017                | 0.022   |
| A1     | 0.000                     | 0.050   | 0.000                | 0.002   |
| D      | 0.950                     | 1.050   | 0.037                | 0.041   |
| E      | 0.550                     | 0.650   | 0.022                | 0.026   |
| b      | 0.200                     | 0.350   | 0.008                | 0.014   |
| 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) | $8.00 \pm 0.1$ | $0.7 \pm 0.05$ | $1.15 \pm 0.05$ | $0.55 \pm 0.05$ | $1.75 \pm 0.1$ | $3.5 \pm 0.05$ | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $2.0 \pm 0.05$ | $0.2 \pm 0.05$ |

## 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 |
|-------------|-----------------|-------------------|-----------|
| TT0361SBX   | 3.3V            | 10,000            | 7 Inch    |