

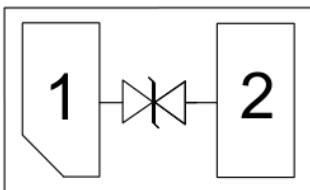
## Features

- ◆ Ultra small package: 1.0x0.6x0.5mm
- ◆ Ultra low capacitance: 0.35pF typical
- ◆ Ultra low leakage: nA level
- ◆ Low operating voltage: 5V
- ◆ Low clamping voltage
- ◆ 2-pin leadless package
- ◆ Complies with following standards:
  - IEC 61000-4-2 (ESD) immunity test
    - Air discharge:  $\pm 20\text{kV}$
    - Contact discharge:  $\pm 15\text{kV}$
  - IEC61000-4-5 (Lightning) 4A (8/20 $\mu\text{s}$ )
- ◆ RoHS Compliant

## Description

The ESDA5B0M5D2 is a bi-directional TVS diode, utilizing leading monolithic silicon technology to provide fast response time and low ESD clamping voltage, making this device an ideal solution for protecting voltage sensitive high-speed data lines. The ESDA5B0M5D2 has an ultra-low capacitance with a typical value at 0.35pF, and complies with the IEC -4-2 (ESD) standard with  $\pm 20\text{kV}$  air and  $\pm 15\text{kV}$  contact discharge. It is assembled into an ultra-small 1.0x0.6x0.5mm lead-free DFN package. The small size, ultra-low capacitance and high ESD surge protection make ESDA5B0M5D2 an ideal choice to protect cell phone, digital video interfaces and other high speed ports.

## Circuit Diagram



## Applications

- ◆ Smart phones
- ◆ Display Ports
- ◆ MDDI Ports
- ◆ USB Ports
- ◆ Digital Video Interface (DVI)
- ◆ PCI Express and Serial SATA Ports

**Absolute Maximum Ratings :** ( $T_c=25^{\circ}\text{C}$  unless otherwise noted)

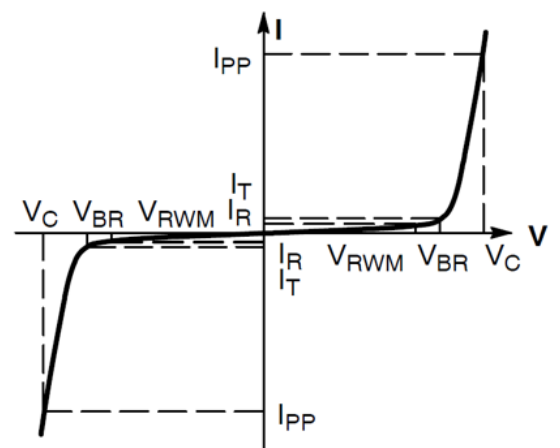
| Parameter                                | Symbol | Value       | Unit               |
|--|--------|-------------|--------------------|
| Peak Pulse Power (8/20 $\mu\text{s}$ )   | Ppk    | 80          | W                  |
| Peak Pulse Current (8/20 $\mu\text{s}$ ) | IPP    | 4           | A                  |
| ESD per IEC 61000-4-2 (Air)              | VESD   | $\pm 20$    | kV                 |
| ESD per IEC 61000-4-2 (Contact)          |        | $\pm 15$    |                    |
| Operating Temperature Range              | TJ     | -55 to +125 | $^{\circ}\text{C}$ |
| Storage Temperature Range                | Tstg   | -55 to +150 | $^{\circ}\text{C}$ |

**Electrical Characteristics :** ( $T_c=25^{\circ}\text{C}$  unless otherwise noted)

| Parameter               | Symbol    | Test Condition                                    | Min | Typ  | Max  | Unit          |
|-------------------------|-----------|---|-----|------|------|---------------|
| Reverse Working Voltage | $V_{RWM}$ |   |     |      | 5.0  | V             |
| Breakdown Voltage       | $V_{BR}$  | $I_T = 1\text{mA}$                                | 6.0 |      | 9.5  | V             |
| Reverse Leakage Current | $I_R$     | $V_{RWM} = 5.0\text{V}$                           |     |      | 0.1  | $\mu\text{A}$ |
| Clamping Voltage        | $V_C$     | $I_{PP} = 1\text{A}$ (8 / 20 $\mu\text{s}$ pulse) |     |      | 12.0 | V             |
| Clamping Voltage        | $V_C$     | $I_{PP} = 4\text{A}$ (8 / 20 $\mu\text{s}$ pulse) |     |      | 20.0 | V             |
| Junction Capacitance    | $C_J$     | $V_R = 0\text{V}$ , $f = 1\text{MHz}$             |     | 0.35 | 0.5  | pF            |

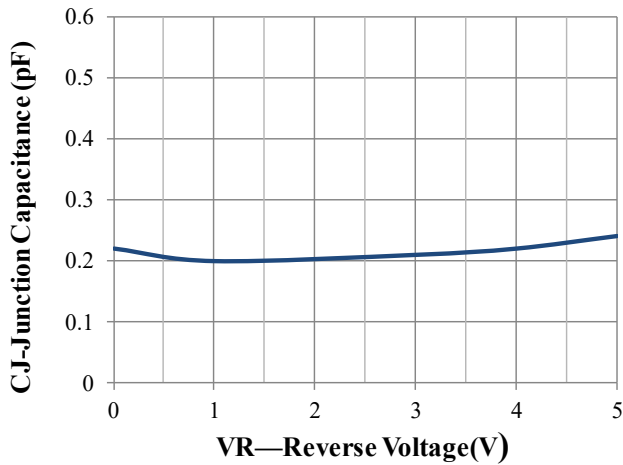
**Portion Electronics Parameter**

| Symbol    | Parameter                           |
|-----------|-------------------------------------|
| $V_{RWM}$ | Peak Reverse Working Voltage        |
| $I_R$     | Reverse Leakage Current @ $V_{RWM}$ |
| $V_{BR}$  | Breakdown Voltage @ $I_T$           |
| $I_T$     | Test Current                        |
| $I_{PP}$  | Maximum Reverse Peak Pulse Current  |
| $V_C$     | Clamping Voltage @ $I_{PP}$         |

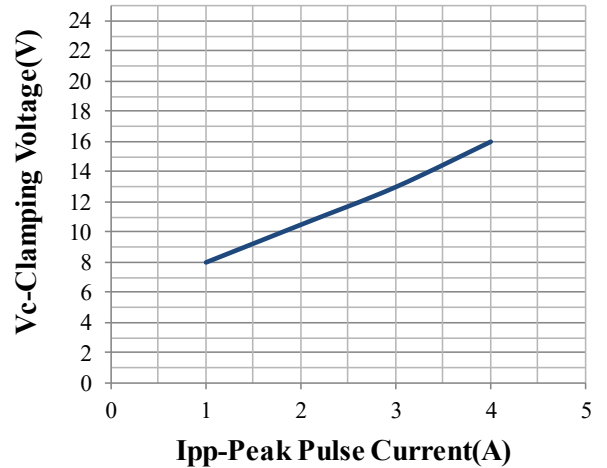


**Bi-Directional TVS**

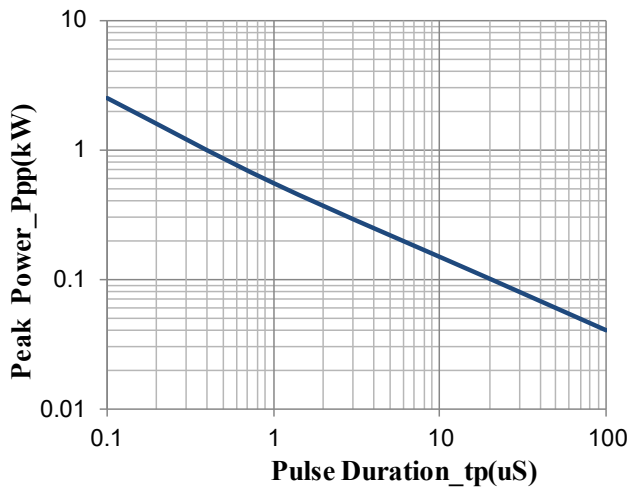
Typical Characteristics: (T<sub>C</sub>=25°C unless otherwise noted)



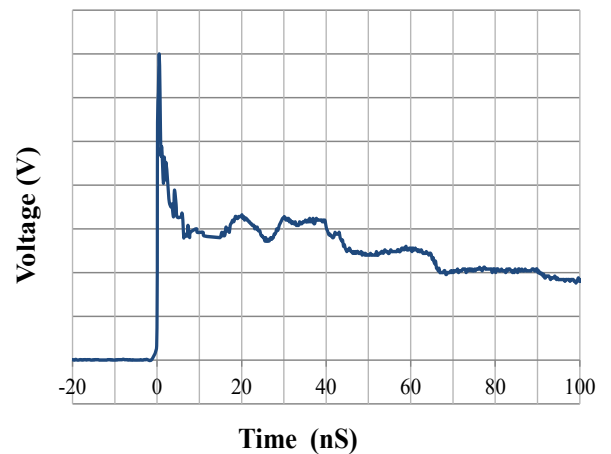
Junction Capacitance vs. Reverse Voltage



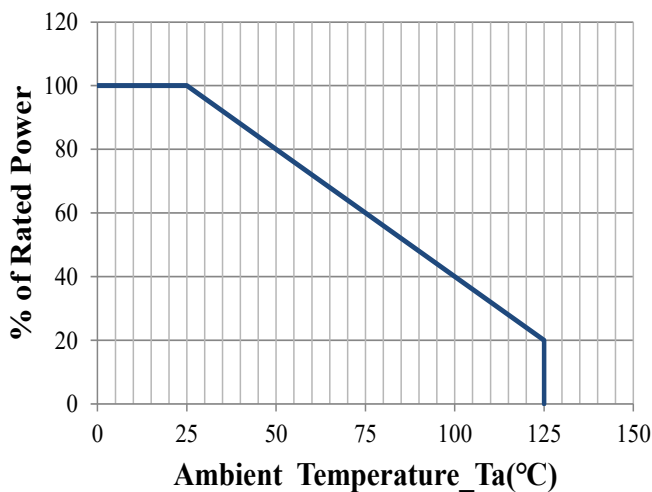
Clamping Voltage vs. Peak Pulse Current



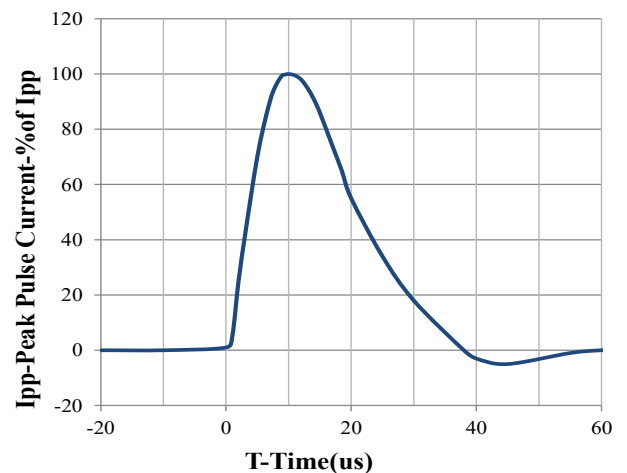
Peak Pulse Power vs. Pulse Time



IEC61000-4-2 Pulse Waveform



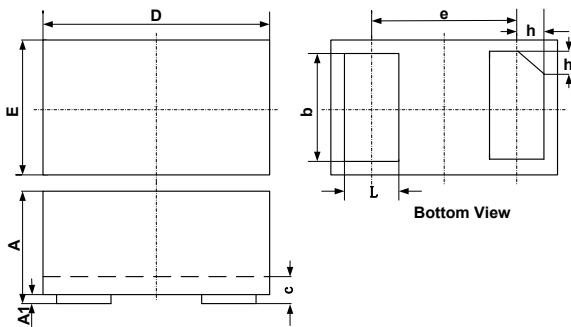
Power Derating Curve



8 X 20us Pulse Waveform

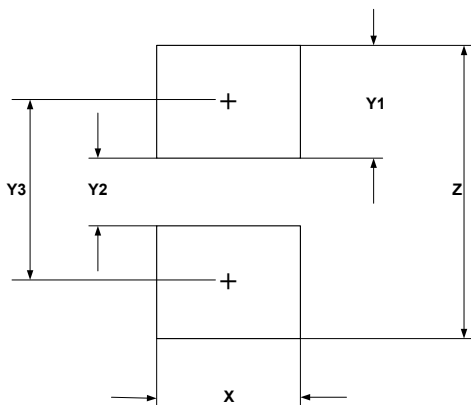
## Package Dimension

### DFN1006-2(0402) Package Outline



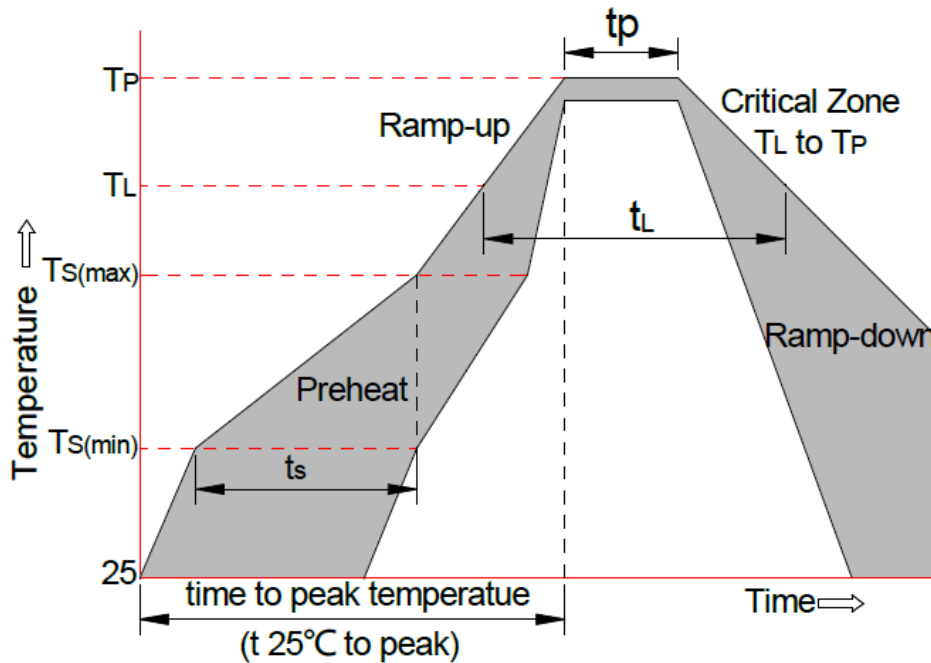
| SYM | DIMENSIONS  |      |      |           |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MILLIMETERS |      |      | INCHES    |       |       |
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.45        | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| A1  | 0.00        | 0.02 | 0.05 | 0.000     | 0.001 | 0.002 |
| b   | 0.45        | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| c   | 0.12        | 0.15 | 0.18 | 0.005     | 0.006 | 0.007 |
| D   | 0.95        | 1.00 | 1.05 | 0.037     | 0.039 | 0.041 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| E   | 0.55        | 0.60 | 0.65 | 0.022     | 0.024 | 0.026 |
| L   | 0.20        | 0.25 | 0.30 | 0.008     | 0.010 | 0.012 |
| h   | 0.07        | 0.12 | 0.17 | 0.003     | 0.005 | 0.007 |

## Suggested Land Pattern



| SYM | DIMENSIONS  |        |
|-----|-------------|--------|
|     | MILLIMETERS | INCHES |
| X   | 0.60        | 0.024  |
| Y1  | 0.50        | 0.020  |
| Y2  | 0.30        | 0.012  |
| Y3  | 0.80        | 0.032  |
| Z   | 1.30        | 0.052  |

### Soldering Parameters



| Reflow Condition  |                                    | Pb-Free Assembly |
|---|------------------------------------|------------------|
| Pre-heat  | -Temperature Min ( $T_{s (min)}$ ) | +150°C           |
|   | -Temperature Max ( $T_{s (max)}$ ) | +200°C           |
|   | -Time (Min to Max) ( $t_s$ )       | 60-180 secs      |
| Average ramp up rate( Liquid us Temp ( $T_L$ ) to peak) |                                    | 3°C/sec. Max     |
| $T_{s (max)}$ to $T_L$ -Ramp-up Rate                    |                                    | 3°C/sec. Max     |
| Reflow  | -Temperature ( $T_L$ ) (Liquid us) | +217°C           |
|   | -Temperature ( $t_L$ )             | 60-150 secs      |
| Peak Temp ( $T_p$ )                                     |                                    | +260(+0/-5)°C    |
| Time within 5°C of actual Peak Temp ( $t_p$ )           |                                    | 30 secs. Max     |
| Ramp-down Rate  |                                    | 6 °C/secs. Max   |
| xTime 25°C to Peak Temp ( $T_P$ )                       |                                    | 8 min. Max       |
| Do not exceed   |                                    | +260°C           |

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