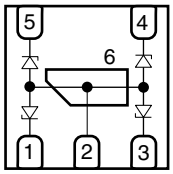
4-Line (Quad) ESD Protection Diode Array in LLP1010-6L



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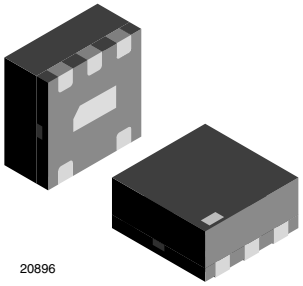


20896

FEATURES

- Ultra compact LLP1010-6L package
- Low package height < 0.4 mm
- 4-line ESD protection (quad)
- Low leakage current < 0.1 µA
- 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

Pb-free

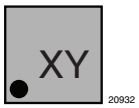
e4

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

MARKING (example only)



20932

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 VESD05A4A-HS4

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 µs; 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 µs; 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 µs; 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 µs; 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	°C
Storage temperature			T_{STG}	-55 to +150	°C

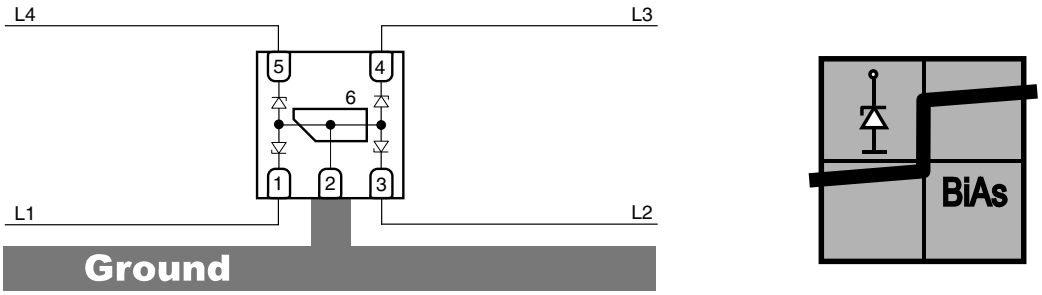
BiAs-MODE 4-LINE BI-DIRECTIONAL ASYMMETRICAL PROTECTION MODE)

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).



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ELECTRICAL CHARACTERISTICS VESD05A4A-HS4

BiAs mode: each input (pin 1, 3, 4 and 5) to ground (pin 2 and/or 6)

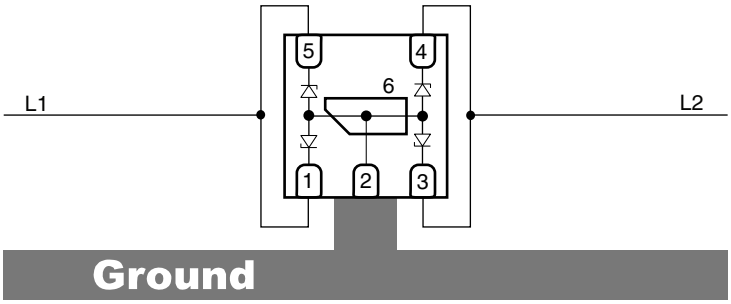
(T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	4	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	5	V
Reverse voltage	at I_R = 0.1 µA	V_R	5	-	-	V
Reverse current	at V_{RWM} = 5 V	I_R	-	< 0.01	0.1	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	6	-	8	V
Reverse clamping voltage	at I_{PP} = 2.5 A	V_C	-	-	12	V
Forward clamping voltage	at I_{PP} = 2.5 A	V_F			2.5	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	12	15	pF
	at V_R = 2.5 V; f = 1 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 x I_{PPM})
- half of the line inductance = reduced clamping voltage
- half of the line resistance = reduced clamping voltage
- double line Capacitance (2 x C_D)
- double Reverse leakage current (2 x I_R)



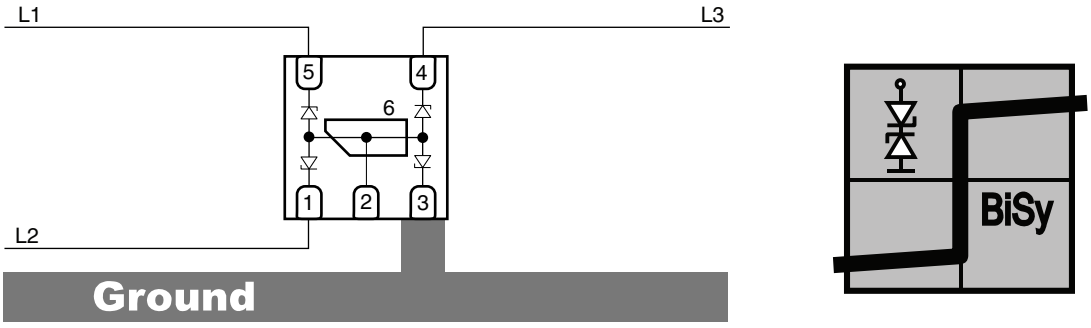
20900

BiSy-MODE (3-LINE BI-DIRECTIONAL 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 °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 µA	V_R	5.5	-	-	V
Reverse current	at V_R = V_{RWM} = 5.5 V	I_R	-	< 0.01	0.1	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	6.5	-	8.7	V
Clamping voltage	at I_{PP} = 2.5 A	V_C	-	11.5	13	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	6	8	pF
	at V_R = 2.5 V; f = 1 MHz		-	5	7	pF

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

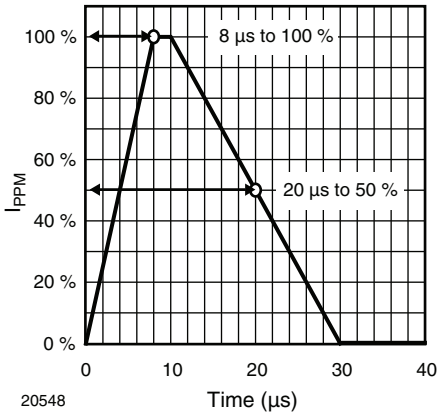


Fig. 1 - 8/20 µs Peak Pulse Current Wave Form acc. IEC 61000-4-5

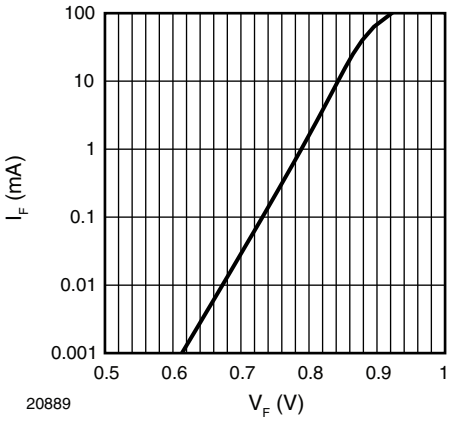


Fig. 4 - Typical Forward Current I_F vs. Forward Voltage V_F

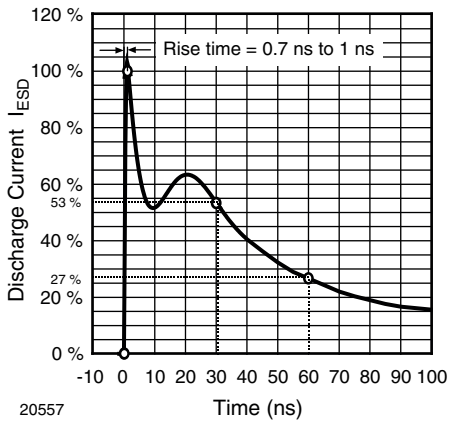


Fig. 2 - ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330 Ω/150 pF)

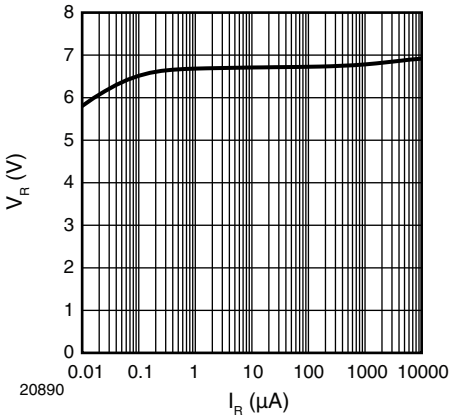


Fig. 5 - Typical Reverse Voltage V_R vs. Reverse Current I_R

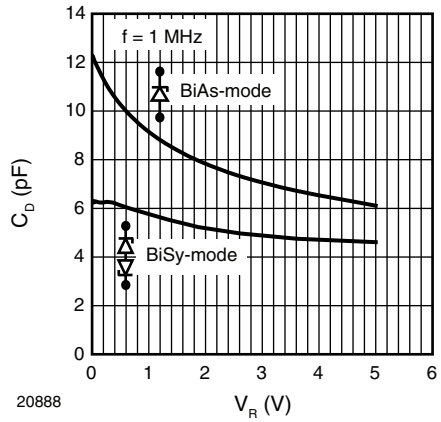


Fig. 3 - Typical Capacitance C_D vs. Reverse Voltage V_R

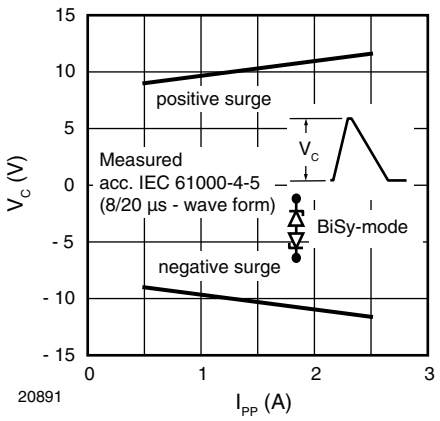


Fig. 6 - Typical Peak Clamping Voltage V_C vs. Peak Pulse Current I_{PP}

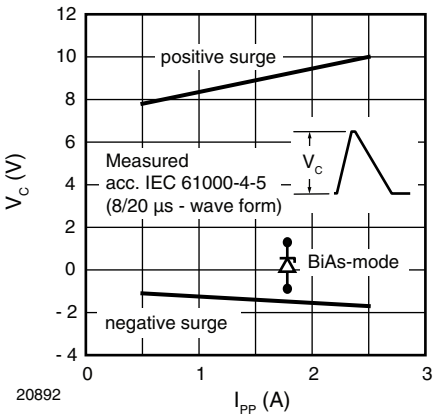


Fig. 7 - Typical Peak Clamping VoltageV_C vs. Peak Pulse Current I_{PP}

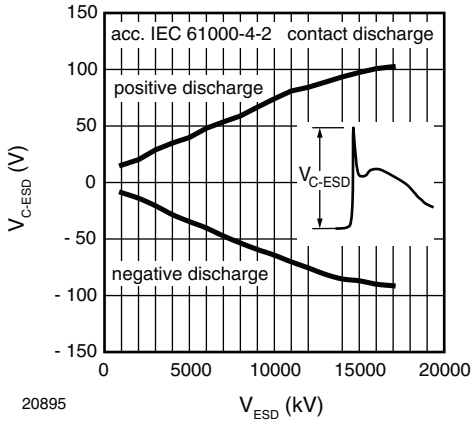


Fig. 10 - Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

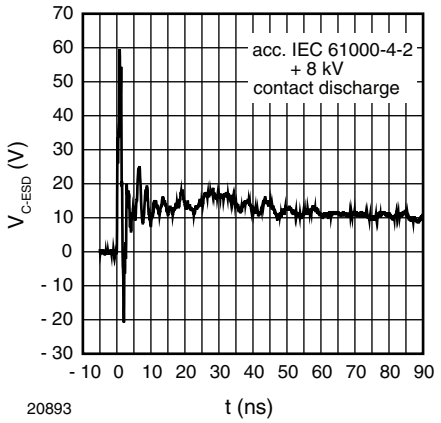


Fig. 8 - Typical Clamping Performance at + 8 kV Contact Discharge (acc. IEC 61000-4-2)

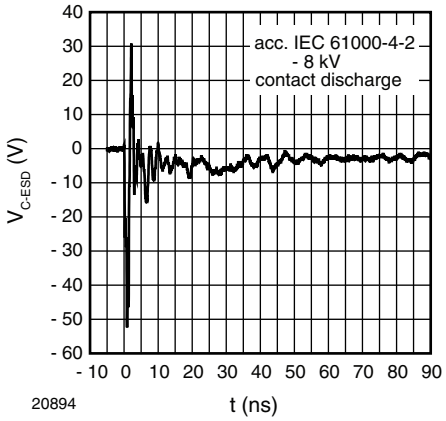
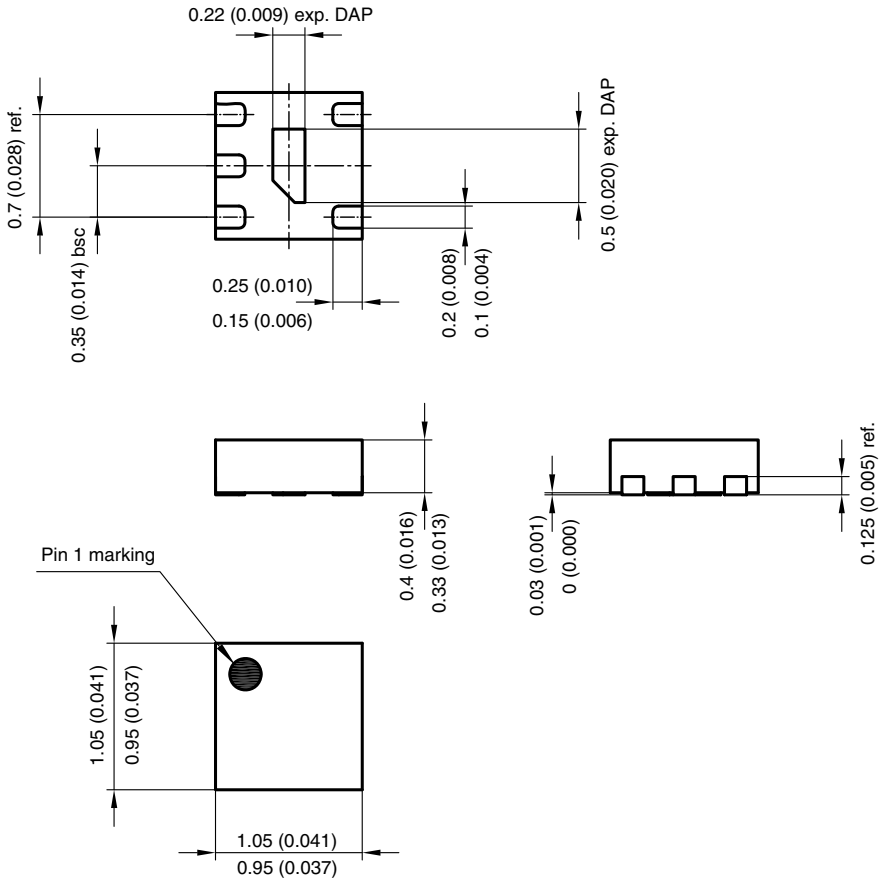
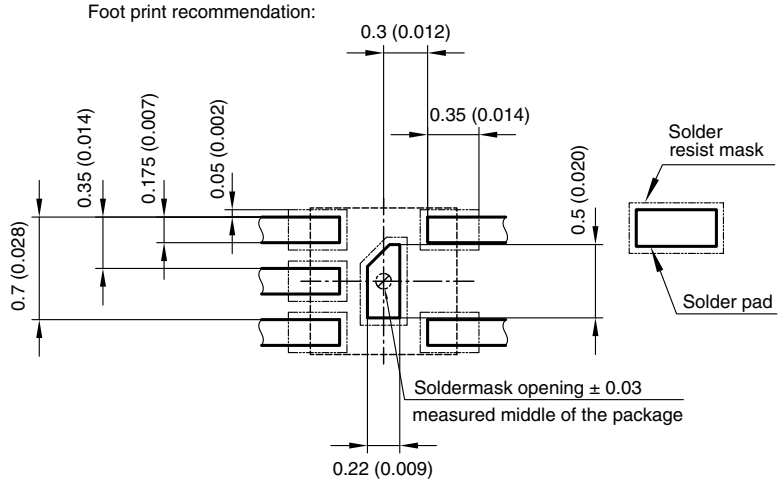


Fig. 9 - Typical Clamping Performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)

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



Foot print recommendation:



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Created - Date: 17.July.2007
Rev. 4 - Date: 09. Sep. 2008
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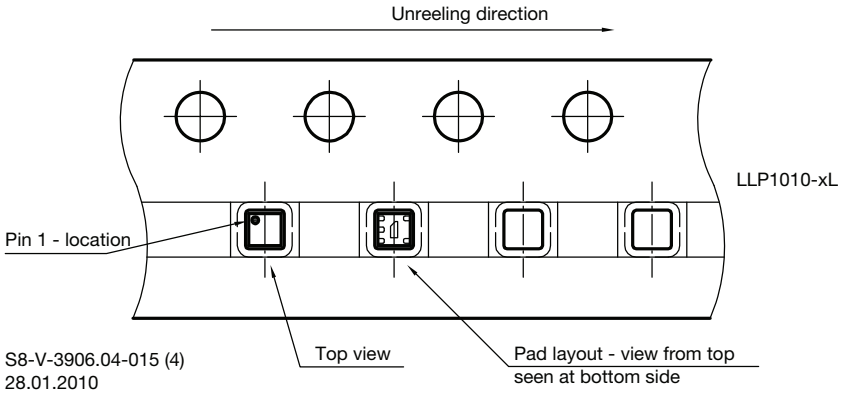

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