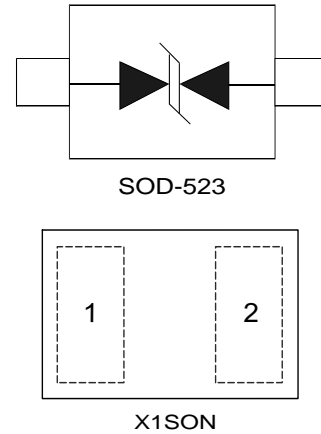


Description

The TPD1E10B06 is a single-channel ESD TVS diode in a small 0402 package convenient for space constrained applications and an industry standard SOD-523 package. This TVS protection product offers ±30 kV contact ESD, ±30 kV IEC air-gap protection, and has an ESD clamp circuit with a back-to-back TVS diode for bipolar or bidirectional signal support. The 12 pF line capacitance of this ESD protection diode is suitable for a wide range of applications supporting data rates up to 400 Mbps.

Typical applications of this ESD protection product are circuit protection for audio lines (microphone, earphone, and speakerphone), SD interfacing, keypad or other buttons, VBUS pin and ID pin of USB ports, and general-purpose I/O ports. This ESD clamp is good for the protection of end equipment like portable devices, wearables, set-top boxes, electronic point-of-sale equipment, appliances, and products for building automation.



Applications

- End equipment:
 - Portable devices
 - Wearables
 - Set-top boxes
 - Electronic point of sale (EPOS)
 - Appliances
 - Building automation
- Interfaces:
 - Audio lines
 - Push-buttons
 - General-purpose input or output (GPIO)

Features

- Provides system-level ESD protection for low-voltage I/O interface
- IEC 61000-4-2 level 4 ESD protection
 - ±30 kV contact discharge
 - ±30 kV air-gap discharge
- IEC 61000-4-5 surge: 6 A (8/20 μs)
- I/O capacitance 12 pF (typical)
- R_{DYN} 0.4 Ω (typical)
- DC breakdown voltage ±6 V (minimum)
- Ultralow leakage current 100 nA (maximum)
- 10-V clamping voltage (maximum at I_{PP} = 1 A)
- Industrial temperature range: –40°C to 125°C
- Small 0402 footprint
(1 mm × 0.6 mm × 0.5 mm)
- Industry standard SOD-523 package
(0.8 mm × 1.2 mm)

Specifications

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | MIN | MAX | UNIT |
|------------------|--|-----|-----|------|
| Peak pulse | IEC 61000-4-5 power (t _p - 8/20 μs) at 25°C | | 90 | W |
| | IEC 61000-4-5 current (t _p - 8/20 μs) at 25°C | | 6 | A |
| T _A | Operating free-air temperature | -40 | 125 | °C |
| T _{stg} | Storage temperature | -65 | 155 | °C |

(1) Stresses beyond those listed under *Absolute Maximum Rating* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

ESD Ratings—JEDEC Specification

| | | | VALUE | UNIT |
|--------------------|-------------------------------|---|-------|------|
| V _(ESD) | Electrostatic discharge - DPY | Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001 | ±2500 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101 | ±1000 | V |
| V _(ESD) | Electrostatic discharge - DYA | Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001 | ±2500 | V |
| | | Charged device model (CDM), per JEDEC specification JS-002 | ±1000 | V |

ESD Ratings—IEC Specification

| | | | VALUE | UNIT |
|--------------------|-------------------------|---|--------|------|
| V _(ESD) | Electrostatic discharge | IEC 61000-4-2 Contact Discharge, all pins | ±30000 | V |
| | | IEC 61000-4-2 Air-gap Discharge, all pins | ±30000 | |

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

| | | MIN | NOM | MAX | UNIT |
|-------------------|--------------------------------|------|-----|-----|------|
| Operating voltage | Pin 1 to 2 or Pin 2 to 1 | -5.5 | | 5.5 | V |
| T _A | Operating free-air temperature | -40 | | 125 | °C |

Thermal Information

| THERMAL METRIC ⁽¹⁾ | | TPD1E10B06 | | UNIT |
|-------------------------------|--|-------------|--------------|------|
| | | DPY (X1SON) | DYA (SOD523) | |
| | | 2 PINS | 2 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 615.5 | 730.8 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 404.8 | 413.4 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 493.3 | 497.7 | °C/W |
| Ψ _{JT} | Junction-to-top characterization parameter | 127.7 | 129.7 | °C/W |
| Ψ _{JB} | Junction-to-board characterization parameter | 493.3 | 491.8 | °C/W |

Thermal Information (continued)

| THERMAL METRIC ⁽¹⁾ | | TPD1E10B06 | | UNIT |
|-------------------------------|--|-------------|--------------|------|
| | | DPY (X1SON) | DYA (SOD523) | |
| | | 2 PINS | 2 PINS | |
| R _{θJC(bot)} | Junction-to-case (bottom) thermal resistance | 162 | - | °C/W |

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.

Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITION | MIN | TYP | MAX | UNIT |
|-----------------------|---|--|-----|------|-----|------|
| V _{RWM} | Reverse stand-off voltage | Pin 1 to 2 or Pin 2 to 1 | | | 5.5 | V |
| I _{LEAK} | Leakage current | Pin 1 = 5 V, Pin 2 = 0 V | | | 100 | nA |
| V _{Clamp1,2} | Clamp voltage with surge strike on pin 1, pin 2 grounded. | I _{PP} = 1 A, t _p = 8/20 μs ⁽²⁾ | | | 10 | V |
| V _{Clamp1,2} | Clamp voltage with surge strike on pin 1, pin 2 grounded. | I _{PP} = 5 A, t _p = 8/20 μs ⁽²⁾ | | | 14 | V |
| V _{Clamp2,1} | Clamp voltage with surge strike on pin 2, pin 1 grounded. | I _{PP} = 1 A, t _p = 8/20 μs ⁽²⁾ | | | 8.5 | V |
| | | I _{PP} = 5 A, t _p = 8/20 μs ⁽²⁾ | | | 14 | |
| R _{DYN} | Dynamic resistance | Pin 1 to Pin 2 ⁽¹⁾ | | 0.32 | | Ω |
| | | Pin 2 to Pin 1 ⁽¹⁾ | | 0.38 | | |
| C _{IO} | I/O capacitance | V _{IO} = 2.5 V; f = 1 MHz | | 12 | | pF |
| V _{BR1,2} | Break-down voltage, pin 1 to pin 2 | I _{IO} = 1 mA | 6 | | | V |
| V _{BR2,1} | Break-down voltage, pin 2 to pin 1 | I _{IO} = 1 mA | 6 | | | V |

- (1) Extraction of R_{DYN} using least squares fit of TLP characteristics between I_{PP} = 10 A and I_{PP} = 20 A.
- (2) Nonrepetitive current pulse 8 to 20 μs exponentially decaying waveform according to IEC 61000-4-5

Typical Characteristics

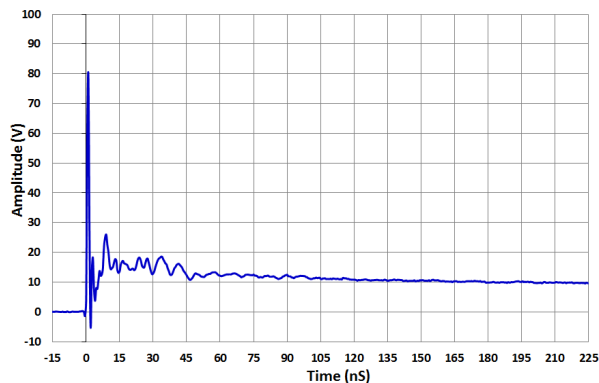


Figure 6-1. IEC 61000-4-2 Clamp Voltage +8 kV Contact ESD

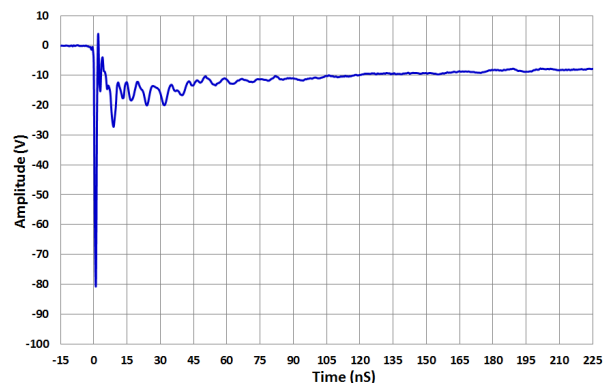


Figure 6-2. IEC 61000-4-2 Clamp Voltage -8-kV Contact ESD

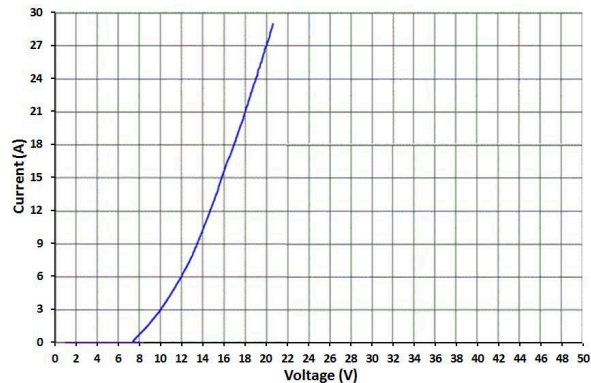


Figure 6-3. Transmission Line Pulse (TLP) Waveform Pin 1 to Pin 2

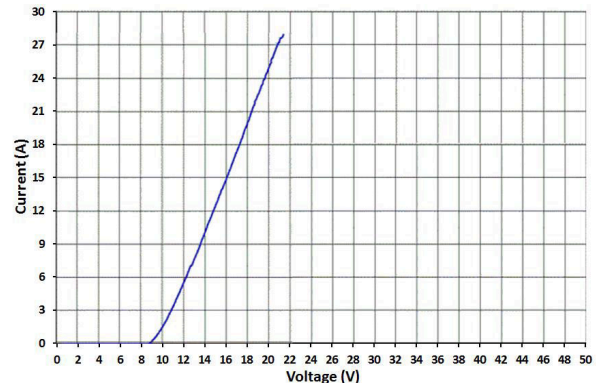


Figure 6-4. Transmission Line Pulse (TLP) Waveform Pin 2 to Pin 1

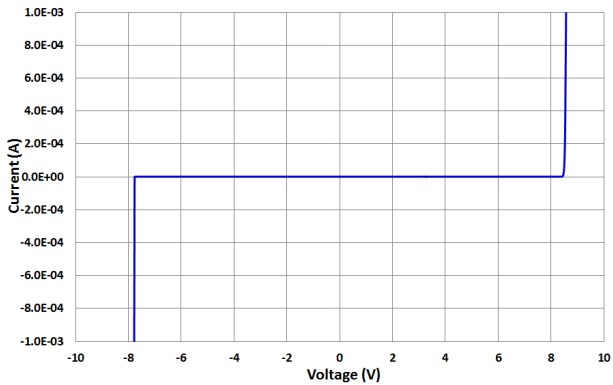


Figure 6-5. IV Curve

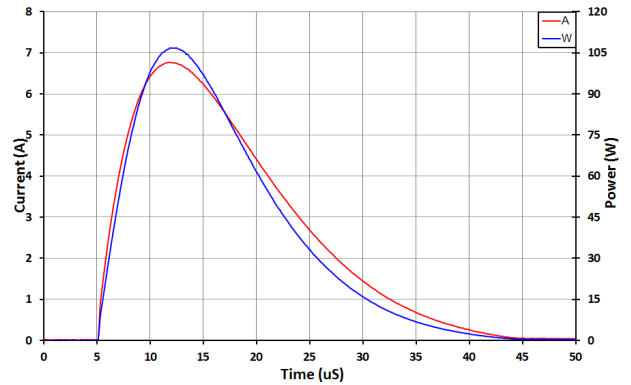


Figure 6-6. Positive Surge Waveform 8 to 20 μ s

Typical Characteristics (continued)

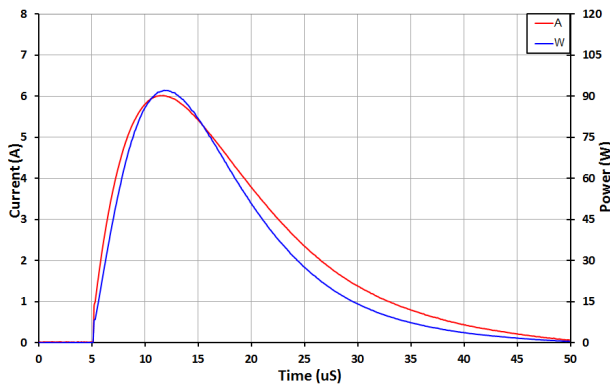


Figure 6-7. Negative Surge Waveform 8 to 20 μ s

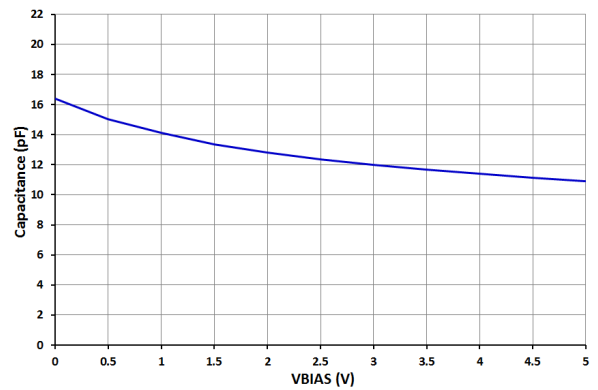


Figure 6-8. Pin Capacitance Across V_{BIAS}

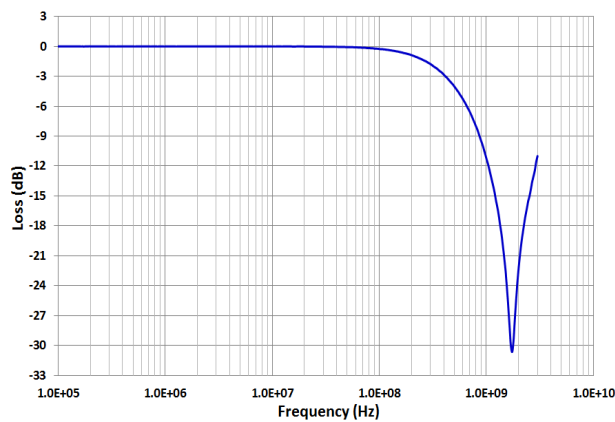
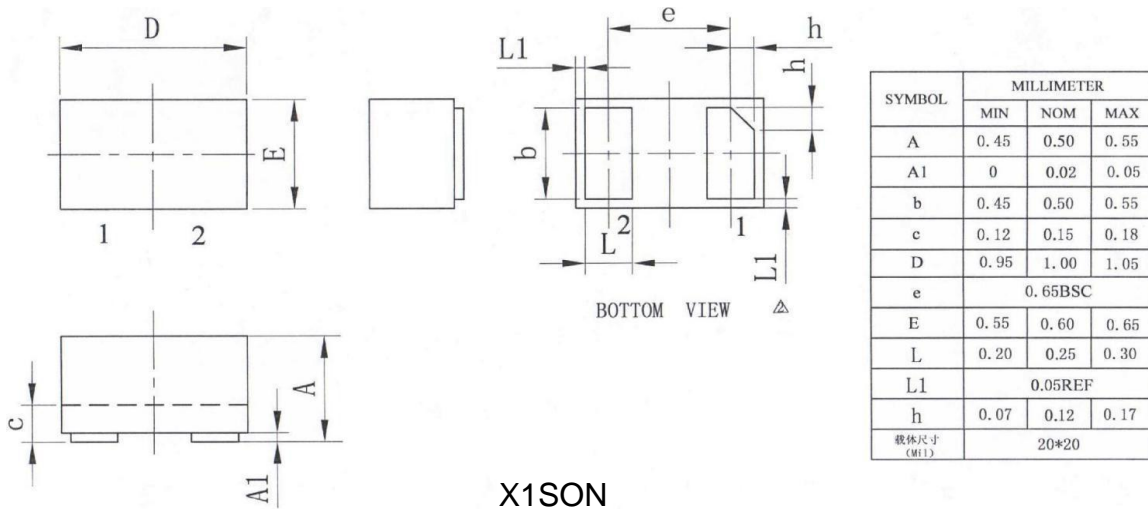
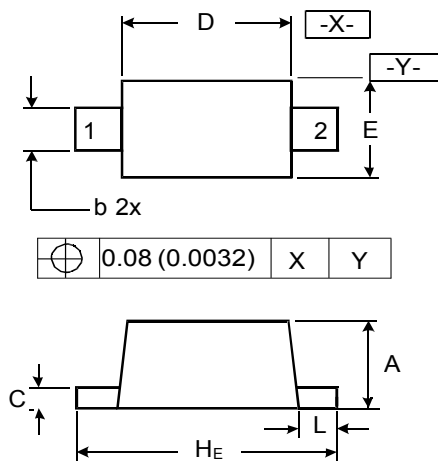


Figure 6-9. Insertion Loss

Outline Drawing – X1SON/SOD-523

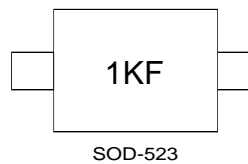
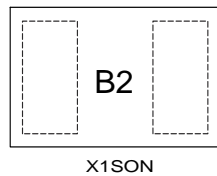


X1SON



SOD-523

Marking



Ordering information

| Order code | Marking codes | Package | Baseqty | Deliverymode |
|-------------------|---------------|---------|---------|---------------|
| UMW TPD1E0B06DPYR | B2 | X1SON | 10000 | Tape and reel |
| UMW TPD1E0B06DPAR | 1KF | SOD-523 | 3000 | Tape and reel |