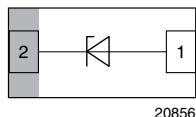
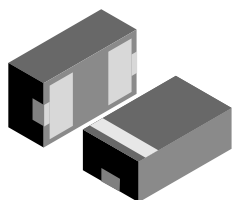




# Low Capacitance, Single-Line ESD Protection Diode



20856



20855

## MARKING (example only)



21121

Bar = cathode marking  
 Y = type code (see table below)  
 X = date code

## LINKS TO ADDITIONAL RESOURCES



## FEATURES

- Ultra compact LLP1006-2L package
- Low package profile < 0.4 mm
- 1-line ESD protection
- High surge current acc. IEC 61000-4-5  $I_{PPM} > 3 A$
- Low leakage current  $I_R < 0.1 \mu A$
- Low load capacitance  $C_D = 0.9 pF$
- ESD immunity acc. IEC 61000-4-2  
 ± 15 kV contact discharge  
 ± 15 kV air discharge
- Soldering can be checked by standard vision inspection; no X-ray necessary
- Pin plating NiPdAu (e4) no whisker growth
- e4 - precious metal (e.g. Ag, Au, NiPd, NiPdAu) (no Sn)
- PATENT(S): [www.vishay.com/patents](http://www.vishay.com/patents)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**  
**GREEN**  
 (5-2008)

ORDERING INFORMATION			
DEVICE NAME	ORDERING CODE	TAPED UNITS PER REEL (8 mm TAPE ON 7" REEL)	MINIMUM ORDER QUANTITY
VBUS051BD-HD1	VBUS051BD-HD1-GS08	8000	8000

PACKAGE DATA						
DEVICE NAME	PACKAGE NAME	TYPE CODE	WEIGHT	MOLDING COMPOUND FLAMMABILITY RATING	MOISTURE SENSITIVITY LEVEL	SOLDERING CONDITIONS
VBUS051BD-HD1	LLP1006-2L	A	0.72 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C

ABSOLUTE MAXIMUM RATINGS VBUS051BD-HD1					
PARAMETER	TEST CONDITIONS		SYMBOL	VALUE	UNIT
Peak pulse current	Acc. IEC 61000-4-5; $t_p = 8/20 \mu s$ ; single shot		$I_{PPM}$	3	A
Peak pulse power	Acc. IEC 61000-4-5; $t_p = 8/20 \mu s$ ; single shot		$P_{PP}$	45	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses		$V_{ESD}$	± 15	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses			± 15	kV
Operating temperature	Junction temperature		$T_J$	-55 to +145	°C
Storage temperature			$T_{STG}$	-55 to +150	°C

PATENT(S): [www.vishay.com/patents](http://www.vishay.com/patents)

This Vishay product is protected by one or more United States and international patents.



**ELECTRICAL CHARACTERISTICS VBUS051BD-HD1**

(Ratings at 25 °C ambient temperature, 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
Reverse stand-off voltage	Max. reverse working voltage	$V_{RWM}$	-	-	5	V
Reverse voltage	At $I_R = 0.1 \mu A$ ; pin 2 to pin 1	$V_R$	5	-	-	V
Reverse current	At $V_R = V_{RWM} = 5 V$ ; pin 2 to pin 1	$I_R$	-	< 0.01	0.1	$\mu A$
Reverse breakdown voltage	At $I_R = 1 mA$ ; pin 2 to pin 1	$V_{BR}$	6.9	7.9	8.7	V
Reverse clamping voltage	At $I_{PP} = 3 A$ ; acc. IEC 61000-4-5; pin 2 to pin 1	$V_C$	-	-	16	V
Forward clamping voltage	At $I_F = 3 A$ ; acc. IEC 61000-4-5; pin 1 to pin 2	$V_F$	-	3.4	4	V
Capacitance	At $V_R = 0 V$ ; $f = 1 MHz$ ; pin 2 to pin 1	$C_D$	-	0.9	1.3	pF

**APPLICATION NOTE**

The VBUS051BD-HD1 is an ESD protection device with the characteristic of a Z-diode with a high ESD immunity and a very low capacitance which makes it usable for high frequency applications like USB2.0 or HDMI.

With the VBUS051BD-HD1 one high speed data line can be protected against transient voltage signals like ESD (electro static discharge). Connected to the data line (pin 2) and to ground (pin 1) negative transients will be clamped close below the ground level while positive transients will be clamped close above the 5 V working range. The clamping behavior of the VBUS051BD-HD1 is bidirectional but asymmetrical (BiAs) and so it offers the best protection for applications running up to 5 V.

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25 \text{ }^\circ C$ , unless otherwise specified)

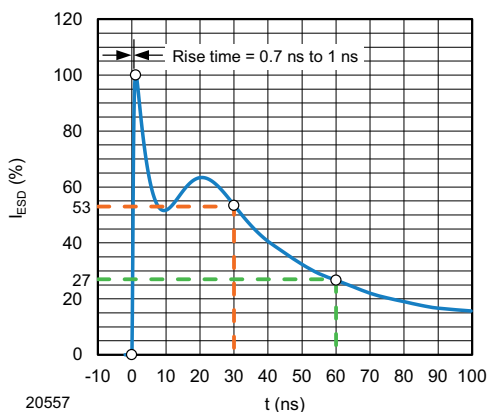


Fig. 1 - ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

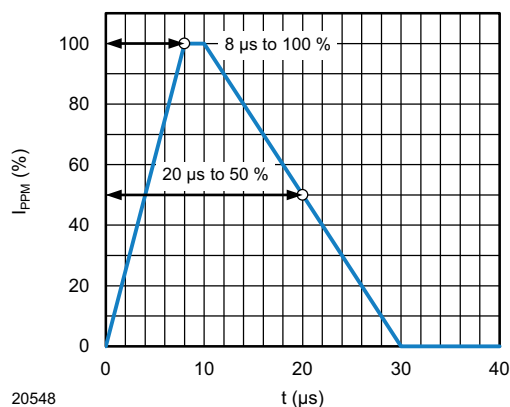


Fig. 2 - 8/20  $\mu s$  Peak Pulse Current Wave Form acc. IEC 61000-4-5

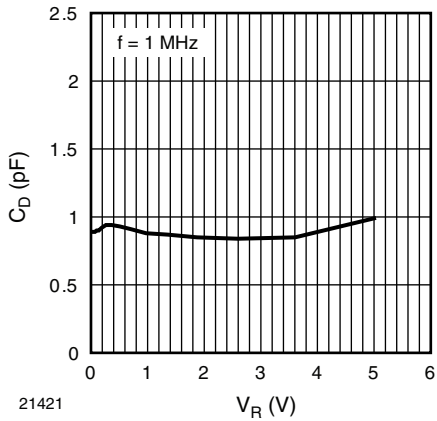


Fig. 3 - Typical Capacitance  $C_D$  vs. Reverse Voltage  $V_R$

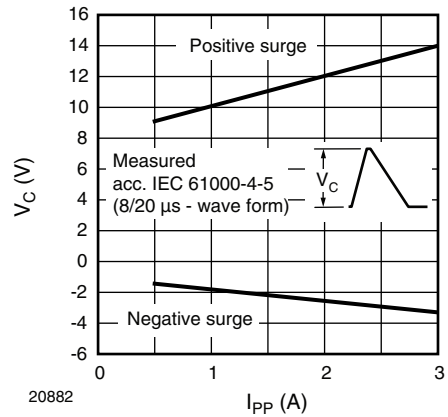


Fig. 6 - Typical Peak Clamping Voltage  $V_C$  vs. Peak Pulse Current  $I_{PP}$

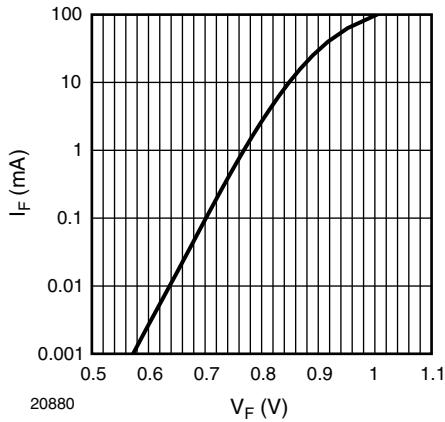


Fig. 4 - Typical Forward Current  $I_F$  vs. Forward Voltage  $V_F$

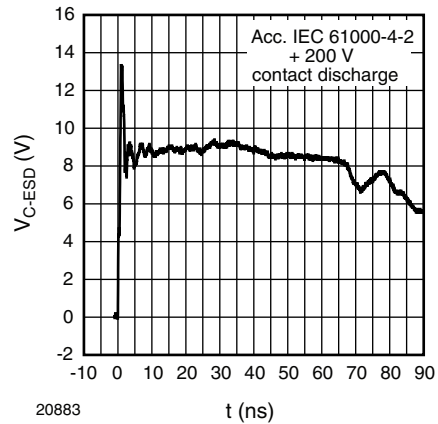


Fig. 7 - Typical Clamping Performance at +200 V Contact Discharge (acc. IEC 61000-4-2)

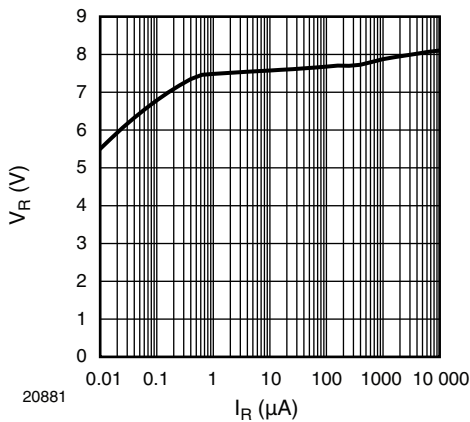


Fig. 5 - Typical Reverse Voltage  $V_R$  vs. Reverse Current  $I_R$

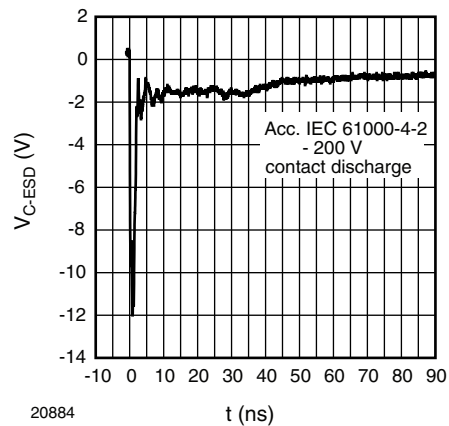


Fig. 8 - Typical Clamping Performance at -200 V Contact Discharge (acc. IEC 61000-4-2)

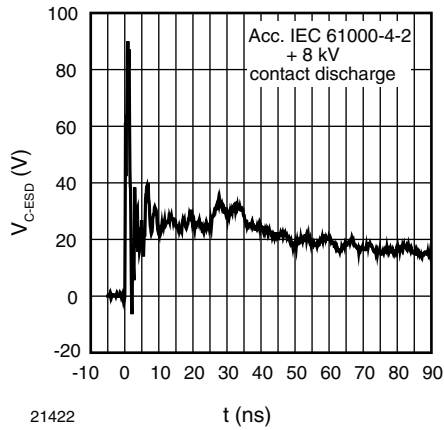


Fig. 9 - Typical Clamping Performance at + 8 kV Contact Discharge (acc. IEC 61000-4-2)

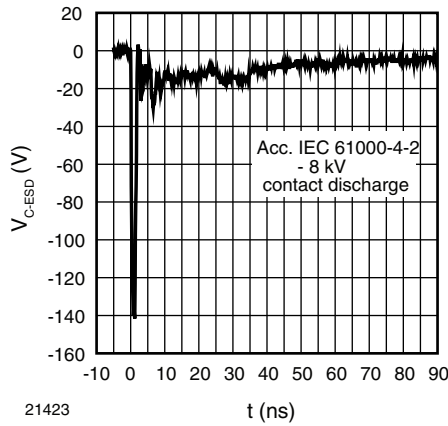


Fig. 10 - Typical Clamping Performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)

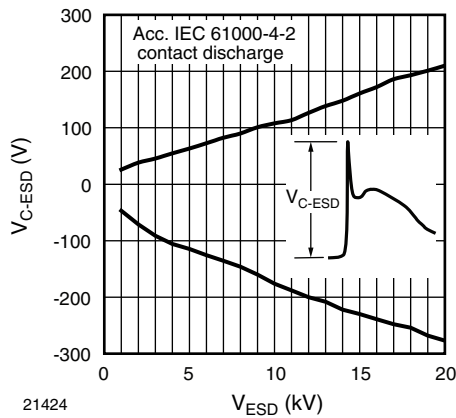
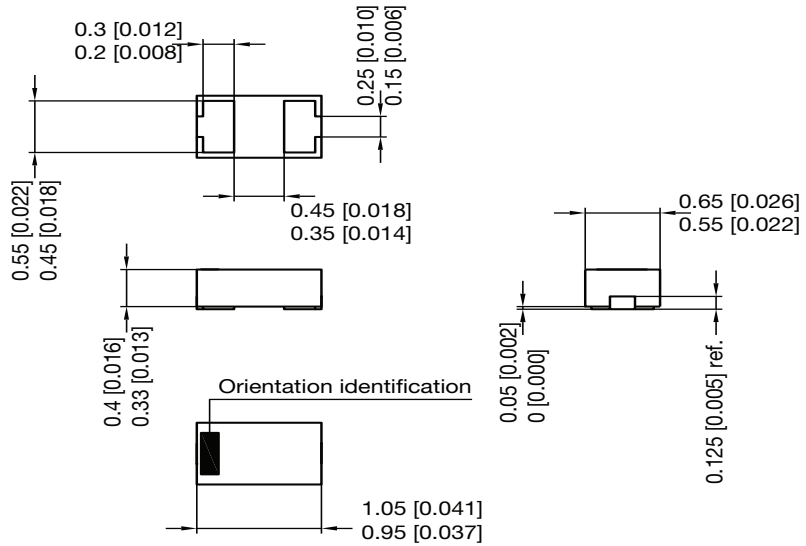


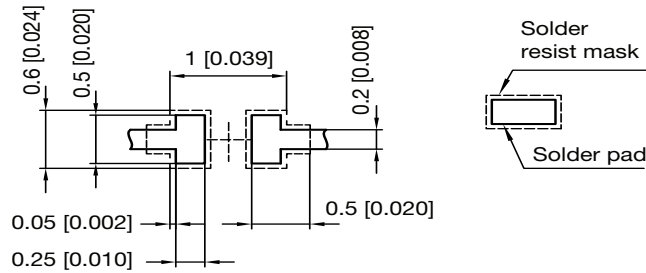
Fig. 11 - Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)



**PACKAGE DIMENSIONS** in millimeters (inches) **LLP1006-2L**

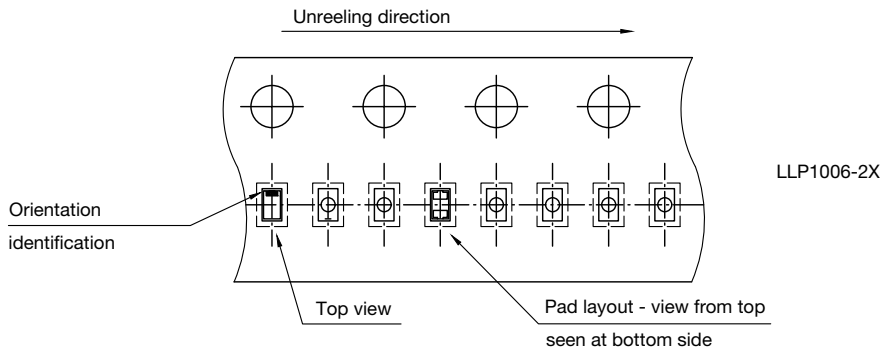


Foot print recommendation:



Pad Design Patented:  
(©US 9.018.537 B2)

Document no.: S8-V-3906.04-005 (4)  
Rev. 7 - Date: 11.May 2016  
20812



S8-V-3906.04-017 (4)  
02.05.2017  
22965



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.