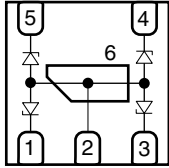
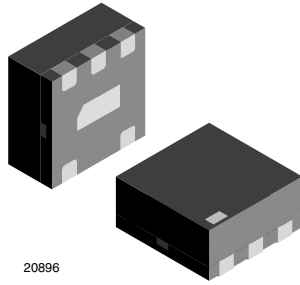


4-Line (Quad) ESD Protection Diode Array in LLP1010-6L



20897



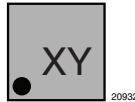
20896

FEATURES

- Ultra compact LLP1010-6L package
- Low package height < 0.4 mm
- 4-line ESD protection (quad)
- Low leakage current < 0.1 μ A
- Low load capacitance $C_D = 12$ pF
- ESD-protection acc. IEC 61000-4-2
± 15 kV contact discharge
± 17 kV air discharge
- Surge current acc. IEC 6100-4-5 $I_{PP} > 2.5$ A
- Soldering can be checked by standard vision inspection. No X-ray necessary
- Pin plating NiPdAu (e4) no whisker growth
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



MARKING (example only)



Dot = pin 1 marking
X = date code
Y = type code (see table below)

ORDERING INFORMATION

DEVICE NAME	ORDERING CODE	TAPED UNITS PER REEL (8 mm TAPE ON 7" REEL)	MINIMUM ORDER QUANTITY
VESD05A4A-HS4	VESD05A4A-HS4-GS08	5000	5000

PACKAGE DATA

DEVICE NAME	PACKAGE NAME	TYPE CODE	WEIGHT	MOLDING COMPOUND FLAMMABILITY RATING	MOISTURE SENSITIVITY LEVEL	SOLDERING CONDITIONS
VESD05A4A-HS4	LLP1010-6L	A	1.07 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	260 °C/10 s at terminals

ABSOLUTE MAXIMUM RATINGS					
PARAMETER	TEST CONDITIONS		SYMBOL	VALUE	UNIT
Peak pulse current	BiAs-mode: each input (pin 1, 3 to 5) to ground (pin 2 and 6); acc. IEC 61000-4-5; $t_p = 8/20 \mu s$; single shot		I_{PPM}	2.5	A
	BiSy-mode: each input (pin 1, 3 to 5) to any other input pin. Pin 2 and 6 not connected. Acc. IEC 61000-4-5; $t_p = 8/20 \mu s$; single shot			2.5	A
Peak pulse power	BiAs-mode: each input (pin 1, 3 to 5) to ground (pin 2 and 6); acc. IEC 61000-4-5; $t_p = 8/20 \mu s$; single shot		P_{PP}	30	W
	BiSy-mode: each input (pin 1, 3 to 5) to any other input pin. Pin 2 and 6 not connected. Acc. IEC 61000-4-5; $t_p = 8/20 \mu s$; single shot			33	W
ESD immunity	Acc. IEC61000-4-2; 10 pulses BiAs-mode: each input (pin 1, 3 to 5) to ground (pin 2 and 6)	Contact discharge	V_{ESD}	± 15	kV
		Air discharge		± 17	kV
	Acc. IEC 61000-4-2 ; 10 pulses BiSy-mode: each input (pin 1, 3 to 5) to any other input pin. Pin 2 and 6 not connected.	Contact discharge	V_{ESD}	± 15	kV
		Air discharge		± 17	kV
Operating temperature	Junction temperature		T_J	- 40 to + 125	$^{\circ}C$
Storage temperature			T_{STG}	- 55 to + 150	$^{\circ}C$

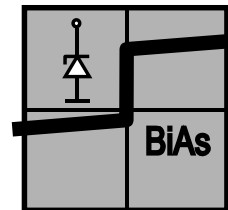
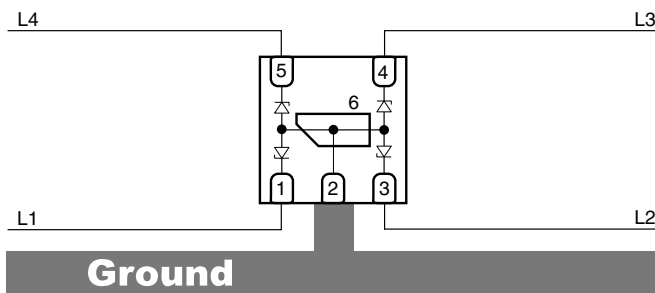
BiAs-MODE (4-LINE BIDIRECTIONAL ASYMMETRICAL PROTECTION MODE)

With the VESD05A4A-HS4 up to 4 signal- or data-lines (L1 to L4) can be protected against voltage transients. With pin 2 and 6 connected to ground and pin 1, 3, 4 and 5 connected to a signal- or data-line which has to be protected. As long as the voltage level on the data- or signal-line is between 0 V (ground level) and the specified Maximum Reverse Working Voltage (V_{RWM}) the protection diode between data line and ground offer a high isolation to the ground line. The protection device behaves like an open switch.

As soon as any positive transient voltage signal exceeds the break through voltage level of the protection diode, the diode becomes conductive and shorts the transient current to ground. Now the protection device behaves like a closed switch. The Clamping Voltage (V_C) is defined by the Breakthrough Voltage (V_{BR}) level plus the voltage drop at the series impedance (resistance and inductance) of the protection device.

Any negative transient signal will be clamped accordingly. The negative transient current is flowing in the forward direction of the protection diode. The low Forward Voltage (V_F) clamps the negative transient close to the ground level.

Due to the different clamping levels in forward and reverse direction the VESD05A4A-HS4 clamping behaviour is Bidirectional and Asymmetrical (BiAs).



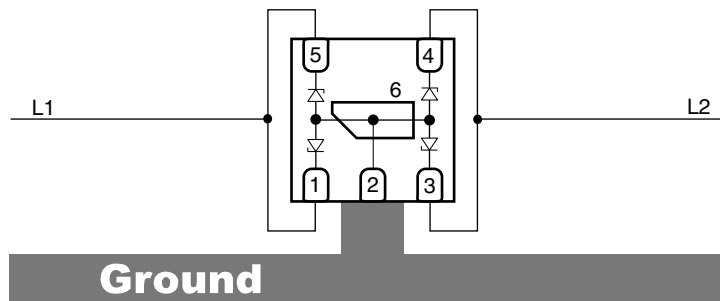
20898

ELECTRICAL CHARACTERISTICS BiAs mode: each input (pin 1, 3, 4 and 5) to ground (pin 2 and/or 6) ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)						
PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	4	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	5	V
Reverse voltage	at $I_R = 0.1\text{ }\mu\text{A}$	V_R	5	-	-	V
Reverse current	at $V_{RWM} = 5\text{ V}$	I_R	-	< 0.01	0.1	μA
Reverse breakdown voltage	at $I_R = 1\text{ mA}$	V_{BR}	6	-	8	V
Reverse clamping voltage	at $I_{PP} = 2.5\text{ A}$	V_C	-	-	12	V
Forward clamping voltage	at $I_{PP} = 2.5\text{ A}$	V_F			2.5	V
Capacitance	at $V_R = 0\text{ V}$; $f = 1\text{ MHz}$	C_D	-	12	15	pF
	at $V_R = 2.5\text{ V}$; $f = 1\text{ MHz}$		-	7.5	8.5	pF

If a higher surge current or peak pulse current (I_{PP}) is needed, some protection diodes in the VESD05A4A-HS4 can also be used in parallel in order to “multiply” the performance.

If two diodes are switched in parallel you get

- double surge power = double peak pulse current ($2 \times I_{PPM}$)
- half of the line inductance = reduced clamping voltage
- half of the line resistance = reduced clamping voltage
- double line Capacitance ($2 \times C_D$)
- double Reverse leakage current ($2 \times I_R$)



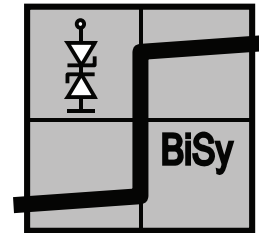
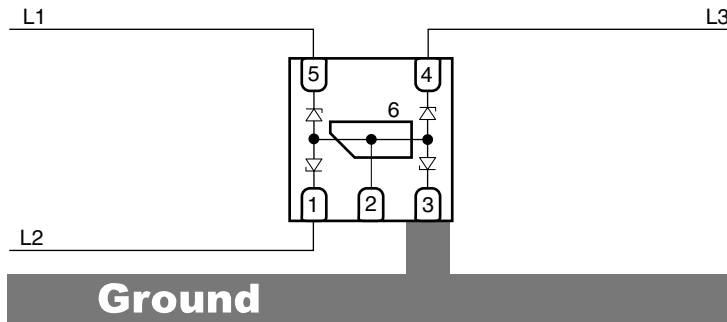
20900

BiSy-MODE (3-LINE BIDIRECTIONAL SYMMETRICAL PROTECTION MODE)

If a bipolar symmetrical protection device is needed the VESD05A4A-HS4 can also be used as a three-line protection device. Therefore three pins (example: pin 1, 3, and 5) has to be connected to the signal- or data-line (L1 to L3) and pin 3 to ground. Pin 2 and 6 must not be connected!

Positive and negative voltage transients will be clamped in the same way. The clamping current from one data line through the VESD05A4A-HS4 to the ground passes one diode in forward direction and the other one in reverse direction. The Clamping Voltage (V_C) is defined by the Breakthrough Voltage (V_{BR}) level of one diode plus the forward voltage of the other diode plus the voltage drop at the series impedances (resistances and inductances) of the protection device.

Due to the same clamping levels in positive and negative direction the VESD05A4A-HS4 voltage clamping behaviour is also Bidirectional and Symmetrical (BiSy).



20901

ELECTRICAL CHARACTERISTICS

BiSy mode: pin 1, 3, 4 or 5 to any other pin (1, 3, 4 or 5) (pin 2 and 6 not connected)

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

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	3	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	5.5	V
Reverse voltage	at $I_R = 0.1\text{ }\mu\text{A}$	V_R	5.5	-	-	V
Reverse current	at $V_R = V_{RWM} = 5.5\text{ V}$	I_R	-	< 0.01	0.1	μA
Reverse breakdown voltage	at $I_R = 1\text{ mA}$	V_{BR}	6.5	-	8.7	V
Clamping voltage	at $I_{PP} = 2.5\text{ A}$	V_C	-	11.5	13	V
Capacitance	at $V_R = 0\text{ V}$; $f = 1\text{ MHz}$	C_D	-	6	8	pF
	at $V_R = 2.5\text{ V}$; $f = 1\text{ MHz}$		-	5	7	pF

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

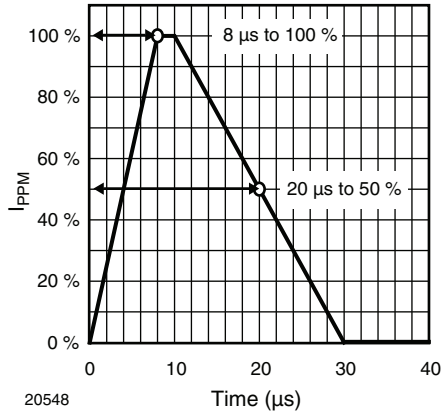


Fig. 1 - 8/20 μs Peak Pulse Current Wave Form acc. IEC 61000-4-5

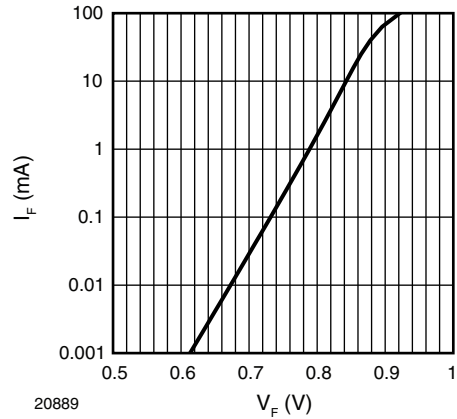


Fig. 4 - Typical Forward Current I_F vs. Forward Voltage V_F

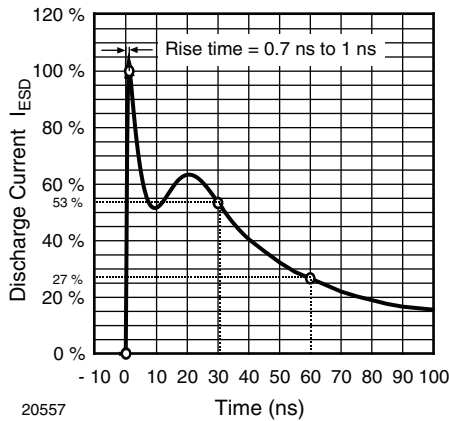


Fig. 2 - ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330 Ω /150 pF)

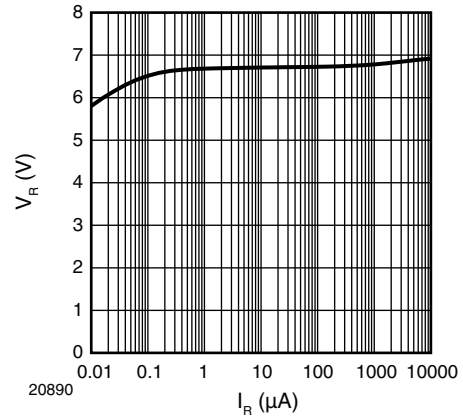


Fig. 5 - Typical Reverse Voltage V_R vs. Reverse Current I_R

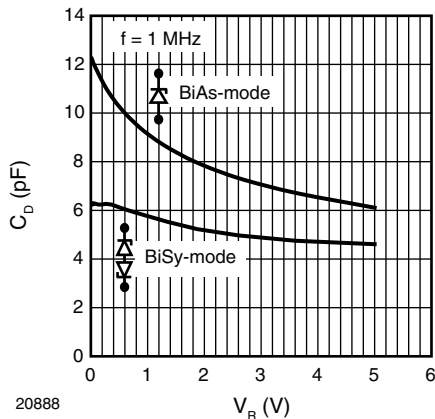


Fig. 3 - Typical Capacitance C_D vs. Reverse Voltage V_R

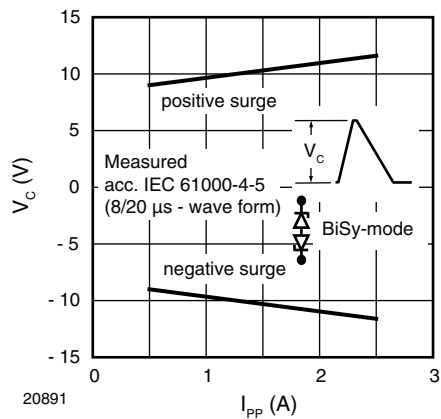


Fig. 6 - Typical Peak Clamping Voltage V_C vs. Peak Pulse Current I_{PP}

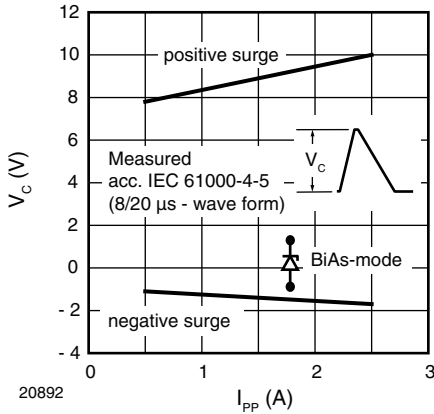


Fig. 7 - Typical Peak Clamping Voltage V_C vs. Peak Pulse Current I_{PP}

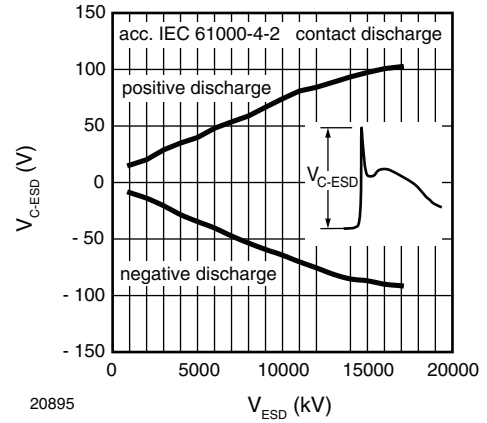


Fig. 10 - Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

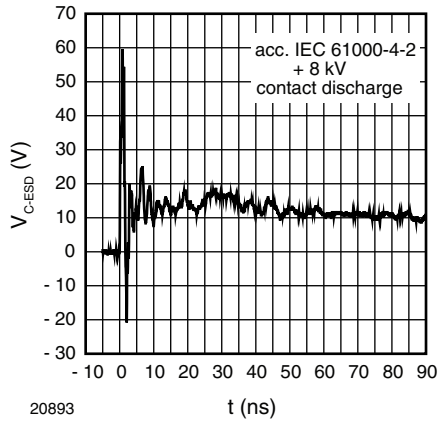


Fig. 8 - Typical Clamping Performance at + 8 kV Contact Discharge (acc. IEC 61000-4-2)

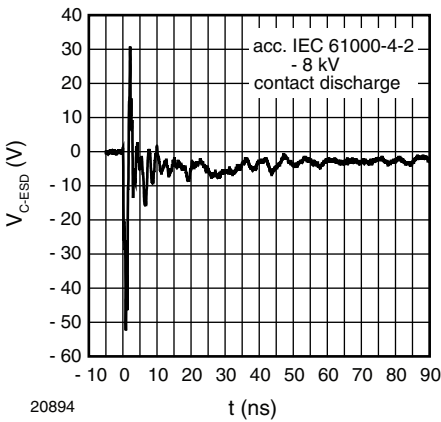
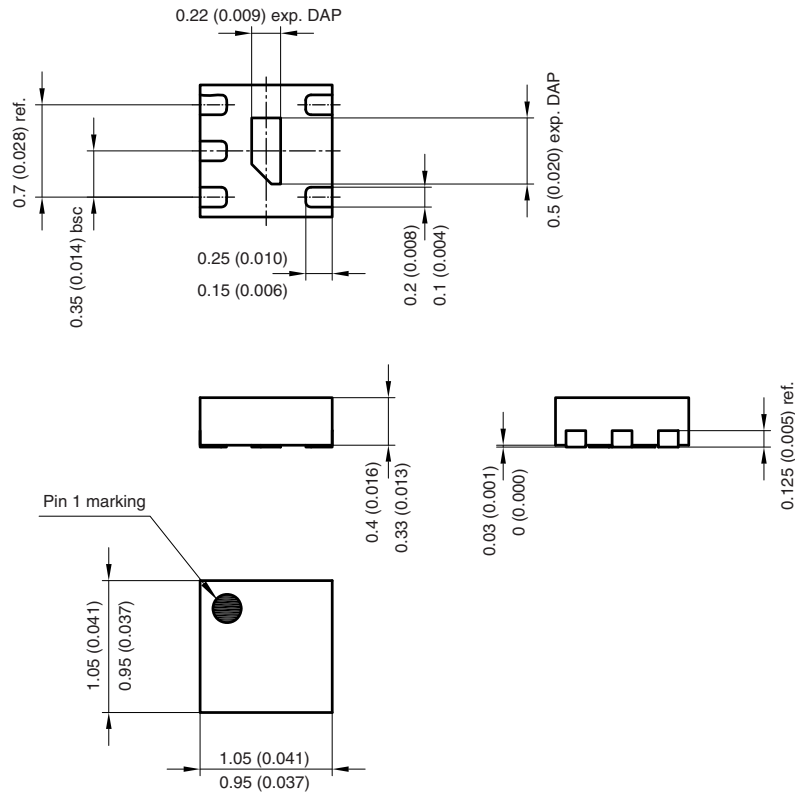


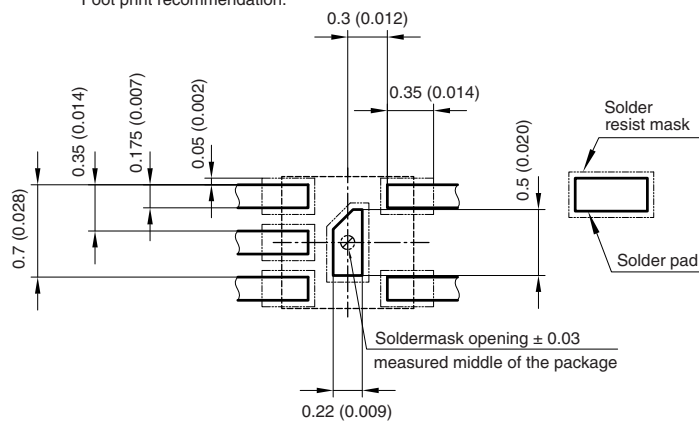
Fig. 9 - Typical Clamping Performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)



PACKAGE DIMENSIONS in millimeters (inches): **LLP1010-6L**



Foot print recommendation:



Document no.:S8-V-3906.04-004 (4)
Created - Date: 17.July.2007
Rev. 4 - Date: 09. Sep. 2008
20899



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.

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 and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. 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.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.