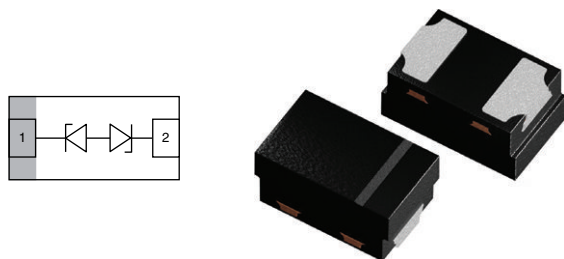


# Single-Line Bidirectional ESD-Protection Diode in DFN1006-2B



## MARKING (example only)



Bar = pin 1 marking

X = date code

YY = type code (see table below)

## LINKS TO ADDITIONAL RESOURCES



3D Models

**SPICE**

Models

## FEATURES

- Compact DFN1006-2B package
- Low package height < 0.5 mm
- 1-line bidirectional ESD-protection
- AEC-Q101 qualified available
- OPEN Alliance compliant  
10BASE-T1S  
100BASE-T1  
1000BASE-T1
- Working range  $\pm 24$  V
- Trigger voltage >100 V
- Capacitance < 2 pF
- ESD immunity acc. ISO 10605 and IEC 61000-4-2 (150 pF/330  $\Omega$ )  $\pm 15$  kV (1000 x contact discharge)
- Lead plating: Sn (e3)
  - Including wettable side walls (flanks)
  - Soldering can be checked by standard vision inspection
  - AOI = automated optical inspection
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## ORDERING INFORMATION

| PART NUMBER<br>(EXAMPLE) | ENVIRONMENTAL AND QUALITY CODE |                                                 |               |      | PACKAGING CODE                 | ORDERING CODE<br>(EXAMPLE) |
|--------------------------|--------------------------------|-------------------------------------------------|---------------|------|--------------------------------|----------------------------|
|                          | AEC-Q101<br>QUALIFIED          | RoHS-COMPLIANT +<br>LEAD (Pb)-FREE TERMINATIONS | TIN<br>PLATED | REV. | 10K PER 7" REEL<br>(8 mm TAPE) |                            |
|                          |                                | GREEN                                           |               |      | 10K = MOQ                      |                            |
| VETH100A1DD1             | -                              | G                                               | 3             | -    | 08                             | VETH100A1DD1-G3-08         |
| VETH100A1DD1             | H                              | G                                               | 3             | -    | 08                             | VETH100A1DD1HG3-08         |

## PACKAGE DATA

| DEVICE NAME  | PACKAGE NAME | TYPE CODE | WEIGHT  | MOLDING COMPOUND<br>FLAMMABILITY RATING | MOISTURE SENSITIVITY LEVEL           | SOLDERING CONDITIONS            |
|--------------|--------------|-----------|---------|-----------------------------------------|--------------------------------------|---------------------------------|
| VETH100A1DD1 | DFN1006-2B   | 2S        | 0.83 mg | UL 94 V-0                               | MSL level 1<br>(according J-STD-020) | Peak temperature<br>max. 260 °C |

## ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25$ °C, unless otherwise specified)

| PARAMETER             | TEST CONDITIONS                                                                        | SYMBOL    | VALUE       | UNIT |
|-----------------------|----------------------------------------------------------------------------------------|-----------|-------------|------|
| ESD immunity          | Contact discharge acc. ISO 10605 and IEC 61000-4-2 (150 pF/330 $\Omega$ ); 1000 pulses | $V_{ESD}$ | 15          | kV   |
| Operating temperature | Junction temperature                                                                   | $T_J$     | -55 to +150 | °C   |
| Storage temperature   |                                                                                        | $T_{stg}$ | -55 to +150 | °C   |

## ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25$ °C, unless otherwise specified)

| PARAMETER          | TEST CONDITIONS / REMARKS                                                                                    | SYMBOL        | MIN. | TYP.  | MAX. | UNIT     |
|--------------------|--------------------------------------------------------------------------------------------------------------|---------------|------|-------|------|----------|
| Protection paths   | Number of lines which can be protected                                                                       | $N_{channel}$ | -    | -     | 1    | lines    |
| Stand off voltage  | Max. working voltage                                                                                         | $V_{RWM}$     | -    | -     | 24   | V        |
| Leakage current    | At $V_R = 24$ V                                                                                              | $I_R$         | -    | 0.001 | 0.1  | $\mu A$  |
| Trigger voltage    | Transmission line pulse (TLP) = 100 ns; $I_{TLP} = 1$ A                                                      | $V_T$         | 100  | -     | -    | V        |
| Clamping voltage   | At $I_{TLP} = 1$ A, $t_p = 100$ ns (TLP)                                                                     | $V_C$         | 26   | 31    | -    | V        |
|                    | At $I_{TLP} = 10$ A, $t_p = 100$ ns (TLP)                                                                    | $V_C$         | -    | 34    | -    | V        |
| Dynamic resistance | $t_p = 100$ ns (TLP)                                                                                         | $r_{dyn}$     | -    | 0.4   | -    | $\Omega$ |
| Capacitance        | At $V_R = 0$ V; $f = 1$ MHz; $V_{AC} \pm 10$ mV                                                              | $C_D$         | -    | 1.7   | 2.0  | pF       |
|                    | At $V_R = 0$ V; $f = 1$ MHz; $V_{AC} \pm 10$ mV; Two devices in series according to OPEN Alliance 10BASE-T1S | $C_D$         | -    | 0.85  | 1.0  | pF       |
|                    | At $V_R = 0$ V; $f = 1$ MHz; $V_{AC} \pm 1$ V                                                                | $C_D$         | -    | 1.4   | -    | pF       |

## TECHNICAL NOTE

The ESD protection diode VETH100A1DD1 is a one line, bidirectional ESD-protection diode made for Automotive EtherNet which meets the OPEN Alliance specifications:

[IEEE 10BASE-T1S EMC Test Specification for Suppression Devices](#)

[IEEE 100BASE-T1 EMC Test Specification for Suppression Devices](#)

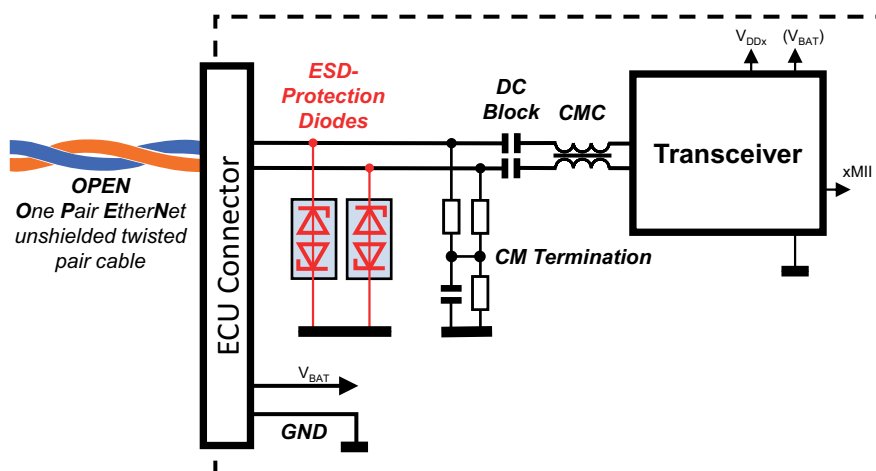
[IEEE 1000BASE-T1 EMC Test Specification for Suppression Devices](#)

The OPEN Alliance specifications specify various tests with the ESD protection diode mounted on test boards simulating the real environment in Automotive Ethernet application.

The test reports include the device classification according to related test specification such as:

- Mixed mode S-parameter measurement
- Damage from ESD
- ESD discharge current measurement and
- Unwanted clamping effect at RF immunity tests

The test reports are available on request (mail to: [ESDprotection@vishay.com](mailto:ESDprotection@vishay.com))



Connected between data line and ground the VETH100A1DD1 blocks voltages between -100 V and +100 V with low leakage current. Such high voltages can be induced in the unshielded twisted One Pair EtherNet (OPEN) cables by electromagnetic fields from anywhere in and around the vehicle where the in-vehicle-network is installed.

It needs a trigger voltage  $V_T$  above 100 V to trigger the voltage snap-back of the ESD-protection diode. In its snap-back state, the VETH100A1DD1 effectively clamps ESD pulses down to around 30 V (at  $I_{TLP} = 1$  A). Additionally with this low dynamic resistance  $r_{dyn}$  the clamping voltage is only slightly depending on the current flowing through the diode to ground.

The very low capacitance  $C_D$  makes the VETH100A1DD1 invisible for the data signals, so that the data rate on the Automotive EtherNet network will not be affected.

## ORDERING INFORMATION TABLE

Device code

|          |            |            |          |          |            |
|----------|------------|------------|----------|----------|------------|
| <b>V</b> | <b>ETH</b> | <b>100</b> | <b>A</b> | <b>1</b> | <b>DD1</b> |
| ①        | ②          | ③          | ④        | ⑤        | ⑥          |

|          |   |                                     |
|----------|---|-------------------------------------|
| <b>1</b> | - | <b>V = Vishay</b>                   |
| <b>2</b> | - | <b>ETH = Ethernet</b>               |
| <b>3</b> | - | <b>100 = Blocking voltage 100 V</b> |
| <b>4</b> | - | <b>A = Version number</b>           |
| <b>5</b> | - | <b>1 = 1-line protection</b>        |
| <b>6</b> | - | <b>DD1 = DFN1006-2B package</b>     |

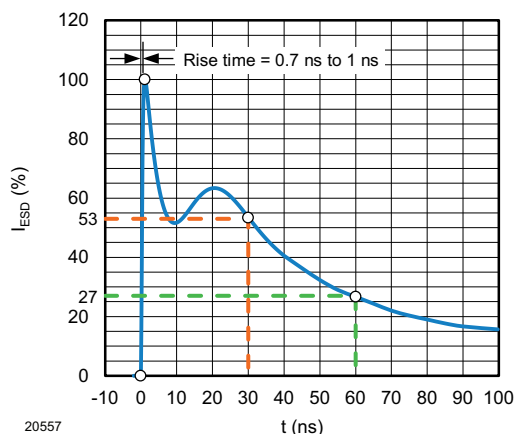


Fig. 1 - ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330  $\Omega$  / 150 pF)

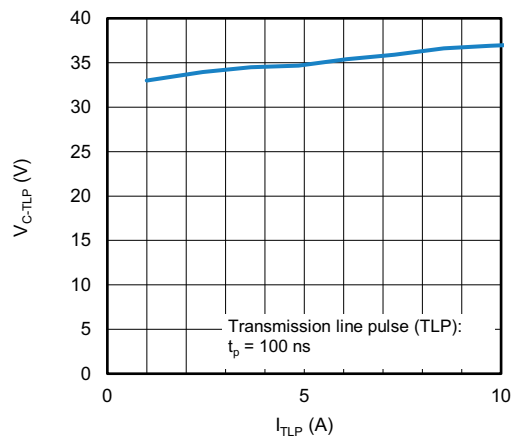


Fig. 4 - Typical Clamping Voltage vs. Peak Pulse Current

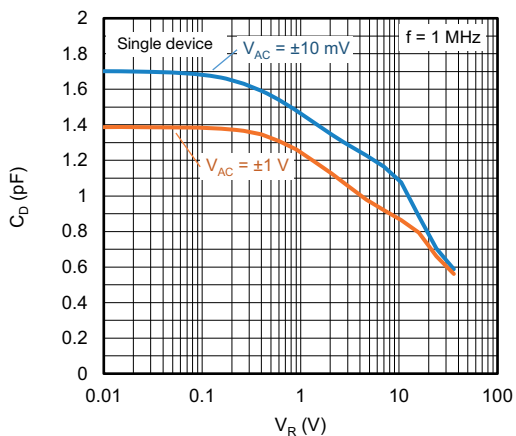


Fig. 2 - Typical Capacitance vs. Reverse Voltage - Single Device

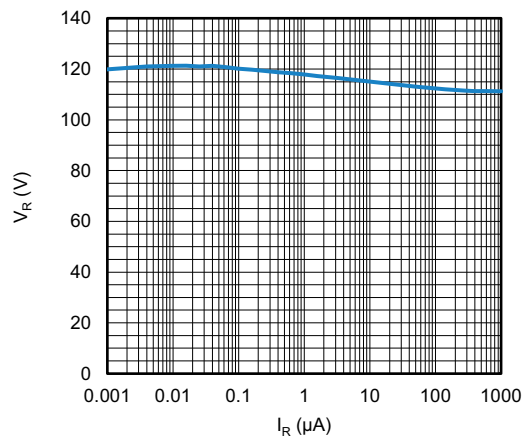


Fig. 5 - Typical Reverse Voltage vs. Reverse Current

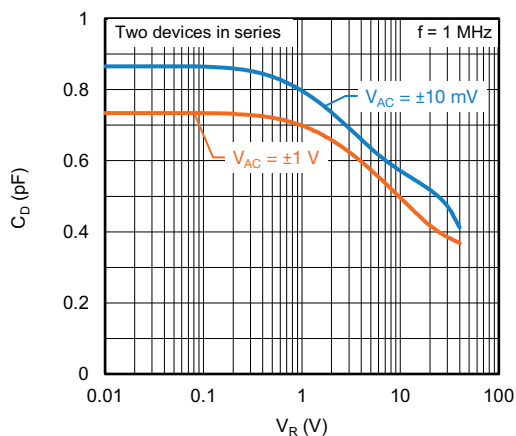


Fig. 3 - Typical Capacitance vs. Reverse Voltage - Two Devices in Series

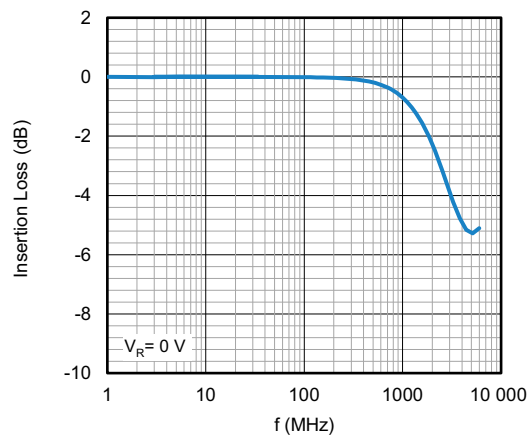


Fig. 6 - Typical Insertion Loss in a 50  $\Omega$  - System

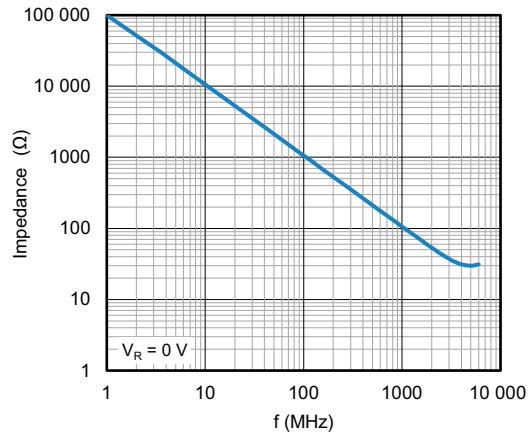
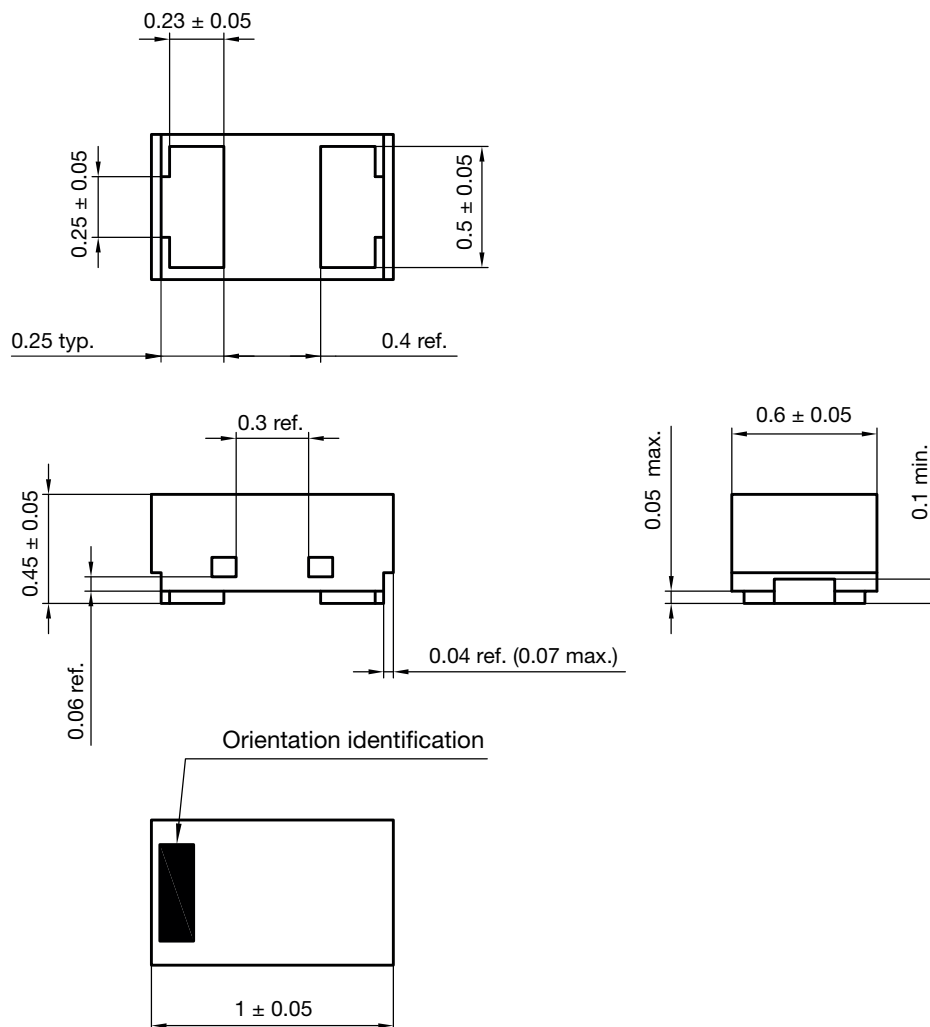


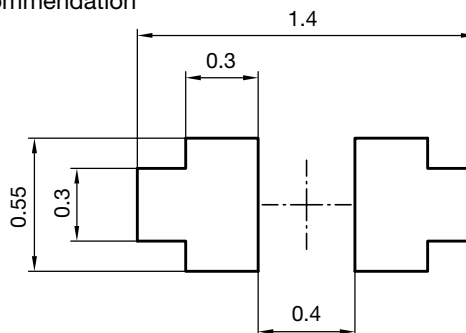
Fig. 7 - Typical Device Impedance vs. Frequency



**PACKAGE DIMENSIONS** in millimeters (inches): **DFN1006-2B**

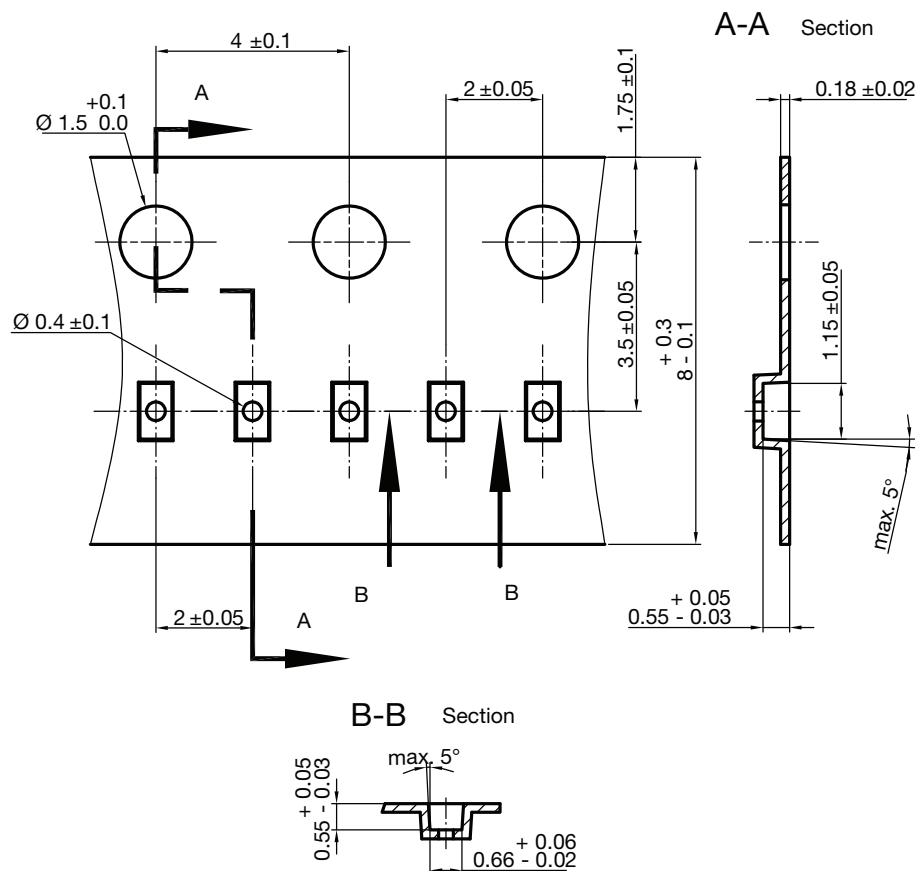


**Footprint recommendation**



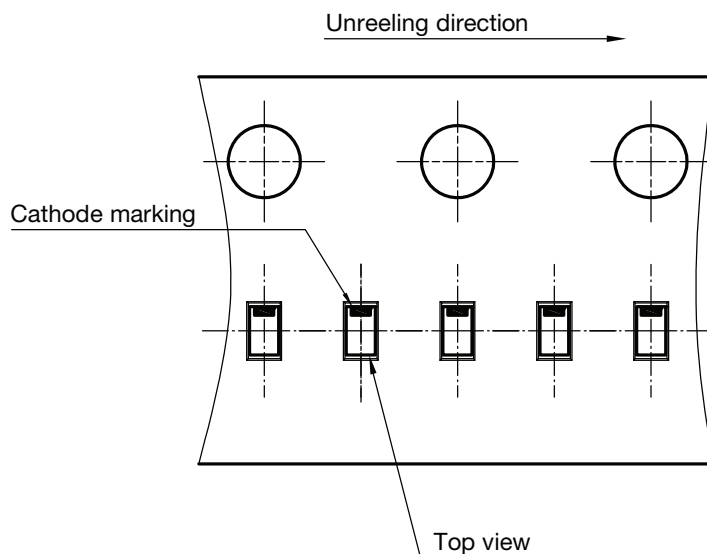
Document no.: S8-V-3906.04-059 (4)  
Created - Date: 11-Jul-2018  
Rev.6 - Date: 12-Nov-2024

23191

**CARRIER TAPE DFN1006-2B**


S8-V-3906.04-063 (4)  
created 28.10.2019

surface resistance:  $10^5 - 10^{11} \frac{\text{OHMS}}{\text{SQ}}$   
Cumulative tolerances of 10 sprocket holes is  $\pm 0.2 \text{ mm}$

**ORIENTATION IN CARRIER TAPE DFN1006-2B**


S8-V-3906.04-064 (4)  
created 28.10.2019



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